



## Foreword

Fire safety in buildings is determined by a number of factors: the provisions of means of escape in case of fire, the ability for a building to resist the effects of fire and to minimize the spread of fire and smoke and the provision of means of access to enable firefighters to effect rescue and fight fire.

Following a review of the Code of Practice for the Provision of Means of Escape in Case of Fire 1996, the Code of Practice for Fire Resisting Construction 1996 and the Code of Practice for Means of Access for Firefighting and Rescue 2004, this Code of Practice is issued to replace the said three Codes of Practice and to provide guidance on compliance with the requirements laid down in the Building (Construction) Regulation 90 and the Building (Planning) Regulations 41, 41A, 41B, 41C and 41D, which include the requirements for fire resisting construction, means of escape and means of access for firefighting and rescue to buildings. In addition, it also provides guidelines on the testing standards for the fire properties of building elements and components, fire safety management of buildings and the alternative approach in fire safety design, i.e. fire engineering approach.

This Code of Practice may be cited as the Code of Practice for Fire Safety in Buildings. It is prepared and issued by the Buildings Department on the basis of the consultancy study on fire engineering approach and fire safety in buildings. The consultancy study was conducted by Ove Arup & Partners Hong Kong Ltd commissioned by the Buildings Department and was supervised by a Steering Committee comprising representatives of professional institutions and other stakeholders of the building industry as well as other Government Departments. Composition of the Steering Committee is as follows:

### Steering Committee:

Chairman	: Assistant Director/Corporate Services	Buildings Department
Members	: Chief Building Surveyor/Legal Services	Buildings Department
	Chief Building Surveyor/New Territories East 2 & Rails	Buildings Department
	Chief Building Surveyor/Fire Safety	Buildings Department
	Chief Structural Engineer/F	Buildings Department
	Senior Building Surveyor/Legislation	Buildings Department
	Deputy Chief Fire Officer (Fire Safety)	Fire Services Department
	Senior Architect/Independent Checking Unit	Housing Department
	Senior Building Services Engineer	Architectural Services Department
	Professor of the Hong Kong Polytechnic University	
	Professor of the Hong Kong University of Science and Technology	
	Representatives of the Hong Kong Institute of Architects	
	Representatives of the Hong Kong Institution of Engineers	
	Representative of the Hong Kong Institute of Surveyors	
	Representative of the Real Estate Developers Association of Hong Kong	
Secretary	: Building Surveyor/Legislation	Buildings Department

This Code of Practice will be reviewed regularly. The Buildings Department welcomes suggestions for improving the Code.

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## **Part A**

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### **Introduction**

**This Part contains three Sections:**

- **Section 1 – General**
- **Section 2 – Performance Requirements**
- **Section 3 – Definitions**

# Section 1 – General

## Subsection A1 – Use of this Part

### Clause A1.1

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This Part should be read in conjunction with all other Parts of this Code.

### Clause A1.2

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- (a) This Code provides the Performance Requirements as well as prescriptive requirements (Deemed-to-Comply provisions) for achieving an adequate level of fire safety in buildings.
- (b) To comply with this Code, a fire safety design should comply with the Performance Requirements in Section 2.
- (c) The Building Authority recognises that fire safety may be achieved in a number of ways. This is particularly pertinent to some buildings where there are genuine difficulties in complying with the Deemed-to-Comply provisions because of their size, use, complexity or location, which may necessitate special consideration.

### Clause A1.3

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Diagram A1 shows the framework for fire safety in buildings.

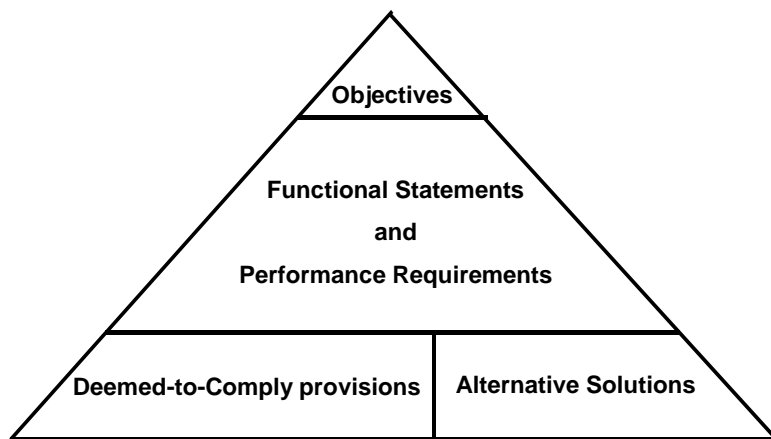


Diagram A1 – Framework for Fire Safety in Buildings

### **Commentary**

The development of the framework for fire safety in buildings is based on hierarchical approach, which is adopted in the performance-based regulatory systems of Australia, United States of America and New Zealand.

With reference to the relevant legislations, the framework for fire safety in buildings is formulated as follows:

- (a) Buildings Ordinance (Cap.123) provides an over-arching goal.
- (b) Regulations provide the detailed objectives and Functional Statements for fire safety as well as Performance Requirements for achieving the objectives of fire safety.
- (c) This Code provides the means of compliance (Deemed-to-Comply provisions) and guidelines for adopting the fire engineering approach (Alternative Solution).

## **Subsection A2 - Fire Safety Objectives**

### **Clause A2.1**

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The long title of the Buildings Ordinance (Cap. 123) provides the goal statement for fire safety design:

*To provide for the planning, design and construction of buildings and associated works; to make provision for the rendering safe of dangerous buildings and land; and to make provision for matters connected therewith.*

### **Clause A2.2**

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For every fire safety design, the following fire safety objectives should be met:

#### **(a) Life Safety**

Fire safety provisions should be provided for:

- 1. protection of life of building occupants
- 2. minimization of fire spread between fire compartments
- 3. prevention of building collapse as a result of fire
- 4. facilitation of firefighting and rescue by fire services personnel

#### **(b) Property Protection**

Fire safety provisions should be provided for:

- 1. minimization of fire spread between fire compartments
- 2. prevention of building collapse as a result of fire
- 3. minimization of fire spread between buildings
- 4. facilitation of firefighting and rescue by fire services personnel

### **Commentary**

There are other fire safety objectives that are relevant: preventing the outbreak of fire, abating fire hazards, improving fire suppression and preventing loss of property. Provisions for some of these objectives can be found in the Buildings Ordinance and regulations.

## **Clause A2.3**

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Functional Statements elaborate the fire safety objectives that a design should meet. The Functional Statements and corresponding Performance Requirements are stipulated in Section 2.

## **Subsection A3 - Compliance**

### **Clause A3.1**

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The adequacy of fire safety provisions in a building should be demonstrated by complying with the Performance Requirements in Section 2. Compliance with Performance Requirements can be achieved by:

- (a) complying with the Deemed-to-Comply provisions in this Code, or
- (b) formulating an Alternative Solution which complies with the Performance Requirements, or
- (c) a combination of (a) and (b).

### **Commentary**

Compliance with the Deemed-to-Comply provisions in this Code may be regarded as a reliable way to comply with the requirements under the Buildings Ordinance for fire safety in buildings. When there is genuine difficulty in complying with the Deemed-to-Comply provisions for buildings of special hazards (due to their size, use, complexity or location), an Alternative Solution can be adopted and proved, in individual cases, to comply with the requirements under the Buildings Ordinance.

The Building Authority accepts the following as relevant considerations for the assessment of the building in respect of fire safety:

- (a) the anticipated risk of a fire occurring in the building;
- (b) the anticipated severity of the fire;
- (c) the ability of the structure of the building to resist the effect of fire and to minimise the spread of fire and smoke; and
- (d) the consequential and possible danger to the people in and around the building.

An acceptable Alternative Solution should take into consideration the criteria within the Performance Requirements and at the same time, apply scientific and engineering principles to the protection of people and property from fire. Such an approach may be the only viable means to achieve an acceptable level of fire safety in some large or complex buildings. Where fire engineering is used to formulate an Alternative Solution, its acceptability will be assessed by reference to a set of qualitative criteria, i.e. the Performance Requirements.

Quantitative and qualitative techniques may be used to evaluate risks and hazards. When quantitative methods are used, any assumptions made should be substantiated by referenced documentation.

## **Subsection A4 - Parts in this Code**

### **Clause A4.1**

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This Code consists of the following parts:

- Part A - Introduction
- Part B - Means of Escape
- Part C - Fire Resisting Construction
- Part D - Means of Access
- Part E - Fire Properties of Building Elements and Components
- Part F - Fire Safety Management
- Part G - Guidelines on Fire Engineering
- Annex A - List of Codes of Practice and Guides issued by Licensing Authorities for Licensed Premises

Parts B to E provide the prescriptive requirements of this Code, or the Deemed-to-Comply provisions, for complying with the Performance Requirements. Parts F and G provide guidelines on fire safety management and fire engineering respectively.

### **Clause A4.2**

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The Code of Practice for Minimum Fire Service Installations and Equipment and Inspection, Testing and Maintenance of Installations and Equipment issued by the Fire Services Department should be read in conjunction with this Code.

### **Clause A4.3**

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Codes of Practice or Guides issued by relevant licensing authorities should be read in conjunction with this Code. Some commonly used Codes of Practice and Guides are listed in Annex A for reference.

## **Subsection A5 - Change in Use or Bounding Conditions**

### **Clause A5.1**

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Apart from alterations and additions, an authorized person should consider if a submission to the Building Authority may be required if a building or fire compartment involves:

- (a) change in use, based on the categories outlined within Subsection A7; or
- (b) change in Bounding Conditions.

#### **Commentary**

A change in one Use Classification to another is considered as a “material change in use” under Section 25 of the Buildings Ordinance (Cap. 123). As the fire risk to occupants may be adversely affected, the suitability of the building for the new use, by reason of its construction, should be assessed and upgrading works may be required.

Bounding Conditions are the set of fire safety provisions to be provided and maintained when adopting performance-based approach to fire safety design and should be specified in the general building plans. Any changes to Bounding Conditions (e.g. change to fire safety provisions, fire compartment or occupant capacity etc.) may invalidate the performance-based fire safety design. The authorized person should review the Bounding Conditions and assess if submission to the Building Authority for approval is required. Part G provides the details on the application of Bounding Conditions.

## **Subsection A6 - Limitation of this Code**

### **Clause A6.1**

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The Deemed-to-Comply provisions have not taken into account the scenarios involving significant and organised arson, terrorism or similar emergencies.

#### **Commentary**

Smaller acts of arson with small fire size involving an individual ignition source may result in an initial fire growth that is faster than that of an accidental fire, but the overall fire development may not differ from an accidental fire and hence meeting the Deemed-to-Comply provisions is an appropriate mitigation. Issues related to fire safety design for major arson or terrorism scenarios can only be addressed through a performance-based approach, on an individual case-by-case basis.

## Subsection A7 - Use Classification

Use Classifications are stipulated in Table A1.

**Table A1: Use Classification**

Types of Premises		Typical Examples / Interpretations
1. Residential	1a. House type dwellings	Single family house up to three storeys high.
	1b. Flats	Flats including service apartments.
	1c. Tenement houses	A building in the domestic part of which any living room, as a place for cooking or sleeping, is intended or adapted for the use of more than one tenant or sub-tenant.
2. Hotel and similar Transient Accommodation		Hotels, guesthouses, barracks, dormitories, hostels, boarding houses, motels, etc.
3. Institutional	3a. Health/child care facilities	Hospitals, purpose-built clinic, nurseries, child care centres, day care centres, drug dependent person treatment areas, homes for the elderly.
	3b. Detention and correctional centres	Detention centres, correctional centres, etc.
4. Commercial	4a. Business facilities	Offices and associated business spaces.
	4b. Mercantile facilities	Retail shops, markets, supermarkets, department stores, food courts, cafés, restaurants, lounges, bars and pubs, banking halls, betting halls, showrooms, etc.
5. Assembly	5a. Places of Public Entertainment	The uses listed in Places of Public Entertainment Ordinance (Cap. 172), such as cinemas, theatres, exhibition centres, stadia.
	5b. Educational establishments	Classrooms, lecture rooms, libraries and study rooms in schools, kindergarten, colleges or universities.
	5c. Transport facilities	Passenger terminals for air, rail, road or sea. Airports, bus termini, railway stations, etc.
	5d. Other Assembly Premises	Places of assembly not specifically listed in Type 5a-c, such as conference centres, skating rinks, gymnasias, churches, public halls and columbaria, etc.
6. Industrial	6a. Industrial workplaces	Industrial workplaces for manufacturing and processing any article, power generation facilities, depots, aircraft maintenance facilities, film production facilities, commercial kitchens, commercial laundries, commercial laboratories etc.
	6b. Warehouses	Container terminals, freight stations, warehouses for general goods storage and logistic centres.
	6c. Storage, manufacturing of hazardous/ dangerous goods premises	Storage or manufacturing premises for flammable goods, explosive goods, explosives production and flammable/hazardous chemical processing.
7. Carparks		Parking structure and garage, including car ports.
8. Plant rooms & the like		Mechanical and electrical plant rooms, IT equipment room, access facilities for telecommunication and broadcasting services etc.

Note:

1. In respect of some Use Classifications, there are specific requirements under the relevant Ordinances, Regulations as well as Codes of Practice/Guides issued by relevant licensing authorities.

**Commentary:**

Eight major Use Classifications are stipulated in Table A1. The Use Classifications are developed according to the potential fire hazard, with consideration to the characteristics of occupancy and building type.

**Use Classification 1      Residential Premises**

Residential premises contain sleeping accommodations as well as other living functions, and occupants are generally familiar with the building layout. The response time of occupants will be increased whilst asleep. It is recognised that the degree of protection should increase as the density of occupants increases. Thus, residential premises are further classified into 3 sub-classes with respect to their characteristics.

House type dwellings basically contain one staircase serving a single family with low occupant capacity.

Self-contained flats are found in both high-rise and low-rise residential buildings, which are separated from each other by fire barriers. This type of use may co-exist with other Use Classifications at lower levels, such as retail, forming a composite building.

Older type tenement houses commonly contain multi-family occupancies within a flat and are relatively dense. Commonly a simple kitchen and bathroom are provided but the remainder of the unit is one large space sub-divided into cubicles.

**Use Classification 2      Hotel and similar Transient Accommodation Premises**

This type of premises contains sleeping accommodation, as well as other living functions, where occupants are usually unfamiliar with the building layout. The response time of occupants will be increased whilst asleep. The movement time of the occupants will be increased as they need more time to find their way to the exit in the unfamiliar environment.

**Use Classification 3      Institutional Premises**

Occupants in this type of premises will often require assistance to evacuate. There are 2 sub-classes.

In health/child care facilities and patient care facilities, significant portion of occupants are generally not capable of self-preservation because of illness, injury or age, and/or physical or mental disability and can only evacuate with assistance. However, some occupants in these facilities are mobile, and can evacuate rapidly, such as outpatients in hospitals, staff in elderly homes, who can assist others to evacuate in the event of fire.

In detention and correctional facilities, persons are under various restraints. These occupancies present a unique problem due to the restraints imposed. Often, the evacuation of occupants is controlled by management, including their ability to walk from one room to another.

**Use Classification 4      Commercial Premises**

Occupants are normally awake in commercial premises. There are 2 sub-classes with respect to functions of commercial premises.

Business facilities are used for financial, managerial, clerical and technical activities performed in relation to the operation of a business. These premises include rooms for audio & video recording facilities, committee rooms, conference rooms, meeting rooms, staff rooms, common rooms, law courts, function rooms, waiting rooms, medical treatment or consultation room etc. Occupants are considered to be awake, mobile, and may be familiar with their surroundings. Also, the contents usually do not present severe fire hazards such as rapid fire development or explosions.

Mercantile facilities are used for retail, stores for displaying and offering merchandise for sale or providing food services to the public. These premises include lounges, cafés, restaurants, bars and pubs, karaoke establishments, supermarkets, malls, markets, barber shops, banking halls, public service counters, amusement centres, massage parlours, bathhouses, betting centres, clubhouses, solemnization premises for marriage etc. Occupants generally are assumed to be somewhat, if not totally, unfamiliar with the building arrangement. The occupants are expected to be mobile and capable of self-preservation but, due to crowding and lack of familiarity, might have some difficulties in locating and walking to exits in an emergency. Also, the display of merchandise can present a higher fire growth rate than in other occupancies.

#### **Use Classification 5      Assembly Premises**

Assembly premises are buildings or parts of buildings in which potential large occupancy gathers for such purposes as deliberation, entertainment, amusement, leisure, catering and education. Assembly premises are further classified into 4 sub-classes in terms of occupant familiarity with buildings.

Use Classification 5a are Places of Public Entertainment as determined under Places of Public Entertainment Ordinance (Cap. 172). The Ordinance governs entertainments such as concerts, performances, cinemas, music shows, etc within theatres and staged venues; circus, amusement rides, exhibitions, sporting, dance parties, etc.

Use Classification 5b are educational establishments such as schools, colleges, universities, non-public and public libraries. Occupants may be familiar with the building compared with other assembly places, and are awake to respond to emergency.

Use Classification 5c are transport facilities for air, rail, road or sea; and railway stations. These facilities have a primary purpose for passenger transit, with occupants who normally stay within a building for a period of time not longer than that necessary to wait for and board a departing vehicle/ship/aircraft or exit the terminal after arrival in an incoming vehicle/ship/aircraft. The premises are designed to suit the primary purpose including the paid/unpaid areas in train stations and restricted areas in airport, with occupants following a planned flow pattern.

Use Classification 5d are other types of assembly premises, not specifically listed under Cap. 172, such as galleries, convention centres, conference centres, churches, amusement arcades, skating rinks, gymnasium, bowling alleys, viewing galleries, museums and columbaria etc. Generally, occupants are not familiar with the building, but they are mobile and capable of self-preservation. The occupant density can be varied greatly, depending upon the function or use of the premises. Occupants may temporarily lose their alertness and/or capability to escape due to the entertainment or exhibition they may be viewing. The fire safety concerns are that the occupants should be warned of a fire at the early stage, that adequate aisle and exit capacity should be available at all times and that the means of escape should be easy to find, well lighted and unobstructed.

#### **Use Classification 6      Industrial Premises**

Industrial premises are buildings generally used as factories, workshops or warehouses in which processing, assembling, mixing, sheltering of goods and products, packaging, finishing, decorating, cleaning, washing and/or repair operations are conducted. These premises include slaughtering houses, film production facilities, power generation plants, shipyards, depots, aircraft maintenance and repair facilities, commercial laboratories, commercial kitchens and commercial laundries etc. Laboratories within schools, hospitals as well as medical laboratories involving collecting samples from visiting human / animal on the premises are excluded.

Occupants are generally familiar with the building and are awake. Occupant density is relatively low in comparison with other premises, except some labour intensive factories. Most manufacturing factories are of a large space to accommodate processing facilities. Dangerous goods may be present.

**Use Classification 7      Carpark Premises**

Carpark premises are similar to vehicle storage with low occupant density. Occupants' familiarity with the carpark depends on whether they are occasional visitors or regular users.

**Use Classification 8      Plant Rooms & the like**

This Use Classification are intended to cover the secondary spaces or back of house spaces within a building such as mechanical and electrical plant rooms, which accommodate very limited number of occupants or are unoccupied including chiller rooms, AHU rooms, compressor rooms, pump rooms, boiler rooms, lift motor rooms, transformer rooms, generator rooms, switchgear rooms, battery and charger rooms, telecommunication and broadcasting services rooms etc.

## **Section 2 – Performance Requirements**

### **Subsection A8 – Means of Escape**

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#### **Functional Statement for Means of Escape**

Building (Planning) Regulation 41(1): Means of escape.

Every building shall be provided with such means of escape in case of emergency as may be required by the intended use of the building.

#### **Performance Requirement B1**

A building, fire compartment or storey should be provided with adequate means of escape for all occupants to evacuate safely without being overwhelmed by the effects of fire.

#### **Performance Requirement B2**

A building, fire compartment or storey should have adequate fire safety provisions to protect evacuating occupants from the impact of fire.

#### **Performance Requirement B3**

The means of escape within a building should have adequate lighting for identification of the locations of exits and paths of travel to an exit in case of fire.

#### **Performance Requirement B4**

Sufficient warning should be provided to the building occupants to evacuate in case of outbreak of fire.

#### **Performance Requirement B5**

Building management should provide an appropriately and effectively managed process to allow for orderly evacuation in case of fire.

#### **Performance Requirement B6**

Adequate signs should be provided for identification of the means of escape in case of fire.

#### **Performance Requirement B7**

Means of escape for tall buildings should be appropriately designed to:

- (a) allow occupants to take a short rest safely, whilst evacuating;
- (b) minimise the threat of smoke within staircases; and
- (c) provide an area for firefighting staging activities.

## **Guidance**

The following factors should be considered for complying with Performance Requirements B1 to B7:

- (a) Use Classification of the building;
- (b) Occupant capacity, nature, location and awareness;
- (c) Fire hazard, its potential growth and duration;
- (d) Building height;
- (e) Building area and fire compartment area;
- (f) Security measures impairing escape;
- (g) Fire safety provisions installed within the building;
- (h) Type, number, size, location and layout of exit routes;
- (i) Suitable resting areas to avoid fatigue;
- (j) Suitable construction to prevent slipping and falling;
- (k) Temperature, visibility, toxicity of smoke;
- (l) Protection from adjoining and adjacent buildings; and
- (m) Fire service intervention.

## **Subsection A9 – Fire Resisting Construction**

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### **Functional Statement for Fire Resisting Construction**

Building (Construction) Regulation 90: Fire resisting construction.

Every building shall be designed and constructed so as to-

- (a) inhibit the spread of fire within the building and to nearby buildings by dividing the building into compartments;
- (b) provide adequate resistance to the spread of fire and smoke by the separation of different uses in a building by compartment walls and floors and by the separation of the building from any adjoining building or site;
- (c) maintain the stability of the building in case of fire; and
- (d) provide adequate resistance to the spread of fire over the roof of one building to another having regard to the position of the building.

### **Performance Requirement C1**

A building should be provided with adequate fire safety provisions to inhibit the spread of fire:

- (a) within a building;
- (b) between buildings or other property;
- (c) to allow occupants to evacuate safely; and
- (d) to allow fire service intervention.

### **Performance Requirement C2**

A building should be constructed to maintain its stability in case of fire to:

- (a) allow sufficient time for occupants to evacuate safely;
- (b) allow fire service intervention.

### **Performance Requirement C3**

The openings or penetrations at fire barriers should be adequately protected to maintain their level of performance in case of fire.

### **Performance Requirement C4**

Building elements should have adequate provisions to minimise the spread of smoke.

### **Performance Requirement C5**

The functions of the fire safety provisions of a building should maintain for a reasonable period of time during a fire.

### **Performance Requirement C6**

Fire safety provisions should be provided to a building or parts of a building undergoing construction, demolition, alteration, repair or maintenance with due consideration to the hazard imposed by the works and the fire safety precautions available.

### **Guidance**

The following factors should be considered for complying with Performance Requirements C1 to C6:

- (a) Use Classification of the building;
- (b) Occupant capacity, nature, location and awareness;
- (c) Fire hazard, its potential growth and duration;
- (d) Building height;
- (e) Building area and fire compartment area;
- (f) Building location in relation to property boundaries;
- (g) Location of roof having regard to other buildings;
- (h) Required duration of tenable conditions to be maintained in fire compartments other than that of fire origin;
- (i) Active fire safety provisions installed within the building;
- (j) The timing of the works; and
- (k) Fire service intervention.

## **Subsection A10 – Means of Access**

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### **Functional statements for means of access**

Building (Planning) Regulation 41A: Access staircases for firemen

Building (Planning) Regulation 41B: Fireman's lifts

Building (Planning) Regulation 41C: Firefighting and rescue stairway

Building (Planning) Regulation 41D: Emergency vehicular access

Every building shall be provided with adequate access to allow firemen safe and unobstructed access to all floors of the building in the event of a fire.

Every building shall also be provided with an emergency vehicular access to allow safe and unobstructed access of a vehicle of the Fire Services Department to the building and to provide for the safe operation of such a vehicle in the event of fire.

### **Performance Requirement D1**

A building should be provided with the following provisions to assist firefighting:

- (a) Access staircases for firemen;
- (b) Fireman's lifts;
- (c) Firefighting and rescue stairways; and
- (d) Emergency vehicular access.

### **Guidance**

The following factors should be considered for complying with Performance Requirement D1:

- (a) Use Classification of the building;
- (b) Occupant capacity, nature, location and awareness;
- (c) Fire hazard, its potential growth and duration;
- (d) Building height;
- (e) Building area and fire compartment area;
- (f) Active fire safety provisions installed within the building; and
- (g) Building location in relation to property boundaries.

## **Subsection A11 – Fire Safety Management**

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### **Functional Statement for Fire Safety Management**

The fire safety provisions provided in a building shall be available during fire emergency.

### **Performance Requirement F1**

The fire safety provisions of a building should be kept in good working order and evacuation procedure are effectively implemented in case of fire.

### **Guidance**

The following factors should be considered for complying with Performance Requirement F1:

- (a) Use Classification of the building;
- (b) Active fire safety provisions installed within the building; and
- (c) Fire hazard, its potential growth and duration.

## Section 3 – Definitions

**“Access staircase”** means a staircase so designed and constructed as to allow firemen safe and unobstructed access to all storeys of a building in the event of fire.

**“Balcony approach”** means a balcony which is used as an external approach to a common staircase and which serves two or more occupancies.

**“Basement”** means any storey, which is below the lower or lowest ground storey and from which any exit route is in an upward direction. A basement may have one or more sides open to the air, due to a sloping site.

**“Bounding Conditions”** means the set of fire safety provisions that must be maintained as a result of a performance-based approach to the fire safety design and that if altered will invalidate the performance-based fire safety design.

**“Compartment area”** means the area of the floors of a building contained within the external surfaces of a fire compartment.

**“Compartment volume”** means the volume of the portion of a building contained within the external surfaces of the walls and floors forming a fire compartment.

**“Cubical extent”**, in relation to a building, means the space contained within the external surfaces of its walls and roof of a building and the upper surface of the floor of its lowest storey, excluding any space within any enclosure on the roof used exclusively for accommodating a water tank or lift gear or any other services, and, if any side of the building is not enclosed by a wall, that side shall be deemed to be enclosed by a wall extending downwards from the outer edge of the roof;

**“Deadend travel distance”** means the overall length of travel within an exit route before an alternative exit is available.

**“Discharge value”** means the number of persons that a staircase of a given width may be assumed to be capable of discharging from a given number of storeys.

**“Element of construction”** means:

- any floor, beam, column, or hanger;
- any loadbearing wall or loadbearing member other than a member forming the roof or part of the roof;
- any required staircase including the landings and supports thereto.

(Note: Any raised flooring system at a height of not more than 600 mm from the original floor will not be considered as an element of construction. In such case, the compartment walls or other fire barriers should start from the structural floor and not just rest on the raised floor.)

**“Emergency Vehicular Access (EVA)”** means a vehicular access used or to be used for access of a vehicle of the Fire Services Department to the building in the event of a fire or other emergency.

**“Exit door”** means a door from a storey, flat, or room, which gives access from such storey, flat or room on to an exit route.

**“Exit route”** means the continuous path of travel from any part of a building to the ultimate place of safety, not including a revolving door, lift or escalator (see Diagram A2).

**“Factory”** is as defined in the Factories and Industrial Undertakings Ordinance (Cap. 59).

**“Fire barrier”** means the construction that has a fire resistance rating separating one space from another. It may form part of a fire compartment.

**“Fire compartment”** means a space enclosed by fire barriers or appropriate construction to all sides such that fire will not spread from the space; or spread into adjoining space.

**“Firefighting and rescue stairway”** means a stairway accommodating an access staircase and a fireman’s lift;

**“Fire resistance rating (FRR)”** means the period of time that a building element is capable of resisting the action of fire when tested in accordance with ISO 834, BS 476: Parts 20 to 24 or equivalent. Fire resistance ratings are designated by three terms, to represent the make up of the element of construction, i.e. X/Y/Z, where:

- X - Stability fire resistance rating (minutes)
- Y - Integrity fire resistance rating (minutes)
- Z - Insulation fire resistance rating (minutes)

**“Fire safety provisions”** means the installations, equipments, systems, building elements or methods used in a building to achieve the fire safety objectives as stated within Subsection A2. The provisions include active fire safety provisions (sprinklers, detectors, alarms etc.) and passive fire safety provisions.

**“Fireman’s lift”** means a lift designed and installed to be used by firemen in the event of a fire;

**“Flat”** means a separate and self-contained dwelling, forming a part of a building from some other part of which it is divided horizontally, and includes a maisonette and tenement floor.

**“Ground storey”** means the storey in which is situated an entrance from a street to the building and, where a building fronts or abuts on more than one street and due to a difference in street levels there are two or more entrances serving different streets and situated in different storeys, means each such storey.

**“Industrial undertaking”** is as defined in the Factories and Industrial Undertakings Ordinance (Cap. 59).

**“Maisonette”** means a flat not being a tenement floor and having more than one but not more than three storeys.

**“Non-combustible”** means a material which satisfies a recognized non-combustibility test stipulated in Part E.

**“Notifiable workplace”** is as defined in the Factories and Industrial Undertakings Ordinance (Cap. 59).

**“Occupant capacity”** means the number of persons, which the room or storey or fire compartment of a building, for the purposes of this Code, is capable of holding. Provided that where there is on any storey the entrance to a maisonette, that storey shall, for the purpose of this definition, be deemed to include all floors of the maisonette.

**“Passive fire safety provisions”** means permanent building features and architectural aspects of a building that prevent fire development and spread. Examples include required staircases, fire rated doors, spandrels, fire barriers, linings with low combustibility etc.

**“Places of public entertainment”** means any building or that part of a building constructed or adapted to be used for any public entertainment and includes the place itself and any means of ingress or egress for the purpose of and in connection with such place, and in cases in which such place consists of a part or parts only of a building includes also any other part or parts of such building used or intended to be used for the purpose of and in connection with such place. Public entertainment in this context is as defined in the Places of Public Entertainment Ordinance (Cap. 172).

**“Protected exit”** means a required staircase, or ramp, or passageway, being enclosed by fire barriers, that leads to an ultimate place of safety.

**“Protected lobby”** means a lobby formed by fire and smoke resisting construction in accordance with Part C to prevent the spread of heat and smoke.

**“Redevelopment site”** means a site that is not a virgin site.

**“Refuge floor”** means a protected floor that serves as a refuge for the occupants of the building to assemble in case of fire, for a short period of time, before reaching an ultimate place of safety.

**“Required staircase”** means an access staircase, whether in a firefighting and rescue stairway or not, or a staircase required for means of escape in case of fire.

**“Smoke seal”** means a sealing compound or component installed at an opening to limit the spread of smoke between two adjoining spaces. Typically it is provided to a door, damper or other penetration where smoke is required to be inhibited.

**“Special hazard”** means a hazard that requires special consideration given the occupant awareness, knowledge of building, fire services systems installed, physical construction and location and width of exits, relative to the ignition risk, spread of fire, generation of smoke, heat or toxic gases that may endanger the life and safety of the occupants. Areas of special hazard have a relatively higher fire risk with regard to ignition. These areas include transformer rooms, central A/C plant rooms, lift machine rooms, main switch rooms, generator rooms, boiler rooms, dangerous goods store rooms, fuel tank rooms and the like.

**“Storey”** means the space between the upper surface of every floor and the upper surface of the floor next above it where such a floor exists and in the case of a top storey the space between the upper surface of that floor and the mean height of the ceiling or roof.

**“Travel distance”** means the horizontal distance measured on the floor along the centreline of the exit route between the furthest point (most remote point) on a storey or within a fire compartment to:

- (a) the centre of the fire rated door to a protected exit or a required staircase, as the case may be; or
- (b) if there is no such door, the first tread of the required staircase; or
- (c) if the exit route leads directly to an ultimate place of safety, any one of the discharge points to the ultimate place of safety.

**“Ultimate place of safety”** means a place of safety for final exit discharge where a protected exit terminates that provides access to an area clear of the effects of fire, where people may safely disperse. The ultimate place of safety is a street or an open area outside the subject building and connects directly with a street, with a width not less than 1.5m wide or the total required width of exit routes discharging into the area, whichever is greater, from which occupants can safely disperse away from the subject building.

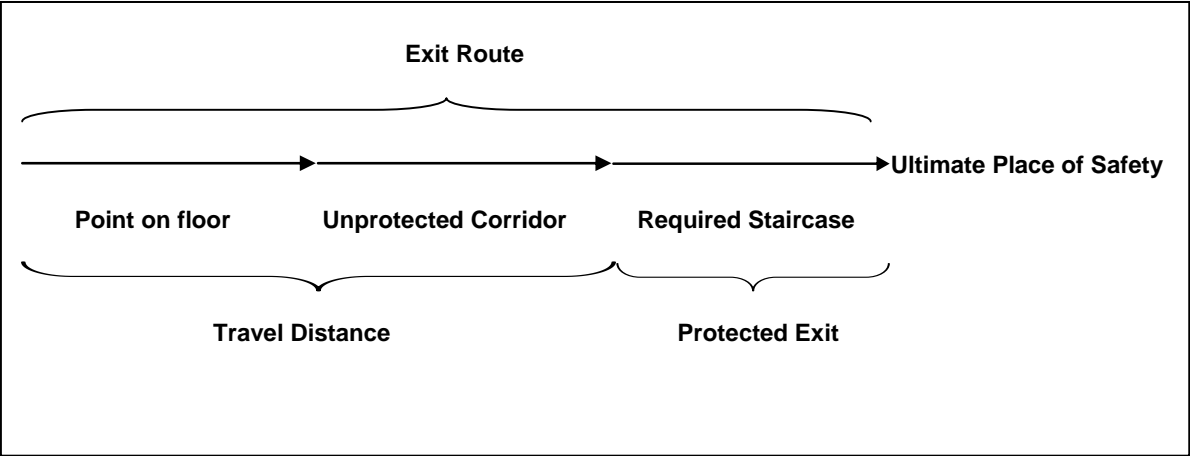
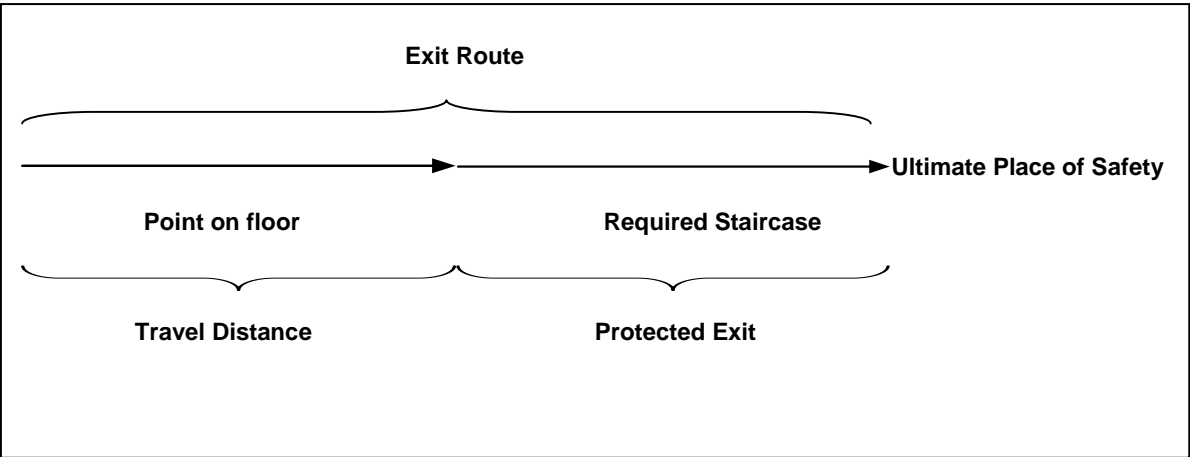
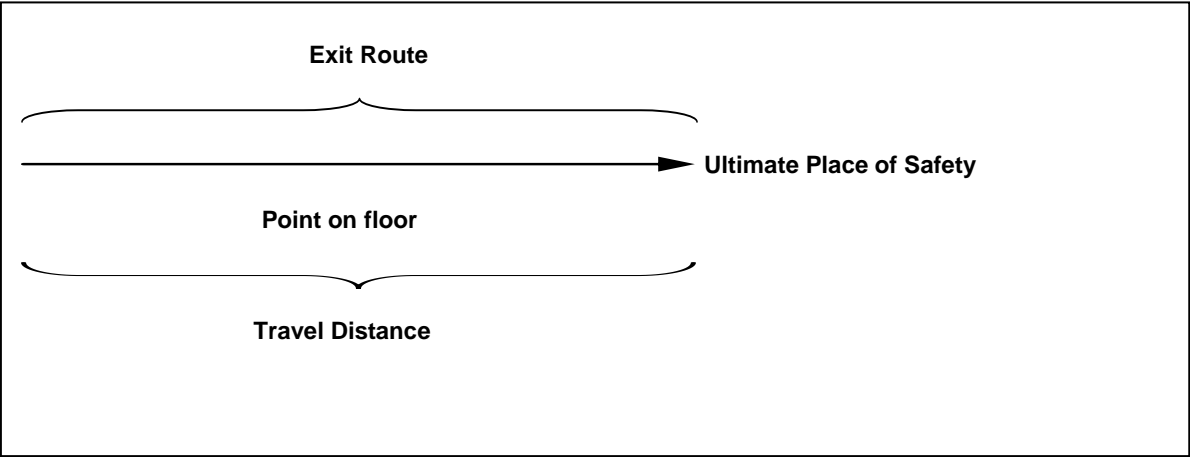
**“Usable floor area”** means the aggregate of the areas of the floor or floors in a storey or a building excluding, unless otherwise specified, any staircase, public circulation space, lift landings, lavatories, water-closets, kitchens in flats, and any space occupied by machinery for any lift, air-conditioning system or similar service provided for the building.

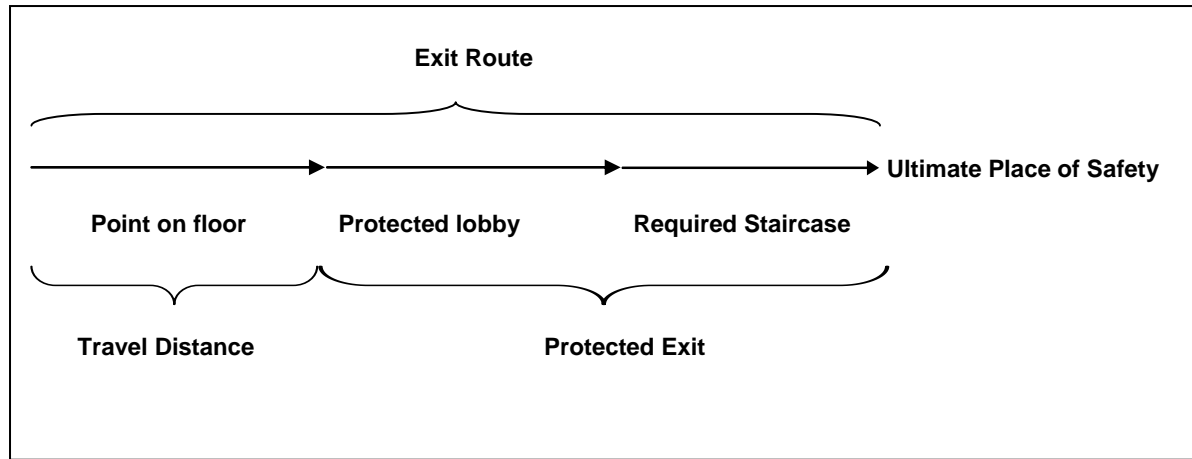
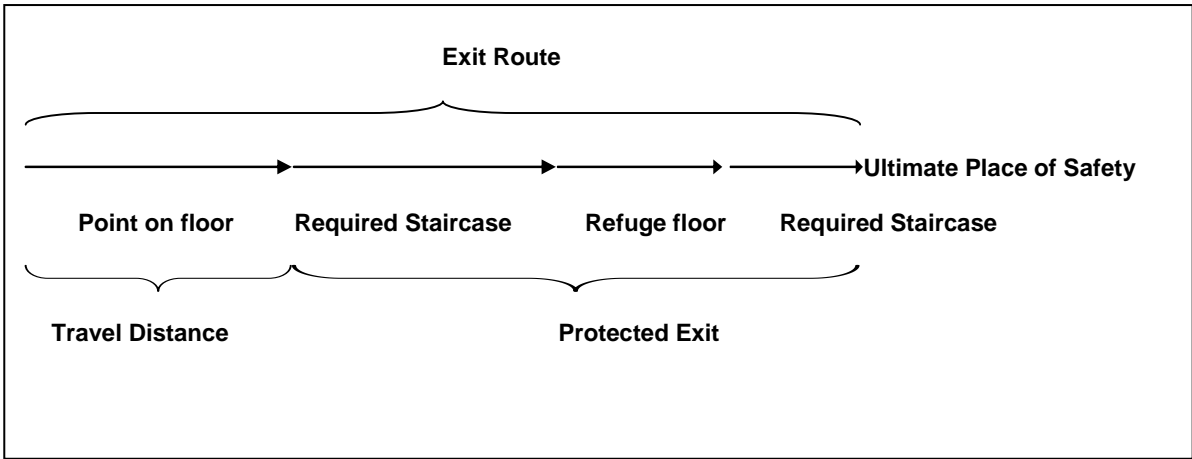
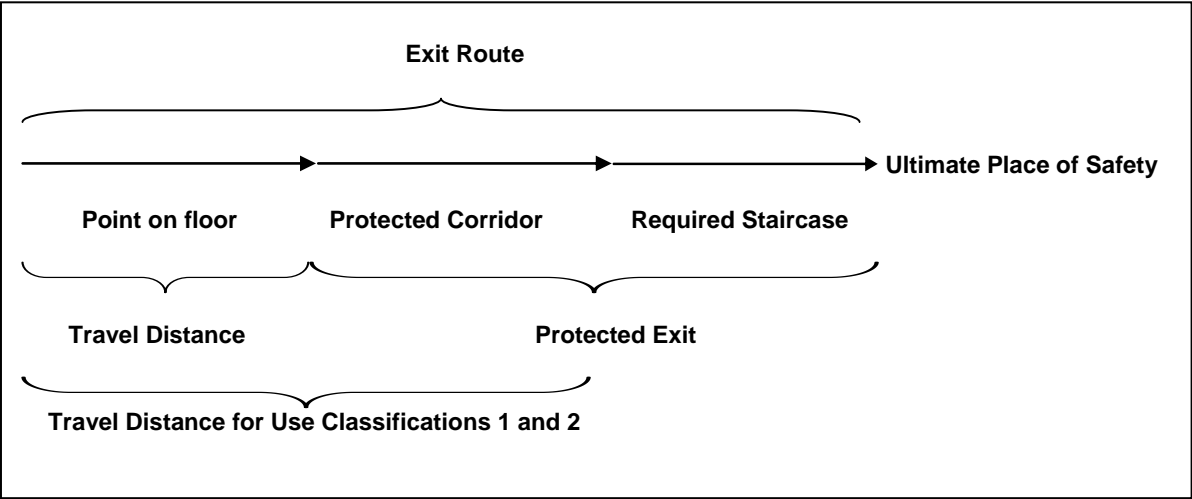
**“Use Classification”** means the categories of use of premises stipulated in Table A1.

**“Virgin site”** means a site where there is no temporary or permanent building, including a building exempted from the Buildings Ordinance under the Buildings Ordinance (Application to the New Territories) Ordinance, in existence before.

**Diagram A2: Illustration of Exit Route**

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**Part B**

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**Means of Escape**

**This Part contains three Sections:**

- **Section 1 – General**
- **Section 2 – Provisions of Means of Escape**
- **Section 3 – Special Provisions on Means of Escape for Use Classification 5a**
- **Section 4 – Provisions of Means of Escape for Persons with a Disability**

## **Section 1 – General**

### **Subsection B1 – Use of this Part**

#### **Clause B1.1**

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This Part provides the Deemed-to-Comply provisions for means of escape and should be read in conjunction with all other Parts in this Code.

#### **Clause B1.2**

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Authorized persons, fire safety consultants and any person responsible for the design of buildings may find this Part useful in ascertaining the requirements under the Buildings Ordinance for provisions of means of escape in case of fire.

#### **Clause B1.3**

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This Part provides guidance on how the Performance Requirements on the provisions of means of escape may be complied with.

### **Subsection B2 – Performance Requirements for Means of Escape**

#### **Clause B2.1**

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Performance Requirements on the provisions of means of escape are stipulated in Subsection A8 of Part A.

### **Subsection B3 – Application**

#### **Clause B3.1**

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The provisions in this Part apply to all buildings with the exception of domestic buildings:

- (a) having not more than three main domestic storeys;
- (b) the level of the highest floor of which is not more than 13m above the ground level;  
and
- (c) used or intended to be used for occupation by a single family.

### **Clause B3.2**

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Where any Ordinance or any Regulations made under any Ordinance includes any provisions relating to means of escape in case of fire, nothing in this Part should be deemed to overrule such provisions. In this connection, attention is drawn to the following Ordinances and the Regulations:

- (a) Bedspace Apartments Ordinance (Cap. 447);
- (b) Child Care Services Ordinance (Cap. 243);
- (c) Education Ordinance (Cap.279);
- (d) Factories and Industrial Undertakings Ordinance (Cap. 59);
- (e) Fire Services Ordinance (Cap. 95);
- (f) Hotel and Guesthouse Accommodation Ordinance (Cap. 349);
- (g) Karaoke Establishments Ordinance (Cap. 573);
- (h) Residential Care Homes (Elderly Persons) Ordinance (Cap. 459).

### **Clause B3.3**

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For situations not covered in this Part, the means of escape requirements will be determined by the Building Authority according to the circumstances of individual cases.

## Section 2 – Provisions of Means of Escape

### Subsection B4 – Assessment of Occupant Capacity

#### Clause B4.1

As a guide to assessing the requirements on means of escape, the following Table B1 should be used as the basis for calculating the occupant capacity of a building or part of a building.

**Table B1: Assessment of Occupant Capacity**

Use Classification	Type of Accommodation	Occupancy Factor (usable floor area in m <sup>2</sup> per person) or otherwise as specified
1b	Flats:	
	- with corridor or balcony access having five or more flats on each floor served by each staircase	4.5
	- flats not covered by the above	9
1c	Tenement houses	3
2	Boarding houses, hostels, hotels, motels, Guesthouses	Number of bedspaces
	Dormitories	3
3a	Day care centres, nurseries, child care centres	4
	Hospitals (areas other than the patient care areas)	9
	Patient care areas	Number of bedspaces
3b	Detention and Correctional Centres	Number of bedspaces
4a	Offices	9
	- Board rooms, conference rooms, function rooms	10
	- Staff rooms	9
4b	Retail shops / Department Stores (including arcade and common areas)	
	Basement, G/F, 1/F & 2/F	3
	3 <sup>rd</sup> floor & above	4.5

Use Classification	Type of Accommodation	Occupancy Factor (usable floor area in m <sup>2</sup> per person) or otherwise as specified
	Markets, supermarkets, showrooms, jewellery and goldsmith shops, pawn shops and money changers	2
	Café, restaurants, dining areas, lounges, bars and pubs	1
	Banking halls (areas accessible to the public)	0.5
	Betting halls (areas accessible to the public)	0.5
	Places where public information or service counters are provided (areas accessible to the public)	0.5
5a	Art galleries, exhibition areas, museums	2
	Cinemas:	
	Seating areas	Number of seats
	Foyer areas	0.5
	Dance floors	0.75
	Sports Stadia	
	standing	0.5
	removable seating	0.5
	fixed seating	Number of seats
	bench seating	450mm/person
	Indoor sports facilities:	
	Sports / activity areas	10
	standing	0.5
	removable seating	0.5
	fixed seating	Number of seats
	bench seating	450mm/person
	Theatres:	
	Seating areas	Number of seats
	Foyer areas	0.5
5b	Libraries	2
	Reading rooms, study rooms	1
	Classrooms of school not covered by the Education Ordinance, lecture rooms	2 or number of seats

Use Classification	Type of Accommodation	Occupancy Factor (usable floor area in m <sup>2</sup> per person) or otherwise as specified
5c	Transport facilities like passenger terminals, railway stations, etc.	Based on actual design and layout
5d	Public halls, assembly halls, conference halls removable seating fixed seating	0.5 Number of seats
	Gymnasia	3
	Swimming Pool	3
	Columbaria	2
	Viewing galleries	0.5
6a	Commercial Laundries	10
	Commercial Laboratories	10
	Factories / Workshops	4.5
	Commercial Kitchens	4.5
6b	Warehouses	30
6c	Storage, manufacturing of hazardous/ dangerous goods premises	30
7	Carparks	30
8	Plant rooms, switch rooms, transformer rooms, etc.	30

Notes:

1. The occupant capacity in a single user specialised industrial workplace will be determined by the Commissioner for Labour according to the specialised trade process proposed.
2. For any use not specified in this Table, the Building Authority should determine the factor to be used.
3. The Building Authority recognises actual counting as a reliable way to establish the occupant capacity of a building.
4. The occupant capacity in Karaoke Establishments should refer to “A Guide to Application for Karaoke Establishment Permits in Restaurant” issued by the Food and Environmental Hygiene Department.
5. The usable floor area for assessing the occupant capacity in the swimming pool in Use Classification 5d refers to the water surface area of the swimming pool.

6. Regarding columbaria in Use Classification 5d, for the avoidance of doubt, except the area for accommodation of niches and staircases, the prescribed width of exit routes including corridors of “balcony approach design” and the circulation areas such as lift lobbies etc. should be included in the calculation of usable floor area of a columbarium.
7. For Use Classification 8, the net floor area should be used in applying the occupancy factor. If the net floor area of a room does not exceeding 100m<sup>2</sup>, the occupant capacity is considered to be zero.

## **Subsection B5 – General Requirements of Exit Routes**

### **Clause B5.1**

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Every building to which this Part applies should be so constructed that there are available from each storey or fire compartment of the building such exits and exit routes as will comply with the requirements set out in this Part.

### **Clause B5.2**

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Every exit route should lead directly to an ultimate place of safety. Such exit route should not be closed with doors or gates unless such doors or gates are capable of being readily opened from inside and in the direction of the exit route without the use of key(s).

### **Clause B5.3**

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If an exit route leads to an open area at any upper floor levels of the building such as the podium level, instead of leading directly to an ultimate place of safety, the exit route at such floor level:

- (a) should be adequately defined by permanent features e.g. handrail or railing;
- (b) should lead to an ultimate place of safety; and
- (c) should be designed and constructed as if it is part of the protected exit complying with the requirements in this Part and Clause C12.4.

See Diagram B1.

### **Clause B5.4**

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In a building where there is an area of special hazard that is directly associated with an area of normal hazard, any opening from such area of special hazard into any exit route should be provided with a protected lobby. The exit route from the area of normal hazard should not pass through any area of special hazard.

[Note: A restaurant with kitchens or food preparation rooms using gas fuel or electricity for food production is considered as “notifiable workplace” under Factories and Industrial Undertakings (Fire Precautions in Notifiable Workplaces) Regulations (Cap.59V). See Clause B13.6 regarding the provisions of means of escape for these premises.]

#### **Clause B5.5**

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Every part of an exit route should be provided at all time with lighting of a horizontal illuminance at floor level of not less than 30 lux. The lighting can be a combination of natural and artificial light and should be backed up by an emergency lighting system that complies with the Code of Practice for Minimum Fire Service Installations and Equipment.

#### **Clause B5.6**

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Exit routes from a building should not discharge into a private lane unless the lane is properly paved and free from any permanent obstruction and the Building Authority is satisfied with the integrity of the lane as an ultimate place of safety.

#### **Clause B5.7**

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If the discharge point of the exit route to the ultimate place of safety is so sited that it adjoins another exit route or other accommodation, the walls enclosing the exit route should be returned along the frontage of the final discharge or project from the frontage for a distance of not less than 450mm, provided that any return should not reduce the effective width of the exit route.

#### **Clause B5.8**

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If the discharge point of an exit route to the ultimate place of safety has a drop in level with a door or gate installed, the door or gate should be set back from the line of drop in level for a distance of not less than the width of the exit route. If the drop level consists of a single step, it should be so marked that the step is clearly visible.

#### **Clause B5.9**

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Every part of an exit route should have a clear headroom of not less than 2000mm, provided that sprinkler heads may be installed along the side wall of the exit route and every such sprinkler head should not project:

- (a) more than 90mm from such side wall; and
- (b) so as to reduce the clear headroom of the exit route by more than 105mm.

#### **Clause B5.10**

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Directional and exit signs should be provided to indicate the location of protected exits and assist occupants with their path of travel along the exit route. Such signs should comply with the requirements in the Code of Practice for Minimum Fire Service Installations and Equipment.

**Clause B5.11**

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If the roof is not accessible by the required staircase(s), a notice in the following form with words and characters of not less than 50mm high should be securely fixed at a conspicuous position at the entrance to the required staircase(s) on every floor.

**This staircase has no access to the roof**

此樓梯不能通往天台

## **Subsection B6 – Buildings with Only One Required Staircase**

### **Clause B6.1**

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Pursuant to Clause B8.1, no building will be permitted to have only one required staircase unless such building complies with the following requirements:

- (a) The building does not exceed 6 storeys in height and the level of the floor of the uppermost storey is not more than 17m above the level of the ground at the discharge point of the required staircase;
- (b) No room or storey of the building may be used for any occupancy other than domestic or offices, except the ground storey may be used for the purposes of a shop or carparking space provided that the requirements for required staircase enclosures in Part C are complied with;
- (c) In the case of a building in which the level of the highest floor is not more than 13m above ground level the usable floor area of any storey above the ground storey should not exceed 250m<sup>2</sup>; and
- (d) In the case of a building in which the level of the highest floor is more than 13 m above ground level:
  - (i) the usable floor area of any storey above the ground storey should not exceed 150m<sup>2</sup>;
  - (ii) access to the required staircase at each storey should be through a protected lobby. Such lobby should be designed as a common area and an integral part of the required staircase so that it could not be readily incorporated as part of any adjacent unit(s) of accommodation;
  - (iii) the required staircase should be continued to the roof;
  - (iv) there should be available on the roof an area of flat surface for refuge of not less than 0.5 m<sup>2</sup> per person based on the total population of the building above ground storey determined according to Table B1. Such flat roof should be accessible directly from the required staircase, clear of any obstruction, and is so positioned that it is readily accessible for rescue purposes; and
  - (v) the roof should comply with the requirements in Subsection C12 of Part C.

## **Subsection B7 – Exits from Rooms and/or Fire Compartments**

### **Clause B7.1**

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There should be available from every room or fire compartment of an occupant capacity exceeding 3 persons not less than the number of exit doors shown in Table B2 according to the occupant capacity of the room or the fire compartment. The width of each exit door and the total width of all the exit doors should be not less than the width shown in Table B2 according to the occupant capacity and the number of exit doors provided.

#### **Commentary**

For different situations, the number and width of exit doors required should be determined by assessing the occupant capacity within a room or within a fire compartment.

### **Clause B7.2**

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Every exit door provided according to Clause B7.1 should give access to an exit route which complies with Subsection B5 and which is independent of any other exit route to which access may be directly obtained from that room. Provided that the occupant capacity does not exceed 200 persons, the exit doors may give access to a single corridor or balcony approach from which it is possible to escape in more than one direction.

### **Clause B7.3**

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Where two or more exit doors (required by Table B2) vary in width, any width of an exit door in such group in excess of 50% above the width of the narrowest exit door in such group should not be included in the calculation for the minimum total width of exit doors as required in column 3 of Table B2.

## **Subsection B8 – Exits from Storeys**

### **Clause B8.1**

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Every building, except those buildings permitted under Clause B6.1 to have only one required staircase, should be so constructed that there are available from each storey not less than 2 exit routes or such greater number as may be required by Table B2. The width of each exit route and the total width of all the exit routes should be not less than the width shown in Table B2 according to the occupant capacity and the number of exit routes provided. Provided that:

- (a) this requirement should apply to only one of the storeys of a maisonette; and
- (b) where two or more exit routes (required by Table B2 to serve a storey) vary in width, any width of an exit route in such group in excess of 50% above the width of the narrowest exit route in such group should not be included in the calculation for the minimum total width of exit routes as required by column 4 of Table B2.

### **Clause B8.2**

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Where two or more required staircases are needed, people using one required staircase should be able to gain access to at least one other required staircase at any time, without having to pass through other person's private premises. Such access should be provided in the following manners:

- (a) at each floor;
- (b) in case of domestic building or composite building not exceeding 15 storeys in height above the lowest ground storey, at least every 5 storeys; or
- (c) in case of refuge floor(s) are provided evenly between floors of the building, at the refuge floor(s) and the roof.

Security measures that prevent access to a required staircase must be automatically deactivated upon actuation of a fire alarm or in power failure situation.

**Table B2**

**Table B2: Minimum number and width of exit doors and exit routes from a room, fire compartment or storey**

Occupant Capacity of room, fire compartment or storey (No. of persons)	Minimum No. of exit doors or exit routes	Minimum total width (in mm)		Minimum Width (in mm) of each	
		Exit doors	Exit routes	Exit door	Exit route
4- 30	1			750	1050
31-200	2	1750	2100	850	1050
201-300	2	2500	2500	1050	1050
301-500	2	3000	3000	1050	1050
501-750	3	4500	4500	1200	1200
751-1000	4	6000	6000	1200	1200
1001-1250	5	7500	7500	1350	1350
1251-1500	6	9000	9000	1350	1350
1501-1750	7	10500	10500	1500	1500
1751-2000	8	12000	12000	1500	1500
2001-2250	9	13500	13500	1500	1500
2251-2500	10	15000	15000	1500	1500
2501-2750	11	16500	16500	1500	1500
2751-3000	12	18000	18000	1500	1500
>3000 persons - the number of exit doors, exit routes and their width to be determined by the Building Authority					

Notes:

1. In the case of Places of Public Entertainment (Use Classification 5a), the requirements in Section 3 should be complied with.
2. The width of an exit door should be the least clear width measured between the vertical members of the door frame.
3. The width of a required staircase, staircase landing, passage or corridor comprising an exit route should be measured between the finished surfaces of the walls or of the inner sides of any balustrade and should not be decreased by the introduction of any projections other than handrails the projection of which should not exceed 90mm.
4. The Table shows the minimum requirement on the assumption that doors can be readily and freely opened by occupants in case of fire.

#### **Commentary**

Floors containing more than 3000 people may be designed by fire engineering. This is particularly relevant for large floor area buildings such as exhibition spaces, conference halls, sports facilities.

## **Subsection B9 – Exits at Ground Storey**

### **Clause B9.1**

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The enclosing walls of every required staircase should be so continued at ground storey as to separate from the remainder of the building any passage or corridor leading from the required staircase to its ground storey discharge point. Every opening from the ground storey to such passage or corridor should be separated from it by a protected lobby; provided that:

- (a) in the case of a building served by two or more required staircases, a cloakroom, lavatory, water-closet, caretaker's office, fire control room or caretaker's counter may open off such passageway; and
- (b) in the case of a building served by three or more required staircases, one in every three such required staircase may discharge through fire rated doors to an entrance hall and that part of the entrance hall which forms the exit route should comply with the requirements of Subsection B5.

### **Clause B9.2**

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Where an exit route from a ground storey also forms part of the exit route from a required staircase, the width of such exit route should be not less than the sum of:

- (a) half the width required for the exit route from the ground storey;
- (b) the width required for the required staircase from the upper storeys; and
- (c) the width required for the required staircase, if any, from the basements.

## **Subsection B10 – Access to Required Staircase(s) within a Building**

### **Clause B10.1**

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In case of a building with one required staircase, attention is drawn to the requirements in Subsection B6.

### **Clause B10.2**

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In the case of a building with two or more required staircases, the access to the required staircases should be so arranged that:

- (a) each required staircase is approached from a different direction provided that deadends are permitted, in accordance with Clause B11.2; and
- (b) the door of one required staircase, or the nearest point in the perimeter of the landing to the required staircase where there is no door, should not be nearer than 6m from the door or a similar point of any other required staircase measured in a straight line along the wall. See Diagram B2.

### **Clause B10.3**

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The means of escape from any part of a building should be so arranged that it is not necessary to pass through one required staircase enclosure including the protected lobby provided under Clause B10.4(b) or Clause B17.5 or the landing of one required staircase, as the case may be, in order to reach another required staircase.

### **Clause B10.4**

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Where internal access is provided:

- (a) no door opening on to an internal common corridor should at any part of its swing reduce the minimum required width of such corridor;
- (b) a protected lobby should be provided to each and every required staircase forming part of a protected exit unless the required staircase is:
  - (i) in a building with only one required staircase described in Subsection B6 in which the level of the highest floor is not more than 13m above ground level; or
  - (ii) in a building which is provided with two or more required staircases and the level of the highest floor is not more than 20m above ground level; or
  - (iii) provided with a pressurization system complying with the Code of Practice for Minimum Fire Service Installations and Equipment; or
  - (iv) a ventilated staircase.

Such lobby should be designed as a common area and an integral part of the required staircase so that it could not be readily incorporated as part of any adjacent unit(s) of accommodation.

### **Clause B10.5**

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A ventilated staircase in Clause B10.4(b)(iv) should have openings that provide effective cross ventilation at each storey level. Such staircase should comply with the following requirements:

- (a) At least 50% of its perimeter is open to external air including; at least 50% of the opening is on the long face of the staircase and at least 25% of the opening is on the other faces;
- (b) The length of opening should be measured on plan and is open from the top of the balustrade or parapet to the underside of the flight of the staircase immediately above;
- (c) The openings should be evenly distributed across the elevations; and
- (d) The requirements in Part C.

## **Clause B10.6**

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Where balcony approach is provided:

- (a) the balcony approach should be protected in accordance with the requirements in Part C;
- (b) the landing of any required staircase should not form part of the balcony approach;
- (c) no door opening on to the balcony approach should at any part of its swing reduce the minimum required width of the balcony approach; and
- (d) where there is a choice of exit routes (no deadend travel distance), every window opening on to the balcony approach should be so arranged that it should not be possible to fix any such window in an open position in such a manner as will reduce the minimum required width of the balcony approach. Windows are allowed to open through 180° and be fixed open in that position or fanlights at a height not less than 2000mm above the balcony level.

## **Subsection B11 – Travel Distance**

### **Clause B11.1**

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Travel distance is defined and explained in Part A.

### **Clause B11.2**

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The deadend travel distance is limited to:

- (a) for Use Classifications 1 and 2:
  - (i) 24m from any point within a flat/hotel guestroom to the exit door of that flat/guestroom;
  - (ii) 15m from the flat/hotel guestroom exit door to the required staircase or to a point, from which travel in different directions to 2 or more exits is available;
- (b) for Use Classification 3:
  - (i) 12m to the protected exit or to a point, from which travel in different directions to 2 or more protected exits is available;
  - (ii) Where balcony approach is provided to the storeys complying with Clause B10.6, 24m to the protected exit or to a point of choice, from which travel in different directions to 2 or more protected exits is available;
- (c) for all other Use Classifications:
  - (i) 18m to the protected exit or to a point, from which travel in different directions to 2 or more exits is available;
  - (ii) Where balcony approach is provided to the storeys complying with Clause B10.6, 24m to the protected exit or to a point of choice, from which travel in different directions to 2 or more protected exits is available.

### **Clause B11.3**

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- (a) In a storey which is served by two or more protected exits or points of discharge to an ultimate place of safety, the maximum travel distance including any deadend travel distance, is limited to:
  - (i) for Use Classifications 1 and 2: 24m from the flat/guestroom exit door to the nearest required staircase; 45m if along balcony approach.
  - (ii) for Use Classification 3: 30m to the nearest protected exit; 45m if along balcony approach.
  - (iii) for all other Use Classifications not provided with balcony approach: 36m to the nearest protected exit; 45m if along balcony approach.
- (b) The horizontal distance measured on plan along the centreline of the exit route between a required staircase or a discharge point and any one of the other required staircases or discharge points, as the case may be, should not exceed 48m. The distance should be measured between:
  - (i) the centre of the fire rated doors to the enclosures of the required staircases;
  - (ii) if there is no such door, the landings of the required staircases; or
  - (iii) in the case of an open podium floor, the points as described in (i) or (ii) above, or the first treads of the open required staircases nearest to the podium.

The requirements stipulated in this Subsection are illustrated in:

- Diagram B2      Internal Corridor Access
- Diagram B3      Open Plan Layout
- Diagram B4      Balcony Approach

### **Clause B11.4**

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Where a flat has three or more levels, at least two levels should each have an access to a protected exit.

### **Clause B11.5**

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An inner room, i.e. a room from which the only exit route is through another room, should not be acceptable unless the following conditions are complied with:

- (a) the occupant capacity of the inner room does not exceed 30;
- (b) the exit route from the inner room does not pass through more than one other room;
- (c) the distance from any point in the inner room to the exit of the room providing the access to the inner room, does not exceed the deadend travel distances stipulated in Clause B11.2;
- (d) the room giving access to the inner room is not an area of special hazard and is under the control of the same occupant; and
- (e) a vision panel, except in the case of a toilet, is located in the door or walls of the inner room. This may be substituted by alternative provisions, such as a fire alarm system audible in the room, which may serve to alert persons in the inner room of any danger from fire or smoke.

This clause does not apply to areas or rooms of a flat escaping through living/dining room or kitchen of the flat.

### **Clause B11.6**

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For any room or storey where two or more exit doors are required to be provided under Table B2, a line measured from any point on the floor of that room and storey to one of the exit doors should form an angle of not less than 30° with a line measured from the same point to any other exit door.

### **Clause B11.7**

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For the purposes of Clauses B11.2 and B11.3, a secondary exit door is not considered to be provided within a room unless a line measured from any point in the room to one of the exit doors forms an angle of not less than 30° with a line measured from the same point to the other exit door.

## **Subsection B12 - Discharge Value and Width of Required Staircase**

### **Clause B12.1**

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The required staircases serving the storeys of a building above the ground storey should have a total discharge value of not less than the total occupant capacity of those storeys assessed in accordance with Subsection B4.

### **Clause B12.2**

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The required staircases serving the basements of a building should have a total discharge value of not less than the total occupant capacity of those basements assessed in accordance with Subsection B4.

### **Clause B12.3**

---

The discharge value of a required staircase in a non-sprinkler protected building should be assessed from Table B3 according to the width of the required staircase and the number of storeys it serves.

### **Clause B12.4**

---

The discharge value of a required staircase in a sprinkler protected building should be assessed from Table B4 according to the width of the required staircase and the number of storeys it serves.

### **Clause B12.5**

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For the purpose of this Subsection, sprinkler protected buildings are those where the whole building is protected by sprinklers complying with the Code of Practice for Minimum Fire Service Installations and Equipment. Where part of a building is protected by sprinklers and other part is not and the required staircases serving these different parts are not separated, the discharge value of such required staircase should be assessed from Table B3.

**Table B3****Table B3: Discharge Value of a Required Staircase in a Non-Sprinkler Protected Building**

No. of storeys served	Width of required staircase					
	1050mm but under 1200mm	1200mm but under 1350mm	1350mm but under 1500mm	1500mm but under 1600mm	1600mm but under 1700mm	1700mm to 1800mm
1	210	240	270	300	320	340
2	242	278	315	351	377	402
3	274	316	360	402	434	464
4	306	354	405	453	491	526
5	338	392	450	504	548	588
6	370	430	495	555	605	650
7	402	468	540	606	662	712
8	434	506	585	657	719	774
9	466	544	630	708	776	836
10	498	582	675	759	833	898
Each additional storey add	32	38	45	51	57	62

Note:

1. The discharge value of a required staircase having a width of more than 1800mm may be obtained by using linear projection from the table.

**Table B4****Table B4: Discharge Value of a Required Staircase in a Sprinkler Protected Building**

No. of storeys served	Width of required staircase					
	1050mm but under 1200mm	1200mm but under 1350mm	1350mm but under 1500mm	1500mm but under 1600mm	1600mm but under 1700mm	1700mm to 1800mm
1	420	480	540	600	640	680
2	452	518	585	651	697	742
3	484	556	630	702	754	804
4	516	594	675	753	811	866
5	548	632	720	804	868	928
6	580	670	765	855	925	990
7	612	708	810	906	982	1052
8	644	746	855	957	1039	1114
9	676	784	900	1008	1096	1176
10	708	822	945	1059	1153	1238
Each additional storey add	32	38	45	51	57	62

Note:

1. The discharge value of a required staircase having a width more than 1800mm may be obtained by using linear projection from the table.

### **Clause B12.6**

---

The discharge value of a required staircase where the direction of exit is upwards should be assessed from Table B3 for non-sprinkler protected building or Table B4 for sprinkler protected building, as the case may be, and multiplied by a reduction factor of 0.8.

### **Clause B12.7**

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The discharge value of a scissors staircase without any intermediate landing between 2 consecutive floors should be assessed from Table B3 for non-sprinkler protected building or Table B4 for sprinkler protected building, as the case may be, and multiplied by a reduction factor of 0.7.

## **Subsection B13 - Doors in Relation to Exits**

### **Clause B13.1**

---

Every door across an exit, or into an exit route from a room or storey with the occupant capacity exceeding 30, should:

- (a) open in the direction of exit; or
- (b) if constructed to open both ways, have a transparent upper view panel.

### **Clause B13.2**

---

If it is necessary to secure an exit door against entry from outside, the locking device should be of the type that is capable of being readily opened from the inside without the use of a key. When a push plate, push bar or a single action lever handle is installed, it should not be encased. A locking device which is electrically operated should be capable of automatic release upon actuation of an automatic heat or smoke detection system or the operation of an alarm system or a central manual override designed and installed to the satisfaction of the Director of Fire Services. Upon power failure, the electrical locking device should be released automatically. In the case of a door to a required staircase or a protected lobby of the required staircase, the security mechanism should not affect compliance with the requirements in Clause B8.2.

### **Clause B13.3**

---

Every door opening on to a landing between flights of a required staircase should not at any point of its swing, reduce the effective radius of the landing to less than the width of the required staircase.

#### **Clause B13.4**

---

Exit door from a room or storey having an occupant capacity in excess of 3 persons should not be less than 750 mm in width. In the case of a double leaf door, no leaf of such door should be less than 600 mm in width and, where the meeting stiles are rebated, a checking device to control the closing order of the doors should be installed. Such checking device should ensure that both leaves of door are closed in the correct order and position.

#### **Clause B13.5**

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Every door giving access to a protected lobby from a required staircase enclosure or from a storey should be provided with a transparent upper view panel of the required FRR.

#### **Clause B13.6**

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In the case of factories and industrial undertakings that are required to be notified to the Commissioner for Labour, i.e. notifiable workplace:

- (a) every exit door leading out of a notifiable workplace, and the doors of every room in a notifiable workplace in which 10 persons or more are employed, should be constructed so as to open outward; and
- (b) every exit door leading out of a notifiable workplace should be fitted with an effective self-closing device.

#### **Clause B13.7**

---

Every door to a required staircase or a protected lobby of the required staircase should comply with the following requirements:

- (a) The self-closing mechanism should not be capable of allowing a check action to hold the door open; and
- (b) Appropriate notices should be fixed to both sides of the doors to remind building users that the doors should normally be kept closed.

#### **Clause B13.8**

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Every door across an exit or into an exit route from a room, except a door to a required staircase or a protected lobby of the required staircase, if required to be self-closing, may be held open in normal times provided that the hold-open device can be released to allow the door to become self-closing again manually and automatically upon actuation of an automatic heat or smoke detection system or the operation of an alarm system or a central manual override designed and installed to the satisfaction of the Director of Fire Services.

## **Subsection B14 – Construction of Required Staircases**

### **Clause B14.1**

---

Every required staircase should be constructed in accordance with the requirements in Part C.

### **Clause B14.2**

---

Required staircases should be arranged in straight flights without winders, each flight should consist of not more than 16 risers nor less than 2 risers. Treads should be not less than 225mm wide, measured clear of nosings and risers should be not more than 175mm high. Provided that:-

- (a) the treads in Use Classification 5a should be not less than 280mm wide and the risers should be not more than 150mm high; and
- (b) the treads in Use Classification 5b should be not less than 250mm wide and the risers should be not more than 150mm nor less than 75mm high.

### **Clause B14.3**

---

Landings should be provided at the top and bottom of each flight not less in width and length than the width of required staircase, and no exit door should be at any part of its swing reduce the effective width or effective radius of such landing as the case may be.

### **Clause B14.4**

---

Every required staircase should have a clear width of not less than that required by Clause B8.1 and a clear headroom of not less than 2000mm.

### **Clause B14.5**

---

No required staircase should exceed 1800mm in width. If a wider staircase is required, it should be divided by a central handrail into separate sections such that each section should be not less than 1050mm but not more than 1800mm in width.

### **Clause B14.6**

---

A handrail should be provided on each side of the required staircase. Every such handrail should:

- (a) be at a height not less than 850mm nor more than 1100mm;
- (b) not project so as to reduce the clear width of the required staircase by more than 90mm, for each handrail; and
- (c) be continuous throughout each flight, but need not be carried round a landing or half landing except in the case of a premises of Use Classification 5a.

## **Subsection B15 - Ramps**

### **Clause B15.1**

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The gradient of every ramp forming part of an exit route should not at any part be steeper than 1:12.

## **Subsection B16 – Lift Lobbies**

### **Clause B16.1**

---

Every lift lobby should have access, without any obstruction and lockable door, to an exit route. Such access should be available at all times to any person who may come out from a lift car to the lift lobby. The provision of a direct intercom link backed up by emergency power for at least 2 hours connecting a lift lobby with the management office of the building will be accepted as an adequate alternative.

## **Subsection B17 - Basements**

### **Clause B17.1**

---

Every basement should have not less than two exits, except a basement:

- (a) the floor of which is not more than 3000mm below the level of the ground to which the exit serving such basement gives access;
- (b) the area of which does not exceed 150m<sup>2</sup>; and
- (c) which is used solely for a lavatory or plant room.

### **Clause B17.2**

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Sufficient directional and exit signs to indicate the direction of exit should be displayed within each required staircase serving the basement. Such signs should comply with the Code of Practice for Minimum Fire Service Installations and Equipment.

### **Clause B17.3**

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No required staircase serving the storeys of a building above the ground storey should be continued direct to a basement.

### **Clause B17.4**

---

In the case of a basement, except a basement used solely as a lavatory, which is below the lowest ground storey and from which all the required exit routes discharge in an upward direction, at least one exit from each floor of the basement should serve that floor only and discharge independently of any other exit into an ultimate place of safety.

### **Clause B17.5**

---

A protected lobby should be provided to every required staircase serving the basement, except for the required staircase provided with a pressurization system complying with the Code of Practice for Minimum Fire Service Installations and Equipment or it is an independent staircase complying with Clause B17.4.

## **Subsection B18 – Refuge Floors**

### **Clause B18.1**

---

Save as provided in Clause B18.5, refuge floors should be provided for all buildings exceeding 25 storeys in height above the lowest ground storey, at not more than 20 storeys and 25 storeys respectively for the buildings in Use Classification 6 and in other Use Classifications from any other refuge floor; or above the street or the ultimate place of safety. For the purpose of this clause, the number of storeys may exclude storeys which contain solely mechanical plants.

### **Clause B18.2**

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Every refuge floor, except that provided under Clauses B18.3 and B18.5, should comply with the following requirements:

- (a) There is no occupied accommodation or accessible mechanical plant room, except fire services water tanks and associated fire service installation plant room, at the same level as the refuge floor;
- (b) The net area for refuge should be not less than 50% of the total gross floor area of the refuge floor and should have a clear headroom of not less than 2300mm;
- (c) The minimum dimension of the area for refuge should be at least 50% greater than the width of the widest required staircase passing through the refuge floor;
- (d) The area for refuge should be separated from the remainder of the building in accordance with the requirements in Part C;
- (e) The area for refuge should be open-sided above safe parapet height on at least two opposite sides to provide adequate cross ventilation; the open sides should comply with the requirements in the Part C;
- (f) Any required staircase passing through a refuge floor should be discontinued at such level so that the exit route is diverted to pass over part of the refuge area before it is continued to exit downwards;
- (g) Every part of the area for refuge should be provided with at all time with lighting of a horizontal illuminance at floor level of not less than 30 lux. The lighting can be a combination of natural and artificial light and should be backed up by an emergency lighting system that complies with the Code of Practice for Minimum Fire Service Installations and Equipment;
- (h) A refuge floor should be provided with such fire service installation and equipment as may be required by the Director of Fire Services; and

- (i) A refuge floor should be served by fireman's lift but not other lifts. The fireman's lift should not open onto the refuge floor in normal operation and the lift landing door at this level should be locked at all times until automatically released upon actuation of the fireman's switch.

See Diagram B5.

### **Clause B18.3**

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The main roof of a building may be regarded as a refuge floor for the purpose of Clauses B18.1 and B18.5 provided that:

- (a) it should be of flat surface and should comply with the requirements in Part C;
- (b) the net area for refuge should be not less than 50% of the gross floor area of a typical floor below the main roof;
- (c) any required staircase serving the floors immediately below the main roof should be continued to give access to the main roof without any obstruction at all times;
- (d) the minimum dimension of the area for refuge should be at least 50% greater than the width of the widest required staircase serving the roof; and
- (e) every part of the area for refuge should be provided with at all time with lighting of a horizontal illuminance at floor level of not less than 30 lux. The lighting can be a combination of natural and artificial light and should be backed up by an emergency lighting system that complies with the Code of Practice for Minimum Fire Service Installations and Equipment.

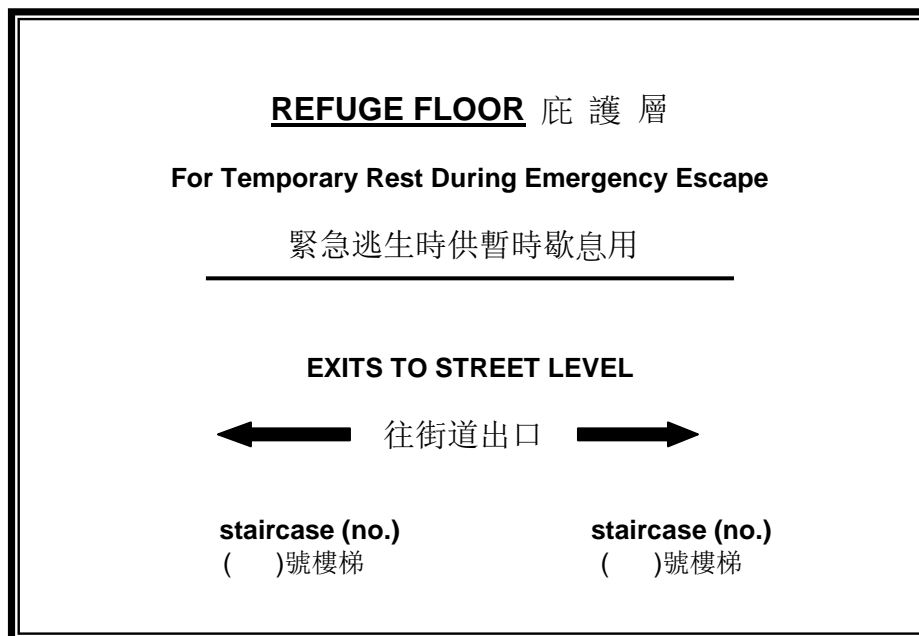
#### **Commentary**

It is not acceptable for an internal staircase from a private flat to access directly to a portion of the main roof which has been designated as the required refuge area. The remaining roof area (not designated as refuge area) may be used as a private roof provided that no structures other than a stairhood is allowed. Such area should be separated from the refuge area by a solid fence wall of not less than 1.5m high. Any stairhood to be erected within 1.8m of the refuge area should have an FRR of not less than -/60/60. In addition, plant rooms adjoining the refuge area should have an FRR of not less than -/120/120 and any unprotected opening of the plant rooms should be located not less than 1.8m away from the refuge area.

#### Clause B18.4

At each refuge floor, notices and signs should be provided in the following manner:

- (a) A sign indicating the required staircase number and a sign indicating the entrance to the refuge floor should be displayed inside each required staircase at a position immediately before entering the refuge floor at a height of 1500mm above the landing or the step immediately below the required staircase;
- (b) A notice in rectangular shape and in the following form should be displayed at a position immediately after entering the refuge floor from each required staircase at a height of 1500mm above the floor level;



- (c) Sufficient directional signs in the following form should be displayed at appropriate positions at the refuge floor at a height of 1500mm above the floor level, to indicate the direction of travel in order to enter the respective required staircase;



- (d) All signs and notices provided under (a), (b) and (c) should: -
  - (i) be in English and Chinese;
  - (ii) be illuminated by a light on two systems as the lighting referred to in Clause B5.5;
  - (iii) have words and characters in block letters not less than 50mm high in white colour on a background in green or the words and characters in green on a background in white or black; and
  - (iv) not be easily defaced or damaged;

- (e) Appropriate notices in English and Chinese in words and characters not less than 25mm high should be provided in a conspicuous part at the main entrance of the building to indicate where the refuge floors are situated.

### **Clause B18.5**

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A domestic building or a composite building exceeding 25 storeys but not exceeding 40 storeys in height above the lowest ground storey is not required to comply with Clauses B18.1 and B18.2 if the main roof of the building is designed as a refuge floor complying with the requirements in Clauses B18.3 and B18.4.

#### **Commentary**

A Performance Requirement has been developed in Part A to provide guidance for the safe evacuation from tall buildings. The following aspects should be complied with:

- (a) provide means of escape for building occupants - Means by which all occupants can escape from a building should be provided.
- (b) allow for occupants to take a short rest, whilst evacuating - It is recognised that persons walking many flights of stairs need to take a short rest during the evacuation.
- (c) minimise the threat of smoke within required staircases – required staircases should be designed to prevent smoke clogging and should provide a tenable environment for evacuation.
- (d) provide an area for firefighting staging activities – Space should be required to provide a means for firefighting staging activities.

Subsection B18 provides the Deemed-to-Comply provisions to comply with the Performance Requirement stipulated in Part A.

## **Section 3 – Special Provisions on Means of Escape for Use Classification 5a**

### **Subsection B19 – Application of this Section**

#### **Clause B19.1**

---

In addition to the general requirements in Sections 1 and 2, all places of public entertainment in Use Classification 5a should comply with the requirements in Subsections B19 to B27.

For a temporary building which is intended to be used or which is licensed for a public entertainment, it should comply with the requirements in Subsection B28.

#### **Clause B19.2**

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A premises of Use Classification 5a including cinema with an occupant capacity not exceeding 50 persons may share the exit routes with other non-domestic accommodations in the same building and the requirements under this Section do not apply to such premises; provided that:-

- (a) the total occupant capacity for all such premises in the same building is not more than 150 persons;
- (b) such premises is not situated in basement;
- (c) any projection room, if provided, should comply with the requirements in Part C; and
- (d) a cinema foyer, where applicable is provided in accordance with Clause B27.8.

### **Subsection B20 - Site Requirements**

#### **Clause B20.1**

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The site of a Use Classification 5a should abut upon and have frontages to two or more thoroughfares.

#### **Clause B20.2**

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The frontages of a building having a Use Classification 5a should, subject to Clause B20.7, form at least one half of the total perimeter of the building excluding recesses and projections which do not prejudicially affect exit routes, and should permit the provision of exit routes in accordance with this Section from each tier or floor direct to two or more thoroughfares.

### **Clause B20.3**

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The thoroughfares in Clause B20.2 should be of such width as will enable the persons who are to be accommodated in the Use Classification 5a to disperse rapidly in the event of fire.

### **Clause B20.4**

---

In the case of a Use Classification 5a which has an occupant capacity more than 500 but not more than 2,000 persons, one of the thoroughfares in Clause B20.2 should be at least 12m wide.

### **Clause B20.5**

---

In the case of a Use Classification 5a which has an occupant capacity more than 2,000 but not more than 3,000 persons, one of the thoroughfares in Clause B20.2 should be at least 12m wide and the other one should be at least 9m wide if it is a carriageway or 6m wide if it is a footway.

### **Clause B20.6**

---

In the case of a Use Classification 5a which has an occupant capacity more than 3,000 but not more than 5,000 persons, one of the thoroughfares in Clause B20.2 should be at least 15m wide and the other one should be at least 9m wide.

### **Clause B20.7**

---

In the case of a Use Classification 5a which has an occupant capacity more than 5,000 persons such further frontage to the thoroughfares in Clause B20.2 should be provided as the Building Authority may require.

### **Clause B20.8**

---

Subject to Clause B20.9, in the case of a Use Classification 5a which has an occupant capacity not more than 500 persons, one of the thoroughfares in Clause B20.2 should be at least 7.3m wide.

### **Clause B20.9**

---

In the case of a Use Classification 5a (other than cinema or theatre) which has an occupant capacity not more than 500 persons in a non-domestic building not having polluting industrial undertakings of Use Classification 6 or the non-domestic part of a composite building, the site of such premises may be permitted to abut on one thoroughfare if the said thoroughfare is an acceptable EVA and Director of Fire Services does not have any adverse comment on the arrangement.

**Commentary**

Modification of the requirement of the Building (Planning) Regulation 49A may be considered for a Use Classification 5a described in Clause B20.9 with a total occupant capacity not more than 500 persons.

**Subsection B21 - Exit Requirements for Use Classification 5a****Clause B21.1**

Buildings of Use Classification 5a should be provided with exits as follows:

- (a) if the Use Classification 5a is located at a storey less than 12m above ground floor level, Table B2 should be complied with;
- (b) if any part of Use Classification 5a is located at a storey 12m or more above ground floor level, Table B5 should be complied with.

**Table B5: Exit Width for Use Classification 5a Located at 12m or more above Ground Floor Level**

Occupant Capacity	Minimum Number of Exits	Minimum Total Width of Exit Route (mm)
31-200	2	2400
201-300	2	2600
301-500	2	4300
501-750	3	6400
751-1000	4	8500
1001-1250	5	10400
1251-1500	6	12500
1501-1750	7	14600
1751-2000	8	16700
2001-2500	10	20800
2501-3000	12	24900

**Notes:**

- Buildings with total occupant capacity of Use Classification 5a over 3000 persons, the minimum number of exits and total width of exit routes required shall be determined by the Building Authority.
- Minimum door width is 1050mm in accordance with Table B2, subject to compliance with other requirements in this Part, especially Subsections B5, B7 and B8.

### **Clause B21.2**

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Adequate exit routes complying with Clause B21.1 should be provided for every tier or floor.

### **Clause B21.3**

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Two of the exit routes from each tier or floor should open into different thoroughfares or ways.

### **Clause B21.4**

---

Each tier or floor in a Use Classification 5a shall be constructed so that it does not have a gradient steeper than 35° to the horizontal and the headroom between any such floor or tier and the underside of the tier or ceiling above it shall in every part be at least 3m.

### **Clause B21.5**

---

In calculating the number of persons who can be accommodated in any tier or floor or part of a tier or floor, the accommodation of all standing and waiting spaces in such tier or floor or part of a tier or floor should be included. Any cafe, lounge, restaurant or foyer should be regarded as a waiting space.

### **Clause B21.6**

---

Exit routes should be arranged so as to afford a ready means of escape from all parts of each tier or floor and should lead directly into thoroughfares.

### **Clause B21.7**

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The exit routes from each part of each tier or floor should be placed in a position remote from the stage.

### **Clause B21.8**

---

All entrances and exit doors, other than pass doors in connection with spaces in which persons await admission, should be arranged so as to be available for exit during the whole of the time that the public are within the premises.

## **Subsection B22 – Exits, Notices, etc.**

### **Clause B22.1**

---

All exit doors or openings from a premises of Use Classification 5a and from the stage and dressing rooms in such place should be clearly indicated by sufficient directional and exit signs. Such signs should comply with the requirements in the Code of Practice for Minimum Fire Service Installations and Equipment.

### **Clause B22.2**

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[Clause deleted.]

### **Clause B22.3**

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Doors and openings other than exits within sight of the audiences, which lead to portions of Use Classification 5a accessible to the public, should have notices placed over them indicating the use of such portions so that such doors and openings will not be mistaken as exits.

### **Clause B22.4**

---

Notices, signs and handpointers indicating the exit direction should be provided.

### **Clause B22.5**

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Notices bearing the words NO EXIT should not be provided.

### **Clause B22.6**

---

Each notice indicating an exit should be illuminated by a light on two systems as the lighting referred to in Clause B25.6.

### **Clause B22.7**

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The lighting of exit notices should not in any circumstances be extinguished or dimmed while the public are in the places of public entertainment.

## **Subsection B23 - Required Staircases**

### **Clauses B23.1**

---

All required staircases in this Section should comply with the following requirements:

- (a) The required staircase have no winders;
- (b) Each flight is of not more than 16 or of less than 3 steps;
- (c) The required staircase should not have more than 2 successive flights without a turn;
- (d) There should be a turn between 2 successive flights if any one of them has more than 12 steps in a flight; and
- (e) Treads should be not less than 280mm wide and risers should be not more than 150mm high.

### **Clauses B23.2**

---

Where a flight of steps in a Use Classification 5a returns, the newel wall should be chased so as to allow the handrail to turn without projecting over the landing.

### **Clause B23.3**

---

Any recess in the walls of a required staircase should be defended by guardrails.

## **Subsection B24 – Barriers**

### **Clause B24.1**

---

Any barriers which may be provided for checking or controlling admission should be arranged so that the portions immediately in the line of exit open automatically upon pressure being applied in the direction of exit and so as not to reduce the width of the exit route. All fixed directional barriers to define the exit route should have adequate strength complying with the requirements in the Building (Construction) Regulation 17(3).

### **Clause B24.2**

---

Rope barriers should be fitted with automatic catches or slip connexions and should be arranged so as not to trail on the floor when parted and the fittings should not project into the gangway or exit route.

## **Subsection B25 – Exit Route Details**

### **Clause B25.1**

---

Chains or padlocks should not be used to secure exit doors. When any other locking mechanism is used, the doors should be readily opened from inside without using a key.

### **Clause B25.2**

---

The gangways and seatways layout should comply with the requirements in Clause B27.6.

### **Clause B25.3**

---

All gangways, exit routes and the treads of steps and required staircases should have slip-resistant surfaces.

### **Clause B25.4**

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The edges of the tread of steps and staircases should be conspicuous.

### **Clause B25.5**

---

Where tiered seating is provided and is located such that persons could fall more than 1000mm, a guard rail should be provided at a height of at least 1100mm to prevent falling.

### **Clause B25.6**

---

All portions of a premises of Use Classification 5a to which the public have access should be provided with lighting of a horizontal illuminance at floor level of not less than 30 lux. The lighting can be a combination of natural and artificial lighting and should be backed up by an emergency lighting system that complies with the Code of Practice for Minimum Fire Service Installations and Equipment.

## **Subsection B26 - Exit from Stages**

### **Clause B26.1**

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Where a permanent stage is provided, an exit should be provided from each side of the stage, and one of such exits should lead directly to a thoroughfare and should comply with Table B2 or Table B5 as appropriate.

### **Clause B26.2**

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An exit route leading directly to a thoroughfare should be provided from the stage basement, and should comply with Table B2 or Table B5 as appropriate.

## **Subsection B27 – Cinemas in Multi-storey Buildings**

### **Clause B27.1**

---

Cinemas accommodating not more than 2,000 people in aggregate in any one building may be situated in any one storey or storeys within a non-domestic building or the non-domestic part of a composite building.

### **Clause B27.2**

---

A cinema or cinemas with an occupant capacity not more than 2,000 people in aggregate situated in a non-domestic building or the non-domestic part of a composite building may share the protected exits with other non-domestic use of the same building, subject to compliance with the following requirements:

- (a) All cinema auditoria should be provided with a dedicated smoke extraction system and other fire service installations to the satisfaction of Director of Fire Services;
- (b) All cinema auditoria should be separated from other accommodations with walls and floors having adequate FRR as required in Part C.
- (c) Every door to a cinema auditorium should have an FRR of not less than that required for the walls of the cinema auditorium. Door openings at the cinema auditoria giving access to the cinema foyer or the adjoining non-domestic accommodations are not required to be provided with a protected lobby;
- (d) Separation should be provided between the cinema auditoria and the cinema foyers in accordance with the requirements in (b) and (c) above. Such separation is not required if the smoke extraction system is also provided to the cinemas foyer to the satisfaction of the Director of Fire Services and, in such case, adequate fire separation should be provided between the foyer and other accommodations of the building. Any openings made in the separating walls between the foyer and adjoining accommodations for communication should be protected by a fire rated door or a fire shutter having an FRR not less than that of the wall;

- (e) The protected exits which serve both the cinema and the adjoining accommodations should be accessible from the common circulation area of the building without having to pass through other private premises;
- (f) If a required staircase is directly connected to a cinema at any one storey and the occupants of the cinema do not need to pass through the adjoining non-domestic accommodation to reach the staircase, the part of staircase from that storey to the final point of discharge should comply with Subsection B23. At the transition point where there is a change in the dimension of treads and risers, a flat landing of length not less than twice the width of the required staircase should be provided. A notice in English and Chinese with words and characters “Beware of steps change” and “小心梯級高度改變” of not less than 50mm high should be provided to alert occupants of the change in the step configuration;
- (g) The shared protected exits should be designed to have adequate widths and sizes based on the total occupant capacity of the cinema and the adjoining non-domestic accommodation complying with the requirements in Subsection B21;
- (h) In a composite building, the exit routes of the cinema should be separated from the exit routes of the domestic parts of the building;
- (i) The exit routes of the cinemas including those shared exits should discharge to streets of not less than 4.5m wide. Two of the exit routes from each floor should discharge into different streets; and
- (j) The cinema is not situated at basement.

The entrance to the cinemas or to the cinema foyer may be provided through the circulation area of the adjoining non-domestic accommodations, such as a shopping arcade, subject to compliance with the above requirements.

### **Clause B27.3**

---

A cinema should not be situated at basement except for the first basement floor. A cinema at the first basement floor should comply with the following requirements:

- (a) All exit routes from the cinema auditorium to the required staircases and from the required staircases to the street should be short and direct ;
- (b) All required staircases/exits from the cinema should discharge independently onto a street;
- (c) All required staircases serving other basement floors should be sealed off at the floor where the cinema is situated;
- (d) At least one of the protected exits should be a firefighting and rescue stairway designed and constructed in accordance with Part D;
- (e) The widths of the required staircases should comply with Table B5;
- (f) The foyer should be located on the ground floor. The minimum size of the foyer should be based on 0.5m<sup>2</sup> per person at a ratio of one in three persons for whom seating accommodation is provided; and
- (g) Access from the cinema to a lift serving other accommodation should be through a protected lobby. The fireman’s lift should open into the ventilated lobby in the firefighting and rescue stairway and such lobby should give access to the cinema auditoria.

#### **Clause B27.4**

---

Where a cinema or a group of cinemas share the protected exits with any part of the adjoining non-domestic accommodation at the same storey, the total numbers and minimum width of the protected exits required for the cinemas and that part of the adjoining non-domestic accommodation designated to share the protected exits with the cinemas should be determined in accordance with Subsection B21, based on the total occupant capacity of both the cinemas and the relevant part of the adjoining non-domestic accommodation.

#### **Commentary**

If the required width of a shared protected exit on a particular floor is greater than that required for the floors below, the required staircase from that particular floor downward to the ground level should be of the width not less than that required for that particular floor.

#### **Clause B27.5**

---

Subject to the following requirements, some of the exits from the cinemas may discharge through the adjoining non-domestic accommodations (e.g. shopping arcade) to the protected exits on the same floor provided that:

- (a) the width of such exits from the cinema should be not more than half of the required total width of exits for that cinema; and
- (b) the common circulation areas (e.g. arcade) of the adjoining non-domestic accommodation and the foyer through which exits from the cinemas will discharge, should have a floor area of not less than  $0.5\text{m}^2$  per person based on the sum of:
  - (i) the total number of persons from the cinemas which is allowed in the design for evacuation through such exits to the adjacent accommodations, calculated on a pro-rata basis by reference to the width of such exits and the total width of the exits required for the cinemas;
  - (ii) the number of persons in the cinema foyer calculated at a ratio of one person per  $0.5\text{m}^2$  of the floor area of the foyer; and
  - (iii) the number of persons in the circulation areas of the adjacent non-domestic accommodation calculated in accordance with Table B1.

### Clause B27.6

The gangways and seatways layout of a cinema auditorium should comply with the following requirements:

- (a) Maximum length of a row of seats in a cinema auditorium should not exceed 12m for a seatway with gangway on one side only, and 24m for a seatway with gangway on two sides;
- (b) The number of seats in a row should not be more than that set out in Table B6. The width of seatway is the minimum clear horizontal distance between the back of one seat unit and the nearest projection of the seat unit in the row behind. Where seats tip up automatically, the width of seatway should be measured between the back of one seat unit and the maximum projection of the seat unit behind when the seat is in the tipped-up position. In all cases there shall be an unobstructed way or space of at least 300mm. The seating should be firmly fixed to the floor;
- (c) Gangways of not less than the width shown in Table B7 should be provided;
- (d) Where steps are provided in intersecting gangways, suitable handgrips should be provided at the ends of the seats; and
- (e) There should be no projection into a gangway that diminishes the clear width of the gangway.

**Table B6 – Maximum number of seats in a row**

Seatway width (mm)	Maximum number of seats in a row	
	Gangway on one side	Gangway on two sides
300 to 324	7	14
325 to 349	8	15
350 to 374	9	18
375 to 399	10	20
400 to 424	11	22
425 to 449	12	24
450 to 474	12	26
475 to 499	12	28
500 or more	Limited by the maximum length of seatway of 12m	Limited by the maximum length of seatway of 24m

**Table B7: Minimum width of Gangways**

No. of persons served	Minimum width of gangways
Less than 500	1 100 mm each
501 – 1000	1 200 mm each
1001 – 1500	1 350 mm each
over 1500	1500 mm each

### **Clause B27.7**

---

Projection rooms should comply with the following requirements:-

- (a) The exit routes from the projection rooms should comply with the requirements in this Section. However, an elevated projection room associated to one cinema auditorium only may be provided with only one exit if the travel distance complies with Subsection B11. The exit or one of the exits from such projection room may discharge through the seating area of the cinema auditorium it serves to the required staircase; and
- (b) A projection room, if not provided with natural ventilation, must be mechanically ventilated to the open air by an independent system.

### **Clause B27.8**

---

Accommodation for persons awaiting admission in the cinema foyer required under regulation 49E of Building (Planning) Regulation should be provided on the basis of 0.5m<sup>2</sup> per person at a ratio of one in six persons for whom seating accommodation is provided.

### **Clause B27.9**

---

The requirements in Subsection B27 may also be applicable to and should be acceptable for other places of public entertainment of Use Classification 5a as if it is a cinema.

## **Subsection B28 – Temporary Buildings**

### **Clause B28.1**

---

Seating should comply with the following requirements:

- (a) There should be an unobstructed way or space of at least 300mm measured between perpendiculars between the back of one seat and the front of the seat immediately behind; and
- (b) The seating should be fixed firmly to the ground, floor or decking and if separated chairs are used they should be securely battened together in lengths of not less than 4.

### **Clause B28.2**

---

Gangways not less than 1.2m in width intersecting the rows of seating should be provided in such a manner that no seat should be more than 3m from a gangway measured in the line of seating, and there should be a gangway abutting each side of the building from which the exit routes should open.

### **Clause B28.3**

---

Gangways not less than 1.2m in width at right angles to the longitudinal gangways required by Clause B28.3 should also be provided in such a manner that the seating is divided into blocks not more than 9m in depth measured between perpendiculars between the front of the seats forming the front row and the back of the seats forming the back row of a block of seating.

### **Clause B28.4**

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Exit route not less than 2.4m in width should be provided in each side of the structure in such manner that there is one exit route at each end of a prolongation of the centreline of each of the gangways required by Clause B28.4 and one such exit route is required at each end of a prolongation of a line 1.2m in front of the first or front row of seating.

### **Clause B28.5**

---

The Building Authority may require further exit from the area of the stage or space provided for the performance in consideration of the hazards associated with the proposed use of the temporary building.

### **Clause B28.6**

---

Exits, gangways, aisles and seatings should be kept at all times free from any obstruction and during the period the temporary building is occupied.

### **Clause B28.7**

---

Any door erected at the exits should open in the direction of exit and any fastening used for maintaining the doors closed should readily give way upon light pressure being applied by one person from inside.

## **Section 4 – Provisions of Means of Escape for Persons with a Disability**

### **Subsection B29 – Application of this Section**

#### **Clause B29.1**

---

For the purpose of this Section, “persons with a disability” have the same meaning as defined in the Design Manual : Barrier Free Access issued by the Buildings Department from time to time.

The provisions in this Section do not apply to:

- (a) a building or parts of a building exempted from the application of Obligatory Design Requirements in the Design Manual : Barrier Free Access issued by the Buildings Department from time to time;
- (b) any floor of a building on a site of an area of not more than 500m<sup>2</sup> subject to the area of such floor being not more than 200m<sup>2</sup>;
- (c) any floor of a building on a site of an area of not more than 500m<sup>2</sup> subject to such floor having not more than two units;
- (d) a building served by ventilated staircases and using balcony approach in accordance with Clauses B10.5 and B10.6 respectively and the provision of fireman’s lift is not required under Clause D3.1;
- (e) a refuge floor; or
- (f) ground storey leading directly to an ultimate place of safety.

#### **Commentary**

Regarding small development mentioned in Clause B29.1(b) and (c) above, the number of occupants is small and the protected exit or fireman’s lift lobby is immediately outside the units. In such circumstances, persons with a disability can stay inside their unit to wait for rescue.

## **Subsection B30 – Temporary Refuge Spaces**

### **Clause B30.1**

---

At least one temporary refuge space with an area of not less than 1.5m x 1.5m should be provided within the protected exit or fireman's lift lobby of every fire compartment at every floor of a building to which this Section applies. One temporary refuge space is allowed for different compartments with by-pass lobbies but no part of the floor served by a temporary refuge space should be more than 60m from that space. Such space should not reduce the minimum width of an exit route, the effective width/radius of the landing of a required staircase nor the minimum area of a fireman's lift lobby. Space for manoeuvring wheelchairs shall be allowed for in the protected exit or fireman's lift lobby. For design flexibility, two number of 0.75m x 1.5m temporary refuge spaces (instead of one 1.5m x 1.5m), in visible location to each other, can be provided in the same protected exit or fireman's lift lobby. Examples are given in Diagram B6.

#### **Commentary**

No exit or accommodation (except pipe duct, building services room or the like not to be used in case of emergency) should be opened off directly to the temporary refuge space in Examples (c) and (d) of Diagram B6.

### **Clause B30.2**

---

The temporary refuge space should be accessible to persons with a disability and free from obstruction at all times.

#### **Commentary**

The area of temporary refuge space should be a clear space and, when being occupied by persons with a disability in case of fire, should not block any fire service installations and equipment.

### **Clause B30.3**

---

Any door from the common area leading to a temporary refuge space should have a clear width of not less than 850mm or such width as required under Table B2, whichever is greater; and door handle at not less than 950mm and not more than 1050mm above the finished floor level, measured from the top surface of the grip should be provided to one side of the door.

#### **Commentary**

Wider doors up to 950mm shall be a good practice to cater for the use of large powered wheelchairs.

#### Clause B30.4

A closed-circuit television and direct intercom link, both backed up by emergency power for at least 1 hour, should be provided to every temporary refuge space for communication with the management office of the building. The height of the intercom link shall not be less than 900mm and not more than 1200mm above the floor level.

##### Commentary

For the purpose of Clause B30.4, management office includes such similar management facilities such as caretaker's counter and the like. The closed-circuit television and direct intercom link should be linked to a monitor and a panel respectively at the management office showing or indicating the temporary refuge spaces at which persons with a disability are waiting for rescue. If the building does not have a management office, such monitor and panel should be placed beside the fire services control panel.

#### Clause B30.5

A securely fixed notice in the following form with an international symbol of accessibility, and words and characters of not less than 50mm high should be displayed at a conspicuous position on the wall and floor of each temporary refuge space.



#### Clause B30.6

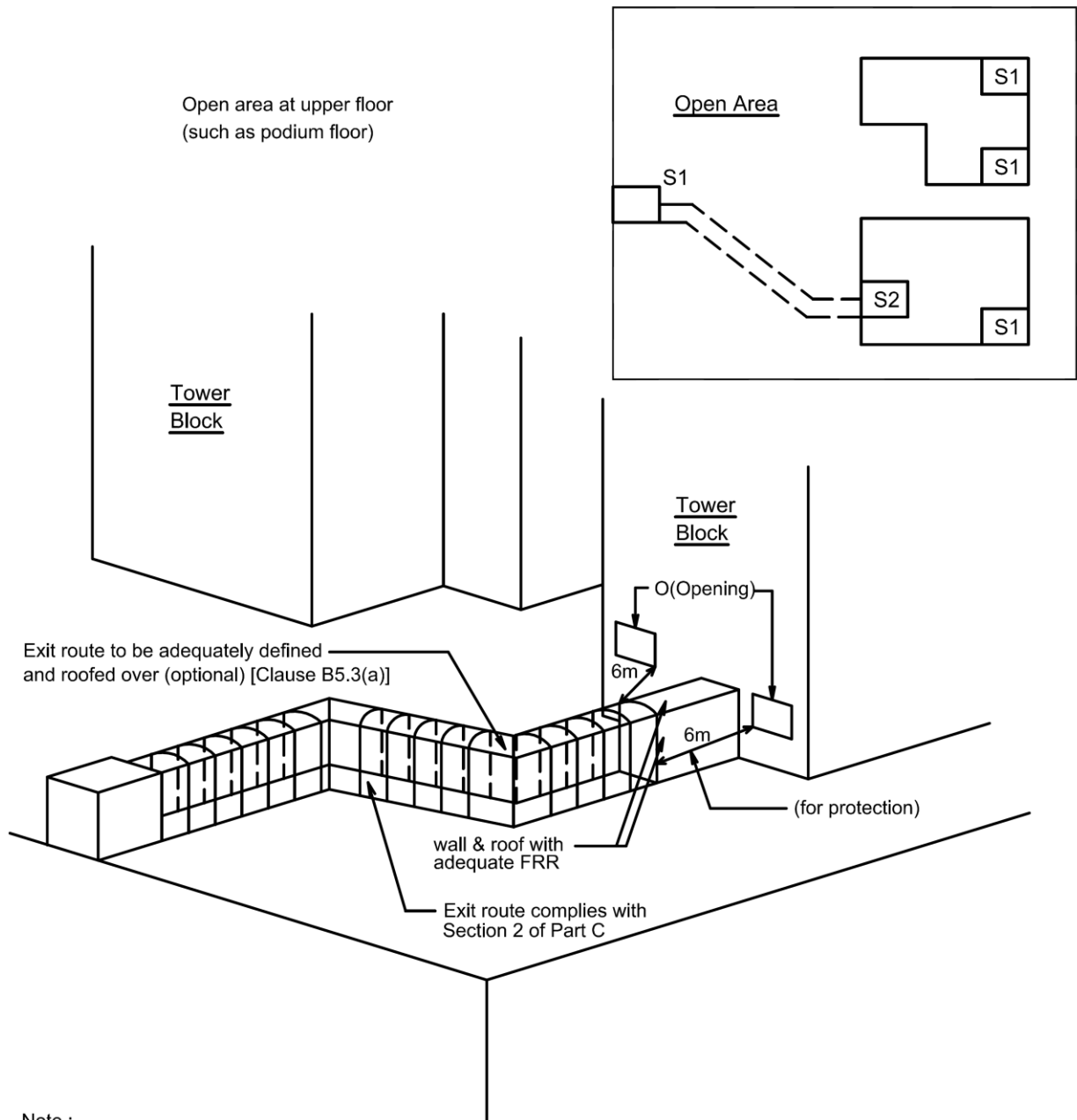
Each temporary refuge space should be well-demarcated on floor by means of contrasting colour to clearly discern from the remainder areas of the storey. For the temporary refuge space provided at a lift lobby as illustrated in Example (a) or (b) of Diagram B6, where a higher standard of finishes and outlook is anticipated, demarcating strips to identify the temporary refuge space may be accepted.

### Clause B30.7

Securely fixed directional signs in the following form with an international symbol of accessibility and words and characters not less than 50mm high should be displayed at conspicuous locations in the common parts of every storey provided with temporary refuge space for guiding persons with a disability to the location of such space.



**Diagram B1: Required Staircase Leading to an Open Area at Upper Floor**



Note :

The exit route across the open area should be designed and constructed as if it is part of the protected exit.

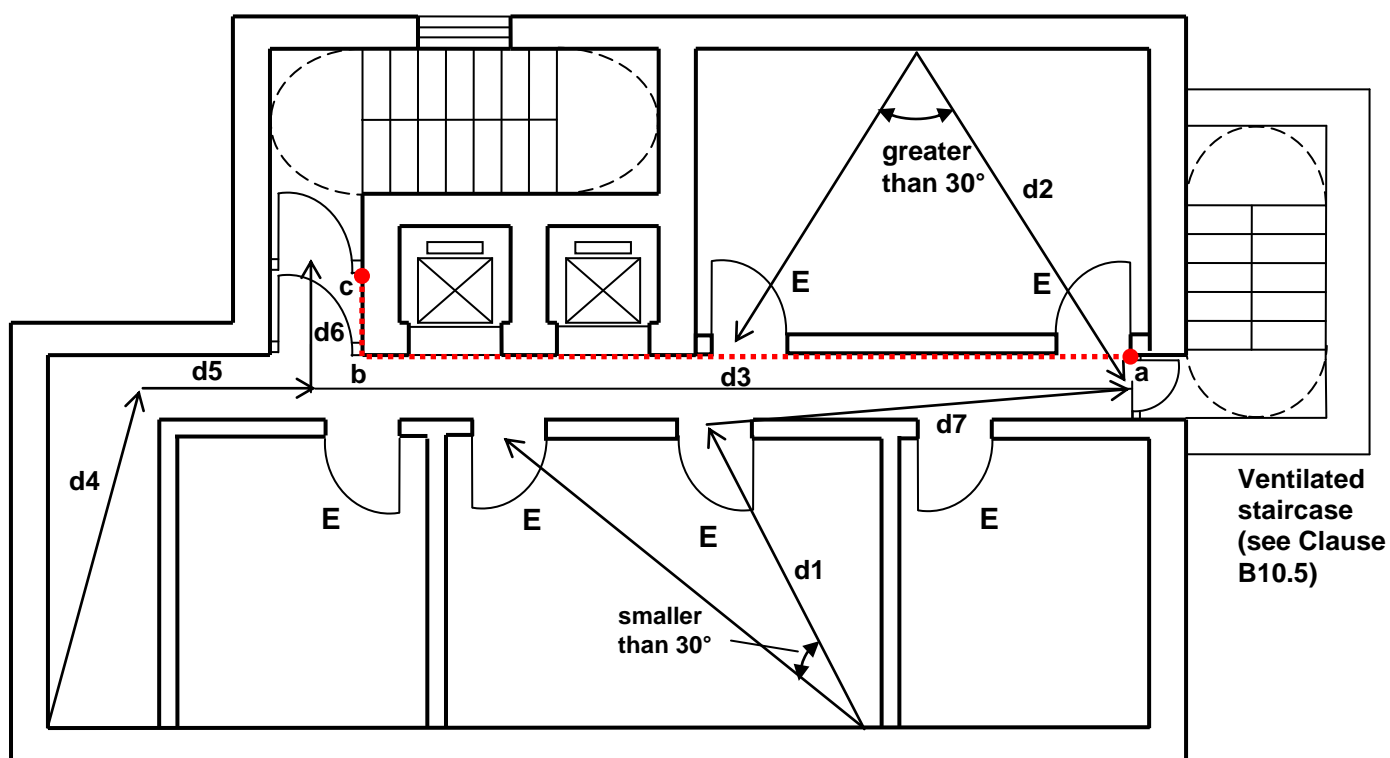
Remarks:

S1 - staircase leading to ultimate place of safety

S2 - staircase discharging to open area at upper floor level (e.g. podium floor)

O - opening not protected by fixed light [See Part C]

## Diagram B2 : Internal Corridor Access

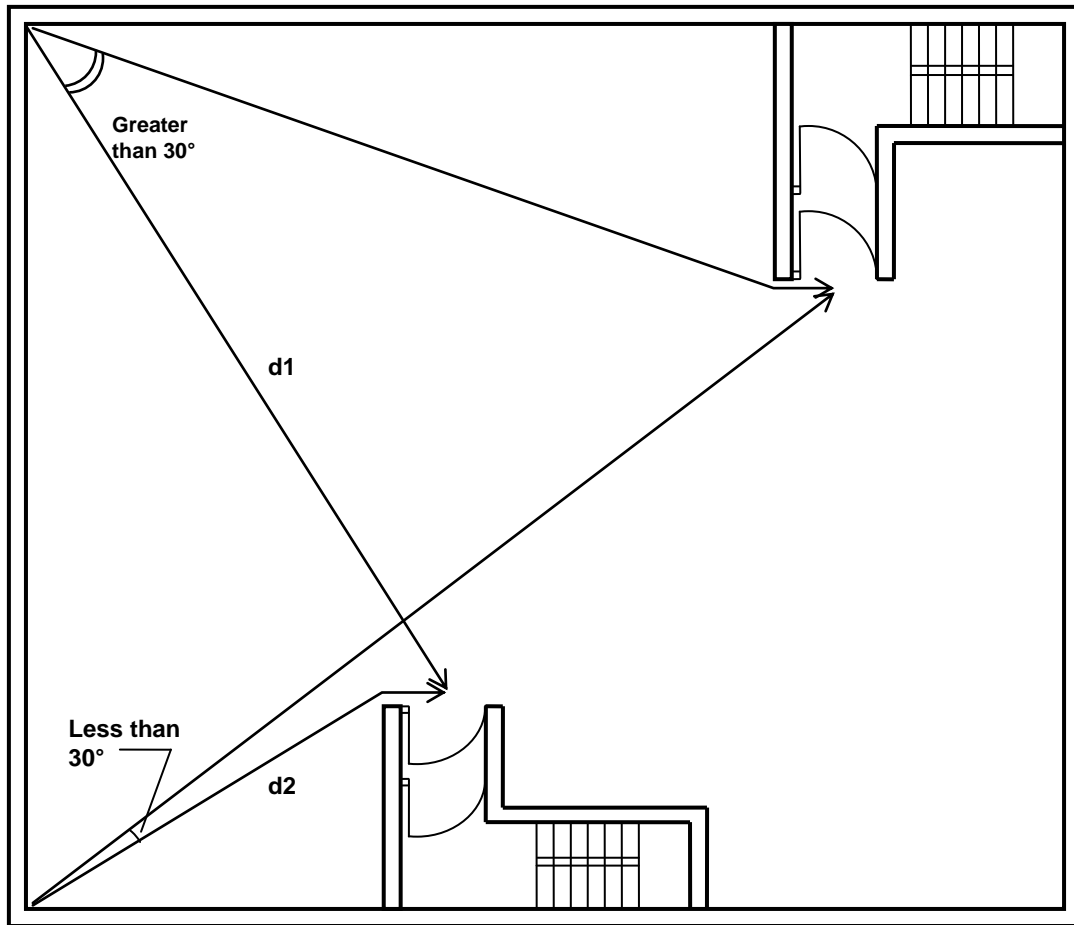


Notes:

E	Exit door	
d4 + d5	Deadend travel distance	See Clause B11.2
d1	Deadend travel distance	See Clause B11.2
a – b – c	Minimum separation between 2 required staircases	See Clause B10.2(b)
d3 + d6	Maximum separation between 2 required staircases	See Clause B11.3(b)
d2	Travel distance	See Clause B11.3(a)
d1 + d7	Travel distance	See Clause B11.3(a)

### Diagram B3: Open Plan Layout

---

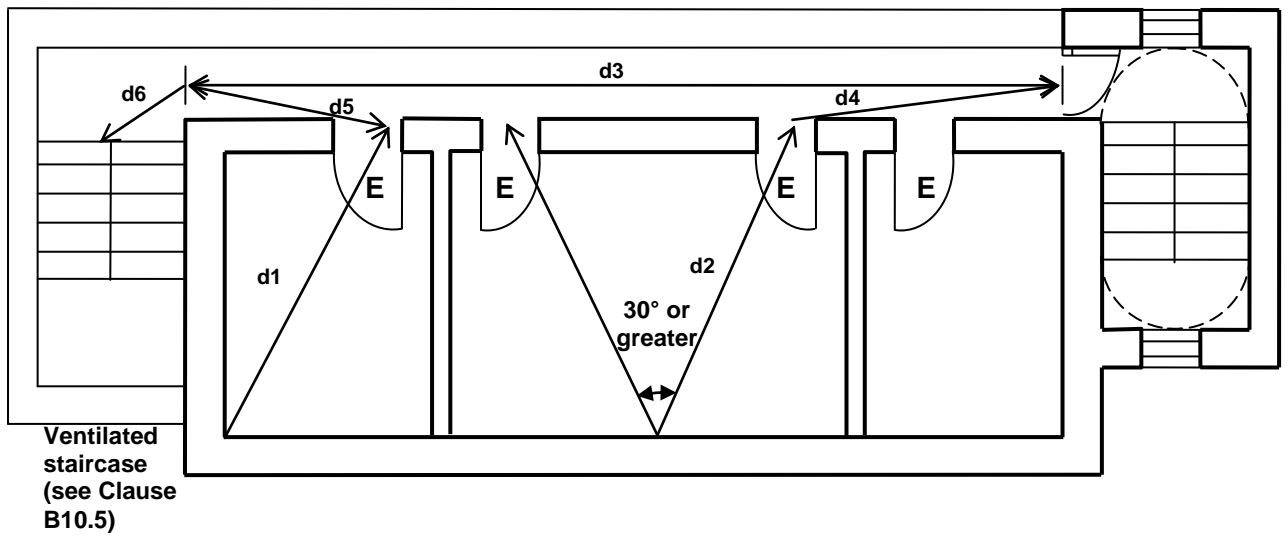


Notes:

$d1$  Travel distance based on two exits being available

$d2$  Deadend travel distance

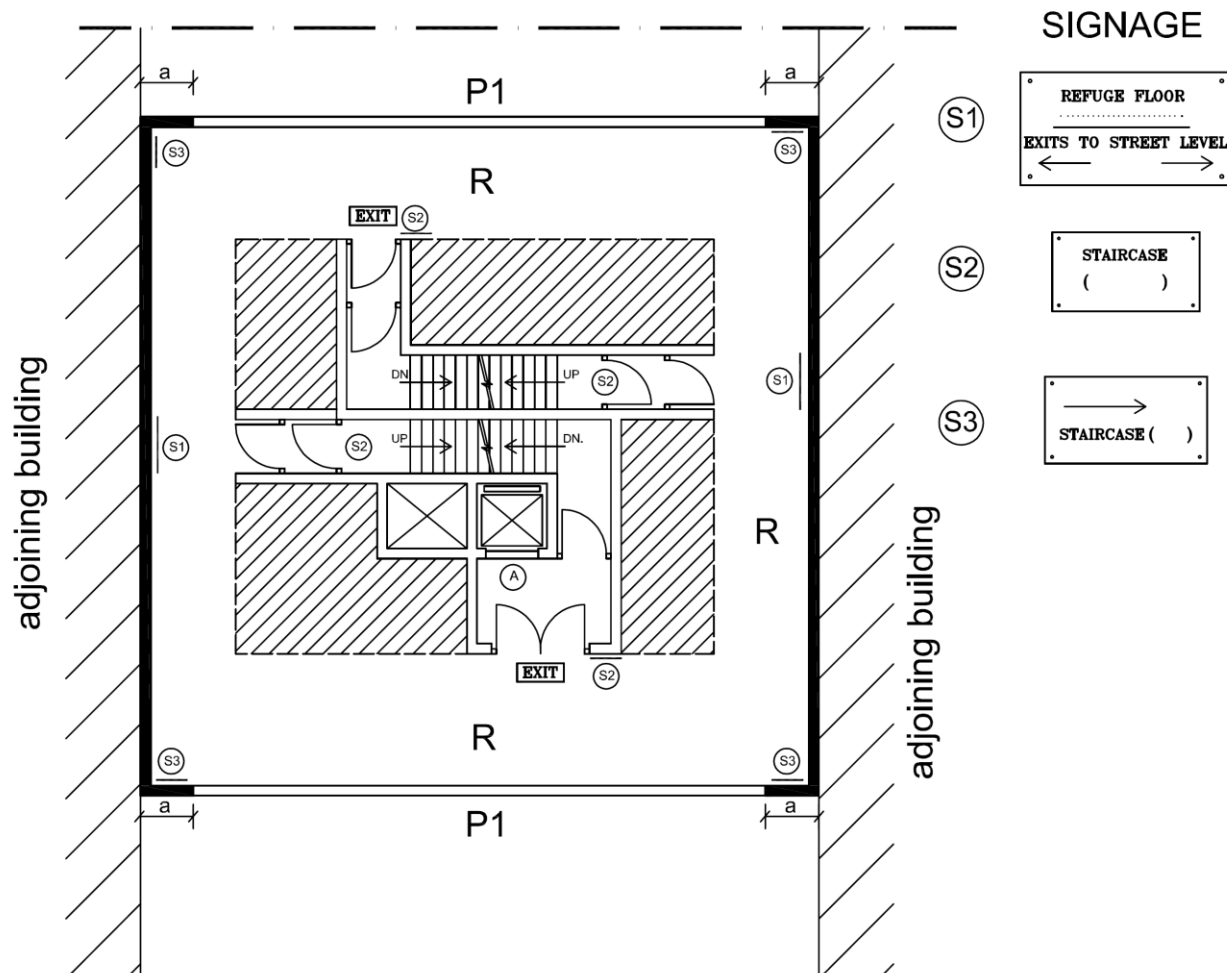
**Diagram B4: Balcony Approach**



Notes:

E	Exit door	
d1	Deadend travel distance	See Clause B11.2
d2 + d4	Travel distance	See Clause B11.3(a)
d1 + d5 + d6	Travel distance	See Clauses B11.2 & B11.3(a)
d3	Maximum separation between 2 required staircases	See Clause B11.3(b)

**Diagram B5: Typical Layout of Refuge Floor**



**KEY:**



Permitted fire service water tank and associated fire service installation plant room; or other mechanical plant room (not accessible from refuge floor)

**R**

Refuge floor (min. 50% of the floor area)

**P1**

Open-sided above parapet height for cross-ventilation



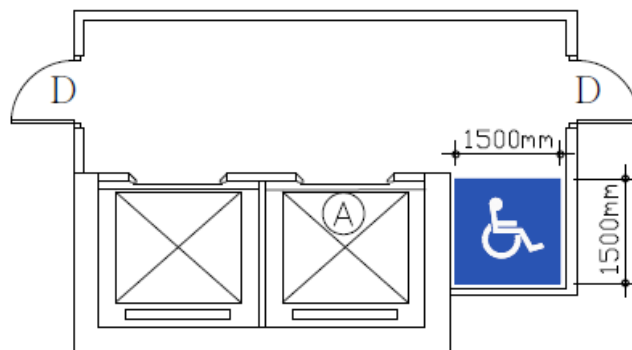
Firemen's lift serves refuge floor but door locked during normal operation

**a**

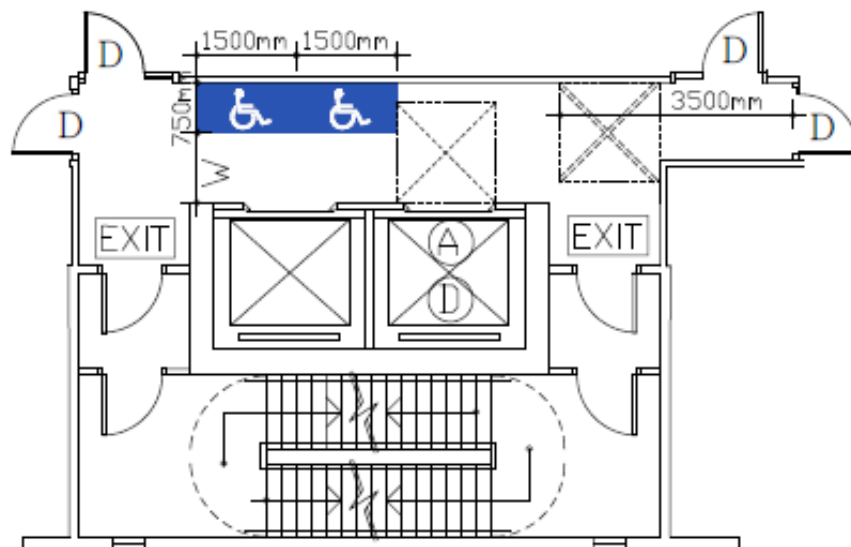
Fire rated wall [See Clause C5.2, C5.3 and C17.2 in Part C]

## Diagram B6: Temporary Refuge Spaces

### Example (a): temporary refuge space in fireman's lift lobby



### Example (b): temporary refuge spaces in fireman's lift lobby



Lobby to fireman's lift of minimum dimensions of 1.5m to be used as wheelchair manoeuvring space



1.5m x 1.5m wheelchair manoeuvring space at 3.5m deadend



Temporary refuge space (0.75m x 1.5m) in fireman's lift lobby

W

Minimum width of exit route

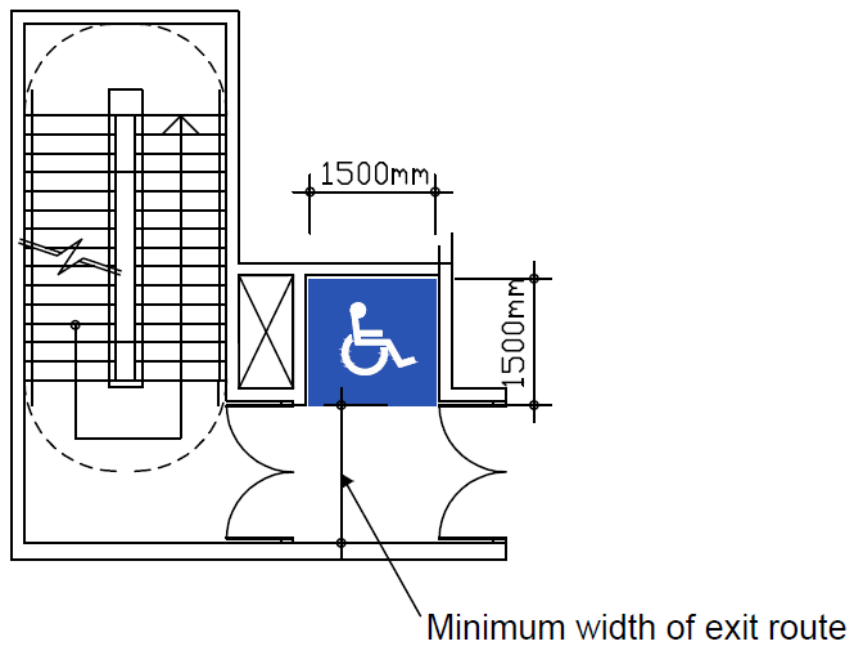
D

Fire rated door for accommodation

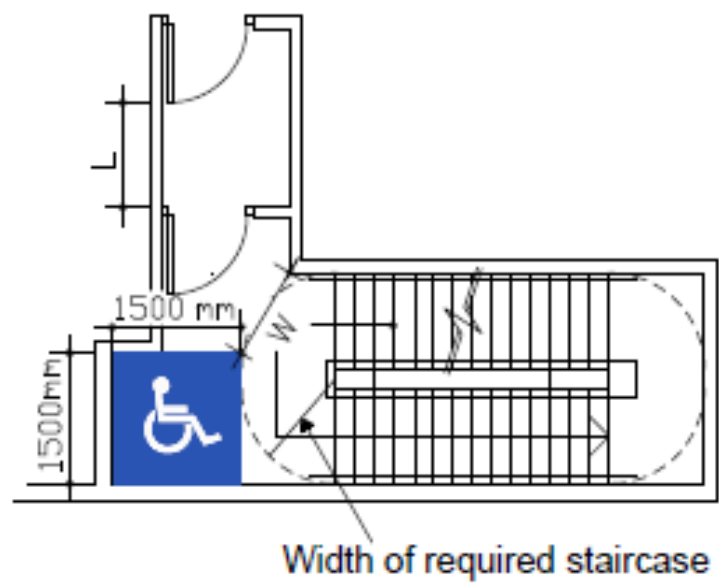


Accessible Lift

**Example (c) : temporary refuge space in protected lobby**



**Example (d): temporary refuge space in landing of required staircase**



L Minimum length of 1.2m for wheelchair users

W Minimum width of exit route

**Part C**  

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**Fire Resisting  
Construction**

**This Part contains three Sections:**

- **Section 1 – General**
- **Section 2 – Provisions for Fire Resisting Construction**
- **Section 3 – Fire Safety Provisions for Cinemas and Theatres**

## **Section 1 – General**

### **Subsection C1 - Use of this Part**

#### **Clause C1.1**

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This Part provides the Deemed-to-Comply provisions on fire resisting construction and should be read in conjunction with all other Parts in this Code.

#### **Clause C1.2**

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Authorized persons, registered structural engineers, fire safety consultants and any person responsible for the design of buildings may find this Part useful in ascertaining the requirements under the Buildings Ordinance for provisions of fire resisting construction.

#### **Clause C1.3**

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This Part provides guidance on how the Performance Requirements on the provisions of fire resisting construction may be complied with.

### **Subsection C2 – Performance Requirements for Fire Resisting Construction**

#### **Clause C2.1**

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Performance Requirements on the provisions of fire resisting construction are stipulated in Subsection A9 of Part A.

## **Section 2 - Provisions for Fire Resisting Construction**

### **Subsection C3 – Fire Compartmentation**

#### **Clause C3.1**

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Every building should be divided into fire compartments by fire barriers without exceeding the fire compartment area/volume specified in Table C1 in order to inhibit the spread of fire.

#### **Clause C3.2**

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A fire compartment should be enclosed by fire barriers. Protection of all openings, joints and penetrations located in a fire barrier should have an FRR not less than that of the fire barrier.

### **Subsection C4 - Fire Compartment Limitations and Fire Resistance Ratings**

#### **Clause C4.1**

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Every element of construction within each fire compartment and every fire barrier of each fire compartment should have an FRR of not less than that as specified in Table C1.

**Table C1 – Fire Resistance Rating and Fire Compartment Limitations**

Use Classification	Compartment Area/ Volume	Fire Resistance Rating (minutes)
1. Residential	Not limited	60
2. Hotel and similar Transient Accommodation	Not limited	60
3. Institutional	Not exceeding 2,500m <sup>2</sup>	60
4. Commercial:		
4a. Business Facilities	Not exceeding 10,500m <sup>2</sup>	60
4b. Mercantile Facilities	Not exceeding 2,500m <sup>2</sup>	60
	Exceeding 2,500m <sup>2</sup> but not exceeding 10,500m <sup>2</sup>	120
5. Assembly:		
5a & 5d. PPE & Other assembly premises	Not exceeding 2,500m <sup>2</sup>	60
	Exceeding 2,500m <sup>2</sup> but not exceeding 10,500m <sup>2</sup>	120
5b. Educational establishments	Not exceeding 2,500m <sup>2</sup>	60
	Exceeding 2,500m <sup>2</sup> but not exceeding 10,500m <sup>2</sup>	120
5c. Transport facilities	Not exceeding 10,500m <sup>2</sup>	120
6. Industrial:		
6a. Industrial workplaces	Not exceeding 10,500m <sup>2</sup>	120
6b. Bulk storage, Warehouses	Not exceeding 28,000m <sup>3</sup> and 10,500m <sup>2</sup>	120
6c. Storage, manufacturing of hazardous/dangerous goods premises	Not exceeding 7,000m <sup>3</sup>	120
7. Carparks	Not exceeding 10,500m <sup>2</sup>	60

Notes:

1. A fire compartment area/volume in excess of that given above will be dealt with on individual merits giving full consideration to enhance means of escape, means of access for firefighting and rescue, fire service installations and fire resisting construction so as to achieve an equivalent level of fire safety.
2. Different Use Classifications should be separated in accordance with Subsection C7.
3. Special hazards should be separated in accordance with Subsection C13.
4. For any use not covered by Table C1, the FRR required will be determined by the Building Authority having regard to the fire load, hazard level and other relevant fire safety provisions of the building.
5. For Use Classification 1 – Residential, each flat should be separated from adjoining flats by fire barriers.
6. For Use Classification 2 – Hotel, each guestroom should be separated from the adjoining guestrooms and other Use Classifications by fire barriers.

#### **Clause C4.2**

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The FRR required for the elements of construction, components and fire barriers should satisfy one or more criteria of stability, integrity or insulation, related to various methods of exposure as specified in Table C2 when tested in accordance with Part E.

#### **Clause C4.3**

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Where a single-storey building does not exceed 7,000m<sup>3</sup> in volume and 7.5m in height, any steelwork construction may be unprotected, provided that the building is separated from any adjoining building or the site boundary by a clear unobstructed open space not less than 6m in width.

#### **Commentary**

No FRR is required for elements of construction of single-storey covered walkways on podium or ground floor if they comply with Subsection C9 and Clause C12.4 and are constructed of non-combustible materials complying with Part E.

**Table C2: Fire Resistance Rating Criteria for Elements of Construction, Fire Barriers and Other Components**

Elements of construction or other components		Criteria to be satisfied			Method of Exposure
		Stability	Integrity	Insulation	
1	Structural frame, beam or column	Y	N	N	Exposed faces only
2	Floor including fire compartment floor	Y	Y	Y	Each side separately
3	Roof forming part of an exit route or performing the function of the floor	Y	Y	Y	From underside
4	Loadbearing wall not being a fire barrier	Y	N	N	Each side separately
5	External wall	Y*	Y	Y	Each side separately
6	Loadbearing wall being a fire barrier	Y	Y	Y	Each side separately
7	Non-loadbearing wall being a fire barrier	N	Y	Y	Each side separately
8	Protected shaft, lobby and corridor	Y*	Y	Y	Each side separately
9	Fire shutter, fire stop, fire dampers, sealing system	N	Y	N (unless specified)	Each side separately
10	Smoke outlet shaft	Y	Y	Y	From outside
11	Enclosure around services other than Item 14	N	Y	Y	From outside
12	Door (including frame and fixing)	N	Y	N (unless specified)	Each side separately (except lift doors – from landing side only)
13	Fixed light (including frame, glazing & fixing)	N	Y	Y	Each side separately
14	Enclosure around services in required staircase/protected lobby	N	Y	Y	Each side separately

Notes:

1. Y = required; N = not applicable; Y\* = required for load bearing elements only.
2. Lintels, posts or jambs of an opening in a fire barrier should be regarded as an integral part of that wall.
3. Subject to Subsection C5 and Clause C9.7, curtain wall glazing does not require to have an FRR.
4. FRR requirements for different Use Classification are listed in Table C1.
5. Any restriction of the cross-section area of the smoke outlet shaft to 75% or less of its original area should be deemed to constitute failure in stability.
6. When an FRR is specified for a fire barrier which consists of different items in this Table, each of such items should satisfy the criteria as specified in this Table.

## **Subsection C5 – Prevention of Fire Spread between Buildings**

### **Clause C5.1**

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Every building should be suitably enclosed by external walls and roof with an FRR to ensure protection against spread of fire to adjoining buildings or site.

### **Clause C5.2 Separation between Buildings on the Same Site**

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Buildings on the same site are regarded as adjoining buildings if they are less than 1.8m apart. Fire barriers should be provided in compliance with the following requirements:

- (a) Where the angle made between two facades of two adjoining buildings is more than 135° as measured on plan:
  - (i) any part of any such building within 900mm of any such adjoining building should be enclosed by imperforate external walls having an FRR of not less than that of the internal elements of construction; and
  - (ii) notwithstanding (a)(i) above, unprotected openings may be made in such external walls of the building provided they are not less than 900mm from such unprotected opening in such adjoining building.
- (b) Where the angle made between two facades of two adjoining buildings is at 135° or less as measured on plan:
  - (i) any part of any such building within 1.8m of any such adjoining building should be enclosed by imperforate external walls having an FRR of not less than that of the internal elements of construction;
  - (ii) openings are permitted within the fire barriers, provided they are at a distance of at least 900mm from the adjoining building and protected by a fixed light having an FRR of not less than that of the storey complying with Table C2; and
  - (iii) notwithstanding (b)(i) & (b)(ii) above, unprotected openings may be made in such external walls of the building provided they are not less than 1.8m from the unprotected opening in such adjoining building.

- (c) Any part of a roof within 1.8m of the adjoining building should be imperforate and having an FRR of not less than that of the internal elements of construction of the storey below. Openings are permitted within the fire barriers, provided they are at a distance of at least 900mm from the adjoining building and protected by a fixed light having an FRR of not less than that of the storey complying with Table C2.

See Diagram C1 for illustration.

### **Clause C5.3 Separation between Buildings not on the Same Site**

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Fire barriers should be provided to buildings of adjoining sites in the following manner:

- (a) If any part of any building is within a distance of not more than 900mm from the site boundary of the adjoining site, the external walls and roofs of that part should have an FRR of not less than that of the internal elements of construction; and
- (b) The external walls and the roof should be imperforate. Openings are permitted, provided they are at a distance of at least 450mm from the common site boundary of the neighbouring site and are protected by fixed light having an FRR of not less than that of the storey and comply with Table C2.

See Diagram C1 for illustration.

## **Subsection C6 – Protection of Flats in Use Classification 1 and 2**

### **Clause C6.1**

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In Use Classification 1 and domestic part of Use Classification 2, where flats or guestrooms are connected to a common internal corridor:

- (a) the common internal corridor should be provided with fire barriers having an FRR that complies with Table C1;
- (b) doors of each flat or guestroom leading to the common internal corridor should have an FRR of not less than that of the fire barrier of the common internal corridor; and
- (c) a smoke seal should be installed to every fire rated door of a flat or guestroom leading to the common internal corridor.

#### **Commentary**

Smoke seal is very effective in preventing the spread of smoke through a fire rated door. A tight-fitting and latched fire rated door does not prevent smoke spread. Smoke seals should be provided to the top and sides of the fire rated door.

## **Subsection C7 - Separation between Use Classifications**

### **Clause C7.1**

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Where parts of any building:

- (a) are for different Use Classifications, including the sub-class in Table A1 in Part A; and/or
- (b) are used for different occupancies,

they should be separated by fire barriers having the longer FRRs in respect of such Use Classification as stipulated in Table C1.

### **Clause C7.2**

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Ancillary small offices, caretakers' quarters and small storage areas or loading and unloading areas in an industrial building, pantries in an office building and snack bar in Use Classification 5a do not require a separation by fire barriers.

### **Clause C7.3**

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Provided that the fire compartment area limitations in Table C1 are complied with, separation by fire barriers are not required between different occupancies for the following uses:

- (a) Use Classification 4a; or
- (b) Retail shops in Use Classification 4b.

### **Clause C7.4**

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Except for shopping arcade in Use Classification 4b, every common internal corridor serving rooms or flats in different occupancies should be separated from such occupancies by fire barriers having an FRR of not less than that of the Use Classification of that floor. Where these FRRs differ, the higher FRR value should be adopted. Any fixed lights installed within the corridor should have an FRR of not less than that of the wall.

#### **Commentary**

For shopping arcade, retail shops are not required to be separated from the common arcade or mall area by fire barriers taking into account that the shops are under a common management and a common fire alarm system actuated by a sprinkler alarm or by break glass points is installed.

### **Clause C7.5**

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For a balcony approach:

- (a) Subject to (b), where part of the exit route is deadend, the deadend balcony approach should be separated from the occupancies it served by fire barriers having an FRR of not less than that of the Use Classification of such occupancies. This includes any doors and fixed lights installed in such separating walls;
- (b) for Use Classification 1, any window within a deadend balcony approach should be fixed and have an FRR of not less than -/30/30.

## **Subsection C8 - Openings through Fire Barriers and Vertical Shafts**

### **Clause C8.1**

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Openings should not be formed at fire barriers forming part of a fire compartment as described in Clause C3.1 unless such openings are protected by fire rated doors or fire shutters having an FRR of not less than that of such fire barriers. If the total width of the openings is more than 25% of the length of the compartment walls concerned, the fire rated doors or fire shutters should have an FRR with regard to the criterion of insulation of not less than that of the fire barrier. Such FRR with regard to the criterion of insulation can be reduced to not less than 30 minutes if sprinkler heads are provided on each side of the fire rated doors or fire shutters. The sprinkler heads should be a part of the fire service installations of the building and should comply with the Code of Practice for Minimum Fire Service Installations and Equipment.

### **Clause C8.2**

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Every opening for passage of air-conditioning ducts, ventilation ducts, electrical trunkings, conduits, pipes, cables and the like through a fire barrier should be protected with fire dampers or other suitable form of fire stop to maintain the required FRR of that fire barrier.

### **Clause C8.3**

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Where a vertical shaft linking different floors is formed by fire barriers, the openings within the vertical shaft for passage of air-conditioning ducts, ventilation ducts, electrical trunkings, conduits, pipes, cables and the like should be fire sealed. FRR to the floor enclosed by the vertical shaft is not required. Doors and hatches, etc provided to the vertical shaft should have an FRR of not less than that of the vertical shaft and be self-closing.

#### **Commentary**

Vertical shafts are normally unoccupied spaces and contain electrical, plumbing or mechanical services.

#### **Clause C8.4**

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Subject to Clause C8.2, building services including the associated ducts, trunkings, conduits, pipes, cables and the like are not required to be enclosed by fire barriers if they are installed within the same fire compartment.

#### **Clause C8.5**

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Any fire sealing system should comply with the following requirements:

- (a) The sealing system should comply with the requirements in Part E;
- (b) The performance of the sealing system should not be affected by moisture or dampness;
- (c) The life of the sealing system should not be shorter than that of the duct, pipe or wire; and
- (d) The sealing should be firmly fixed.

#### **Clause C8.6**

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Where water-borne metallic pipes pass through fire barriers, gaps between the pipes and the fire barriers should be properly filled by fire rated material having an FRR of not less than that of the fire barrier that it penetrates.

#### **Clause C8.7**

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Fire shutters should be constructed, installed and assembled to the satisfaction of the Building Authority and the operation of the fire shutters should be designed, installed, tested and maintained to the satisfaction of the Director of Fire Services. Fire dampers should be designed, installed, tested and maintained to the satisfaction of the Director of Fire Services or the Building Authority, as appropriate.

#### **Commentary**

Fire dampers that are directly associated with the ducting and trunking under the Building (Ventilating Systems) Regulations are within the ambit of the Director of Fire Services. They include blade type fire dampers manufactured and installed in accordance with the standards and requirements stipulated by the Director of Fire Services.

## **Subsection C9 – Protection of Required Staircases and Lifts**

### **Clause C9.1**

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All liftwells should comply with the following requirements:

- (a) all liftwells, except for openings for doors and ventilation or openings between the liftwell and the machine or pulley room, should be separated from the rest of the building by fire barriers having an FRR of not less than 120/120/120;
- (b) penetrations in a liftwell wall around frames or reveals of lift landing doors, floor indicator panels and lift call buttons should be properly sealed to maintain the FRR of the wall and comply with Part E;
- (c) a door provided at a lift landing to give access to the car of a lift and any other door to the liftwell wall should have an FRR of not less than that of the fire barriers therein with regard to integrity, or not less than -/120/-; and
- (d) where a lift connects basement with storeys above the ground storey, the lift doors at the basement should be protected by a smoke seal lobby complying with Part E.

#### **Commentary**

The FRR required for the lift car landing doors is for the purpose of resisting a fire from the occupied side of the floor but not from the lift car side.

### **Clause C9.2**

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Provided that the lift machine or pulley room is completely separated by fire barriers from the rest of the building (except for the opening for lift car cable/rope), fire resisting construction is not required for the lift car including landing doors and the liftwell, if any, of a bullet lift, panorama lift and the like serving a single fire compartment.

### **Clause C9.3**

---

All protected exits and protected lobbies should comply with the following requirements:

- (a) They should be separated from the rest of the building by fire barriers having an FRR of not less than that of the Use Classification of that fire compartment to which they connect;
- (b) Any doorway giving access to the protected exits should be provided with a fire rated door having an FRR, with regard to the criteria of integrity and insulation, of not less than that of the fire barriers therein;
- (c) The fire rated doors at the doorway giving access to a protected lobby should have an FRR that complies with Clause C16.5 with regard to the criteria of integrity and insulation; and
- (d) All required staircases and their protected lobbies should not accommodate any services other than emergency services such as fire hydrants, sprinkler systems, emergency lights, exit signs, closed-circuit television and direct intercom link unless such services are enclosed by fire barriers having an FRR of not less than that of the walls separating the protected exit from the rest of the building. Any access openings in such enclosures should be provided with a fire rated door having an FRR, with regard to the criteria of integrity and insulation, of not less than that of the fire barriers therein.

### **Clause C9.4**

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Each element of construction of a required staircase including the landings and supports enclosed within the walls having the required FRR need not have an FRR but must be non-combustible.

### **Clause C9.5**

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Where the ground storey of a building provided with only one required staircase is used for any occupancy other than domestic or office, the required staircase from ground to first floor level should be separated from the rest of the building by a fire barrier having the longer of the FRRs specified in Table C1 and the wall enclosing the required staircase should, at the main entrance, be returned for a distance of not less than 450mm along the frontage of the ground storey.

### **Clause C9.6**

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Subject to Subsection C5, Clause C9.7 and C9.8, an external wall of a required staircase and its protected lobby may be unprotected and openings may be made in the external wall.

### Clause C9.7

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Where any external wall of a required staircase and its protected lobby opposing, either directly or indirectly, and within 6 m of:

- (a) the opposite side of a street;
- (b) a common boundary with an adjoining site;
- (c) any other external wall having an FRR of less than that required for the wall separating the required staircase or protected lobby concerned from the rest of the building, or other opening not protected by fixed light with an FRR of that required for the wall of the required staircase or protected lobby concerned of the same building; or
- (d) any other building on the same site,

that part of the external wall should have an FRR of not less than that required for the wall separating such required staircase or protected lobby from the remainder of the building. It should also be imperforate, unless protected by fixed light which should not occupy more than 25% of the area of the external wall of the storey in which it is located and having an FRR of not less than that of the wall or, in the case of the discharge point at ground storey or roof level, a fire rated door having an FRR of not less than that of the wall. See Diagram C2 for illustration.

#### Commentary

The distance of 6m should be measured in a straight line between the features listed in (a) to (d) of the clause and the side of the subject window of a required staircase or protected lobby, nearest to such features. Any screen on such side of the window having the required FRR of not less than that of the required staircase or protected lobby could be regarded as solid screen wall in measuring the required minimum 6m distance. See Example (b) in Diagram C2 for illustration.

### Clause C9.8

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Where the external wall coming under Clause C9.6 continues in the same plane with other external walls of the same building and both such walls have an FRR of less than that required for the wall separating the required staircase or protected lobby concerned from the rest of the building, the remaining fire resisting walls of the required staircase or protected lobby should, at the junction with the external wall, be extended for a distance of not less than 450 mm at any angle, except that at the final discharge point at ground storey, the extension should not project beyond the external wall. See Diagram C3 for illustration.

#### Commentary

The separation distances specified in Diagram C3 are to prevent fire spread or to prevent thermal injuries to escaping occupants and are not intended to prevent smoke spread.

## **Subsection C10 - Protection of Openings between Floors**

### **Clause C10.1**

For sprinkler protected building, at any internal unprotected opening in floors within a fire compartment, such as those for escalators, circulation staircases or walkways, the following should be provided:

- (a) a barrier of not less than 450mm measured vertically downwards from the underside of the floor should surround the opening. The barrier should have an FRR of not less than -/30/- and be non-combustible complying with the requirements in Part E. If false ceilings are hung in the vicinity of the opening, the barrier should extend not less than 450mm below the false ceiling. See Diagrams C4 and C5 for illustration; or
- (b) a smoke curtain activated by a smoke detection system subject to the approval from the Building Authority and the Director of Fire Services.

#### **Commentary**

The 450mm downstand at the edge of a void is for the purpose of ensuring the formation of a hot smoke layer to activate sprinkler protection. The 450mm downstand will, in the very early stages of a fire, provide a barrier to the expanding hot layer. The barrier is not intended to prevent smoke from spreading between floors as fire develops.

The smoke curtain mentioned in Clause C10.1(b) above should:

- (a) be deployed upon receipt of a fire alarm /smoke detection alarm signal or in the event of main power failure;
- (b) not be less than 450mm measured vertically downwards from the underside of the floor or below the false ceiling if false ceilings are hung in the vicinity of the opening; and
- (c) be tested to BS EN12101-1 for 600°C for at least 30 minutes and BS EN 1634-3.

### **Clause C10.2**

A curtain wall or other similar construction, which protects the building against the elements and which extends beyond one storey in height, should be constructed entirely of non-combustible materials (except for window sealants and gaskets). Any void formed between the curtain wall and the perimeter of the building onto which the curtain wall is fixed should be sealed to form an effective smoke and fire barrier to prevent smoke and fire spread between floors. The smoke and fire barrier should have:

- (a) an FRR of not less than that of the floors; and
- (b) D-stability duration of not less than the FRR of the floors and the maximum leakage is not more than  $25\text{m}^3/\text{h}/\text{m}^2$  at 25Pa at ambient temperature when tested in accordance with BS EN 12101-1.

### Clause C10.3

---

An atrium in a sprinkler protected building should comply with the following requirements:

- (a) the atrium should be separated from all other spaces by fire barriers having an FRR of not less than that of those spaces. The fire barrier can be formed by fire rated walls, fire shutters, fire curtains or fire rated glazings;
- (b) the volume of an atrium should not exceed 28,000m<sup>3</sup>;
- (c) the maximum height from lowest connected floor to the underside of the lowest structural member of the ceiling of the upper-most connected floor should not exceed 15m. See examples in Diagram C6;
- (d) a sprinkler system designed and installed to the satisfaction of the Director of Fire Services must provide coverage to the base of the atrium;
- (e) the atrium cannot have more than 3 floors interconnected; and
- (f) other fire separation requirements on special designs to be determined by the Building Authority.

#### Commentary

An atrium is formed when floors are linked through openings between floors, there is a risk of smoke spread that could affect adversely the life safety of occupants, especially on the upper floors of the atrium. The fire separation of the atrium from the surrounding areas can be achieved by fire barriers, fire rated glazing or automated fire shutters / curtains.

## Subsection C11 – Protection against External Fire Spread

### Clause C11.1

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Subject to Subsection C5, the external wall of a building at any floor should be separated from the external wall at the floor next below by:

- (a) a spandrel that is a vertical element of 900mm, with an FRR of not less than that of the intervening storey; or
- (b) a horizontal projection of 500mm, with an FRR of not less than that of the intervening storey.

This clause does not apply to a single family house or a sprinkler protected building.

See Diagram C7 for illustration.

#### Commentary

A 900mm spandrel or 500mm horizontal projection is effective in slowing flame spread only and may not prevent fire spread. A sprinkler system installed in compliance with the requirements of the Director of Fire Services is the most effective form of fire control to prevent vertical fire spread.

### **Clause C11.2**

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For Use Classification 1, openings of not more than 110mm in diameter are allowed at the fire rated spandrels of the kitchen and bathroom for the penetration of plumbing and drainage pipes.

## **Subsection C12 – Protection of Roofs**

### **Clause C12.1**

---

All roofs, together with the members forming the roof structure, should be constructed of non-combustible materials complying with Part E.

### **Clause C12.2**

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The roof of every building with only one required staircase, forming part of a protected exit in which the level of the highest floor is more than 13m above ground level should have an FRR of not less than that of the storey below.

### **Clause C12.3**

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The main roof or any other part of the roof, which is used or intended to be used as a refuge floor or part of a refuge floor, should have an FRR of not less than that of the storey below.

### **Clause C12.4**

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Where a protected exit leads to a temporary place of safety, which is an open area located at an upper floor instead of leading directly to a street or to an ultimate place of safety, such as podium level, the exit route at the temporary place of safety should comply with Subsection C9. In particular, the floor of the temporary place of safety should have an FRR of not less than that of the storey below.

## **Subsection C13 - Protection of Areas of Special Hazard**

### **Clause C13.1**

---

Areas of a building accommodating a special hazard should be separated from the rest of the building by fire barriers having an FRR of not less than -/120/120. If the special hazard area is connected directly to a protected exit, the fire barriers should have an FRR of not less than -/240/240.

#### **Commentary**

For the purpose of this clause, the hazard of occupancy should be the relative danger to the start and spread of fire, the relative danger of smoke or gases generated and the relative danger of explosion or other occurrence which may endanger the lives and safety of occupants. The definition of special hazard is given in Part A. The protection to means of escape should be enhanced where an area of special hazard opens direct to a protected exit.

### **Clause C13.2**

---

A kitchen in a restaurant may be regarded as ancillary accommodation to the restaurant for the purpose of assessing the fire resisting construction requirements. Such a kitchen should comply with the following requirements:

- (a) the kitchen should be enclosed by fire barriers having an FRR of not less than -/60/60 and any opening in the enclosure should be protected by fire rated door(s) having an FRR of not less than -/60/60; and
- (b) protected lobby in compliance with Clause C16.5 should be provided between the kitchen and
  - (i) any exit route from the main building; and/or
  - (ii) the dining area of the restaurant where the kitchen has a usable floor area exceeding 45m<sup>2</sup> and the lobby opens onto an exit route of the dining area; and
- (c) subject to compliance with Clause C16.1, hold-open device for the doors of the kitchen may be installed.

### **Clause C13.3**

---

In any Use Classification 1 provided with a single exit door, a kitchen adjacent to such door should be separated from the rest of the flat by walls having an FRR of not less than -/30/30 and the entrance to the kitchen should be provided with a fire rated door having an FRR of not less than -/30/30.

#### **Clause C13.4**

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If fire barrier is not provided in accordance with Clause C13.3 (i.e. an open kitchen), the following fire safety provisions should be provided:

- (a) smoke detector(s) fitted with sounder base should be provided inside the subject flat. The alarm signal of the smoke detector(s) should be connected to the local fire services control panel of the building and should not be linked to the Fire Services Communication Centre;
- (b) smoke detector(s) should be provided at the common area outside the subject flat. The alarm signal of the smoke detector(s) should be connected to the local fire services control panel, the common fire alarm system of the building and the Fire Services Communication Centre;
- (c) sprinkler head(s) should be provided to cover the notional open kitchen area. The alarm signal of the system should be connected to the local fire services control panel, the common fire alarm system of the building and the Fire Services Communication Centre;
- (d) a full height wall having an FRR of not less than -/30/30 should be provided adjacent to the flat exit door. The width of the wall should not be less than 600mm; and
- (e) For open kitchen in premises with internal staircase(s), a barrier of not less than 450mm measured vertically downwards from the underside of the floor shall be provided. The barrier should surround the notional open kitchen area and should have an FRR of not less than -/30/- and be non-combustible complying with the requirements in Part E. If false ceilings are hung in the open kitchen, the barrier should extend not less than 450mm below the false ceilings.

#### **Commentary**

The specification and location of the smoke detectors should be considered carefully when they are installed inside the flats to minimize false alarms. Also taking into account the effect of humidity, medium or low sensitivity smoke detectors are recommended to be installed in living areas and placed away from the cooking range(s) and bathroom.

The smoke detectors and sprinklers are fire service installations designed in accordance with the Code of Practice for Minimum Fire Service Installations and Equipment and should be subject to annual inspection and certification by a registered fire service installation contractor.

The full height wall having an FRR of not less than -/30/30 should be erected with a material that is not easily removable (e.g. reinforced concrete construction).

## **Subsection C14 – Protection of Basements**

### **Clause C14.1**

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Every basement should be provided with the following:

- (a) fire barriers forming the fire compartment between the ground storey and a basement should have an FRR of not less than -/240/240. This includes all protected exits serving the basement;
- (b) all elements of construction of the basement should have an FRR of not less than 240/240/240;
- (c) fire barriers forming fire compartment walls within basements should have an FRR of not less than -/120/120; and
- (d) where a basement has the same Use Classification as the ground storey and any upper storeys, the basement may be united with the ground and upper storeys, provided that every element of construction and fire barriers in all such storeys should have an FRR of not less than that of the basement as specified in (a), (b) and (c) above.

### **Clause C14.2**

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Every basement that is enclosed on four sides should be provided with smoke outlets, which should:

- (a) be not more than 30m apart and situated along the street frontages or adjacent to external walls;
- (b) be sited at a high level, be evenly distributed around the perimeter of the building and be so arranged as to create a through draft;
- (c) be provided to every fire compartment as described in Clause C3.1 in the basement;
- (d) have an area in aggregate of not less than 0.5% of the floor area they serve or, in areas used for bulk storage or warehouse, not less than 2.5% of the floor area they serve;
- (e) be not less than 1m in its least dimension;
- (f) be situated as far away as possible from the discharge points of all required staircases and be suitably indicated on the external face of the building;
- (g) be covered by stall-boards or pavement light that can be easily broken by firefighters in an emergency; and
- (h) be maintained unobstructed or covered only with a grill or louvres constructed of metal other than aluminium where they are terminating in the open air in a position inaccessible to a firefighter.

### **Clause C14.3**

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Where a dynamic smoke extraction system is provided in a basement which is subject to the satisfaction of the Director of Fire Services, smoke outlets should be provided as follows:

- (a) have at least one smoke outlet for every 3,500 m<sup>3</sup> of fire compartment volume, but in no case less than 1 outlet per floor;
- (b) be readily accessible to firefighter in an emergency; and
- (c) comply with the requirements of Clause C14.2, except (d) and (h) thereof unless incompatible with the requirements in (a) and (b).

### **Clause C14.4**

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Where a smoke outlet shaft serving a basement extends into or through another storey, it should have an FRR or be protected with an enclosure having an FRR not less than that required for the element of construction of the storey served or through which it passes, whichever is the higher. Where a smoke outlet shaft serving a basement adjoins another smoke outlet shaft, they should be similarly separated from each other. An unenclosed smoke outlet shaft should be capable of resisting accidental mechanical damage to the satisfaction of the Director of Fire Services.

## **Subsection C15 – Linked Buildings**

### **Clause C15.1**

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A bridge may link two or more buildings and should comply with the following:-

- (a) Where fire barrier is provided at each end of the bridge, the elements of construction of the bridge and such fire barriers should have the longest of the FRR of the storey(s) the bridge links. If the fire barriers are fire shutters, by-pass lobbies clearly indicated by exit signs should be provided. The external walls at the junctions of the bridge and the building(s) should comply with the requirements in Subsection C5.
- (b) Where no fire barrier is provided at each end of the bridge and the bridge is unenclosed, i.e. both sides of the bridge are provided with, throughout its whole length, protective barriers or parapets not higher than 1.2m, it should be constructed of non-combustible materials and the elements of construction should have the longest of the FRR of the storey(s) it links.
- (c) Where no fire barrier is provided at each end of the bridge and the bridge is not unenclosed, it will be regarded as an integral part of the fire compartment it links and should comply with the relevant requirements in this Code with regards to the building(s) it links.

#### **Commentary**

Where fire barriers are not provided at each end of the bridge, the bridge should be an unenclosed bridge constructed of non-combustible materials to prevent spread of fire and allow disperse of smoke. Otherwise, the bridge will be considered as a part of the building(s) it links.

### Clause C15.2

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A tunnel linking two or more buildings should be provided at each end with fire barriers having the longest of the FRR of the storey(s) it links. If fire shutters are used, by-pass lobby clearly indicated by exit signs should be provided. Doors including by-pass lobby should have an FRR of not less than that of the fire barriers. The tunnel should be of non-combustible construction.

#### Commentary

##### Use of Fire Shutters and By-Pass Lobby

Fire shutters are fire barriers but also prevent means of escape movement. Occupants may not realise the by-pass doors are means of escape and will often not use the by-pass doors provided. Therefore, appropriate exit sign should be provided.

### Subsection C16 – Fire Rated Doors

#### Clause C16.1

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All fire rated doors should be self-closing and comply with the requirements in Part E.

#### Clause C16.2

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Fire rated doors to a required staircase forming part of a protected exit and its protected lobby should remain closed. Other fire rated doors are allowed to be held open provided that the hold-open device can be released manually and upon actuation of a smoke detection system or the operation of a fire alarm system, designed and installed to the satisfaction of the Director of Fire Services.

#### Clause C16.3

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Except for fire rated doors with hold-open devices complying with Clause C16.2, all fire rated doors should be provided with a notice on both sides stating in English and Chinese with words and characters, not less than 10mm high, as follows:



#### **Clause C16.4**

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All fire rated doors should be closely fitted around their edges to impede the passage of smoke or flame. The bottom gap between such doors and the floor should not exceed 10mm.

#### **Commentary**

The bottom gap between the fire rated door and the floor shall be not more than the designed values of such door specified in the fire test report.

#### **Clause C16.5**

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A protected lobby should comply with the following requirements:

- (a) all fire barriers should be constructed from the soffit of upper storey or from the underside of a false ceiling to the floor. The fire barriers and the false ceiling should have an FRR of not less than that of the Use Classification of that floor; and
- (b) if the FRR of the door facing the occupied side (or in case of Clause C13.2, the kitchen side) is not less than the FRR of the fire barriers of that storey, the second door is not required to have an FRR. Both doors should be provided with smoke seals; or
- (c) if both doors of the protected lobby have the same FRR, the FRR of both doors can have an FRR of not less than half of the fire barriers of that lobby. Both doors should be provided with smoke seals.

## **Subsection C17 – Protection for Refuge Floor at Intermediate Floor Level**

### **Clause C17.1**

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The area for refuge on every refuge floor in a building should be separated from the rest of the building, including vertical shafts or ducts passing through such floor, by walls and floors having an FRR of not less than -/120/120. Any vertical shafts or ducts passing through a refuge floor should not open directly onto that floor.

#### **Commentary**

One means of complying with the Performance Requirement for tall building is provided in Subsection B18 of Part B, which details information for refuge floors, including aspects of fire resisting construction and should be read in conjunction with this Subsection.

Access through a protected lobby will not be considered as open directly onto the refuge floor.

### **Clause C17.2**

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Where the side of a refuge floor is required to be open, the open side should not directly or diagonally be within a distance of less than 6 m from:

- (a) the opposite side of a street;
- (b) a boundary of another site;
- (c) any other external wall having an FRR of less than 120/120/120; or
- (d) any other building on the same site.

If the subject matter in (b), (c) or (d) are on or beyond the same plane of the open side of the refuge floor, this requirement does not apply.

### Commentary

- (a) If a communal sky garden is incorporated in a refuge floor, the following requirements should be observed :
- (i) in Subsection B18 and C17, except those special provisions mentioned below, should be complied with. In assessing the net area for refuge and the minimum dimension of the area for refuge, no account should be taken of the space occupied by any planters, equipment and furniture in the refuge floor;
  - (ii) all garden furniture and equipment in the refuge floor should be firmly fixed;
  - (iii) all furniture, equipment and rubbish bins should be of non-combustible materials and so sited that they will not obstruct the exit routes and lift openings. Rubbish bins, where provided, should be fitted with self-closing lids; and
  - (iv) the garden should not be used for activities involving the use of naked fire e.g. barbecuing. A notice to this effect should be posted at prominent locations at the garden.
- (b) Where a communal sky garden is incorporated in a refuge floor, a relaxation on the restriction to provide lift door openings onto such floors may be granted subject to the following:
- (i) the lift landing doors should open onto a protected lobby with the doors and walls having an FRR of not less than -/120/120; and
  - (ii) the lift operation is arranged in such a manner that the landing doors at the refuge floor, other than those for fireman's lifts, will be automatically locked when the fire alarm is on.
- (c) While live plants are unlikely to pose undue fire risk<sup>1</sup>, the use of artificial plants/soil should be avoided where possible. The authorized person should advise the management to include in the fire safety management plan ensuring that any artificial plants and soil substrate materials are non-combustible and do not emit toxic gases in case of fire.
- (d) The Building Authority may impose additional requirements depending on the special circumstances of individual cases. Authorized persons proposing communal sky gardens in refuge floors with special design are advised to conduct a fire engineering assessment. The Fire Services Department also welcomes any enquiries prior to formal submission of plans.

<sup>1</sup>Live plants that are likely to be highly flammable (such as those secreting resinous sap or having volatile waxes or oils in their leaves, twigs and stems) should be used with caution.

## **Section 3 – Fire Safety Provisions for Cinemas and Theatres**

### **Subsection C18 - Fire Safety Provisions for Cinemas and Theatres**

#### **Clause C18.1**

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Cinemas in a non-domestic building or the non-domestic part of a composite building that shares exit routes with other parts of the non-domestic uses in the same building should comply with the following requirements:

- (a) each cinema auditorium should form a fire compartment of its own having an FRR complying with Table C1;
- (b) a dedicated smoke extraction should be provided to all cinema auditoria, activated by ceiling mounted smoke detection system, designed and installed to the satisfaction of the Director of Fire Services;
- (c) fixed seating and furnishing materials should comply with the requirements for the retarding of ignition as stipulated in Part E; and
- (d) all projectors and the associated equipment should be placed within a projector room or projector rooms which are separated from the cinemas and other accommodations by walls and floors having an FRR of not less than -/60/60. Every door to a projection room should have an FRR of not less than that of the wall and be provided with a smoke seal. This requirement should not apply to cinemas where no film projection, and no electric arc, xenon, or other light source projection equipment which generates hazardous gases, dusts or radiation are used.

#### **Clause C18.2**

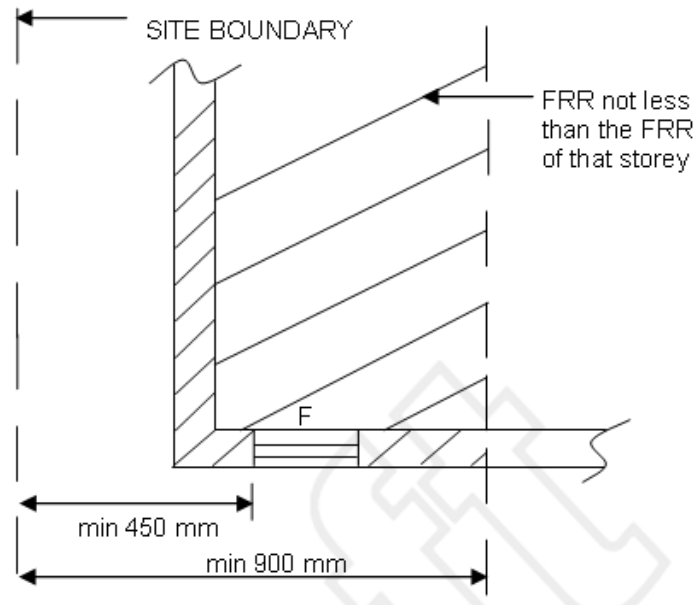
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Theatres should have the following fire safety provisions:

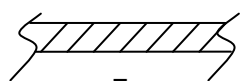
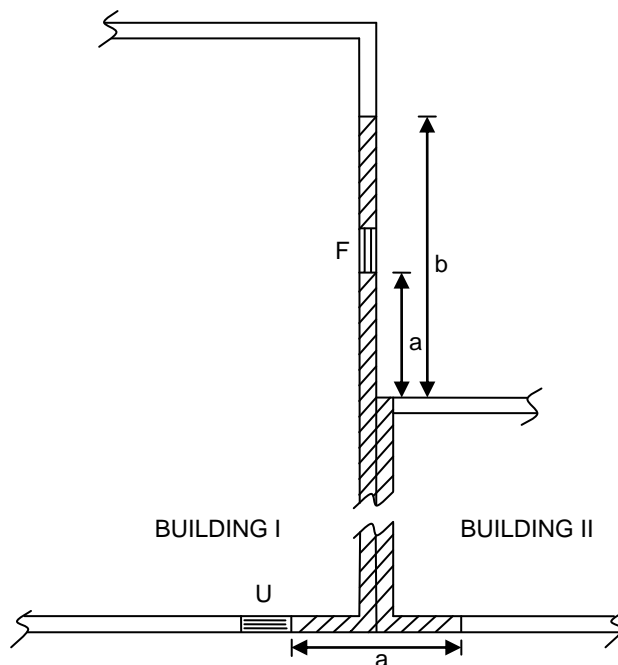
- (a) the theatre should be fully sprinkler protected, designed and installed to the satisfaction of the Director of Fire Services and provided with a proscenium wall that separates the stage area from the seating areas;
- (b) the proscenium wall separating the stage and the seating area should have an FRR of not less than -/60/60; and
- (c) the opening within the proscenium wall should be provided with a fire curtain or water curtain to achieve fire separation between the stage and seating areas, designed and installed to the satisfaction of the Director of Fire Services. The fire curtain should have an FRR of at least -/30/- and be able to restrict the passage of smoke.

## Diagram C1: Prevention of Fire Spread between Buildings (See Clauses C5.2 and C5.3)

### Example (a): Buildings not on the same site (plan view)



### Example (b): Buildings on the same site (plan view)



F

FRR of external walls  $\geq$  FRR of that storey

U

fixed lights having an FRR not less than that of the storey

a

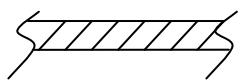
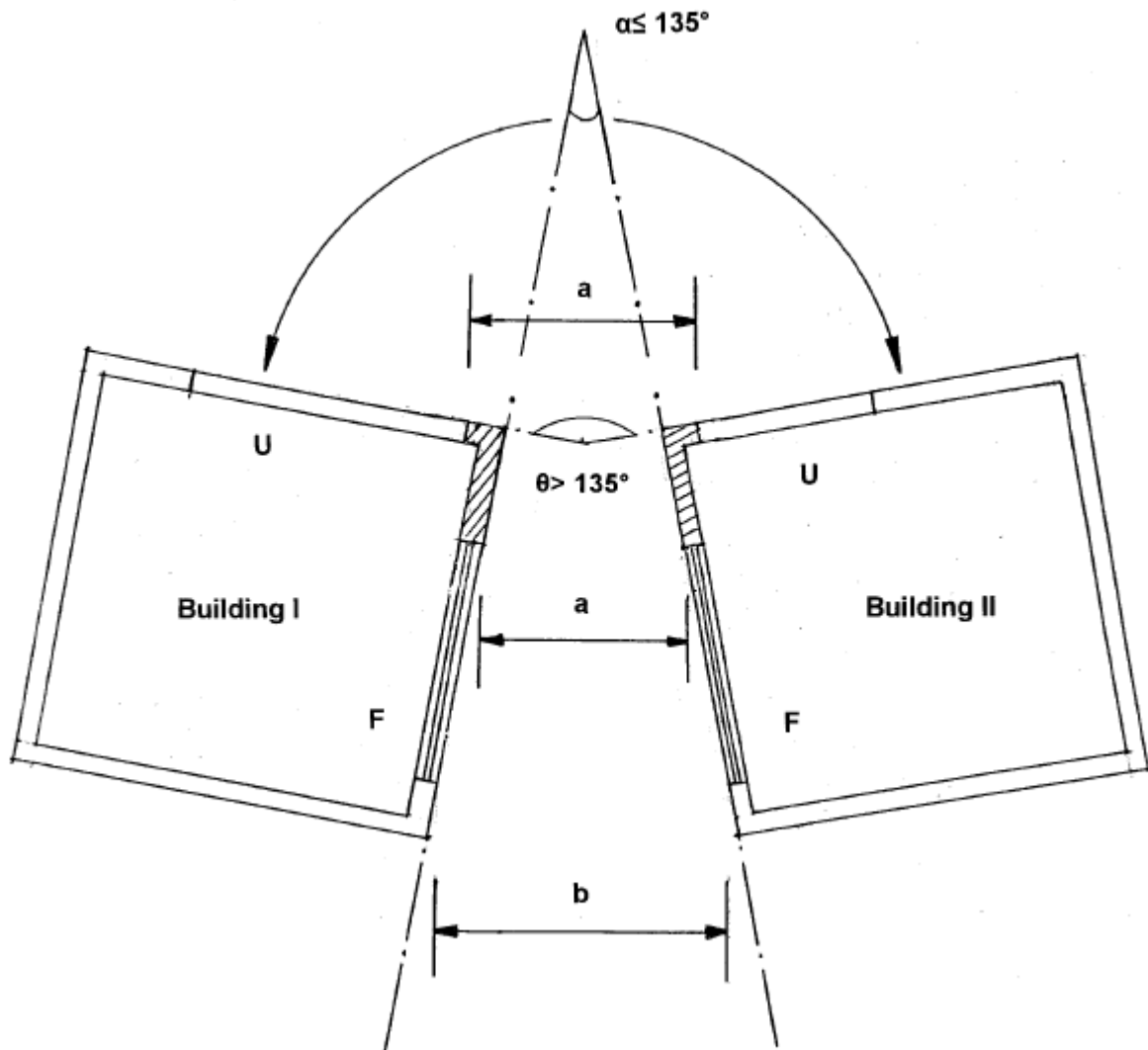
unprotected openings

b

min. 900mm

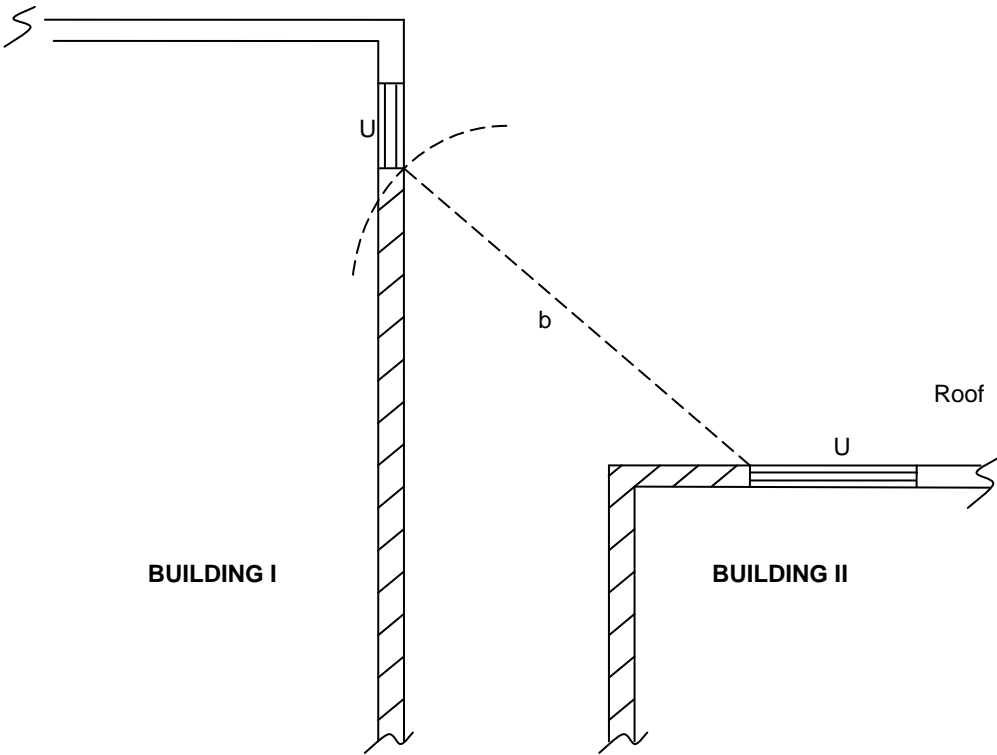
min. 1800mm

**Example (c): The minimum distance between unprotected openings of two buildings on the same site (plan view)**



F	FRR of external walls $\geq$ FRR of that storey
U	Fixed lights having an FRR not less than that of the storey
a	unprotected openings
b	min. 900mm
$\theta$	min. 1800mm
$\alpha$	The angle made between facades of two adjoining buildings $> 135^\circ$
	The angle made between facades of two adjoining buildings $\leq 135^\circ$

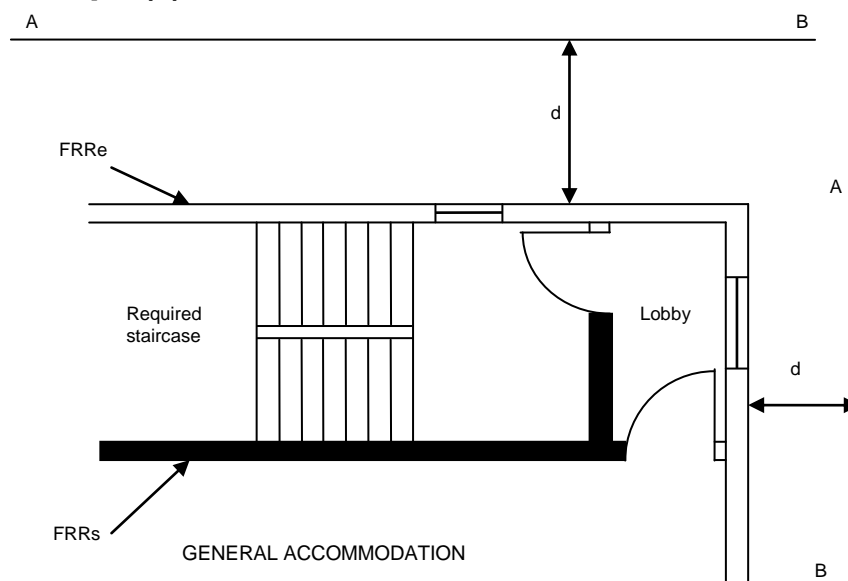
**Example (d): The minimum distance between unprotected openings of two buildings  
(Section view)**



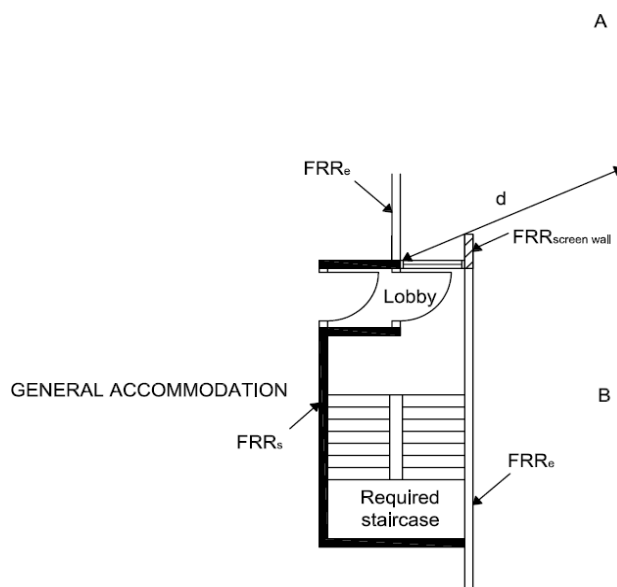
	FRR of external walls/roof ≥ FRR of that storey
U	unprotected openings
b	min. 1800mm

## Diagram C2: Openings at the External Walls of Required Staircases and Protected Lobbies (see Clause C9.7)

### Example (a)



### Example (b)



FRR<sub>e</sub> : FRR of the external wall

FRR<sub>s</sub> : FRR of the required staircase

FRR<sub>screen wall</sub>: FRR of the screen wall  $\geq$  FRR<sub>s</sub>

Where AB is:

- Opposite side of the street,
- Common boundary with an adjoining site,
- Any other external wall of FRR < FRR<sub>e</sub> or unprotected opening of the same building
- Any other building on the same site

External wall may be unprotected if  $d > 6\text{m}$

External wall with FRR<sub>e</sub>  $\geq$  FRR<sub>s</sub> if  $d \leq 6\text{m}$

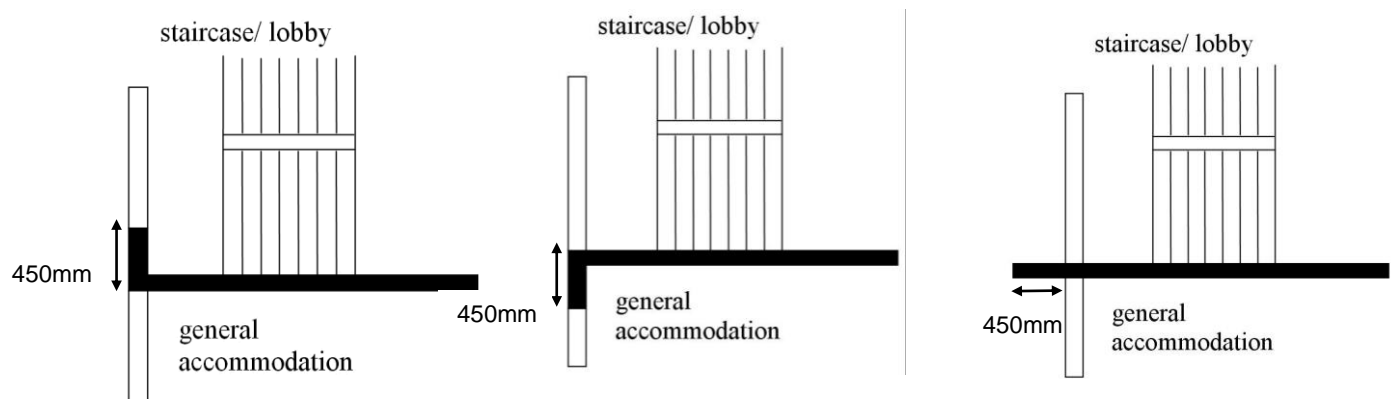
Openings: i)  $d \leq 6\text{m}$  - Fixed light with FRR  $\geq$  FRR<sub>e</sub>

- Door with FRR  $\geq$  FRR<sub>e</sub> for:

- Discharge point at G/F
- Podium/Roof level

ii)  $d > 6\text{m}$  - unprotected

**Diagram C3: Separation between Required Staircase and Protected Lobbies from the General Accommodation (see Clause C9.8)**



FRR<sub>e</sub> : FRR of the external wall

FRR<sub>s</sub> : FRR of the required staircase



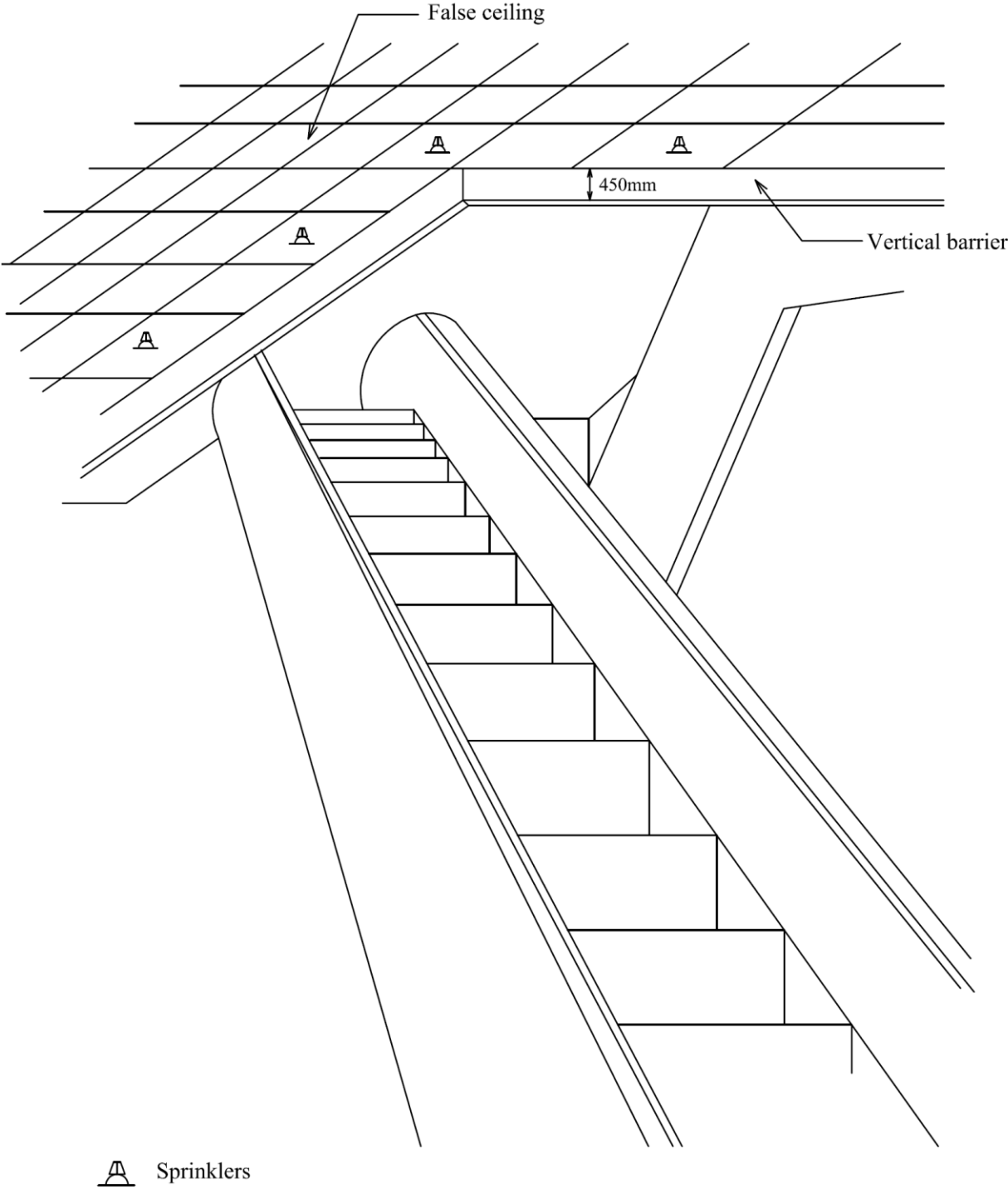
External wall with FRR<sub>e</sub>



Wall separating the staircase or lobby from the rest of the building with FRR<sub>s</sub>

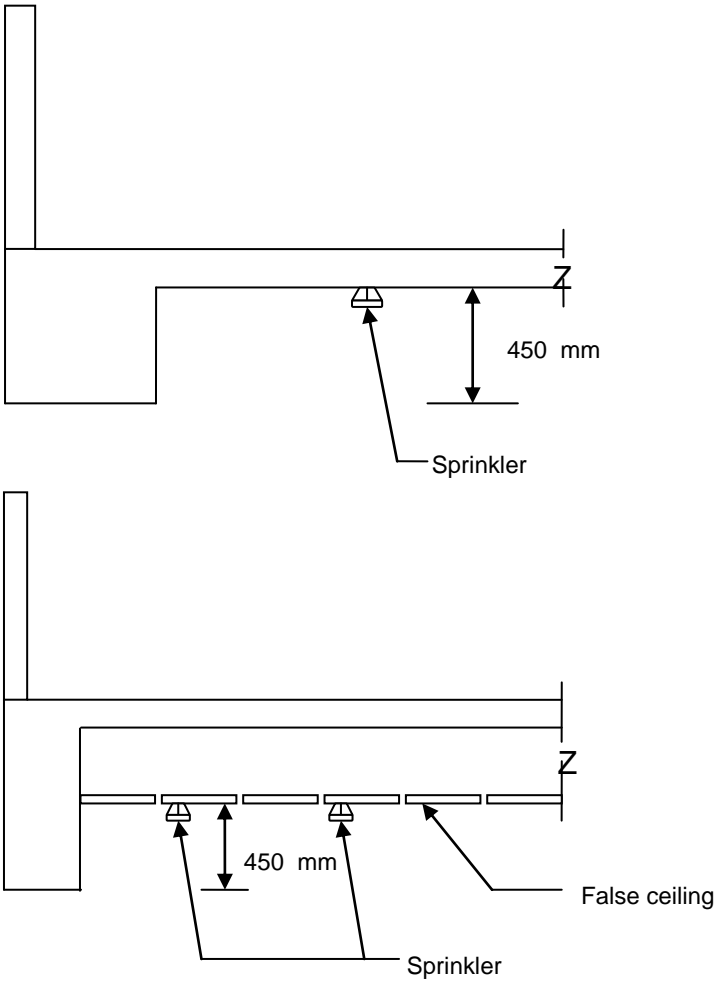
Where FRR<sub>s</sub> ≥ FRR<sub>e</sub>

**Diagram C4: Vertical Barrier at Escalator (see Clause C10.1)**



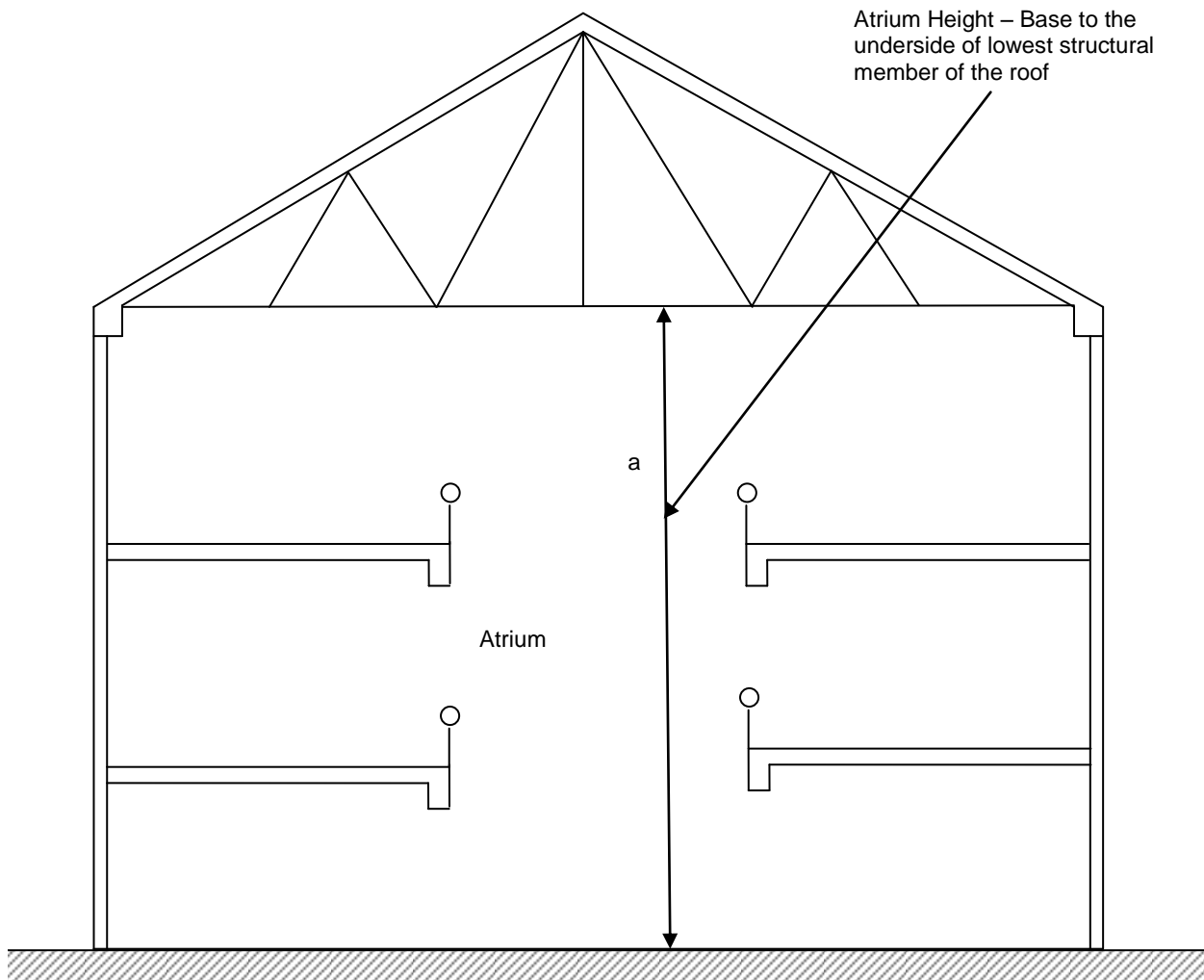
**Diagram C5: Vertical Barrier at Atrium (See Clause C10.1)**

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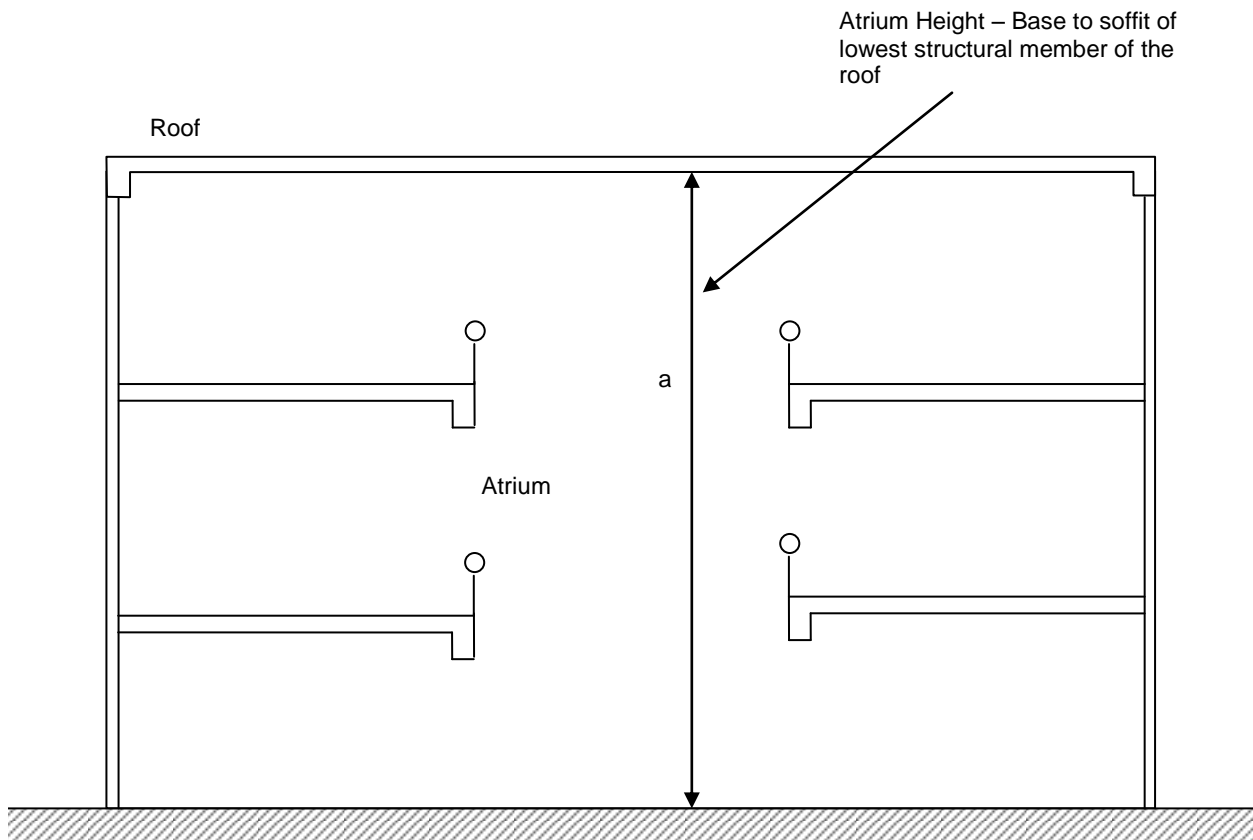
## Diagram C6: Examples on Measuring Atrium Height (See Clause C10.3(c))

### Example (a): Pitched Roof



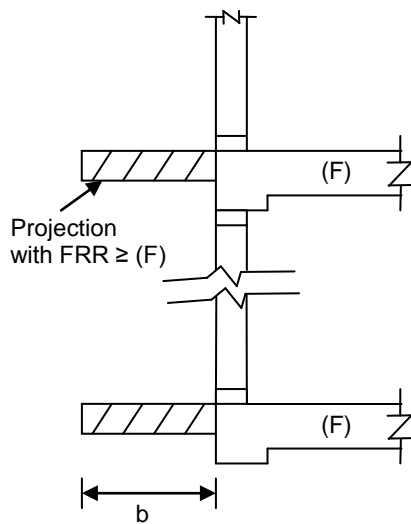
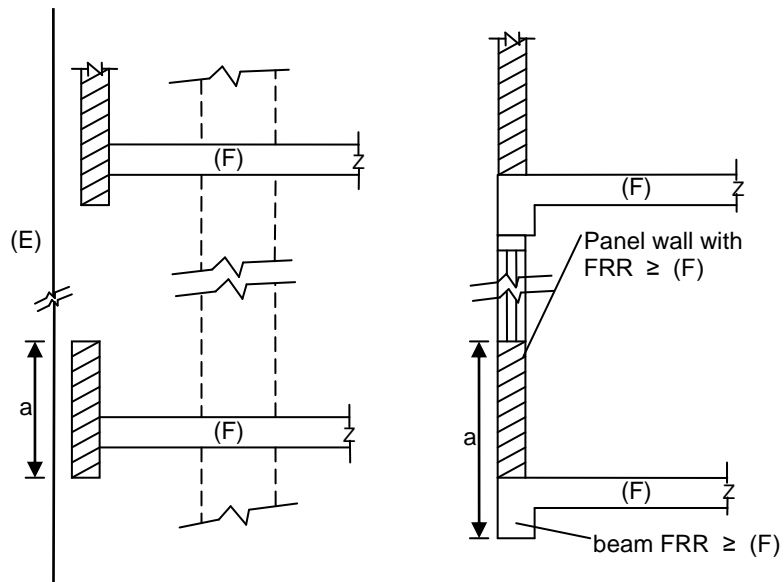
$a \leq 15 \text{ m}$

**Example (b): Flat Roof**

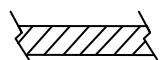


$$a \leq 15 \text{ m}$$

**Diagram C7: Protection against Spread of Fire by Spandrels (see Clause C11.1)**



(F) FRR of Intervening floor



Spandrel having FRR ≥ that of (F)

$a \geq 900 \text{ mm}$

$b \geq 500 \text{ mm}$

(E) External wall (e.g. curtain wall) with no FRR or FRR < that of (F)

**Part D -**  

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**Means of Access**

**This Part contains six Sections:**

- **Section 1 – General**
- **Section 2 – Provision of Access Staircase, Fireman's Lifts and Firefighting and Rescue Stairway**
- **Section 3 – Access Staircase**
- **Section 4 – Fireman's Lift**
- **Section 5 – Firefighting and Rescue Stairway**
- **Section 6 – Provision of Emergency Vehicular Access**

## **Section 1 – General**

### **Subsection D1 – Use of this Part**

#### **Clause D1.1**

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This Part provides the Deemed-to-Comply provisions on means of access and EVA and is to be read in conjunction with all other Parts of this Code.

#### **Clause D1.2**

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Authorized persons, fire safety consultants and any person responsible for the design of buildings may find this Part useful in ascertaining the requirements under the Buildings Ordinance for the provisions of access to buildings for the purposes of firefighting and rescue.

#### **Clause D1.3**

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This Part provides guidance on how the Performance Requirements on the means of access may be complied with.

#### **Commentary**

Fire safety in a building is determined by a number of factors, one of which is the means of access to it to enable fire services personnel to effect rescue and fight fire. Requirements for means of access to buildings are laid down in the Building (Planning) Regulations 41A, 41B, 41C and 41D.

The Building (Planning) Regulations 41A, 41B and 41C deal with the means of access to the building. They require that every building shall be provided with an adequate number of access staircases, fireman's lifts and/or firefighting and rescue stairways having regard to the intended use of the building, its height and size. These staircases, lifts or stairways shall be so designed and constructed or installed as to allow firemen safe and unobstructed access to various floors of the building in the event of a fire. Sections 2 to 5 provide guidance on compliance with these requirements.

The Building (Planning) Regulation 41D deals with the means of access for emergency vehicles to a building. It requires every building to be provided with an EVA which is so designed and constructed as to allow safe and unobstructed access of a vehicle of the Fire Services Department to the building and to provide for the safe operation of such a vehicle, in the event of a fire or other emergency. The Building (Planning) Regulation 41D(2) provides that the design and construction of an EVA shall be in accordance with such requirements as may be specified by the Building Authority from time to time having regard to the intended use of the building. Section 6 specifies such requirements.

### **Subsection D2 – Performance Requirements for Means of Access**

#### **Clause D2.1**

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Performance Requirements relevant to means of access including EVA are stipulated in Subsection A10 of Part A.

## **Section 2 – Provision of Access Staircase, Fireman’s Lift and Firefighting and Rescue Stairway**

### **Subsection D3 - Number of Access Staircases, Fireman’s Lifts and Firefighting and Rescue Stairways**

#### **Clause D3.1**

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Such numbers of access staircases, fireman’s lifts and firefighting and rescue stairways should be provided in a building as required by the Building (Planning) Regulations 41A, 41B and 41C. The number of these means of access for firefighting and rescue as required are summarised in Table D1.

#### **Clause D3.2**

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In any building which the Building Authority considers to be likely to bear a high risk to life from fire, such as Use Classification 5a, 5d or 6, additional number of fireman’s lifts and/or firefighting and rescue stairways may be required.

**Table D1 : Number of Access Staircases, Fireman's Lift and Firefighting and Rescue Stairways Required**

Type of Building		No. of Access Staircases required	No. of Fireman's Lifts required	No. of Firefighting and Rescue Stairways required
(1)	All buildings and all basements	Not exceeding 1 storey	-	-
(2)	Domestic buildings for single family	Not exceeding 3 main storeys	-	-
(3)	Domestic buildings or offices with G/F shop or carport	(a) exceeding 1 storey but not exceeding 6 storeys and uppermost floor not exceeding 13m above ground and usable floor area not exceeding 250m <sup>2</sup> per floor	One	-
		(b) exceeding 1 storey but not exceeding 6 storeys and uppermost floor exceeding 13m but not exceeding 17m above ground and usable floor area not exceeding 150 m <sup>2</sup> per floor	One	-
(4)	Domestic buildings or domestic part of composite building other than buildings in (2) and (3)	(a) exceeding 1 storey but not exceeding 30m above mean level of lowest street, irrespective of cubical extent	Two or more (as many as escape staircases)	-
		(b) exceeding 2 storeys and exceeding 30m above mean level of lowest street, irrespective of cubical extent	Two or more (as many as escape staircases)	One within 60m of any part of floor
(5)	Non-domestic buildings or non-domestic part of composite buildings other than Use Classification 6, Use Classification 5a, hotels, hospitals or buildings in (3)	(a) exceeding 1 storey but not exceeding 15m above mean level of lowest street, irrespective of cubical extent	Two or more (as many as escape staircases)	-
		(b) exceeding 1 storey and exceeding 15m but not exceeding 30m above the mean level of the lowest street and not exceeding 7000m <sup>3</sup> in cubical extent including basements	Two or more (as many as escape staircases)	-
		(c) exceeding 2 storeys and exceeding 15m but not exceeding 30m above mean level of the lowest street and exceeding 7000m <sup>3</sup> in cubical extent including basements	Two or more (as many as escape staircases)	One within 60m of any part of floor
		(d) exceeding 2 storeys and exceeding 30m above mean level of lowest street, irrespective of cubical extent	Two or more (as many as escape staircases)	One within 60m of any part of floor
(6)	Use Classification 5a, hotels or hospitals	(a) exceeding 1 storey but not exceeding 2 storeys	Two or more (as many as escape staircases)	-

Type of Building		No. of Access Staircases required	No. of Fireman's Lifts required	No. of Firefighting and Rescue Stairways required
	(b) exceeding 2 storeys, irrespective of height above mean level of lowest street and cubical extent	Two or more (as many as escape staircases)	One within 60m of any part of floor	-
(7) Use Classification 6	(a) exceeding 2 storeys but not exceeding 30m above the mean level of the lowest street and not exceeding 7000m <sup>3</sup> in cubical extent including basements	Two or more (as many as escape staircases)	One within 60m of any part of floor	-
	(b) exceeding 1 storey but not exceeding 30m above the mean level of the lowest street and exceeding 7000m <sup>3</sup> in cubical extent including basements	Two or more (as many as escape staircases)	One within 60m of any part of floor	One within 60m of any part of floor
	(c) exceeding 1 storey and exceeding 30m above the mean level of the lowest street but not exceeding 7000m <sup>3</sup> in cubical extent including basements	Two or more (as many as escape staircases)	One within 60m of any part of floor	One within 60m of any part of floor
	(d) exceeding 1 storey, 30m above the mean level of the lowest street and 7000m <sup>3</sup> in cubical extent including basements	Two or more (as many as escape staircases)	One within 60m of any part of floor	One within 60m of any part of floor
(8) All basements	(a) exceeding 2 storeys and exceeding 7000m <sup>3</sup> in cubical extent	Two or more (as many as escape staircases)	One within 60m of any part of floor	One within 60m of any part of floor
	(b) exceeding a depth of 9m from the floor level of the ground storey above the basement to the floor level of the lowest storey in the basement and exceeding 7000m <sup>3</sup> in cubical extent	Two or more (as many as escape staircases)	One within 60m of any part of floor	One within 60m of any part of floor

Note:

1. An access staircase in a firefighting and rescue stairway will be counted as one access staircase for the purpose of the Building (Planning) Regulation 41A and a fireman's lift in a firefighting and rescue stairway will be counted as one fireman's lift for the purpose of the Building (Planning) Regulation 41B.

## **Section 3 – Access Staircase**

### **Subsection D4 - Required Staircase as Access Staircase**

#### **Clause D4.1**

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The required staircases in every building provided in accordance with the Building (Planning) Regulation 41(1) and Part B can be taken as access staircases for the purposes of the Building (Planning) Regulation 41A but can only be taken as access staircases in firefighting and rescue stairways if the requirements of the Building (Planning) Regulation 41C and this Part are also complied with.

### **Subsection D5 – Firefighting and Rescue Stairway as Required Staircase**

#### **Clause D5.1**

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Every access staircase in a firefighting and rescue stairway provided in accordance with the Building (Planning) Regulation 41C and this Part may be taken as a staircase for means of escape for the purposes of the Building (Planning) Regulation 41(1) if the requirements for required staircases in Part B are also complied with.

## **Section 4 – Fireman’s Lift**

### **Subsection D6 - Designation of Fireman’s Lift**

#### **Clause D6.1**

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Where more than one lift installed in a building is required to have a fireman’s lift, the lift which is to be the fireman’s lift should be that designated by the Director of Fire Services.

#### **Clause D6.2**

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A lift mainly intended for the transport of goods in a building of Use Classification 6 should not be designated as a fireman’s lift.

### **Subsection D7 - Access to a Fireman’s Lift at Ground Storey**

#### **Clause D7.1**

---

Access to a fireman’s lift (“fire service access point”) should be available at a ground storey in the perimeter of the building either directly from a street which is accessible by the vehicles of the Fire Services Department or through an open area having a minimum dimension of 1.5m and having access free from any permanent obstruction to such a street. Such access should not be closed with doors or gates unless they are capable of being readily openable without the use of a key.

#### **Clause D7.2**

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A fireman’s lift may be set back from the fire service access point at the ground storey in the perimeter of the building provided that the horizontal distance from the fire service access point to the doors of the fireman’s lift is not more than 18m. In cases where the physical characteristics and constraints of a site render it desirable, the Building Authority may allow a longer horizontal distance provided that level of fire safety is not adversely affected.

#### **Clause D7.3**

---

The passage from the fire service access point to the fireman’s lift should –

- (a) have a clear width of not less than 1500mm and a clear headroom of not less than 2000mm; and
- (b) be separated from the remainder of the ground storey by walls having an FRR of not less than that required for the elements of construction in the ground storey. Any opening in these walls for communication with ground storey should be through a protected lobby complying with Clauses C9.3 and C16.5.

#### **Clause D7.4**

---

A notice in the following form indicating the fire service access point should be displayed at a conspicuous position outside the building near the point:



The height of the words and characters on the notice should be not less than 20mm. Such notice should be either illuminated by two separate systems of electric light or a type of safety sign which is self-energized in respect of luminosity and which requires no external source of power.

#### **Subsection D8 - Floors Served by a Fireman's Lift**

##### **Clause D8.1**

---

Fireman's lifts should be provided to enable firefighters to reach any floor that may be on fire in the building without having to traverse more than two floors and should be arranged in such a way that:

- (a) in the case of a single fireman's lift, it serves at least the alternate floors;
- (b) in the case of multiple fireman's lifts within a common liftwell, the lifts may serve different zones of the building provided that the zones to be served are clearly indicated;
- (c) in all cases, subject to Clause D8.1(d), the pattern of service should be uniform and regular, i.e. a lift serves either the odd floors, even floors or all floors; and
- (d) Where refuge floors are provided, every such refuge floor should be served by at least one fireman's lift. The lift doors opening onto the refuge floors should comply with Clause B18.2(i).

##### **Clause D8.2**

---

Where the pattern of service adopted for a fireman's lift is such that the top floor is to be served, the top floor should be served unless the lift machine room has to be located at the top floor due to height restrictions.

### **Clause D8.3**

---

The lowest landing of a fireman's lift serving the storeys above ground storey or topmost landing of a fireman's lift serving the basement, as the case may be, should be situated at the level of the fire service access point in Subsection D7. If this is not possible due to site constraints or other special reasons acceptable to the Building Authority, such landing may be situated not more than one floor above or below the level of the fire service access point.

### **Clause D8.4**

---

No part of the floor served by a fireman's lift should be more than 60m from the door of the lift lobby measured along actual passages. If the internal layout is not known at the design stage or is not shown on plan, a direct line measurement of 45m may be used for design purposes, provided that the layout of the floor when occupied satisfies the 60m requirement.

## **Subsection D9 - Liftwell of a Fireman's Lift**

### **Clause D9.1**

---

A separate liftwell should be provided for each fireman's lift and up to three fireman's lifts may share the same liftwell. See Diagram D3.

### **Clause D9.2**

---

A notice should be displayed outside the liftwell indicating the fireman's lift by the words 'FIREMAN'S LIFT' and "消防員升降機" in English and Chinese and the floors served. The height of the words and characters on the notice should be not less than 15mm.

## **Subsection D10 – Lift Car of a Fireman's Lift**

### **Clause D10.1**

---

The car of a fireman's lift should have a minimum internal dimension of 1.1m, a net internal floor area of not less than 1.35m<sup>2</sup> and a rated load of not less than 680 kg.

## **Subsection D11 – Lobby to a Fireman's Lift**

### **Clause D11.1**

---

Each point of discharge from a fireman's lift to the floor served, except at the fire service access point in Subsection D7, should be through a lobby having a floor area of not less than 2.25m<sup>2</sup> and a minimum dimension of 1.5m. The lobby should be separated from that floor by walls and doors having an FRR of not less than that required for the elements of construction in that floor, subject to a maximum of 120 minutes and complying with the requirements in Table C2.

### **Clause D11.2**

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Openings for lighting and/or ventilation may be made in an external wall enclosing the lobby provided that the requirements in Clauses C9.6 to C9.8 of Part C are complied with.

### **Clause D11.3**

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Where only one or some of the lifts in a bank of lifts are fireman's lifts, they may share a common lift lobby, provided that such lobby is provided on every floor served by any of these lifts.

### **Clause D11.4**

---

Every lobby to a fireman's lift should have direct access, without any obstruction and lockable door, to a protected exit. Such lobby should be designed as a common area and an integral part of the fireman's lift so that it could not be readily incorporated as part of any adjacent unit(s) of accommodation.

## **Subsection D12 – Doors of a Fireman's Lift**

### **Clause D12.1**

---

The door opening of a fireman's lift should not be less than 800mm wide and 2000mm high. The doors should be fitted with power operated automatic self-closing device.

## **Subsection D13 – Control and Operation of a Fireman's Lift**

### **Clause D13.1**

---

A fireman's lift should be designed and installed in accordance with the special control, operational, electrical and mechanical requirements for fireman's lifts specified in the Code of Practice on the Design and Construction of Lifts and Escalators published by the Director of Electrical and Mechanical Services.

## **Section 5 – Firefighting and Rescue Stairway**

### **Subsection D14 - Access to a Firefighting and Rescue Stairway at Ground Storey**

#### **Clause D14.1**

---

Access to a firefighting and rescue stairway (“fire service access point”) should be available at a ground storey in the perimeter of the building either directly from a street which is accessible by the vehicles of the Fire Services Department or through an open area having a minimum dimension of 1.5m and having access free from any permanent obstruction to such a street. Such access should not be closed with doors or gates unless they are capable of being readily opened without the use of a key.

#### **Clause D14.2**

---

A firefighting and rescue stairway may be set back from the fire service access point at the ground storey in the perimeter of the building provided that the horizontal distance between the fire service access point and the doors of the fireman’s lift or the first step of the access staircase in the stairway is not more than 18m. In cases where the physical characteristics and constraints of the site render it desirable, the Building Authority may allow a longer horizontal distance provided that fire safety standards are not adversely affected. In any case, both the fireman’s lift and the access staircase in the stairway should be accessible from the same street.

#### **Clause D14.3**

---

A firefighting and rescue stairway and the passage from the fire service access point to the stairway should be separated from the remainder of the ground storey (including a lobby or hall to cargo lifts) by walls having an FRR required in Clause D17.2. Any opening in these walls for communication with the ground storey should be through a protected lobby complying with Clauses C9.3 and C16.5.

#### **Clause D14.4**

---

The passage from the fire service access point to the firefighting and rescue stairway should have a clear width of not less than 1500mm and a clear headroom of not less than 2000mm.

### Clause D14.5

---

A notice in the following form indicating the fire service access point should be displayed at a conspicuous position outside the building near the point:



The height of the words and characters on the notice should be not less than 20mm. Such notice should be either illuminated by two separate systems of electric light or a type of safety sign which is self-energized in respect of luminosity and which requires no external source of power.

## Subsection D15 - Floors Served by a Firefighting and Rescue Stairway

### Clause D15.1

---

Both the access staircase and the fireman's lift in a firefighting and rescue stairway should serve every floor, including refuge floor, and every part of the building. When the roof of a building is served by other staircases, the access staircases in the firefighting and rescue stairway should also serve the roof. For the avoidance of doubt, the fireman's lift is not required to serve the roof but it should serve the top floor except where the lift machine room has to be located at the top floor due to height restriction.

### Clause D15.2

---

Where a building is required to have a firefighting and rescue stairway, areas for ancillary uses such as carparking and loading and unloading in the building, whether occupying the whole floor or part of a floor, should also be served by the firefighting and rescue stairway.

### Clause D15.3

---

The lowest landing of the fireman's lift in a firefighting and rescue stairway serving the storeys above ground storey or the topmost landing of that serving the basement, as the case may be, should be situated at the level of the fire service access point in Subsection D14. If this is not possible due to site constraint or other special reasons acceptable to the Building Authority, such landing may be situated not more than one floor above or below the level of the fire service access point.

#### **Clause D15.4**

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Every access staircase in a firefighting and rescue stairway serving the upper floors should not continue directly to serve the basements.

#### **Clause D15.5**

---

Every access staircase in a firefighting and rescue stairway passing through a refuge floor should discontinue at such level so that the access route is diverted to pass over the area for refuge before it is continued to access upwards. The doors of the fireman's lift opening onto the refuge floor should comply with Clause B18.2(i).

#### **Clause D15.6**

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No part of the floor served by a firefighting and rescue stairway should be more than 60m from the door of the lobby to the stairway measured along actual passages. If the internal layout is not known at the design stage or is not shown on plan, a direct line measurement of 45m may be used for design purposes, provided that the layout of the floor when occupied satisfies the 60m requirement.

### **Subsection D16 - Access to a Floor from a Firefighting and Rescue Stairway**

#### **Clause D16.1**

---

In every floor, except the ground storey, served by a firefighting and rescue stairway, access from the stairway to that floor should be through a lobby which should –

- (a) have a floor area of not less than 5m<sup>2</sup> and not more than 10m<sup>2</sup> with a minimum dimension of 1.5m;
- (b) in storeys above ground storey, have an external wall as one of its enclosing walls;
- (c) in storeys above ground storey, be provided with natural ventilation by means of openings on the external wall complying with Clause D16.1(b). Such openings -
  - (i) should have a total area of not less than 25% of the floor area of the lobby;
  - (ii) should be situated as near the ceiling as is practicable and in no case should the top of such openings be less than 1.9m above the level of the lobby floor;
  - (iii) should face directly into the external air which has a horizontal area of not less than 21m<sup>2</sup> and is vertically uncovered and unobstructed above. If it is enclosed on all sides, it should have an area of not less than 1m<sup>2</sup> per 1m height of the enclosing walls and have a minimum dimension of 1.5m;
  - (iv) may be provided with windows which should be side hung, open outward a minimum of 30°, be openable from inside without the use of a key and be fitted with simple lever handles or rotary drives to simple rack or gear operated devices; and

(d) in storeys below ground storey, be provided with natural ventilation by:

- (i) unobstructed smoke outlets having a cross-sectional area of not less than 1m<sup>2</sup> for each lobby and ventilating into the outside air above ground storey. Lobbies at basement should be individually ventilated by separate smoke outlets provided at the ceiling of the lobby. Such smoke outlets may be covered at or above ground storey with breakable covers and should be located at least 5m clear of the final discharge point of an exit route or a fire service access point. This distance may be reduced to not less than 2.5m if, and only if, any smoke from such smoke outlets is directed away from and is not likely to affect, by natural convection, any exit route or fire service access point. The smoke outlet shafts should have an FRR or be enclosed by construction having an FRR of not less than that of the perimeter walls of the firefighting and rescue stairway. An unenclosed smoke outlet shaft should be capable of resisting accidental mechanical damage to the satisfaction of the Director of Fire Services; or
- (ii) openings complying with Clause D16.1(c)(i), (c)(ii) and (c)(iv) and ventilating into an open well having an area of not less than 1m<sup>2</sup> per 1m height of the wall enclosing the open well and having a minimum dimension of 1.5m,

provided that the natural ventilation to the lobby is not required if the access staircase to which the lobby leads is a staircase which is open on 3 sides for a height of not less than 900mm between the top of the balustrade or parapet and the underside of the flight of stair immediately above, and which is open to a void having an area of not less than 10m<sup>2</sup> and a minimum dimension of 1m and being unobstructed above to provide adequate ventilation.

See Diagram D2 for illustration.

### **Clause D16.2**

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Every fireman's lift in a firefighting and rescue stairway should open into the lobby in accordance with Clause D16.1.

### **Clause D16.3**

---

The access staircase and the fireman's lift in a firefighting and rescue stairway should communicate with each other at every floor served by the stairway.

## **Subsection D17 - Protection of a Firefighting and Rescue Stairway**

### **Clause D17.1**

---

Every firefighting and rescue stairway should be enclosed by walls and these walls, the landings, flights, balustrades, partition walls and finishing, including wall and ceiling lining and floor finishing, in the stairway should be constructed of wholly non-combustible materials complying with Part E.

### **Clause D17.2**

---

The perimeter enclosing walls that separate the access staircase, the fireman's lift and the lobby in a firefighting and rescue stairway from the floor served by the stairway, together with any supporting structure and floor slabs forming the enclosures of the stairway should have an FRR of not less than that required for the elements of construction in that floor.

### **Clause D17.3**

---

Within the perimeter of a firefighting and rescue stairway, walls or partitions which separate the access staircase and the lobby from each other should have the FRR of not less than that required for the elements of construction in that floor.

### **Clause D17.4**

---

The doors of the lobby to a firefighting and rescue stairway should have an FRR of not less than that required for the walls therein and complying with the requirements in Table C2 and Clause C16.5. They should not be fitted with any bolts, locks or other fastenings except that, if for security reasons, the door between the lobby and the floor served may be fitted with a lock which is openable from the floor side without the use of a key. If a locking device is electrically operated, the lock should be capable of automatic release upon actuation of an automatic heat or smoke detection system or the operation of an alarm system or a central manual override designed and installed to the satisfaction of the Director of Fire Services. Upon power failure, the electrical locking device shall also release automatically.

### **Clause D17.5**

---

Openings formed in the external walls of a firefighting and rescue stairway should also comply with Clauses C9.6 to C9.8 of Part C and in no case should such openings be formed within 450mm measured horizontally from any opening in the external walls of the same building.

## **Subsection D18 – Construction of Access Staircase in a Firefighting and Rescue Stairway**

### **Clause D18.1**

---

Every access staircase in a firefighting and rescue stairway should:

- (a) have a clear width of not less than 1050mm and a clear headroom of not less than 2000mm;
- (b) be arranged in straight flights without winders and each flight should consist of not more than 16 risers nor less than 2 risers. Treads should be not less than 225mm wide, measured clear of nosings, and risers should be not more than 175mm high;
- (c) be provided with landings at the top and bottom of each flight with a minimum dimension of not less than the width of the flight and no door should at any part of its swing reduce the effective width or effective radius of such landings; and
- (d) be provided with handrails on each side of the staircase at a height of not less than 850mm and not more than 1100mm above the steps or landings. The handrails should not project so as to reduce the clear width of the staircase by more than 90mm for each handrail and should be continuous throughout each flight of the staircase but need not be carried round a landing or half landing.

## **Subsection D19 – Ventilation of Access Staircase in a Firefighting and Rescue Stairway**

### **Clause D19.1**

---

Every access staircase in a firefighting and rescue stairway should be provided with:

- (a) Pressurization designed as required in Clause D21.1; or
- (b) Natural ventilation :
  - (i) at each storey above the ground storey, by openings in the external enclosure wall having a total area of not less than 15% of the internal area on plan of the access staircase. Such openings may be provided with windows which should be side hung, open outward a minimum of 30°, be openable from inside without the use of a key and be fitted with simple lever handles or rotary drives to simple rack or gear operated devices; and
  - (ii) at it highest point, by a vent capable of being opened manually or automatically by a remote control switch and having an area of not less than 5% of the internal area on plan of the access staircase. The remote control switch should be situated in a conspicuous position at the fire service access point of the stairway at ground storey.

## **Subsection D20 - Fireman's Lift in a Firefighting and Rescue Stairway**

### **Clause D20.1**

---

Up to three fireman's lifts, but no other lifts, may be installed and may share the same liftwell in a firefighting and rescue stairway. A lift mainly intended for the transport of goods should not be designated as a fireman's lift.

### **Clause D20.2**

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Every fireman's lift in a firefighting and rescue stairway should comply with the requirements in Clauses D9.2 and Subsections D10, D12 and D13.

## **Subsection D21 – Mechanical Ventilation of a Firefighting and Rescue Stairway**

### **Clause D21.1**

---

Any natural ventilation to a firefighting and rescue stairway and its lobby required in this Part may be omitted where a mechanical system to control the ingress of smoke into the stairway or lobby, such as pressurization, is provided to the satisfaction of the Director of Fire Services.

## **Section 6 – Provision of Emergency Vehicular Access**

### **Subsection D22 - EVA to Virgin Sites**

#### **Clause D22.1**

---

For the purpose of the Building (Planning) Regulation 41D, this Subsection specifies the design and construction requirements of EVA serving buildings erected or to be erected on virgin sites. For the avoidance of doubt, the requirements in this Subsection should also apply to all subsequent redevelopments on virgin sites.

#### **Clause D22.2**

---

Every EVA to which this Subsection applies should be designed and constructed complying with the following requirements, unless otherwise specified in this Subsection:

- (a) the width of an EVA in the form of a carriageway should not be less than 7.3m. An EVA that is not in the form of a carriageway should be hard-paved, not less than 6m wide and well demarcated on site;
- (b) if there is any overhead structure over any part of the EVA, a clear headroom of not less than 4.5m should be maintained;
- (c) the gradient of the EVA should not be steeper than 1:10. For such portion of the EVA that is not serving any major façade of any building, the gradient may be increased to not steeper than 1:6. Wherever there is a change in gradient, the EVA should be designed and constructed in compliance with the requirements illustrated in Diagram D5 so as not to cause any obstruction to the vehicles of the Fire Services Department;
- (d) the EVA should allow safe and unobstructed access and safe operation of a vehicle of the Fire Services Department having the following specifications :
  - (i) Gross weight 30,000 kg
  - (ii) Turning circle 26m
  - (iii) Length 12m

Turning space for vehicles of the Fire Services Department should be provided at all deadend EVA;

- (e) the EVA should serve at least one major facade of the building. For this purpose, a major facade of a building is the facade having not less than one-fourth of the total length of all the perimeter walls of the building. In case the major facade is less than one-fourth of the total length of all the perimeter walls of the building, the EVA should serve this major facade and, in addition, other facades of the building such that the aggregate length of the facades served is not less than one-fourth of the total length of all the perimeter walls of the building. A part of the building facade is deemed to be served by the EVA if the horizontal distance between the EVA and such part of the facade does not exceed 10m. This requirement on horizontal distance from the EVA shall not apply to the level of the building facade more than 60m high measuring from the level of the EVA serving the facade. The part of the EVA serving a building facade should not be covered.

### **Clause D22.3**

---

Subject to Clause D22.2 above, every EVA should comply with the following requirements according to the Use Classification of the building it serves:

- (a) for Use Classification 6, EVA should be provided to serve two opposite facades that are remote from each other and each having a length of not less than one-fourth of the total length of all perimeter walls of the building. If access to the site from more than one street is available, the EVA serving the two facades should gain access from different street. The EVA should be in the form of a two-way carriageway and the width of the carriageway should be not less than 13.5m if there is no central divider. If there is a central divider, the width of each carriageway should not be less than 7.3m. If any such EVA is outside the site, a reserve area of not less than 6m wide measured from the building boundary alongside that EVA should be provided as an additional EVA (see illustration in Diagram D6);
- (b) for Use Classification 5a, the EVA should comply with the requirements of thoroughfares stipulated in Subsection B20;
- (c) for a building with mixed Use Classifications, the EVA should comply with the most stringent requirements for any particular Use Classification in this Clause.

### **Clause D22.4**

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For an EVA which is not normally used as access for other vehicles to the building, an emergency crash gate conforming to or equivalent to the Highways Department standards as illustrated in Diagram D7 should be provided perpendicular to the centre line of the EVA. A clear space should be provided in front of the crash gate in accordance with the illustration in Diagram D8.

## **Subsection D23 - EVA to Redevelopment Sites**

### **Clause D23.1**

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For the purpose of the Building (Planning) Regulation 41D, this Subsection specifies the design and construction requirements of EVA serving buildings erected or to be erected on redevelopment sites, i.e. not virgin sites.

### **Clause D23.2**

---

Every EVA to which this Subsection applies should be designed and constructed complying with the requirements in Clause D22.2(b), (c) and (d). An EVA that is not in the form of a carriageway should be hard-paved and well demarcated on site.

### **Clause D23.3**

---

Subject to Clause D23.2 above, every EVA should comply with the following requirements according to the Use Classification of the building it serves:

- (a) for Use Classification 6, the EVA should serve at least one major façade of the building complying with Clause D22.2(e). Such EVA should have a minimum width of 7.3m;
- (b) for Use Classification 5a, the EVA should comply with the requirements of thoroughfares in Clause B20;
- (c) for a building of any other types of Use Classifications, the EVA should serve at least one major façade of the building complying with Clause D22.2(e). Such EVA should have a minimum width of 6m;
- (d) for a building with mixed Use Classifications, the EVA should comply with the more stringent requirements for any particular Use Classification in this Clause.

### **Clause D23.4**

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Emergency crash gates should be provided to the EVA complying with Clause D22.4.

## **Subsection D24 - EVA Signs**

### **Clause D24.1**

---

For the purpose of the Building (Planning) Regulation 41D, this Subsection specifies the requirements of signage for EVA to indicate the extent of the designated EVA within a site.

### **Clause D24.2**

---

For an EVA in the form of a carriageway:

- (a) a sign showing the layout of the EVA should be erected at the entrance of the EVA (see Diagram D9);
- (b) EVA indication signs should be erected at an interval of not more than 100m along the EVA (see Diagram D10); and
- (c) "No Parking" signs conforming to the standards stipulated in the Road Traffic (Parking on Private Roads) Regulations and the Code of Practice for Private Roads issued by the Transport Department should be erected at an interval of not more than 50m along the EVA except where designated carparks are marked (see Diagram D11).

### **Clause D24.3**

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For an EVA which is not in the form of a carriageway:

- (a) a sign showing the layout of the EVA should be erected at the entrance of the EVA (see Diagram D9); and
- (b) EVA indication signs should be provided complying with Clause D24.2(b) above. Alternatively, emergency route signs should be fixed to kerbstones, planters, or other similar objects as appropriate at an interval of not more than 100m to mark the EVA. Such signs should be painted or engraved and should be made of durable materials such as metal (see Diagram D12).

## **Subsection D25 - Exemption and Modification**

### **Clause D25.1**

---

A building may be exempted from any or all of the design and construction requirements of EVA stipulated in Subsections D22, D23 and D24 and under the Building (Planning) Regulation 41D(3) in the following cases:

- (a) where the purpose for which the building is to be used constitutes a low fire risk; or
- (b) where the site is situated in an area the topographical features of which make the provision of an EVA or the compliance with requirements in Subsections D22, D23 and D24 above impracticable.

### **Clause D25.2**

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Where the circumstances in Clause D25.1 arise that an EVA will not be provided or where the EVA provided cannot comply with the standards as stipulated in this Section, an application for exemption from the Building (Planning) Regulation 41D(1) or (2) should be submitted for consideration by the Building Authority, justified by a fire safety assessment report (FSAR). Part G provides the details on the preparation of the FSAR.

### **Commentary**

The submission of the FSAR to the Building Authority under Clause D25.2 should assess the probability of occurrence and the likely consequence of a fire incident. Factors such as fire load, spread of fire and density of population in different parts of the building, the behaviour of the occupants in case of panic and the impact of topographical constraints (in case of Clause D25.1 (b) only) to the ingress and escape to and from the building should be analysed. The Building Authority in consultation with the Director of Fire Services will consider such an application on its individual merits, aiming to comply with the relevant Performance Requirement in Part A.

Examples of buildings that may be considered as having low fire risk under Clause D25.1(a) include a microwave transmitter station, an unmanned transposer station, a beach house or a pylon supporting cables. Factors mentioned above should be analysed to determine whether a building is of low fire risk.

Examples of sites that may be considered as having topographical constraints under Clause D25.1(b) include a site abutting a stepped street or abutting a road or street that is not up to the standards in this Part and the owner of the site has no control over such road or street. For sites located in remote areas or in outlying islands where the vehicles of the Fire Services Department of smaller size can be deployed, the access requirements will be specified by the Building Authority in consultation with the Director of Fire Services on a case-by-case basis.

## **Subsection D26 - Enhanced Fire Safety Provisions**

### **Clause D26.1**

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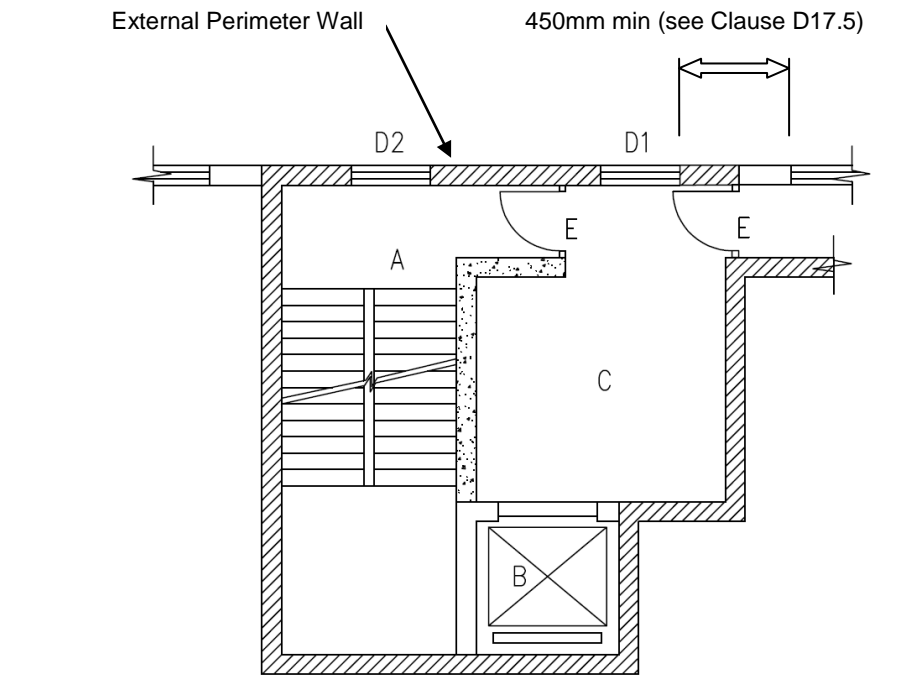
Under the Building (Planning) Regulation 41D(4), the Building Authority may require to enhance the fire safety provisions to compensate for the non-provision or deficiency of EVA when exemption is granted as stipulated under Subsection D25. The enhanced fire safety provisions so required may include enhanced provisions of means of escape, means of access, fire resisting constructions, fire service installations or a combination of these fire safety provisions.

#### **Commentary**

Based on the consideration to protection of means of escape and adequacy of water supply for fire suppression, additional fire service installations in pursuance of the Code of Practice for Minimum Fire Service Installations and Equipment may be required as enhanced fire safety provisions for the building in case of non-provision or deficient provision of EVA. The following typical enhancements on fire safety provisions may vary according to special circumstances of each case:

- (a) sprinkler system for light hazard group designed and installed to the satisfaction of the Director of Fire Services should be provided to protect all common areas of domestic buildings including lift lobbies, staircases, common corridors and all exit routes leading to ground storey. An independent sprinkler tank of appropriate capacity should be provided. For composite (domestic and commercial) buildings, sprinkler system for the appropriate hazard group should be provided to protect the entire commercial portion (irrespective of floor area) and all common areas of the domestic portion. Sprinkler heads should be of the approved fast response type;
- (b) pressurization of staircase or natural venting of staircase should be provided in accordance with the standards and specifications as laid down in the Code of Practice for Minimum Fire Service Installations and Equipment;
- (c) a direct line to the Fire Services Communication Centre should be provided and connected to the sprinkler alarm system and manual fire alarm system. Despite the provision of such direct line, the capacity of the sprinkler water tank, with both ends fed water supply, is not allowed to be reduced to 2/3;
- (d) enhanced size of water tank/inflow rate for sprinkler or fire hydrant/hose reel system tank;
- (e) any combination of the above items.

## Diagram D1: Requirements of a Firefighting and Rescue Stairway above Ground Storey



Perimeter enclosure walls with FRR required in Clause D17.2



Lobby walls with FRR required in Clause D17.3

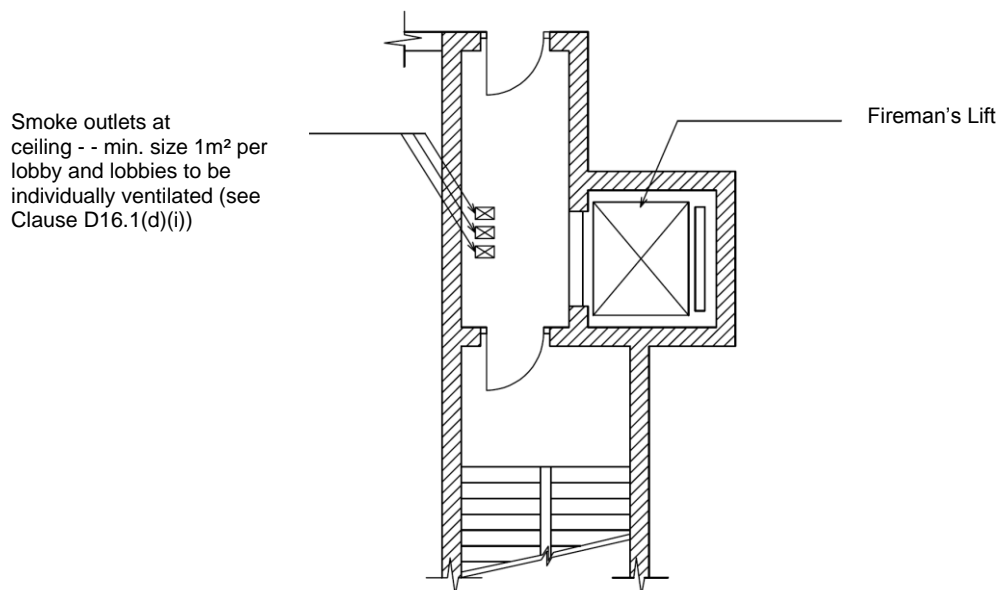
- A Access Staircase - min. width 1.05m (see Clause D18.1 (a))
- B Fireman's Lift - min. car size 1.35m<sup>2</sup> and rated load 680kg (see Clause D10.1)
- C Ventilated Lobby - size 5m<sup>2</sup> - 10m<sup>2</sup> and min. dimension 1.5m (see Clause D16.1(a))
- D1 Lobby Openings - min. size 25% of lobby floor area (see Clause D16.1(c))
- D2 Staircase windows - min. size 15% of staircase area (see Clause D19.1(b))
- E Lobby Doors - self-closing, complying with Part C (see Clause D17.4)

### Note:

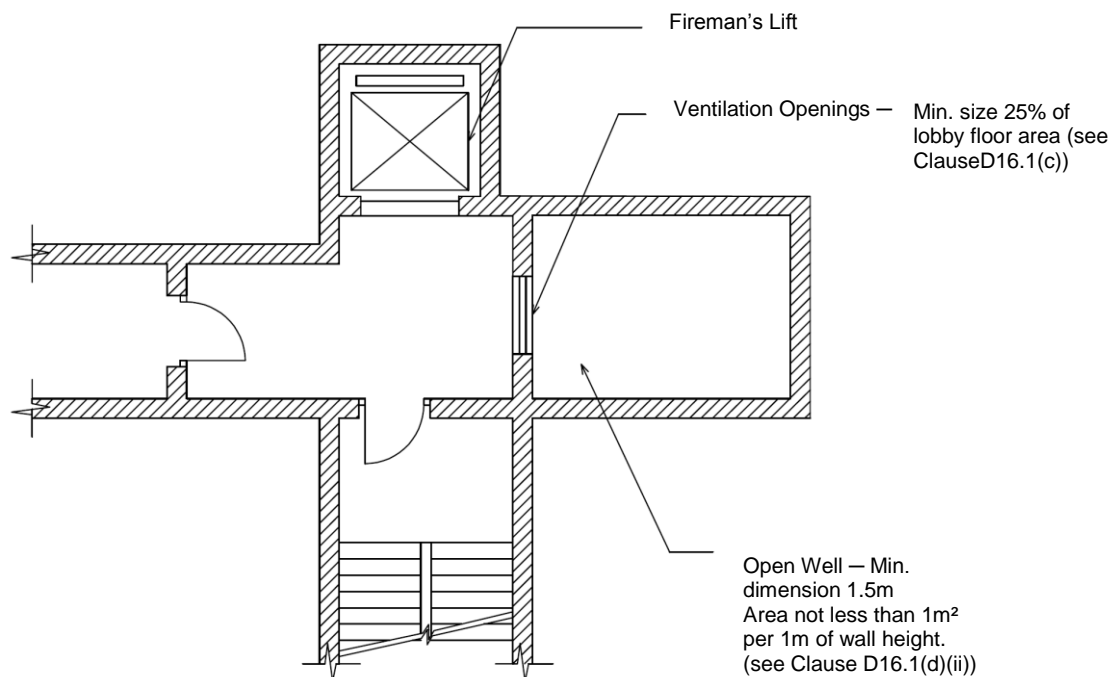
1. Ventilation may be omitted where a suitable mechanical system, such as pressurization, is provided to the satisfaction of the Director of Fire Services (see Clause D21.1)

## Diagram D2: Ventilation of Lobby of Firefighting and Rescue Stairway Below Ground Storey

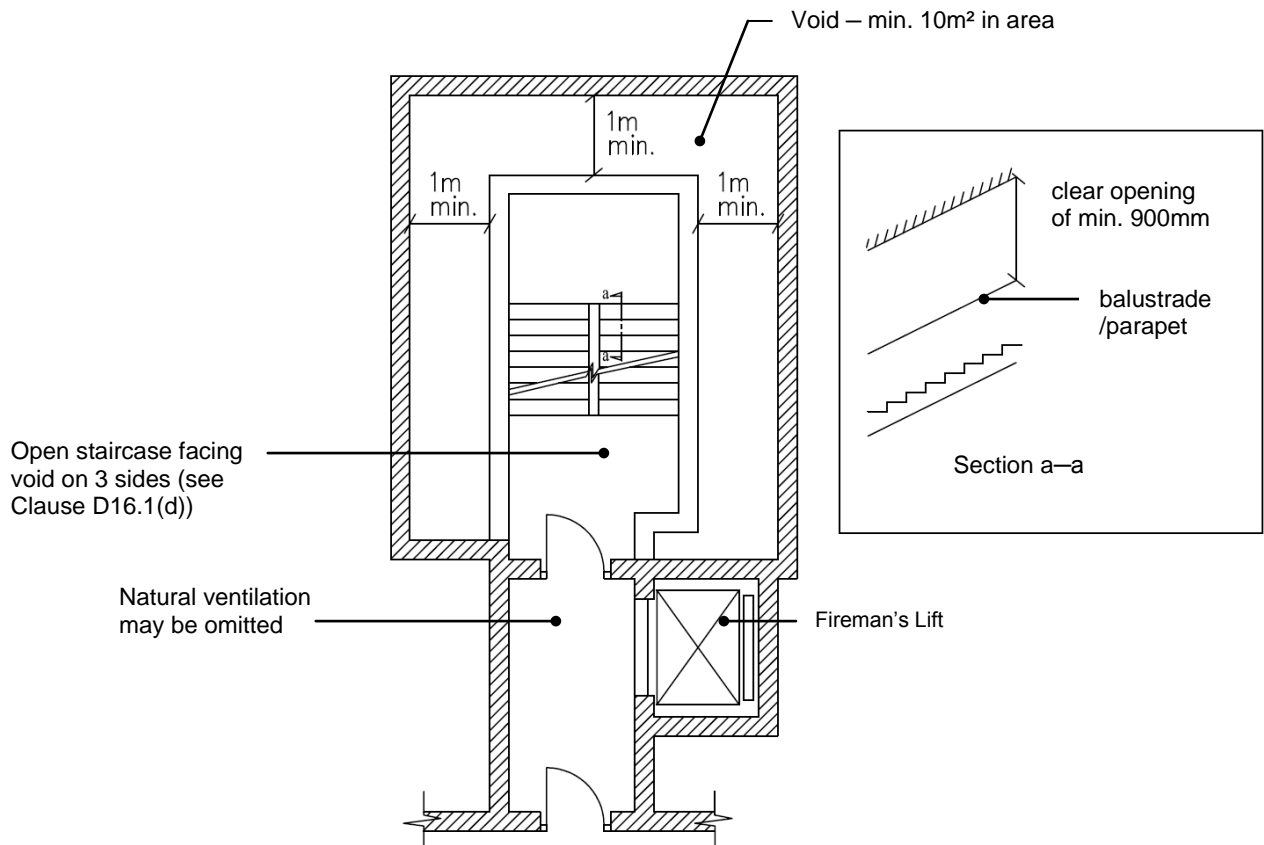
### Alternative 1 (smoke outlets)



### Alternative 2 (open well)



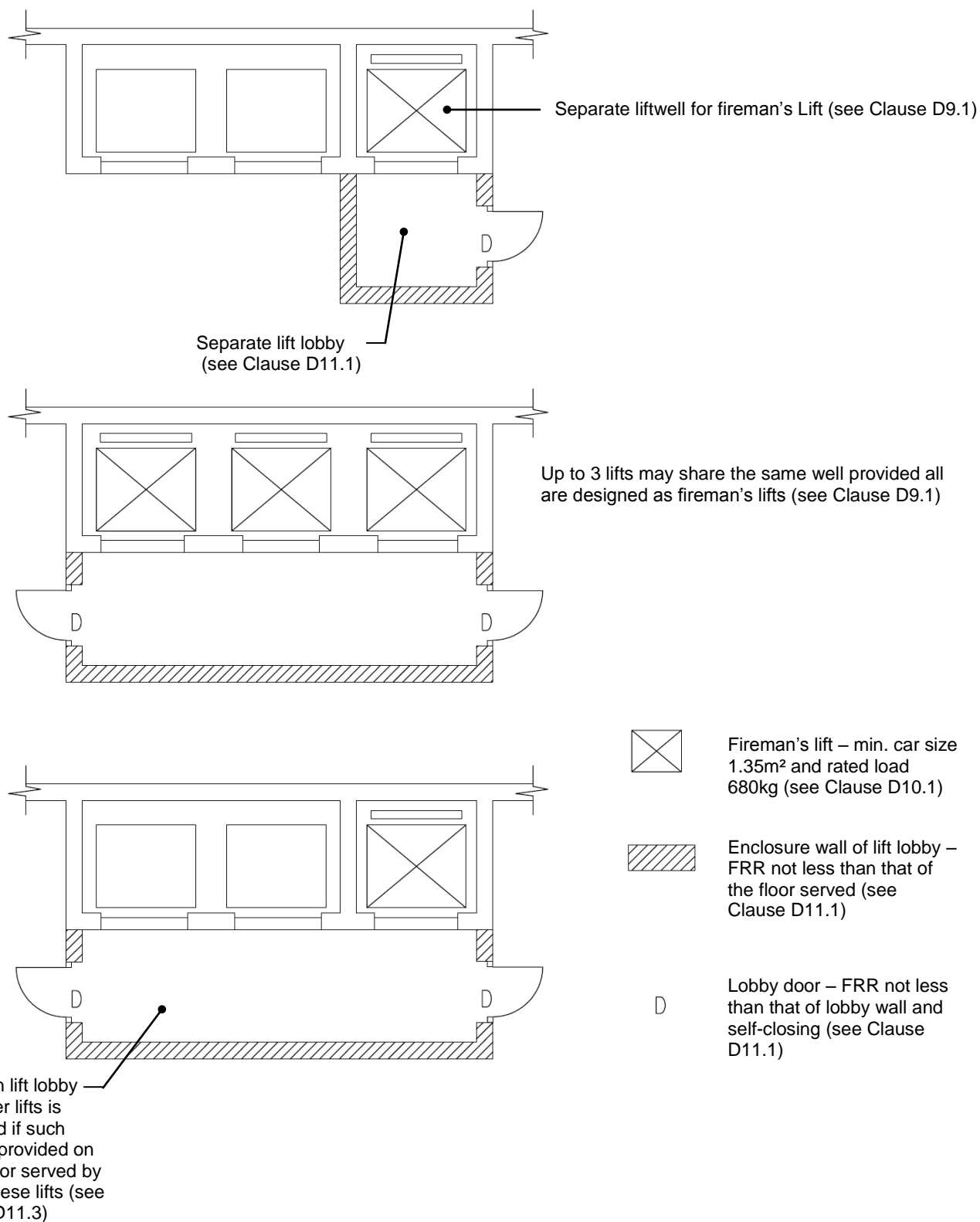
### Alternative 3 (open staircase)



#### Note:

1. Ventilation may be omitted where a suitable mechanical system, such as pressurization, is provided to the satisfaction of the Director of Fire Services (see Clause D21.1)

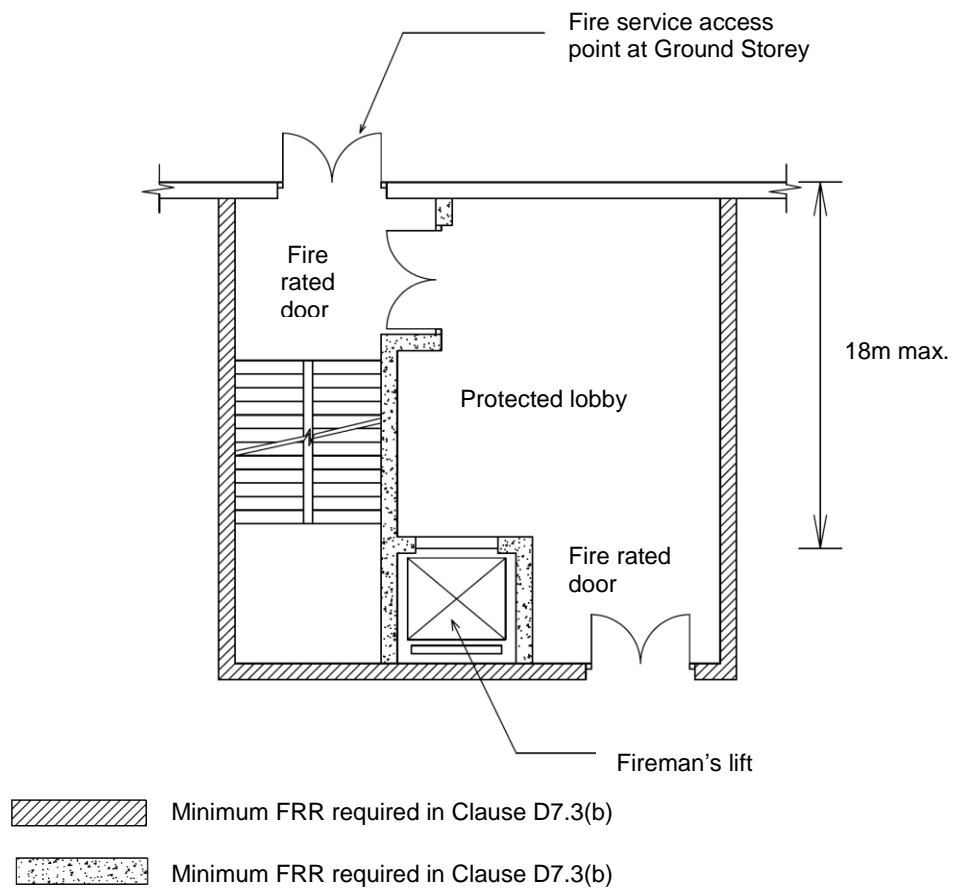
### Diagram D3: Fireman's Lift



#### Note:

- Where more than one lift is installed, the Director of Fire Services shall designate the fireman's lift (Clause D6.1)

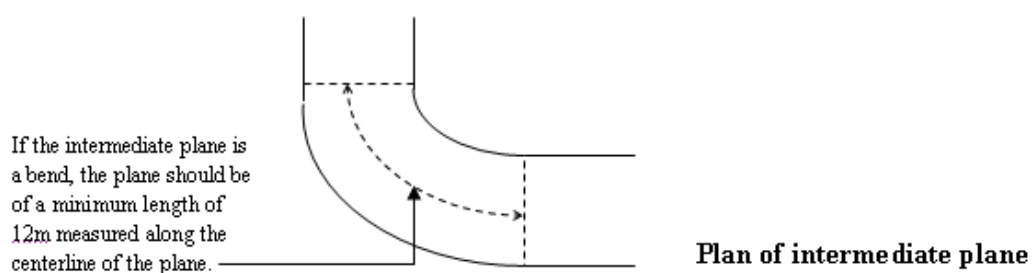
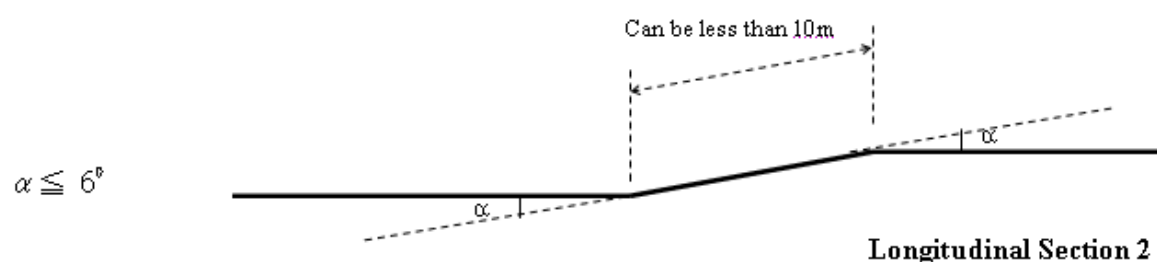
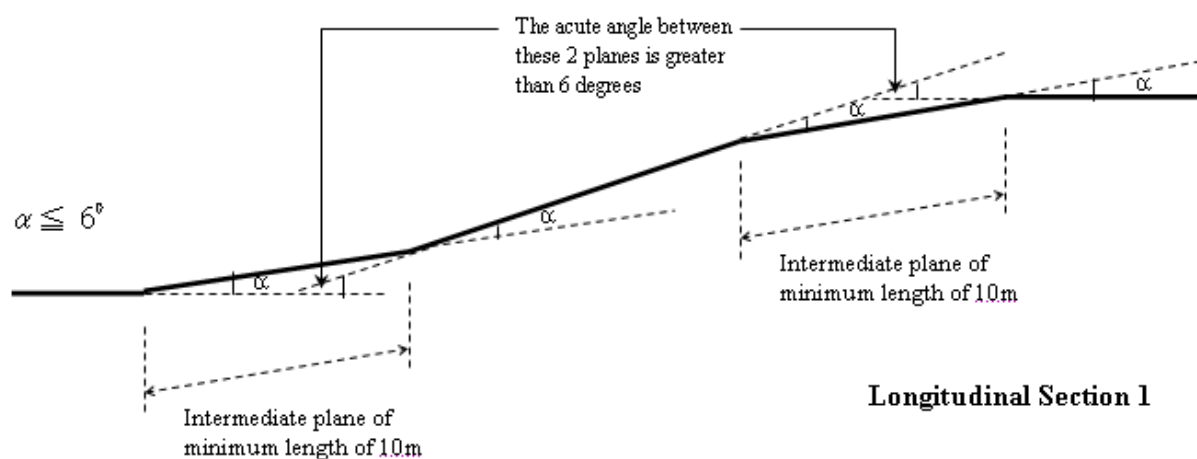
**Diagram D4: Access to a Fireman's Lift at Ground Storey (see Clause D7.2)**



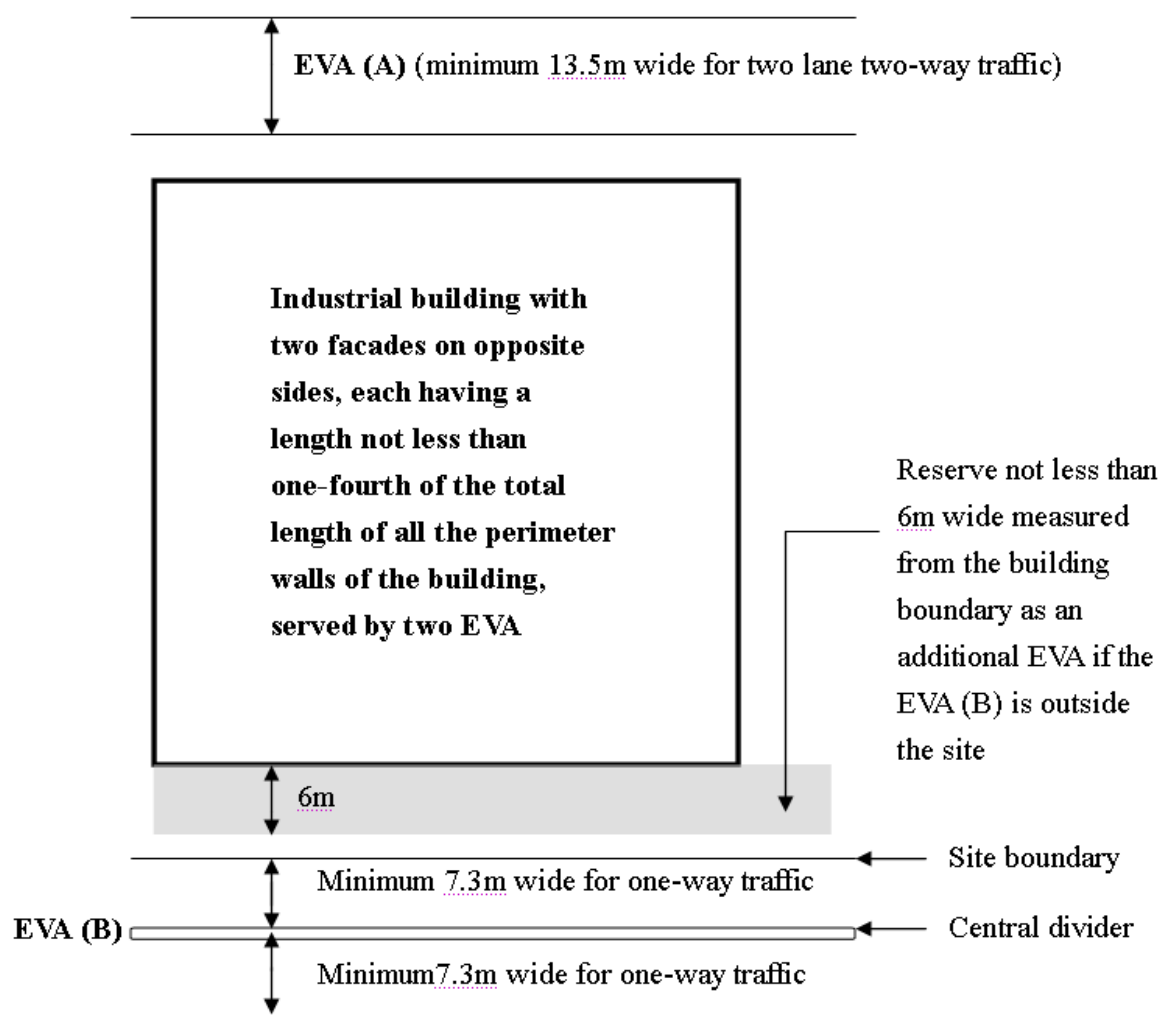
## Diagram D5: Requirement on Change in Gradient of EVA (Clause D22.2(c))

Notes:

1. For any change in gradient of EVA, the acute angle  $\alpha$  between the two adjoining planes shall not be greater than 6 degrees.
2. In the case of a change in gradient of EVA where the acute angle between the two planes is larger than 6 degrees, there should be provided an intermediate plane of a minimum length of 10m such that the requirement in Note 1 above is complied with, i.e. all the acute angles  $\alpha$  between the adjoining planes shall not be greater than 6 degrees.
3. If the intermediate plane is a bend, the plane should be of a minimum length of 12m measured along the centerline of the plane.



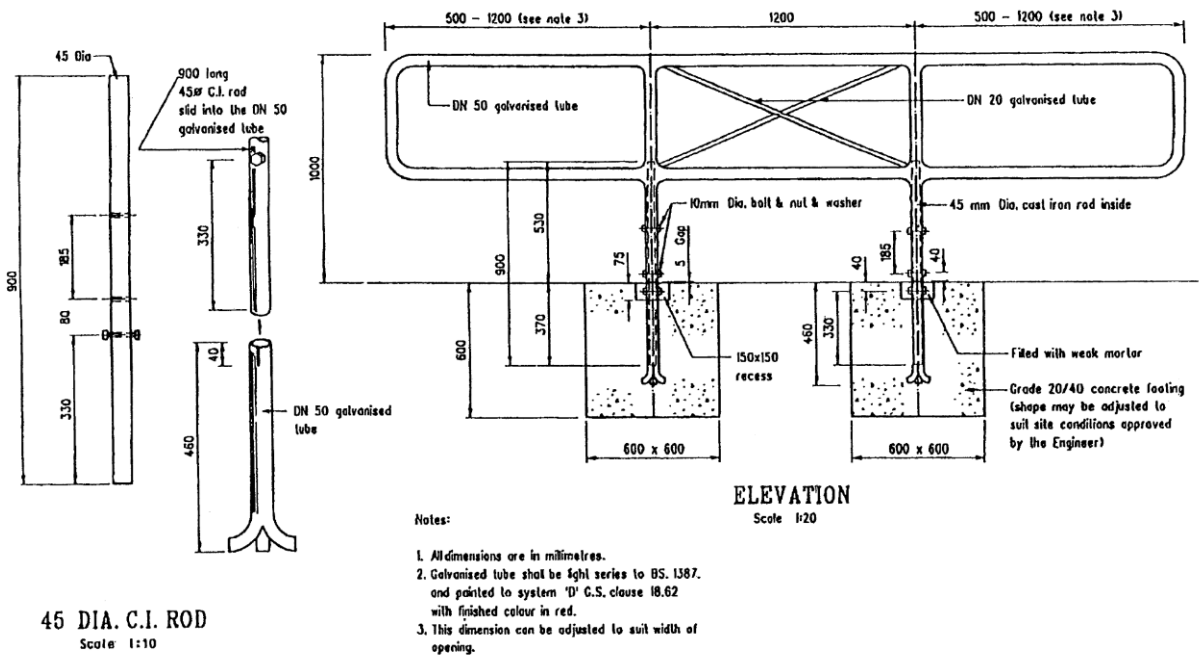
**Diagram D6: Requirements of EVA for Buildings for Use Classification 6 in Virgin Sites (Clause D22.3(a))**



Note:

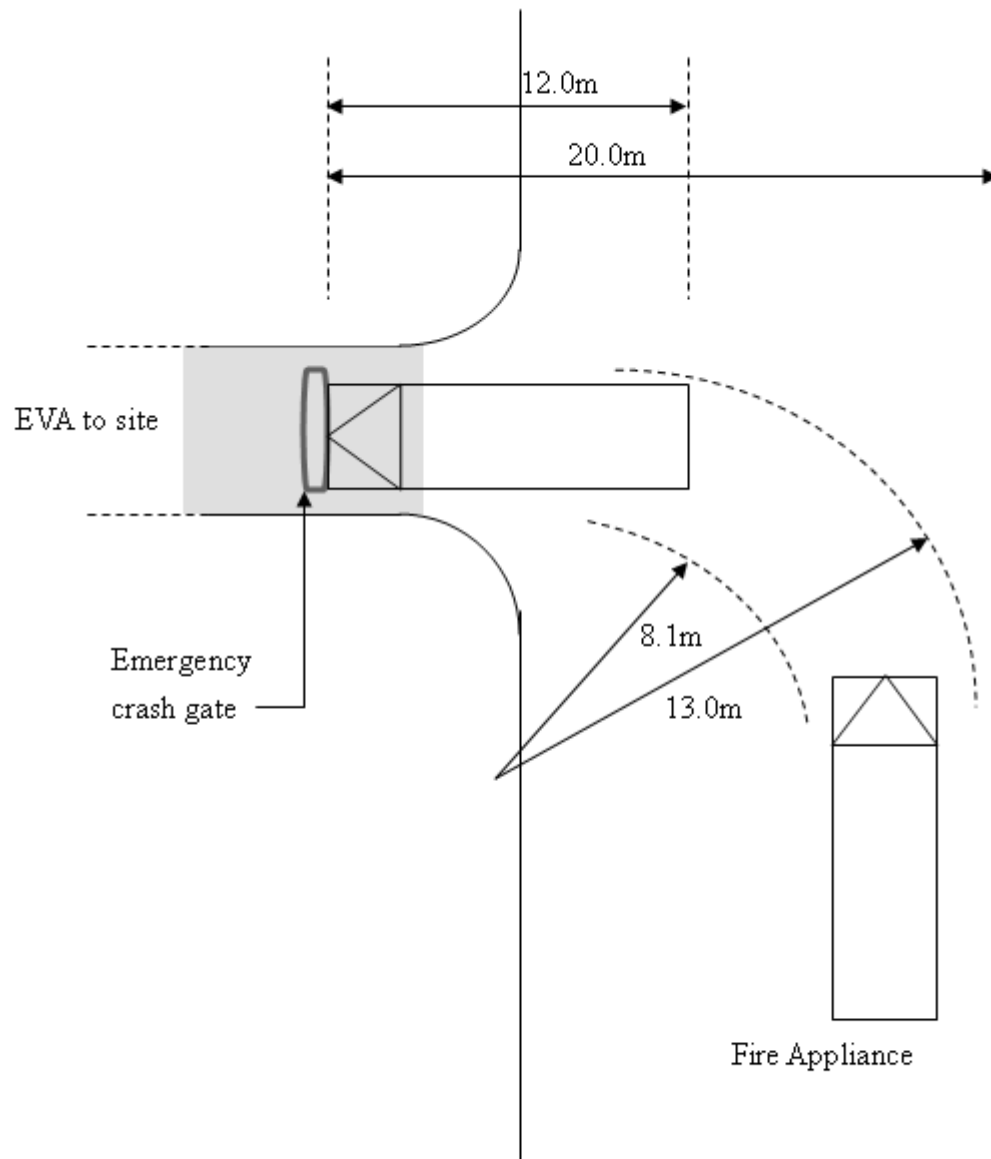
1. EVA (A) and EVA (B) should be two separate EVAs if access to the site from more than one street is available.

## Diagram D7: Emergency Crash Gate (Clause D22.4)

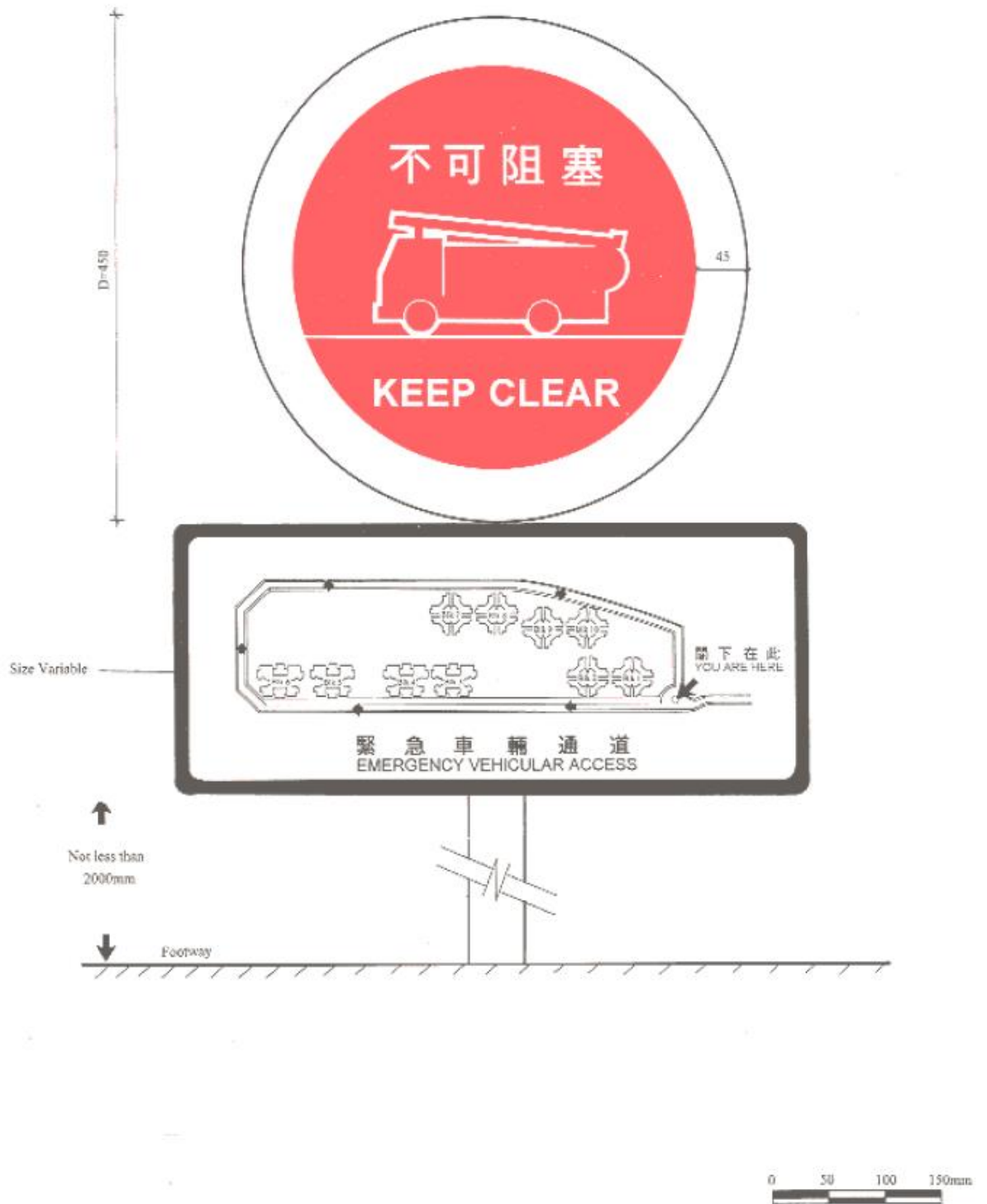


**Diagram D8: Provision of Clear Space for Emergency Crash Gate  
(Clause D22.4)**

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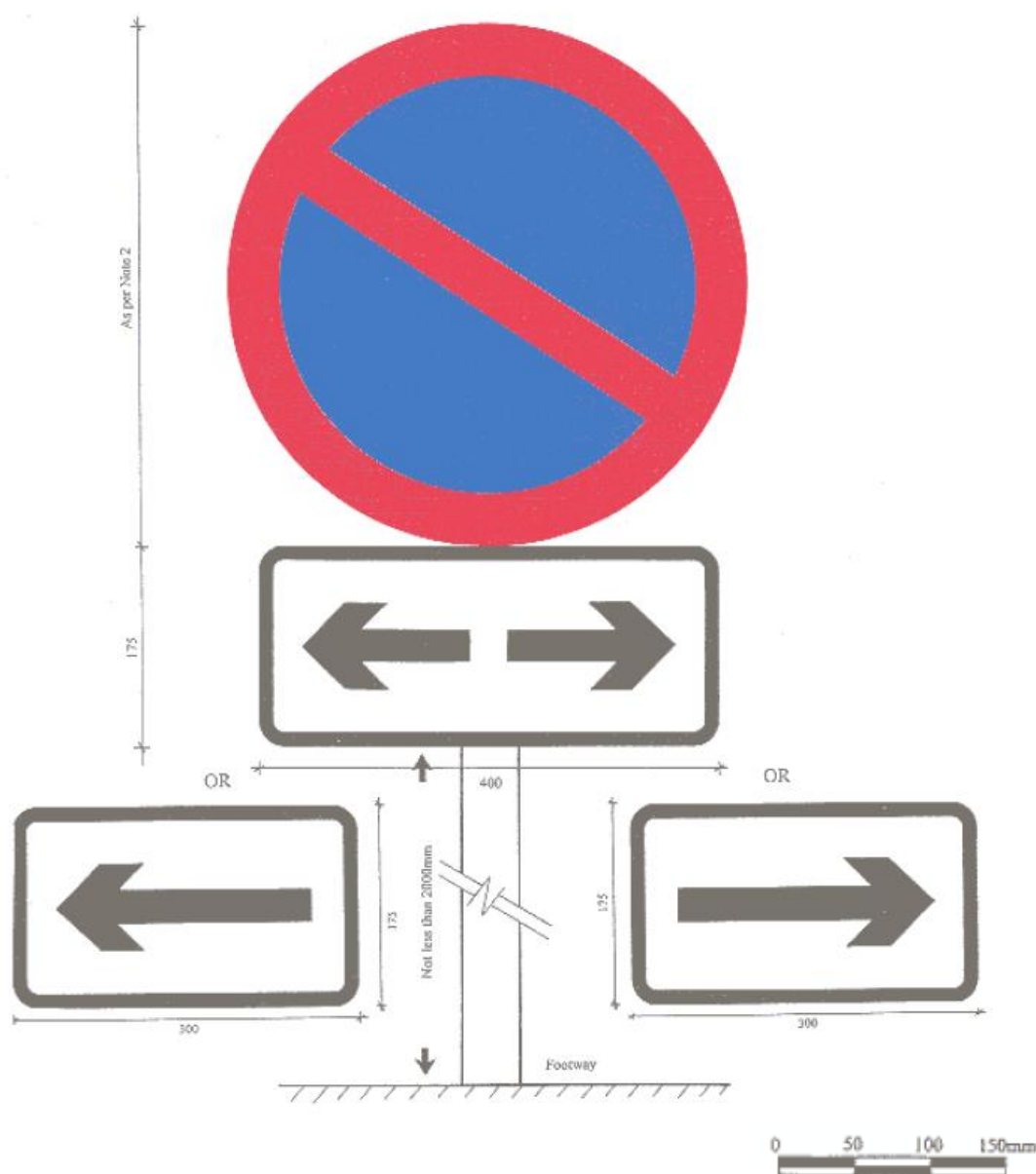
**Diagram D9: Layout Sign at Entrance of EVA (Clauses D24.2(a) and D24.3(a))**



**Diagram D10: Indication Sign along EVA in the Form of Carriageway  
(Clause D24.2(b))**



**Diagram D11: No Parking Sign (Clause D24.2(c))**



**Notes:**

1. The specifications of "No Parking" signs shall follow the provisions in Road Traffic (Parking on Private Roads) Regulations, Cap. 374, Laws of Hong Kong and the Code of Practice for Private Roads.
2. The diameter of the "No Parking" sign to be erected at both ends of the EVA shall be 450mm whereas for those in between, signs of 200mm or 300mm diameter may be employed.

**Diagram D12: Route Sign Along EVA Not in the Form of Carriageway  
(Clause D24.3(b))**

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**Part E -**  

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**Fire Properties of  
Building Elements and  
Components**

**This Part contains six Sections:**

- **Section 1 – General**
- **Section 2 – Loadbearing Elements**
- **Section 3 – Non-loadbearing Elements**
- **Section 4 – Protection of Openings in Fire Barriers**
- **Section 5 – Non-combustibility**
- **Section 6 – Fire Testing Authorities**
- **Reference – List of Tables**

## **Section 1 – General**

### **Subsection E1 – Use of this Part**

#### **Clause E1.1**

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This Part provides the Deemed-to-Comply provisions for the fire properties of building elements and components and should be read in conjunction with all other Parts in this Code.

#### **Clause E1.2**

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The Building (Construction) Regulation 90 stipulates the requirements for the design and construction of buildings to inhibit and resist the spread of fire and Regulations 39 and 43 stipulate the combustibility requirements for cladding and curtain walls. This Part provides guidance on how the fire properties of building elements and components may comply with these Regulations.

#### **Clause E1.3**

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Relevant parts of the International standard of ISO and the national standards stipulated in this Part are considered acceptable to the Building Authority for demonstrating the fire properties of the building elements and components. Where it is intended to use other standards, authorized persons should demonstrate complying with Clause E16.2 that such standards are equivalent or not inferior to the international or the national standards stipulated in this Part.

### **Subsection E2 – Scope**

#### **Clause E2.1**

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Part E is applicable to all Use Classifications in Table A1 of Part A.

#### **Commentary**

There are two principal groups of fire tests for building elements, materials and components:

- (a) Reaction to fire – the extent to which a product burns and contributes to the development of a fire. Products include walls, floors and ceiling linings, etc.
- (b) Resistance to fire – the ability of a product to prevent the spread of flame and/or smoke from a fully developed (post-flashover) fire, and where relevant, to maintain stability, integrity and insulation characteristics.

## Section 2 – Loadbearing Elements

### Subsection E3 – Fire Tests for Loadbearing Elements

#### Clause E3.1

---

Loadbearing elements should be tested in accordance with the following applicable standards to demonstrate the required FRR (structural stability, integrity and insulation as appropriate):

- (a) BS EN 1363-1:1999, *Fire resistance tests. General requirements*;
- (b) BS EN 1365-1:1999, *Fire resistance tests for loadbearing elements. Walls*;
- (c) BS EN 1365-2:2000, *Fire resistance tests for loadbearing elements. Floors and roofs*;
- (d) BS EN 1365-3:2000, *Fire resistance tests for loadbearing elements. Beams*;
- (e) BS EN 1365-4:1999, *Fire resistance tests for loadbearing elements. Columns*;
- (f) BS EN 1365-5:2004, *Fire resistance tests for loadbearing elements. Balconies and walkways*;
- (g) BS EN 1365-6:2004, *Fire resistance tests for loadbearing elements. Stairs*.

#### Commentary

FRR of loadbearing elements is classified in accordance with BS EN 13501-2:2007, *Fire Classification of Construction Products and Building Elements – Classification using data from fire resistance tests, excluding ventilation services*.

#### Clause E3.2

---

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476: Part 20:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)*;
- (b) BS 476: Part 21:1987, *Fire tests on building materials and structures. Methods for determination of the fire resistance of load bearing elements of construction*.

## Section 3 – Non-loadbearing Elements

### Subsection E4 – Fire Tests for Non-loadbearing Elements

#### Clause E4.1

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Composite walls involving plasterboard systems should be constructed in accordance with the manufacturer's specifications. The assembled products should be tested in accordance with BS EN 1364-1:1999, *Fire resistance tests for non-loadbearing elements. Walls* to demonstrate the required FRR.

#### Clause E4.2

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Other materials used as fire barriers should be installed in accordance with the manufacturer's specifications and tested in accordance with an appropriate testing regime, such as BS EN 1364-1:1999, *Fire resistance tests for non-loadbearing elements. Walls*.

#### Clause E4.3

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Materials forming a ceiling that requires an FRR should be tested in accordance with BS EN 1364-2, *Fire resistance tests for non-loadbearing elements. Ceilings*.

#### Clause E4.4

---

False ceilings and elevated floors that require an FRR should be tested in accordance with the following applicable standards:

- (a) BS EN 1366-6:2004, *Fire resistance tests for service installations. Raised access and hollow core floors*;
- (b) BS EN 1364-2:1999, *Fire resistance tests for non-loadbearing elements. Ceilings*.

#### Clause E4.5

---

The following British Standards will still be applicable until they are obsolete:

BS 476 Part 22:1987, *Fire tests on building materials and structures. Methods for determination of the fire resistance of non-loadbearing elements of construction*.

#### Commentary

False ceilings and elevated floors forming part of an air plenum should be non-combustible – see Subsection E10.

## Section 4 - Protection of Openings in Fire Barriers

### Subsection E5 - Openings in Fire Barriers (Doors, Windows, Shutters and associated Penetrations)

#### Clause E5.1

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Elements that protect openings, such as doors, windows and fire shutters in fire barriers should be tested in accordance with the following applicable standards to demonstrate the required FRR (integrity and insulation as appropriate):

- (a) BS EN 1634-1:2008, *Fire resistance and smoke control tests for door, shutter and openable window assemblies and elements of building hardware. Fire resistance test for doors, shutters and openable windows;*
- (b) BS EN 1634-2:2008, *Fire resistance tests for door, shutter and openable window assemblies and elements of building hardware. Fire resistance characterisation test for elements of building hardware;*
- (c) BS EN 1634-3:2004, *Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware. Smoke control test for door and shutter assemblies;*
- (d) BS EN 14600:2005, *Doorsets and openable windows with fire resisting and/or smoke control characteristics. Requirements and classification.*

#### Commentary

The FRR of fire rated doors, fire shutters and openable windows designed for installation within openings in vertical separating elements should be tested in accordance with BS EN 1634-1:2008. BS EN 1634-1:2008 sets out two options of maximum temperature rise criteria for insulation. These options are based on the classification of thermal insulation (Classification I1 or I2) and the classification shall be in accordance with BS EN 13501-2:2007. The thermal criterion of Classification I1 is recommended for consistency with BS 476.

#### Clause E5.2

---

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476: Part 20:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles);*
- (b) BS 476: Part 22:1987, *Fire tests on building materials and structures. Methods for determination of the fire resistance of non-load bearing elements of construction.*

#### Clause E5.3

---

All tested fire rated doors, fire shutters and fire windows should be “tagged” or otherwise labelled to ensure ease of identification.

### Commentary

The FRR of elements to prevent fire spread through openings in fire barriers is classified in accordance with BS EN 13501-2:2007, *Fire classification of construction products and building elements. Classification using data from fire resistance tests, excluding ventilation services*.

The performance for protected openings in fire barriers includes:

- (a) Integrity – the ability of the element of construction that has a fire separating function, to withstand fire exposure on one side only, without the transmission of fire to the unexposed side as a result of the passage of flames or hot gases;
- (b) Thermal insulation – the ability of the element of construction to withstand fire exposure on one side only, without the transmission of fire as a result of significant transfer of heat from the exposed side to the unexposed side. Transmission shall be limited so that neither the unexposed surface nor any material in close proximity to the surface is ignited;
- (c) Radiation – the ability of the element of construction to withstand fire exposure on one side only, so as to reduce the probability of the transmission of fire as a result of significant radiated heat either through the element or from its unexposed surface to adjacent materials;
- (d) Self-closing – the ability of an open door to close fully into its frame and engage any latching device that may be fitted, without human intervention, by stored energy, or by mains power backed up by stored energy in case of power failure.

## Subsection E6 - Openings in Fire Barriers (Ventilation Ducts and associated Penetrations)

### Clause E6.1

---

Elements that protect openings where ventilation ducts and the like penetrations in fire barriers, such as seals, should be tested in accordance with the following applicable standards to demonstrate the required FRR (integrity and insulation as appropriate):

- (a) BS EN 1366-1:1999, *Fire resistance tests for service installations. Fire resistance tests for service installations. Ducts*;
- (b) BS EN 1366-8:2004, *Fire resistance tests for service installations. Smoke extraction ducts*;
- (c) BS EN 1366-9:2008, *Fire resistance tests for service installations. Single compartment smoke extraction ducts*.

### Clause E6.2

---

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476: Part 20:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)*;
- (b) BS 476: Part 24:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of ventilation ducts*.

## **Subsection E7 - Openings in Fire Barriers (General Penetrations)**

### **Clause E7.1**

---

Penetration seals for electrical cables, plumbing and other services, should be tested in accordance with the following applicable standards to demonstrate the required FRR (integrity only):

- (a) BS EN 1366-3:2009, *Fire resistance tests for service installations. Penetration seals*;
- (b) BS EN 1366-4:2006, *Fire resistance tests for service installations. Linear joint seals*.

### **Clause E7.2**

---

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476: Part 20:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)*;
- (b) BS 476: Part 23:1987, *Fire tests on building materials and structures. Methods for determination of the contribution of components to the fire resistance of a structure*.

#### **Commentary**

The same control on pipe penetrations applies to all pipes penetrating fire barriers, irrespective of they are water-borne, their diameter or material of construction.

## **Subsection E8 - Fire and Smoke Dampers**

### **Clause E8.1**

---

Fire and smoke dampers in ventilation ducts should be tested in accordance with the following applicable standards to demonstrate the required FRR (integrity only):

- (a) BS EN 1366-2:1999, *Fire resistance tests for service installations. Fire dampers*;
- (b) BS ISO 10294-1:1996, *Fire-resistance tests. Fire dampers for air distribution systems. Test method*;
- (c) BS ISO 10294 -2:1999, *Fire-resistance tests. Fire dampers for air distribution systems. Classification, criteria and field of application of test results*;
- (d) BS ISO 10294-3:1999, *Fire-resistance tests. Fire dampers for air distribution systems. Guidance on the test method*;
- (e) BS ISO 10294-5:2005, *Fire-resistance tests. Fire dampers for air distribution systems. Intumescent fire dampers*.

### **Clause E8.2**

---

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476: Part 20:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)*;
- (b) BS 476: Part 23:1987, *Fire tests on building materials and structures. Methods for determination of the contribution of components to the fire resistance of a structure*.
- (c) BS 476: Part 24:1987, *Fire tests on building materials and structures. Method for determination of the fire resistance of ventilation ducts*.

### **Clause E8.3**

---

All newly installed dampers should be inspected and certified by a registered specialist contractor in the ventilation works category that the dampers are in safe and efficient working order.

## **Subsection E9 – Smoke Leakage for Doors with Smoke Seal**

### **Clause E9.1**

---

Doors with smoke seal should be tested at ambient temperature and medium temperature and demonstrated to comply with the smoke leakage rate criteria in accordance with the following applicable standards:

- (a) BS EN 1634-3:2004, *Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware. Smoke control test for door and shutter assemblies*;
- (b) BS EN 14600:2005, *Doorsets and openable windows with fire resisting and/or smoke control characteristics. Requirements and classification*;
- (c) ISO 5925-1:2007, *Fire tests - Smoke-control door and shutter assemblies - Part 1: Ambient- and medium-temperature leakage tests*;
- (d) UL 1784:2009, *UL Standard for safety air leakage tests of door assemblies*; or
- (e) AS 1530:Part 7:2007, *Methods for fire tests on building materials, components and structures- Smoke control assemblies. Ambient and medium*.

### **Clause E9.2**

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[Clause deleted.]

## Section 5 – Non-combustibility

### Subsection E10 – Non-combustibility

#### Clause E10.1

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Any product that complies with one of the following is considered to be non-combustible:

- (a) Class A1 in BS-EN 13501-1:2007, *Fire classification of construction products and building elements - Classification using data from reaction to fire tests*;
- (b) BS EN ISO 1182:2010, *Reaction to fire tests for products. Non-combustibility test* and BS EN ISO 1716:2010 *Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)*;
- (c) BS 476-4:1970, *Fire tests on building materials and structures. Part 4: Non-combustibility test for materials*.

#### Commentary

Other appropriate non-combustibility tests include:

- (a) AS 1530.1:1994, *Methods for fire tests on building materials, components and structures Part 1: Combustibility test for materials*;
- (b) ASTM E136–11, *Standard test method for behavior of materials in a vertical tube furnace at 750°C*.

### Subsection E11- Limited Combustibility

#### Clause E11.1

---

Materials of limited combustibility are classified as Class A2-s3, d2 or better in accordance with:

- (a) BS EN 13501-1:2007, *Fire classification of construction products and building elements, Part 1 – Classification using data from reaction to fire tests* to BS EN ISO 1182:2002, *Reaction to fire tests for building products – Non-combustibility test*;
- (b) BS EN ISO 1716:2010, *Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)* and BS EN 13823:2010, *Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item*.

### Commentary

The European classifications are developed through a suite of fire tests. Building elements except flooring, are classified as A1, A2, B, C, D, E or F (with A1 being the highest performance and F being the lowest) in accordance with BS EN 13501-1:2007, *Fire classification of construction products and building elements, Classification using data from reaction to fire tests*.

The relevant fire tests are:

- (a) BS EN ISO 1182:2010, *Reaction to fire tests for products. Non-combustibility test*;
- (b) BS EN ISO 1716:2010, *Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)*;
- (c) BS EN 13823:2010, *Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item*;
- (d) BS EN ISO 11925-2:2010, *Reaction to fire tests. Ignitability of building products subjected to direct impingement of flame. Single-flame source test*;
- (e) BS EN 13238:2010, *Reaction to fire tests for building products. Conditioning procedures and general rules for selection of substrates*.

The European test methods are based on performance in the ISO 9705, *Room Corner Test*. Products tested in accordance with the room corner test (ISO 9705), in tandem with the Cone Calorimeter (ISO 5660-1) are acceptable.

Table E1 is the comparison of classification of fire performance of materials tested in accordance with BS EN 13501-1:2007 and BS 476: Parts 4 and 7.

**Table E1 - European Classes on Reaction to Fire Performance**

European Classification	British Standard Equivalent
A1	Non-combustible
A2	Limited combustibility
B	0
C	1
D	3
E	4
F	Unclassifiable or no performance determined

## Subsection E12 - External Facades

### Clause E12.1

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External facades should be tested in accordance with the following applicable standards:

- (a) BS EN 1364-3:2006, *Fire resistance tests for non-loadbearing elements. Curtain walling. Full configuration (complete assembly)*;
- (b) BS EN 1364-4:2007, *Fire resistance tests for non-loadbearing elements. Curtain walling. Part configuration*.

#### Commentary

There are other options for testing of facades, including:

- (a) Large scale testing:
  - (i) NFPA285:2006, *Standard fire test method for evaluation of fire propagation characteristics of exterior non-loadbearing wall assemblies containing combustible components*;
  - (ii) ULC-S134-92, *Fire test of exterior wall assemblies (Vertical channel test)*.
- (b) Small scale testing:
  - (i) ULC-S134-92, *Fire test of exterior wall assemblies (Vertical channel test)*;
  - (ii) AS 1530.1:1994, *Methods for fire tests on building materials, components and structures Part 1: combustibility test for materials*.

## Subsection E13 – Linings of Internal Wall and Ceiling and Decorative Finishes

### Clause E13.1

---

Linings of internal wall and ceiling and decorative finishes in the following Use Classifications, where the combustibility is required to be controlled, should comply with the following when tested in accordance with BS EN 13501-1:2007:

- (a) All Use Classifications – within protected exits, Classification C of Table E1;
- (b) Use Classification 3 – general accommodations (including corridors, circulation spaces and rooms) that are not forming the protected exit, Classification B or above of Table E1;
- (c) Use Classification 5a – within cinemas, auditoria and theatres, Classification C or above of Table E1;

When tested in accordance with the British Standards, the performance should meet the equivalent European classification in Table E1.

### Clause E13.2

---

For compliance with Clause E13.1, the linings and finishes should be tested in accordance with the following applicable standards:

- (a) BS EN ISO 1182:2010, *Reaction to fire tests for products. Non-combustibility test*;
- (b) BS EN ISO 1716:2010, *Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)*;
- (c) BS EN 13823:2010, *Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item*;
- (d) BS EN ISO 11925-2:2010, *Reaction to fire tests. Ignitability of building products subjected to direct impingement of flame. Single-flame source test*.

### Clause E13.3

---

The following British Standards will still be applicable until they are obsolete:

- (a) BS 476-4:1970, *Fire tests on building materials and structures. Part 4: Non-combustibility test for materials*.
- (b) BS 476 Part 6:1989, *Fire tests on building materials and structures - Method of test for fire propagation for products*;
- (c) BS 476 Part 7:1997, *Fire tests on building materials and structures - Method of test to determine the classification of the surface spread of flame of products*.

#### Commentary

Decorative finishes are materials that are fixed to walls and ceilings. For cinemas and theatres only, decorative finishes also include seat linings.

There is another option for testing of linings: NFPA 265: 2011, *Standard methods of fire tests for evaluating room fire growth contribution of textile coverings on full height panels and walls*.

## Subsection E14 - Linings and Coverings of Floors

### Clause E14.1

---

Linings and coverings of floors, where the combustibility is required to be controlled, should comply with the following when tested in accordance with BS EN 13501-1:2007:

- (a) All Use Classifications – within protected exits, Classification C of Table E1;
- (b) Use Classification 3 – general accommodation (including corridors, circulation spaces and rooms) that are not forming the protected exit, Classification B or above of Table E1;
- (c) Use Classification 5a – within cinemas, auditoria and theatres, Classification C or above of Table E1.

When tested in accordance with the British Standards, the performance should meet the equivalent European classification in Table E1.

### Clause E14.2

---

For compliance with Clause E14.1, the linings and coverings of floors should be tested in accordance with the following applicable standards:

- (a) BS EN ISO 1182:2010, *Reaction to fire tests for products. Non-combustibility test*;
- (b) BS EN ISO 1716:2010, *Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)*;
- (c) BS EN ISO 9239-1:2010, *Reaction to fire tests for floorings. Determination of the burning behaviour using a radiant heat source*;
- (d) BS EN ISO 11925-2:2010, *Reaction to fire tests. Ignitability of building products subjected to direct impingement of flame. Single-flame source test*.

### Clause E14.3

---

Other small scale tests may also be applicable:

- (a) BS 4790:1987, *Determination of the effects of a small source of ignition on textile floor coverings (hot metal nut method)*;
- (b) BS 6307:1982, ISO 6925-1982, *Method for determination of the effects of a small source of ignition on textile floor coverings (methenamine tablet test)*.

#### Commentary

Whilst a floor is not usually the prime vehicle for fire spread, the contribution of floor coverings such as carpets to fire spread can be significant. The Flooring Radiant Panel represents the exposure of a carpet or other floor covering to a nearby fire, and measures the propensity of the floor covering to be an agent of flame spread over flat floors (in the absence of significant air flow). The Hot Nut Test (BS 4790) and the Methenamine Pill Test (BS 6307, ISO 6925) represent small ignition sources falling on a carpet in the absence of any external radiation.

## **Subsection E15 - Acoustic and Thermal Insulation**

### **Clause E15.1**

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Acoustic and thermal insulation in ductings and concealed locations should be tested in accordance with the following applicable standards:

- (a) BS EN ISO 1182:2010, *Reaction to fire tests for products. Non-combustibility test*;
- (b) BS EN ISO 1716:2010, *Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)*;
- (c) BS EN 13823:2010, *Reaction to fire tests for building products. Building products excluding flooring exposed to the thermal attack by a single burning item*;
- (d) EN ISO 11925-2:2010, *Reaction to fire tests. Ignitability of building products subjected to direct impingement of flame. Single-flame source test*;
- (e) BS EN 13501-1:2007, *Fire classification of construction products and building elements. Classification using data from reaction to fire tests*.

### **Clause E15.2**

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The following British Standards will still be applicable until they are obsolete:

- (a) BS 476-4:1970, *Fire tests on building materials and structures. Part 4: Non-combustibility test for materials*;
- (b) BS 476 Part 6:1989, *Fire tests on building materials and structures. Method of test for fire propagation for products*;
- (c) BS 476 Part 7:1997, *Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products*.

## **Section 6 – Fire Testing Authorities**

### **Subsection E16 - Criteria for Choosing Testing Authorities**

#### **Clause E16.1**

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The Building Authority will recognize the laboratories accredited by the Hong Kong Accreditation Services (HKAS) under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) or other laboratory accreditation bodies which have reached mutual recognition agreements with HOKLAS. The Building Authority will also recognize the certification bodies accredited by HKAS under the Hong Kong Certification Body Accreditation Scheme (HKCAS) or other accredited certification bodies which have reached multilateral recognition arrangements with HKCAS.

#### **Clause E16.2**

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The fire properties of materials, products or construction components should be tested in accordance with or assessed against the standards stipulated in this Part and certified as being capable of achieving such fire properties to the satisfaction of the Building Authority. Such certification should be established by:

- (a) a test report prepared by a recognized laboratory. The test should be within the accredited scope for testing of the laboratory; or
- (b) an assessment report prepared by a recognized laboratory or certification body. The subject category or type of the materials, products or components of the assessment should be within the accredited scope for testing or certification by the laboratory or the certification body.

## **Reference – List of Tables**

1. The FRR of the standard of construction and building materials are set out in the following Tables for reference.
2. In this List :
  - “gypsum plaster” means gypsum building plaster complying with BS EN 13279;
  - “gypsum plaster board” means gypsum plaster board complying with BS EN 520.
3. The List contains:
  - Table E2 on Walls Constructed Wholly of Non-combustible Materials
  - Table E3 on Walls not Constructed Wholly of Non-combustible Materials
  - Table E4 on Floors and Landings
  - Table E5 on Steel Columns and Beams
  - Table E6 on Reinforced Concrete Columns and Beams
  - Table E7 on Stairs

**TABLE E2****WALLS CONSTRUCTED WHOLLY OF NON-COMBUSTIBLE MATERIALS**

Construction and Materials	Minimum thickness in mm (excluding plaster) for FRR of		
	240 mins	120 mins	60 mins
<b>SOLID CONSTRUCTION</b>			
Solid bricks of clay, concrete or sand lime without plaster	225	225*	100
Reinforced concrete -			
(a) containing not less than 1 per cent of vertical reinforcement	180	100	75
Concrete cover to main reinforcement	25	25	15
(b) containing less than 1 per cent of vertical reinforcement	240	160	120
Concrete cover to main reinforcement	25	25	25
<b>HOLLOW BLOCK CONSTRUCTION</b>			
Clay blocks (outer web not less than 13mm thick) of 2 cells not less than 50 per cent solid finished with 13mm gypsum plaster on each side		100	100
Concrete blocks of one cell in wall thickness not less than 50 per cent solid finished with 13mm gypsum plaster on each side			190

\* Where finished with 13mm gypsum plaster on each side, the thickness may be reduced to 100mm.

**TABLE E3****WALLS NOT CONSTRUCTED WHOLLY  
OF NON-COMBUSTIBLE MATERIALS**

Construction and Materials	Minimum thickness of finish in mm on each face for FRR of	
	120 mins	60 mins
<b>SOLID CONSTRUCTION</b>		
Wood wool slabs – complying with BS EN 13168 -		
(a) 50mm minimum thickness with gypsum plaster finish		13
(b) 75mm minimum thickness with gypsum plaster finish	13	6
Gypsum plaster board in cores not less than 19mm thick in section not more than 1.2m wide supported top, bottom and sides in steel channels or a timber framework, with gypsum plaster finish		10
<b>HOLLOW CONSTRUCTION</b>		
Steel or timber framing with facings on each side of -		
(a) Portland cement plaster, Portland cement-lime plaster or gypsum plaster on metal lathing		19
(b) 2 layers of 10mm thick gypsum plaster board with gypsum plaster finish		Nil
(c) 13mm thick gypsum plaster board with gypsum plaster finish		6
(d) 19mm thick gypsum plaster board with gypsum plaster finish		Nil

**TABLE E4**  
**FLOORS AND LANDINGS**

Construction and Materials	Minimum thickness in mm for FRR of		
	240 mins	120 mins	60 mins
<b>SOLID REINFORCED CONCRETE CONSTRUCTION</b>			
Thickness of concrete	170	125	100
Concrete cover to all reinforcement -			
simply supported	55*	35	20
continuous	45*	25	20
<b>SOLID PRESTRESSED CONCRETE CONSTRUCTION</b>			
Depth including screed	170	125	100
Concrete cover to all reinforcement -			
simply supported	65*	40	25
continuous	55*	35	20

\* Reinforcement consisting of expanded metal lath or a wire fabric not lighter than 0.5kg/m<sup>2</sup> with 2mm diameter wire at not more than 100mm centres or a continuous arrangement of links at not more than 200mm centres should be incorporated in the concrete cover at a distance not exceeding 20mm from the face.

**TABLE E5**  
**STEEL COLUMNS AND BEAMS**

Construction and Materials	Minimum thickness of protection in mm for FRR of		
	240 mins	120 mins	60 mins
<b>SOLID PROTECTION</b>			
Columns and hangers (mass per metre not less than 45kg)			
(a) Concrete not inferior to Grade 20 and reinforced in accordance with the Code of Practice for the Structural Use of Steel	75	50	50
(b) Solid bricks of clay, concrete or sand lime	75	50	50
Beams (mass per metre not less than 30 kg)			
Concrete not inferior to Grade 20 and reinforced in accordance with the Code of Practice for the Structural Use of Steel	75	50	50
<b>HOLLOW PROTECTION</b>			
Columns and hangers (mass per metre not less than 45kg)			
(a) Solid bricks of clay, concrete or sand lime reinforced in every horizontal joint with steel binding wire not less than 2.5mm in thickness or steel mesh weighing not less than 0.5kg/m <sup>2</sup> .	115	50	50
(b) Portland cement plaster, Portland cement-lime plaster or gypsum plaster on metal lathing.			19
(c) Gypsum plaster on 10mm gypsum plaster board with 1.6mm diameter wire binding at 100mm pitch			13
(d) Gypsum plaster on 19mm gypsum plaster board with 1.6mm diameter wire binding at 100mm pitch		13	7
Beams (mass per metre not less than 30kg)			
(a) Portland cement plaster or Portland cement-lime plaster on metal lathing			19
(b) Gypsum plaster on metal lathing		22	16
(c) Gypsum plaster on 10mm gypsum plaster board with 1.6mm diameter wire binding at 100mm pitch			13
(d) Gypsum plaster on 19mm gypsum plaster board with 1.6mm diameter wire binding at 100mm pitch		13	7

In this Table –

“hollow protection” means there is a void between the protective material and the web of the steel section, such hollow protection to columns should be effectively sealed at each floor level.

“solid protection” means casing which is bedded close to the steel without any intervening cavities and with all joints in that casing made full and solid.

**TABLE E6****REINFORCED CONCRETE COLUMNS AND BEAMS**

Construction and Materials	Minimum overall size of column in mm for FRR of		
	240 mins	120 mins	60 mins
<b>REINFORCED CONCRETE COLUMNS AND HANGERS</b>			
(a) Fully exposed columns and hangers	450	300	200
Concrete cover to main reinforcement	35	35	25
(b) 50 per cent exposed of columns and hangers	350	200	160
Concrete cover to main reinforcement	35	25	25
(c) One face exposed of columns and hangers	240	160	120
Concrete cover to main reinforcement	25	25	25
<b>REINFORCED CONCRETE BEAMS</b>			
Width of beam	280	200	200
Concrete cover to main reinforcement -			
simply supported	80*	50*	30
continuous	60*	40	30
<b>PRESTRESSED CONCRETE BEAMS</b>			
Width of beam	280	200	200
Concrete cover to tendons -			
simply supported	90*	70*	30

\* Reinforcement consisting of expanded metal lath or a wire fabric not lighter than  $0.5\text{kg/m}^2$  with 2mm diameter wire at not more than 100mm centres or a continuous arrangement of links at not more than 200mm centres should be incorporated in the concrete cover at a distance not exceeding 20mm from the face.

**TABLE E7****STAIRS**

Construction and Materials	Minimum thickness in mm for FRR of		
	240 mins	120 mins	60 mins
Reinforced concrete construction -			
Thickness at waist of slab	170	125	95
Concrete cover to all reinforcement	55*	35	20

\* Reinforcement consisting of expanded metal lath or a wire fabric not lighter than  $0.5\text{kg/m}^2$  with 2mm diameter wire at not more than 100mm centres or a continuous arrangement of links at not more than 200mm centres should be incorporated in the concrete cover at a distance not exceeding 20mm from the face.

**This Part contains five Sections:**

- **Section 1 – General**
- **Section 2 – Fire Safety Management**
- **Section 3 – Maintenance Plan**
- **Section 4 – Training Plan**
- **Section 5 – Fire Action Plan**
- **Appendix F1 – Sample Checklist on Housekeeping**

## **Section 1 – General**

### **Subsection F1 – Use of this Part**

#### **Clause F1.1**

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This Part provides guidelines for managing and maintaining the fire safety provisions of buildings and should be read in conjunction with all other Parts in this Code.

#### **Commentary**

Management and maintenance of fire safety provisions are important as it is necessary to assure that the fire safety provisions installed can operate effectively for the intended life of the building.

Effective fire safety management can reduce potential fire danger, assist occupants to reach the ultimate place of safety in case of fire and regular maintenance will ensure all fire safety provisions in the building can be kept in good workable conditions. Of particular concern is the existence of unauthorized building works (UBW) affecting the fire safety of the occupants.

### **Subsection F2 – Performance Requirements for Fire Safety Management**

#### **Clause F2.1**

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Performance Requirements for the maintenance and management of fire safety provisions are stipulated in Subsection A11 of Part A.

### **Subsection F3 – Scope**

#### **Clause F3.1**

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This Part is applicable to all Use Classifications in Table A1 of Part A.

### **Commentary**

Maintenance and management of fire safety provisions should be carried out through the following means:

- (a) Passive fire safety provisions at common parts should be inspected and repaired under the Buildings Ordinance (Cap. 123).
- (b) Active fire safety provisions should be inspected, tested and maintained by registered fire service installation contractors under the Fire Service (Installations and Equipment) Regulations (Cap. 95B).
- (c) Ventilating systems should be inspected by registered specialist contractor (ventilation works) under the Building (Ventilating Systems) Regulations (Cap. 123J).
- (d) Competent persons, e.g. authorized persons, should be commissioned by the building owners to carry out inspections, maintenance and certification of fire safety provisions.
- (e) Checklist on housekeeping (sample at Table F1) should be provided to guide the carrying out of routine maintenance works on passive fire safety provisions and the rectification of any irregularities identified. Such guidelines would enhance the owners' awareness on fire safety and are effective means on fire safety management for buildings.

A competent person should be responsible for carrying out inspections, making recommendation on maintenance and repair works and ensuring the appropriate contractors have completed the necessary maintenance and repair works for fire safety provisions in compliance with the relevant statutory requirements.

Building owners (or Owners' Corporation) should engage a competent person to coordinate all maintenance and repair works. The competent person should also be responsible for:

- (a) Documenting all fire safety provisions within the building.
- (b) Documenting the period of inspections, testing and replacement, as appropriate.
- (c) Checking the record keeping of maintenance actions.
- (d) Checking that the actions in fire safety management plan are undertaken.
- (e) Checking the period of maintenance and repairs.
- (f) Allowing all documentation to be checked by relevant authority, when required.

## **Section 2 - Fire Safety Management**

### **Subsection F4 - Fire Safety Management**

#### **Clause F4.1**

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Fire safety management should be carried out at regular intervals through routine inspections and maintenance of fire safety provisions for rectifying any identified irregularities. The following guidelines on fire safety management are advisory in nature. However, where fire engineering approach is adopted in fire safety design of a building, the submission of an FSAR for an Alternative Solution may require the support of a fire safety management plan which will then form part of the approved general building plans. Compliance with the fire safety management plan will also be imposed as a condition when granting modification under section 42 of the Buildings Ordinance for not meeting the relevant requirements laid down in Building (Planning) Regulations 41(1), 41A, 41B, 41C, 41D and Building (Construction) Regulation 90.

#### **Clause F4.2**

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To ensure effectiveness, fire safety management should be implemented through the documentation and implementation of a fire safety management plan, as required in Clause F4.5.

The authorized person should assist in compiling the fire safety management plan. For example, the authorized person should advise the developer/owner/the future management office to gather a set of approved general building plans (with exit routes highlighted), the fire service installations plans and any relevant documents of the fire safety provisions installed from relevant authorities, for incorporating into the fire safety management plan.

The management office and the Owners' Corporation should keep the fire safety management plan in the management office and to ensure that the management procedures stated in the fire safety management plan are implemented effectively, for example, conducting regular inspection and maintenance of fire rated doors, conducting regular fire drill, providing training to the management staff on how to use fire hose reels and fire extinguishers etc.

#### **Clause F4.3**

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Where fire engineering approach is adopted for fire safety design of a building, the authorized person should ensure that the Bounding Conditions (to be included as part of the general building plans) and a copy of the final FSAR adopted are included in the fire safety management plan.

The Bounding Conditions listed in the approved general building plans should be included in the Deed of Mutual Covenant (DMC), where applicable, to ensure compliance.

**Clause F4.4**

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The fire safety management plan and the Bounding Conditions (applicable when adopting fire engineering approach in building design), should be observed during the life of a building. Periodic review and audit to the procedures stated in the fire safety management plan should be conducted for ensuring the adequacy of the existing fire safety provisions for accommodating any new changes occurred in the building. All the records of building alterations should be included in the fire safety management plan.

**Clause F4.5**

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The fire safety management plan should include the following:

- (a) maintenance plan,
- (b) training plan, and
- (c) fire action plan

as detailed in Sections 3, 4 and 5 respectively.

## Section 3 – Maintenance Plan

### Subsection F5 – Maintenance Plan

#### Clause F5.1

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The maintenance plan should include the following documents and information:

- (a) Approved general building plans with the exit routes highlighted;
- (b) Documents indicating the details/specifications of the fire safety provisions installed;
- (c) Period for regular maintenance of the fire safety provisions installed;
- (d) Method statements for maintenance;
- (e) Repair methods;
- (f) Records of maintenance or repair works carried out;
- (g) Housekeeping; and
- (h) A copy of the final FSAR, if any.

#### Clause F5.2

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Inspection to fire safety provisions should be conducted by competent person or registered fire service installation contractors at regular intervals. The competent person should assess the conditions of the fire safety provisions and make recommendations on the maintenance or repair works.

#### Clause F5.3

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Maintenance of active fire safety provisions, which include installations and equipment, should comply with the requirements in the Code of Practice for Inspection, Testing and Maintenance of Installations and Equipment.

#### Clause F5.4

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UBW will affect the fire safety provisions of buildings and may cause fatal consequences endangering the safety of the occupants. Before carrying out any building works or change in use of a building, building professionals should be consulted.

#### Commentary

Regular inspections can identify any UBW, changes in use, alterations and other issues such as blocking of exit routes, which may affect the fire safety of the building. Immediate and appropriate action must be taken to ensure all fire safety provisions are maintained properly and are effective in case of emergency.

Besides the enforcement actions that can be taken under the Buildings Ordinance (Cap. 123), there are other legislations that can be enforced by other departments to rectify the irregularities. For example:

- (a) Under the Fire Services (Fire Hazard Abatement) Regulation (Cap. 95F), it is an offence to block exit routes, such as obstructing or locking the “means of escape”. Apart from issuing a fire hazard abatement notice to the responsible person, who may be the building owner, tenant, occupier or person in charge of the premises,

the Director of Fire Services may institute direct prosecution against the person concerned.

- (b) As defined in the Fire Services (Fire Hazard Abatement) Regulation (Cap. 95F), “means of escape” means such means of escape as may be required for the safety of persons having regard to the use or intended use of the premises. Hence, the Fire Services Department requires all building exit door(s) including any door or gate erected at the section of a common staircase between the topmost floor and the roof to be readily and conveniently openable from the staircase side without the use of a key.
- (c) Under the Fire Service (Installations and Equipment) Regulations (Cap. 95B) 7(1) and 9(1), only a registered contractor who satisfies the requirements under regulation 3A of the Fire Service (Installation Contractors) Regulations (Cap. 95A), should maintain, inspect or repair; and should issue maintenance certificate for any fire service installation.
- (d) The Occupational Safety and Health Ordinance (Cap. 509) requires the provision of a safe environment for building occupants. It states the responsibilities of employers and occupiers of premises to contribute to safety and health in the workplaces including fire precautions, by providing good maintenance for means of escape and other fire safety measures.
- (e) The Education Regulation (Cap. 279A) 38 requires fire drill to be carried out at least once every 6 months for all schools. The written record of all such drills should be documented in a school log book.

#### **Clause F5.5**

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Good housekeeping should be maintained to reduce the chances of fire and blockage of exit routes and temporary refuge spaces. Housekeeping methods include methods for proper waste disposal, keeping combustible materials from possible ignition sources and ensuring exit routes and temporary refuge spaces are free from obstruction etc. A sample checklist is given in Table F1 for reference.

#### **Clause F5.6**

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When carrying out alteration, additions, renovation and repair works, the following items should be observed:

- (a) All means of escape should be maintained at all times. It should be free from obstruction and adequately signed and lit.
- (b) All fire rated doors along exit routes should be maintained and kept closed at all times.
- (c) All fire barriers should be maintained.
- (d) Alternative measures for ensuring adequate standard of fire safety should be provided if any means of escape, fire rated doors or fire barriers etc. have to be temporarily removed.
- (e) Flame-retardant sheetings should be used for covering the scaffoldings erected around the building.

- (f) Any inflammable and combustible materials to be kept in the building should be stored under safe custody and avoid accumulating excessive quantity. Attention is drawn to the Dangerous Goods Ordinance and Regulations (Cap. 295).
- (g) All relevant notifications to the Fire Services Department regarding temporary shut-down of fire service installations should be made in accordance with the Fire Services Department's requirements.
- (h) First-aid and firefighting equipment should be located where it is readily accessible. Training should be provided to all workers on the operation of the equipment.
- (i) Emergency plan should be established and appropriate training should be provided to all workers.

The above requirements should be observed and brought to the attention of all concerned in carrying out alteration, additions, renovation and repair works under their supervision.

### **Clause F5.7**

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For maintenance or replacement works of lift installations, the integrity of liftwells should be protected in order to inhibit the spread of fire between fire compartments through the liftwells and openings. The following fire safety requirements should be complied with:

- (a) Subject to (b) below, all landing doors should remain in a closed position in the course of maintenance or replacement works of lift installations.
- (b) Where landing doors need to be kept open for the works, normally no more than one such door in a liftwell should be in an opened position at any one time. The door opening, other than the one at which the lift car is levelled with the floor landing, is to be attended by lift workers. If the works necessitate more than one door in a liftwell to be opened at the same time, the following additional conditions should be observed :
  - (i) the maximum number of landing doors to be kept open at the same time is three; and
  - (ii) no hot works or welding operations will be carried out.
- (c) Where landing doors are to be taken down, removal of more than one landing doors in a liftwell at any one time should be avoided.
- (d) If more than one landing door is to be removed at any one time, the door openings should be protected by temporary hoarding having an FRR of not less than -/120/- .
- (e) Openings in the hoarding are not allowed except small openings for ventilation of the liftwell and access doors to the liftwell.
- (f) Each ventilation opening should not exceed 5,500mm<sup>2</sup> in area and should be located at the upper portion of the hoarding. The number of such openings should be limited to two per liftway, subject to a maximum of four in the hoarding.
- (g) Access door in the hoarding should have an FRR of not less than that of the hoarding. Such door should be self-closing and provided with locking device to prevent trespassing. The locking device should be so arranged that it can be readily opened from the inside without the use of a key.
- (h) Temporary hoarding to enclose a liftwell should not be erected to cause, as far as reasonably practicable, any obstruction or reduction in the width of any exit route.

- (i) Any temporary works including scaffoldings, formworks, plankings and struttings etc. erected inside a liftwell during maintenance or replacement works should be constructed of non-combustible materials.
- (j) Arrangements should be made to ensure that all temporary openings during maintenance or replacement works are protected by either having all opened lift landing doors returned to the closed position or enclosing such openings properly with fire resisting hoarding before leaving any unfinished works unattended during lunch breaks or at the end of a day's work.

The above requirements should be observed and brought to the attention of all concerned in carrying out maintenance or replacement works of the lift installations under their supervision.

### **Clause F5.8**

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If open kitchens in flats are provided in accordance with Clause C13.4, the following conditions should be incorporated into the fire safety management plan and DMC, where applicable, to ensure the implementation and operation of the following fire safety provisions:

- (a) Smoke detectors provided inside the flats and at the common lobby outside the flats should not be removed or obstructed;
- (b) Sprinkler head provided at the ceiling immediately above the open kitchen should not be removed or obstructed;
- (c) The full height wall having an FRR of not less than -/30/30 adjacent to the flat exit door should not be removed; and
- (d) The fire service installations in (a) and (b) above should be subject to annual check conducted by the management's registered fire service installation contractor.

The management office should assist the owners to carry out annual maintenance of the fire service installations and submit the maintenance certificate to the Fire Services Department. The owners should allow access for the registered fire service installation contractors to carry out annual check and maintenance.

## Section 4 –Training Plan

### Subsection F6 –Training Plan

#### Clause F6.1

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Proper and adequate training should be provided to staff for ensuring that they are familiar with the fire safety provisions installed and the actions to be taken in case of fire. For example, the familiarization with the exit routes, evacuation procedures for guiding occupants to the ultimate place of safety in case of fire and use of firefighting equipment etc.

#### Clause F6.2

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The training plan should include descriptions of staff duties on routine inspection and their duties in case of fire, regular staff training programme, staff training records etc. Fire wardens should be appointed for managing evacuation in case of fire.

#### Clause F6.3

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Fire drills and fire safety seminars should be conducted at regular intervals for staff and the occupants, including persons with a disability.

#### Commentary

A fire drill is a method of practicing the evacuation of a building in case of fire in which the management staff can also identify and remedy the need and problems with the evacuation procedures for the occupants including persons with a disability.

#### Occupant Training

Tall building evacuation requires not only building elements such as refuge floors, but also requires managed evacuation strategies and training for all occupants.

A key aspect for consideration is whether occupants on upper floors are expected to evacuate to the street level. The training provided to occupants will affect how they will react in a fire or other emergency situation.

Some building occupants may have a perception that they will never have to walk down to the street level in a fire emergency and may just need to stay at the nearest refuge floor. This may result in blockage at refuge floors, as occupants may wait at the refuge floor and not move any further. To overcome this potential blockage of occupants at refuge floors, fire wardens should ensure the occupants do not remain on the refuge floors causing blockage. This is particularly important if whole building is to be evacuated.

Occupants and staff should be trained by regular fire drills to familiarise themselves with the procedure of emergency evacuation in the fire action plan.

## **Section 5 – Fire Action Plan**

### **Subsection F7 – Fire Action Plan**

#### **Clause F7.1**

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Fire action plan should be formulated to establish the procedures to be taken in case of fire. For example, report the fire to the Fire Services Department by dialling 999, inform the occupants and assist them to escape to the ultimate place of safety etc. It may include any contingency plan or evacuation plan.

#### **Clause F7.2**

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The fire action plan should include the evacuation procedures for persons with a disability. Where temporary refuge spaces have been provided, their locations should be illustrated in the evacuation plan. If the safety condition permits, management staff should be maintained in the management office for communicating with any person waiting for rescue in the temporary refuge spaces and inform the firefighters of the locations of the temporary refuge spaces where people are waiting for rescue.

## Appendix F1 – Sample Checklist on Housekeeping

Table F1 provides a sample checklist on housekeeping. It provides general guidelines and suggested actions that should be taken for the upkeep of fire safety provisions installed in a building. The list is not exhaustive.

**Table F1: Sample Checklist on Housekeeping**

Items	Action	Yes	No	N/A	Follow-up Action
<b>1 - Means of Escape</b>					
1.1	Exit routes are free from obstructions at all times.				
1.2	No unauthorized alteration(s) along the exit route.				
1.3	Metal gate or roller shutter is not installed across the exit routes.				
1.4	Doors or gates within common areas are readily openable from the inside without the use of a key.				
1.5	Doors or gates do not swing onto the exit routes reducing the effective width of the exit routes.				
1.6	Fire rated doors are self-closing and be kept closed at all times.				
1.7	Combustible linings are not installed within the exit routes.				
1.8	Adequate lighting is provided for the exit routes and is kept in good condition.				
1.9	Adequate signs are provided along the exit routes.				
1.10	The balustrades and handrails in the required staircases and along the exit routes are maintained in good condition.				
1.11	Any hold-open devices to all fire rated doors are tested for ensuring they are in good condition.  (Particular attention is given to check any obstructions nearby the fire rated doors that are held open by hold-open devices in normal times.)				
1.12	All temporary refuge spaces are free from obstruction.				
1.13	Closed-circuit television and intercom link for the temporary refuge spaces are kept in good condition.				
<b>2 - Fire Resisting Construction</b>					
2.1	Fire rated doors for protected exits, fireman's lift lobbies, required staircases, plants rooms etc. are kept in good condition including the ironmongeries and glazed panels, if any.				

Items	Action	Yes	No	N/A	Follow-up Action
2.2	Fire rated doors and doors with smoke seal are kept in the closed position.				
2.3	Fire rated doors and doors with smoked seal have not been removed or replaced by doors of lower FRR than the approved ones.				
2.4	No unauthorized alteration(s) have been made to the fire resisting constructions.				
2.5	Fire barriers are kept in good condition and free of unprotected openings. The FRR is maintained.				
2.6	Non-emergency services such as electric cables and similar installations in required staircases are adequately enclosed by fire barriers. The fire barriers are kept in good condition. All access panels are kept in closed position.				
2.7	No unauthorized openings are formed in protected exits, in particular required staircase walls.				
2.8	No penetrations are made through a fixed light.				
2.9	Fire shutters are not obstructed.				
2.10	Vision panels to fire rated doors remain intact.				
2.11	Penetrations within fire barriers are sealed with fire seals or fire stops.				
2.12	No exhaust fans, air-conditioning units or similar installations are installed in a protected exits, in particular required staircases.				
2.13	Smoke vents at basement and their outlets are not obstructed / blocked. Basement smoke extraction system is regularly inspected and checked by registered fire service installation contractor.				
<b>3 – Access for Firefighting and Rescue</b>					
3.1	Access to fireman's lifts is unimpeded from the street.				
3.2	The walls of fireman's lift lobby are kept in good condition and free of unprotected openings. The FRR is maintained.				
3.3	EVA is free from obstructions and is kept in good condition.				
<b>4 – Others</b>					
4.1	No change in Use Classification that may have fire safety implications.				
4.2	If open kitchens are provided, smoke detectors, sprinkler, other active fire safety provisions installed are not obstructed and can function				

Items	Action	Yes	No	N/A	Follow-up Action
	properly. The fire rated wall adjacent to the flat exit door remains intact.				
4.3	Fire safety seminars and fire drills are organized regularly.				
4.4	Electrical installations in the building are inspected and checked by registered electrical contractors regularly.				
4.5	Appropriate fire safety precautionary works are provided when carrying out alterations, additions and repair works <sup>2</sup> .				

Notes:

1. N/A means "Not applicable".
2. When carrying out alterations, additions and repair works, appropriate fire safety precautionary works should be provided in accordance with Clause F5.6 or F5.7, as the case may be. Specific checklist should be formulated based on these two clauses for ensuring the fire safety of the occupants.

**Part G**  
**Guidelines on Fire Engineering**

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**This Part contains ten Sections:**

- **Section 1 – Introduction**
- **Section 2 – Framework for Fire Engineering**
- **Section 3 – Introduction to Fire Engineering**
- **Section 4 – Methodologies of Fire Engineering**
- **Section 5 – Fire Safety Sub-systems**
- **Section 6 – Design by Fire Engineering**
- **Section 7 – Fire Safety Assessment Report**
- **Section 8 – Bounding Conditions**
- **Section 9 – Computer Models**
- **Section 10 – References**

## **Section 1 - Introduction**

### **Clause G1.1 Use of this Part**

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The Guidelines in this Part are developed to:

- (a) provide guidance for complying with the fire safety objectives in the Buildings Ordinance and the Performance Requirements stipulated in Part A; and
- (b) provide a framework for fire engineering to develop an Alternative Solution.

### **Clause G1.2 Objectives of this Part**

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The objectives of this Part are to:

- (a) provide guidance for the process of applying fire engineering for fire safety design in buildings; and
- (b) provide guidance on the available methodologies on conducting fire engineering.

### **Clause G1.3 Limitations of this Part**

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This Part has inherent limitations, including:

- (a) the Guidelines are not applicable to protect those person(s) directly involved with fire ignition (initiation) (e.g. arson). Fire safety provisions are not generally designed to protect such persons;
- (b) the Guidelines are intended to be used by persons who have adequate qualifications, experience and knowledge in the field of fire engineering; and
- (c) the Guidelines are not applicable for fire hazards related to handling of explosive materials.

## Section 2 - Framework for Fire Engineering

### Clause G2.1 Performance Requirements and Level of Safety

The Performance Requirements in Part A may apply differently to different buildings and different Use Classifications, e.g. the Performance Requirements related to means of escape are interpreted and applied differently for a shopping centre, a high-rise domestic building and a hospital. Although there is no explicit level of safety stated for the Performance Requirements in Part A, when adopting a performance-based approach, the Building Authority will normally accept a level of performance not inferior to that of the Deemed-to-Comply provisions. The Deemed-to-Comply provisions in Parts B to E provide a benchmark on the acceptable level of fire safety of buildings.

#### Commentary

It is not possible to design or obtain a goal of absolute safety for all building occupants, with respect to fire safety. There is always a finite risk of injury, death or property damage as a result of a fire. Due to the difficulty in predicting the outcomes of fire and its impact on life safety and property safety, all fire safety solutions, whether performance-based or those complying fully with the Deemed-to-Comply provisions will have a certain risk to life and property associated. Deemed-to-Comply provisions in this Code provide a benchmark with respect to the acceptable level of risk, with regard to the risk of fatality, injury and loss of adjacent structures through fire. It is not intended that this benchmark should be “absolute safety” or “zero risk” because these concepts are not achievable and the benchmark risk needs to take into account what the community expects and the cost to the community, which may only be determined by a cost benefit analysis.

In order to complete a performance-based assessment (Alternative Solution), acceptance criteria must be developed in order to analyse the outcome of the design. The relationship between the acceptance criteria and the relevant Performance Requirements may vary in different scenarios and must be considered on a case-by-case basis, which is part of the fire engineering approach process.

### Clause G2.2 Complying with the Framework for Fire Engineering

This Part provides guidance on the application of fire engineering for the formulation of an Alternative Solution for fire safety provisions in buildings to comply with the fire safety objectives, Functional Statements and Performance Requirements in Part A.

For example, an Alternative Solution for the provisions of means of escape may be formulated as follows:

#### Step 1 Fire Safety Objectives

The fire safety provisions in a building should achieve the fire safety objectives and they should be provided for:

1. Protection of life of building occupants.
2. Minimization of fire spread between fire compartments.
3. Prevention of building collapse as a result of fire.
4. Facilitation of firefighting and rescue by fire services personnel.

## **Step 2 Functional Statement**

The Functional Statement clarifies the fire safety objectives. The Functional Statement for means of escape is provided in the Building (Planning) Regulation 41(1), stating *“Every building shall be provided with such means of escape in case of emergency as may be required by the intended use of the building.”*

## **Step 3 Performance Requirements**

The Performance Requirements provide the criteria by which a solution for fire safety can be formulated. The Performance Requirements consists of two parts:

- (a) The Performance Requirement itself; and
- (b) The guidance to the Performance Requirements which provides the factors to be considered for demonstrating compliance.

Performance Requirements B1 to B7 should be complied with.

## **Step 4 Relevant Performance Requirements**

Performance Requirements under various Functional Statements may need to be satisfied for an Alternative Solution. For example, an assessment of means of escape requires assessment of all Performance Requirements B1 to B7 but Performance Requirement C1 may also have to be evaluated as this relates to the protection of the means of escape from fire.

All relevant Performance Requirements should be assessed against the Deemed-to-Comply provisions for an Alternative Solution.

## **Step 5 Guidance**

The guidance lists a “checklist” that should be considered in conjunction with each of the Performance Requirement. For example, the assessment of means of escape for a high-rise domestic building (Use Classification 1), as part of an Alternative Solution, should be based on the assessment of Performance Requirements B1 to B7.

Taking Performance Requirement B1 as an example, which states that:

*“A building, fire compartment or storey should be provided with adequate means of escape for all occupants to evacuate safely without being overwhelmed by the effects of fire.”*

This indicates that the design must satisfy that the subject building has adequate number of required staircases and exits of adequate width, both of which have adequate protection allowing all occupants to evacuate in case of fire. The number and design of required staircases or exits and the protection required to achieve a safe evacuation can be further determined by an evaluation of the guidance in G2.3. For example, each Performance Requirement can be addressed in detail through the use of the guidance, which assists the design of appropriate fire safety provisions that satisfy the relevant Performance Requirement and hence, meet the Functional Statement and finally achieve compliance.

This process can be carried out for all relevant Performance Requirements, as part of an Alternative Solution and the process of evaluation should be supported through calculations and detailed assessment.

## Step 6 Demonstrate Compliance

Compliance with the Performance Requirements can be achieved by:

- (a) Complying with the Deemed-to-Comply provisions in this Code, or*
- (b) Formulating an Alternative Solution which complies with the Performance Requirements, or*
- (c) A combination of (a) and (b).*

Compliance has to be demonstrated by proving that all relevant Performance Requirements are satisfied. The Alternative Solution involves a process of setting the relevant acceptance criteria and then providing an assessment that demonstrates the acceptance criteria are met. The fire safety sub-systems in Section 5 provide the evaluation methodology for detailed assessment.

### Commentary

It is expected that most of the Alternative Solutions will be based on demonstrating a building is safe and complies with the Performance Requirements, the Functional Statements and the fire safety objectives through fire safety provisions.

The interpretation and application of Performance Requirements will vary for different buildings or Use Classifications.

Because of the uncertainties that can arise from the qualitative Performance Requirements and interpretations in the methods and data available to determine whether the acceptance criteria have been met, it is recommended that sensitivity assessment and design redundancies (with careful evaluation on relevant safety factor) are addressed as part of the fire engineering assessment to be evaluated by utilising the fire safety sub-systems (see Section 5).

### Clause G2.3 Evaluation Criteria on Guidance to Performance Requirements

The following criteria should be evaluated when considering the Guidance to Performance Requirements:

#### Guidance to Performance Requirements for Means of Escape

	<i>Guidance Statement</i>	<i>Evaluation of Factors</i>
<b>B-a</b>	<b>Use Classification of the building</b>	The Use Classification of a building will have impact on the number of exits required, due to the number of occupants in the building. The Use Classification also determines whether the occupants of the building are potentially asleep, awake, familiar with the building or require assistance to evacuate.
<b>B-b</b>	<b>Occupant capacity, nature, location and awareness</b>	The total number of required staircases or exits is dependent on the number of occupants and the travel distances expected. Care should be taken for high occupancy buildings and where occupants maybe unfamiliar with the building.
<b>B-c</b>	<b>Fire hazard, its potential growth and duration</b>	The fire hazard within the Use Classification may impact adversely on evacuating occupants and will need to be considered with regard to the speed of fire growth, intensity and smoke spread.
<b>B-d</b>	<b>Building height</b>	Occupant evacuation may be more difficult for taller buildings and hence extra provisions such as refuge floors are provided.
<b>B-e</b>	<b>Building area and fire compartment area</b>	Required staircases and exits are dependent on the overall building size and the fire compartments that separate the building. Openings between fire compartments, especially floor voids can increase the risk of fire and smoke spread impacting on evacuation.
<b>B-f</b>	<b>Security measures impairing escape</b>	Doors to a required staircase may be electronically secured and security devices which can be released in case of fire or other methods to ensure exit and access must be considered.
<b>B-g</b>	<b>Fire safety provisions installed within the building</b>	The fire safety provisions within the building may assist the timely evacuation of occupants by providing earlier detection or allowing faster movement to a safe environment.
<b>B-h</b>	<b>Type, number, size, location and layout of exit routes</b>	Exit routes must be adequately sized and readily located for all occupants to evacuate safely and used efficiently. Exit signs assist occupants finding their ways to the required staircases.
<b>B-i</b>	<b>Suitable resting areas to avoid fatigue</b>	For tall buildings, refuge floors are required to allow occupants descending to have a short rest at intermediate floors before they continue using the required staircases.

<b>B-j</b>	<b>Suitable construction to prevent slipping and falling</b>	Staircases should be constructed to reduce the risk of occupants slipping and falling through the provision of handrails, tread and riser dimensions and lighting.
<b>B-k</b>	<b>Temperature, visibility, toxicity of smoke</b>	The exposure of occupants may be received from a fire will need to be assessed if the proposed layout of the floor has exits and protection of exits that differ from the Deemed-to-Comply provisions.
<b>B-l</b>	<b>Protection from adjoining and adjacent buildings</b>	Required staircases within a building will need to be protected from a fire in an adjoining or adjacent building.
<b>B-m</b>	<b>Fire service intervention</b>	Appropriate access to the building and firefighting equipment to allow firefighters to suppress a fire is required.

#### Guidance to Performance Requirements for Fire Resisting Construction

	<b><i>Guidance Statement</i></b>	<b><i>Evaluation of Factors</i></b>
<b>C-a</b>	<b>Use Classification of the building</b>	The Use Classification of a building will have impact on the fire load, fire intensity, duration of burning and the hazard to the occupants. The Use Classification will also have impact on firefighting operations.
<b>C-b</b>	<b>Occupant capacity, nature, location and awareness</b>	The total number of occupants, their location within the building and their ability to evacuate, will need to be considered with regard to the FRR and compartmentation to be provided.
<b>C-c</b>	<b>Fire hazard, its potential growth and duration</b>	The fire hazard within the Use Classification will have impact on the FRR and compartmentation required. The impact on evacuating occupants will need to be considered with regard to the speed of fire growth, intensity and smoke spread.
<b>C-d</b>	<b>Building height</b>	Building height will be a factor for consideration for the determination of FRR, compartmentation and firefighting access.
<b>C-e</b>	<b>Building area and fire compartment area</b>	Overall building size and compartmentation need to be considered to reduce the impact of a potential fire. Fire compartmentation may also be utilised to separate more hazardous areas to facilitate evacuation of occupants. Openings between fire compartments, especially floor voids can increase the risk of fire and smoke spread.
<b>C-f</b>	<b>Building location in relation to property boundaries</b>	The potential for fire to spread between buildings must be considered and openings should be provided with appropriate fire barriers.
<b>C-g</b>	<b>Location of roof having regard to other buildings</b>	The potential for fire to spread to other buildings via a roof must be considered.

<b>C-h</b>	<b>Required duration of tenable conditions to be maintained in fire compartments other than that of fire origin</b>	Fire compartment and fire barrier may be required to prevent untenable conditions occurring before occupant evacuation in parts of a building remote from the area of fire origin. This will be of particular importance where floor voids are present.
<b>C-i</b>	<b>Active fire safety provisions installed within the building</b>	The active fire safety provisions within a building may assist in providing protection to evacuating occupants and assist firefighting operations.
<b>C-j</b>	<b>The timing of the works</b>	Where a building or fire compartment is undergoing alterations or additions, the works being undertaken may result in hazardous conditions and the extent that these works impact on occupants and firefighting operations should be considered.
<b>C-k</b>	<b>Fire service intervention</b>	FRR and compartmentation will assist firefighters in carrying out their firefighting operations.

#### Guidance to Performance Requirements for Means of Access

<b>Guidance Statement</b>		<b>Evaluation of Factors</b>
<b>D-a</b>	<b>Use Classification of the building</b>	The Use Classification of a building will have impact on the fire load, fire intensity, duration of burning and the hazard to the occupants and firefighters. The Use Classification will also impact on the numbers of persons and assistance that may be required from firefighters for complete evacuation.
<b>D-b</b>	<b>Occupant capacity, nature, location and awareness</b>	The total number of occupants, their location within the building and their ability to evacuate, will need to be considered with regard to the FRR and compartmentation to be provided to assist firefighting operation and safe evacuation.
<b>D-c</b>	<b>Fire hazard, its potential growth and duration</b>	The fire hazard within the Use Classification will have impact on the FRR and compartmentation required for firefighting access and operations. The impact of the fire hazards on evacuating occupants will need to be considered with regard to the firefighting access.
<b>D-d</b>	<b>Building height</b>	Building height will be a factor for consideration for the determination of FRR and compartmentation to assist firefighting access and their operations.
<b>D-e</b>	<b>Building area and fire compartment area</b>	Overall building size and compartmentation need to be considered with regard to firefighting access.
<b>D-f</b>	<b>Active fire safety provisions installed within the building</b>	The active fire safety provisions within a building may assist in providing protection to evacuating occupants and assist firefighting access and operations.

<b>D-g</b>	<b>Building location in relation to property boundaries</b>	EVA needs to be considered with regard to the location of the building and neighbouring buildings. The potential for fire to spread between buildings must be considered and openings should be provided with appropriate fire barriers.
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#### Guidance to Performance Requirements for Fire Safety Management

	<b><i>Guidance Statement</i></b>	<b><i>Evaluation of Factors</i></b>
<b>F-a</b>	<b>Use Classification of the building</b>	The Use Classification of a building will have impact on the fire safety maintenance required and the motivation to complete the maintenance correctly. The Use Classification also determines the need for fire safety management and training to assist safe evacuation of occupants.
<b>F-b</b>	<b>Active fire safety provisions installed within the building</b>	The active fire safety provisions within a building will determine the type of maintenance to be provided and the fire safety management strategy to be implemented.
<b>F-c</b>	<b>Fire hazard, its potential growth and duration</b>	The fire hazard within the Use Classification will have impact on the need for fire safety management plans to be in place and well practiced to assist evacuation of occupants. The fire hazards within a building may also have impact on the type and frequency of fire safety maintenance.

## Section 3 – Introduction to Fire Engineering

### Clause G3.1 Introduction

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The Building Authority recognizes that fire safety may be approached in a number of ways the best of which is not necessarily prescriptive, namely an alternative approach. This is particularly pertinent to buildings of special hazards which, because of their size, use, complexity or location, may necessitate special consideration and specific standards. The alternative approach may be a performance-based approach whereby the relevant Performance Requirement(s) need to be identified and demonstrated through a fire safety assessment.

Where an alternative approach is adopted to develop an Alternative Solution, the relationship between the Deemed-to-Comply provisions and the Performance Requirements must be considered. An FSAR should be submitted to illustrate the formulation of an Alternative Solution.

#### Commentary

The International Standards Organisation (ISO) defines fire safety engineering as:

*“The application of engineering principles, rules and expert judgement based on a scientific appreciation of the fire phenomena, of the effects of fire, and the reaction and behaviour of people, in order to:*

- *save life, protect property and preserve the environment and heritage;*
- *quantify the hazards and risk of fire and its effects;*
- *evaluate analytically the optimum protective and preventative measures necessary to limit, within prescribed levels, the consequences of fire.”*

### Clause G3.2 Relevant Considerations

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The approach to develop and complete the FSAR will vary for each building, due to variation in the number and type of non-compliances with the Deemed-to-Comply provisions in this Code. The aspects that require a detailed assessment are:

- (a) Number and inter-relationship (if any) of the non-compliances with the Deemed-to-Comply provisions in this Code.
- (b) Alternative Solutions to be addressed.
- (c) Relevant Performance Requirements.
- (d) Building site and access.
- (e) Building form and construction.
- (f) Use Classification and interaction of occupants.
- (g) Occupant capacity and means of escape.
- (h) Fire hazards and ignition sources.
- (i) Credible fire scenarios and sensitivity assessment.
- (j) Fire safety provisions to be provided.
- (k) Management measures.
- (l) Fire service intervention.

### **Clause G3.3 Application**

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A performance-based approach using fire engineering can be adopted to formulate an Alternative Solution when there is genuine difficulty in complying with the Deemed-to-Comply provisions in this Code, especially for buildings of special hazards (due to their size, use, complexity or location).

Fire engineering aims to attain an overall level of safety that is equivalent to that which would result if fire safety was achieved through full compliance with the Deemed-to-Comply provisions in this Code and it can offer higher flexibility in design of buildings.

#### **Commentary**

Fire engineering allows detailed assessment of the fire safety provisions (taking into account the active, passive and management provisions) which will be most appropriate for the occupants, building and site characteristics and fire service intervention. The performance-based approach must take into account the potential for future changes or variations that may occur, with any significant variation in building form, fire load or occupancy characteristics that should be addressed by a new assessment as required by the Bounding Conditions (see Section 8).

However, despite advances in the science, fire safety is not a well-defined problem as certain areas of knowledge are still not yet well-developed and some variables depend on the assumed future state of a building. In fact, fire engineering is not as mature as other traditional engineering disciplines, with the absence of any simple approach that can be readily accepted and understood by the practitioners and related parties. Thus, there are constraints in the application of fire engineering.

### **Clause G3.4 Safety Margins and Safety Factors**

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There are various safety margins or safety factors that can be utilised for fire engineering. A safety margin can be used for a time-based assessment whereas a safety factor can be used for other comparative assessments or test verification methods. As an example, life safety fire engineering assessments are typically performed utilising a deterministic time based analysis and therefore the use of safety margins is more appropriate than safety factors.

Safety margins are adjustments made to compensate for uncertainty in the methods, calculations, assumptions and engineering judgement employed in the development of engineering designs. Safety margins do not necessarily need to be a number, for instance, in calculating the physical evacuation time for a group of people that has a mix of ambulant occupants and mobility impaired occupants, an inherent safety margin will have been included if the calculation assumes the majority of occupants are mobility impaired with a slower travel speed.

On the other hand, safety factors are adjustments made to numerical quantities of some uncertain parameters in order to provide an appropriate degree of reliability.

## **Safety Factors and Safety Margins for Use in Design**

Safety factors or safety margins for fire engineering will vary, depending on the type of assessment and analysis being undertaken. Safety factors for normal scenarios as part of a fire engineering design will typically range from 1.5 to 2.0. Where the degree of reliability has been verified with the carrying out of an analysis with single system failure, the safety factor used can be suitably reduced or even be omitted.

Safety margins will be dependent on the worst credible fire or potentially a “worst credible fire” with single system failures to ensure the overall design is robust.

### **Commentary**

Safety factors are commonly used, but need to be applied carefully, due to the number of inputs that a design is dependent on. Providing an overall safety factor of 1.5 may not be practical as the inputs will differ markedly in the make-up of the analysis – i.e. calculation of means of escape time is based on detection time, which can be calculated fairly accurately relative to other inputs. Pre-movement time will have a wide range of values compared to other inputs. Travelling time and queuing time can be calculated reasonably accurate.

Safety margins or safety factors should be determined according to the nature of the problems and the degree of knowledge available to solve such problems. They should be developed as part of the acceptance criteria for the fire engineering, to be confirmed on a case-by-case basis. The authorized person who is responsible for the fire engineering approach must be able to justify and explain the safety margins or safety factors utilised for their specific case.

## **Engineering Judgement**

A performance-based approach to design may require more engineering judgement than other form of analysis, as part of the design and approval process. The level of judgement for fire engineering is higher than many other engineering disciplines because a fire engineering approach requires a fire safety strategy to be developed from first principles, which is the basis of performance-based design that requires consensus between the designers and the Building Authority on all assumptions, inputs, limitations and acceptance criteria, on a case-by-case basis.

Fire engineering is a newer field of engineering and greater judgement is needed. The assumptions of a fire engineering design should be more conservative and should normally have higher safety factors.

### **Commentary**

To provide a structured approach to fire engineering analysis, the use of the fire safety sub-systems is recommended to be utilised for all Alternative Solutions (see Section 5).

## **Section 4 –Methodologies of Fire Engineering**

### **Clause G4.1 Introduction**

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Fire engineering offers a flexible alternative where compliance with the Deemed-to-Comply provisions in this Code is impractical. It provides an Alternative Solution achieving:

- (a) a level of safety that is equivalent to that which would result if fire safety was achieved through full compliance with the Deemed-to-Comply provisions in this Code; or
- (b) an acceptable level of safety such that the agreed acceptance criteria and the Performance Requirements are satisfied.

### **Clause G4.2 Complying with the Performance Requirements**

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Fire engineering provides a framework to demonstrate that the Performance Requirements are satisfied even though some of the design solutions adopted fall outside the Deemed-to-Comply provisions in this Code where additional fire safety provisions are proposed to compensate for the deviation or shortfall.

If the design being considered is not substantially different from the Deemed-to-Comply provisions or can be readily accommodated by adopting conservative assumptions, it may simply be a case of demonstrating like-for-like substitution or “equivalence” with Deemed-to-Comply provisions and fire safety objectives without having to embark on a full fire safety strategy. However, a practical test is required to demonstrate the equivalence.

### **Clause G4.3 Assessment Methodologies**

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There are two types of assessment methods:

- (a) Qualitative analysis – use of engineering judgement with documented reasoning and arguments, to compare an Alternative Solution against the Deemed-to-Comply provisions, without calculations.
- (b) Quantitative analysis – utilising numerical methods to assess an Alternative Solution, which may involve data and probabilistic methods. There are two means to carry out quantitative analysis, i.e. deterministic and probabilistic.

#### **Deterministic Methods**

This method is based on making predictions of the likely outcomes in the event of a fire and selecting appropriate fire safety provisions to achieve the required objectives. Application of this method is typically through showing a level of fire safety equivalent to the Deemed-to-Comply provisions, but it may also take an absolute approach to satisfy the Performance Requirements.

A hazard analysis has to be carried out, followed by an engineering approach based on the accepted fire loads and demonstrating the ability to resist such loads, based on physical relationships derived from scientific theories and empirical results of fire dynamics. The credible fire scenarios, timeline analysis, fire/smoke models and evacuation models have to be established.

#### **Commentary**

The approach is often assisted by fire models and computational methods and can offer a more certain indication of achieved safety. Provided the hazards are identified, it is possible to devise strategies for the management or design solutions which will ensure reasonable safety of the occupants, and the protection of essential emergency plant and equipment.

### **Probabilistic Methods**

Risk in the context of fire engineering consists of two components, i.e. the likelihood of occurrence and the consequence. Probabilistic method is essentially an assessment of risk for evaluating the fire safety performance to justify an Alternative Solution. It is based on assigning reliabilities to the performance of various fire safety provisions and assigning frequencies of occurrence of events. The risk of a fire starting and developing with the likely effects of the fire at the worst location and time of ignition should be analysed.

The fire loads, the number and location of occupants and the fire safety provisions should also be assessed to verify whether the acceptance criteria are met. The first two steps are to determine the geometry, construction and Use Classification and to identify the relevant Performance Requirements. The third step is to identify deviations from the Deemed-to-Comply provisions and to propose an Alternative Solution to address the deficiency. The risk levels associated with the proposed fire safety provisions can then be established.

The method is a scenario analysis, considering all possible scenarios. Some parts of the analysis can be quantified with numbers (quantitative analysis), but much of the analysis requires engineering judgement on the development and consequences of a fire and the likely location and movement of people (qualitative analysis).

#### **Commentary**

Probabilistic methods require data for events such as fire starts, causes and implications. Due to the lack of such data in Hong Kong, such methods should be used with caution. An absolute risk level evaluation should be carried out only if quality data are available and an acceptable level of risk is clearly defined. Otherwise, a comparative risk evaluation should be carried out to ascertain relative levels of fire safety for the building, where the Deemed-to-Comply provisions are used as a base case.

Probabilistic methods for assessment can only be of limited use due to the lack of internationally recognised and mature assessment methods. At present, there are no tools available for calculating risk in absolute terms, which have been successfully validated and are reliable in their operation.

## Evaluation Acceptance - Equivalence or Absolute

One of the most accepted approaches of demonstrating that an Alternative Solution complies with the Performance Requirements is a process of demonstrating “equivalence” (or carrying out a comparative assessment). The term “equivalent” is used to show an Alternative Solution adopted achieving a level of fire safety comparable with the level of safety achieved by the Deemed-to-Comply provisions.

Demonstrating equivalence to the Deemed-to-Comply provisions is where equal performance between the designed system and what is expected under full compliance with the Deemed-to-Comply provisions is achieved i.e. the outcome under a given fire scenario should be similar for either the complying system or the proposed Alternative Solution.

The fire safety performance of an element or fire safety sub-system should be compared to the level of fire safety that would be achieved in an identical building in which that element, or fire safety sub-system is designed in compliance with the Deemed-to-Comply provisions.

There are two evaluation methods to establish the level of fire safety for a particular Alternative Solution.

The use of “equivalent level of fire safety” is one evaluation method for assessing the fire safety level achieved by an Alternative Solution. It is often the base-line performance for fire engineering.

The other method is an absolute evaluation. An absolute evaluation is carried out where the results of the analysis are matched against the Performance Requirements without comparison to the Deemed-to-Comply provisions, hence requiring agreed acceptance criteria. This requires more substantiation through calculations and also requires prior agreement of the analysis inputs and acceptance criteria by the Building Authority.

## Clause G4.4 References

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The following are useful references:

- *International Fire Engineering Guidelines*, Australian Building Codes Board, Canberra, Australia, Edition 2005, 2005.
- Drysdale, D., *An Introduction to Fire Dynamics*, 3rd Edition, John Wiley and Sons, Chichester, UK, 2011.
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- Pauls, J.L., and Jones, B.K., “Building Evacuation: Research Methods and Cases Studies”, *Fires and Human Behavior*, John Wiley and Sons, New York, 1980.
- BS 7974, *The Application of Fire Safety Engineering Principles to the Design of Buildings*, British Standards Institute, London, 2001.

## Section 5 – Fire Safety Sub-systems

### Clause G5.1 Introduction

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The framework of fire safety “sub-systems” should be used to assess, evaluate and document all the fundamental aspects of an Alternative Solution for a building.

The sub-systems form a set of parameters that must be considered for all Alternative Solutions. The interaction of the sub-systems and their direct correlations with the Performance Requirements should be identified for setting the design principles and the basis of the assessment fundamentals. All sub-systems must be considered even though some of them fully comply with the Deemed-to-Comply provisions. The sub-systems are described below:

**Sub-system 1:** Fire Initiation and Development - fire science principles and fundamentals.

**Sub-system 2:** Smoke Development, Spread and Control - assessment of smoke development is required to assess life safety, considering smoke movement, visibility and smoke layer temperature.

**Sub-system 3:** Fire Detection, Warning and Automatic Suppression - active fire safety provisions relevant to the fire hazard, to relevant standards, with regular inspection, testing and maintenance carried out to ensure the systems are operable at all times.

**Sub-system 4:** Fire Spread, Impact and Control - fire spread can be limited by the fire safety provisions installed. Assessing fire development, pre-flashover and post flashover fires is required for assessment of life safety and the impact of fire on property.

**Sub-system 5:** Occupant Characteristics and Evacuation - prediction of occupants' behaviour and egress must be based on analysis of occupant characteristics and the fire safety provisions provided.

**Sub-system 6:** Fire Service Intervention - interaction of firefighters must be considered.

#### Commentary

The fire safety sub-systems provide a framework for carrying out a fire engineering design. All sub-systems should be examined in a holistic manner. Some of the sub-system aspects may fully comply with the Deemed-to-Comply provisions and hence may need little justification, whereas other sub-systems may have significant non-compliances and require substantial assessment but all must be considered.

## **Clause G5.2 Sub-systems – Description of Principles**

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### **Sub-system 1 - Fire Initiation and Development**

Fire initiation and development is a fundamental of any performance-based assessment for fire safety. Information and inputs to the assessment of this sub-system that may be required as part of an Alternative Solution include:

- (a) fire compartment characteristics;
- (b) fire load density;
- (c) expected fuel configuration;
- (d) ignition sources;
- (e) expected design fires;
- (f) rate of heat release;
- (g) fire compartment ventilation and limitations;
- (h) development of smoke;
- (i) calculation of temperature in smoke layer; and
- (j) time to reach flashover or if flashover is reached.

Assessment should be based on considering the likelihood of fire occurrence and not just assuming a fire occurs. In general, due to the lack of data and tools, a probabilistic assessment on absolute terms (e.g. probability of fire deaths per year) cannot be undertaken.

The approach must be based on realistic assessment of the likely fire growth rate, likely fire size and rate of fire spread through a fire compartment, based on the ventilation available.

#### **Commentary**

To understand the likelihood of a fire developing and growing, statistical information is required on the location of a fire, how it develops and the effectiveness of active fire suppression systems etc.

### **Sub-system 2 - Smoke Development**

The interaction of occupants with smoke is a fundamental for assessment of life safety. The assessment should be based on smoke layer height and visibility, with consideration of toxicity, where appropriate. The acceptance criteria for life safety with regard to smoke are to be based on:

- (a) smoke movement and layer height;
- (b) smoke visibility; and
- (c) smoke layer temperature.

Information and inputs to the assessment of this sub-system that may be required as part of an Alternative Solution include:

- (a) occupant characteristics;
- (b) fire compartment characteristics;
- (c) fire load density;
- (d) expected fuel configuration;
- (e) expected design fires;
- (f) rate of heat release;
- (g) fire compartment ventilation and limitations;
- (h) effects of elevated temperatures on elements of building construction;
- (i) calculation of temperature in smoke layer;
- (j) smoke layer height and interface height;
- (k) smoke visibility / optical density;
- (l) effect of fire suppression systems on properties of the fire and smoke;
- (m) smoke control equipment present, active and passive;
- (n) relevant standards to be complied with; and
- (o) maintenance and testing.

If a probabilistic method is undertaken, the data on the effectiveness of smoke control measures (both active and passive), elements of construction and fire suppression systems are required.

### **Sub-system 3 - Fire Detection, Warning and Automatic Suppression**

To mitigate the hazards represented within the other sub-systems, active fire safety provisions are required. These provisions provide warning to the occupants and may also provide automatic suppression in case of fire.

Performance-based design is not expected to occur on a sub-system level, unless in special circumstances, e.g. specialised smoke management or fire suppression systems within tall atria.

Information and inputs to the assessment of this sub-system that may be required as part of an Alternative Solution include:

- (a) fire compartment characteristics;
- (b) expected design fires;
- (c) rate of heat release;
- (d) calculation of temperature in smoke layer;
- (e) smoke layer height and interface height;
- (f) smoke visibility / optical density;
- (g) types of smoke or heat detection equipment;
- (h) types of automatic suppression systems;
- (i) activation of smoke control measures through fire alarm panel;

- (j) activation of other fire safety provisions through fire alarm panel;
- (k) activation of warning systems to occupants;
- (l) activation of alarm system to the Fire Services Department;
- (m) smoke control equipment present, active and passive;
- (n) relevant standards to be complied with; and
- (o) maintenance and testing.

#### **Commentary**

An assessment of this sub-system requires a thorough understanding of the potential failure modes and likelihood of failures of the sub-system. The likelihood of failure or activation of a system is also reliant on the type of maintenance and testing carried out. This data are not available in Hong Kong at present.

#### **Sub-system 4 - Fire Spread, Impact and Control**

Fire spread can be limited by either active or passive fire safety provisions or a combination of both. Generally the fire barriers of a fire compartment will limit fire and smoke spread, as will the type of fuels present and internal linings. The other key system for fire control is the use of fire suppression systems, especially automatic sprinkler systems. Hose reels and extinguishers can also be used.

The Fire Services Department provides the last means of defence against fire spread within a fire compartment and between fire compartments or buildings. Assessing the impact of fire service intervention is also required.

Information and inputs to the assessment of this sub-system that may be required as part of an Alternative Solution include:

- (a) fire compartment characteristics;
- (b) fire load density;
- (c) expected fuel configuration;
- (d) expected design fires;
- (e) rate of heat release;
- (f) influence of lining materials;
- (g) ventilation and limitations;
- (h) calculation of temperature in smoke layer;
- (i) smoke control equipment present, active and passive;
- (j) automatic alarm systems;
- (k) automatic suppression systems;
- (l) time to flashover or if flashover is reached;
- (m) sealing of all penetrations;
- (n) use of the time-equivalence concept;
- (o) knowledge of inherent fire resistance performance;

- (p) effects of elevated temperature on elements of construction;
- (q) structural stability of load bearing building elements;
- (r) relevant standards to be complied with;
- (s) fire service intervention; and
- (t) maintenance and testing.

#### **Commentary**

An assessment of this sub-system requires an understanding of the expected failure processes for fire seals, fire barriers, automatic systems and fire service intervention. Also the likelihood that occupants will extinguish a fire by using devices such as hand-held extinguishers or hose reels should be considered.

### **Sub-System 5 - Occupant Characteristics and Evacuation**

Occupant escape from fire is made up of the following components:

- (a) detection of fire and occurrence of the warning cue;
- (b) recognition of the cue and pre-movement activities of occupants; and
- (c) movement to a safe place.

Fire initiation is based on the fuel characteristics and ventilation, which is determined within sub-system 1. The time for detection of the fire and an alarm to be activated is developed within sub-system 3.

Recognition of an alarm or cue is dependent on the occupant characteristics within the fire compartment and also within the building as a whole. The ability to recognise an alarm and then act on it is dependent on the type of warning system provided, which is required to be tailored to the expected occupant characteristics.

Occupant movement is dependent on the mobility of the occupant, the number of occupants, number of exits, travel distance to exits and ability to make decisions as to which exit to choose.

Information and inputs to the assessment of this sub-system that may be required as part of an Alternative Solution include:

- (a) fire compartment characteristics;
- (b) occupant characteristics, including physical and mental capabilities;
- (c) occupant numbers and distribution;
- (d) prior fire safety training for occupants;
- (e) presence of a warden system and its effectiveness;
- (f) established fire emergency organisational structure and procedures;
- (g) frequency of false alarms;
- (h) building layout and exit route characteristics;
- (i) type of detection;
- (j) occupant warning systems and mode of alarm;
- (k) life safety protection systems;

- (l) fire service access, search and rescue abilities; and
- (m) maintenance and testing.

All components are times and together they equate to the total evacuation time. The total evacuation time is the Required Safe Egress Time, i.e. RSET.

#### **Commentary**

Pre-movement time is a very difficult value to estimate, given the reliance on the human characteristics, especially if the occupancy involves sleeping groups or persons who have paid to enter an area. Pre-movement times have been researched for many years and ranges of values have been established within the fire engineering field. This information is a very important input into the design process and the assumed values, the range of values and how they are applied are required to be justified.

Pre-movement time is therefore usually not a discrete value but a range of values, given that people react differently due to their own perceived risk and also their location to the fire event. Some occupants are of relatively long pre-movement times because they are remote from a fire event and hence are not directly at risk. Typically a range is considered appropriate, due to the uncertainty and expected range of pre-movement times that will be possible for any design or actual fire.

Data on how people may react in a fire in Hong Kong is also relevant, categorised for example by age group, sex, physical and mental capability, level of education, any prior fire training received, responsibility held at the time of fire, ability to recognise and respond to alarms etc. An assessment will be highly dependent on the human factors.

#### **Sub-system 6 - Fire Service Intervention**

Often the impact of the Fire Services Department is ignored with an assumption that firefighters would arrive after all occupants have evacuated. This is a very conservative approach as the Fire Services Department is often on the fire ground when occupants are still leaving the building.

One method of predicting fire service intervention is to utilise a design methodology that is provided by the Fire Services Department. This is often entitled as an “intervention model”. This is a formalised method for quantifying the operations of the Fire Services Department. It is typically an event-based methodology that considers the time taken for the various firefighting functions to be performed.

Information and inputs to the assessment of this sub-system that may be required as part of an Alternative Solution include:

- (a) building and fire compartment characteristics;
- (b) occupant characteristics and numbers;
- (c) exit path characteristics;
- (d) fire safety provisions;
- (e) dispatch and routes details;
- (f) EVA;
- (g) ability for investigation;
- (h) area and time for set-up;
- (i) means of access available;
- (j) availability of water supplies;
- (k) prevention of spread of fire to other buildings; and
- (l) fire control and extinguishment.

## **Commentary**

### Intervention Model of Fire Services Department

This section provides the Fire Services Department's intervention model with guidance on methodologies that may be adopted for quantifying the following:

- (a) the arrival of the fire service at the fire scene;
- (b) investigation by the fire service;
- (c) fire service set-up;
- (d) search and rescue;
- (e) fire service attack;
- (f) fire control; and
- (g) fire extinguishment.

The components of fire service intervention that will need quantification may be grouped under two main headings:

- (a) pre-fire control and extinguishment activities; and
- (b) fire control and extinguishment.

The first group of activities relates mostly to the series of events that take place from the time the fire service is notified to the time it is ready to attack the fire. The effect of fire service activities does not lend itself easily to quantification and many aspects of the procedure will need to be based on qualitative judgement rather than numerical calculations.

Computer models may provide guidance on how to quantify fire control and extinguishment events and times. Other methods based on thermodynamics and heat transfer theory may also be utilized for this purpose. However, it will be necessary to utilize the expertise of the local fire service to validate many of the decision-based input parameters used.

The computer model should assume the following prioritized outcomes:

- (a) the safety of building occupants who must be able to leave the building (or remain in refuge floor) without being subject to untenable conditions;
- (b) the protection of firefighters who must have reasonable time to search for any trapped occupants, before conditions become hazardous to their safety occur; and
- (c) the protection of adjacent fire compartments and buildings from fire spread due to radiation, flame impingement, flying brands or structural collapse.

The computer model should be used (in whole or in part) to generate the following information:

- (a) the time taken for firefighters to reach a particular location in a building;
- (b) the water flow rate required for fire extinguishment or control that is necessary to compensate for deletion of a sprinkler system;
- (c) the required water flow rate and building separation necessary to prevent fire spread to adjoining property;
- (d) the time firefighters will be inside a building for search and rescue activities during which firefighter tenability and structural stability should be maintained; and
- (e) the robustness of the Alternative Solution.

## **Section 6 - Design by Fire Engineering**

### **Clause G6.1 Application of Fire Engineering at Different Stages**

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The application of fire engineering at different stages of a project (fire engineering process) is described below for new buildings. For existing buildings, the role and involvement will differ, depending on the alterations, additions or changes in Use Classification that are proposed:

#### **(a) Building Planning / Feasibility**

- (i) The role of fire engineering is to identify areas of non-compliance with the Deemed-to-Comply provisions and provide generalised design advice regarding occupant type, numbers, FRR, fire safety provisions, site access, neighbouring buildings etc. in broad terms.

#### **(b) Schematic Design**

- (i) As the design detail advances, the major fire safety provisions can be confirmed.

#### **(c) Detailed Design**

- (i) As the design proceeds to a detailed design stage, all fire safety provisions and Alternative Solutions should be addressed in detail. The FSAR should be completed for submission and acceptance.

#### **(d) Construction**

- (i) During construction stage, fire safety provisions may change or require re-assessment. A revised FSAR should be submitted as appropriate.

#### **(e) Commissioning**

- (i) Towards the end of the construction, all fire safety provisions will require inspection and commissioning. The authorized person should be involved and confirm that all fire safety provisions are installed as per the approved plans, FSAR and related documents (reports, drawings and specifications).

#### **(f) Management in Use**

- (i) The authorized person should assist in documenting all Bounding Conditions that will form part of a fire safety management plan. He should also assist to develop maintenance and management procedures for the building owners.

### **Clause G6.2 Fire Engineering Process**

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#### **Feasibility and Schematic Design**

During the early stages of a project, whether it be a new building or addition and alteration works to an existing building, fire engineering may be used in two different ways, namely in the design and assessment of fire safety sub-systems or in the evaluation of a specific fire safety provision.

In the early stages of a project, where the building design is evolving, the fire engineering process may contribute to the development of the design and the evaluation of the various design options. In the later stages, when the design has become essentially fixed, a fire engineering evaluation should be carried out to demonstrate that the Alternative Solution

complies with the relevant fire safety objectives and Performance Requirements in this Code, utilising the approach and methodology of the fire safety sub-systems.

From this latter process, an FSAR is generated which forms the basis of the documentary evidence required in support of an Alternative Solution.

### **Clause G6.3 Pre-submission Enquiry**

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If fire engineering is adopted, the authorized person should consider the implications of fire safety on the building design and consult the Building Authority at the early stage so that the fire safety objectives can be agreed at the outset. In this connection, the Building Authority may be approached prior to submission of general building plans for agreement in principle to any fire engineering design being considered.

The authorized person should take on a pivotal role in the consultative procedures when the fire strategy and fire engineering design is being developed.

The authorized person should then submit the FSAR together with the general building plans to the Building Authority for approval.

### **Clause G6.4 Assessment Approaches**

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The principles of design of Alternative Solutions should be based on assessing the fire safety sub-systems and their interaction with each other.

The basis of many life safety assessments for a fire engineering approach is the utilisation of the “time-line” method where the “required time” for egress is compared with the “available time” for egress. This approach is the “RSET versus ASET” approach, where RSET is the Required Safe Egress Time and ASET is the Available Safe Egress Time. This involves the interaction of the sub-systems 1 to 5. This can lead to the assessment and justification. For example, travel distances that exceed the Deemed-to-Comply provisions in this Code.

An Alternative Solution should follow one of the following three assessment methods for fire engineering:

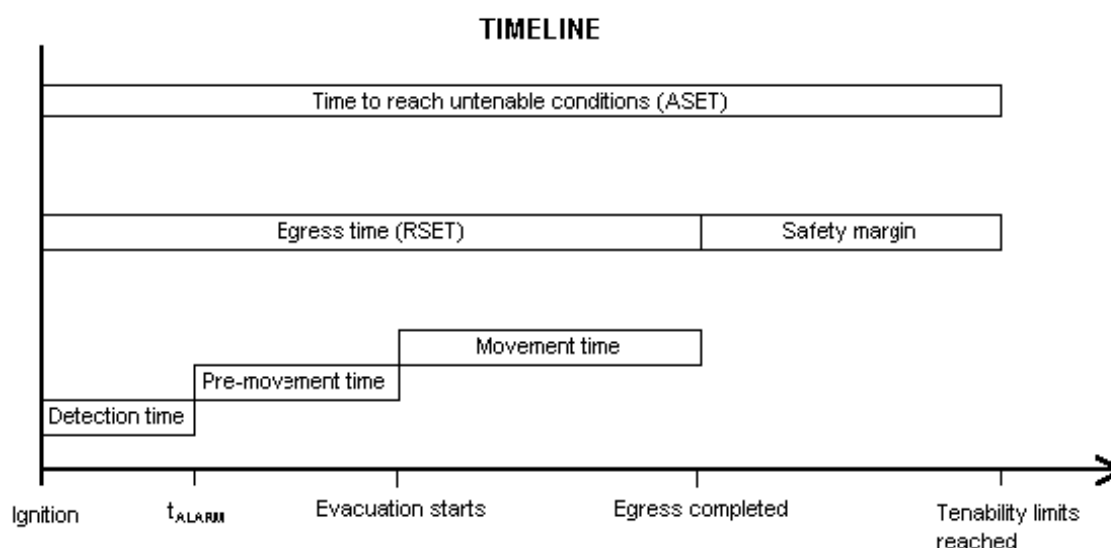
- (a) Assessment Type 1: Qualitative analysis or quantitative with calculations, generally based on a simple assessment involving a single sub-system. This may be an equivalence assessment.
- (b) Assessment Type 2: This assessment involves a quantitative analysis of more than one sub-system, but does not involve detailed analysis of all sub-systems. The assessment can be a deterministic, absolute or comparative analysis, based on the assessment of multiple fire scenarios. An equivalence assessment may form part of this process.
- (c) Assessment Type 3: This assessment involves all six sub-systems and the evaluation should be based on probabilistic methods. As there is currently no method or means to establish an absolute acceptance criterion, only comparative analysis will be accepted. This assessment can only be used for special or complex buildings.

Assessment Type 2 is the most common type of analysis. A time line assessment is illustrated in Diagram G1, showing the basis of Assessment Type 2, which consist of the following aspects:

- (i) evacuation assessment, made up of detection time, pre-movement time, physical travel time, and time to exit from a fire compartment;
- (ii) fire development calculations showing rate of heat release for a fire within the fire compartment for a range of scenarios;
- (iii) smoke development calculations for the fire compartment; and
- (iv) safety factor or safety margin as part of the comparison of the two timelines.

Time line assessments provide a very clear and transparent process for assessing a fire safety design. The time line assessment has three parts – tenability calculations, means of escape calculations and a safety margin (or factor).

**Diagram G1: Graphical Representation of a Timeline Assessment**



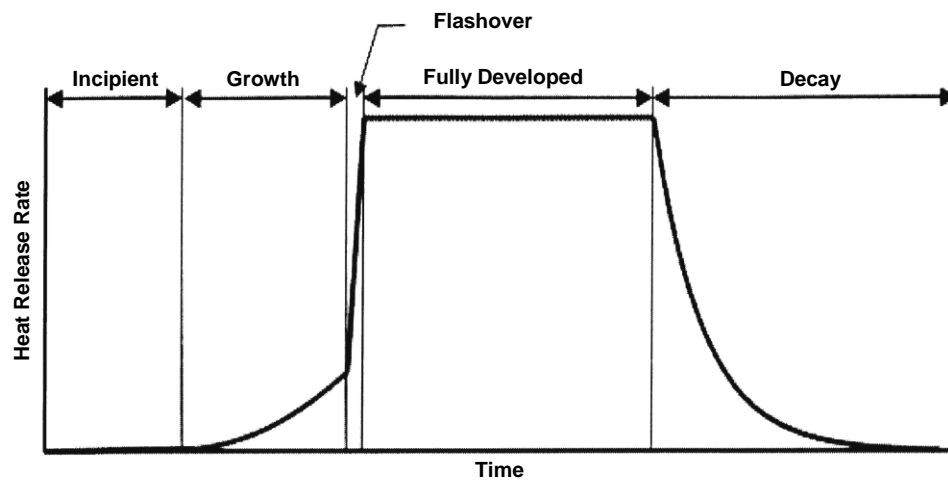
## Clause G6.5 Design Fires

A design fire is an engineering description of the development of a fire for use in a design fire scenario. Design fire curves are described in terms of heat release rate (HRR) versus time. The formulation of a design fire is crucial to any fire safety design as the design fire acts as the “test load” to the proposed fire safety strategy.

A fire is either fuel controlled or ventilation controlled. Fuel controlled fires are typically represented by short period fires, with steep HRR curves. If the ventilation is limited within the fire compartment, then the HRR will be limited, due to the limited oxygen available for combustion. Ventilation controlled fires are typically represented by longer duration fires with HRR curves that have a less steep curve.

In developing a design fire, the effects of the fire growth characteristics, the mass of fuel, the layout of the fuel and the effects of the fire compartment on the combustion processes should be taken into account as appropriate to justify the design fire.

A typical schematic HRR curve for a fire compartment is shown in Diagram G2 below. This curve illustrates the main aspects of HRR within a fire compartment. Each phase is further described.



**Diagram G2: Typical Phases of a Fire Curve**

### Incipient Phase

The incipient phase of a fire can last a few milliseconds to days depending on the initial fuels involved, ambient conditions, ignition source, etc. In most cases, the incipient phase is ignored and the growth phase is started from time zero.

### Growth Phase

The growth phase is considered to begin when the radiation feedback from the flame governs the mass loss rate. Assuming the fire compartment is vented, the burning rate is primarily influenced by the fuel properties and orientation. During the growth phase the fire spreads across the fuel surfaces, increasing the burning area and corresponding HRR. The mass loss rate is assumed to be independent of the fire enclosure and governed more by the flame-spread rate.

The growth phase is the most important aspect of the design fire. This is typically modelled with a  $t^2$  rate of growth.

### Commentary

The ability to predict flame spread through empirical models has encouraging results but is limited to comparatively simple geometries such as room corners. Research on the growth rate for complex objects like upholstered furniture and complex storage arrays is ongoing. Therefore, fire safety consultants are forced to using experimental data or correlations to estimate the fire growth rate.

### Flashover

Although there is no universally accepted definition for flashover, it can be described as a transition from a developing fire to full room involvement. This transition typically occurs over a short time span measured in seconds. The increase in radiation from the upper layer not only ignites all of the combustibles in the room but also enhances the mass loss rate of all the burning objects.

Typical definitions of flashover including:

- (a) Gas temperatures at near ceiling level in the order of 600°C;
- (b) Radiation heat flux at floor level exceeding 20 kW/m<sup>2</sup>; and
- (c) Flames emerging from enclosure openings.

These definitions are practical criteria for physical observation only. From a modelling point of view, flashover is modelled as a linear transition from a growing fire to a fully developed fire over a very short period of time.

#### **Fully Developed / Post-Flashover**

In the fully developed or post-flashover phase of the fire, all of the combustible objects in the fire compartment are burning including the floor (if combustible). The mass loss rate is controlled either by fuel surface area or the available air supply. In most cases, the fire is controlled by the available oxygen, i.e. ventilation controlled.

#### **Commentary**

Some fire models calculate the ventilation rate into and out of a fire compartment and have the capability to adjust the HRR within the fire compartment accordingly. Any excess fuel that cannot burn within the fire compartment due to a lack of oxygen is available to burn in other locations where there is sufficient oxygen (i.e. outside the openings).

#### **Decay Phase**

Once a fire has consumed most of the available fuel the HRR will diminish.

#### **Determining Appropriate Design Fires**

A fire engineering assessment should be based on the establishment of appropriate design fires, which should be based on:

- (a) Use Classification of the fire compartment;
- (b) fire load energy density information;
- (c) typical configuration of fuels;
- (d) ventilation conditions; and
- (e) fire suppression systems or passive fire safety provisions.

A range of design fires should be established for an assessment or a conservative design fire may be chosen.

Initiation of a fire, or the ignitability of an object is normally not analysed but assumed to occur and the growth of fire is modeled. The initial growth of the fire, once started, can be particularly important for aspect of fire spread and tenability. Estimating fire spread between objects is often calculated to assess how quickly a fire within a fire compartment may spread.

### Commentary

Different design fire scenarios should be developed with an aim to approximate credible fire scenarios (including small arson with small fire size, as appropriate) to test the robustness of the Alternative Solution.

The number, type and location of design fires are dependent on the building type and the Alternative Solutions being assessed. A risk-based approach to developing design fires can also be utilised, where the design fires to be chosen are not clear or there are a multiple number of design fires to be assessed.

Quantification of design fires will be dependent on the Use Classification, the ventilation, the agreed types of fuel present and will therefore vary between projects and be applied on a case-by-case basis for each project.

A significant amount of detailed information relating to design fires is available through peer-reviewed journals and key references. The process of choosing and quantifying the appropriate design fires is to be based on the realistic expectations for ignition hazards, fire growth, combustibles reasonably expected and fire duration, based on the ventilation conditions.

By considering possible scenarios as part of the FSAR, the expectations of analysis for the fire engineering assessment can be readily determined. The fire safety sub-systems approach to analysis assists in developing the appropriate sensitivity of input parameters and redundancy of fire safety provisions installed.

A common method of describing growing fires is the “T-squared” (or  $t^2$ ) concept. T-squared fires are generic fire growth rates based on fuel characteristics and are the most common and practical curves for estimating the growth of a fire. These curves are defined in NFPA 92B <sup>1</sup> and Enclosure Fire Dynamics <sup>2</sup>. The “T-squared” curves as they are often referred to are design tools to represent fire growth rate of general combustible items. There are four curves used, slow, medium, fast and ultra-fast.

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<sup>1</sup> NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas*, National Fire Protection Association, Quincy, MA, 2009.

<sup>2</sup> Karlsson, B., and Quintiere, J. G., *Enclosure Fire Dynamics*, CRC Press, Boca Raton, FL, 2000.

## Examples on Design Fires

Typical examples on design fires are provided in Table G1 for reference. These examples are deduced based on the parameters given in the Table. The suitability on adopting the design fire provided in Table G1 should be considered diligently and be verified on case-by-case basis.

**Table G1 – Examples on Design Fire Sizes**

Use Classification		Examples on Design Fire Size
1. Residential		<p>For considering a pre-flashover fire, the growth rate of design fire for residential is medium. See Note (1).</p> <p>For considering a post-flashover fire, the most commonly used design fire depends on Ventilation Controlled Fire. Note (2) illustrates an example on the calculation methodology.</p>
2. Hotel and similar Transient Accommodation		Sprinkler controlled fire for a hotel room with a headroom of 3.0m and standard response type of sprinkler is expected to be about 1.7MW.
3. Institutional	3a. Health/child care facilities	Sprinkler controlled fire for a hospital with a headroom of 3.0m and standard response type of sprinkler is expected to be about 1.7MW.
	3b. Detention and correctional centres	Sprinkler controlled fire with a headroom of 2.5m and standard response type of sprinkler is expected to be about 1.5MW.
4. Commercial	4a. Business facilities	Sprinkler controlled fire for an office with a headroom of 2.5m and standard response type of sprinkler is expected to be about 1.5MW.
	4b. Mercantile facilities	<p>Sprinkler controlled fire with a headroom of 2.5m and standard response type of sprinkler is expected to be about 1.5MW.</p> <p>If no sprinkler is provided, the fire size is expected to be based on fuel load density obtained by measured survey loads, <math>q</math>, which is given in <math>\text{MJ} \cdot \text{m}^{-2}</math>. By assuming a conservative burn-out time of 20 minutes (i.e. 1200 s), the unit heat release is estimated to be:</p> $Q_U = q / 1200$ <p>where <math>Q_U</math> (<math>\text{kW} \cdot \text{m}^{-2}</math>) is the unit heat release rate and <math>q</math> (<math>\text{kJ} \cdot \text{m}^{-2}</math>) is the measured survey load. See Note (3) for an example.</p>
5. Assembly	5a. Places of Public Entertainment	Sprinkler controlled fire with a headroom of 2.5m and standard response type of sprinkler is expected to be about 1.5MW.
	5b. Educational establishments	

Use Classification		Examples on Design Fire Size
	5c. Transport facilities	See Note (4) for vehicle fires.
		Range from 5 MW to 22 MW for train fire. See Note (5).
	5d. Other Assembly Premises	Sprinkler controlled fire with a headroom of 2.5m and standard response type of sprinkler is expected to be about 1.5MW.
6. Industrial		Sprinkler controlled fire for an industrial building or a warehouse with a headroom of 3.5m and standard response type of sprinkler is expected to be about 2.0MW.
7. Carpark		Carparks should be protected by sprinklers as required by FSI Code. Any fire in the carpark is expected to be controlled avoiding any fire spread from one vehicle to another. See Note (6) for details.
8. Plant rooms & the like		Sprinkler controlled fire for a plant room and the like with a headroom of 3m and standard response type of sprinkler is expected to be about 1.7MW.

Notes:

- (1) Reference can be made to *CIBSE Guide E Fire Safety Engineering*, The Chartered Institution of Building Services Engineers, London, 3rd Edition, 2010.
- (2) An example for a residential unit with the living room dimension of 6m (L) x 3m(W) x 3.2m (H), having two windows of 3m (W) x 2.5m(H) and 0.8m(W) x 1.2m(H) based on the equations in CIBSE Guide E and CIBSE TM19<sup>3</sup>. The rate of burning is calculated as:

$$R = 0.02 \left[ A_o h^{1/2} (A_T - A_o) (W/D) \right]^{1/2} \quad (\text{Equation 1})$$

Where,

$A_o$  = Sum of window areas,  $m^2 = 3 \times 2.5 + 0.8 \times 1.2 = 8.46m^2$

$A_T$  = Total area is the area of room surface (wall, floor, ceiling),  $m^2$   
 $= 6 \times 3 \times 2 + (3+6) \times 2 \times 3.2 = 93.6m^2$

$h$  = Weighted average of window height, m  
 $= (3 \times 2.5 \times 2.5 + 0.8 \times 1.2 \times 1.2) \div 8.46 = 2.3525 \text{ m}$

$W$  = Width of the wall containing window,  $m = 3m$

$D$  = Depth of room behind the window,  $m = 6m$

<sup>3</sup> CIBSE Technical Memoranda TM19, *Relationships for Smoke Control Calculations*, Chartered Institution of Building Services Engineers, London, 1995.

For multiple openings with different heights, h can be calculated by:

$$h = \frac{\sum A_i h_i}{A_w} \quad (\text{Equation 2})$$

where, i = 1, 2, 3.....represents different windows.

$$D/W = \frac{W_2}{W_1} \frac{A_{w1}}{A_w} \quad (\text{Equation 3})$$

where,

$W_1$  = Width of wall 1 (containing the greatest window area), m = 3m

$W_2$  = Width of wall 2 (depth of room behind the greatest window area), m = 6m

$A_{w1}$  = Window area on wall 1,  $m^2 = 3 \times 2.5 = 7.5 \text{ m}^2$

$A_w$  = Sum of window areas on all wall,  $m^2 = 8.46 \text{ m}^2$

$$\text{Therefore, } D/W = \frac{W_2}{W_1} \frac{A_{w1}}{A_w} = \frac{6}{3} \times \frac{7.5}{8.46} = 1.77$$

$$R = 0.02 \left[ A_o h^{1/2} (A_T - A_o) (W/D) \right]^{1/2} = 0.02 \left[ 8.46 \times 2.3525^{1/2} (93.6 - 8.46) \left( \frac{1}{1.77} \right) \right]^{1/2} = 0.5 \text{ kg/s}$$

The equivalent heat release rate is given by  $Q = H_c \times R$ , where  $H_c$  is the heat of combustion (kJ/kg) and  $R$  (kg/s) is the mass rate of burning. When assuming the burning material is wood ( $H_c = 13.0 \times 10^3 \text{ kJ/kg}$ ), the calculated heat release rate is equal to  $13.0 \times 10^3 \times 0.5 = 6.5 \text{ MW}$ .

### (3) Design Fire based on Measured Survey Load

$$Q_U = q / 1200$$

where  $Q_U$  ( $\text{kW} \cdot \text{m}^{-2}$ ) is the unit heat release rate and  $q$  ( $\text{kJ} \cdot \text{m}^{-2}$ ) is the measured survey load.

A commonly used value of unit heat release rate for retail shop is  $550 \text{ kWm}^{-2}$  as shown in Table 6.3 of CIBSE Guide E. Therefore, when considering an example of a retail shop with the floor area of  $50 \text{ m}^2$ , the total heat release rate is about  $550 \text{ kW/m}^2 \times 50 \text{ m}^2 = 27.5 \text{ MW}$ .

- (4) For Use Classifications 5c and 7, the examples of fire size for different types of vehicles for road tunnel design can make reference to NFPA 502, *Standard for Road Tunnels, Bridges, and Other Limited Access Highways*, National Fire Protection Association, Quincy, MA, 2011 and Ingason, H., "Design Fires in Tunnels", Second International Symposium, Lausanne, 2006. The following should also be considered:

- (i) The designer should consider the rate of fire development (peak HRR may be reached within 10 minutes), the number of vehicles that could be involved in the fire, and the potential for the fire to spread from one vehicle to another.
- (ii) Temperatures directly above the fire can be expected to be as high as  $1000^\circ\text{C}$  to  $1400^\circ\text{C}$  ( $1832^\circ\text{F}$  to  $2552^\circ\text{F}$ ).
- (iii) The HRR may be greater than in the table if more than one vehicle is involved.

- (iv) A design fire curve should be developed in order to satisfy each specific engineering objective in the design process (e.g., fire and life safety, structural protection, etc.).
- (5) The examples on design fire sizes are adopted in some projects of Mass Transit Railway Corporation. The design fire sizes depend on the type and model of the trains.
- (6) Though sprinklers are provided for carparks, there is experiment comparing the fire sizes for two different situations: (1) a free burning vehicle with no sprinkler and (2) a burning vehicle with sprinklers. The fire sizes of the two situations are very similar. This is because the vehicle has a canopy at the top which can shield off the sprinkler water and cannot effectively suppress or control the fire inside the car.

#### **Commentary**

Examples of the expected HRR for various items may refer to NFPA 92B<sup>4</sup>, as are the design curves. They represent a general worst credible fire scenario that is easily compared, as a basic design tool. When fuel items are burnt and the data recorded, it can be compared with the  $t^2$  fire growth curves.

The amount of fire load has been traditionally perceived to be related directly to fire growth rate, i.e. a higher fire load density will lead to a faster fire growth. Scientifically, how fast a fire grows depends on the fuel properties (e.g. liquid fuels burn much faster than solid fuels), the exposed surface area, and the amount of external heat energy and oxygen available to the fuel.

The quantity of fire load has also been used to represent the degree of fire hazard in buildings. Whilst it is correct that an enclosure having more fuel will lead to a longer fire duration (under same ventilation conditions), sole reliance on fire load density to characterize fire hazard has not addressed other parameters that equally contribute to the fire hazard, including potential fire growth rate, flame spread properties of furnishings, ease of ignition of the dead and live fire load in the enclosure, the potential ventilation available through door and window openings, and the likely types of ignition source.

The following references are suggested:

- *CIBSE Guide E Fire Safety Engineering*, The Chartered Institution of Building Services Engineers, London, 3rd Edition, 2010.
- PD 7974-1, *The Application of Fire Safety Engineering Principles to the Design of Buildings – Part 1: Initiation and Development of Fire within the Enclosure of Origin (Sub-System 1)*, British Standards Institution, London, 2003.
- ISO/TR 13387-2, *Fire Safety Engineering – Part 2: Design Fire Scenarios and Design Fires*, British Standards Institution, London, 1999.
- NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas*, National Fire Protection Association, Quincy, MA, 2009.
- Society of Fire Protection Engineers, *SFPE Engineering Guide to Performance-Based Fire Protection Analysis and Design of Buildings*, National Fire Protection Association, Quincy, MA, 2000.
- NFPA 502, *Standard for Road Tunnels, Bridges and Other Limited Access Highways*, National Fire Protection Association, Quincy, MA, 2011.
- Ingason, H., “Design Fires in Tunnels”, Second International Symposium, Lausanne, 2006.

<sup>4</sup> NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas*, National Fire Protection Association, Quincy, MA, 2009.

## Clause G6.6 Smoke Control

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In general, smoke control (smoke hazard management) systems are designed to:

- (a) reduce the impact of smoke and heat on occupants evacuating from a fire compartment where a fire is located; and
- (b) limit the spread of smoke between fire compartments.

The impact of smoke from a fire can be controlled through both active and passive fire safety provisions. Active fire safety provisions are activated by smoke detection or sprinkler protection and include fans to exhaust smoke, operable vents or other systems such as smoke curtains and shutters. These systems will control and vent both heat and smoke to reduce the spread of smoke and also permit evacuation by occupants.

Smoke can also be controlled by passive fire safety provisions, which includes compartmentation that limits fire spread within a building.

### Commentary

The design for the control of smoke within a fire compartment or atrium is complex and requires detailed understanding of fire growth, fluid dynamics and building safety systems.

The design for smoke hazard management systems must include careful consideration of make up air. The impact of wind would only be considered for smoke control with the use of natural ventilation.

Smoke hazard management for occupant safety will have different design and acceptance criteria than smoke clearance systems, which are designed to vent smoke to assist firefighting activities.

Guidance for the design of smoke hazard management systems should be sourced from guides such as those listed below:

- PD 7974-2, *The Application of Fire Safety Engineering Principles to the Design of Buildings – Part 2: Spread of Smoke and Toxic Gases within and beyond the Enclosure of Origin (Sub-System2)*, British Standards Institution, London, 2002.
- NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas*, National Fire Protection Association, Quincy, MA, 2009.
- CIBSE Guide E Fire Safety Engineering, Chartered Institution of Building Services Engineers, London, 3<sup>rd</sup> Edition, 2010.
- ISO/TR 13387-5, *Fire Safety Engineering – Part 5: Movement of Fire Effluents*, British Standards Institution, London, 1999.
- Klote, J.H., and Milke, J.A., *Principles of Smoke Management*, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Atlanta, GA, 2002.
- Morgan, H.P. et al., *Design methodologies for smoke and heat exhaust ventilation*, BRE 368, Construction Research Communication Ltd, London, 1999.

## **Clause G6.7 Occupant Movement**

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Occupants within a building need various cues before they decide to evacuate. These cues include visually seeing smoke or warnings from other persons. Another cue is an effective alert and warning system. This includes tones and recorded or live messaging systems, with clear instructions.

The time taken from when a fire is detected, either through smoke detection or other form of detection to when occupants start to evacuate, is the pre-movement time. The pre-movement time is a variable as persons will receive different cues and persons in different locations will react in a diverse manner. The pre-movement time varies as persons have different commitments to the activities they are involved at the time of the fire, whether that be working, shopping, sleeping or watching a movie. Hence, pre-movement time should be a distribution.

Pre-movement time also varies between Use Classifications. Persons who are asleep typically take much longer time to react and prepare themselves to evacuate. Persons who are working are relatively alert and are more familiar with the exits and surroundings. Table G2 summarizes various well-referenced pre-movement times. The same set of guidelines should be applied consistently throughout the whole fire safety assessment.

**Table G2 – Summary of Pre-movement Times**

Pre-movement time						
	PD7974 <sup>[1]</sup>		SFPE <sup>[2]</sup>	NZ Framework <sup>[3]</sup>		CIBSE Guide E <sup>[4]</sup>
	T1 <sup>a</sup>	T2 <sup>b</sup>		Origin	Remote	
<b>Occupants are awake and familiar with the building (office, industrial)</b>						
Voice alarm signal/ trained staff	0.5 <sup>c</sup>	1 <sup>c</sup>	< 1	0.5	1	1
Standard alarm signal throughout the building	1 <sup>c</sup>	2 <sup>c</sup>	3			
Local/ Standard Alarm Signal & non-trained staff	> 15 <sup>c</sup>	> 15 <sup>c</sup>	> 4			
<b>Occupants are awake and unfamiliar with the building (Retail, restaurant, cinema, theatre)</b>						
Voice alarm signal/ trained staff	0.5 <sup>d,e</sup>	2 <sup>d,e</sup>	< 2	0.5	1	3
Standard alarm signal throughout the building	1 <sup>d,e</sup>	3 <sup>d,e</sup>	3	1	2	
Local/ Standard Alarm Signal & non-trained staff	> 15 <sup>d,e</sup>	> 15 <sup>d,e</sup>	> 6			
<b>Occupants are sleeping and familiar with the building (Dwelling – individual occupancy)</b>						
Voice alarm signal/ trained staff	-	-	< 2	1	5	5
Standard alarm signal throughout the building	5	5	4			
Local/ Standard Alarm Signal & non-trained staff	10	> 20	> 5			
<b>Occupants are sleeping and familiar with the building (Serviced flats, hall of residence)</b>						
Voice alarm signal/ trained staff	10	20	< 2	1	5	5
Standard alarm signal throughout the building	15	25	4			
Local/ Standard Alarm Signal & non-trained staff	> 20	> 20	> 5			
<b>Occupants are sleeping and unfamiliar with the building (Hotel, boarding house)</b>						
Voice alarm signal/ trained staff	15	15	< 2	1	5	20
Standard alarm signal throughout the building	20	20	4		10	
Local/ Standard Alarm Signal & non-trained staff	> 20	> 20	> 6			
<b>Occupants are awake and require assistance (Day care, clinic, dentist)</b>						
Voice alarm signal/ trained staff	0.5 <sup>f</sup>	2 <sup>f</sup>	< 3	1	2	2
Standard alarm signal throughout the building	1 <sup>f</sup>	3 <sup>f</sup>	5			
Local/ Standard Alarm Signal & non-trained staff	> 15 <sup>f</sup>	> 15 <sup>f</sup>	> 8			
<b>Occupants are sleeping and require assistance (Hospital, nursing home)</b>						
Voice alarm signal/ trained staff	5	10	< 3	5	30	-
Standard alarm signal throughout the building	10	20	5			
Local/ Standard Alarm Signal & non-trained staff	> 10	> 20	> 8			

All values are in minutes

Note a: Pre-movement time of the first few occupants

Note b: Pre-movement time of the last few occupants

Note c: For a large complex building, add 0.5

Note d: For a simple multi-storey building, add 0.5

Note e: For a large complex building, add 1.0

Note f: These times depend upon the presence of staff

References used:

[1] PD 7974-6, *The Application of Fire Safety Engineering Principles to the Design of Buildings – Part 6: Human Factors: Life Safety Strategies – Occupant Evacuation Behaviour and Conditions (Sub-System 6)*, British Standards Institution, London, 2004.

[2] Proulx, G., "Movement of People," in *SFPE Handbook of Fire Protection Engineering*, 3rd ed., Section 3, Chapter 13, P.J. DiNenno et al. (Eds.), National Fire Protection Association, Quincy, MA, 2002.

[3] Beever, P, et al., "A New Framework for Performance Based Fire Engineering Design in New Zealand," *8th International Conference on Performance-Based Codes and Safety Design Methods*, Sweden, 2010.

[4] CIBSE Guide E *Fire Safety Engineering*, Chartered Institution of Building Services Engineers, London, 3<sup>rd</sup> Edition, 2010.

## Clause G6.8 Tenability Criteria

For the purposes of assessing quantitative modelling results, tenability criteria are required, which are assumed to provide an indication of the level of life safety for evacuating occupants with respect to the heat and smoke conditions within the building. Authorized persons should propose for the Building Authority's acceptance the most appropriate tenability criteria for their Alternative Solution.

Factors that may affect the tenability criteria include Use Classification and variation in size of fire compartments or buildings.

Tenability is normally determined by assessing one or all of the following:

- (a) smoke layer height;
- (b) radiated heat transfer;
- (c) convected heat transfer;
- (d) toxicity;
- (e) visibility;
- (f) smoke temperature.

### Smoke Layer Height

2m should be adopted as the acceptable smoke layer height unless otherwise justified by the authorized person.

#### Commentary

Whilst accepted values for smoke layer height have varied in the past for Hong Kong, Paragraph 1.1.2(a) under Part IV of Fire Services Department Circular Letter No. 4/96 states that apart assisting firefighters, a smoke extraction system has advantages:

*"assisting in the provision of clear egress for escaping persons. Generally a smoke free zone of 2m in height is to be aimed for in the design. "Smoke free" does not imply complete elimination of smoke, but that visibility is not greatly impaired".*

Values adopted overseas are provided below for information:

- PD 7974-6, *The Application of Fire Safety Engineering Principles to the Design of Buildings – Part 6: Human Factors: Life Safety Strategies – Occupant Evacuation Behaviour and Conditions (Sub-System 6)*, British Standards Institution, London, 2004.
- In Australia, the National Construction Code Series (previously referred to as the Building Code of Australia) requirements for smoke exhaust capacity in Spec E2.2b, are based on keeping smoke 2m above the floor.
- In New Zealand, as described in the Fire Engineering Design Guide <sup>5</sup>, a layer height of 2m is used.

<sup>5</sup> *Fire Engineering Design Guide*, Centre for Advanced Engineering at the University of Canterbury, Christchurch, New Zealand, 2008.

## **Radiated Heat Transfer**

Radiated heat transfer occurs when the smoke layer is above occupants' heads, and is a function of the smoke layer depth, smoke layer emissivity, and distance from the smoke layer to occupants. Radiated heat transfer can also impact on occupants who are in the hot smoke layer. A value of  $2.5 \text{ kW/m}^2$  (in the order of  $200^\circ\text{C}$ ) is acceptable to occupants for a short period of exposure.

## **Convected Heat Transfer**

Convected heat transfer only occurs once occupants are in contact with the smoke layer, and is therefore a function of the occupant height and the smoke temperature.

## **Toxicity**

Toxicity becomes an issue when occupants are in contact with the smoke layer. The relative conservativeness of the layer height limits should be an indication of the confidence in the modelling being conducted, and the other levels of redundancy and contingency in the design. It is very specific to the Use Classifications and the occupants. If toxicity becomes an issue when occupants are in contact with the smoke layer, the authorized persons should consider this factor for special cases. It is recommended that the CO concentration should not exceed 1,000ppm.

## **Visibility**

Visibility can delay evacuation until such time as the other three factors above cause untenability but it is only an issue if the smoke has descended to a height where it impacts on evacuating occupants. The optical density should not exceed  $0.1 \text{ m}^{-1}$  (i.e. 10m visibility).

## **Smoke Temperature**

If the smoke layer falls below the acceptable smoke layer height, it is recommended that the temperature should not exceed  $60^\circ\text{C}$ .

## **References for Use**

The following references are useful for determining acceptance criteria:

- PD 7974-6, *The Application of Fire Safety Engineering Principles to the Design of Buildings – Part 6: Human Factors: Life Safety Strategies – Occupant Evacuation Behaviour and Conditions (Sub-System 6)*, British Standards Institution, London, 2004.
- CIBSE Guide E Fire Safety Engineering, Chartered Institution of Building Services Engineers, London, 3<sup>rd</sup> Edition, 2010.
- ISO/TR 13387-8, *Fire Safety Engineering – Part 8: Life Safety - Occupant Behavior, Location and Condition*, British Standards Institution, London, 1999.
- *SFPE Engineering Guide to Human Behavior in Fire*, Society of Fire Protection Engineers, Bethesda, MD, 2003.
- Purser, D.A., "Assessment of Hazards to Occupants from Smoke, Toxic Gases, and Heat," in *SFPE Handbook of Fire Protection Engineering*, 4th ed., Section 2, Chapter 6, P.J. DiNenno et al. (Eds.), National Fire Protection Association, Quincy, MA, 2008.
- *SFPE Engineering Guide to Predicting 1st and 2nd Degree Skin Burns*, Society of Fire Protection Engineers, Bethesda, MD, 2000

## **Section 7 - Fire Safety Assessment Report (FSAR)**

### **Clause G7.1 Framework of FSAR**

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The fire engineering for an Alternative Solution will be assessed based on all information being documented in the FSAR. It provides the basis on which an analysis is conducted to assess the impact of a fire on the occupants under a worst credible scenario and time of ignition for the Alternative Solution. The FSAR should present details of the relevant aspects of the Alternative Solution, which fall into one of the following three categories:

- (a) Active fire safety provisions
- (b) Passive fire safety provisions
- (c) Fire safety management

The FSAR should identify and set out the strategy for the Alternative Solution. The format and content of the FSAR are as follows:

**(a) Introduction:**

- (i) States the nature of the problems identified
- (ii) Sets out the overall objectives of the fire strategy
- (iii) Highlights the key parameters

**(b) Building and Use Classification:**

- (i) Building site – location, boundary distances, access, fire service water supplies
- (ii) Building form – area, height, number of floors, (atria and basements, if any)
- (iii) Use Classification – floor by floor use, connection between buildings, storage, parking
- (iv) Occupancy – type, number, location, characteristics
- (v) Special features and inter-relationship with other properties

**(c) Code Compliance:**

- (i) Deemed-to-Comply provisions that are not complied with
- (ii) Alternative Solutions
- (iii) Relevant Performance Requirements
- (iv) Guidance used

**(d) Technical Justification:**

- (i) Sub-systems to be addressed
- (ii) Acceptance criteria
- (iii) Method of analysis
- (iv) Analysis tools
- (v) Hazard analysis, ignition sources, fire loads
- (vi) Fire scenarios, design fires
- (vii) Interaction of design fires with occupants and building
- (viii) Safety factor, if any

**(e) Trial Design Solution:**

- (i) Sub-systems being analysed
- (ii) Active fire safety provisions – smoke detection, occupant warning, sprinklers etc.
- (iii) Passive fire safety provisions – fire compartments, sealing of penetrations, FRR etc.
- (iv) Fire safety management– maintenance, housekeeping, evacuation planning etc.
- (v) Means of escape strategy
  - Occupant behaviour and reaction
  - Occupant way finding
- (vi) Smoke control
  - Purpose of smoke control system
  - Activation
  - Capacity
  - Zoning
- (vii) Fire spread
  - Combustibility of linings and furnishings
  - FRR of fire barriers
  - Fire compartment size
  - External fire spread
- (viii) Structural Performance
  - Structural response to elevated temperatures
  - Required FRR
- (ix) Sprinkler systems
  - Hazard classification
  - Water supplies
  - Extent of coverage
  - Type of heads
- (x) Occupant Warning / Alarm system
  - Type and extent of the system
  - Coverage and spacing
  - Manual call points / Break glass alarms
  - Interaction with other active systems
  - Position of indicator panels
  - Signal to emergency services

- (xi) First-aid firefighting
  - Hose reels
  - Portable fire extinguishers
- (xii) Facilities for firefighters
  - EVA
  - Fire service water supplies
  - Firefighting and rescue stairway
  - Fireman's lifts
  - Fire control centre / indicator panel
  - Active system controls
  - Inter-floor communication
- (xiii) Emergency lighting and exit signs
- (xiv) Management
- (xv) Maintenance of fire safety provisions
- (xvi) Housekeeping
- (xvii) Fire drills
- (xviii) Staff training

The FSAR should contain calculations, sketches and diagrams to support the conclusions and objectives of the report. Detailed information should include smoke filling, design fire and egress calculations as may be applicable.

To illustrate the design concepts, diagrams and sketches showing fire compartmentation, means of escape and expected smoke control approach should also be included.

## **Clause G7.2 Assessment of Structural Performance**

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The assessment and analysis of structural elements or frames and the structural response to elevated temperatures should be assessed as appropriate.

Important design aspects to be considered include:

- (a) importance of design fires, utilisation of test data as design fires;
- (b) calculation of FRR, based on full fire compartment burn-out;
- (c) use of the time-equivalence method and its limitations, with regard to application to individual members and fire compartments;
- (d) use of calculation methods for assessing heat transfer to structural members or elements of construction;
- (e) use of test information and the applicability of adapting test information for a specific case;
- (f) development of suitable acceptance criteria;
- (g) role of fire service intervention and accounting for firefighters;
- (h) relevant safety factors and safety margins;

- (i) use of materials such as timber, steel and concrete and their limitations. Use of building materials that are sensitive to flame impingement should be carefully addressed, e.g. structural glazing; and
- (j) methods of protection and their limitations.

### **Clause G7.3 Commissioning and Field Testing**

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All fire safety provisions must be commissioned and tested.

Testing of passive fire safety provisions must comply with Part E.

Requirements on acceptance testing for FSI are stipulated in the Code of Practice for Inspection, Testing and Maintenance of Installations and Equipment.

#### **Hot Smoke Tests**

Hot smoke tests may be utilised as part of building commissioning and testing to ascertain if active fire safety provisions are operating effectively and are interacting as they should, i.e. smoke detection activating door closers and sounding an alert in the appropriate zone.

The use of hot smoke tests may not be fully effective in testing fire engineering solutions for smoke control systems. Hot smoke tests are typically carried out in the range of 1 to 1.5MW in order to avoid damage to on-site environment. Since this range is substantially smaller than most design fires, they do not adequately represent the design fires. In this connection, the testing of fire engineering solution for smoke control systems may be assisted by computer modelling and validation.

A hot smoke test can be carried out for special buildings, provided the limitations of the test are understood.

### **Clause G7.4 Maintenance and Management**

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Authorized persons should be aware of the expected maintenance and management requirements that may result from the Alternative Solution, which should be listed in the fire safety management plan. The requirements on fire safety management plan are stipulated in Part F.

## Section 8 - Bounding Conditions

### Clause G8.1 Definition

“Bounding Conditions” is defined in Part A meaning a set of fire safety provisions that must be maintained as a result of a performance-based approach to the fire safety design and that if altered will invalidate the performance-based fire safety design.

#### Commentary

Definition of the same term in the International Code Council Performance Code for Buildings and Facilities <sup>6</sup> (IPCBF) as:

*Conditions, which if exceeded, invalidate the performance-based design. These could be maximum allowable conditions such as fuel load or type and arrangement of fuel load that must be maintained throughout the life of a building to ensure that design parameters are not exceeded.*

In the Users Guide to the IPCBF<sup>6</sup>, it is stated that as:

*Bounding conditions, which establishes limitations on changes to the building or facility systems or components, maintenance, and operation features which are identified as critical or necessary preventative features to provide a safe environment for occupants. Bounding Conditions are established by the design professional and have concurrence of the Code Official for performance-based designs. Essentially, Bounding Conditions establish the sensitivity of a design to change.*

### Clause G8.2 Application

For a project where an Alternative Solution has been developed, the authorized person should document a draft list of Bounding Conditions.

He should include the draft list for submission as part of the general building plans. The final Bounding Conditions will then be specified in the approved general building plans, the fire safety management plan and the DMC as described in Part F.

#### Commentary

The approach described in this section provides a framework for control of alterations and additions and maintaining fire safety throughout the lifetime of a building designed under a performance-based regime. The Bounding Conditions provide a practical means by which maintenance and management can be undertaken and provided for such a building. Any future additions, alterations or changes of use and all maintenance for active and passive fire safety provisions can be checked against the recorded Bounding Conditions. The Bounding Conditions should be checked to be current and up to date at least annually by building management or owners.

<sup>6</sup> International Code Council Performance Code for Buildings and Facilities, International Code Council, USA, 2009.

### **Clause G8.3 Example of Information for Bounding Conditions**

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The following list is a sample showing information that should be listed for Bounding Conditions and specific information will be required to tailor for buildings adopting performance-based approach on a case-by-case basis:

- (a) Number of floors
- (b) Design occupancy/Use Classification
- (c) List of non-compliances with the Deemed-to-Comply provisions
- (d) Maximum design population
- (e) Maximum design travel distance
- (f) Design number and width of required staircases
- (g) Expected fire load energy density (design upper limit)
- (h) Fire compartment limit(s)
- (i) FRR to structures
- (j) FRR to fire compartments
- (k) Design internal finishes
- (l) Installed fire safety provisions and relevant installation standards
- (m) Others

#### **Commentary**

The Bounding Conditions listed in the approved general building plans, fire safety management plan and the DMC can be used for the basis of checking the detailed documentation for the installed fire safety provisions to continuously check for compliance throughout the lifetime of the building.

## Section 9 - Computer Models

### Clause G9.1 Introduction and Overview

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The computer-based fire engineering software that is considered to be acceptable will be based on those packages that are used currently in the field of fire engineering, on a common basis and have been well validated. The selection of appropriate computer software will be determined by the authorized person based on appropriate justification and accepted by the Building Authority.

The following aspects should be considered for the selection or use of a software package:

- (a) issuing company / institution of the software package;
- (b) validation and verification of the package;
- (c) availability of the package;
- (d) history of use;
- (e) applicability;
- (f) transparency; and
- (g) ease of use.

New software packages will be considered if sufficient evidence and validation material are provided. For all computer-based modelling packages, the authorized person should show that the software is relevant, fit for the purpose, validated and the user is competent. As an example, a spreadsheet program can be utilised for simple smoke modelling to derive extract rates or vent sizes in simple spaces.

The computer models used for fire development to determine sprinkler actuation time or clear smoke height are commonly based on two zones model.

With all computer-based calculations, all input parameters are to be fully and clearly documented and provided with explanatory notes in the FSAR.

Computational fluid dynamic (CFD) analysis software based on field model is the domain of skilled specialists to simulate fire/smoke development with results such as velocity profile and temperature gradient presented in graphic form. They are time consuming to run and are usually used where no other approach appears to be capable of dealing with the complexities of the case. They should be used with caution as the output is highly dependent on the knowledge and skill of the consultant and therefore the results should be verified by appropriate means.

Evacuation time is another simulation field where computer models can be used. Software is used in the simulation of the movement of occupants during evacuation, usually to demonstrate that exit capacity is adequate in a design that is not amenable to simple hand calculation.

## **Section 10 - References**

The range of overseas codes and standards applicable to fire safety is constantly increasing and publications are frequently amended or revised. Although authorized persons and fire safety consultants may not have all relevant information readily in hand, they should be aware of these publications.

Product data and articles in fire safety journals help keep authorized persons and fire safety consultants up-to-date with new developments in fire safety matters. Various standard documents are available describing fire engineering approach to design such as the British Standard PD 7974 all parts, the International Fire Safety Engineering Guidelines, NFPA (National Fire Protection Association) and SFPE (Society of Fire Protection Engineer) Handbooks. They provide specific guidance on fire load, smoke control, means of escape from buildings for special occupancies, equations and relationships, calculation methods along with valuable data for use in the development of the case to demonstrate adequacy of fire safety.

## **Annex A**

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### **List of Codes of Practice and Guides issued by Licensing Authorities for Licensed Premises**

### **Codes of Practice and Guides issued by Relevant Licensing Authorities**

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Premises subject to licences have specific occupant characteristics and hence there are specific needs for fire safety provisions. This Annex provides a list of Codes of Practice and Guides issued by the relevant licensing authorities (but not exhaustive) for reference and information only.

- (a) "A Guide to Application for Restaurant Licences" issued by the Food and Environmental Hygiene Department
- (b) "A Guide to Application for Places of Public Entertainment Licences (Cinemas/Theatres)" issued by the Food and Environmental Hygiene Department
- (c) "A Guide to Application for Places of Public Entertainment Licences for Places other than Cinemas and Theatres" issued by the Food and Environmental Hygiene Department
- (d) "A Guide to Application for Karaoke Establishment Permits in Restaurants" issued by the Food and Environmental Hygiene Department
- (e) "A Guide to Application for Liquor Licences and Club Liquor Licences" issued by the Liquor Licensing Board
- (f) "Code of Practice for Residential Care Homes (Elderly Persons)" issued by the Social Welfare Department
- (g) "Operation Manual for Pre-primary Institutions" issued by the Education Bureau and the Social Welfare Department
- (h) "Code of Practice on Mutual Help Child Care Centres" issued by the Social Welfare Department
- (i) "Code of Practice for Drug Dependent Persons Treatment and Rehabilitation Centres" issued by the Social Welfare Department
- (j) "Code of Practice for Residential Care Homes for Persons with Disabilities" issued by the Social Welfare Department
- (k) "A Layman's Guide to Licence Applications under the Hotel & Guesthouse Accommodation Ordinance (Chapter 349)" issued by the Home Affairs Department
- (l) "A Layman's Guide to Application of Certificate of Compliance under the Clubs (Safety of Premises) Ordinance, Chapter 376" issued by the Home Affairs Department
- (m) "Guidelines for Registration of a New School (For Premises not designed and constructed as a school)" issued by the Education Bureau
- (n) "A Guide to the Application for a Massage Establishment Licence" issued by the Police Licensing Office, Hong Kong Police Force
- (o) "Guidance Notes on Application for the Grant of Amusement Game Centre Licence", "Guide for Applicants for Public Dance Hall Licence" and "Guide for Applicants for Mahjong/ Tin Kau Licence" issued by the Home Affairs Department
- (p) "Code of Practice for Dance Party Organisers" issued by the Narcotics Division of the Security Bureau.

## Guides on Specific Requirements for Materials in Licensed Premises

This list is not exhaustive and is provided for information purpose only. All information should be checked with the respective Departments for up-to-date standards.

Premise	Licensing document	Issued by	Requirements for usage of insulation, decorative and finishing materials
Places of Public Entertainment	PPA/109	FSD	<p>PPA/109 specifies various fire safety requirements for facilities that require a Public Entertainment Licence to operate. The requirements on decorative and finishing materials in PPA/109 are:</p> <ul style="list-style-type: none"> <li>All decorative materials including curtains, draperies and other textile hangings shall be of fire-resistant fabric and shall conform with British Standard 5867: Part 2<sup>7</sup> fabric type B when tested in accordance with BS 5438<sup>8</sup>, or be brought up to that standard by use of an approved fire retardant solution certified by a Class II registered Fire Service Installation (FSI) Contractor and a certificate to this effect from the Contractor shall be forwarded to Director of Fire Services as documentary proof of compliance.</li> <li>No decoration of a readily combustible nature to be permitted. Where combustible wall and ceiling linings are used they shall be of Class 1 or 2 Rate of Surface Spread of Flame as per British Standard 476: Part 7, or be brought up to that standard by treating with an approved fire retardant paint/solution by a Class II registered FSI Contractor and a certificate to this effect from the Contractor shall be forwarded to Director of Fire Services as documentary proof of compliance.</li> <li>Requirements on PU foam filled mattresses and upholstered furniture as described in FSD Circular Letter No. 1/2000.</li> </ul>
Restaurants	A Guide to Application for Restaurant Licences (PPA/101(A), PPA/101(D), PPA/101(F), PPA/101(G), PPA/101(H), PPA/101(J) issued by FSD for stating the fire safety standards in	FEHD	<p><u>Food business in small houses/General (fast food) restaurant</u></p> <p>All combustible materials used as false ceilings, partitions are required to be treated with two coatings of fire retardant paint/solution on all exposed parts, which are certified by a Class II FSI Contractor.</p> <p>All draperies and curtains are required to be treated with flame retardant solutions and certified by a Class II FSI Contractor. All draperies and curtains are required to be made of materials containing fire resistant</p>

<sup>7</sup> Specification for fabrics for curtains and drapes. Flammability requirements.

<sup>8</sup> Methods of test for flammability of vertically oriented textile fabrics and fabric assemblies subjected to a small igniting flame.

Premise	Licensing document	Issued by	Requirements for usage of insulation, decorative and finishing materials
	application of respective licences)		<p>fibres and acceptable to the Director of Fire Services.</p> <p><u>Light refreshment restaurants with low fire potential/Barbecue or hot pot restaurants with low fire potential</u></p> <p>All combustible materials used as false ceilings, are required to be treated with two coatings of flame retardant paints on all exposed parts and certified by a Class II FSI Contractor.</p> <p>All combustible wall furnishings, if installed and do not exceed the total maximum quantity of 60 kg/m<sup>2</sup> are required to be treated with two coatings of fire retardant paints/solutions on all exposed parts and certified by a Class II FSI Contractor.</p> <p>If an area not exceeding 30% of the seating accommodation is partitioned by combustible materials, these shall be treated with two coatings of fire retardant paints on all exposed parts and certified by a Class II FSI Contractor.</p> <p><u>Light refreshment restaurants with high fire potential/Factory canteens with high fire potential/Barbecue or hot restaurants with high fire potential/General restaurants with high fire potential</u></p> <p>All combustible materials used as false ceilings, partitions or wall furnishings, are treated with two coating flame retardant paints on all exposed parts and certified by a Class II FSI Contractor.</p> <p>All draperies and curtains are required to be treated with flame retardant solutions and certified by a Class II FSI Contractor. All draperies and curtains are required to be made of materials containing fire resistant fibres and acceptable to the Director of Fire Services.</p>
Clubs/ clubhouses	Standard Licensing Conditions Part I: Building Safety Conditions Part II: Fire Safety Conditions	HAD	<p>All combustible materials used as false ceilings, partitions or wall furnishings are required to be treated with two coatings of fire retardant paint/ solution on all exposed parts, which are certified by a Class II FSI Contractor.</p> <p>All draperies and curtains are required to be treated with flame retardant solutions and certified by a Class II FSI Contractor. All draperies and curtains are required to be made of materials containing fire resistant fibres and acceptable to the Director of Fire Services.</p>
Educational schools	Guidelines for Registration of a New School	EB	<p>If linings for acoustic, thermal insulation and decorative purpose are provided within protected means of escape, the linings are required to meet Class 1 or 2 rate of surface spread of flame, BS 476 : Part 7 or be brought up to that standard by treating with approved flame retardant paints/solutions on all exposed parts. The works are required to be carried out by a registered Class II FSI</p>

Premise	Licensing document	Issued by	Requirements for usage of insulation, decorative and finishing materials
			Contractor and a copy of the Certificate (Form FS 251) is required to be submitted to Director of Fire Services upon completion. If PU foam filled mattresses and upholstered furniture is used within the premises, they are required to meet the flammability standard to BS 7177: 1996 and BS 7176: 1995 for use in medium hazard premises/building or standards acceptable to the Director of Fire Services.
Hotels/ guesthouses	Standard Licensing Conditions Part I: Building Safety Conditions Part II: Fire Safety Conditions	HAD	If linings for acoustic, thermal insulation and decorative purpose are provided within protected means of escape, the linings are required to meet Class 1 or 2 rate of surface spread of flame, BS 476 : Part 7, or its international equivalent, or be brought up to that standard by treating with approved flame retardant paints/solutions on all exposed parts. A copy of the Certificate (Form FS 251) issued by registered FSI Contractor is required to be submitted to Licensing Authority as proof of compliance. If linings for acoustic, thermal insulation purpose in ductings and concealed locations are provided, the linings are required to meet class 1 or 2 rate of surface spread of flame, BS 476 Part 7, or its international equivalent, or be brought up to that standard by treating with approved flame retardant paints/solutions on all exposed parts. A copy of the Certificate (Form FS 251) issued by registered FSI Contractor is required to be submitted to Licensing Authority as proof of compliance.
Child care centres	Code of Practice, Child Care Centres Ordinance (Cap. 243) and Regulations, Operation Manual (CCC/101 (9 <sup>th</sup> revision) issued by FSD, which is attached in the above Code of Practice)	SWD	If linings for acoustic, thermal insulation and decorative purpose are provided within protected means of escape, the linings are required to meet Class 1 or 2 rate of surface spread of flame, BS 476 : Part 7, or its international equivalent, or be brought up to that standard by treating with approved flame retardant product on all exposed parts. A copy of the Certificate (Form FS 251) issued by registered FSI Contractor is required to be submitted to the Director of Fire Services as proof of compliance. If linings for acoustic, thermal insulation purpose in ductings and concealed locations are provided, the linings are required to meet Class 1 or 2 rate of surface spread of flame, BS 476 : Part 7, or its international equivalent, or be brought up to that standard by treating with approved flame retardant product on all exposed parts. A copy of the Certificate (Form FS 251) issued by registered FSI Contractor is required to be submitted to the Director of Fire Services as proof of compliance.
Drug dependent persons	Code of Practice for Drug Dependent Persons Treatment	SWD	No specific requirement on usage of insulation, decorative and finishing materials.

Premise	Licensing document	Issued by	Requirements for usage of insulation, decorative and finishing materials
treatment & rehabilitation centres	and Rehabilitation Centres		
Massage establishments	A Guide to the Application for a Massage Establishment Licence	CP	No specific requirement on usage of insulation, decorative and finishing materials.
Bedspace apartments	-	HAD	A general requirement is specified in Bedspace Apartments Ordinance (Cap. 447), which is: All fixtures, fittings, equipment, facilities and installations in or on such premises and any exit routes and means of escape shall be properly maintained in good repair and a safe condition free from any risk of fire or injury to person.
Residential care homes for elderly	Code of Practice for Residential Care Homes (Elderly Persons)	SWD	All linings for acoustic, thermal insulation and decorative purpose are provided within protected means of escape are required to meet Class 1 or 2 rate of surface spread of flame, BS 476 : Part 7, or its international equivalent, or be brought up to that standard by treating with approved flame retardant product on all exposed parts. A copy of the Certificate (Form FS 251) issued by registered FSI Contractor is required to be submitted to the Director of Social Welfare as proof of compliance. All linings for acoustic, thermal insulation purpose in ductings and concealed locations are provided are required to meet Class 1 or 2 rate of surface spread of flame, BS 476 : Part 7, or its international equivalent, or be brought up to that standard by treating with approved flame retardant product on all exposed parts. A copy of the Certificate (Form FS 251) issued by registered FSI Contractor is required to be submitted to the Director of Social Welfare as proof of compliance.

Notes:

CP = Commissioner of Police

EB = Education Bureau

FEHD = Food and Environmental Hygiene Department

FSD = Fire Services Department

HAD = Home Affairs Department

SWD = Social Welfare Department