Before the Queenstown Lakes District Council Proposed District Plan Hearings Panel

Under the Resource Management Act 1991

And

In the matter of the Proposed Queenstown Lakes District Plan (Strategic Direction Chapter)

Statement of Evidence of Donald Keith McIntosh
Strategic, Technical and Operational Evidence on behalf of the New Zealand Fire Service Commission (submitter #438)

Dated: 2 March 2016

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INTRODUCTION

1 My full name is Donald Keith McIntosh. I hold the position of Area Manager Central/North Otago at the New Zealand Fire Service (**NZFS**) based in Queenstown. I have been employed in this position since 1 July 2012. In this role I am responsible for the operational efficiency of 21 fire brigades and for fire risk management for the urban fire districts within my Area.

2 I have 26 years of management experience in NZFS and have served in a range of management roles. Full details of my qualifications and professional experience are at Attachment **A** to this evidence.

3 I am providing evidence in relation to the submission by the New Zealand Fire Service Commission (**the Commission**) on the Strategic Direction Chapter.

4 The Commission is the governing body that controls NZFS and is the National Rural Fire Authority (**NRFA**). The Fire Service Act 1975 and the Forest and Rural Fires Act 1977, establish the governance, management, and operational arrangements for protecting life and property from fire in New Zealand. NZFS is referred to in this evidence where the issue relates to operational matters.

CODE OF CONDUCT

5 In accordance with the 'Minute and Directions of Hearings Commissioners on Procedures for Hearing of Submissions' dated 25 January 2016, I confirm that I have read the code of conduct for expert witnesses as contained in the Environment Court's Practice Note 2014. I have complied with the Practice Note when preparing my written statement of evidence, and will do so when I give oral evidence before the hearings panel.

6 The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for the opinions expressed are also set out in the evidence to follow.

7 Unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

8 My evidence should be read in conjunction with the evidence of Ainsley McLeod filed with the Hearings Panel on 26 February 2016.

EXECUTIVE SUMMARY

9 The statutory purpose of the Commission includes promoting fire safety with a view to:

9.1 Continually reduce the incidence of fire, and its attendant risks to life and property.

9.2 Unifying fire safety law and practice.

10 The primary duty of NZFS is to provide for the prevention, suppression and extinction of fire, and the safety of persons and property endangered by fire.

11 The role of NZFS has widened however, and it now plays a crucial role in providing responses to many types of non-fire emergencies such as hazardous substances emergencies, motor vehicle accidents, medical emergencies, civil emergencies and response to incidents in extreme weather.

12 Fire stations are a vital community facility and they need to be located in the area they service. While predominantly used by firefighters, fire stations also play an important role in the community they serve. For example:

12.1 In a civil defence emergency the station is seen as a base for the community, and in particular for liaison with other emergency services in any natural disaster.

12.2 NZFS liaises closely with schools to provide fire safety education to their students. Fire stations host open days and school visits.

12.3 NZFS provides information in relation to smoke alarms and installation.

12.4 NZFS provides community access to fire safety information and advice on electric blankets, stoves, caravans, candles and kitchen fires, automatic fire alarm installations, evacuation procedures and practice.

12.5 NZFS also adopts and works with at risk groups within the community for fire safety education and practice.

13 The optimal location of a fire station is at the centre of a defined turn-out area that takes in the community it serves and strategically placed to meet or exceed response time guidelines set by the Commission.

14 Coupled with optimally located fire stations, the key enabler to ensuring effective NZFS operational capability is the provision of supporting infrastructure, namely well-designed transportation networks, sufficient firefighting water supplies, and access for NZFS vehicles.

15 Failure to provide adequate firefighting water supplies and vehicle access for firefighters can result in unnecessary loss of life and property, including housing, community assets and infrastructure. It also can also cause downstream economic, social and environmental losses.

16 Inadequate supporting infrastructure also exposes firefighters to unacceptable and unnecessary risk and restricts their ability to perform emergency response functions.

17 The *New Zealand Fire Service Firefighting Water Supplies Code of Practice SNZ PAS 4509:2008* is the key document setting out the requirements for firefighting water supply in New Zealand. It also covers the vehicular requirements of the NZFS to ensure access to those water supplies.

18 Appropriate recognition of the Code of Practice in planning documents provides the Commission and NZFS with an assurance that when fires occur within a particular district, NZFS will have sufficient resources to protect life and property.

19 Recognising and providing for the mitigation of the risk of fire, and other natural hazards, including by providing the infrastructure needed by responding firefighters, contributes greatly to the safety and wellbeing of communities.

THE ROLE OF THE COMMISSION AND FIRE SERVICE

20 The Commission is a Crown entity under section 4 of the Fire Service Act 1975 (**the FSA**). The Commission's principle roles include:

20.1 Co-ordination of fire safety throughout New Zealand;[1]

20.2 Governance and operation of NZFS;[2] and

20.3 Exercising the functions of the NRFA, including the coordination of all matters relating to national rural fire control.[3]

21 In relation to fire safety, section 20 of the FSA provides:

> Commission to promote fire safety
>
> (1) It shall be a matter of prime importance for the Commission to take an active and co-ordinating role in the promotion of fire safety in New Zealand.
>
> (2) In so promoting fire safety, the Commission shall be concerned to—
>
> (a) reduce continually the incidence of fire and the attendant risk to life and property:
>
> (b) achieve unity and completeness of fire safety law and practice.

22 In terms of the operation of NZFS, its primary duty remains to make provision for the prevention, suppression and extinction of fire, and the safety of persons and property endangered by fire in every fire district.[4] There is also a duty of the National Commander, as head of NZFS, to ensure NZFS is maintained in a state of operational efficiency.[5]

23 However, over time the role of NZFS has widened significantly. It now plays a crucial role in providing responses to many types of non-fire emergencies such

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[1] Sections 20 and 21 FSA, and section 47 of the Building Act 2004

[2] Section 14 FSA

[3] Section 14 and 14A FSA

[4] Section 17O FSA

[5] Section 17O FSA

as hazardous substances emergencies, motor vehicle accidents, medical emergencies, civil emergencies and response to incidents in extreme weather. A review of the Fire Service indicates this expanded role will continue.[6]

24 Calls NZFS attended nationally for the 2014/2015 year included:

72,853	Total incidents. This included:
5,413	Structure Fires
5,102	Vegetation Fires
4,815	Motor Vehicle accidents
10,304	Medical Emergencies
3,245	Hazardous Material Incidents
28,199	Total non-fire emergencies attended

25 Attachment **B** highlights the changes nationally in fire and non-fire emergency calls NZFS responded to over the last 6 years.

26 Through fire safety public education programmes, emergency response and rural fire co-ordination, the Commission seeks to achieve the following outcomes:

26.1 Reduced consequences of unwanted fires for people, property, communities and the environment.

26.2 Reduced adverse consequences of non-fire emergencies for people, property, communities and the environment.

[6] Following the review, the Minister of Internal Affairs Hon Peter Dunne announced on 13 November 2015 that the Fire Service will be replaced by a new organisation with an expanded role. I will be an amalgamation of the current New Zealand Fire Service, the National Rural Fire Authority, and the Rural Fire Authorities (including Enlarged Rural Fire Districts).

26.3 New Zealanders to have access to fire services and place a high level of trust and confidence in those services.

27 In order to achieve its objectives, the Commission monitors the performance of NZFS against national service delivery guidelines (**NSDG**). Response time guidelines for time critical attendances must be met or exceeded for both fire and non-fire emergencies. These response time guidelines are:

Response time guidelines - structure fire incidents inside fire districts	
8 minutes	90 percent of the time for career stations
11 minutes	90 percent of the time for volunteer stations

Response time guidelines - first response to medical emergencies inside fire districts	
8 minutes	90 percent of the time for career stations
11 minutes	90 percent of the time for volunteer stations

Response time guidelines - non-fire emergencies	
30 minutes for motor vehicle accidents	90 percent of the time
20 minutes for incidents requiring the specialist hazardous materials unit	90 percent of the time within large urban areas
60 minutes for incidents requiring the specialist hazmat unit	90 percent of the time for the rest of New Zealand

28 To discharge its statutory functions, the Commission operates nationwide with:

1,730	Career Fire Fighters
8,100	Urban Volunteer Fire Fighters
3,500	Co-ordinate Rural Volunteer Fire Fighters
79	Manned Fire Stations
360	Volunteer Fire Stations
187	Support Rural Fire Stations

THE COMMISSION'S FACILITIES IN THE QUEENSTOWN LAKES DISTRICT

29 There are currently six fire stations located within the Queenstown Lakes District:

Fire Station	Address
Queenstown Volunteer Fire Brigade	3 Isle Street, Queenstown
Frankton Volunteer Fire Brigade	54 Douglas Street, Frankton

Arrowtown Volunteer Fire Brigade	2 Hertford Street, Arrowtown
Lake Hawea Volunteer Fire Brigade	Noema Terrace
Luggate Volunteer Fire Brigade	51 Main Road
Wanaka Volunteer Fire Brigade	45 Ardmore Street

30 The current facilities in Queenstown, Arrowtown, Lake Hawea and Luggate, and the new facilities under construction in Wanaka are considered to be sufficient (currently) to service the surrounding areas. The main issue within the Queenstown-Lakes District is the adequacy of facilities in Frankton. The existing station will need to be replaced in the medium term to meet the increasing demands that development in this area is creating.

31 Currently the Frankton station is one of the busiest single pump volunteer stations in the region and is experiencing increasing call numbers. The existing volunteer station was built in 1975 on a site of 1077m^2 with the addition of a meeting/social room in 2005. The station was constructed as a single bay sub-station to Queenstown, however, the current brigade strength of 24 has far outgrown the facilities of the existing station, and these existing facilities need to be replaced.

32 Without adequate redevelopment of the Frankton station, the ability for NZFS to efficiently and effectively respond may be compromised. This underpins the need for appropriate activity status' and development controls within the Plan to support this development, be it at the current site or elsewhere within Frankton.

LOCATION OF FIRE STATIONS

33 NZFS can only provide the most effective service if fire stations are located at the centre of a turnout area that takes in the community they protect. The turnout area is determined in terms of response times. That is, the time taken for an appliance to respond to the edge of the turn-out area from the fire station. A fire station is strategically placed to meet or exceed the NSDG in the turn out area it covers. It follows that the ability to locate fire stations in their optimum locations enables NZFS to achieve the NSDG.

34 NZFS is developing a 50 year Station Location and Resourcing Plan. This plan uses a complex National Risk Resourcing Model (**NRRM**), which relies on various data sources to identify optimum locations for fire stations. The NRRM provides a nationally consistent methodology to determine both fire station placement and the allocation of fire appliances and staff to those stations.

35 To achieve the optimum fire station location this may mean that they are required to be located in all areas, including residential areas. They cannot always be placed in less sensitive environments because the location of fire stations is necessary to enable the NZFS to respond to emergencies in the surrounding area.

36 Fire stations are typically located on prominent sites on main roads providing quick access to arterial routes which allows quicker travel times. These high profile locations also ensure the fire station is seen, which provides the public with reassurance that help is nearby in an emergency.

37 To identify the optimal locations for its facilities, NZFS undertakes data analysis, computer modelling work, and internal and external stakeholder engagement and future development plans around the district to consider what the future area could look like. The optimal location of a fire station is at the centre of a defined turn out area that takes in the community it serves. A fire station is strategically placed to meet or exceed the response time guidelines in the turn out area it covers.

38 Typically fire stations in small to medium towns are serviced by a volunteer fire station located in the centre of the township. These volunteer stations also provide an essential response to the public who live outside of the urban fire district. Each rural fire station also backs up their neighbouring station for larger incidences and for the occasions when volunteer crews are not able to gather enough numbers to make a response, or it is delayed. As development occurs, and towns expand however, it is critical the level of service provided by NZFS can meet the changing needs of the community.

39 What does not change however, is the need for fire stations to be strategically located to best serve their communities be that residential, industrial or commercial etc and meet the ever-changing call demand.

40 While predominantly used by career firefighters and volunteers, fire stations also play an important role in the community they serve. For example:

40.1 In a civil defence emergency the station is seen as a base for the community, and in particular for liaison with other emergency services in any natural disaster.

40.2 NZFS liaises closely with schools to provide fire safety education to their students. Fire stations host open days and school visits.

40.3 NZFS provides information in relation to smoke alarms and installation.

40.4 NZFS provides community access to fire safety information and advice on electric blankets, stoves, caravans, candles and kitchen fires, automatic fire alarm installations, evacuation procedures and practice.

40.5 NZFS also adopts and works with at risk groups within the community for fire safety education and practice.

FIRE STATION DESIGN

41 The Commission specifically designs its individual stations to meet its operational functional requirements within the particular location, and engages architectural firms to produce the design for new fire stations. As a community facility, fire stations are designed to be sympathetic to and fit in with the communities they are located within.

42 New fire stations are designed and constructed to meet the resilience requirements of Building Importance Level 4 (highest)[7] to ensure that they can still function after natural disasters and can be utilised as refuge centres if required.

43 The Commission designs its fire stations to a set of national guidelines, the New Zealand Fire Service Fire Station Design Guideline, and Design Manual to

[7] Clause A3 New Zealand Building Code, Building Regulations 1992, Schedule 1.

ensure there is sufficient physical space and features to meet the functional requirements of an operational fire station. The Design Guide is attached as **Attachment D** to this brief of evidence. The Design Manual is attached as **Attachment E** to this brief of evidence.

44 While the Commission takes responsibility to design fire stations that are sympathetic to, and fit within their locality, key operational constraints must be taken into account in the design. Key operational considerations for a fire station include:

44.1 Sufficient height and length of fire appliance parking bays.

44.2 An appliance cleaning area containment system.

44.3 Adequate set back distance from road frontages to minimize traffic disruption when entering the station and to provide maximum visibility for other road users when leaving the station.

44.4 Office, ablutions (including for decontamination of fire-fighters), working and living areas to accommodate the staff rostered on duty (generally four per fire station 24/7).

44.5 Adequate staff parking areas for bicycles and cars.

ACTIVITIES AT A FIRE STATION

Emergency call outs

45 When responding to an emergency callout the station alarms sound, lights come on and the front doors open. The crew dress in their protective clothing and get into the appliance. The appliance leaves the station with flashing lights (and siren only if required) to attend the emergency incident and doors close automatically behind the appliance. External speakers are normally on a time switch so they do not activate after 9.00 pm and before 6.00am.

46 Sirens on fire appliances are used as traffic warning devices. Their main purpose is to warn road users that a fire appliance is responding to an emergency. Use of

sirens must be in accordance with the Land Transport (Road User) Rules 2004 (Rules 7.4, 11.18 and 11.9).

47 Sirens must be used when travelling through controlled intersections (stop signs and give way signs). Sirens and flashing lights must be used when travelling through a red light signal.

48 Sirens are not normally used when leaving a fire station. The exception to this is only if there is a need to 'clear traffic' or warn other road users. Under all other circumstances, fire appliances respond from the fire station under flashing lights only.

49 At night time, sirens are very rarely used and would only be used if traffic conditions/volumes deem it necessary. However, this scenario is very rare. Use of sirens is more frequent during the day than at night.

50 The design and use of sirens on fire appliances has changed. Today sirens are fitted to the bumper or grill and are only forward pointing. Sirens do not direct sound in any other direction. The use of sirens is controlled by the Officer in Charge and the driver of the fire appliance. Staff must strictly adhere to NZFS policies and procedures and all relevant land transport requirements.

Usual daily activities at a volunteer fire station

51 The following paragraphs describe the type of activities that take place at the Queenstown Volunteer Fire Station:

51.1 During the day, the fire station is generally quiet, except for the need to respond to an emergency.

51.2 The Queenstown Volunteer Fire Brigade responded to over 300 emergency incidents, including fires, road accidents, medical emergencies, rescues, hazardous substance incidents, environmental disasters, farm accidents, and public assistance in 2014/15, some in support of Frankton station. Frankton responded to 119 in the same period.

51.3 The brigade is notified of an emergency callout by the siren operating at the fire station, as well as the back- up pager system. Members of the brigade will respond to the call. They arrive at the fire station, generally by car, parking on the street adjacent to the station. They proceed into the station and put on their protective gear. They then board either the fire appliance or crew van. The responding crew members would leave the station, through the front roller doors of the appliance bay that close on departure. Crews return the vehicles to the station once the callout is complete.

51.4 A volunteer brigade usually trains one evening per week (7pm – 9pm) to maintain a state of operational readiness.[8]

51.5 Due to the variety of emergencies that a brigade responds to, training involves various firefighting exercises both indoors and outdoors.

51.6 Outdoor training generally involves exercises using the fire appliance, the portable pump, the unrolling, rolling, connecting and spraying water by members of the Brigade. Other exercises include ladder work and motor vehicle accident scene management, rope work, and carrying out breathing apparatus training scenarios.

51.7 The brigade is responsible for ensuring the appliances and equipment used for firefighting are maintained in a state of operational readiness and efficiency. During training evenings, firefighters also carry out routine testing and checking of their equipment to ensure that it is operationally ready to attend an emergency incident.

SUPPORTING INFRASTRUCTURE

52 Coupled with optimally located fire stations, the key enabler to ensuring effective NZFS operational capability is the provision of supporting infrastructure, namely well-designed transportation networks, adequate firefighting water supplies and access for NZFS vehicles.

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[8] As required by section 34 of the Fire Service Act and its agreement of service, under that section with the Commission.

53 Failure to provide suitable transport networks, adequate firefighting water supplies and access for NZFS vehicles can result in unnecessary loss of life and property, including housing, community assets and infrastructure. It can also cause downstream economic, social and environmental losses.

54 It places a high degree of risk on those who rely on NZFS for help and assistance during an emergency. It can result in significantly greater risk to life, fire spread to neighbouring property, community impact resulting from hazardous substances emergencies, disruption and economic loss to business and commerce, and places unnecessary risk on firefighters. Inadequate infrastructure compromises NSFS's ability to discharge its statutory functions and meet response time guidelines.

Sufficient firefighting water supplies

55 When considering fire risk, the provision of a readily available sufficient water supply will significantly affect the extent to which a firefighting resource can save life and property. Should a fire occur, NZFS will respond if called and will commence firefighting operations using whatever water is available, but delays in accessing an adequate water supply allow a fire to continue to develop, to a size that more often results in a complete loss. Of note, in a residential house, fire can spread very rapidly and can result in a complete loss within minutes.

The New Zealand Fire Service Firefighting Water Supplies Code of Practice

56 The key document setting out the requirements for firefighting water supply in New Zealand is the *New Zealand Fire Service Firefighting Water Supplies Code of Practice SNZ PAS 4509:2008* (**the Code of Practice**).[9]

57 It is published in accordance with section 30(3) of the FSA, which requires the National Commander of NZFS to publish a Code of Practice specifying standards for water supply, volume and pressure which are required for firefighting in urban fire districts.[10]

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[9] Superseding SNZ PAS 4509:2003

[10] Section 30 of the Fire Service Act 1975 is set out at Attachment C.

58 As set out under section 30(3), the purpose of the Code of Practice is to provide direction on what constitutes a sufficient supply of water for firefighting in urban fire districts. It is intended for use by territorial authorities, water supply authorities, developers and NZFS.

59 The Code of Practice is a publicly available national standard, prepared under the supervision of a committee of the Standards Council established under the Standards Act 1988.[11]

60 The Code of Practice provides techniques to define a sufficient firefighting water supply that may vary according to the circumstances. It is based on an assessment of the minimum water supplies needed to fight a fire and to limit fire spread according to different building's fire hazards. The firefighting water supplies required to address the fire hazard may be established by use of tables within the Code, or by calculation. The Code of Practice is written to provide flexibility as to how the firefighting water supplies can be provided.

Access to property

61 The time it takes to access a building from the road and the space available for firefighters to undertake firefighting or rescue operations can have a significant impact on what NZFS is able to achieve.

62 Without adequate NZFS vehicle access, firefighters are severely restricted in the duties they can perform. The ability of firefighters to get resources to a site, and to position them safely and effectively, directly impacts on the outcome of the emergency they are attending and therefore the overall impact of the emergency on surrounding properties and communities.

63 The Code of Practice recognises that adequacy of a firefighting water supply includes not only assessment of the water supply that must be available, but also the location, connections, markings and access to fire hydrants to enable the

[11] Representatives on the committee included Building Research Association New Zealand (BRANZ), Department of Building and Housing (now MBIE), Fire Protection Association of New Zealand (FPANZ), Insurance Brokers Association of New Zealand Inc, Local Government New Zealand, New Zealand Fire Equipment Association, New Zealand Water & Wastes Association, and New Zealand Fire Service.

water supply to be used. Roading widths, surfaces and gradients where hydrants are located also need to support NZFS vehicles.

64 Without adequate water supply, firefighters will not be able to effectively protect life and property, limit surrounding exposures or prevent unnecessary losses. It adds a much greater degree of unnecessary risk to both the public and responding firefighters.

65 Appropriate recognition of the Code of Practice in planning documents provides the Commission and NZFS with an assurance that, when fires occur within a particular district, NZFS will have sufficient water resources and vehicular access to protect life and property. In my opinion, these matters are a critical component when considering land development and planning.

66 The significant contribution that adequately designed water supplies and vehicle access provides to the safety of responding firefighters is of particular note. Failure to provide infrastructure 'tools' to support effective emergency responses exposes firefighters to unacceptable and unnecessary risk, and compromises their ability to perform their emergency response functions, such as entry into building and structures to perform rescues, limiting fire spread to neighbouring properties, and dealing quickly with hazardous substance emergencies.

67 In my experience, early design, consideration and consultation with NZFS, via the Code of Practice, on the most appropriate firefighting water supply and access infrastructure provides dividends time and time again. This is the most cost effective and efficient approach for developers and provides a higher degree of certainty for developers, home or business owners, Councils and NZFS.

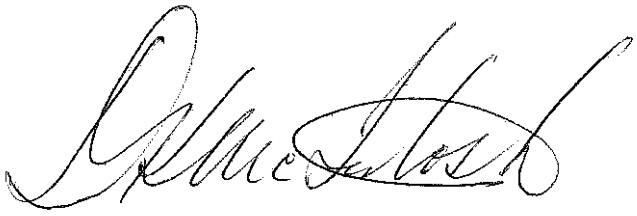
68 Retrospective consideration of firefighting water supplies and NZFS vehicle access generally results in significantly higher costs being incurred and can be impossible due to site layout constraints. Such an approach more often than not creates unnecessary disruption, is vastly more expensive, and strains relationships between developers, Councils, the public and NZFS.

69 While the NZFS and Council have an agreement in place around conditions and advice notes being placed on any new resource consents granted around the Code of Practice, the inclusion of this requirement in the Plan is our preference.

CONCLUSION

70 My conclusions are set out at the beginning of my evidence under the heading Executive Summary.

71 It is for these reasons that the Commission is seeking that a new objective and policies are added in the Strategic Direction Chapter to ensure that emergency services are provided for throughout the district, including for their necessary access to properties and the water required for firefighting.



Donald Keith McIntosh

2 March 2016

Attachment A

Donald Keith McIntosh Employment History

PROFESSIONAL EXPERIENCE

NEW ZEALAND FIRE SERVICE

- Area Manager/Commander, Central/North Otago, 2012 to present
- Assistant Region Commander, Bay/Waikato & Southern Regions, 1998-2012
- Fire Region Commander (Acting), Northland, 1998
- Assistant Area Chief Fire Officer, Bay of Plenty, 1995-1997
- Assistant Fire Commander, Palmerston North, 1990-1995

ACADEMIC HISTORY

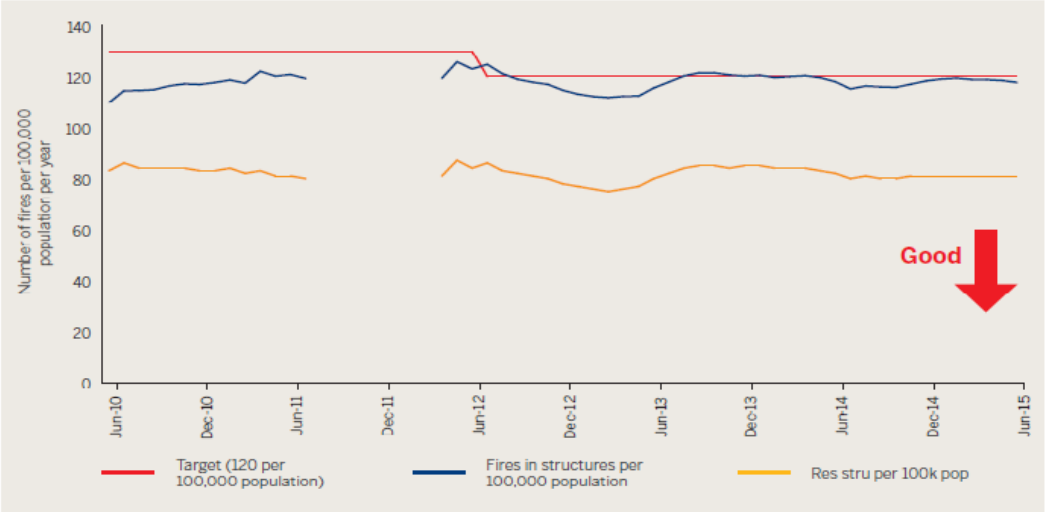
- Master of Business Administration (MBA) 1996
- Member (by examination) of the Institution of Fire Engineers (MIfireE)

ATTACHMENT B

Structure Fires and Non-Fire Emergency Statistics

Structure Fires

Figure 1 Fires in structures per 100,000 population per year



Note: In the previous annual report, the number of fires in structures per 100,000 population in 2013/14 was reported as 116, 77 per 100,000 population of which were in residential structures. Those figures later increased to 118 and 82 respectively as a result of late reporting.

Non-Fire Emergencies

(Medical calls, natural disasters, weather events, motor vehicle accidents)

Figure 3 Non-fire emergencies attended by the New Zealand Fire Service

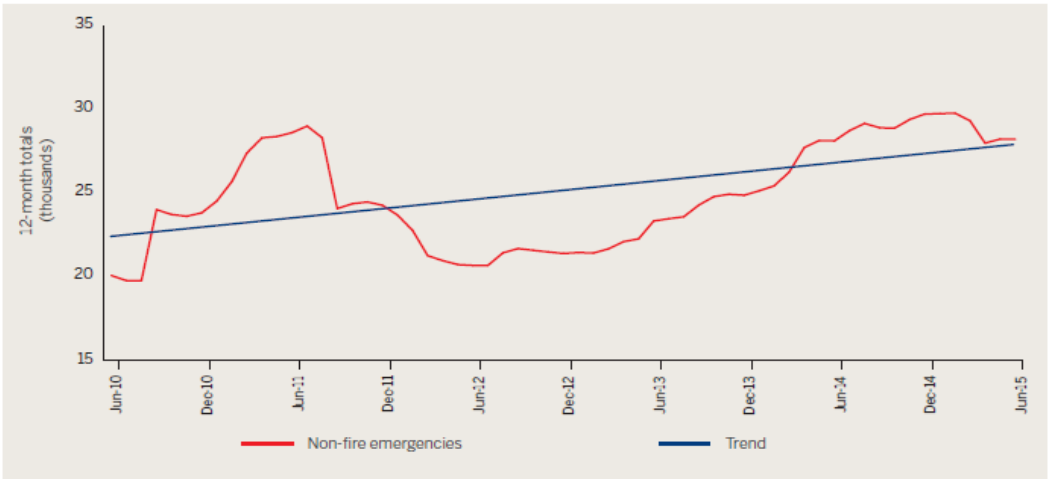
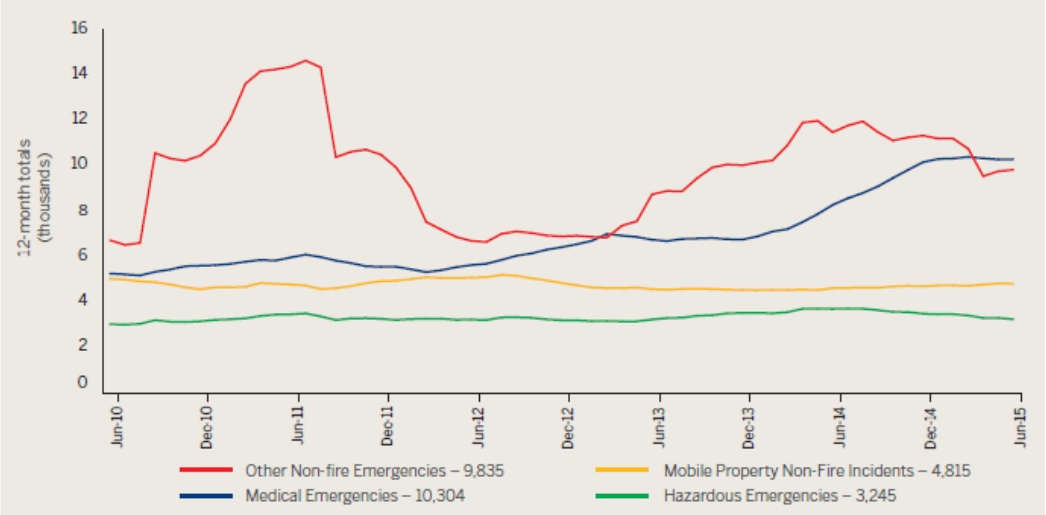


Figure 4 Non-fire emergencies attended by the New Zealand Fire Service per year



ATTACHMENT C

Section 30 Fire brigade to have use of water in mains, etc

(1) Subject to the overall requirements of the Controller under the Civil Defence Emergency Management Act 2002, while a state of emergency exists under that Act, every fire brigade , defence fire brigade, and industrial fire brigade shall, free of charge,—

(a) Have the use of all hydrants and control valves installed in any water mains and of all water in the water mains for the purpose of extinguishing any fire or stabilising or rendering safe any hazardous substance emergency or for the purpose of fire brigade drills conducted under the authority of the Chief Fire Officer:

Provided that no such brigade shall use for drills water supplied by any person or authority (except within its own Fire District) without the consent of that person or authority; and

(b) Have the use of all water in any river, creek, stream, watercourse, channel, lake, lagoon, well, tank, or other source of water supply whatsoever for the purpose of extinguishing any fire or stabilising or rendering safe any hazardous substance emergency.

(2) The National Commander may from time to time cause to be made such checks as the National Commander considers necessary as to the adequacy of water supplies, including tests of water volume and pressure in any water main, in any Fire District or within any area concerning any property that the Fire Service is under an obligation to protect pursuant to section 38 or section 39 of this Act, and shall advise the territorial authority or authorities as to the sufficiency or otherwise of the water supply of the Fire District or the area available for fire fighting and for the effective operation of such fire protection systems that may from time to time be installed in buildings or property installations within the Fire District or the area.

(3) In carrying out its duties pursuant to subsection (2) of this section the National Commander shall publish a Code of Practice specifying standards for water supply volume and pressure which are required. This Code of Practice shall be notified by the National Commander in the *Gazette*.

ATTACHMENT D - DESIGN GUIDE

NEW ZEALAND FIRE SERVICE
Whakaratonga Iwi

Fire station design guideline

February 2015

About this guideline

Introduction

APG Architects Ltd were commissioned by the New Zealand Fire Service (NZFS) to work with us and develop design guidelines for application across all NZFS fire stations.

This design guideline has been sponsored by National Commander Paul Baxter and Deputy National Commander Paul McGill, and facilitated by Property Team members. It integrates current operational thinking and design philosophies in its approach to fire station design.

The Property Team continually strives to improve facilities, and takes positive design improvements from each build project and incorporates them into the next project. We also strive to further develop our knowledge and understanding of global developments, and where these are suitable to New Zealand conditions, adopt them into our fire station designs.

When design improvements and global developments are recognised, they will be incorporated into the appropriate section of this guideline.

Purpose

The purpose of this guideline document is to:

- outline the 'high level' accommodation requirements the NZFS requires in its volunteer, career and composite fire stations, and the key spatial relationships between these spaces
- assist NZFS personnel at national and local levels in the design of volunteer, career and composite stations.

Application

The NZFS-appointed consultancy team and National Property Manager will use this information and work closely in collaboration with the local end user to achieve a well-designed facility serving the needs of NZFS personnel.

Important note

If you are referring to a printed copy of this guideline, make sure it is the current edition. This can be found on FireNet under Asset Management > Property.

Related documents

Codes and standards

New Zealand Building Code (NZ Building Code)
Clause G4 of the New Zealand Building Code, which references AS 1668.2 requirements.

Contents

Record of amendments

Date	Brief description of amendment

Design principles and key flows

Introduction

The design philosophy of a fire station can be broadly summarised as follows:

- To control the entry of carcinogen-contaminated personnel and equipment back into the building.
- To provide direct and un-obstructed paths of travel into the Appliance Bay under emergency response conditions.

Contamination zones

The strategies of contamination zones and managing contamination is achieved by managing the level of contamination as follows:

Zone	Hazard level	Types of spaces
HOT Zone (Red)	High	All spaces exposed to carcinogens that house vehicles, apparatus, tools, equipment, decontamination wash procedures (BA Mask), and Level 2 PPE laundry pickup.
TRANSITION Zone (Yellow)	Moderate	All spaces used in the washing of firefighters and laundering of Level 1 gear upon return from an incident. This is the zone that transitions between HOT and COLD zones.
COLD Zone (Green)	Low	All living spaces intended for extended occupancy.

Spaces by zone

A summary of the spaces within each zones is shown below:

Cold Zone	Transition Zone	Hot Zone
Entry	Laundry	Appliance Bay
Meeting and quiet spaces	Dirty Wash cubicles	Sprinkler Room
Operations Room	Level 2 PPE Lockers	Workshop
Public Toilet	Level 2 Drying Cupboard	Hose Store
Turnout		BA Wash
Lounge		BA Filling
Dining		Level 2 Bag and Tag
Kitchen		Level 2 PPE Courier Pickup
Bedrooms		
Gymnasium		

Key space relationship and flows

In addition to the three 'zones', the following relationships and flows are to be considered in the design response:

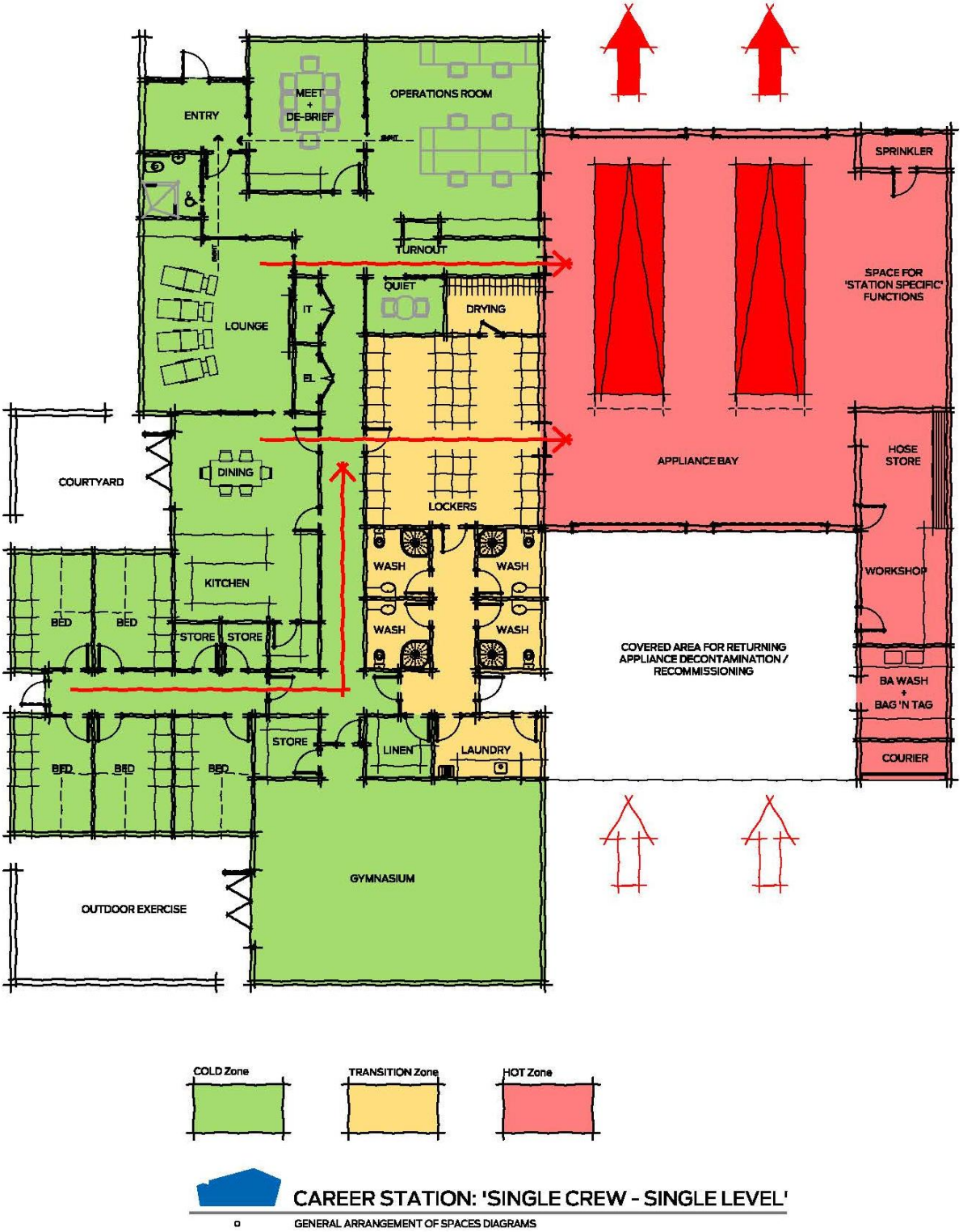
- Configure spaces so as to provide a user-friendly efficient flow to the Appliance Bay. Consideration is to be given to:
  - minimal 'turns' towards the Appliance Bay
  - distances of travel, and
  - multiple response pathways (consider two stairwells for two-storey design responses).
- An open plan operations area is to visually and physically connect to the Appliance Bay and be in close proximity to the main entry.
- Locate a meeting/debriefing space that connects with the main entry (public use/meetings) and Operations Room (debrief). Accessing this space immediately off the entry allows for controlled access of the public before entering the operational areas of the station.
- Where sites restrict a single level design approach, the bedrooms and associated wash amenities can be located on the first floor. Avoid placement over the Appliance Bay in order to minimise vertical distance travel.
- Kitchen/dining/lounge accommodation in all situations is to be located on the ground level, to maintain an interactive frontage to the public.

There will no doubt be situations where there will need to be adjustments to suit local site conditions, user group requirements and co-location with other emergency agencies and community groups. However, these general arrangements provide a strong and proven starting point for the development of the concept design.

General arrangement of spaces - career stations

Career station diagram

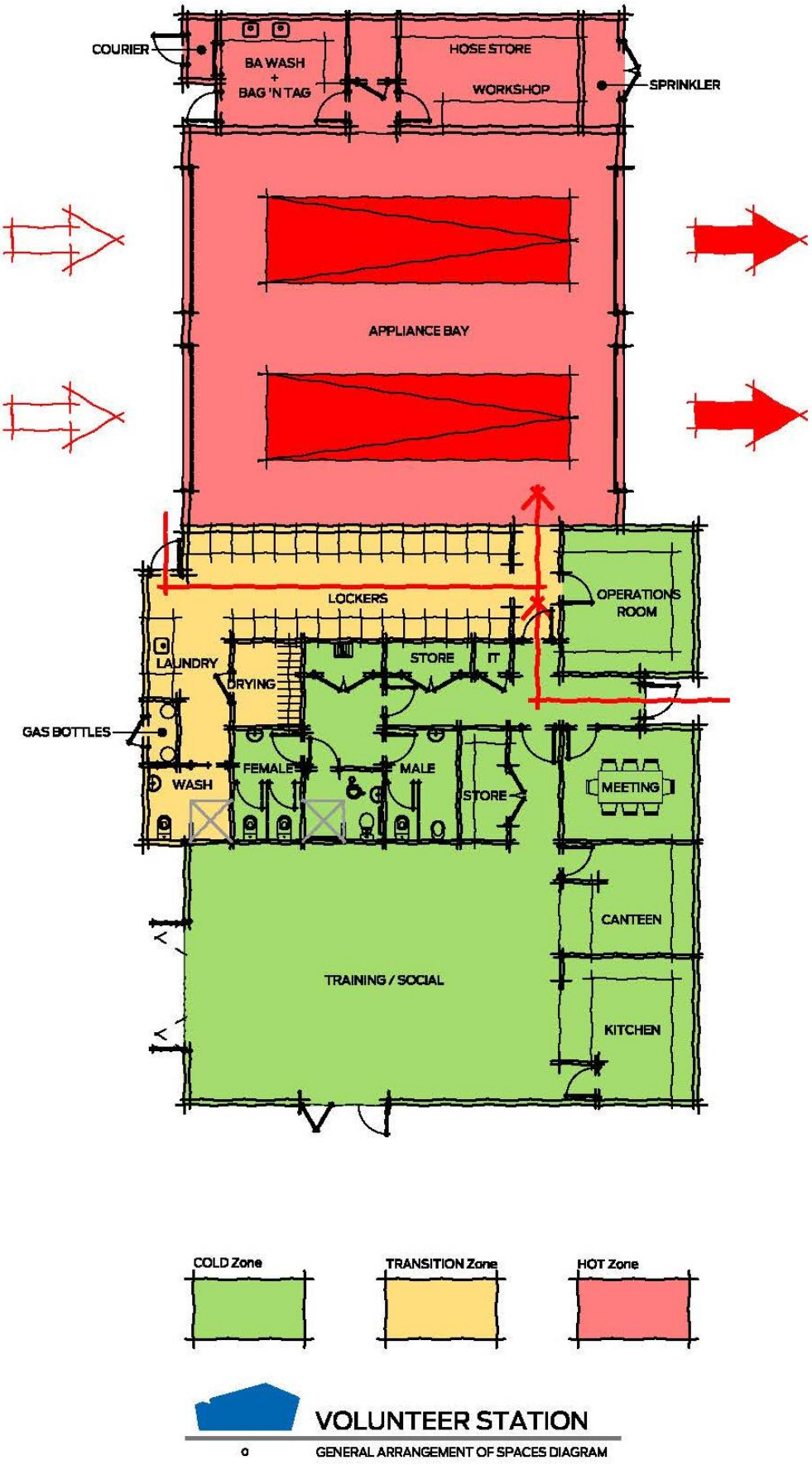
The diagram below shows the general arrangement of spaces in a single-level single-crew career fire station.



General arrangement of spaces - volunteer stations

Volunteer stations

The diagram below shows the general arrangement of spaces in a single-level single-crew career fire station.



Accommodation and space relationships schedules

Introduction

The site, services and accommodation schedules summarise the key core requirements for Volunteer, Career and Composite stations. They also summarise optional and specialist spatial requirements that may not be applicable to all standard station designs.

These schedules are developed by the project user groups and consulting team, and remain 'living documents' until signed off by the Project Sponsor/Project Manager and Management Team as appropriate.

Accommodation schedules

The accommodation schedules are follows:

- Table 1 – Volunteer site and services schedule
- Table 2 – Volunteer accommodation schedule
- Table 3 – Career site and services schedule
- Table 4 – Career accommodation schedule
- Table 5 – Composite site and services schedule
- Table 6 – Composite accommodation schedule
- Table 7 – Area office schedule.

Notes on the schedules

- Single crew = 4 'on duty' plus 1 spare for reliever.
- Double crew = 8 'on duty' plus 2 spare for relievers.
- Where spaces are written in red, these are additional spaces required to serve first floor bedroom design responses.
- Where spaces are highlighted in yellow, these are optional/specialist spaces that may not be applicable to all station designs and are subject to a Regional Management business case submission to the National Property Manager for consideration and approval.

Table 1 – Volunteer site and services schedule

Space/item	Area	Key links/connections	Comments
Front apron		Connects to Appliance Bay	Min. 9 m deep front boundary.
Flagpole		Close to front entry	9 m high freestanding.
Visitor car parks		Connects to front entry	1 standard plus 1 accessible parking space.
Operational car parks		Link as close as possible to external door into locker room	Varies based on size of station and number of brigade members.
External courtyard	≈ 100m^2	Connects to Training/Social Room	Fences to maintain visual privacy from public.
Grassed area (waste and stormwater disposal)			Area/requirements determined by Project Engineer and Local Authority.
Rainwater harvesting (rural stations)		The placement of the tank should incorporate sufficient area to park the appliance to allow filling	22,500L tank; submersible pump and hose coupling for appliance filling.
Fire hydrant (urban stations)		Located within rear yard	Pillar hydrant located in the yard for appliance filling. Check proximity of nearest street hydrant and discuss requirements with the local brigade.
Secure yard		Locate in close proximity to locker room entry point	Contains operations car parks; used for training. Size to allow turning circle of appliance where design permits 'drive-through'.
Siren pole		Located near building within rear yard	Pole can include turnout/communication aerials.
Generator space		Located within rear yard	Space to accommodate a trailer-mounted generator in close proximity to building-mounted generator plug.
'Car wreck' storage compound	60m^2	Within rear yard	Must be secure and fenced to maintain visual privacy from public. To be confirmed by Regional Management on a case-by-case basis.

Table 2 – Volunteer accommodation schedule

Room	Zone	Area	Key links/connections	Comments
Entry		4 m^2	Connects to Operations Room/Meeting Room	
Operations Room		15 m^2	Connects to Appliance Bay. Must have visual connection to Appliance Bay and external carpark area.	Incorporates turnout system in cabinetry.
Meeting Room		12 m^2		
Training/Social Room		75 m^2		In replacement stations, the size is to be confirmed by the Regional Management where existing spaces exceed the proposed allowance. Size may vary if station is a replacement and is comparing 'like to like'.
Kitchen		15 m^2	Connects to Training Room	
Canteen		10 m^2	Connects to Training Room	
Amenities (small) • Lobby • Unisex wc/whb • Unisex accessible wc/whb		≈10 m^2	Links to Training/Social Room	To be assessed against brigade establishment numbers and NZBC requirements.
Amenities (standard) • Lobby • Male toilet - wc, whb, ur • Female toilet - 2 x wc, whb • Accessible wc/shwr cubicle		≈20 m^2	Links to Training/Social Room	To be assessed against brigade establishment numbers and NZBC requirements.
Level 2 lockers		≈1 m2 per person	Connects to Appliance Bay and washroom	1.7 x 0.6 m space allocation/locker.
Drying Cupboard for Level 2 gear		3-5 m2	Links to Appliance Bay/ Locker Bay	
Washroom (unisex) - shwr, wc, whb		5 m2	Connects to Locker Room and Laundry	
Laundry		≈5-7 m2	Connects to washroom	Includes washing machine/dryer.
Appliance Bay		72 m^2	Connects to Watch Room/ Lockers	Single Bay 12 x 6 complete with vehicle extraction system.
		144 m^2	Connects to Watch Room/ Lockers	Double Bay 12 x 12 complete with vehicle extraction system.
BA Wash (small)		N/A	Washroom and Locker Room	Bench within Appliance Bay. Includes double sink, washing machine/dryer, bench space.
BA Wash (standard)		10 m^2	Connects with washroom and Locker Room	Includes double sink, washing machine/dryer, bench space.
Level 2 'Bag and Tag'		-	Integrates with BA Wash	
Courier Pickup		2 m^2	Connects to 'Bag and Tag'	External access for Courier.
Workshop/Hose Store		15 m^2	Links to Appliance Bay	
External Store/Cupboard		≈2 m^2	N/A	Gas bottle store.
Generator Plug			Connects with Rear Yard	Locate near proposed mobile generator space.
Uniform Stores			To be confirmed within Project Team	To be confirmed by Regional Management on a case-by-case basis.

Table 3 – Career site and services schedule

Space/item	Area	Key links/connections	Comments
Front apron		Connects to Appliance Bay	Min. 9m deep; 12m preferable.
Rear covered apron		Connects to rear of Appliance Bay	Extend Appliance Bay.
Flagpole		Close to front entry	9m high; freestanding.
Visitor car parks		Connects to front entry	1 standard plus 1 accessible parking space.
Operational car parks	Determined by Local Authority District Plan for carpark size and manoeuvring	Located in rear secure yard	• 8 per single crew of 4 • 16 per double crew of 8 Allows for shift handover where incoming/ departing crews share the site simultaneously.
External courtyard		Connects to operational living areas (lounge/dining)	Must be fenced to maintain visual privacy from public and security of the station.
Rainwater harvesting		Located in rear yard	22,500 L **in-ground** tanks under rear yard slab, complete with pumps etc.
Fire hydrant (urban stations)		Located within rear yard	In-ground and/or pillar hydrants - discuss with local brigade.
Secure yard		Typically at the rear of the site	Contains operational car parks. Used for training. Size to allow turning circle of appliance where design permits 'drive-through'.
Vehicle wash		Located within rear yard	Area to incorporate a Hynds Envirovalve 'stormwater to sewer' diverter valve. The zone within the yard is to be clearly identified.
Generator space		Located within rear yard, in close proximity to generator plug	Consider generator size and placement with respect to yard layout and serviceability.
Training facilities		Consider separate training building or integration of training facilities into the main station building design	To be confirmed by Regional Management on a case-by-case basis. Regional Training requirements may not be required on every site.
Deep lift well	N/A	Located within rear yard	To be confirmed by Regional Management on a case-by-case basis. Deep lift well testing may not be required on every site.
Traffic warning lights	N/A	Connects to turnout alarm. Located on the road	Traffic lights may be required where turning out onto arterial/high traffic roads. Consider LED strip lighting within road and associated road markings/signage.
Secure bicycle park area	15 m^2	Located in rear yard	To be confirmed by Regional Management.

Table 4 – Career accommodation schedule

G= Ground floor; F= First floor

Room	Level	Zone	Area	Key links/connections	Comments
Entry	G		5-8 m^2	Link with to Operations/ Meeting Room	
Public toilet	G		5 m^2	Close to entry/meeting areas	To meet NZBC accessibility requirements.
Meeting/debrief Room (10 people)	G		20-35 m^2	Connects to Operations Room	Used for public meetings/operational debriefing. Dual access from entry and station.
Operations Room (single crew)	G		≈6-8 m^2 per person	Visual and pedestrian link to Appliance Bay and main entry	• 4 work stations • 1 hot desk (reliever) • Turnout console incorporated in space • Utility zone for photocopier
Operations Room (double crew)	G		≈6-8 m^2 per person	Visual and pedestrian link to Appliance Bay and main entry	• 8 work stations • 2 hot desks (reliever) • Turnout console incorporated in space • Utility zone for photocopier
Turnout	G		N/A	Located in corridor to Appliance Bay (by Operations Room)	
Quiet room (2-4 people)	G		5 m^2	Connects to Operations Room	
Data cupboard	G		≈2 m^2	Near office zone	
General store (s)	G		TBA		Defined by project brief requirement.
Kitchen	G		15 m^2	Connects to dining and links to external deck	Single crew
	G		25 m^2		Double crew
Dining	G		15 m^2	Connects to kitchen and links to external deck	Single crew
	G		25 m^2		Double crew
Lounge	G		30 m^2	Links to kitchen/dining areas	Single crew
	G		65 m^2		Double crew
Gymnasium	G		70 m^2		Single crew
	G		85 m^2		Double crew

Bedrooms	G/F		10-12 m^2	Links to bedroom amenities and laundry	• 5 beds per single crew.
					• 10 beds per double crew.
					• Includes:
					  ○ 5 individual lockers per bedroom
					  ○ Study desk
					  ○ King single bed.

First floor washroom (unisex) - shwr, wc, whb	F		5 m^2 per cubicle	Connects to bedrooms	• 2 per 4 people (single crew) • 4 per 8 people (double crew)
First floor laundry	F		10 m^2	Links with bedroom area	
Linen cupboard	G/F		6 m^2	Links with laundry	

Room	Level	Zone	Area	Key links/connections	Comments
Level 2 lockers	G		≈1 m^2 per person	Connects to Appliance Bay, washrooms and laundry areas	• Min. 1.5 m in front of lockers (single row) • Min. 1.8 m in front of lockers (double row)
Drying Room for Level 2 gear	G		7-10 m^2	Links to Locker Room	
Washroom (unisex) - shwr, wc, whb	G		5 m^2 per cubicle	Connects to Laundry and Locker Room	• 2 per 4 people (single crew) • 4 per 8 people (double crew)
Laundry	G		10 m^2	Connects to Washroom	Includes washing machine/dryer
Appliance Bay	G		145 m^2	Connect to Operations Room/ Lockers	Double bay 11 x 14 m (min. 12 m deep) where site permits. Provide covered roof area 10 m deep at rear of appliance bay.
BA Wash	G		10 m^2	Direct access from external covered area	
Level 2 ‘Bag and Tag'	G		N/A	Integrates with BA Wash	
Courier Pickup	G		3 m^2	Connects with ‘Bag and Tag’	External access for courier.
Workshop/Hose Store	G		≈20 m^2	Links to Appliance Bay	Can be accessed externally.
Sprinkler Valve Room	G		≈5 m^2		Size varies depending on booster pump requirements.
Generator Capability	G			Connects to exterior	Minimum requirement is a generator plug. If operational requirements dictate (e.g. Coordination Centre capability) a mobile generator will be considered.
Foam Store	G		10 m^2	Links to exterior and Appliance Bay	To be confirmed by Regional Management on a case-by-case basis.
BA Filling Workshop	G		30 - 35 m^2	Links to Appliance Bay	To be confirmed by Regional Management on a case-by-case basis.
BA Compressor	G		5 m^2	Connects to BA Filling	To be confirmed by Regional Management on a case-by-case basis.

Table 5 – Composite site and services schedule

Space/item	Area	Key links/connections	Comments
Front apron		Connects to Appliance Bay	Min. 9 m; 12 m preferable.
Flagpole		Close to front entry	9 m high; freestanding.
Visitor Car Parks		Connects to front entry	1 standard plus 1 accessible parking space.
Operational car parks (Career)	Determined by Local Authority District Plan for carpark size and manoeuvring	Located in rear secure yard	• 8 per single crew of 4 • 16 per double crew of 8 Allows for shift handover where incoming/ departing crews share the site.
Operational car parks (Volunteer)		Link as close as possible to external door into locker room	Varies based on size of station and number of brigade members (10 min.).
External courtyard (Career)		Connects to operational living areas (lounge/dining)	Must be fenced to maintain visual privacy from public and security of the station.
External courtyard (Volunteer)	≈ 100 m^2	Connects to Training/Social Room	Fenced to maintain visual privacy from public.
Rainwater harvesting		Located in rear yard	22,500 L **in-ground** tanks under rear yard slab, complete with pumps etc.
Fire hydrant (urban stations)		Located within rear yard	In-ground/pillar hydrants - discuss with local brigade.
Secure yard		Typically at the rear of the site	Contains operational car parks; used for training. Size to allow turning circle of appliances where design permits 'drive-through'.
Vehicle wash		Located within rear yard	Area to incorporate a Hynds Envirovalve 'stormwater to sewer' diverter valve. The zone within the yard is to be clearly identified.
Generator space		Located within rear yard in close proximity to generator plug	Consider generator size and placement with respect to yard layout and serviceability.
'Car wreck' storage compound	60 m^2	Located in rear yard	Must be secure and fenced to maintain visual privacy from public. To be confirmed by Regional Management on a case-by-case basis.
Training facilities		Consider separate training building or integration of training facilities into the main station building design	To be confirmed by Regional Management on a case-by-case basis. Regional Training requirements may not be required on every site.
Deep lift well	N/A	Located within rear yard	To be confirmed by Regional Management on a case-by-case basis.
Traffic warning lights	N/A	Connects to turnout alarm; located on the road	Traffic lights may be required where turning out onto arterial/high traffic roads. Consider LED strip lighting within road and associated road markings/signage.
Secure bicycle park area	15 m^2	Located in rear yard	To be confirmed by Regional Management.

Table 6 – Composite accommodation schedule

G= Ground floor; F= First floor

Room	Level	Zone	Area	Key links/connections	Comments
Entry	G		5-8 m^2	Link with to Operations/Meeting Room	
Public toilet	G		5 m^2	Close to entry/meeting areas	To meet NZBC accessibility requirements.
Meeting/debrief Room (10 people)	G		20-35 m^2	Connects to Operations Room	Used for public meetings/operational debriefing. Dual access from entry and station.
Operations Room (single crew)	G		6-8 m^2 per person	Visual and pedestrian link to Appliance Bay and main entry	• 4 work stations • 1 hot desk (reliever) • Turnout console incorporated in space • Utility zone for photocopier.
Operations Room (double crew)	G		6-8 m^2 per person	Visual and pedestrian link to Appliance Bay and main entry	• 8 work stations • 2 hot desks (reliever) • Turnout console incorporated in space • Utility zone for photocopier.
Turnout	G		N/A	Located in corridor to Appliance Bay (by Operations Room)	
Quiet room (2-4 people)	G		5 m^2	Connects to Operations Room	
Open Plan Office (volunteers)	G		15 m^2		
Data cupboard	G		≈2 m^2	Near office zones	
General store(s)	G		TBA		Defined by project brief requirements.
Training/Social Room (volunteer)	G		75 m^2		In replacement stations, the size is to be confirmed by Regional Management where existing spaces exceed the proposed allowance. Size may vary if station is a replacement and is comparing 'like to like'.
Kitchen (volunteer)	G		15 m^2	Connects to Training Room/ Canteen	
Canteen (volunteer)	G		10 m^2	Connects to Kitchen/Training Room	
Amenities (standard) • Lobby • Male toilet - *w*c, whb, ur • Female toilet - 2 x wc, whb • Accessible wc/shwr cubicle	G		≈20 m^2	Links to Training/Social room	To be assessed against brigade establishment numbers and NZBC requirements.
Kitchen	G		15 m^2	Connects to dining and links to external deck	Single crew
	G		25 m^2		Double crew
Dining	G		15 m^2	Connects to kitchen and links to external deck	Single crew
	G		25 m^2		Double crew
Lounge	G		30 m^2	Links to kitchen/dining areas	Single crew
	G		65 m^2		Double crew

Room	Level	Zone	Area	Key links/connections	Comments
Gymnasium	G		70 m^2		Single crew
	G		85 m^2		Double crew

Bedrooms	G/F		10-12 m^2	Links to bedroom amenities and laundry	• 5 beds per single crew
					• 10 beds per double crew
					• Includes:
					  ○ 5 individual lockers per bedroom
					  ○ study desk
					  ○ king single bed.

First floor washroom (Unisex) - shwr, wc, whb	F		5 m^2 per cubicle	Connects to bedrooms	• 2 per 4 people (single crew) • 4 per 8 people (double crew)
First floor laundry	F		10 m^2	Links with bedroom area	
Linen cupboard	G/F		6 m^2	Links with laundry	
Level 2 Lockers	G		≈1 m^2 per person	Connect to Appliance Bay, washrooms and laundry areas	• Min. 1.5 m in front of lockers (single row). • Min. 1.8 m in front of lockers (double row).
Drying Room for Level 2 gear	G		≈9 m^2	Links to Appliance Bay/Locker Room	
Washroom - shwr, wc, whb	G		5 m^2 per cubicle	Connect to Decontamination/ BA Wash area and Locker Room	• 2 per 4 people (single crew). • 4 per 8 people (double crew).
Laundry	G		10 m^2	Connects to dirty wash and exterior access for courier pickup	Includes washing machine/dryer, bench to 'bag & tag' contaminated gear, courier pickup area.
Appliance Bay	G		145 m^2	Connect to Watch Room/ Lockers	Double Bay 11 x 14 m (min. 12 m deep) where site permits. Provide covered roof area 10 m deep at rear of appliance bay.
BA Wash	G		10 m^2	Direct access from external covered area	
Workshop/Hose Store	G		≈20 m^2	Links to Appliance Bay	Can be accessed externally.
Level 2 'Bag and Tag"	G		N/A	Integrates with BA Wash	
Courier pickup	G		3 m^2	Connects with 'Bag and Tag'	External access for courier.
Sprinkler Valve Room	G		≈5 m^2		Size varies depending on booster pump requirements.
Generator Capability	G			Connects to exterior	Minimum requirement is a generator plug. If operational requirements dictate (e.g. Coordination Centre capability) a mobile generator will be considered.
Uniform stores	G		To be confirmed within Project Team		To be confirmed by Regional Management on a case-by-case basis.
Foam store	G		10 m^2	Links to exterior and Appliance Bay	To be confirmed by Regional Management on a case-by-case basis.
BA filling workshop	G		30–35 m^2	Links to Appliance Bay	To be confirmed by Regional Management on a case-by-case basis.
BA compressor	G		5 m^2	Connects to BA Filling	To be confirmed by Regional Management on a case-by-case basis.

Table 7 – Area office schedule

Room	Level	Zone	Area	Key links/connections	Comments
Lobby/Reception	F		25 m^2	Links to stairwell from main ground floor building entry point	
Lecture/Training Room	F		85 m^2	Connects to Lobby/Reception	
Kitchen	F		15 m^2	Connects to Lecture/Training Room	Consider access off lobby to allow caterers to access kitchen.
Amenities (standard) • Lobby • Male toilet - 2 x wc, 2 x whb, 2 x ur • Female toilet - 2 x wc, 2 x whb • Accessible wc/shwr cubicle	F		30 m^2	Links to Lobby and Lecture/ Training Room	To be assessed against office occupancy load and NZBC requirements.
Cleaner's cupboard	F		4 m^2	Connects to amenities	
Office utility/file area	F		20 m^2	Connects to Reception and office areas	Consider central location.
Quiet room (1-2 people)	F		5 m^2	Links to open plan office area	
Meeting room (4 people)	F		10 m^2	Links to open plan office area	
Meeting room (8 people)	F		20 m^2	Links to open plan office area	
Open plan office (managers)	F		≈13 m^2 per person	Link in close proximity to quiet room/meeting rooms	
Open plan office (Fire Safety)	F		≈10 m^2 per person	Link in close proximity to quiet room/meeting rooms	
Breakout café area	F		30 m^2 (≈2.5 m^2 per person)		Includes kitchenette station. Size may vary depending on office occupancy numbers.
Storage	F				To the project brief requirements.

ATTACHMENT E - DESIGN MANUAL

NEW ZEALAND FIRE SERVICE
Whakaratonga Iwi

Fire station fire design manual

February 2015

PR5-2 MN

Document information

Introduction	This manual is to be used for the fire safety design of New Zealand Fire Service (Fire Service) fire stations, to satisfy the requirements of clauses C1 - C6 of the NZ Building Code. For new buildings, if this design manual (fire) cannot be followed in full, use Verification Method C/VM2 to demonstrate compliance.
Document conventions	Notes shown under 'Comment', occurring throughout this design manual, are for guidance purposes only and do not form part of this document. Words in *italic* are defined either below, or in the Building Code Handbook.
Within the scope of this document	This design manual (fire) is restricted to fire stations operated by the Fire Service. This covers *buildings*, or parts of *buildings*, from which the Fire Service operates and responds, and includes: • full-time fire stations • composite fire stations • volunteer fire stations. As this manual incorporates many of the requirements of risk groups SM, WB and VP (C/AS2, 5 and 7 respectively), it is not necessary to refer to these acceptable solutions when designing Fire Service-operated fire stations.
Outside the scope of this document	Buildings or parts of buildings other than fire stations are outside the scope of this manual. Fire stations that include any of the following features are outside the scope of this design manual (fire): • Atriums. • Intermediate floors, other than limited area intermediate floors. • Other emergency service providers, unless shared with Fire Service sites (e.g. Police Stations, Ambulance). • Urban Search And Rescue (USAR) base buildings. • Firefighting brigades not operated by the Fire Service (rural fire stations; industrial and airport brigades). • Any other building, or part of a building, on a Fire Service site, that does not provide a direct operational response. **Comment**: Other facilities not involved in frontline operational response, such as Area offices and training facilities, are not included in the scope of this document. These spaces would be designed to the relevant document, and would be either fire separated or a separate building.
Hazardous substances	This manual does not provide for any use, storage or processing of hazardous substances. While fire stations will store limited quantities of fuel, the quantities stored are typically below the hazardous substances threshold. However, compliance with NZBC F3 and the Hazardous Substances and New Organisms Act 1996 shall be ensured where applicable, in addition to the requirements of this manual.

Definitions

The following definitions are specific to Fire Service buildings. For a full list of definitions relating to the fire safety clauses of the Building Code, refer to the NZ Building Code Handbook.

Term	Definition
Aerial appliance	This type of fire appliance includes a basket and extendable boom to provide an aerial platform for firefighting and rescue activities. These include the Type 5 appliances.
Appliance bay	This is the single level part of the station where the operational vehicles and equipment are kept in a ready state to respond to incidents.
BA/Compressor room	This refers to the Breathing Apparatus (BA) cleaning room, which normally contains a compressor used to refill air cylinders.
Chief Fire Officer (CFO)	The person employed (or volunteering) to be in charge of a fire district.
Crew room	Usually refers to areas such as a kitchen space, lounge area, quiet spaces and TV room.
Fire appliance	Any vehicle used to respond to fires. They are typically referred to by a type to denote their performance and capabilities (Type 2, Type 4 etc.).
Muster bay	Area within the station where attending employees assemble to gather appropriate personal protective equipment (PPE) prior to attending an incident. (e.g. locker bay where PPE is kept).
Watch room	This refers to the operational office, in volunteer stations this typically contains the IT equipment where the alarm and turnout information is received and dispatched from within the station. This room may be occupied in a full time station, but will be intermittently occupied in a volunteer station.

Record of amendments

Date	Brief description of amendment

Contents

Part 1. General

1.1. Types of fire station

Within New Zealand, the Fire Service operates out of the following types of fire station:

- **Career stations:** These are typically located within urban areas, and firefighters are stationed there on a full-time basis. These sites include sleeping facilities.
- **Composite stations:** These stations comprise both career and volunteer firefighters, and are typically provided in larger towns or on the perimeter of cities. These sites include sleeping facilities.
- **Volunteer stations:** Within the majority of rural towns the Fire Service operates through volunteer brigades, whereby the residents respond to incidents within their local area. As the volunteers respond from their place of work or home, these sites rarely include sleeping facilities.

1.2. Fire design

The key element that impacts on the fire design is the presence of sleeping facilities for firefighters. While the architectural detail of each station will be different, the fundamental configuration of a fire station consists of a number of 'blocks'.

The fire design philosophy is that where the building contains one or more sleeping blocks, these will be fire separated from the balance of the station with a fire protected egress route (i.e. either egress directly to a safe place or via a safe path).

Whether or not sleeping is provided, the appliance bay block is to be smoke separated from the brigade facilities block.

This is shown diagrammatically below:

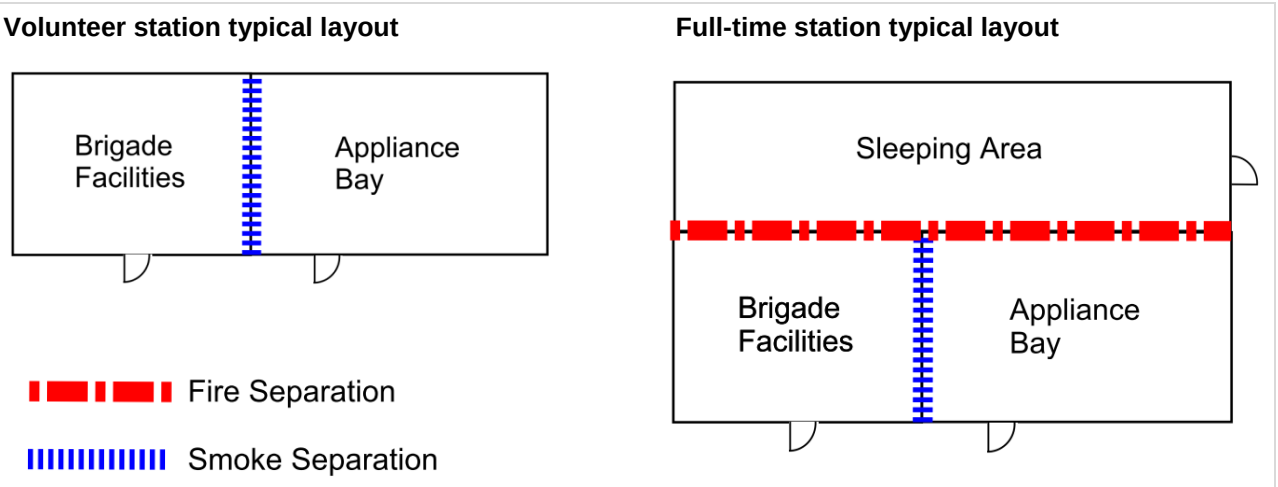


Figure 1.2: Generalised fire engineering layout for fire stations

While Figure 1.2 shows separate egress doors from each block, egress from multiple blocks may also be via a common safe path.

The underlying logic is that occupants of each block are not required to egress through an adjacent block.

1.3. Using this design manual (fire)

The process for using this manual shall be as follows:

Step 1: Determine the input parameters

a) Establish the relevant building measurements (these will include building height, floor plans, wall openings and distances to relevant boundaries).

b) Work out the occupant loads for the relevant building spaces (refer to Paragraph 1.5).

Step 2: Satisfy the fire safety requirements

Satisfy the *fire* safety requirements of this manual (Parts 2-7), based on the *occupant loads* and on the *building's* dimensions and features where required.

> **Comment**:
> Applying the manual depends largely on the basic building measurements as above. Therefore, this should be determined as accurately as possible before using this document.

1.4. Alterations and changes of use to buildings

The *building work* itself shall comply fully with this design manual (fire).

If this manual is being used where an existing *building* is undergoing:

- an alteration, Parts 1, 2, 3 and 4 of this design manual (fire) shall be considered to the extent necessary for compliance with the *Building Act*
- a change of use, Parts 1, 2, 3, 4, 5 and 6 of this design manual (fire) shall be considered to the extent necessary for compliance with the *Building Act.*

Where compliance with the requirements of the *Building Act* for alterations and changes of use is not fully demonstrated through using this design manual (fire), the level of assessment required shall be agreed with the *building consent authority* or *territorial authority*. Given the importance level of fire stations, the minimum level of assessment is expected to be a gap assessment.

> **Comment**:
>
> The extent of assessment should be consistent with a number of risk factors including:
>
> a) Age of the *building.*
> b) *Importance level* of the *building (IL4).*
> c) Extent of the alteration.
> d) Information held on file.

1.5. Calculating occupant loads

Occupant load

1.5.1. The *occupant load* shall be determined from the number of people in each space of the *building*. The *occupant load* may need to be evaluated not only for each block within the building, but also for:

a) a space or open floor area involving one or more activities

b) a single *firecell*, and

c) each floor within a *firecell*.

Occupant densities

1.5.2. *Occupant loads* shall be calculated from the occupant densities given in Table 1.1, based on the floor area of the part of the *building* housing the activity.

The floor area to be used is the total floor area (except where Paragraph 1.5.3 applies) including that occupied by internal partitions and permanent *fixtures*, and if a *building* space has alternative activity uses, the activity having the greatest occupant density shall be used. If an activity is not specifically described in Table 1.1, the nearest reasonable description shall be used.

Comment:
When using Table 1.1 to calculate the *occupant load*, note that for the part of the *building* housing the activity, the occupant densities in Table 1.1 already allow for a proportion of the floor area appropriate to the activity being occupied by furniture, partitions, *fixtures* and associated equipment.

Table 1.1: Occupant densities for fire stations

Activity	Occupant density (m2/person)
Meeting rooms	2.5
Offices	10
Kitchens	10
Reception areas	10
Workrooms, workshops	5
Spaces with loose seating and tables	1.1
Boiler rooms, plant rooms	30
Parking buildings, garages	50

Sleeping accommodation firecells

1.5.3. The *occupant load* of sleeping area firecells shall be taken as the number of bed spaces.

Comment:

In this document, the term ‘beds’ is used to denote the number of people expected to be sleeping in the *firecell*. Therefore, a double bed counts as two beds, a tier of three single bunks (one above another) counts as three beds and four reclining chairs count as four beds.

The number of beds depends on the individual layout in every case. Clearly dormitories will have a far greater number of beds within any given area than single bedrooms.

Avoiding duplication

1.5.4. Duplication shall be avoided by:

a) Ensuring that, where people may be involved in more than one activity, they are counted only once.

b) Not including an *occupant load* for areas such as *exitways*, lift lobbies or sanitary facilities that are used intermittently by people already counted elsewhere in the *building*.

c) While the occupant load of sleeping area firecells is required to be determined to assess the means of escape from the sleeping area firecell, these occupants are the same as those in the operational area of the station. Therefore they should not be counted twice when determining the total occupant load of the building.

Justification for exceptions

1.5.5. If, in a particular situation, the *occupant load* derived from Table 1.1 is less than that which will occur, the basis of any proposal for a lesser *occupant load* shall be substantiated to the *building consent authority*.

1.5.6. If the maximum *occupant load* is greater than that calculated from Table 1.1, the higher number shall be used as the basis for the *fire* safety design and will need to be justified to the *building consent authority.*

Part 2. Firecells, fire safety systems, fire resistance ratings

2.1. Provision of firecells

Firecell floor area limits

2.1.1. When less than 15m from a *relevant boundary*, the floor area of an unsprinklered *firecell* shall not exceed 5000m^2.

2.1.2. If a *firecell* is 15m or more from a *relevant boundary*, or is sprinkler protected, except when *risk groups* require subdivision or other area limitations are imposed by this design manual (fire), the *firecell* floor area may be unlimited.

2.2. Fire safety systems

Systems required for this *risk group*

2.2.1. The *fire safety systems* for *firecells* required for this *risk group* shall be as follows:

For buildings that...	Systems required:
include sleeping accommodation	a) Type 7 alarm system. b) Type 18 *building fire* hydrant system, unless the Fire Service hose run distance from Fire Service vehicular access to any point on any floor is less than 75m. c) A minimum of one in ground fire hydrant within the site. This is required for training purposes rather than Building Code compliance.
don't include sleeping accommodation	a) Type 3 alarm system. A direct connection to the Fire Service is required in all buildings. b) Type 18 *building fire* hydrant system, unless the Fire Service hose run distance from Fire Service vehicular access to any point on any floor is less than 75m. c) A minimum of one in ground fire hydrant within the site. This is required for training purposes rather than Building Code compliance. **Comment**: The direct connection to the Fire Service may be either via a fire alarm monitoring company or via an alternative approved means.
have an escape height exceeding 4m	**In addition to** the requirements above: a) Type 9 smoke control in air handling systems. **Comment**: For buildings not including sleeping accommodation, a Type 6 sprinkler system may be substituted for the Type 3 system where property protection may be wanted.

2.2.2. *Fire safety system* types shall be as defined in Table 2.1.

2.2.3. The alarm systems required in a *fire station* shall be interconnected to alert all *building* occupants in the event of *fire*.

Table 2.1: Fire safety systems specified in this manual		
Type of system	**System description**	**Relevant Standards for installation**
3	Heat detection system with manual call points	NZS 4512
4	Smoke detection and alarm system with manual call points	NZS 4512
6	Automatic fire sprinkler system (Appendix B modified)	NZS 4541
7	Automatic fire sprinkler system with smoke detection and alarm system	NZS 4541, NZS 4512
9	Smoke control in air handling system	AS/NZS 1668.1
18	Building fire hydrant system	NZS 4510

2.3. Fire resistance ratings (FRR)

FRR values

2.3.1. Unless explicitly stated otherwise in this manual, the *fire resistance ratings* (*FRRs*) that apply to fire stations shall be as follows:

- *Life rating* = 60 minutes.
  This applies to *fire* rating requirements in "Part 3: Means of escape" and "Part 4: Control of internal fire and smoke spread".
- *Property rating* = 120 minutes.
  This applies to *fire* rating requirements in "Part 5: Control of external fire spread".

Structural elements in a single storey *building* need not be *fire* rated if *FRR*s are not required for any other reason.

Comment: Throughout this manual, minimum FRRs are specified for particular situations. It is therefore essential to check for specific requirements. Alternatively, the property rating may be calculated using the methodology outlined in C/VM2.

2.3.2. If a *fire* sprinkler system is provided, the *FRRs* that apply to fire stations shall be:

- *Life rating* = 30 minutes
- *Property rating* = 60 minutes

General requirements for FRRs

2.3.3. *FRRs* shall apply to the sides of *primary* and *secondary elements* that are exposed to *fire*.

2.3.4. When different *FRRs* apply on each side of a *fire separation*, being a wall, the higher rating shall apply to both sides.

2.3.5. Floors shall have an *FRR* for exposure from the underside.

2.3.6. The *FRR* of a *primary element* integral with a *fire separation* shall be no less than that of the *fire separation*.

2.3.7. Except as required by Paragraph 4.3.3, areas of *external wall* not permitted to be *unprotected areas* shall be rated for *fire* exposure from within a *firecell*.

General requirements for FRRs (continued)

2.3.8. Areas of *external wall* not permitted to be *unprotected areas* shall be rated for *fire* exposure from both sides equally where:

a) walls are within 1.0m of the relevant boundary, or

b) the building height is more than 10m, or

c) the final exit is two or more floor levels below in any building with sleeping areas.

2.3.9. *Building elements* shall have an *FRR* of no less than that of any *building element* to which they provide support within the *firecell* or in any adjacent *firecell*.

2.3.10. Structural framing members connected to *building elements* with an *FRR* shall be rated at no less than the elements to which they are connected, or alternatively their connections and supports shall be designed so that their collapse during *fire* will not cause collapse of the *fire* rated elements.

Applying insulation component in FRR

2.3.11. *Insulation* ratings shall apply to:

a) all *fire separations*, except as noted below in Paragraph 2.3.12, and

b) parts of *external walls* that are not permitted to be *unprotected areas*, and

c) parts of *external walls* that are within 2.0m of an external *exitway* where it is a single *means of escape from fire* (see Paragraph 3.11.2).

2.3.12. *Insulation* ratings are not required to apply to:

a) glazing installed in accordance with Paragraph 4.2, or

b) where sprinklers are installed throughout the building in accordance with NZS 4541 as appropriate, or

c) fire stops in accordance with Paragraph 4.4.5, or

d) fire resisting glazing in accordance with Paragraph 5.4.3.

Part 3. Means of escape

3.1. General principles

3.1.1. All *buildings* shall have *means of escape from fire* which include *escape routes*. An *escape route* (see Figure 3.1) shall provide protection to any occupant escaping to a *safe place* from a *fire* within a *building*.

3.1.2. The components of an *escape route*, in ascending order of protection, are the *open paths*, *exitways* (these may comprise *smoke lobbies* and *safe paths*) and *final exits* (see Figure 3.1). Two or more of these components will be necessary, depending on the total *travel distance*. An *escape route* shall not pass from a higher to lower level of protection in the direction of escape.

3.1.3. Provided the allowable lengths of *open paths* are not exceeded, an *escape route* may comprise only an *open path* and *final exit*.

3.1.4. *Escape routes* shall comply with NZBC D1. Ramps, stairs, ladders, landings, *handrails*, doors, vision panels and openings shall comply with Acceptable Solution D1/AS1.

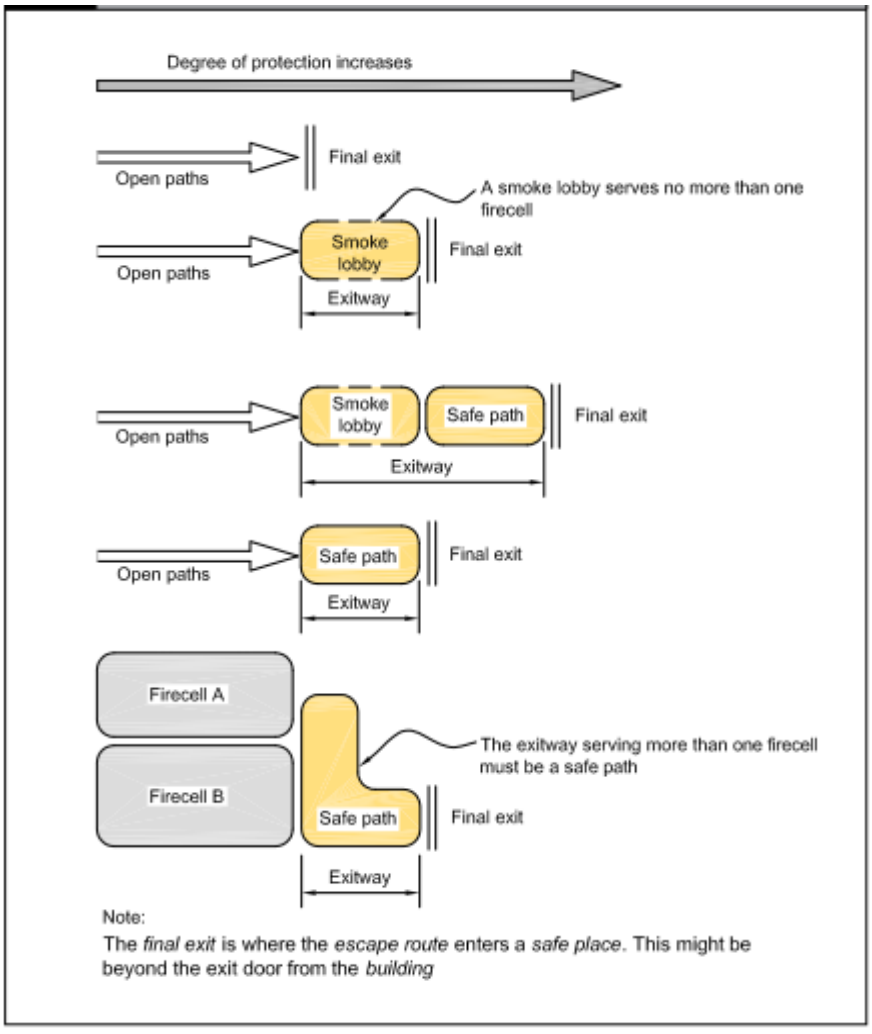


Figure 3.1: Egress routes

3.2. Number of escape routes

3.2.1. Except where Paragraph 3.13 allows the use of single *escape routes*, every *occupied space* in a *building* shall be served by two or more *escape routes*, in accordance with Paragraph 3.2.2 below (see Figure 3.2).

3.2.2. The minimum number of *escape routes* from a firecell or floor level, except in those situations where single *escape routes* are permitted (see Paragraph 3.13), shall be two.

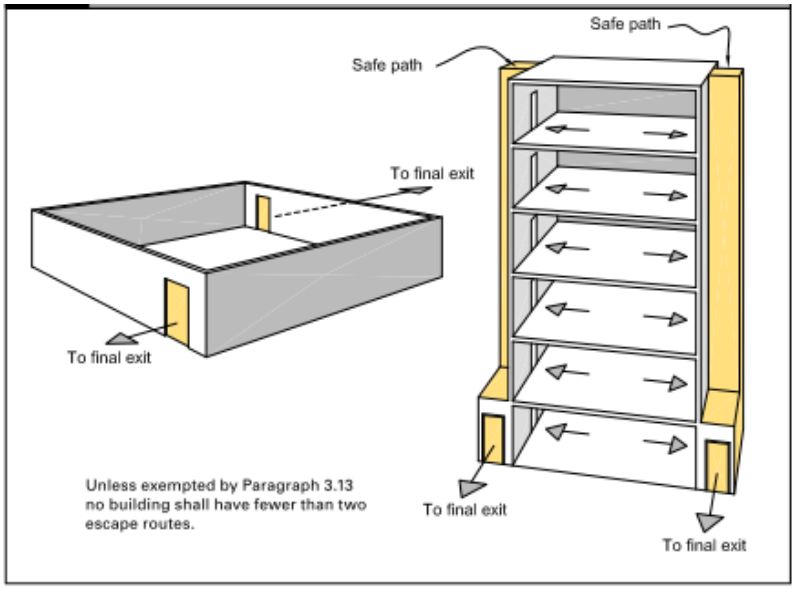


Figure 3.2: Minimum number of escape routes

3.3. Height and width of escape routes

Height requirements

3.3.1. Height requirements within *escape routes* shall be as follows:

a) The clear height shall be no less than 2100mm across the full width, except that isolated ceiling fittings not exceeding 200mm in diameter may project downwards to reduce this clearance by no more than 100mm; and

b) Any door opening within, or giving access to, any *escape route* shall have a clear height of no less than 1955mm for the required width of the opening.

Width requirements

3.3.2. Width requirements within *escape routes* shall be as follows:

a) **Width of all available escape routes**: The total combined width of all available *escape routes* shall allow 7mm/person for horizontal travel and 9mm/person for vertical travel.

b) **Not an accessible route or accessible stair**: For all new buildings, if the *escape route* is not an *accessible route or accessible stairs*, it shall have a minimum width of 850mm for horizontal travel and 1000mm for vertical travel.

For existing buildings, if the escape route is not an accessible route or accessible stairs, the *occupant load* is less than 50, and the *escape route* is within an *open path*, its width may be reduced to 700mm for horizontal travel and 850mm for vertical travel.

3.3.2 Escape route width (continued)

c) **Accessible routes and accessible stairs**: If the escape route is an *accessible route or accessible stairs*, it shall have a minimum width of 1200mm for horizontal travel and 1100mm for vertical travel.

d) **Provision for unusable escape routes**: Except where *dead ends* and single *escape routes* are permitted, the total required width in unsprinklered *firecells* shall still be available should the widest of the *escape routes* be unusable due to the location of the *fire* or any other reason (see Figure 3.3).

> **Comment**: See paragraph 3.14.4 for allowable widths of doors.
>
> Requirement d) may be achieved either by providing additional *escape routes* or by making the minimum required number wider.

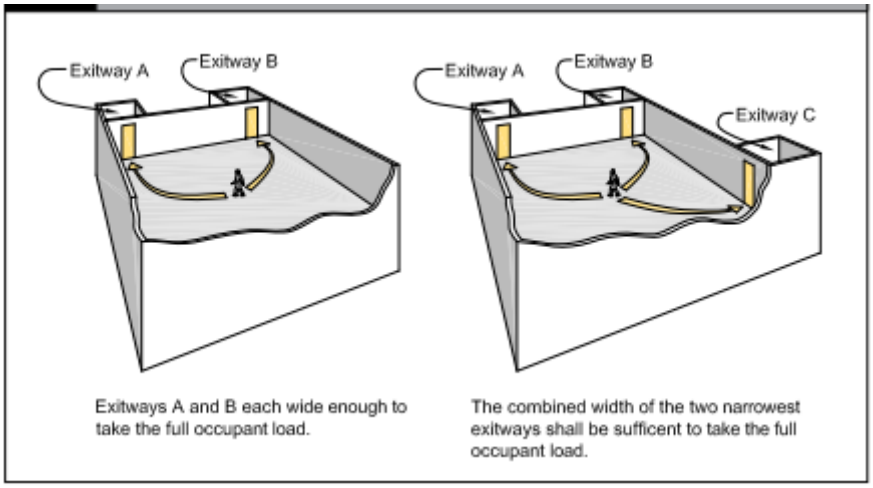


Figure 3.3: Exitway widths in unsprinklered firecells

e) **Sprinkler concession**: If the *firecell* is sprinklered, requirement d) does not apply (i.e. it is not necessary to provide **extra** width to allow for the possibility that one *escape route* may be unusable).

f) **Horizontal escape route with a single direction of escape**: This shall be wide enough at any point to take the full ***occupant** load* from all contributing *occupied spaces*. However, the *escape route* may have its width increased progressively as it passes the exit from each *occupied space* (see Figure 3.4).

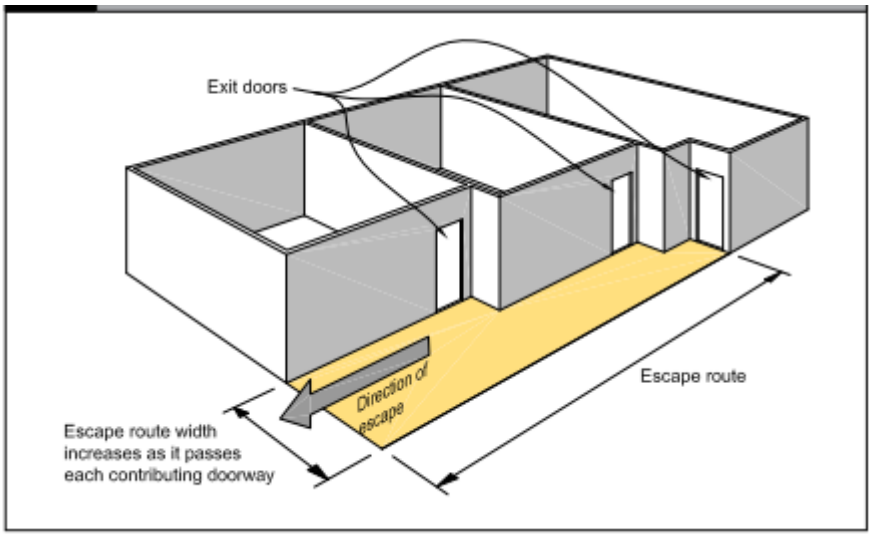


Figure 3.4: Increase in width for horizontal escape routes having a single direction of escape

3.3.2 Escape route width (continued)

g) **Horizontal escape route with two directions of escape**: This shall have sufficient width for the full length of the route to allow for the *occupant load* from all contributing *occupied spaces*. However, this shall not apply if the requirements of Paragraph 3.7.4 e) are met for escape through adjacent *firecells*.

h) **Intermediate floors**: For *firecells* containing an *intermediate floor*, both the vertical and horizontal parts of the *open path escape route* shall be wide enough to take the full *occupant load* from all contributing *occupied spaces*.

i) **Vertical safe paths serving firecells at more than one level**: These shall have minimum widths at any point determined only by the largest total *occupant load* from any level passing that point in the direction of escape.

> **Comment:** In vertical *safe paths* it is not necessary to provide for cumulative *occupant load* as the *escape route* passes each floor level.

j) **Basements**: If an *escape route* from upper floors is joined at the level of a *final exit* by an *escape route* from a basement or lower floors, the *escape route* width at the point they combine shall be increased to accommodate the *occupant loads* from both directions (see Figure 3.5).

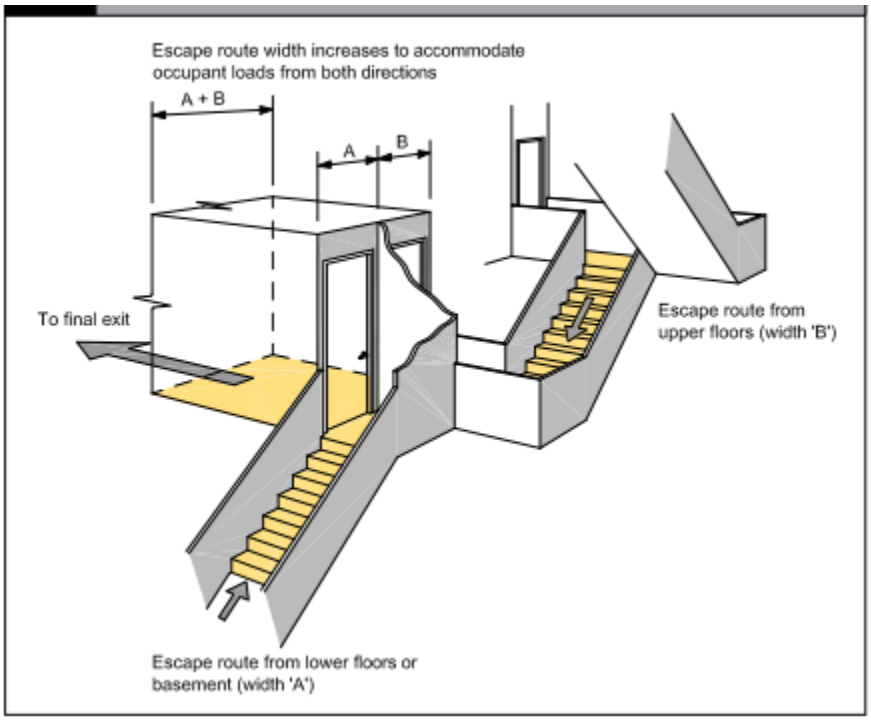


Figure 3.5: Escape routes from lower and upper floors

k) **Ladders**: The width requirements of Paragraph 3.3.2 b) do not apply to ladders where their use is permitted in this document.

Handrails and limitations to stairway widths

3.3.3. For safe evacuation on stairs, all *stairways* shall have at least one *handrail*. Furthermore, *stairways* in *escape routes* wider than:

a) 1500mm shall have *handrails* on both sides, and

b) 2000mm (see Figure 3.6) shall also be provided with intermediate *handrails* that are equally spaced and that provide a width not greater than 1500mm for each section of the *stairway*.

Comment: Acceptable solution D1/AS1 requires all *stairways* to have at least one *handrail*, and also requires *accessible* stairs to have *handrails* on both sides.

Curved and spiral stairs

3.3.4. If curved or spiral stairs form part of an *escape route*, the required width shall be that described as 'walking area' in Acceptable Solution D1/AS1.

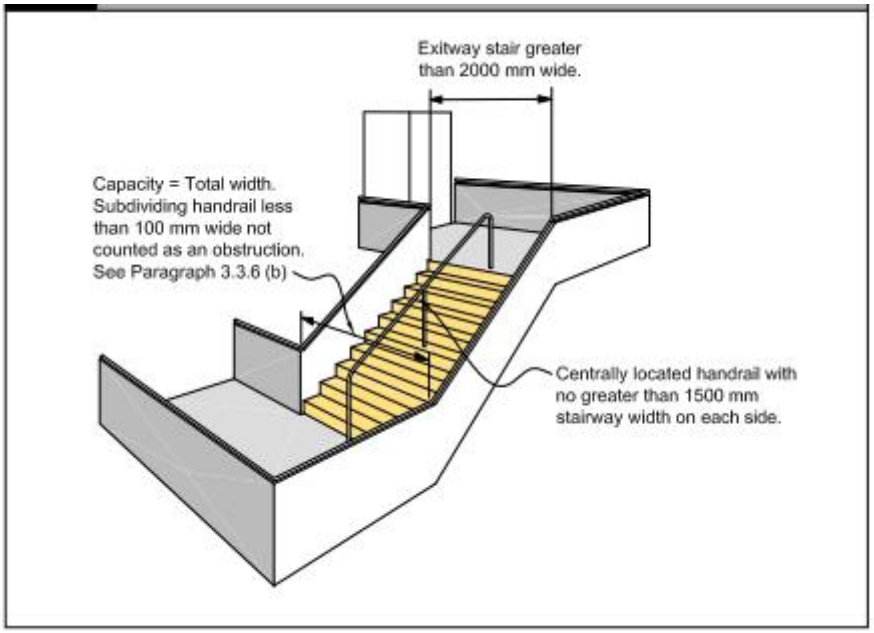


Figure 3.6: Limitations to stairway width

Obstructions

3.3.5. Except as permitted by Paragraph 3.14.6, *escape routes* shall not be obstructed by access control systems such as automatic sliding doors, chains, turnstiles, sliding bars, crowd control barriers or similar devices. The following minor obstructions are acceptable within the width of an *escape route*:

a) Minor projections complying with the requirements of Acceptable Solution D1/AS1 such as signs, switches, alarm sounders and similar projections.

b) Handrails complying with Acceptable Solution D1/AS1, projecting no more than 100mm into the width, and *handrails* subdividing wide *stairways* that reduce the width by no more than 100mm (see Paragraph 3.3.3).

c) Door assemblies that reduce the width of an *exitway* by no more than 125mm when the door is fully open.

Comment: The 125mm obstruction allows for projecting parts of the door frame assembly, the thickness of the door when open and similar acceptable obstructions.

3.4. Length of escape routes

General requirements

3.4.1. An *escape route* may be any length, but:

a) The lengths of *dead ends* and total *open paths* shall not exceed the distances given in Table 3.1, adjusted as necessary for reductions on:
   i) *intermediate floors* (see Paragraph 3.4.3), and
   ii) stairs and ladders (see Paragraph 3.4.4).

b) If the distance to the *final exit* exceeds the allowable length for the total *open path*, the remainder of the *escape route* shall be a *safe path*. (See Paragraph 3.9.6 for *safe path length restrictions within a single floor level.)*

Table 3.1: Travel distances on escape routes

Path	Type 3 system	Type 6 or Type 7 system
Dead end open path	35m	40m
Total open path	75m	100m

Open path lengths

3.4.2. When determining *open path* lengths, including any *dead end*, the following shall apply:

a) **Start point**: The length shall be measured from no more than 1.0m from the most remote point in a space.

b) **Furniture and fittings**: Allowance shall be made for the *travel distance* around obstructions such as furniture, fittings and office equipment located in the *open path* (see Figure 3.7 (a)).
If the location of such obstructions is not known, the allowable *travel distance* shall be taken as the length plus the width of the space (see Figure 3.7 (b)).

c) **Multiple escape routes**: If two or more *escape routes* are required, *open path* lengths from any point on a floor to no fewer than two exits from the *firecell* shall not exceed the lengths specified in Table 3.1.

d) **Termination**: An *open path* ends either at:
   i) the start of an *exitway*, or
   ii) a *final exit*, or
   iii) the point where the *escape route* passes into an adjacent *firecell* on the same level (see paragraph 3.7.4.)

Open path lengths
(continued)

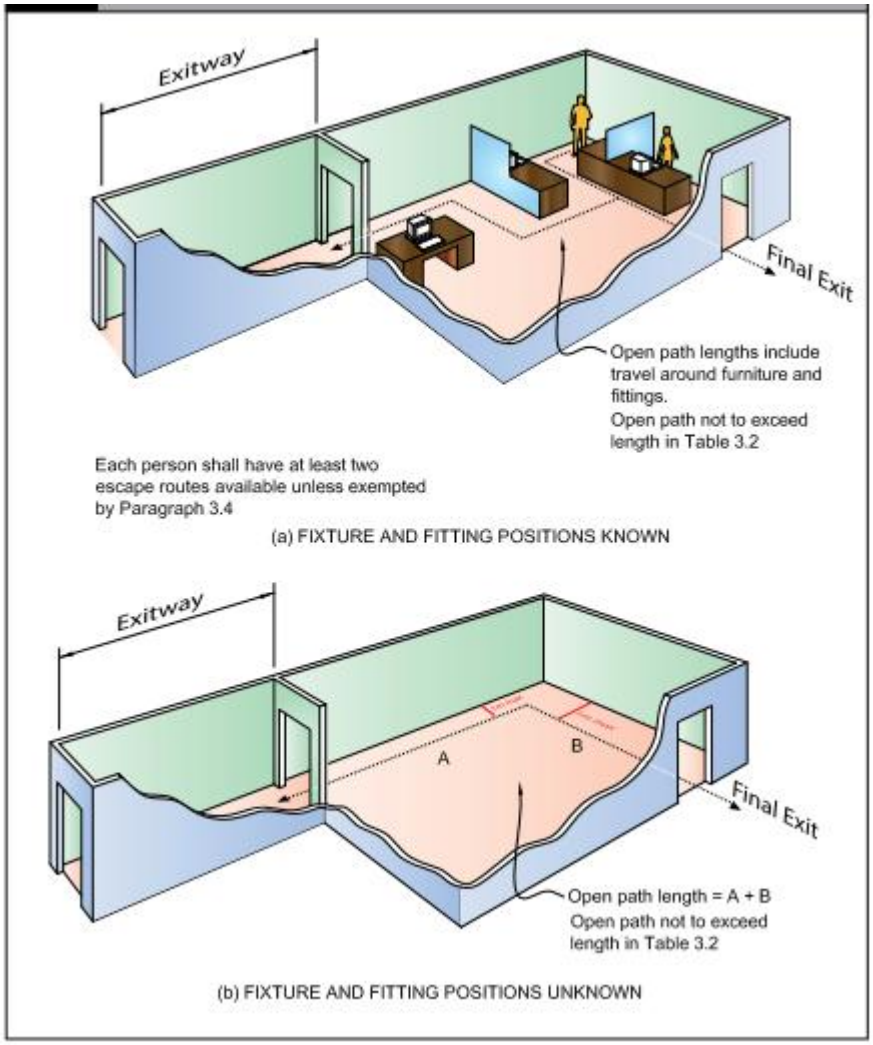


Figure 3.7: Length of open paths

Intermediate floors

3.4.3. On *intermediate floors* (see Figure 3.8) the *open path* length, for compliance with Table 3.1, shall be taken as 1.5 times the measured length. However, the length - as measured in accordance with Paragraph 3.4.2 c) - may be used if the *intermediate floor* is a *smokecell* and an *escape route* is available from the *intermediate floor* without passing through any lower space in the same *firecell*.

Comment: People on an *intermediate floor* may be exposed to smoke at an earlier stage than people on a full floor. Reduced *open path travel distances* mean reduced exposure time to smoke from the *fire*.

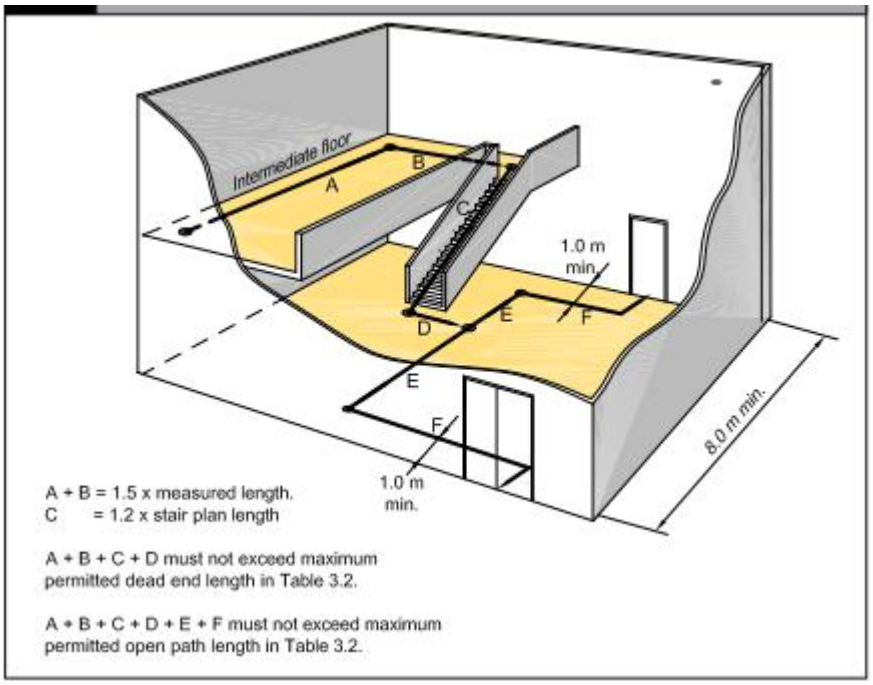


Figure 3.8: Intermediate floor open path lengths

Stairs and ladders

3.4.4. Stairs and ladders occurring in an *open path* (see Figure 3.9) shall have their *open path* length taken as:

a) **For straight and curved stairs**: The plan length measured on the stair centreline multiplied by 1.2, plus the plan length of each landing.

b) **For spiral stairs**: Twice the vertical height.

c) **For ladders**: Three times the vertical height.

Comment: It is acceptable to use two spiral stairs as part of the escape routes from such situations as an intermediate floor down to the firecell floor. Likewise, where ladders are permitted to serve such situations as maintenance platforms in industrial plant, two ladders may be used as the escape routes.

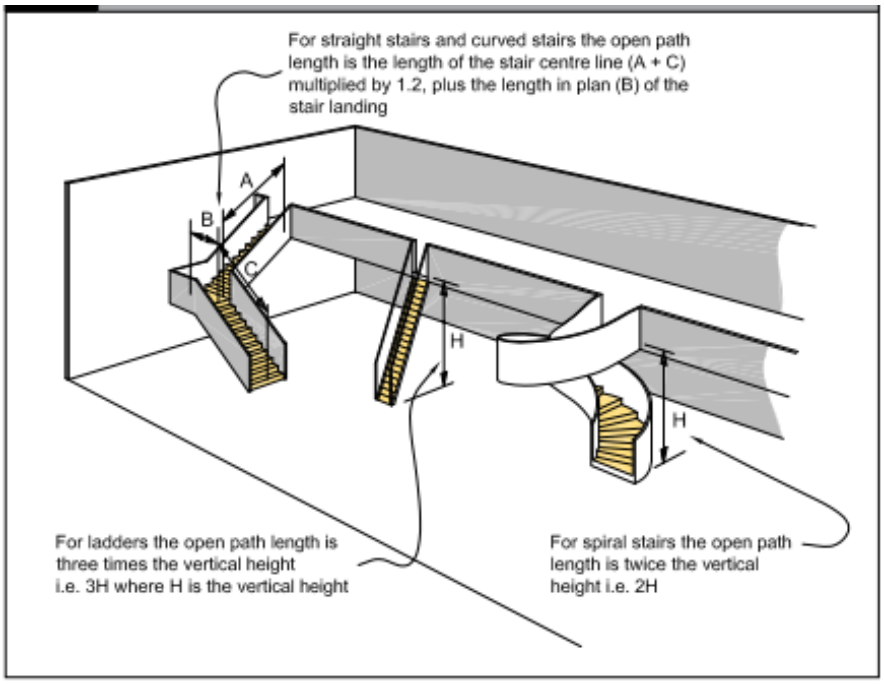


Figure 3.9: Stairs and ladders

Escape through adjoining building

3.4.5. Due to the requirement to remain operational following a disaster, escape via an adjacent building is not allowed for.

3.5. Escape from basements

Requirements

3.5.1. Except in cases where there are two or more *escape routes* serving only the *basement firecells,* and each *escape route* terminates in a *safe place*, *safe paths* serving *basement firecells* shall be preceded by a *smoke lobby* that shall have a plan area in accordance with Paragraph 3.9.2.

Single escape routes

3.5.2. A single *escape route* and *final exit* is acceptable from *basements* (see Figure 3.10) where, in addition to the requirements of Paragraph 3.13.1 and the *smoke lobby* requirements of Paragraph 3.5.1, there are no more than two *basement* floor levels.

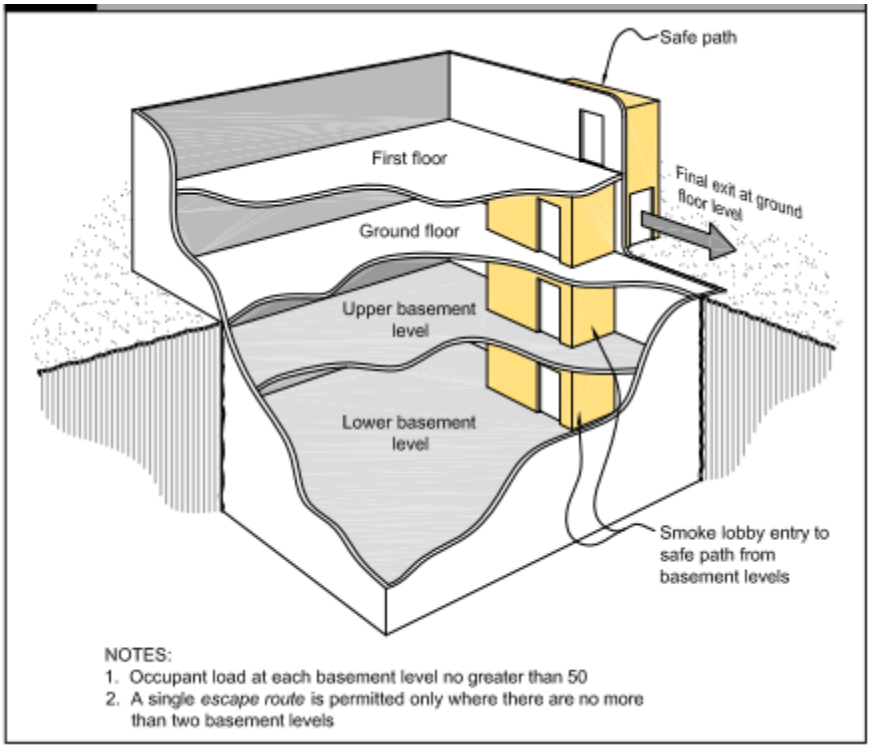


Figure 3.10: Single escape routes from basement levels

3.6. Open paths

Number and size

3.6.1. *Open paths* shall satisfy the specific requirements of Paragraphs 3.6.2 to 3.7 where they apply to a particular *building*.

Open path separation

3.6.2. If two or more *open paths* are required, they shall be separated from each other, and remain separated until reaching an *exitway* or *final exit* (see Figure 3.11). Separation shall be achieved by diverging (from the point where two *escape routes* are required) at an angle of no less than 90° until separated by:

a) a distance of at least 8.0m, or

b) *smoke separations* and *smoke control doors*.

Comment: If this separation or protection is not provided, the length of the *open path* is limited to that of a *dead end*. This is critical in planning single *stairway buildings,* as the *stairway* must be positioned within the *dead end travel distance* limits.

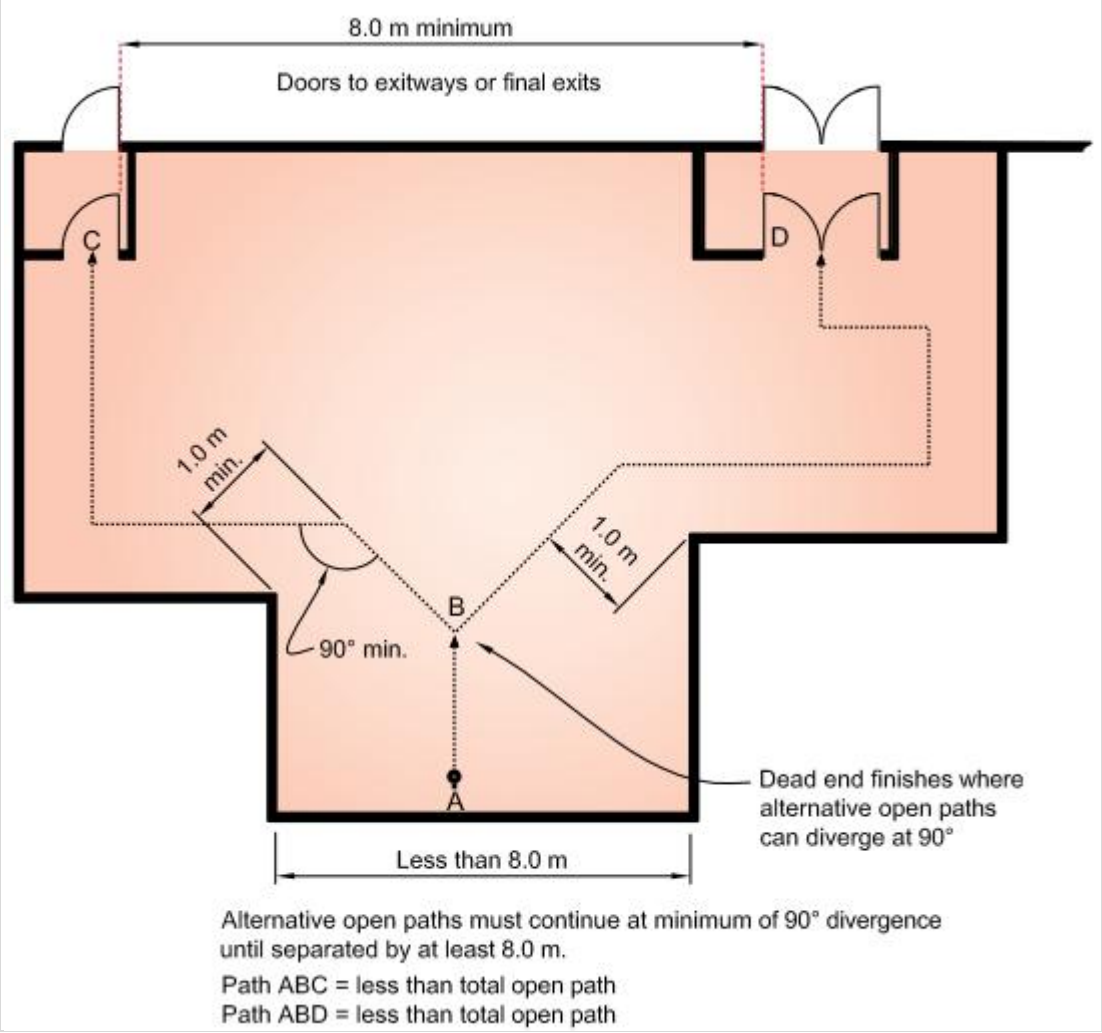


Figure 3.11: Open path separation

3.7. Special cases of open paths

Ramps

3.7.1. Where stairs are not used, changes in level on an *escape route* shall be formed as ramps and shall comply with Acceptable Solution D1/AS1.

Separate tenancy

3.7.2. This design manual (fire) does not allow for escape via a separate tenancy.

Open paths via unenclosed stairs

3.7.3. Unenclosed stairs in *escape routes* (stairs that are not *smoke* or *fire separated* from other spaces) shall not exceed a height of 4.0 m within the *firecell*. Where the height exceeds 4.0 m, the *escape route* from that level shall be a *safe path* until it reaches a *final exit*.

Passing into an adjacent firecell

3.7.4. An *open path* may pass into an adjacent *firecell* on the same level (see Figure 3.12) and recommence as a new *open path*, provided that:

a) All *firecells* on the *escape route* have no fewer than two directions of escape, separated as required by Paragraph 3.6.2; and

b) Adjacent *firecells* into which evacuation may take place have a floor area sufficient to accommodate not only their own occupants, but also the occupants from the adjacent *firecell*. This shall be calculated on the basis of the *occupant load* of the two *firecells*; and

c) Each *firecell* has at least one other *escape route* independent of the route into the adjacent *firecell*. This other route may be by way of a *final exit* or via a third *firecell*, provided that the exit from that third *firecell* is independent of exits from the other two *firecells*; and

d) The *escape route* does not pass through more than three *fire separations* before entering an *exitway* or *final exit*; and

e) The *escape route* width meets the requirements of Paragraph 3.3.2 for the *firecell* on the *escape route* that has the greatest *occupant load*.

Comments:

Open path lengths in each *firecell* are controlled by the requirements of Paragraph 3.4.2 for that *firecell*.

Refer to Paragraph 3.14.3 to determine whether doors between *firecells* need to be hung to swing both ways because escape may be in either direction, and Paragraph 3.14.8 for *hold-open device* requirements.

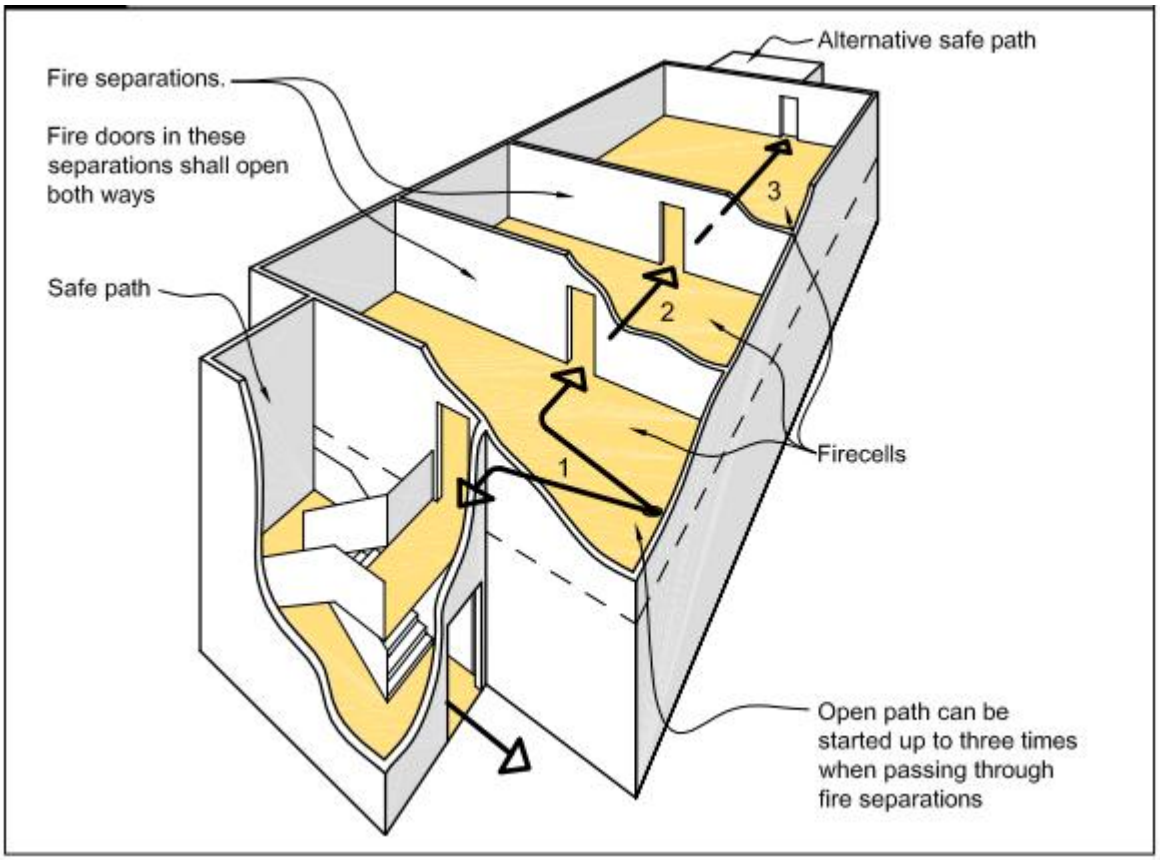


Figure 3.12: Open path passing into an adjacent firecell

Escape via an intermediate floor

3.7.5. An *open path* may pass from a *firecell* on to an *intermediate floor* and recommence as an *open path*, provided that:

a) Where two or more *escape routes* are required from that *firecell*, only one *escape route* shall be via the *intermediate floor*; and

b) The *intermediate floor* is served by at least two *escape routes*, separated as required by Paragraph 3.6.2 and terminating at separate *firecells*, *exitways* or *final exits* at the same level as the *intermediate floor*; and

c) The *intermediate floor open path* lengths shall not exceed the requirements of Paragraph 3.4.3.

3.8. Dead ends

No more than 50 occupants

3.8.1. A *dead end* shall not serve an *occupant load* greater than 50.

Ladders

3.8.2. The *escape route* from a *dead end* may be a ladder complying with Acceptable Solution D1/AS1 if:

- it serves only a support function, or
- it provides the same function in support of other *risk groups*, and
- the *occupant load* does not normally exceed four.

Ladders are not permitted as *escape routes* in any other circumstances (see also Paragraph 3.4.4).

3.9. Exitways

Definition

3.9.1. *Exitways* consist of *smoke lobbies* and *safe paths*.

Smoke lobby floor area

3.9.2. If a *smoke lobby* is required preceding a vertical *safe path* (see Paragraph 3.5.1 and Figure 3.13), its floor area shall be calculated for the *occupant load* using that *smoke lobby* by assuming that:

a) Part of the *occupant load* will be accommodated in the *stairway* vertical *safe path* between the level being considered and the next level in the direction of escape, with the remaining occupants accommodated in the *smoke lobby*, and

b) The occupant density for calculating the required holding area is 0.25m^2 per person in the *stairway*. The floor area shall be taken as:
- the area of the first landing, plus
- the plan area of the flights of stairs between the two floor levels, plus
- the areas of any intermediate landings.

Additional space shall be provided for door swings.

Comment: This paragraph does not call up a requirement for a *smoke lobby*, but when they are required by other parts of this design manual (fire), this Paragraph states how *smoke lobbies* are to be sized.

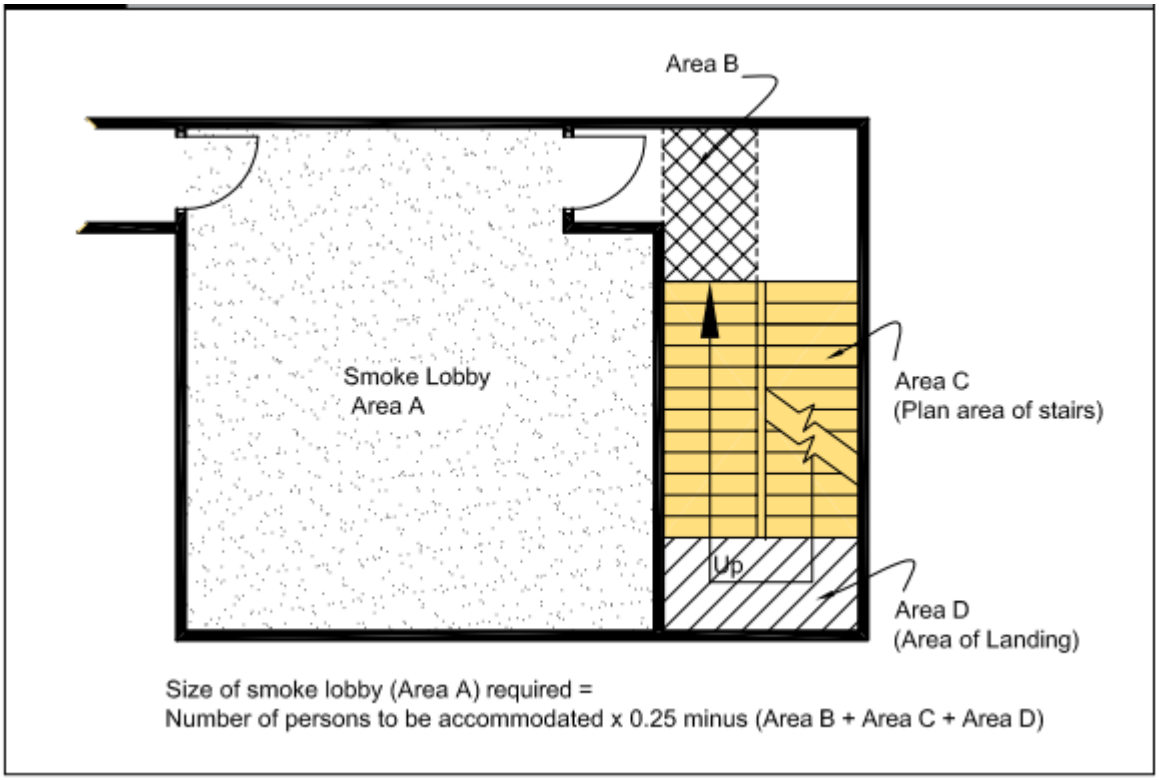


Figure 3.13: Sizing of smoke lobbies

Safe paths

3.9.3. *Escape routes* from *firecells* shall enter directly into an *exitway* or *final exit*.

3.9.4. *Safe paths* shall be separated from each other, and from all spaces by:

a) *fire separations*, or

b) if they are external to the *building*, by distance or appropriate *construction* (see Paragraph 3.11).

3.9.5. Except where the conditions for escape via an external *escape route* (see Paragraph 3.11) or successive *open paths* (see Paragraph 3.7.4) apply, exit doors from sleeping area *firecells* shall open directly onto a:

a) *horizontal safe path*, or

b) *final exit.*

Safe path length restrictions

3.9.6. There is no limit on the length of a vertical *safe path*. Horizontal *safe paths* shall be no longer than specified in Table 3.2.

Table 3.2: Travel distances on horizontal safe paths

Path	Type 3 system	Type 6 or Type 7 system
Single direction	25m	40m
Two or more directions	180m	Unlimited

Safe path termination

3.9.7. Horizontal *safe paths* shall terminate at any of the following:

a) the entrance to an internal *stairway* that is a separate *safe path*, or

b) an external balcony leading to either an open or enclosed *stairway*, or

c) an opening in an *external wall* that enters on to a bridge leading to an open or enclosed *stairway*, or

d) a *final exit*.

Safe path separation and glazing

3.9.8. The vertical and horizontal portions of internal *safe paths* shall be separated at every floor level by *fire separations* and *fire doors* with smoke control capability.

3.9.9. Glazing in *safe paths* shall comply with the *requirements* of Paragraph 4.2.

3.10. Control of exitway activities

Prohibited activities

3.10.1. *Exitways* shall not be used for:

a) any storage of goods, solid waste or solid waste containers, or

b) entry points to solid waste chutes, or

c) the location of furniture or other *combustibles*, or

d) storage of cloaks or linen, or

e) a cleaner's cupboard not *fire separated* from the *exitway*, or

f) the location of an electrical switchboard or similar, or

g) any activity (other than as permitted by Paragraph 3.10.2).

Permitted activities

3.10.2. Some activities are permitted in an *exitway* if:

a) an alternative *escape route* is available from all *firecells* served by the *safe path* in which the activities occur, and

b) the *escape route* is not impeded by the activity or the occupants involved in that activity, and

c) those activities:

i) are visible to users of the *exitway*, except in the case of *sanitary fixtures*

ii) exist only to provide support functions to the activities of the *risk group* served by the *exitway*, and

iii) can include, but are not limited to, a reception counter and toilet facilities.

Lifts

3.10.3. A passenger lift, but not a goods lift, may be located in a vertical *safe path* containing a *stairway*, provided the following conditions are satisfied:

a) The lift shaft and all its openings are located entirely within a single *firecell* containing the vertical *safe path*; and

b) Passenger access into and from the lift takes place entirely within the *safe path*; and

c) No other activity occurs within the vertical *safe path*; and

d) The lift machine room is a separate *firecell*, and the openings for lift ropes through the *fire separation* are as small as practicable, and any *penetrations*, such as for electrical cables, are *fire stopped* (see Paragraph 4.4 for *fire stopping*.)

3.10.4. Lift landings located in *open paths* (see Figure 3.14) shall either be within a *smokecell* separated from all other areas or have lift landing doors with smoke control capability.

This requirement does not apply if the *building* is protected with a Type 7 system or the lift shaft has a pressurisation system designed to AS 1668.1.

Lift doors shall be as specified in Paragraphs 4.14.3 and 4.14.11.

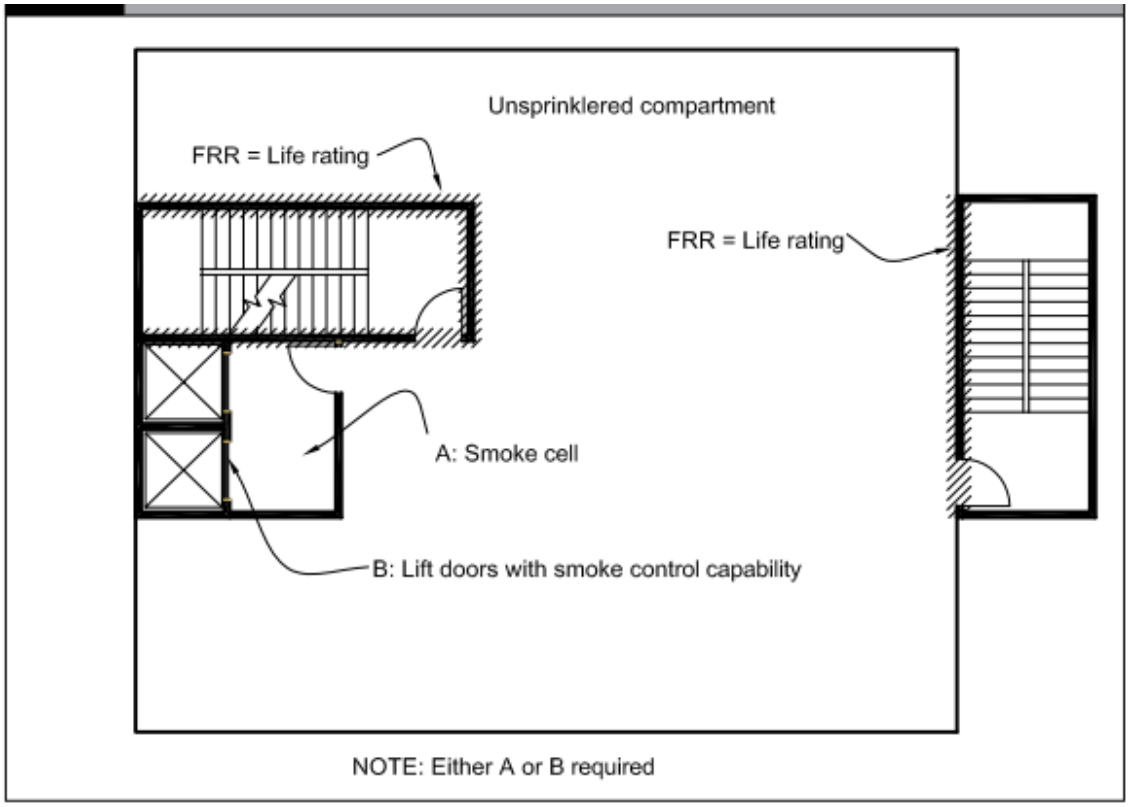


Figure 3.14: Lifts and smoke lobby on open paths

3.11. External escape routes

Safe path separation requirements

3.11.1. Where an *escape route* enters a space exposed to the open air (e.g. an open *stairway*, a balcony, across a roof or a ground level path), it shall meet the requirements for a *safe path* between that point and the *final exit*. *Safe path* separation requirements shall be achieved by providing either distance or *fire* rated *construction* between the *escape route* and adjacent *firecells*, as specified in Paragraphs 3.11.2 to 3.11.5.

> **Comment**: Balconies with one direction of escape comply with the requirements of a *safe path* if the *external wall* beside the balcony has no *unprotected areas* or the balcony is large enough to allow separation by distance from the *external wall* (see Paragraph 3.11.2). Balconies with two directions of escape from all *firecell* exits are also considered to be *safe paths*, even if the adjacent *external wall* has 100% *unprotected area*.

Separation by distance

3.11.2. Separation by *distance* shall be achieved by:

a) If there is only one direction of escape, roofs and *external walls* with no *unprotected areas* closer to an external *escape route* than:
   i) 2.0 m if unsprinklered (see Figure 3.15), or
   ii) 1.0 m if all *firecells* passed by the external *escape route* are sprinklered; or

> **Comment**: This provision is to limit heat radiation exposure to occupants who have only one direction of escape. Therefore the limiting distances apply horizontally to both sides of the *escape route*.

b) Locating the escape route so that it diverges from external walls (see Paragraph 3.11.4 a); or

c) Providing alternative directions of escape from the point where the escape route passes through an external wall and becomes an external escape route (see Paragraph 3.11.4 b).

3.11.3. If the distance separating *external walls* or roofs from an external *dead end escape route* is less than permitted by Paragraph 3.11.2, those walls and roofs shall comply with the *FRR* requirements of Paragraphs 5.3 and 5.7.3 to 5.7.5.

Glazing shall comply with Paragraph 4.2.

3.11.4. For an *escape route* that passes through an opening in an *external wall*, the *external wall* need not be *fire* rated if:

a) The direction of escape to a single *final exit* diverges from the *external wall* at an angle of no less than 45° in plan, or

b) The directions of escape to alternative *final exits* diverge from each other at an angle of no less than 90° in plan and those directions of escape do not travel past any *firecell* for a distance of more than 5.0 m.

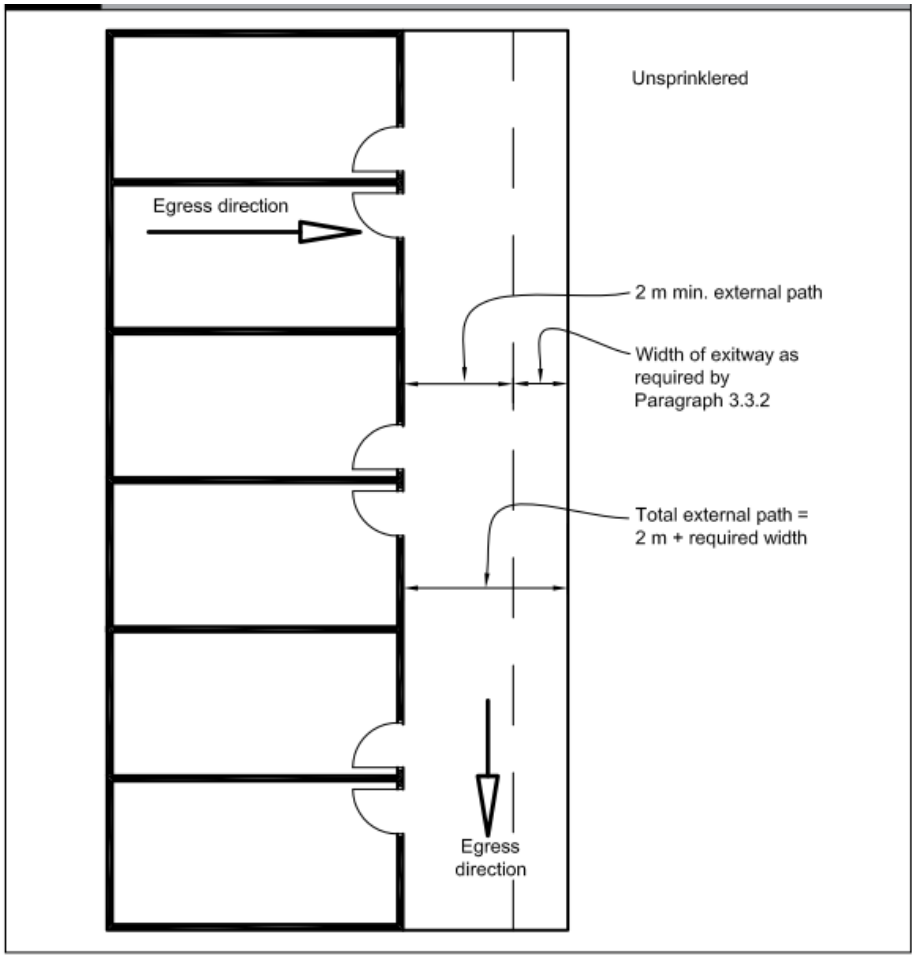


Figure 3.15: External escape routes

Separation by fire rated construction

3.11.5. Except where the separation distance requirements of Paragraph 3.11.2 are achieved:

a) *External walls* and roofs adjacent to external *escape routes* shall comply with the *FRR* requirements of Paragraphs 5.3 and 5.7 and shall have no *unprotected areas*, except that glazing for *safe paths* complying with Paragraph 4.2 shall be permitted; and

b) If the *escape route* is a balcony with a single direction of escape, and the vertical distance between the underside of the balcony and the closest *unprotected area* in the *external wall* below is less than 5.0m (see Figure 3.16), balcony barriers shall:

i) have no openings, and

ii) be protected with a material having a *Group Number* of no greater than 2; and

> **Comment**: See Verification Method C/VM2 Appendix A for method of assigning the *Group Number.*

c) If the vertical separation between the undersides of an external *escape route* and *unprotected areas* in the *external wall* below is less than 5.0m:

i) the floor of an external *escape route* closer to an *external wall* than required by Paragraph 3.11.2 shall have an *FRR* of no less than required by Paragraph 2.3, and

> **Comment**: If the *escape route* is a balcony with two directions of escape, the *external wall* need not be a *fire separation* and the requirements for the floor of the balcony c) i) and the balcony b) do not apply.

ii) treads and risers of stairs on external escape routes shall either be constructed from a material with a critical radiant flux of no less than 2.2 kW/m^2 or shall be protected on the underside with a material having a Group Number of no greater than 2; and

d) If the escape route comprises external horizontal and internal vertical safe paths, a smoke separation shall be provided between them.

Ventilation openings

3.11.6. The open area of a balcony or bridge shall be no less than 50% of the balcony floor area, and shall be evenly distributed along the open sides and any approach ramp. Where an *escape route* on a balcony is served by an open *stairway*, similar ventilation shall be provided on the *stairway*.

Open sides shall not be enclosed above a height of 1100mm from the floor, except that a fixed open grille may be used if it provides the required free air space.

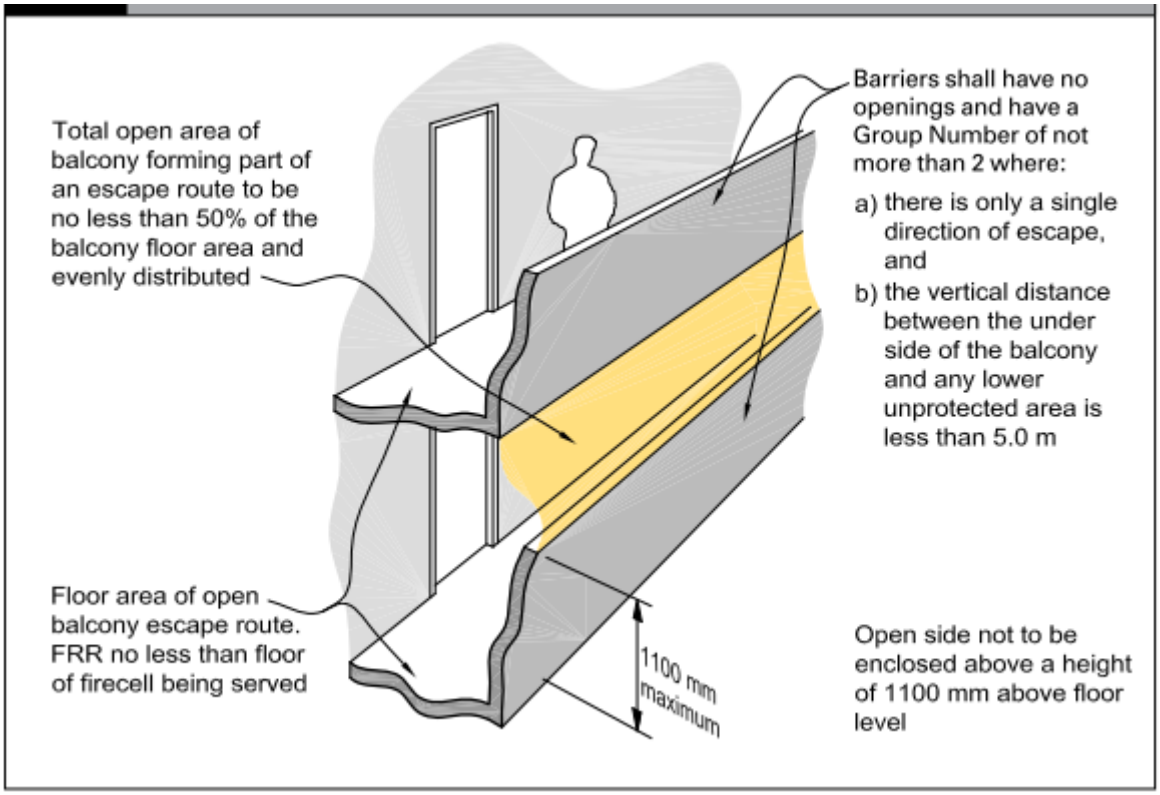


Figure 3.16: Open balconies

Barriers

3.11.7. Changes in *exitway* floor level, other than in the direction of travel, shall have barriers that comply with Acceptable Solution F4/AS1.

3.12. Final exits

Final exit separation

3.12.1. *Final exits* that open onto the same *safe place* shall be spaced no closer than 5.0m centre to centre. This applies to both internal and external *exitways*.

> **Comment**: This provision allows quick dispersal and reduces the risk of a crowd blocking a *final exit*.

3.13. Single escape routes

Requirements

3.13.1. Single *escape routes* shall only be permitted if:

a) The *open path* length does not exceed the limits specified in Table 3.2; and

b) The total *occupant load* from all *firecells* on each level served by the *escape route* is no greater than 50; and

c) The *escape height* is no greater than:
   i) 10m if unsprinklered, or
   ii) 25m if sprinklered; and

d) In buildings with more than two floors, the vertical safe path is preceded by a smoke lobby on all floors except the topmost floor (refer to Paragraph 3.9.2 for sizing of the smoke lobby); and

e) There are no more than 2 basement levels below ground and the vertical safe path from the basement levels is preceded by a smoke lobby (see Figure 3.10).

3.13.2. A single *escape route* from sleeping area *firecells* is permitted provided that, in addition to the requirements of Paragraph 3.13.1:

a) The *escape route* within each sleeping area *firecell* terminates at a *final exit* or opens onto a *safe path* that complies with the requirements of Paragraphs 3.9.4 to 3.9.11; and

b) The particular requirements for *stairways*, balconies and split level *exitways*, given in Paragraphs 3.7.3 and 3.13.3, are satisfied; and

c) The length of any *safe path* on a floor does not exceed the maximum *dead end* length permitted by Table 3.1.

Balconies, bridges and external stairways

3.13.3. Balconies, bridges and external stairways may be part of a single external escape route where:

a) The escape height is no greater than 16m if unsprinklered, or 25m if sprinklered; and

b) The escape route on the balcony, bridge and stairway meets the requirements of Paragraph 3.11 for protection, construction and ventilation; and

c) The length of any bridge between the external wall and stairway is no less than 3.0m.

3.14. Doors subdividing escape routes

Door closers and latching

3.14.1. Except as permitted by Paragraph 3.14.6 (automatic doors and access control systems), doors on *escape routes* shall satisfy the following requirements:

a) They shall be hinged or pivoted on one vertical edge only, except that sliding doors may be used where the space, including an *exitway*, has an *occupant load* of less than 20. Roller shutter doors or tilt doors shall not be used as *escape route* width except in an intermittently *occupied space* where the roller shutter door is the only *access route* and is open at all times the space is occupied; and

b) *Fire* and *smoke control doors* shall be self-closing, and the self-closing device shall either be:
   i) active at all times, or
   ii) activated by releasing a *hold-open device* in response to operation of a smoke detector (see Paragraph 3.14.9), or
   iii) a self-closer that is activated by operation of a smoke detector but allows the door to swing freely at other times. The smoke detector requirements shall be the same as for a *hold-open device* (see Paragraph 3.14.9); and

c) If such doors are required to be secure, they shall be fitted with simple fastenings that can be readily operated from the direction approached by people making an escape complying with Paragraph 3.14.11; and

d) They shall not be fitted with any locking devices unless these comply with Paragraph 3.14.2; and

e) They shall have door handles that satisfy the requirements of Acceptable Solution D1/AS1 for use by people with disabilities; and

f) They shall be constructed to ensure that the forces required to open these doors do not exceed those able to be applied:
   i) with a single hand to release the latch (where fitted), and
   ii) using two hands to set the door in motion, and
   iii) using a single hand to open the door to the minimum required width.

Comment: These requirements are based on the force requirements of Appendix C C6.1.3.

Locking devices

3.14.2. If the *building* is occupied, locking devices shall:

a) Be clearly visible, located where such a device would be normally expected and, in the event of *fire*, designed to be easily operated without a key or other security device, and allow the door to open in the normal manner.

If the operation of a locking device is unusual, such as the pressing of a button close to the door, it shall have signage that complies with NZBC F8.3.1; and

Comment: Examples of unacceptable locking or security devices are card access and keypad locks that are not interfaced with the *fire* alarm and detection systems.

b) If they are of an electromechanical type, be readily opened by a method satisfying the requirements of Paragraph 3.14.2 a) in the event of a power failure or door malfunction; and

c) Not prevent people in vertical safe paths from entering other floors.

Comment: One way of ensuring compliance with Paragraph 3.14.2 is to develop a *building* management plan.

A *building* management plan procedure should be approved by the *building consent authority* and should include a provision to ensure that all *escape route* doors are unlocked when anybody is lawfully in the *building*. This design manual (fire) does not prevent the Fire Service, for security purposes, from locking *escape route* doors when the *building* is unoccupied.

People escaping down a stair have to be able to move from one stair to another via a horizontal *safe path* corridor so that, if one stair becomes smoke-logged or unusable for any other reason, people can continue their escape along an alternative route. If the stair is a single means of escape, people will still need to move out of the stair and wait for rescue by emergency services within the floor.

Direction of opening

3.14.3. Doors on *escape routes* shall be hung to open in the direction of escape. However, this is not required if the number of occupants of spaces with egress using the door is no greater than 50. If escape may be in either direction, doors shall swing both ways. For manual sliding doors, see Paragraph 3.14.1.

Degree and width of opening

3.14.4. Doors on *escape routes* (see Figure 3.17) shall satisfy the following requirements:

a) In *open paths*, provide an unobstructed opening width of no less than 760mm and, when multi-leaf, have no single leaf less than 500mm wide; and

b) Within *exitways* (including entry and *final exit* doors), reduce the minimum *exitway* width required by Paragraph 3.3 by no more than the 125mm allowed under Paragraph 3.3.5 d) to 875mm; and

c) Open no less than 90°; and

d) Open onto a floor area that:
   i) extends for a distance of no less than the arc of the door swing, and
   ii) is at the same level on both sides of the door for the full width of the *escape route*; and

> **Comment**: A 20mm threshold weather-stop is acceptable on external doors (see Acceptable Solution D1/AS1).

e) When opened, not cause the door swing to obstruct the minimum required width of any escape route. For example, doors that open onto a corridor used as an escape route shall not obstruct the minimum required width of that escape route (see Figure 3.18).

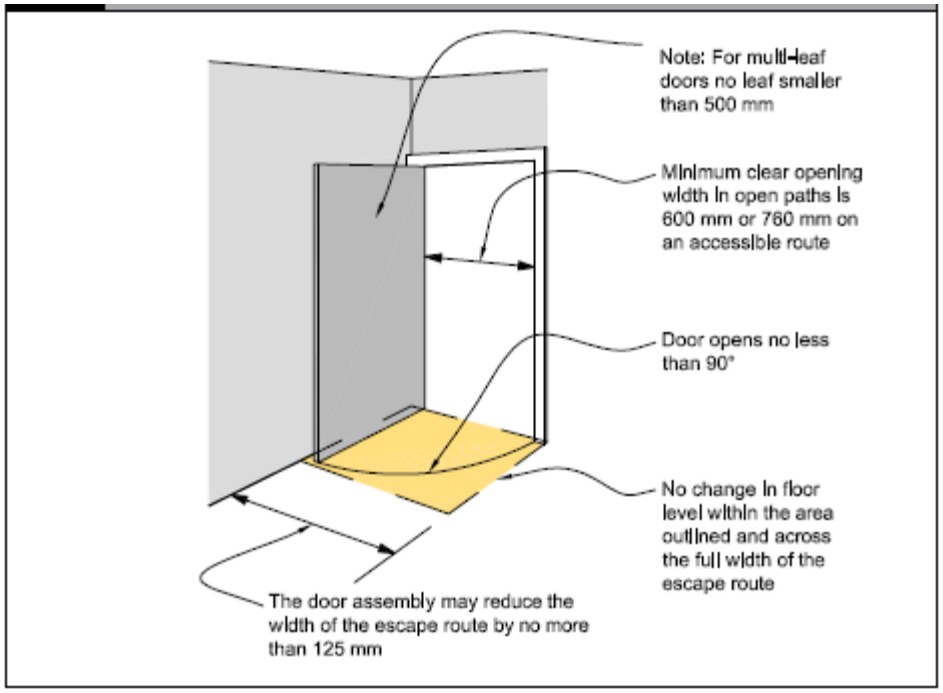


Figure 3.17: Degree and width of openings

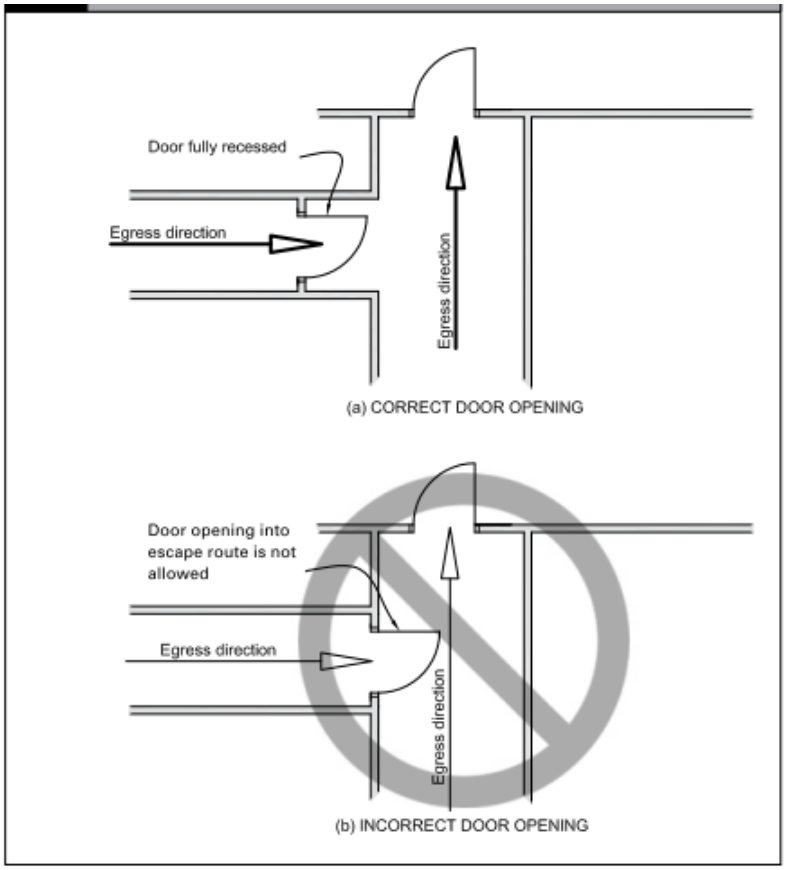


Figure 3.18: Door opening

Vision panels

3.14.5. Vision panels shall be provided on doors that:

a) are hung to swing both ways, or

b) lead into, or are within, *exitways* and swing in the direction of escape, or

c) subdivide corridors used as *escape routes*.

Automatic doors

3.14.6. Automatic doors (of all types) shall:

a) Not be allowed across an *escape route* at any point leading into or within an *exitway;* but

b) Be allowed in an *open path* or at a *final exit*, provided that in the event of a power failure or malfunction, the doors or access control systems continue to provide a safe *means of escape from fire* without reducing the required width, by:

i) automatically opening and remaining open, or

ii) being readily pushed to the outward open position by the *building* occupants in an emergency (see Figure 3.19).

> **Comment**: Access control systems may be in the form of turnstiles or entrance gates, in both horizontal and vertical planes. These are usually found in shopping centres, entertainment venues and similar occupancies. The requirements in ii) are based on the force requirements in Appendix C C6.1.3.

3.14.7. Paragraph 3.14.6 b) need not apply if alternative swing doors of the required width are provided immediately adjacent to the revolving or sliding doors. See Paragraph 3.15 for signage requirements.

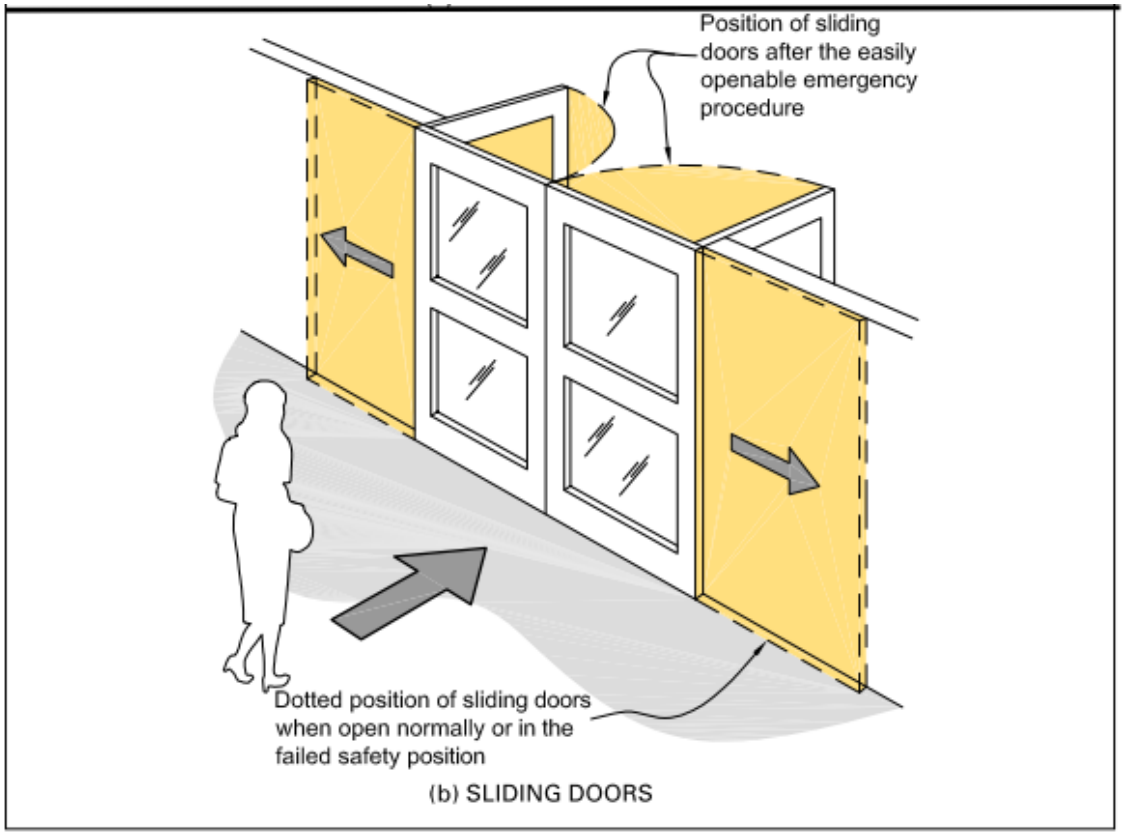


Figure 3.19: Automatic sliding doors

Hold-open devices

3.14.8. Detector activated *hold-open devices* shall be fitted to *fire doors* or *smoke control doors* required:

a) Between *open paths* and *exitways* if the *occupant load* is greater than 1000; and

b) For subdividing long corridors (see Paragraph 4.10); and

c) In *fire separations* where an *escape route* passes into an adjacent *firecell* (see Paragraph 3.7.4); and

> **Comment**: An example of c) would be between a horizontal *safe path* or *smoke lobby* and a vertical *safe path*.

d) In locations where, due to the type or volume of occupant traffic using the doors, the doors may be kept open by unauthorised means.

> **Comments**:
>
> *Hold-open devices* are used where it is not practical to assume that *fire doors* and *smoke control doors* will remain closed because of the type or volume of occupant traffic using these doors. The devices should eliminate the unsafe practice of wedging or otherwise keeping self-closing doors open.
>
> For the convenience of *building* occupants, it is often useful to provide a clearly labelled push-button release adjacent to doors with *hold-open devices*.

Detectors for releasing hold-open devices

3.14.9. Detectors for releasing *hold-open devices* shall be smoke detectors that are:

a) Integral with the *hold-open device* and comply with Appendix C; or

b) Located on the ceiling adjacent to the *doorset* on both sides of the *doorset*; or

c) Part of an automatic smoke detection system on both sides of the *doorset*.

Delayed action unlocking devices and access control systems

3.14.10. This design manual (fire) does not allow for delayed action unlocking devices and access control systems.

Simple fastenings

3.14.11. Doors on *escape routes* (whether or not the doors are *fire doors*) shall be fitted with simple fastenings that can be easily operated from the direction from which people approach when making their escape.

Comment: This generally excludes the use of keyed locks and bolt fastenings. See Paragraph 3.14.2 for security and safety.

3.15. Signs

Requirements

3.15.1. All *escape routes*, *fire doors* and *smoke control doors* shall have signs complying with NZBC F8.

Part 4. Control of internal fire and smoke spread

4.1. Firecells

Requirements

4.1.1. *Firecells* shall be *fire separated* from each other by the *life rating* specified in Paragraph 2.3 of this manual (see Paragraph 2.3 to determine that life rating).

4.1.2. The appliance bay and supporting spaces shall be a separate smokecell. Supporting spaces are all those that provide direct support to the operational response, and include:

- the watch room
- muster bays, and
- BA service/compressor rooms where required.

In existing stations this may also include some offices/meeting rooms.

4.1.3. Refer to Paragraph 4.6 for the requirements of sleeping accommodation areas.

4.2. Glazing in fire and smoke separations

General glazing requirements

4.2.1. Glazing in *fire separations* shall be fixed *fire resisting glazing* having the same *FRR* values for *integrity* and *insulation* as the *fire separation*, except where uninsulated glazing is permitted within vision panels and for sprinklered *buildings*.

4.2.2. Uninsulated *fire resisting glazing* with the same *integrity* value as the *fire separation* is permitted in *fire separations* in sprinklered *buildings* and in *external walls* in accordance with Paragraph 5.4.

4.2.3. There is no restriction on the area of glazing in *smoke separations* (including *smoke lobbies*). Non-*fire resisting glazing* may be used if it is toughened or laminated *safety glass*. Glazing shall have at least the same smoke-stopping ability as the *smoke separation*.

Fire doors and smoke control doors

4.2.4. Glazing in *fire doors* shall be *fire resisting glazing*, having the same *integrity* value as the door. If the door requires an *insulation* value, an uninsulated vision panel may be used without downgrading the *insulation* value of the door. Vision panels shall comply with NZS 4520.

4.2.5. Glazing in *smoke control doors* shall meet the requirements for *smoke separations*.

4.3. Structural stability during fire

Stability of building elements having an FRR

4.3.1. To avoid premature failure, this manual requires the structural *stability* of primary *building elements* with an *FRR* to be retained for the duration of that *FRR*. *Primary elements* located entirely within a *firecell* and providing support to *fire separations* may need to be evaluated for *fire* exposure from multiple sides simultaneously.

> **Comment**: This situation arises when a *primary element*, such as a column or wall located entirely within a *firecell*, provides lateral support to a *firecell* boundary wall or vertical support to the *firecell* floor/ceiling.
>
> Results against the standard furnace tests for *fire* resistance may not be suitable as they commonly relate to exposure from one side only. Separate evaluation is required to assess the performance of *primary elements* when exposed to *fire* from more relevant sides simultaneously.

4.3.2. During a *fire*, *primary elements* shall resist collapse under:

a) the design dead and live loads required by NZBC B1, and
b) any additional loads caused by the *fire*.

> **Comment**: NZBC B1.3.3 (c) and (i) require that structural *stability* takes account of vertical and horizontal loads, temperature and *fire* effects.
>
> Additional loadings can arise from changes in length or other deformations in *building elements* as a result of high temperatures.
>
> Yield strength of most materials generally reduces with temperature increase, so that strength reduction is related to the time that the *primary element* is exposed to *fire*.
>
> Factors that need to be taken into account include the maximum temperature attained, the capacity of the element to absorb heat, potential loss of section, the degree of exposure, whether any applied coating is used to protect the element from the effects of *fire*, and the degree of restraint provided by the surrounding structure.

Unrated primary elements

4.3.3. In many cases *primary elements* are rated for *structural adequacy*, and sometimes for *integrity* and *insulation*. However *primary elements* need not have an *FRR* where any of the following circumstances exist:

a) They are located outside an *external wall* that is 2.0m or more from the *relevant boundary*, and are shielded from the effects of *fire* by protected areas of the wall (see Figure 4.1).

b) They are added to strengthen an existing *building* and are required only to carry horizontal loads induced by wind or earthquake.

Providing vertical stability

4.3.4. *Building elements* required to have an *FRR* shall have their vertical *stability* provided in one or more of the following ways:

a) *Primary elements* in a vertical orientation (e.g. walls and columns) shall be rated for structural adequacy.

b) *Primary elements* in a horizontal orientation (e.g. floors and beams) shall be supported by *primary elements* with at least an equivalent *structural adequacy* rating.

Providing horizontal stability

4.3.5. *Building elements* required to have an *FRR* shall have their horizontal *stability* provided in one or more of the following ways:

a) Be cantilevered from a structural base having an *FRR* of no less than that of the *building element* concerned.

b) Be supported within the *firecell* by other *building elements* having an *FRR* no less than that required for the element being supported. The *structural adequacy* and diaphragm action of supporting *building elements* located entirely within a single *firecell* must be assessed when exposed to fire from all relevant sides simultaneously.

c) Be supported by *primary elements* outside the *firecell*.

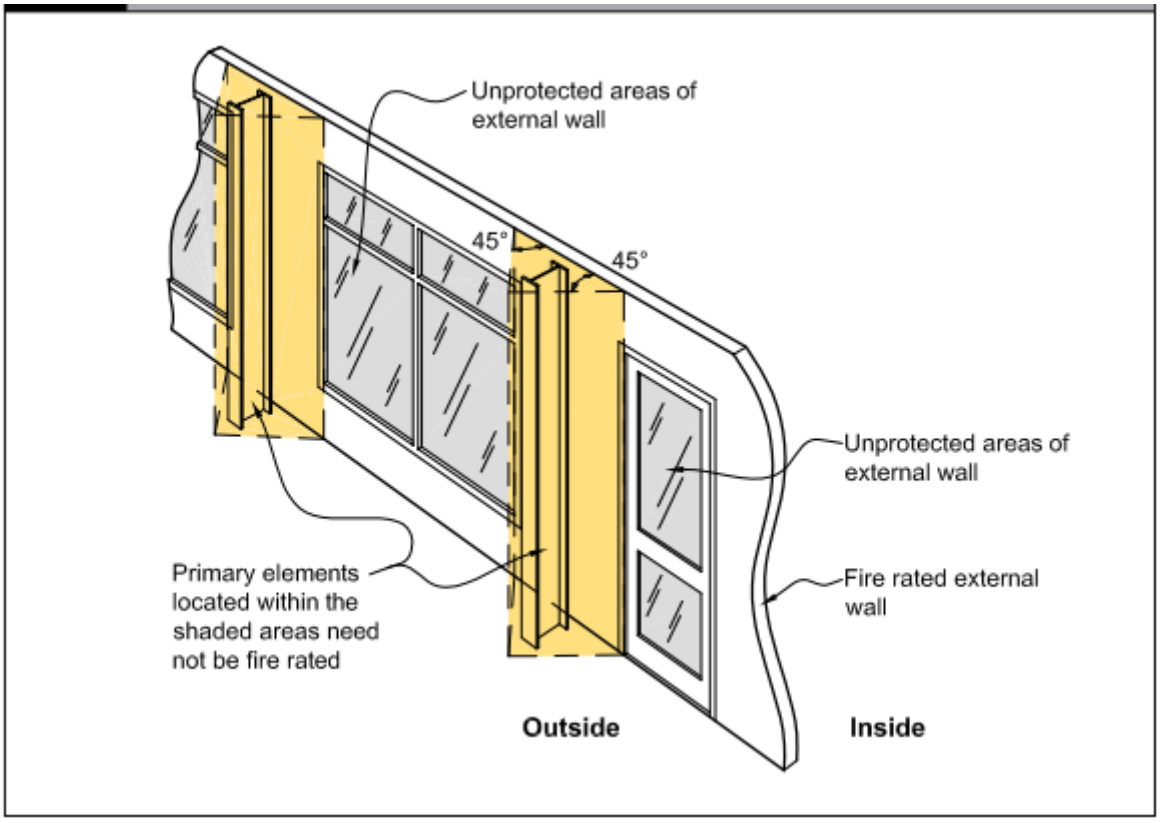


Figure 4.1: Permissible positioning of unrated primary elements

Comment: It is assumed that *fire* will be restricted to the *firecell* of origin at least for the time required by the *property rating* of the *primary element* concerned.

The *stability* to a beam or *fire separation* may, for example, be provided by beam or diaphragm action of a floor or wall that is rated only for *structural adequacy*.

A *standard test* for *fire* resistance commonly exposes *fire separations* from one side only and may not be a suitable measure for determining the *structural adequacy* of a *building element* when exposed to *fire* from more than one side simultaneously.

4.4. Fire stopping

Introduction

4.4.1. The continuity and effectiveness of *fire separations* shall be maintained around *penetrations*, and in gaps between or within *building elements,* by the use of *fire stops*.

Fire stops

4.4.2. *Fire stops* shall have an *FRR* of no less than that required for the *fire separation* within which they are installed, and shall be tested in accordance with Appendix C C5.1.

4.4.3. *Fire stops* and methods of installation shall be identical to those of the prototype used in tests to establish their *FRR*.

4.4.4. The material selected for use as *fire stops* shall have been tested for the type and size of the gap or *penetration*, and for the type of material and *construction* used in the *fire separation*.

> **Comment:** There are many types of *fire stops* (e.g. mastics, collars, pillows), each designed to suit specific situations. A *fire stop* is appropriate for a particular application if it passes the test criteria when installed as proposed.

4.4.5. A *fire stop* for a *penetration* is not required to have an *insulation* rating if means are provided to keep *combustible* materials at a distance of 300mm away from the *penetration* and *fire stop* to prevent ignition.

4.5. Firecell construction

Requirements

4.5.1. Each of the *building elements* enclosing a *firecell* is permitted to have a different *FRR*, as this rating will depend on the characteristics of the *firecell*, the reason for the *FRR*, and the *risk groups* contained on either side of any *fire separation*.

> **Comment**: An *FRR* of zero may apply to some walls and most roofs.

4.5.2. Except where *intermediate floors* are permitted, each floor in a multi-storey *building* shall be a *fire separation*.

4.5.3. *Fire* and *smoke separations* shall have no openings other than:

a) for closures such as *doorsets,* and

b) *penetrations* complying with Paragraph 4.4, and

c) for glazing permitted by Paragraph 4.2.

4.5.4. *Firecell* and *smokecell* effectiveness shall be maintained by ensuring continuity of *fire* and *smoke separations* at separation junctions, and around joints where closures, *protected shafts* and *penetrations* occur.

Junctions of fire separations

4.5.5. Where *fire separations* meet other *fire separations* or *fire* rated parts of *external walls*, they shall either be bonded together or have the junction *fire stopped* over its full length (see Figures 4.2 and 4.3).

4.5.6. Where one *fire separation* is a wall and the other a floor, the wall/floor junction shall be *constructed* with the *FRR* required for the higher rated element.

Junctions with roof

4.5.7. Vertical *fire separations* and *external walls* shall either:

a) Terminate as close as possible to the external roof cladding and *primary elements* providing roof support, with any gaps fully *fire stopped* (see Figures 4.2 and 4.3); or

b) Extend not less than 450mm above the roof to form a parapet.

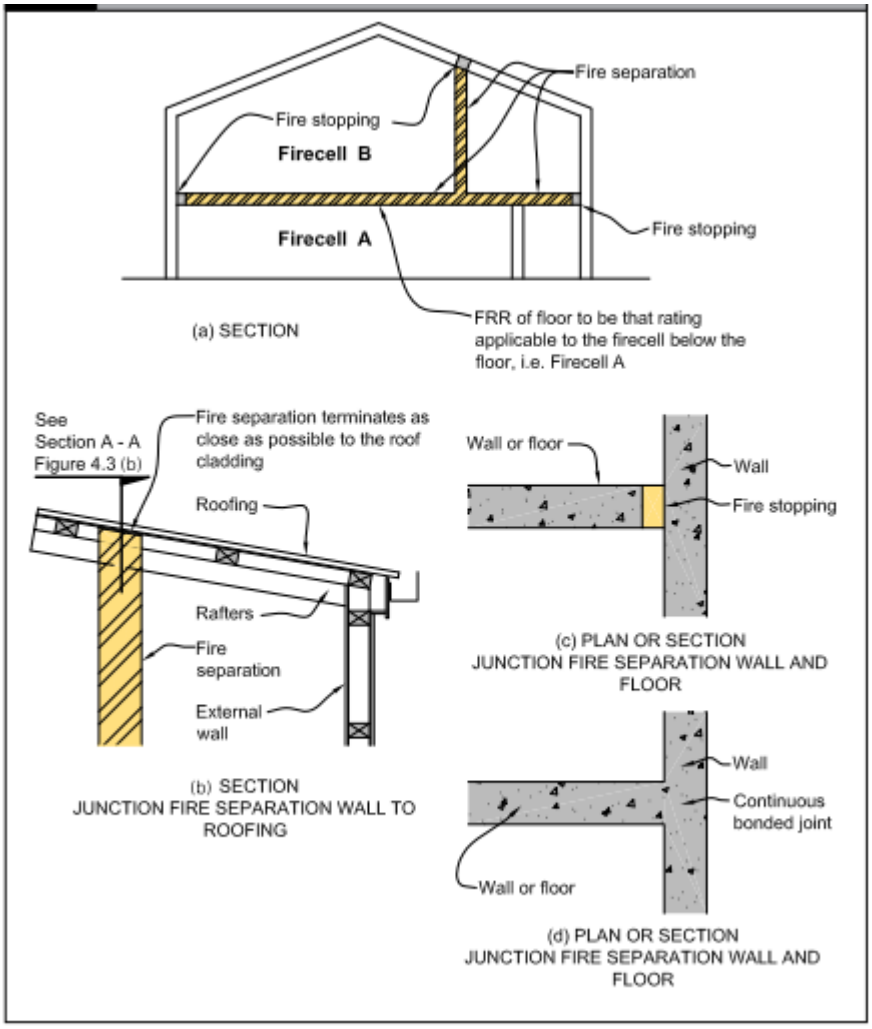


Figure 4.2: Junctions with fire separations - 1

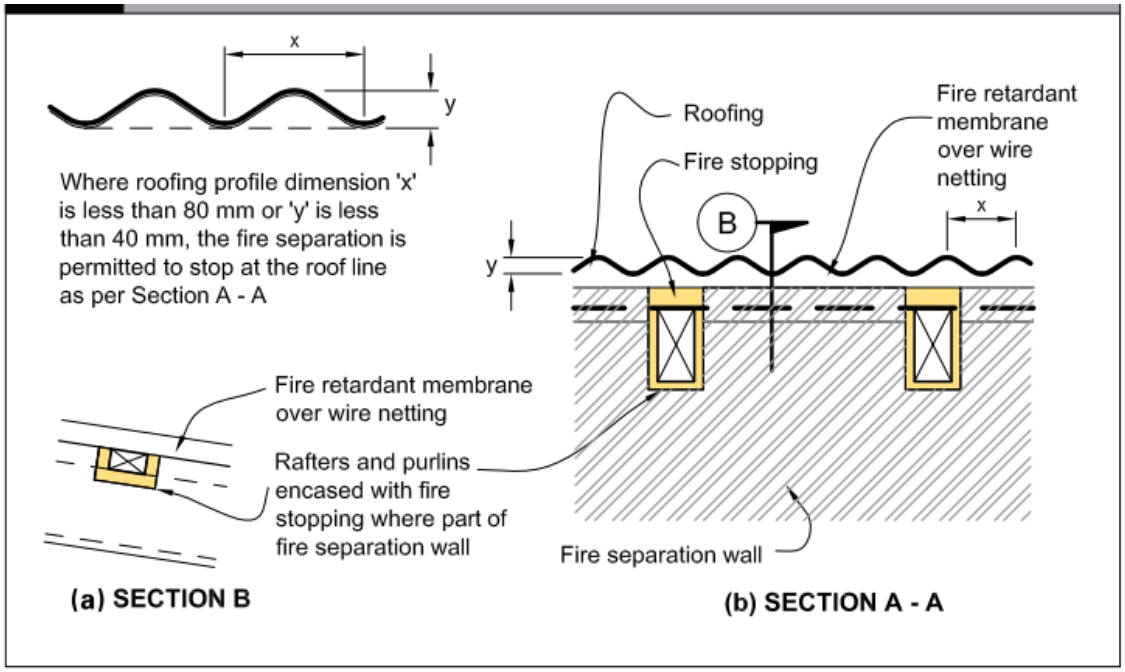


Figure 4.3: Junctions with fire separations - 2

Ceiling space firecells

4.5.8. Large roof or ceiling spaces may be *constructed* as separate *firecells* above more than one occupied *firecell*, provided that the ceiling is a *fire separation* rated from below. In this situation, vertical *fire separations* in the *firecell* below need terminate only at the ceiling.

Sealing of gaps

4.5.9. To avoid the passage of smoke through *fire* and *smoke separations*, gaps shall be sealed with *fire* resistant materials complying with AS 1530.4 in their intended application if they are located:

a) in smoke separations, and between smoke and fire separations

b) around glazing in smoke separations

c) between fire or smoke separations and unrated parts of external walls.

4.5.10. Gaps around *penetrations* shall be *fire stopped* (see Paragraph 4.4).

4.6. Specific requirements for sleeping areas firecells

Requirements

4.6.1. A sleeping area may be subdivided into separate suites. Each suite shall be a separate *firecell* and contain no more than 12 beds. *Fire separations* between adjacent suites on the same floor level shall have an *FRR* in accordance with Paragraph 2.3.

4.6.2. Intermittently *occupied spaces*, such as tea bays and sanitary facilities, which provide direct support functions to the sleeping area may be included in a sleeping area firecell.

4.6.3. Spaces such as storerooms, laundry facilities, communal kitchens, dining rooms and lounges and meeting spaces shall be separated from sleeping area firecells with *fire separations* having an *FRR* in accordance with Paragraph 2.3. It is acceptable for these non-sleeping activities to share a common *firecell*.

4.7. Exitways

Requirements

4.7.1. *Exitways*, unless external and separated by distance, shall comprise *smoke lobbies* in accordance with Paragraph 3.9.2 and/or *safe paths* that are *firecells*.

4.7.2. The *safe path* shall be separated from all adjoining *firecells* by *fire separations* with an *FRR* in accordance with Paragraph 2.3 throughout its length. If the *escape height* is greater than 10m, the *fire separation* shall have an *FRR* meeting the *property rating*.

4.7.3. *Safe paths* that are stairs leading from lower floors or *basements,* and that continue to floors above the level of the *final exit*, shall have the lower levels *fire separated* from the *final exit* level. The *fire separation* shall have an *FRR* in accordance with Paragraph 2.3 or that required for the lower level, whichever is the greater.

4.7.4. *Safe paths* that are long corridors shall be subdivided by *smoke separations* in accordance with Paragraph 4.10.

4.7.5. Air ducts passing through *exitways* shall not include *combustible* materials.

4.8. Intermittent activities

Support activities

4.8.1. Intermittent activities providing direct support to a primary activity of another *risk group* may be included with the other *risk group*, and do not require *fire* or *smoke separation* unless they are provided for enclosed waste storage or car parking.

The *fire safety systems* required for each *risk group* shall also apply throughout these spaces.

If these spaces are required to be separate *firecells*, they shall have *fire separations* with *FRRs* in accordance with Paragraph 2.3.

Comment: Examples of spaces that provide support functions and are occupied intermittently include corridors, WC facilities, and laundry rooms.

Solid waste storage

4.8.2. Solid waste storage areas shall be enclosed when located adjacent to *occupied spaces*; in other situations these areas may be unenclosed. Enclosed solid waste storage areas within any *firecell* shall themselves be a separate *firecell* separated from adjacent *firecells* by *fire separations* having an *FRR* of no less than 60 minutes (see Paragraph 4.9.5 for waste chutes).

Plant, boiler and incinerator rooms

4.8.3. Any space within a *building* (see Figure 4.4) containing an incinerator, plant, boiler or machinery that uses solid fuel, gas or petroleum products as the energy source (but excluding space and local water heating appliances) shall be a separate *firecell* with an *FRR* of no less than 90 minutes, and shall have:

a) At least one *external wall*;and

b) External access that may be at any floor level including the roof. Where alternative internal access is provided it shall be via a *smoke lobby* that is protected with a heat detector connected to a Type 2, 3 or 4 alarm system; and

c) Its floor level no lower than the ground level outside the *external wall* if gas is the energy source.

4.8.4. If plant is contained in a *building* that is solely for the purposes of containing such plant, and that *building* is separated by 3.0 m or more from any adjacent *building*, only Paragraph 4.8.3 c) shall apply.

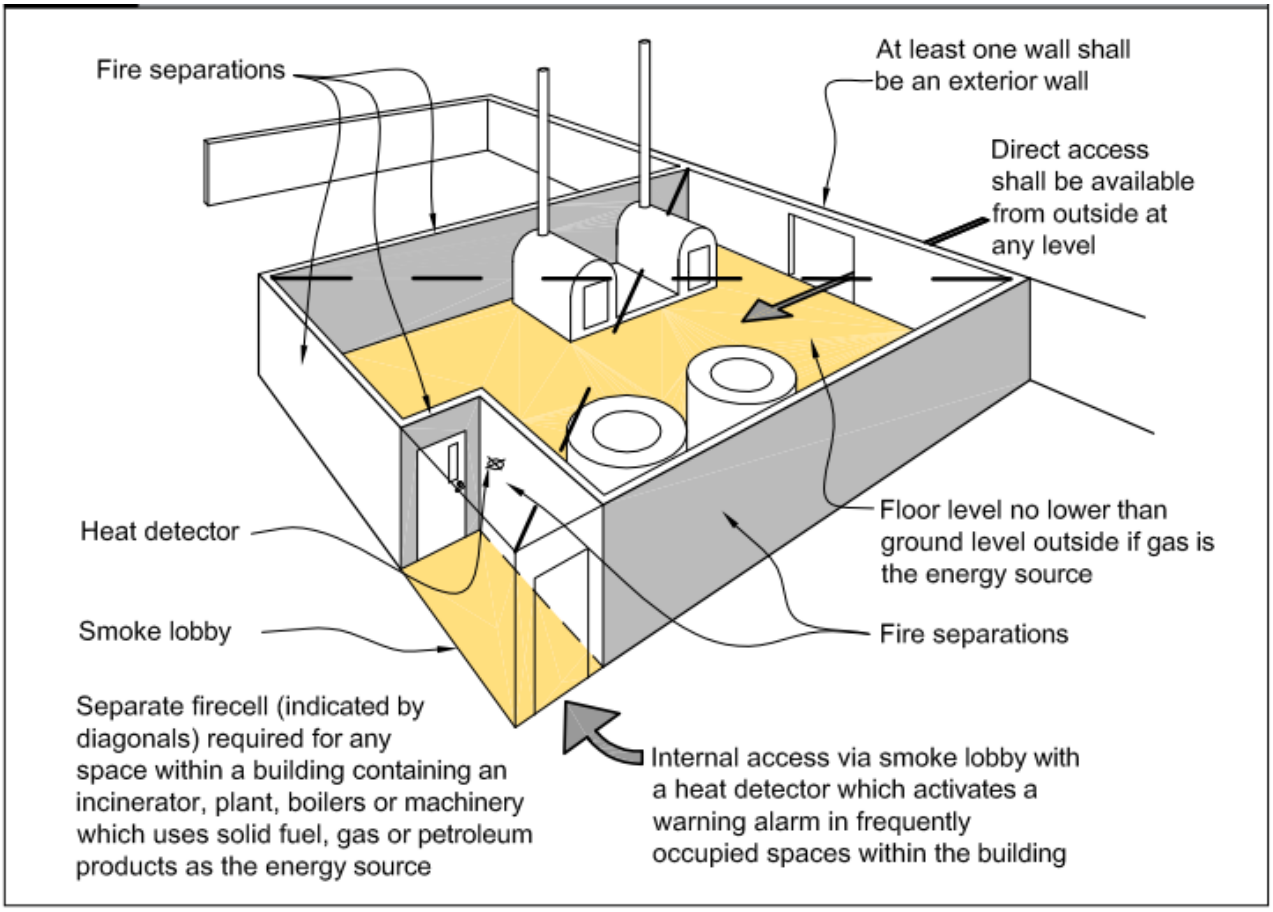


Figure 4.4: Plant, boiler and incinerator rooms

4.9. Protected shafts

Lifts, conveyors and services

4.9.1. Lifts, conveyors and services that pass from one *firecell* to another shall be enclosed within *protected shafts*.

> **Comment**: Paragraph 3.10.3 describes the requirements for the installation of a passenger lift in a vertical *safe path* containing a *stairway*, and requires the vertical *safe path* to be a single *firecell*.

Fire separation

4.9.2. Every *protected shaft* shall be a separate *firecell* within the *firecell* or *firecells* in which it is located (see Figure 4.5). The shaft walls between each floor shall have an *FRR* of no less than that required by the *life rating* of the *risk group* for that level.

> **Comment**: The *FRR* of the shaft wall applies to both sides equally, except in the case of lift landing doors (see Paragraph 4.14.11).

4.9.3. *Protected shafts* that do not extend through the roof or lowest floor shall be enclosed at top and bottom by *construction* that satisfies the relevant requirements of Paragraph 4.4 for *fire stopping* (see Figure 4.5).

Openings in protected shafts

4.9.4. There shall be no openings in *protected shafts* except for:

a) Access panels having an *FRR* of no less than that required for the shaft.

b) *Doorsets* providing access to lifts and complying with smoke control requirements.

c) Openings for lift ropes passing into a lift motor room, which shall be as small as practicable.

d) *Fire dampers* serving a ventilation duct and complying with requirements for *fire resisting closures*.

e) *Penetrations* that satisfy Paragraph 4.4 for *fire stopping*.

f) Fittings with an *FRR* of no less than that required for the *protected shaft*.

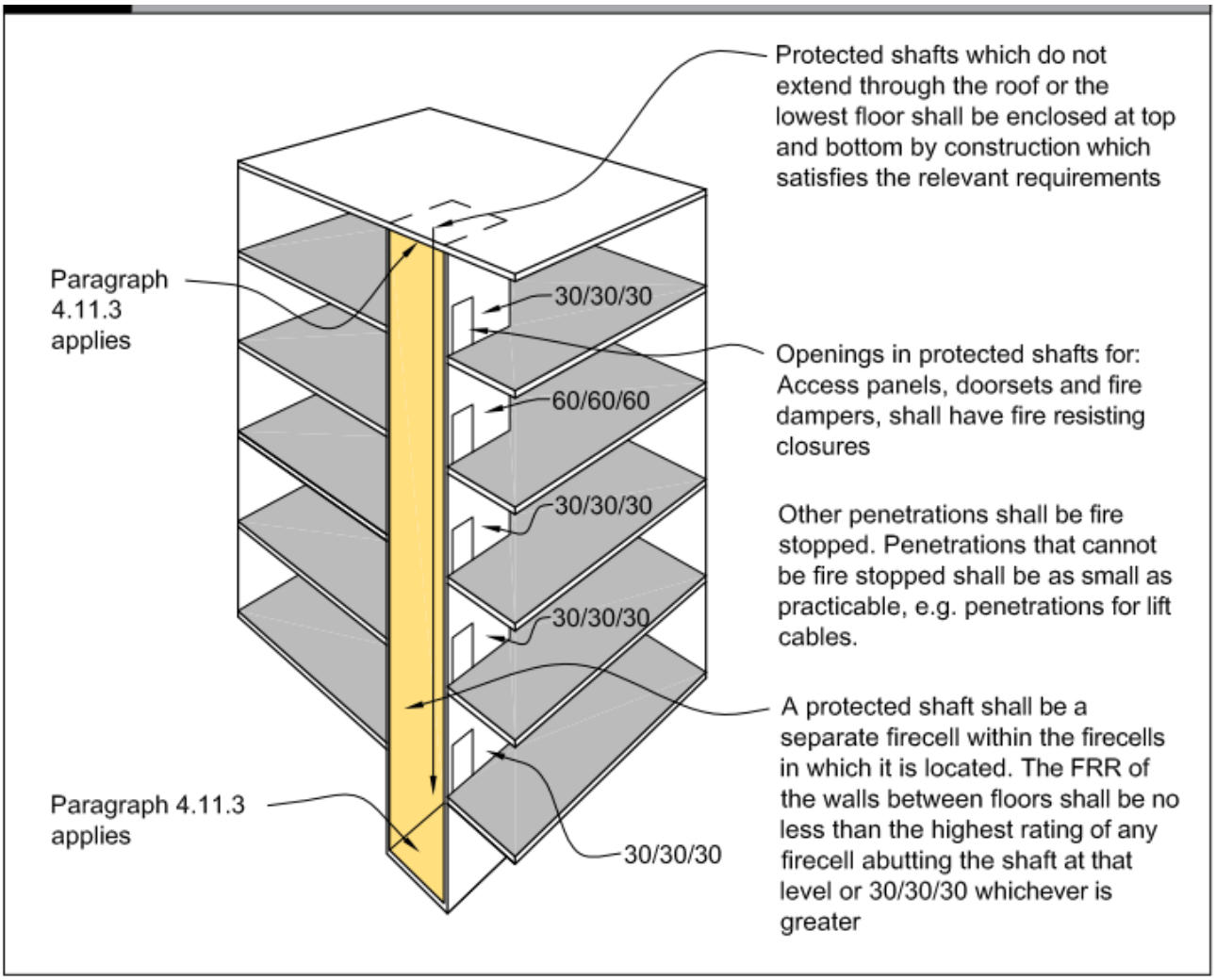


Figure 4.5: Protected shafts

Solid waste and linen chutes

4.9.5. Solid waste and linen chutes that pass from one *firecell* to another shall be *protected shafts* or contained within a *protected shaft*. If the *building* is unsprinklered, each chute shall be equipped with automatic sprinkler heads connected to any water supply pipe capable of meeting the minimum design criteria for the selected sprinkler head. These sprinklers shall be installed at the top of each chute and in the space into which the chute discharges.
The minimum residual pressure in the water supply pipe shall be 50 kPa with two sprinkler heads operating.

> **Comment:** The minimum residual pressure requirement for any operating sprinkler is to ensure sufficient flow rate and area coverage to control a *fire*.

4.9.6. Solid waste and linen chutes shall have no inlet or discharge openings within an *exitway*.

4.10. Long corridor subdivision

Requirements

4.10.1. Long corridors shall be subdivided by *smoke separations* and *smoke control doors* (see Figure 4.6), which shall be evenly spaced along the corridor and no further apart than:

a) 40m within *open paths*, or

b) 80m within *safe paths*.

These lengths may be increased by 50% where the *building* is sprinklered.

Comments:

The *smoke control doors* are to swing both ways if required by Paragraph 3.14.3.

Hold-open devices are required by Paragraph 3.14.8 to allow the doors to remain open during normal use of the *building,* but to close automatically in the event of a *fire*.

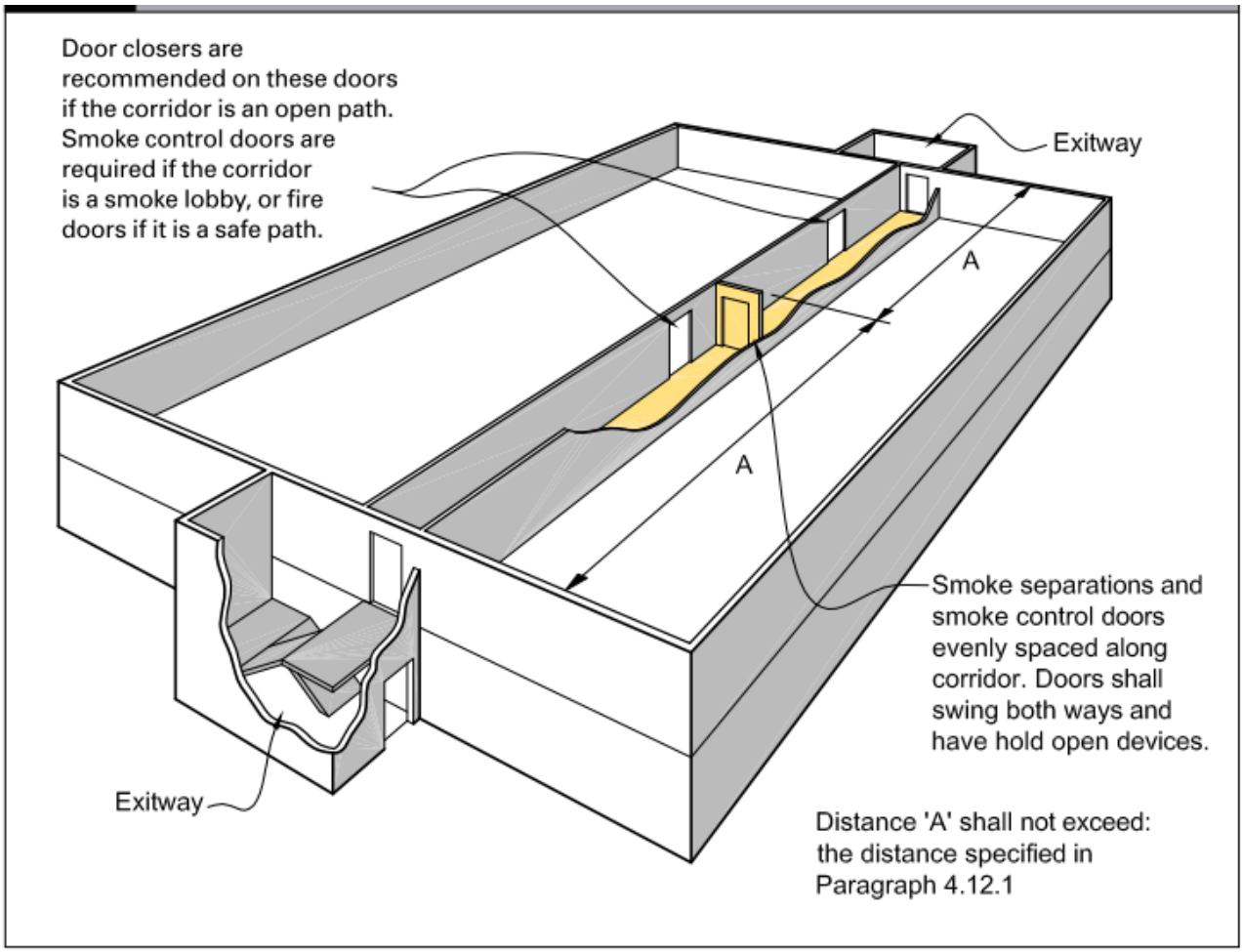


Figure 4.6: Long corridor subdivision

4.11. Floors

Requirements

4.11.1. Floors in *buildings* shall be *fire separations* (see Figure 4.7) except if any of the following conditions are satisfied:

a) The floor is an *intermediate floor* within a *firecell* (see Paragraph 4.11.3 for the *FRR* requirement); or

b) The floor is the lowest floor above an unoccupied subfloor space, and complies with Paragraph 4.12.1.

4.11.2. Floors only need to be rated from the underside (see Figure 4.7). The *FRR* of a floor shall be that rating applicable to the *firecell* directly below the floor.

Intermediate floors

4.11.3. *Intermediate floors* and stairs used as access, and their supporting *primary elements* within the *firecell*, shall have *FRRs* of at least 30 minutes.

4.11.4. *Intermediate floors* shall satisfy the following conditions:

a) If there are two or more separate *intermediate floors*, the levels of those floors above the *firecell* floor differ by no more than 1.0m; and

b) The total combined *occupant load* on the *intermediate floors* is not greater than 100; and

c) The total combined area of the *intermediate floors* is no greater than specified in Paragraph 4.11.5.

4.11.5. The total combined area of the *intermediate floors* within the *firecell* shall be the lowest of:

a) 20% of the area of the *firecell* floor, not including the area of the *intermediate floors*, if the *intermediate floors* are enclosed or partitioned; or

b) 40% of the area of the *firecell* floor, not including the area of the *intermediate floors*, if the *intermediate floors*:

i) are completely open, or

ii) if enclosed or partitioned, a Type 4 system is installed; or

c) The area that allows up to 100 occupants on the *intermediate floors* based upon the occupant density of the space, in accordance with Paragraph 1.4.

Comment:

The smaller (20%) floor area is a concession for spaces used essentially for storage with a low *occupant density*.

Firecells containing *intermediate floors* require the same *fire* safety precautions as single level *firecells* having the same total *occupant load* and *escape height*. As 100 occupants is the maximum *occupant load* of an *intermediate floor* (depending on the activity on that floor), the area of that floor cannot exceed that necessary to accommodate 100 persons.

Basement floors

4.11.6. *Basement firecells* shall be separated from one another, and from the lowest *firecell* above ground level, by *fire separations* having *FRRs* in accordance with Paragraph 2.3.

4.12. Subfloor spaces

Requirements

4.12.1. In *buildings* with an unoccupied subfloor space between the ground and lowest floor (see Figure 4.7), the *FRR* of that floor shall be in accordance with Paragraph 2.3, except that no *FRR* is required if the following conditions are satisfied:

a) Vertical *fire separations* and *external walls* extend down to ground level and enclose the space; and

b) Access is available only for intermittent servicing of plumbing, drainage or other static services; and

c) The space is not used for storage and does not contain any installation such as machinery or heating appliances that could create a *fire hazard*, except when *fire separated* from the rest of the subfloor space.

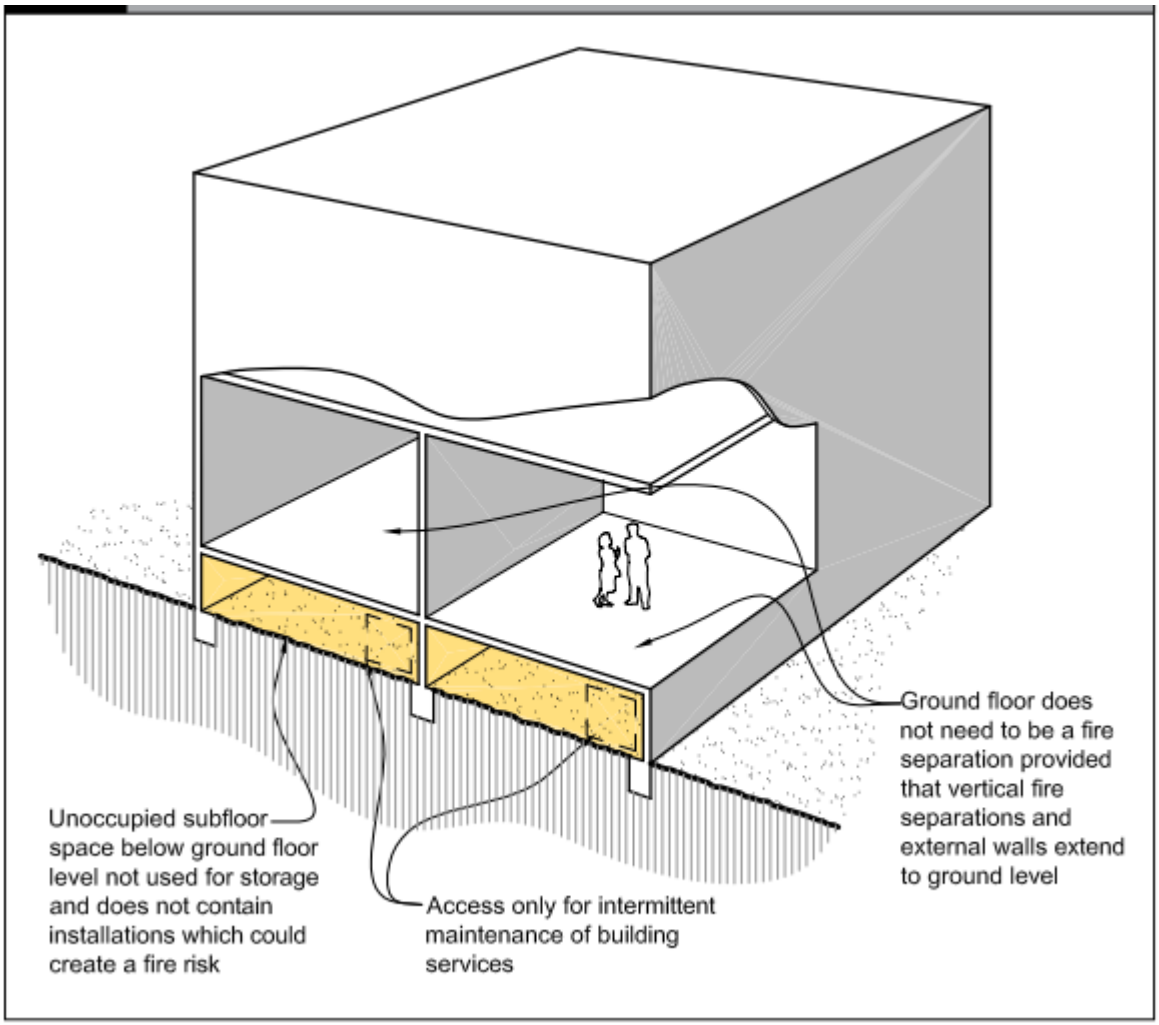


Figure 4.7: Subfloor spaces

4.13. Concealed spaces

Requirements

4.13.1. The spread of *fire* in *concealed spaces* and cavities shall be avoided by ensuring that extensive voids do not pass from one *firecell* to another, and by blocking off smaller voids with *cavity barriers* or, where appropriate, by using *fire stops*. See Paragraph 4.4.

> **Comment**:
>
> Enclosing spaces with *fire* and *smoke separations* is one of the methods of controlling *fire* and smoke spread for satisfying this manual. However, if *fire separations* are internal walls, it is essential that those walls enclose any upper *concealed space* by extending beyond the ceiling to the floor or roof above.
>
> Smoke detection and alarm systems are often relied on to provide *building* occupants, particularly sleeping *risk groups*, with early warning in the event of *fire*. However, where the smoke detectors are located only in the *occupied spaces*, smoke and *fire* can travel unobserved in upper *concealed spaces* that have not been *fire* or *smoke separated*. See Paragraph 4.13.2 for subdivision requirements for *concealed spaces*.

Concealed spaces within firecells

4.13.2. An upper *concealed space* may be used as an air handling plenum (see Figure 4.8) if the following requirements are satisfied:

a) The upper *concealed space* does not extend into another *firecell*; and

b) The ceiling and its supports and surfaces within the *concealed space* are *non-combustible*; and

c) Electrical wiring is supported clear of the ceiling members and other equipment; and

d) Any material used such as pipe insulation or acoustic insulation complies with the requirements of Table 4.1; and

e) Where the air handling plenum is used as an air supply path, detector activation causes the ventilation system to switch from circulation to extract as required by Paragraph 4.16.2.

> **Comment:** Paragraph 4.13.2 e) does not apply when the air handling plenum is used as an air exhaust path with a separate ducted air supply to the *firecell*.

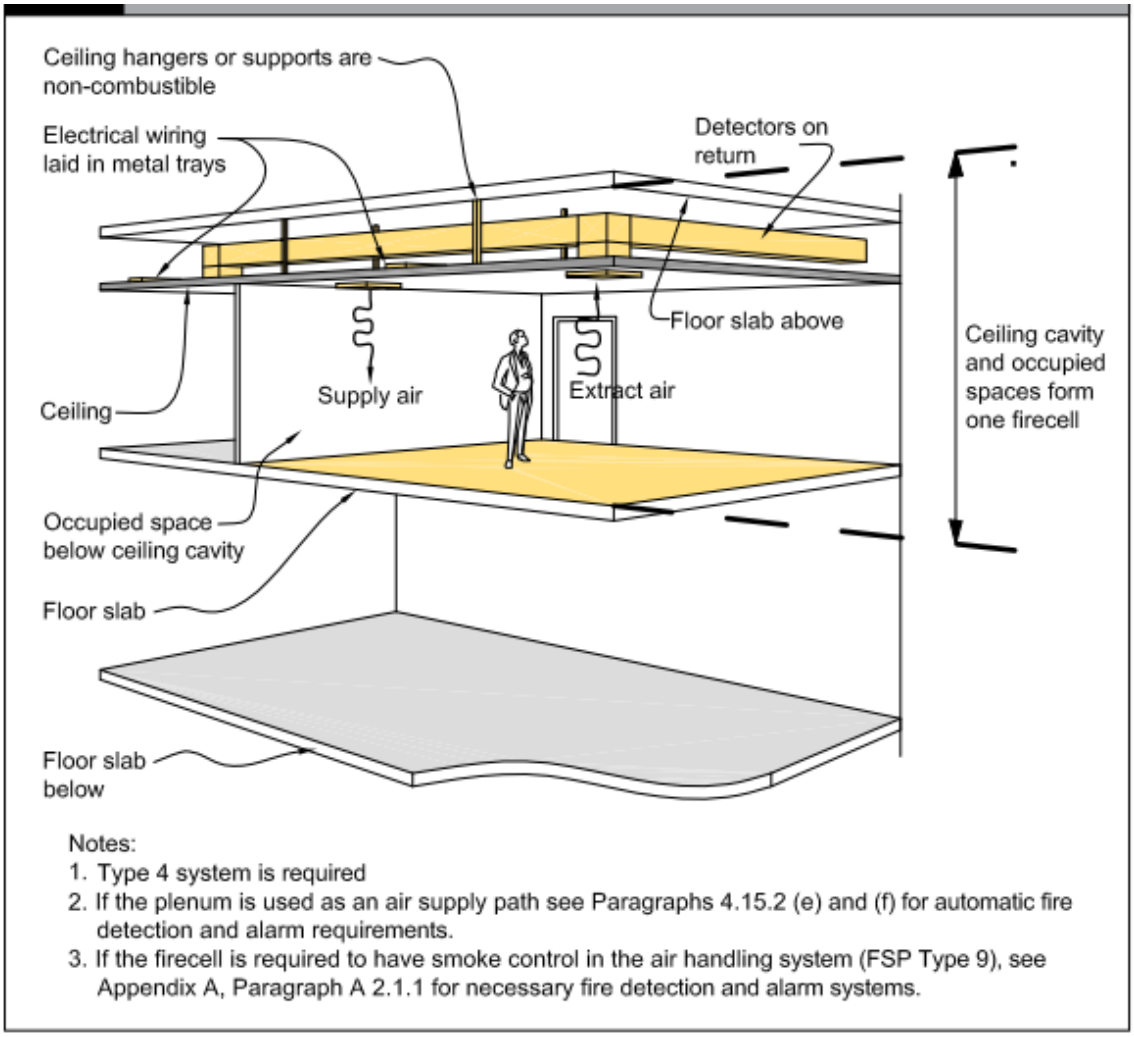


Figure 4.8: Concealed spaces within firecells

Cavity barriers in walls and floors

4.13.3. Any *concealed space* that may be a path for *fire* spread within internal walls or floors that are *fire separations*, or within *external walls*, shall have *cavity barriers* or be *fire stopped* (see Paragraph 4.4), at all common junctions (see Figures 4.9 and 4.10).

Comment: In multi-storey *buildings*, it is essential to avoid rapid vertical *fire* spread between floors. Paragraph 5.7.14 deals with the particular requirement for *external walls*, where 'curtain wall' type *construction* may create extensive cavities.

Exceptions to cavity barrier requirements

4.13.4. *Cavity barriers* are not required in the following circumstances:

a) Below a floor next to the ground if the *concealed space* is:
   i) less than 1.0m in height, or
   ii) not normally accessed and has no openings through which litter can accumulate; or

b) If the *concealed space* results from the over-cladding of an existing *external wall* or roof, provided that the existing cladding is *non-combustible*; or

c) In a wall or roof panel system encapsulated with a material having a *Group Number* of no greater than 2.

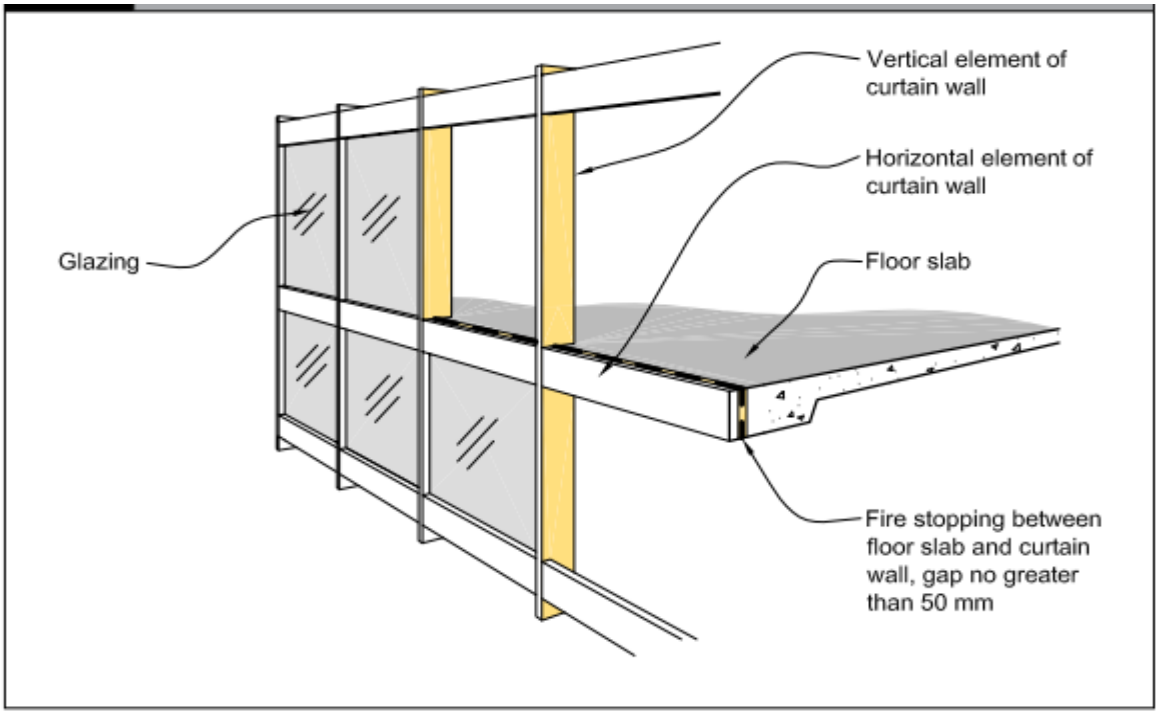


Figure 4.9: Curtain wall

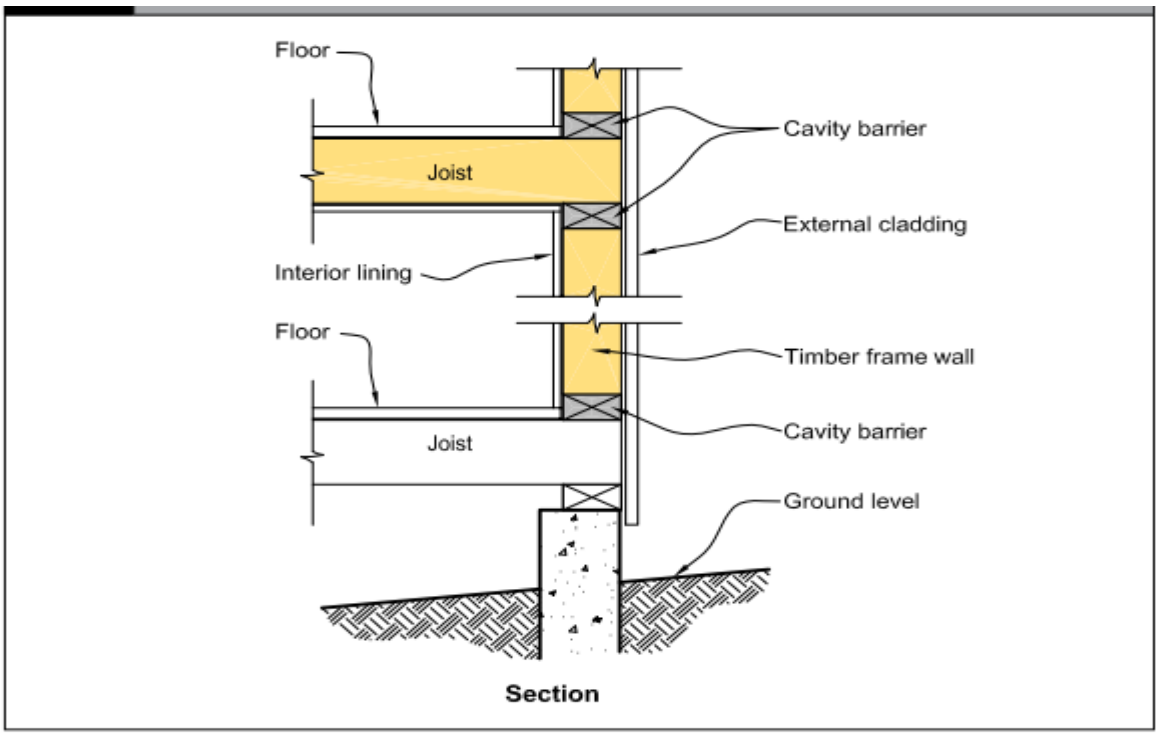


Figure 4.10: Hollow construction

Comment: See Verification Method C/VM2 Appendix A for the method for assigning *Group Numbers* to materials.

Cavity barrier construction

4.13.5. *Cavity barriers* shall:

a) Not reduce the *FRR* required for the element within which they are installed;

b) Where practical, be tightly fitted and mechanically fixed to rigid *construction,* but if this is not possible gaps shall be *fire stopped*; and

c) Be fixed in a way that avoids impairment of their *fire separation* function as a result of:

i) *building* movement due to subsidence, shrinkage or thermal change, or

ii) collapse or failure of their components or fixings, or of abutting materials and any *penetrations* during a *fire*.

4.14. Closures in fire and smoke separations

General requirements

4.14.1. If activities within a *building* require openings in *fire* or *smoke separations* (e.g. for the passage of people, goods or services or for light), closures to those openings shall have the *fire* resistance and smoke control performance as follows:

a) An FRR of -/60/30 sm if unsprinklered (except as permitted by Paragraphs 4.14.11 and 4.14.12); or

b) An *FRR* of -/30/- sm if sprinklered.

Comment: sm indicates that the closure performs as part of a *smoke separation*. See Paragraph 4.14.2 b) for doors in *smoke separations* and Paragraph 4.14.10 for access panels.

Door requirements

4.14.2. *Doorsets* that are required to be:

a) *Fire doors* shall comply with Appendix C C6.1.1;

b) *Smoke control doors* shall, except as allowed by Paragraph 4.14.3, comply with Appendix C C6.1.2; and

c) *Fire doors* with smoke control capability shall comply with both a) and b).

Comment: Smoke seals may be of the brush type and need not incorporate intumescent material. However, intumescent seals may be required if the door is also a *fire door*.

4.14.3. *Doorsets* installed in *fire separations* between *firecells* and vertical *safe paths* or *protected shafts* shall have smoke seals on all edges, except that smoke seals may be omitted:

a) At the sill of *doorsets*; and

b) For lifts, if either:

i) the *firecell* is sprinklered and has an automatic smoke detection system, or

ii) a *smokecell* is placed between the doors and the rest of the *firecell*, other than when the lift shaft is permitted to be in the vertical *safe path*.

Fire door and smoke control door installation	**4.14.4.** *Fire doors* and *smoke control doors* shall be installed in accordance with Paragraph 3.14.
Doorset markings	**4.14.5.** *Doorsets* shall be clearly marked to show their *FRR* and, if required, to show their smoke stopping capability. Other signage requirements shall be as specified in Paragraph 3.15. **4.14.6.** Markings and labelling shall, in all other respects, comply with NZS 4520.
Glazing in doors	**4.14.7.** Glazing in *fire doors* and *smoke control doors* shall comply with Paragraph 4.2.
Smoke control doors	**4.14.8.** *Smoke control doors* complying with Paragraphs 4.14.2 to 4.14.7 shall be provided: a) At smoke control separations in vertical *safe paths*; b) Where a corridor or an *escape route* passes through a *smoke separation* (see Figure 4.11 and for long corridors Figure 4.6); and c) Between an *open path* and a *smoke lobby* (see Figures 4.12 and 4.13).

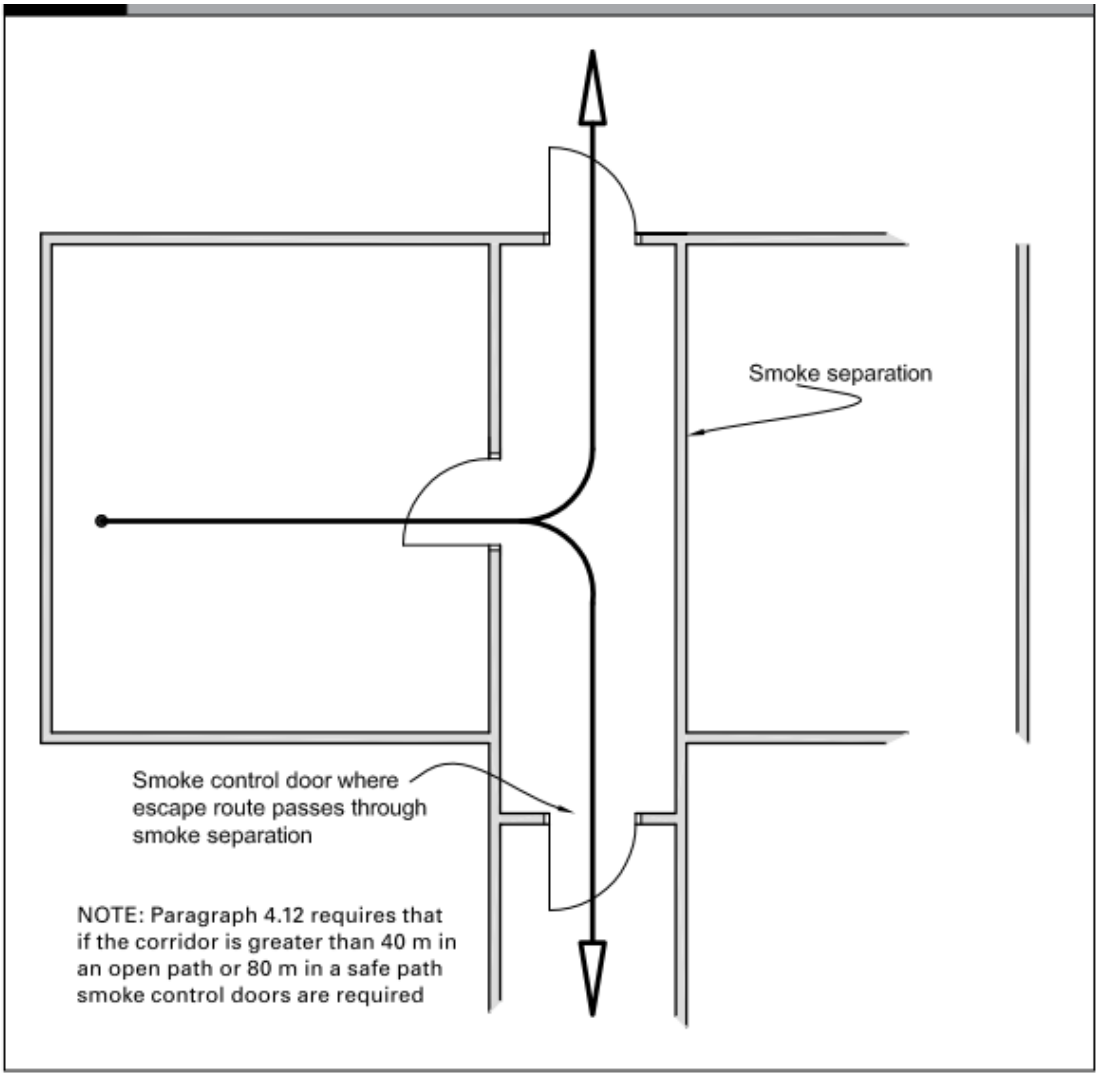


Figure 4.11: Smoke control doors

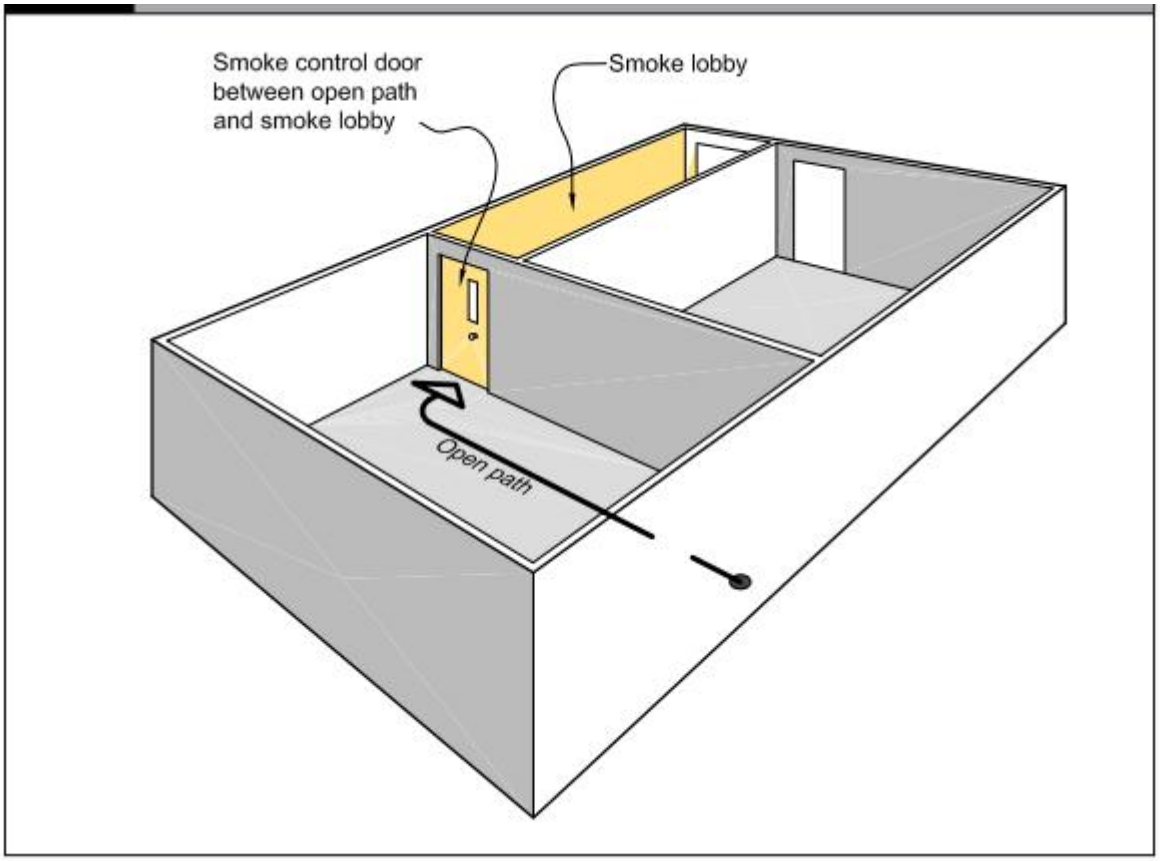


Figure 4.12: Smoke control doors on smoke lobbies

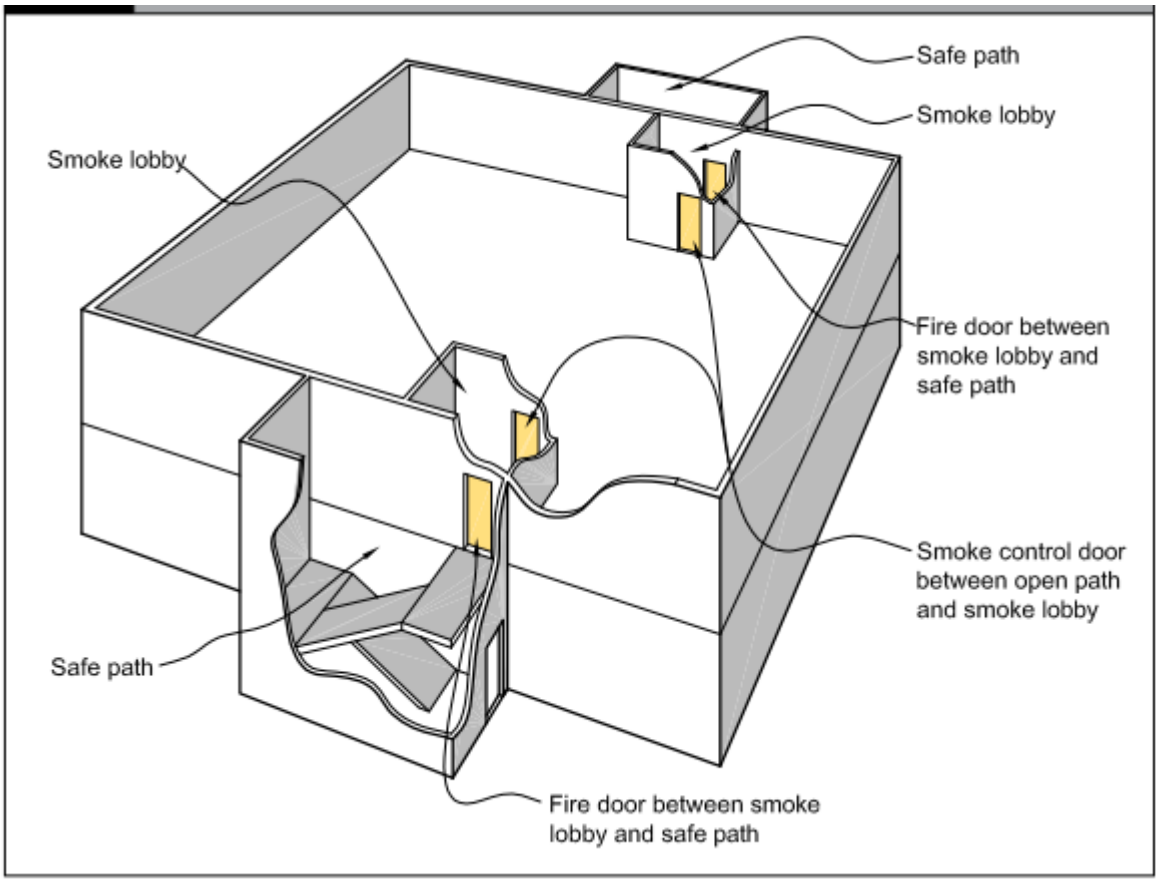


Figure 4.13: Fire doors and smoke control lobbies

Fire doors

4.14.9. *Fire doors* shall be provided:

a) Between an *open path* and a *safe path* (see Figures 3.12 and 4.14);

b) Between a *smoke lobby* and a *safe path* (see Figure 4.13);

c) Where the *escape route* passes through a *fire separation* (see Figure 4.14);

d) Where the *escape route* passes through a *fire separation* that isolates the *safe path* from levels below the *final exit* (see Figure 4.15); and

e) In *fire separations* between vertical and horizontal portions of internal *safe paths*.

Comments:

Doors at *final exits* are not required to be *fire* rated.

Fire doors in *exitways* protect occupants from the effects of *fire* during evacuation. *Fire doors* at the head of stairs to *basements,* as required by Paragraph 4.7.3, isolate the *basement* section of the vertical *safe path*.

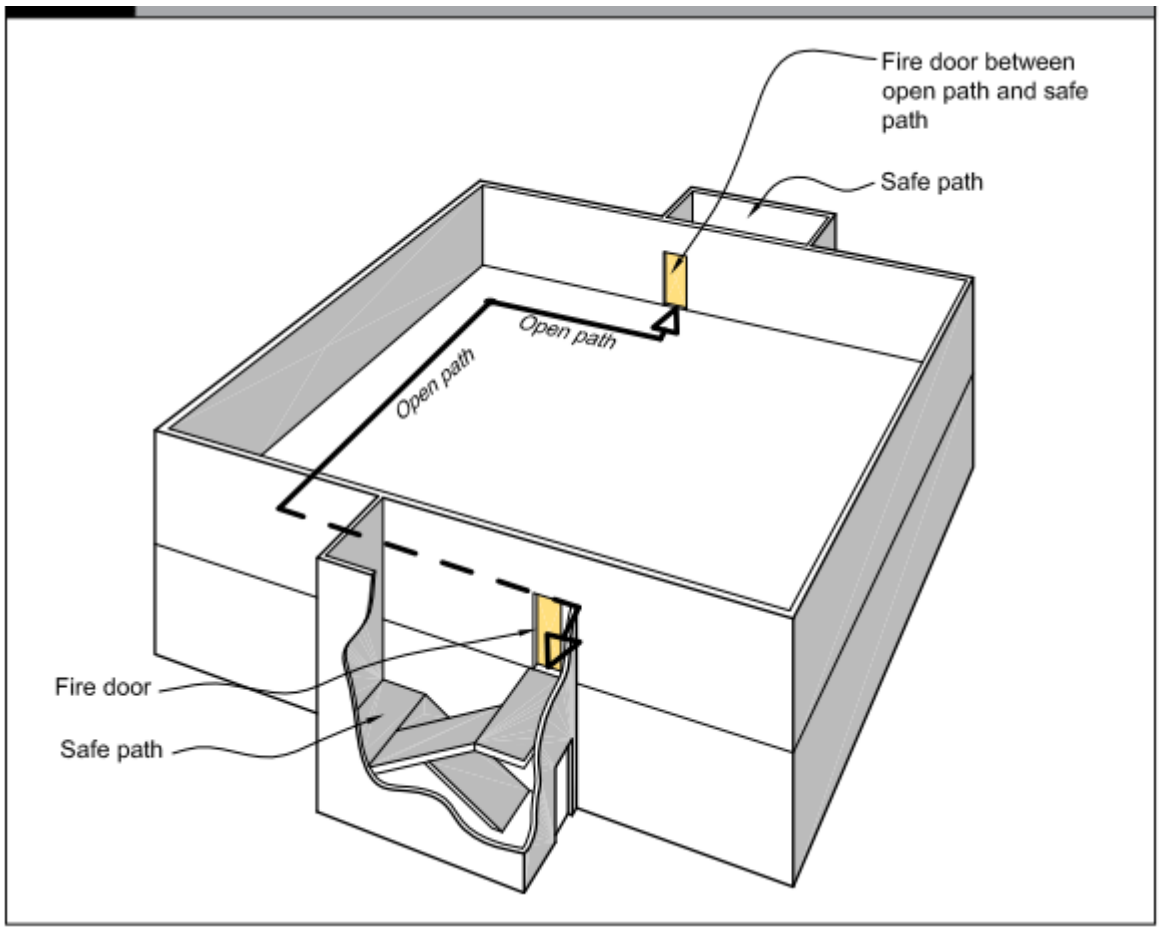


Figure 4.14: Fire doors

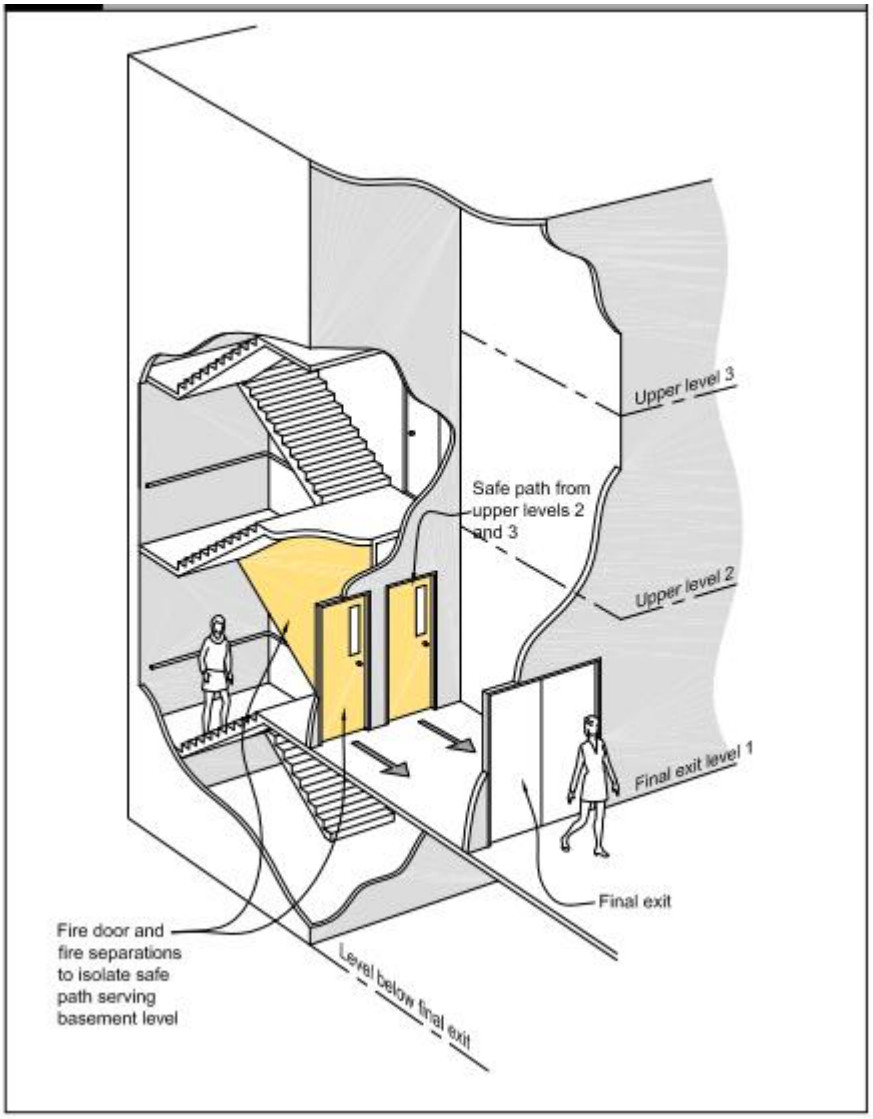


Figure 4.15: Fire doors to separate floors above and below final exit level

Protected shaft access panels

4.14.10. Access panels to *protected shafts* shall have the *fire* resistance performance as required by Paragraph 4.13.2 and shall:

a) be capable of being opened only with a special tool, and

b) if smoke seals cannot be provided, be tight-fitting with a maximum total gap of 8mm around the panel (see Figure 4.16).

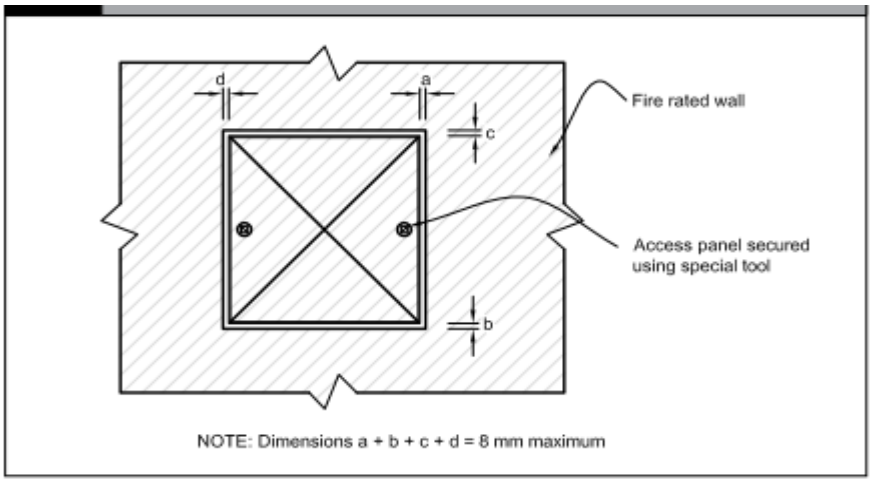


Figure 4.16: Access panels

Lift landing doors

4.14.11. Other than where Paragraph 3.10.3 for a passenger lift within a vertical *safe path* applies, *doorsets* for lift landing doors opening into lift shafts that are *protected shafts* shall be *fire doors* complying with Paragraphs 4.16.1 to 4.16.3 except that an *insulation* rating is not required. Lift landing doors need not be *fire* rated from the shaft side.

Fire dampers

4.14.12. Unless fully enclosed by *construction* with an *FRR* of no less than that required for the *fire separation*, any air duct passing through a *fire separation* shall be equipped with a *fire damper* which, in the event of duct failure or collapse due to *fire*, closes the opening through the separation.

The *fire damper* shall have an *FRR* of no less than that of the *fire separation*, except that the *damper blade* is not required to have:

a) An insulation rating if means to prevent combustible materials being placed closer than 300mm to the fire damper and air duct are provided, or

b) A structural adequacy rating.

The *fire damper* shall be capable of being readily accessed for servicing.

Comment: *Fire dampers* are not effective in stopping smoke and are not required in *smoke separations*. Smoke control in ducts is effected by smoke control devices in the air handling system (see Paragraph 4.16.).

Fire shutters

4.14.13. If a floor has a service opening (e.g. for stairs, a conveyor, forklift access or similar installation) that is not used as part of an *escape route* and which is fitted with a *fire shutter*, the floor may be treated as a *fire separation*.

4.14.14. The *fire shutter* shall be automatically activated by a signal from a smoke detector.

4.14.15. A *fire shutter* shall include a device to retard the rate of closing to no more than 150mm per second.

4.15. Interior surface finishes, floor coverings and suspended flexible fabrics

Surface finish requirements

4.15.1. *Surface finish* requirements for walls, ceilings, ducts and insulation shall be as specified in Table 4.1.

Foamed plastics and exposed combustible insulating materials

4.15.2. If *foamed plastics building* materials or exposed *combustible insulating materials* form part of a wall, ceiling or roof system, the complete system shall achieve a *Group Number* as specified in Table 4.1 and the *foamed plastics* shall comply with the flame propagation criteria as specified in AS 1366 for the material being used. This requirement does not apply to *building elements* listed in Paragraph 4.15.6.

Comments: The completed system may or may not include a surface lining product enclosing any insulation material from any adjacent *occupied space*. If a surface lining is not included, then the *foamed plastics* or *combustible insulating materials* when tested alone shall achieve a *Group Number* of 3, otherwise a surface lining is also required such that the completed system achieves a *Group Number* of 3.

This paragraph applies to *foamed plastics building* materials whether exposed to view from the *occupied space* or enclosed.

Table 4.1: Surface finish requirements

Area of building	Maximum permitted *Group Number*	
	Buildings not protected with a fire sprinkler system	Buildings protected with a fire sprinkler system
Exitways All occupied spaces in importance level 4 buildings	1S	2
Ducts for HVAC systems: Internal surfaces	1S	2
Ducts for HVAC systems: External surfaces	3	3
Acoustic treatment and pipe insulation within air handling plenum	3	3

Comments:

The method for assigning the *Group Number* to a material and for establishing the smoke production rate is specified in Verification Method C/VM2 Appendix A.

Particular note should be made of the requirements for ducts. There are also instances of certain *surface finishes* being assigned *Group Numbers* without evaluation e.g. films and paint coatings.

Flooring

4.15.3. Flooring shall be either *non-combustible* or, when tested to IS0 9239-1, shall have a critical radiant flux of not less than that specified in Table 4.2.

4.15.4. Paragraph 4.15.3 shall apply to flexible finishes such as carpets, vinyl sheet or tiles, and to finished or unfinished floor surfaces.

Wood and wood products in floors

4.15.5. In any *firecell* that has a *firecell* below, the flooring may be of wood products (wood products include boards manufactured from wood fibres or chips bound by an adhesive) provided it has either a thickness of no less than 20mm, or the floor assembly has an *FRR* of -/30/30 when exposed to *fire* from the flooring side.

Table 4.2: Critical radiant flux requirements for flooring

Area of building	Minimum critical radiant flux when tested to ISO 9239-1	
	Buildings not protected with a fire sprinkler system	Buildings protected with a fire sprinkler system
Exitways in all buildings	2.2 kW/m^2	2.2 kW/m^2
Firecells accommodating more than 50 people	2.2 kW/m^2	1.2 kW/m^2
All other occupied spaces	1.2 kW/m^2	1.2 kW/m^2

Exceptions to surface finish requirement

4.15.6. *Surface finish* requirements do not apply to:

a) Small areas of non-conforming product within a *firecell* with a total aggregate surface area of not more than 5.0m^2;

b) Electrical switches, outlets, cover plates and similar small discontinuous areas;

c) Pipes and cables used to distribute power or services;

d) Handrails and general decorative trim of any material such as architraves, skirtings and window components, including reveals, provided these do not exceed 5% of the surface area of the wall or ceiling they are part of;

e) *Damp-proof courses*, seals, caulking, flashings, thermal breaks and ground moisture barriers;

f) Timber joinery and structural timber *building elements constructed* from solid wood, glulam or laminated veneer lumber. This includes heavy timber columns, beams, portals and shear walls not more than 3.0m wide, but does not include exposed timber panels or permanent formwork on the underside of floor/ceiling systems;

g) Individual *doorsets*; and

h) Continuous areas of permanently installed openable wall partitions having a surface area of not more than 25% of the divided room floor area, or 5.0m^2, whichever is less.

Suspended flexible fabrics	**4.15.7.** When tested to AS 1530 Part 2, suspended flexible fabrics shall, within all *occupied spaces*, including *exitways*: a) Have a *flammability index* of no greater than 12; and b) When used as underlay to roofing (whether or not the space is sprinklered) or exterior cladding that is exposed to view, have a *flammability index* of no greater than 5.
Membrane structures	**4.15.8.** The fabric of structures such as canopies shall be tested to AS 1530 Part 2 and shall achieve a *flammability index* of no greater than 12.
Air ducts	**4.15.9.** Where air ducts are contained wholly within a *protected shaft*, provided the shaft does not also contain lifts, only the interior *surface finish* of the air duct is required to comply with Table 4.1.

4.16. Building services plant

Automatic activation	**4.16.1.** When any smoke detection system is activated, it shall automatically turn off all air-conditioning and mechanical ventilation plant that is not required or designed for *fire* safety.
Air handling systems	**4.16.2.** Where smoke control in air handling systems is required to prevent the recirculation of smoke through an air handling system to other *firecells* in a *building*, these systems shall be as specified in Appendix A, A2.1.

Part 5. Control of external fire spread

5.1. Fire separation for buildings with more than one title

Requirements

5.1.1. When a *building* is subdivided so that the *building* straddles more than one title, each part of the *building* located on a separate title, other than titles comprising vehicle parking areas, shall be separated from:

a) the part of the *building* on an adjacent title, by *fire separations* having an *FRR* meeting the *property rating* in accordance with Paragraph 2.3, and

b) any external area in common (unless Paragraph 5.1.2 applies), by *external walls* complying with Paragraph 5.3, except that, if roofed, the area in common shall be a *firecell*, separated from adjacent titles by *fire separations* meeting the *property rating* in accordance with Paragraph 2.3.

Comment:

In a) above, vertical *fire separations* provide *fire* ratings between titles. Floors between titles are also *fire separations* and provide the horizontal separation.

In b) above, a *notional boundary* is established between the titles, and the permitted *unprotected area* in the *external walls* of both titles is determined with respect to that *notional boundary*. When the area in common is roofed, the danger to life and adjacent property is increased; hence the need for greater precautions.

5.1.2. If a *building* is subdivided (as in Paragraph 5.1.1 a)) and all the titles and any areas in common are sprinklered throughout, the requirements for *fire separations* of Paragraph 5.1.1 b) need not apply. However, the requirements for *fire separation* of *safe paths* in Paragraphs 4.7.2 and 4.7.3 shall still apply.

Comment: Generally it will not be a case where a fire station will be subdivided across more than one title, however this section has been included for completeness.

5.2. Horizontal fire spread from external walls

Separation

5.2.1. Specific separation requirements for *unprotected areas* in *external walls* shall be applied in the following circumstances:

a) If, due to the configuration of a single *building* or the siting of other *buildings* on the same property, *external walls* of adjacent *firecells* are exposed to each other at an angle of 90° or less, and one or both *firecells* contain sleeping *risk groups* or *exitways*; or

b) If there are *unprotected areas* in *external walls* facing a *relevant boundary* to *other property* at an angle of 90° or less.

Comment: When the vertical planes of two *external walls* of separate *firecells*, or of an *external wall* and a *relevant boundary* of *other property* (where the wall faces that *boundary*), intersect at an angle of 90° or less, there is potential danger of *fire* spread between *firecells* or to *other property*.

Separation (continued)

5.2.2. Protection shall be achieved by using one or more of the following approaches:

a) Providing a sprinkler system with a water supply complying with NZS 4541 and consisting of two independent supplies one of which is not dependent on town mains;

b) Distance separation (see Paragraph 5.5);

c) Limiting *unprotected areas* in *external walls* (see Paragraph 5.5);

d) Using *fire resisting glazing* (see Paragraph 5.4).

5.2.3. Where the intersection angle of the *building* and the *relevant boundary* is 90° or greater, there are no requirements and an *unprotected area* of 100% is permitted for the *external wall*.

5.2.4. If a wall or part of a wall is less than 1.0m from the *relevant boundary,* a combination of small *unprotected areas* and *fire resisting glazing* is permitted as detailed in Paragraph 5.4.

5.2.5. Table 5.2 applies only to the permitted *unprotected area* in *external wall*s 1.0m or more from the *relevant boundary*. This can be combined with the areas of *fire resisting glazing* and small *unprotected areas* in Paragraph 5.4.

5.2.6. Regardless of the method adopted, all parts of an *external wall* other than allowable *unprotected areas* shall have the appropriate *FRR* as specified by the relevant parts of this design manual (fire).

Analysis required for all external walls

5.2.7. The analysis shall be done for all *external walls* of the *building* to check the permitted *unprotected area* in each wall.

Notional boundary – firecells on the same property

5.2.8. For *firecells* under common *ownership* in the same *building*, or in separate *buildings* on the same property, a *notional boundary* shall be used instead of the *relevant boundary.*
In such cases, when applying Tables 5.1, 5.2 and 5.3, the words *relevant boundary* shall be interpreted as *notional boundary*.

5.2.9. Where one or both *firecells* on the same property contain sleeping accommodation or *exitways*, analysis shall be done separately for each *firecell* with respect to the same *notional boundary*.

5.3. FRRs of external walls

Requirements

5.3.1. *Building elements* that are part of an *external wall* shall be *fire* rated as required by Paragraph 2.3.

5.3.2. Any part of an *external wall* enclosing a *firecell* and not permitted to be an *unprotected area* shall have an *FRR* based on calculations in the current C/VM2 document. This external fire rating shall be to burnout.

5.3.3. When the *unprotected area* of an *external wall* is permitted to be 100%, but the *primary elements* in the line of that wall are required to be *fire* rated, the rating of those *primary elements* shall be no less than the *life rating* in accordance with Paragraph 2.3.

Comment: *Primary elements* are required to be *fire* rated in *buildings* with an *escape height* of greater than 25 m and where they support, or are an integral part of, other *fire* rated *building elements.*

5.4. Small openings and fire resisting glazing

Requirements

5.4.1. *External wall construction* shall meet the following requirements:

a) *Unprotected areas* (referred to as Type A areas) and areas of *fire resisting glazing* (referred to as Type B areas) shall be located to comply with Figure 5.1; and

b) The remainder of the wall shall be *fire* rated equally for exposure to *fire* on both sides.

Size and spacing of Type A and Type B areas

5.4.2. Type A areas shall be no greater than 0.1m^2. Type B areas shall be no greater than permitted by Table 5.1 according to the distance from the *relevant boundary*.

5.4.3. The *fire resisting glazing* shall be rated for *integrity* and the *FRR* of both the glazing and the *external wall* shall be in accordance with Paragraph 2.3.

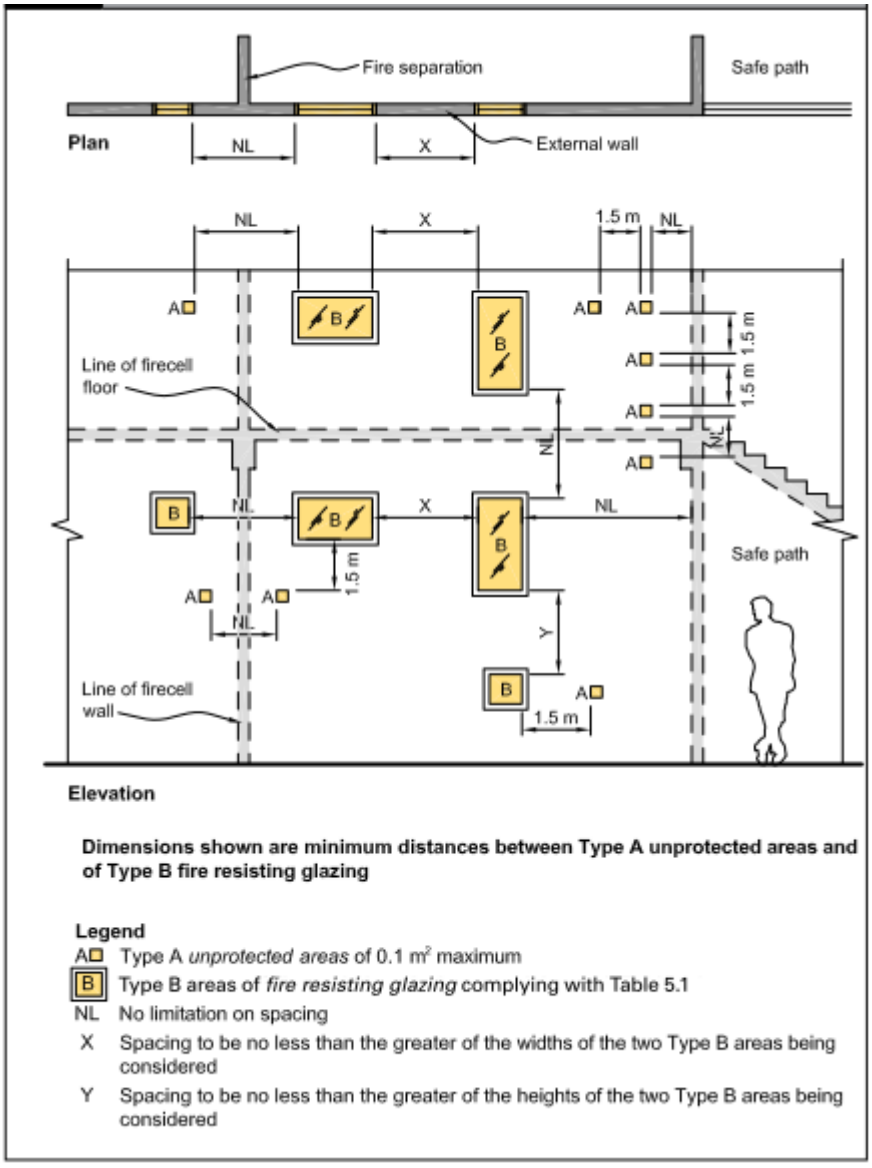


Figure 5.1: Method 1 – Permitted small unprotected areas and fire resisting glazing

Size and spacing of Type A and Type B areas (continued)

5.4.4. There is no limitation on the spacing between adjacent Type A and Type B areas that occur in different *firecells*. Within a *firecell* the following requirements shall apply:

a) Type A areas shall be no closer, both vertically and horizontally, than 1.5m to another Type A or to a Type B area;

b) Type B areas shall be no closer to one another, vertically or horizontally, than the dimensions X or Y shown on Figure 5.1; and

c) Where Type B areas are staggered, rather than being aligned vertically or horizontally, the shortest distance, in any direction, between adjacent areas shall be no less than the greater of the X and Y measurements.

Table 5.1: Permitted areas of fire resisting glazing

Buildings other than warehouses with storage height greater than 3.0 m but less than 5.0 m			Warehouses with storage height greater than 3.0 m but less than 5.0 m	
Minimum distance to *relevant boundary* (m)		**Glazing area (m^2)**	**Minimum distance to *relevant boundary* (m)**	
Unsprinklered	**Sprinklered**		**Unsprinklered**	**Sprinklered**
0.0	0.0	1.0 or less	0.0	0.0
0.7	0.0	1.5	0.9	0.4
0.8	0.0	2.0	1.1	0.5
0.9	0.0	2.5	1.2	0.5
1.0	0.0	3.5	1.4	0.6
1.1	0.0	4.0	1.5	0.7
1.2	0.0	5.0	1.6	0.7
1.2	0.1	5.5	1.7	0.8
1.3	0.1	6.0	1.8	0.8
1.3	0.2	7.0	2.0	0.9
1.4	0.2	7.5	2.1	0.9
1.4	0.3	8.0	2.2	1.0
1.5	0.3	8.5	2.3	1.0
1.6	0.3	9.0	2.4	1.1
1.6	0.4	9.5	2.5	1.1
1.7	0.4	10.0	2.6	1.2
1.9	0.5	11.0	2.7	1.3
2.0	0.6	12.0	2.9	1.4
2.1	0.6	13.0	3.1	1.5
2.2	0.7	14.0	3.2	1.6
2.3	0.8	15.0	3.4	1.7

5.5. Table method for external walls

Using the table method

5.5.1. The table method for *external walls* is the means of satisfying the requirements of this Design manual (fire) for the control of external *fire* spread, and shall be applied to *external walls of buildings* that are parallel to or angled at less than 90° to the *relevant boundary*.

Table 5.2 is split into three parts according to the angle incident between the subject wall and the *relevant boundary*.

If the wall is parallel to the *boundary* or the angle is less than 45°, then columns 2 and 3 shall be used (see Figures 5.2 and 5.3).

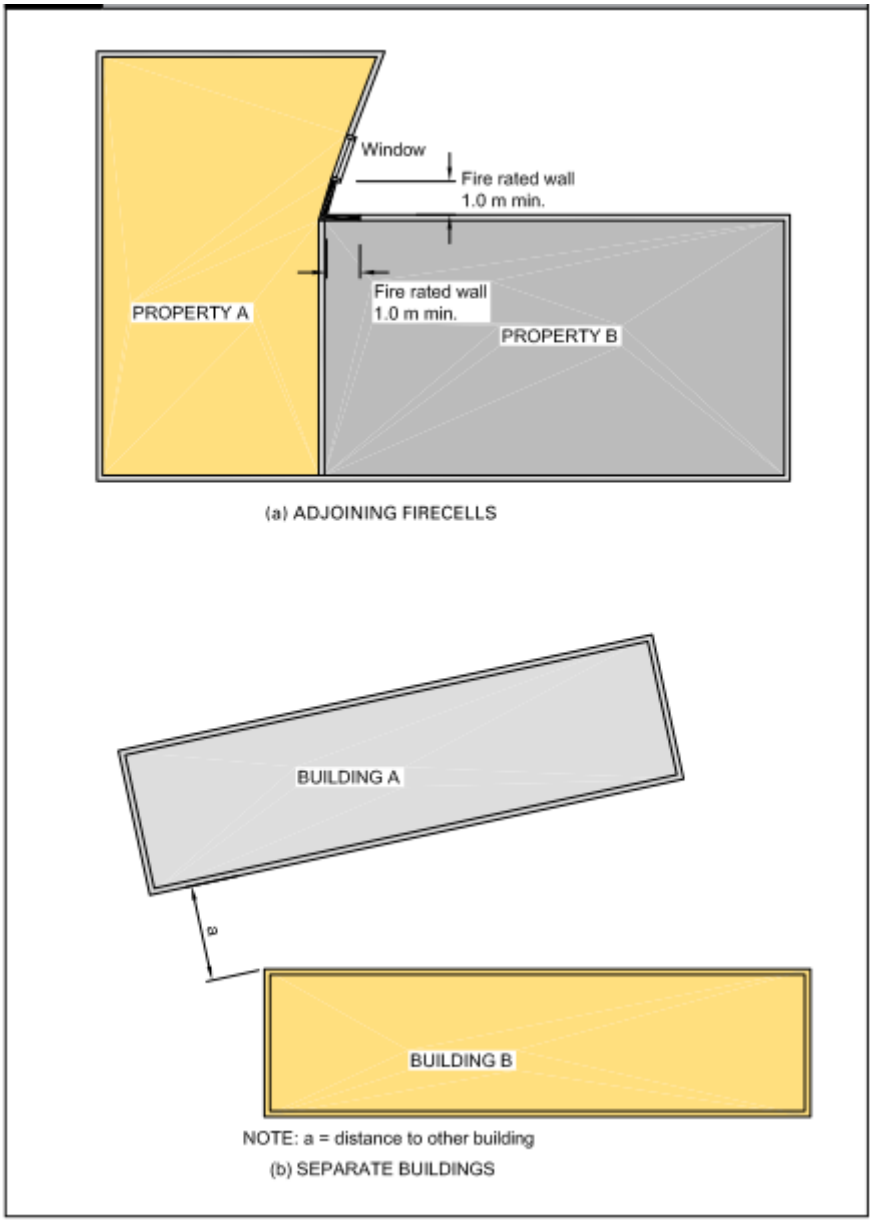


Figure 5.2: Separation of unprotected areas

Using the table method for external walls (continued)

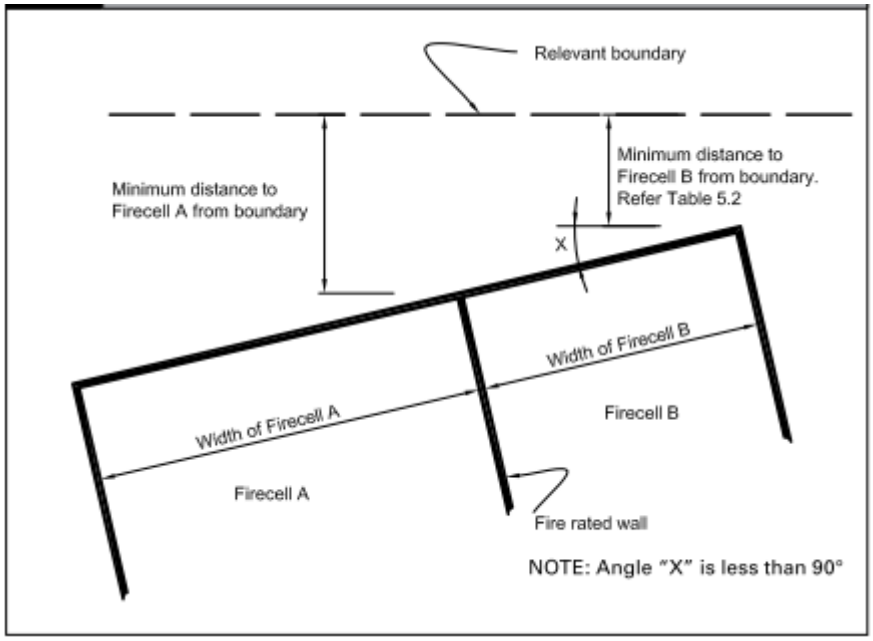


Figure 5.3: Measuring distance to the relevant boundary

5.5.2. The table method shall be used to determine the percentage of *unprotected area* in the *external wall* of each *firecell* depending on the distance to the *relevant boundary*.

5.5.3. Table 5.2 can also be used to determine the required distance from the *relevant boundary* where the percentage of *unprotected area* has previously been determined. Select the appropriate percentage (under the rectangle width column) and read the permitted distance to the *relevant boundary* from the left hand column of Table 5.2.

5.5.4. If Table 5.2 does not contain the exact measurements for the *firecell* being considered, use the next highest value (for rectangle width or *boundary* distance).

5.5.5. The largest individual *unprotected area* in the *external wall* and distance to any adjacent *unprotected areas* shall be restricted to the maximum dimensions specified in Table 5.3.

5.5.6. If the *firecell* is wider than 30m, the *external wall* shall be divided into a number of 30m widths and each of these can be assessed separately when considering the size of the largest individual *unprotected area*.

Comment: This allowance permits the largest individual *unprotected area* to be repeated a number of times along the length of a *firecell external wall* without *fire* rated *construction* between each *unprotected area*.

Table 5.2: Minimum percentage of unprotected area for external walls

Minimum distance to *relevant boundary* (m) (see Figure 5.3)	Percentage of wall area allowed to be unprotected											
	Angle between wall and *relevant boundary* up to 45°				Angle between wall and *relevant boundary* 46° to 60°				Angle between wall and *relevant boundary* 61° to 90°			
	Width of unsprinklered *firecell*		Width of sprinklered *firecell*		Width of unsprinklered firecell		Width of sprinklered *firecell*		Width of unsprinklered *firecell*		Width of sprinklered *firecell*	
	Up to 10m	Greater than 10m	Up to 10m	Greater than 10m	Up to 10m	Greater than 10m	Up to 10m	Greater than 10m	Up to 10m	Greater than 10m	Up to 10m	Greater than 10m
1	20	20	40	40	20	20	40	40	25	20	50	40
2	25	25	50	50	30	25	60	50	35	25	70	50
3	30	30	60	60	40	30	80	60	40	30	80	60
4	40	35	80	70	50	35	100	70	50	40	100	80
5	50	40	100	80	65	40		80	60	50		100
6	60	50		100	80	50		100	75	60		
7	75	55			90	60			90	75		
8	90	60			100	70			100	90		
9	100	70				80				100		
10		80				90						
11		90				100						
12		100										

Table 5.3: Maximum size of largest permitted single unprotected area in external walls

Minimum distance to *relevant boundary* (m) (see Figure 5.3)	Sprinklered *firecells*		Unsprinklered *firecells*	
	Maximum largest single *unprotected area* (m^2)	Minimum distance to adjacent *unprotected areas* (m)	Maximum largest single *unprotected area* (m^2)	Minimum distance to adjacent *unprotected areas* (m)
1	15	1.5	1	0.5
2	35	2.5	4	1
3	60	3.5	10	5
4	96	4	16	7
5	139	4.5	23	8
6	No restriction	No restriction	31	8.5
7	No restriction	No restriction	40	9.5
8	No restriction	No restriction	51	11
9	No restriction	No restriction	64	13
10	No restriction	No restriction	77	13.5

5.6. Horizontal fire spread from roofs and open sided buildings

Requirements

5.6.1. In *buildings*, other than offices and laboratories where the roof of an unsprinklered *firecell* is within 1.0m of a *relevant boundary*, horizontal *fire* spread shall be resisted by either:

a) Type A areas shall be no closer, both vertically and horizontally, than 1.5m to another Type A or to a Type B area;

b) *Fire* rating (for *fire* exposure from below) that part of the roof within 1.0m of the *relevant boundary*. The *FRR* shall be based on the *property rating* for the *firecell*, except that *insulation* is not required; or

c) Extending the wall, being a *fire separation* along or adjacent to the *relevant boundary*, no less than 450mm above the roof to form a parapet.

Roof projections

5.6.2. If the *external wall* is required to have an *FRR*, the eaves projection shall be *constructed* with the same *FRR* as the *external wall*. Alternatively, the *external wall* shall be extended to the underside of the roof and the eaves need not be *fire* rated (see Figure 5.4).

5.6.3. If the *external wall* is not required to have an *FRR*, roof eaves projecting from that wall need not be rated provided that no part of the eaves *construction* is closer than 650mm to the *relevant boundary*.

5.6.4. If the *external wall*, on its own, is not required to have an *FRR*, but roof eaves extend to within 650mm of the *relevant boundary*, the total eaves *construction* and the *external wall* from which they project shall have an *FRR* in accordance with Paragraph 2.3 (see Figure 5.4).

Comment: Eaves *construction* includes the guttering or spouting and any other projections from the eaves, although guttering or spouting need not be *fire* rated.

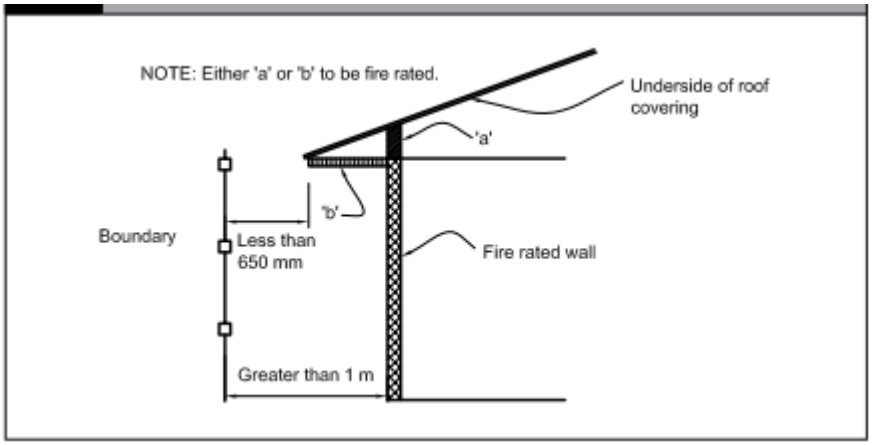


Figure 5.4: Eaves projection

Open sided buildings

5.6.5. An open sided *building* may be either a detached *building* or be connected to another building (see Figure 5.5). For the open sided *building* to be deemed 'detached', the horizontal distance between the other *building* and the roof of the open sided *building* shall be no less than:

a) 1.0m for a roof area exceeding 40m^2, and

b) 0.3m for a roof area no greater than 40m^2.

5.6.6. A *building* having only a single floor level may be *constructed* with walls and roof having 100% *unprotected area* provided that:

a) At least two sides of the perimeter wall are completely open to the environment; and

b) If attached to another *building*, both *buildings* are under the control of the same occupancy; and

c) For unlimited roof plan areas, no part of the roof is closer than 3.0m to a *relevant boundary*; and

d) For roof plan areas of no greater than 40m^2, no part of the roof is closer than 0.3m to a *relevant boundary*.

Comment: Examples of open sided *buildings* having a roof area exceeding 40m^2 are loading canopies, while those with roof areas of less than 40m^2 would be structures such as lean-tos.

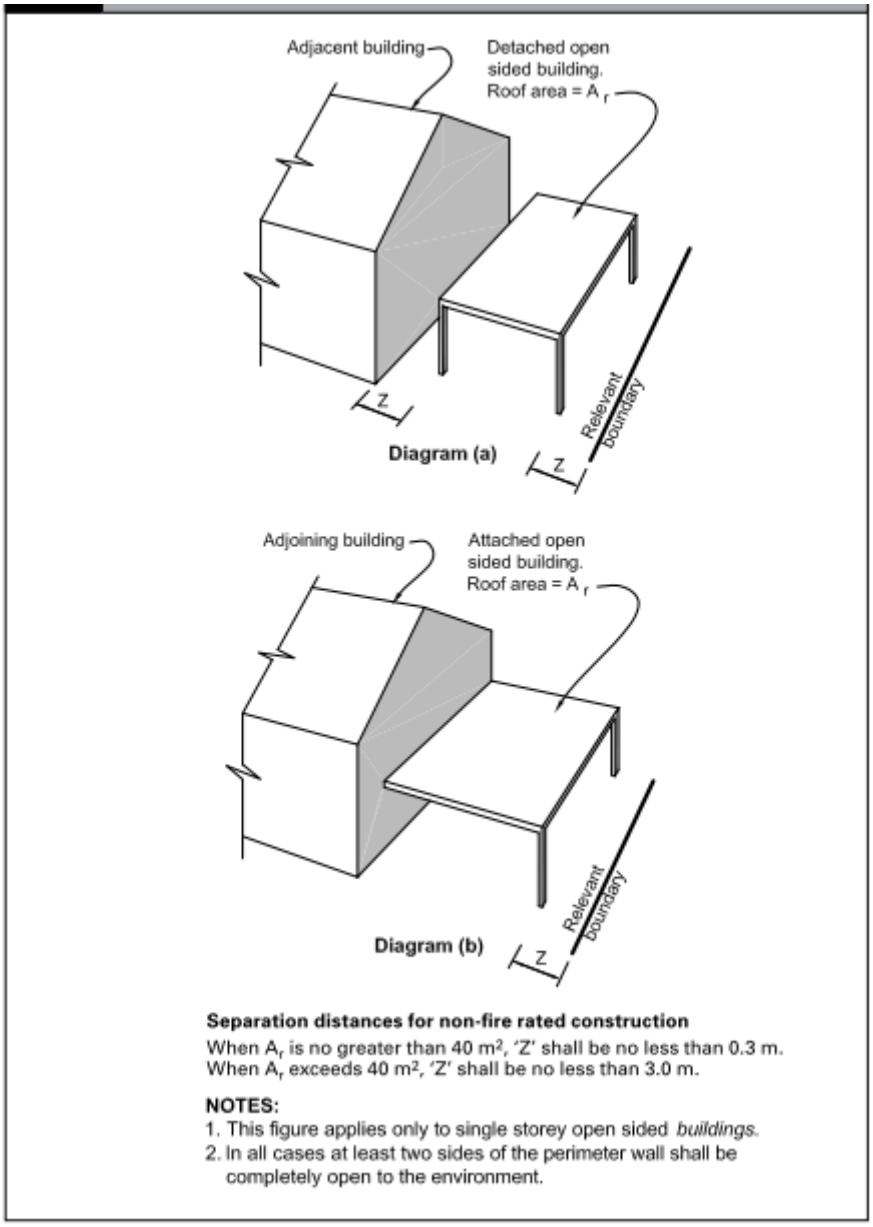


Figure 5.5: Open sided buildings – distance and FRR requirements

5.7. Vertical fire spread

Roofs

5.7.1. Sleeping *risk groups*, *other property* and external *exitways* shall be protected against vertical fire spread from roofs.

5.7.2. Protection against *fire* spread shall be achieved using one or more of the following methods:

a) Separation by distance;

b) *Fire* rating the adjoining *external wall*;

c) *Fire* rating all or part of the roof against the threat of *fire* from the underside;

d) Installing sprinklers in the *firecell* below the roof.

External exitways over roofs

5.7.3. Subject to Paragraph 3.11.3, when an external *exitway* crosses a roof or is above or adjacent to a roof on the same or another *building*, the roof within 3.0m of any part of the *exitway*, and all supporting elements, shall have an *FRR* in accordance with Paragraph 2.3.

Primary elements

5.7.4. *Primary elements* providing support to an area of *fire* rated roof shall have an *FRR* of no less than that of the roof.

5.7.5. When supporting an unrated roof:

a) *Primary elements* such as columns or walls that are required to be *fire* rated shall be rated from floor level to the underside of the roof framing members; and

b) Any roof framing members connected to these *fire* rated columns or walls shall also be rated if their collapse in *fire* would cause the consequential collapse of the rated columns or walls.

Fire spread from an adjacent lower roof

5.7.6. *Fire* spread from a roof close to and lower than an *external wall* shall be avoided by compliance with Paragraph 5.7.7 where *firecells* behind the wall contain other property, sleeping risk groups SI, SM or *exitways*, and are located in the same *building* (as the lower roof), or in an adjacent *building* on the same title.

5.7.7. Where the distance between any part of an *external wall* and a lower roof is less than 9.0m vertically or 5.0m horizontally (see Figure 5.6), protective measures shall be applied either to the roof as specified in Paragraph 5.7.8 or to the wall as specified in Paragraph 5.7.9.

5.7.8. Roof protection shall be achieved by:

a) Providing sprinklers throughout the *building*; or

b) *Constructing* that part of the roof within 5.0m horizontally of the wall, with an *FRR* in accordance with Paragraph 2.3. of the *firecell* below the roof.

5.7.9. *External wall* protection above an adjacent lower roof shall be provided by *constructing* the critical part of the wall (closer to the roof than 9.0m vertically or 5.0m horizontally (see Figure 5.6) with an *FRR* in accordance with Paragraph 2.3.

External fire spread between different levels of the same building

5.7.10. Except where *firecells* are sprinklered, *unprotected areas* in *external walls* shall be protected against vertical *fire* spread where any of the following conditions occur:

a) Firecells containing sleeping risk groups or *exitways* have an escape height of 10m or more; or

b) Firecells containing other property are located one above the other.

5.7.11. If the conditions of Paragraph 5.7.10 occur, *unprotected areas* in the *external walls* of the *firecells* (see Figure 5.7) shall be separated by no less than:

a) 1.5m where any parts of the *unprotected areas* are vertically aligned above one another, or

b) 900mm where the *unprotected areas* on one level are horizontally offset from those on the other level (see Comment below Paragraph 5.7.13).

Spandrels and apron projections

5.7.12. Spandrels may be omitted where an apron projecting no less than 0.6m is *constructed*. Table 5.4 provides acceptable combinations of apron projection and spandrel height.

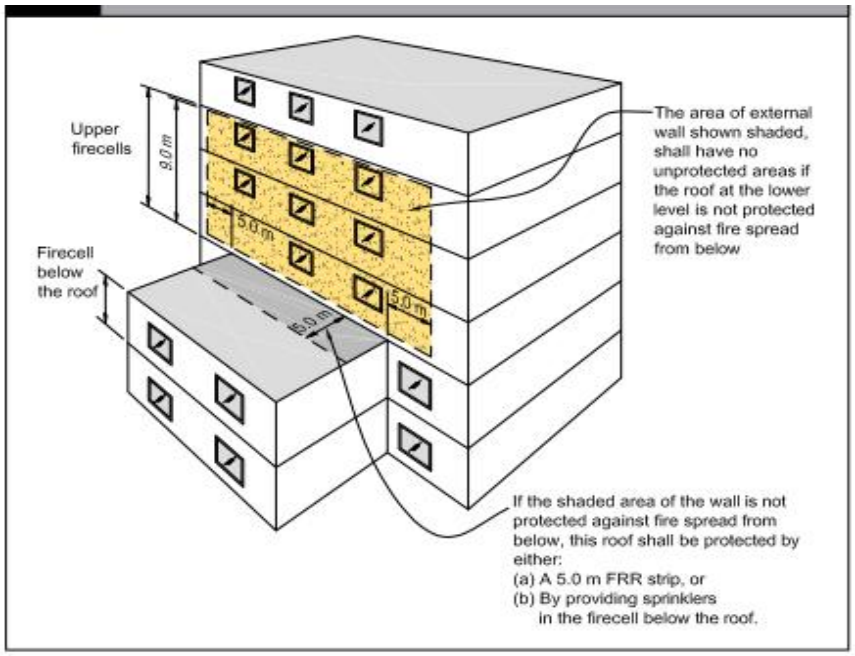


Figure 5.6: External walls and roof, vertical fire spread

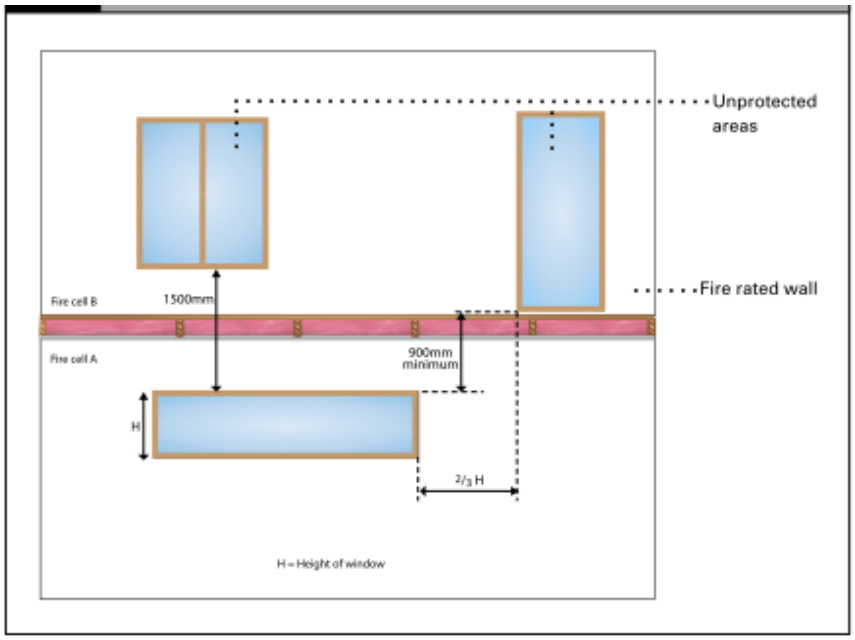


Figure 5.7: Separation of unprotected areas

5.7.13. Aprons shall extend horizontally beyond the outer corners of the *unprotected area* by no less than the apron projection distance. Aprons and spandrels shall have *FRRs* of no less than that of the floor separating the upper and lower *firecells*. Spandrels shall be rated from both sides. Aprons need only be rated from the underside.

Table 5.4: Combinations of aprons and spandrels	
Apron projection (m)	Spandrel height (m)
0.0	1.5
0.3	1.0
0.45	0.5
0.6	0.0

Comments:

The arrangement of windows in each *external wall* is crucial to the prevention of spread of *fire* from floor to floor vertically due to flame projection. The requirements of Paragraph 5.7.11 allow a chess board arrangement, vertical spacing of 1.5m, or aprons.

See also Paragraph 5.3 for application of *FRRs* to *external walls.*

Spandrels and apron projections (continued)

5.7.14. Where there is a gap between an *external wall* and a *fire separation*, which together enclose a *firecell*, the space between the *fire separation* and the *external wall* shall be no greater than 50mm and shall be *fire stopped* (see Paragraphs 4.13.3 to 4.13.5 and Figure 4.10).

5.7.15. Eaves and floors overhanging an *external wall* shall be protected as required by Paragraphs 5.6.3 to 5.6.5.

Roof storage

5.7.16. Storage of *combustible* materials on a roof is not permitted within 1.5m of a higher *external wall* if the adjacent *building* above contains sleeping *risk groups*.

External thermal insulation on walls in multi-storey buildings

5.7.17. Buildings of three or more floors with an *external wall* cladding system incorporating an externally applied *combustible* insulant shall have horizontal *fire stop* barriers installed in the cladding system at intervals of not more than two floors.

5.7.18. For framed wall systems, a barrier shall be *constructed* within the framed cavity, and a *fire stop* barrier shall be *constructed* at the same level within the cladding system. An acceptable detail for barriers is shown in Figure 5.8.

5.7.19. This requirement does not apply to *combustible* insulant positioned between studs and dwangs/nogs in a conventional framed wall system.

5.7.20. Paragraph 5.7.17 applies where the floors are *fire separations* between *firecells*. It does not apply to any *external wall* satisfying the test requirements of Paragraph 5.8.2 b).

Comments:

Horizontal *fire stop* barriers are needed to prevent progressive involvement of insulants in *fire* by restricting hot gases or flames from travelling upwards within the insulation layer. In practice, it may be necessary to specify movement joints to control cracking of the render or surface coating. These may be conveniently incorporated within barriers. Further guidance and suitable *fire* barrier details may be found in BRE Defect Action Sheet DAS 131 with additional information provided in BRE Report 135.

Combustible insulants may include expanded polystyrene (EPS), polyisocyanurate, or polyurethane. The insulants may be covered on the exterior side with a sheet material or with a thin rendered cementitious or polymeric coating. However, Paragraph 5.7.17 still applies.

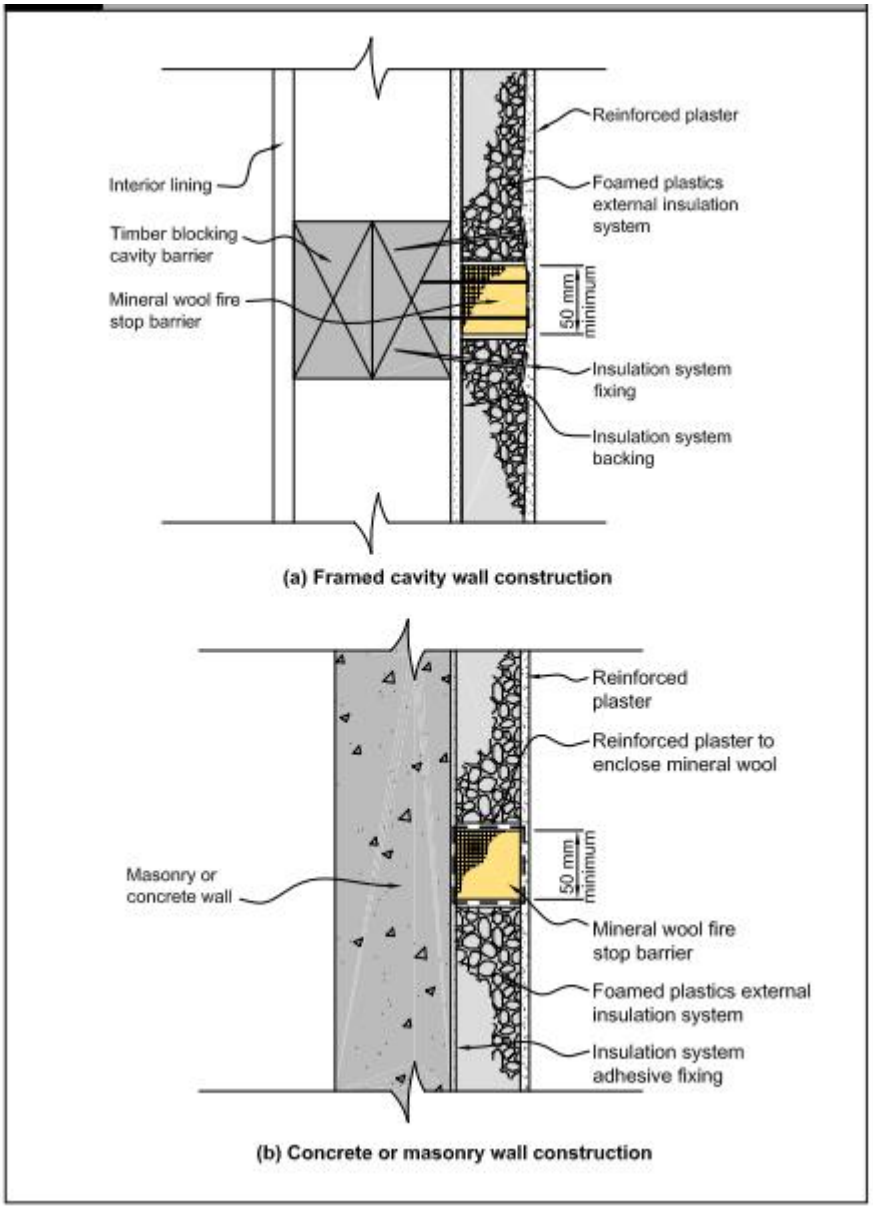


Figure 5.8: Barriers to vertical fire spread in foamed plastics external insulation systems

5.8. Exterior surface finishes

External walls

5.8.1. The *external wall* cladding system shall be tested in accordance with the relevant *standard test* in Appendix C C7.1 and shall satisfy the following requirements:

a) If the distance to the *relevant boundary* is less than 1.0m, the peak *heat release rate* shall not exceed 100 kW/m^2 and the total heat released shall not exceed 25 MJ/m^2; and

b) If the distance to the *relevant boundary* is 1.0m or more and the *building* height is greater than 7.0m the peak *heat release rate* shall not exceed 150 kW/m^2 and the total heat released shall not exceed 50 MJ/m^2.

5.8.2. The requirements in Paragraph 5.8.1 do not apply if:

a) *Surface finishes* are no more than 1mm in thickness and applied directly to a *non-combustible* substrate; or

b) The entire wall assembly has been tested at full scale in accordance with NFPA 285 and passed the test criteria.

5.8.3. The requirements in Paragraph 5.8.1b) do not apply if the *building* is sprinklered and has a *building height* of 25m or less.

> **Comment:** Other full-scale façade test methods may also be acceptable to the *building consent authority*.

5.8.4. Where a *building* has *firecells* containing different *risk groups*, the acceptable peak *heat release rate* and total heat released of an *external wall* cladding system may have different values provided that:

a) For each *risk group* the value is no greater than required by Paragraph 5.8.1 for the *building height* (not just the height of the *firecell*); and

b) The value applied to a *firecell* is no greater than required by any *firecells* at a higher level on that wall.

Comments:

For *external walls*, the acceptable properties of *external wall* cladding systems depend on the *building height*, presence of sprinklers and the distance from the *relevant boundary*.

An *external wall* cladding system includes any applied *surface finish* such as paint or other coating combined with the substrate material. *Fire* tests should be carried out on samples representative of the finished product as used on the *building* to determine compliance.

While the specific *heat release rate* of a cladding system must be verified by *standard test* results, the following is an indication of the performance of some types of *construction*:

- *Non-combustible* materials such as concrete, brick, glass and steel meet the requirements of Paragraph 5.8.
- *Cellulose fibre-cement products with applied finishes/coatings less than 1mm thick would usually meet the requirements of Paragraph 5.8.1*.
- *Ordinary timber products would usually not meet the requirements of Paragraph 5.8.1.*

Where the combustibility of a timber product is modified through the application of a *fire retardant* treatment to meet the requirements of Paragraph 5.8.1, it is to be subjected to pre-test accelerated weathering as described in Appendix C C7.3.

Part 6. Firefighting

6.1. Fire Service vehicular access

Requirements

6.1.1. Any areas that are to be used by the appliance shall:

a) Be able to withstand a laden weight of up to 25 tonnes with an axle load of 8 tonnes; and

b) Be trafficable in all weathers; and

c) Have a minimum width of 4.0m; and

d) Provide a clear passageway of no less than 3.5m in width and 3.5m in height at site entrances, internal entrances and between *buildings**; and[1]

e) Provide access to a *hard-standing* within 20m of:

i) An entrance to the *building*, and

ii) Any inlets to fire sprinkler or *building fire* hydrant systems.

*For stations that include an aerial appliance, confirm the minimum width and height requirements with local operational staff.

6.2. Information for firefighters

Fire alarm control panel/ hazardous substance signage

6.2.1. The fire alarm control panel shall be located in a position close to the Fire Service attendance point and in accordance with NZS 4512 and NZS 4541 as appropriate.

6.2.2. If *hazardous substances* are present in the *building* warning signage in accordance with NZBC F8 shall be displayed.

6.3. Firefighting facilities

Fire hydrant system

6.3.1. Building fire hydrant systems shall be installed as specified in Paragraph 2.2 and shall meet the requirements of Appendix A A2.1.1.

6.3.2. The control features of fire safety systems shall be located at a position with ready access from street level and protected from the effects of fire, including debris falling from upper floors.

Fire Service lift control

6.3.3. Fire Service lift control is required where the escape height exceeds 10m. The control of lifts under fire conditions shall comply with NZS 4332.

[1] 6.1.1.d) is currently under review, however fire design should ensure clear passageways that are appropriate for the station.

Part 7. Prevention of fire occurring

The design, *construction* and/or installation of certain types of fixed appliances using controlled combustion and other fixed equipment is specified as follows.

7.1. Solid fuel appliances

AS/NZS 2918

7.1.1. AS/NZS 2918, with the modifications given in Paragraph 7.1.2, is an acceptable solution for the installation of:

a) Domestic solid fuel burning appliances, installed in commercial situations; and

b) *Flue systems*.

A normative Appendix is an integral part of this Standard.

Modifications to AS/NZS 2918

7.1.2. Delete Paragraph 3.8 and substitute the following:

"3.8 Seismic restraint

The appliance and the floor protector shall be mechanically fixed to the floor itself.

The test seismic force shall be taken as the application of a horizontal force equal to 0.40 times the appliance weight acting in any direction at the mid-height of the combustion chamber. The appliance shall not move, tilt or be dislodged from its installed position during the application of the test force.

The weight of the flue system and a wetback, if fitted, shall not be included in the test."

Delete Section 7 and substitute the following:

"7.1 Ventilation

Ventilation shall be in accordance with Acceptable Solution G4/AS1.

7.2 Water heating equipment

Water heating appliances installed in conjunction with the heating appliance shall be vented and shall comply with Acceptable Solution G12/AS1."

7.2. Gas-burning appliances

AS/NZS 5601.1

7.2.1. For gas-burning appliances AS/NZS 5601.1 sections 6.7, 6.8 and 6.9 and Appendix H are Acceptable Solutions for the *construction* and installation of *flues*, and sections 5.11, 6.2, 6.3 and 6.10 are Acceptable Solutions for the installation of appliances, with the modifications given in Paragraph 7.2.2.

Modifications to AS/NZS 5601.1

7.2.2. Delete paragraph 6.2.11 and substitute the following:

"6.2.11 Seismic restraint Seismic restraint of appliances installed in buildings shall be designed in accordance with B1/VM1 Paragraphs 2.0 and 13.0."

Add a Note to 6.4 as follows:

"Ventilation requirements are contained in Acceptable Solution G4/AS1. The ventilation requirements of this Standard may exceed the performance requirements of NZBC G4."

7.3. Oil-fired appliances

AS 1691

7.3.1. AS 1691, with the modifications given in Paragraph 7.3.2, is an Acceptable Solution for the installation of domestic oil-fired appliances.

Modifications to AS 1691

7.3.2. Delete Paragraph 2.2.3 and substitute the following:

"2.2.3 Electrical equipment.

Electrical equipment shall comply with Acceptable Solution G9/AS1 or Verification Method G9/VM1."

Delete "CSIRO durability Class 2 or better" from Paragraph 3.1.2 (b) and substitute "H5 treatment".

Delete the Note to Paragraph 3.1.2 (d).

Delete Paragraph 3.1.4 and substitute the following:

"3.1.4 Stability

The appliance shall be mechanically fixed to the building.

The test seismic force on the fuel tank shall be taken as the application of a horizontal force in kilograms numerically equal to 0.40 times the tank volume in litres acting at the centre of the tank. The test seismic force on the appliance shall be taken as the application of a horizontal force equal to 0.40 times the appliance operating weight acting at the centre of the appliance.

The appliance and the fuel tank shall resist their respective seismic forces with no significant movement."

Delete the words "without specific approval" from Paragraph 3.2.8 (b).

Delete Paragraph 5.1.1.

Add Note to 5.2.2:

"Note: Refer to Acceptable Solution G4/AS1 for ventilation requirements."

7.3.3. AS/NZS 2918 Sections 2 and 4 are also Acceptable Solutions for the installation of *flues* for domestic oil-fired appliances.

7.4. Downlights

7.4.1. Recessed luminaires shall be installed with clearances from *building elements* including insulation of 100mm.

Comment: The requirement for a clearance of 100mm from recessed luminaires also applies when installing or replacing insulation where recessed luminaires are present.

7.5. Open fires

Open fires not permitted

7.5.1. Open fireplaces are not permitted in fire station buildings.

Appendix A (normative): Fire safety systems

A1.1 Fire alarm and sprinkler systems

Requirements

A1.1.1 *Fire* alarm systems used in *fire safety systems* shall satisfy the requirements of Acceptable Solution F7/AS1. *Fire* sprinkler systems used in the *fire safety systems* shall, except where specified, also satisfy the requirements of Appendix B.

A1.2 Requirements common to alarm systems

Requirements

A1.2.1 Each *fire* alarm system, regardless of method of activation, shall be provided with a means of communication with the Fire Service in accordance with Acceptable Solution F7/AS1.

A2.1 Fire safety system descriptions

Introduction

A2.1.1 The following table provides a brief description of *fire safety systems* not otherwise described in Acceptable Solution F7/AS1. See F7/AS1 for descriptions of *fire* alarm systems Types 3, 6 and 7.

Table A1: Fire safety systems

System type	Brief description
Type 9 – Smoke control in air-handling systems	Where smoke control is required in relation to heating, ventilating or air conditioning systems, it shall comply with the requirements of either: a) AS/NZS 1668: Part 1 and interface with any Type 4 or 7 system installed if it is self contained detection, control and provision of output signal/alarm; or b) NZS 4512 to provide ancillary function output for control of the *HVAC* system if a Type 4 or 7 alarm system is used as a means of smoke detection.
Type 18 – Fire hydrant systems for buildings	Fire hydrant systems shall comply with NZS 4510.

Appendix B (normative): Fire sprinkler systems

B1.1 Introduction

Requirements

B1.1.1 Wherever sprinklers are required by this design manual (fire), they shall comply with the relevant New Zealand Standard, amended as shown in Paragraphs B2.1.

B2.1 Automatic fire sprinkler systems

Amendments to NZS 4541

B2.1.1 . NZS 4541 is amended as follows:

Clause 103 Definitions

Sprinkler system A system including:

(a) to (i) No change.

(j) Delete.

(k) Delete.

(l) No change.

Clause 205 Delete entire clause.

Clause 208 Delete entire clause.

Clause 1203 Routine Surveys

Clause 1203.1 Delete first two paragraphs and replace with:

“It is important that a sprinkler system at all times complies with this Standard as amended by Paragraph B2.1 of Appendix B of the Fire Station Design manual (fire) in all respects. To ensure that building alterations, changes in process or storage patterns or progressive deterioration of system components do not prejudice system compliance, a comprehensive survey shall be carried out biennially at intervals not exceeding 28 months. Such surveys shall be carried out by an independent qualified person.”

Appendix C (normative): Test methods

C1.1 General

This Appendix contains test methods for confirming that specific *building elements* satisfy relevant provisions of the Documents for Protection from Fire. It includes both established *standard tests* and other test methods for *building elements* in situations where *standard tests* are unavailable.

C2.1 Flammability of floor coverings

Critical radiant flux	Materials shall be assigned a critical radiant flux when tested to: ISO 9239 Reaction to fire tests for flooring – Part 1: Determination of the Burning Behaviour using a radiant heat source.

C3.1 Flammability of suspended flexible fabrics and membrane structures

Flammability index	Materials shall be assigned a *flammability index* when tested to: AS 1530 Methods for fire tests on building materials and structures – Part 2: Test for flammability of materials.

C4.1 Properties of lining materials

Combustibility test	Materials shall be classified as *non-combustible* or *combustible* when tested to: AS 1530 Methods for fire tests on building materials and structures – Part 1: Combustibility test for materials

C5.1 Fire resistance

Fire resistance testing	**C5.1.1** *Primary* and *secondary elements*, closures and *fire stops* shall be assigned a *fire resistance rating (FRR)* when tested to: a) AS 1530 Methods for fire tests on building materials and structures – Part 4: Fire resistance tests of elements of building construction, or b) NZS/BS 476 Fire tests on building materials and structures – Parts 21 and 22, or c) EN 1363 Fire resistance tests – Part 1: General requirements. **Comment**: Fire and smoke curtains are commonly tested to EN 1363-1. **C5.1.2** *Fire stops* shall be tested: a) In circumstances representative of their use in service, paying due regard to the size of expected gaps to be *fire stopped* and the nature of the *fire separation* within which they are to be used; and b) In accordance with AS 4072: Components for the protection of openings in fire-resistant separating elements – Part 1: Service penetrations and control joints.

C6.1 Fire doors and smoke control doors

Introduction

C6.1.1 *Fire doors* shall be evaluated in circumstances representative of their use in service, and shall comply with NZS 4520 Fire-resistant doorsets.

Smoke control doors

C6.1.2 A door shall be deemed to be a *smoke control door* if, in addition to the requirements in this document for *smoke control doors:*

a) The door is a *fire door* that is fitted with appropriate smoke seals, or if:

b) It is *constructed* with solid core leaves. Solid timber core leaves, when used, shall have a leaf thickness of no less than 35mm; and

c) It is provided with smoke seals as required by this document. Smoke seals shall be in continuous contact with the mating element, and located so as to minimise interruption by hardware; and

d) The frames are constructed of timber, and the jambs are no less than 30mm thick; and

e) Any vision panel cut-outs are no less than 150mm from the leaf edges; and

f) The maximum average clearances (excluding pre-easing) are

   i) Leaf to frame 3mm

   ii) Leaf to leaf 5mm

   iii) Leaf to top of any floor covering 10mm; and

g) Any additional facings shall be adhesive fixed; and

h) It is provided with signage identifying it as a smoke control door in accordance with Acceptable Solution F8/AS1.

Frictional forces

C6.1.3 The forces required to open any *fire door* or *smoke control door* on an *escape route* shall not exceed 67 N to release the latch, 133 N to set the door in motion, and 67 N to open the door to the minimum required width. These forces shall be applied at the latch stile. These requirements do not apply to horizontal sliding doors in *risk group* SI or to power-operated doors.

Self-closing provision

C6.1.4 All *fire* and *smoke control door* leaves shall be self-closing, and provision shall be made for the self-closing device to be adjustable during commissioning to satisfy the requirements of Paragraph C6.1.3 after installation.

C6.1.5 Where it is desirable in normal circumstances for a *fire door* or *smoke control door* to operate freely, it is acceptable to use a self-closer mechanism that activates in the event of *fire* but does not operate at other times.

Automatic smoke-sensing devices

C6.1.6 Automatic smoke-sensing devices complying with NZS 4512, if used, shall be positioned within the stream of air that passes the door when the *smoke control door* is fully open.

C7.1 Fire properties of external wall cladding systems

Introduction

C7.1.1 *Fire* properties of *external wall* cladding systems shall be determined in accordance with:

ISO 5660 Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method).

Testing

C7.1.2 In addition to meeting the general requirements of ISO 5660 Part 1, testing shall be in accordance with the following specific requirements:

a) An applied external heat flux of 50 kW/m^2;

b) A test duration of 15 minutes;

c) The total heat release measured from start of the test;

d) Sample orientation horizontal; and

e) Ignition initiated by the external spark igniter.

C7.1.3 Timber claddings that have a *fire retardant* treatment incorporated in or applied to them shall be subjected to the regime of accelerated weathering described in ASTM D 2898 Method B with the water flow rate from Method A before testing in accordance with the requirements of Paragraph C7.1.1.

C7.1.4 *External wall* cladding systems that comprise only materials individually classified as *non-combustible* may be deemed to satisfy all the requirements of Paragraph 5.8.1.

Comments:

The *non-combustible* classification represents a more onerous performance level than those required by Paragraph 5.8.1 and is therefore acceptable.

A *non-combustible* classification may be claimed only if the respective materials have been subjected to testing as described in Paragraph C7.1.1.

C7.1.5 Claddings incorporating a metal facing with a melting point of less than 750°C covering a *combustible* core or insulant shall be tested as described in Paragraph C7.1.2 without the metal facing present.

Comment: Aluminium has a melting point of less than 750°C.

Index

References are to the relevant paragraphs, figures or tables in this document unless otherwise stated. References to Appendices are prefixed by the Appendix letter.