Ministry of Business, Innovation & Employment

Commentary

for Acceptable Solutions C/AS1 to C/AS7

December 2013

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Acceptable Solutions C/AS1 to C/AS7

Document history	
Date	Alterations
April 2012	First edition published
February 2013	Paragraph 2.2.4, Figure 2 and Table 1
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This document's status
This document is issued as guidance under section 175 of the Building Act 2004. While the Ministry has taken care in preparing this document it is only a guide and, if used, does not relieve any person of the obligation to consider any matter to which that information relates according to the circumstances of the particular case. The document may be updated from time to time and the latest version is available from the Ministry's website at www.dbh.govt.nz

Part 1: General
Acceptable Solutions C/AS1 to C/AS7

1.1 Introduction and scope

This commentary document is a companion to the Acceptable Solutions C/AS1 to C/AS7 for the New Zealand Building Code Clauses C1 to C6: Protection from Fire. It provides further explanation and background on:

- The provisions of the Acceptable Solutions
- The intent of the requirements, and
- In some cases, what these requirements do not apply to.

It is intended that the commentary will be a living document that is added to and updated as considered appropriate and necessary.

Any requests for additions or further explanation should be made to the Department of Building and Housing.

Where paragraph numbers are given in this document, these provide commentary for the corresponding paragraphs in the Acceptable Solutions (which all have a common numbering system for ease of use). Commentary is not provided for every paragraph in the Acceptable Solutions.

Scope

1.1.1 The Acceptable Solutions can be used for simple *buildings* categorised in any of the seven *risk groups* described in Table 1.1 of the Acceptable Solutions, except in the cases listed in Table 2 of this document. There is a corresponding Acceptable Solution for each *risk group*. No modelling or calculation other than simple mathematics is required.

Table 1 of this document and the commentary below provide further detail on each *risk group* and its associated Acceptable Solution.

Table 1: Description of risk groups and Acceptable Solutions

Acceptable Solution	*Risk group*	Description
C/AS1	SH	Detached houses and *buildings* subdivided into multiple dwellings, provided that: • People from each dwelling have their own independent *escape route* to a *safe place* (ie, their own corridor and *stairway*), and • The *buildings* are no more than two units high (there is no limit on the number of units side by side). Not included: *buildings* with any corridor or *stairway* serving more than one dwelling, detached boarding houses with facilities for six or more guests (see *risk group* SM).
C/AS2	SM	All multiple unit accommodation *buildings* not included in *risk group* SH. Note: there are some minor differences in requirements depending on whether the accommodation is considered permanent (ie, the occupants would be considered to be familiar with the *building* and its features) or temporary. Apartments and flats are considered permanent accommodation, while hotels, motels, hostels, serviced apartments and similar *buildings* are considered temporary accommodation. The Acceptable Solution for this *risk group* also specifies particular *fire* safety requirements for education accommodation, which has been singled out because of its particular nature. This category includes boarding schools (both primary and secondary education) and university halls of residence. Not included: Early childhood education (see *risk group* CA).
C/AS3	SI	All *buildings* or spaces where care is provided to occupants that are incapacitated in some way, are unable to evacuate unaided for any other reason, or would be delayed in their evacuation. It includes detention spaces in police stations and courthouses (but not prisons) and hospitals (excluding special care facilities such as places using general anaesthetic, hyperbaric chambers etc), residential care homes and hospices. It also includes clinics that provide medical day treatment that requires the incapacitation/sedation of those undergoing the treatment; for example, by kidney dialysis, dental procedures or chemotherapy. Not included: Early childhood education (see *risk group* CA)
C/AS4	CA	*Buildings* or places where people congregate or visit, including any place where people are given treatment but are not incapacitated in any way. This includes halls, recreation centres, public libraries (as long as the lending items can be accessed by an adult standing on the floor), cinemas, *theatres*, shops, places providing personal services (such as beautician and hairdressing salons), day schools, restaurants, cafes and *early childhood centres*. It also includes dental and doctors' surgeries, provided those undergoing treatment are not incapacitated. Not included: Dentists' and doctors' practices where patients are incapacitated such as with sedation (see *risk group* SI)

Acceptable Solution	*Risk group*	Description
C/AS5	WB	Places where people work, such as offices (including those providing professional services such as law, engineering and accountancy offices), factories and manufacturing plants (except where *foamed plastics* are part of the process), laboratories and workshops. It also includes storage areas, as long as the storage is less than 5.0 m high. **Not included:** places where personal, rather than professional, services are provided (see *risk group* CA), manufacturing plants where *foamed plastic* is part of the process (see *risk group* WS or use C/VM2), warehouses or storage areas with storage height 5.0 m or greater (see *risk group* WS, or use C/VM2 if unsprinklered).
C/AS6	WS	*Buildings* where large quantities of commodities are stored or where the risk is higher than in other *risk groups*. This includes warehouses where the height of storage is 5.0 m or greater, climate-controlled stores where the storage height is 3.0 m or greater, and *buildings* that are used for trading or bulk retail where the products are stored at a height of 3.0 m or more above the floor.
C/AS7	VP	Any place where vehicles are parked or stored. This includes car, truck and bus parks as well as light aircraft hangars. These can be within a *building* used for other purposes or their own separate *building*. **Not included:** car showrooms with fewer than six cars (see *risk group* CA).

Commentary on the Acceptable Solutions and risk groups

C/AS1: Risk group SH *Risk group* SH applies to detached houses and to *buildings* containing a number of separate residential units, provided there is no more than one unit above another. Therefore, the Acceptable Solution covers the *fire* safety requirements for a row of townhouses and maisonettes as well as two-storey apartment blocks.

While each *household unit* may have more than one floor, it must still have its own independent *escape route*. If the *building* provides a shared *escape route*, then C/AS2 will apply. If a detached house is used as a boarding house, it may have the facilities to accommodate up to five paying guests and still fall within this *risk group*. Boarding houses accommodating six or more paying guests are categorised as *risk group* SM.

The *fire* safety requirements for *risk group* SH are relatively minor and are limited to having maximum *travel distances,* restricting the use of *foamed plastics* on walls and ceilings, and protecting *other property*.

C/AS2: Risk group SM *Risk group* SM applies to any place where people sleep, except:

- those *household units* covered in *risk group* SH (C/AS1), and
- where people are cared for or detained (refer to *risk group* SI (C/AS3)).

Accommodation types

Permanent versus temporary accommodation

The Acceptable Solution for this *risk group* has different *fire* safety requirements depending on whether the *buildings* in this category provide permanent or temporary accommodation.

For the purposes of this Acceptable Solution, permanent accommodation is considered to be that where occupants live on a permanent basis such that this accommodation would be regarded as their residential address. Other accommodation within this category is considered to be temporary.

When developing this Acceptable Solution, a time limit of 90 days was suggested as determining the difference between permanent and temporary accommodation. However, it was accepted that, in certain cases, people may not live in a fixed place for 90 days but would still consider their residence status as permanent. Equally, temporary accommodation may be used as a more permanent place of residence (for example, serviced apartments might be used on a long-term or semi-permanent basis for working week accommodation), but this activity would still be classified as temporary accommodation.

Generally, houses that are used as student accommodation and the like would be regarded as permanent accommodation. However, student hostels provided by universities and other tertiary education institutions would be considered as temporary accommodation despite the fact that a student may reside in the hostel for a full academic year. The reason is that any student may only reside in the hostel for a few weeks or months. Such accommodation is also likely to be used outside the academic year to accommodate visitors for conferences or other events, and these occupants will not be familiar with that particular *building*.

Education accommodation

Education accommodation covers primary or secondary schools that have boarding students or that provide sleeping facilities for school-age occupants.

C/AS3: Risk group SI *Risk group* SI includes all the activities associated with the care or detention of people (except for prisons or special care facilities such as those using general anaesthetic). It is important to note that *buildings* will fall into this category if occupants need to rely on others in any way or if they are restricted in their ability to escape from the *building*.

However, this *risk group* specifically excludes early childhood education activities, which are classified as *risk group* CA and have their own specific *fire* safety requirements.

C/AS4: Risk group CA *Risk group* CA includes the activities in *buildings* that involve people in groups where a proportion of those people are not working. This includes schools and other education facilities, shops and shopping malls. Note that spaces being used for personal services such as hairdressers, beauty therapists, dentists and doctors are included in this *risk group*, unless any occupant is incapacitated in some way. In these cases the *risk group* for the *building* or part of the *building* will be SI.

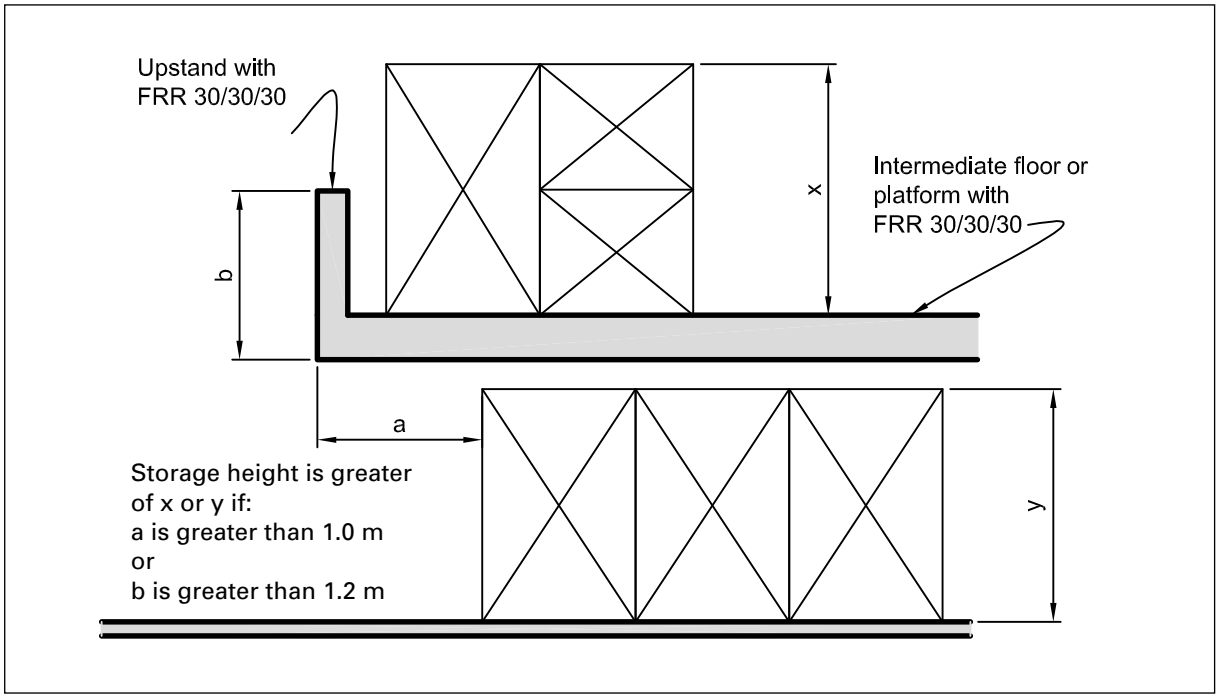
C/AS5: Risk group WB *Risk group* WB covers the activities in *buildings* where people are working. Examples are offices including where professional services are provided (such as offices for lawyers, accountants or consultants) but not where a personal service is provided (such as doctors and dentists).

This *risk group* also includes warehouses with storage up to a height of 5.0 m. It has been deemed that storage above this height will require sprinkler protection for the purposes of compliance with an Acceptable Solution.

Storage height and stack height: the terms storage height and stack height are both used for the height to which items are stored in a warehouse or similar situation. When the Acceptable Solution refers to storage height, it generally means the height from the floor of the storage area to the top of the stack or pile.

However, in some cases storage may be on a raised platform, rack or *intermediate floor*. If there is no storage below the raised platform, rack or intermediate floor, then the storage height is the height from the bottom of the stack to the top, height 'x' in Figure 1.

Figure 1: Storage height with intermediate floor



If there is storage above and below the platform, rack or *intermediate floor,* then the storage height is determined as follows.

a) If the raised platform, rack or *intermediate floor* is *fire* rated and the upper storage is protected from spread of *fire* by either:

   i) ensuring the *fire* rated floor extends 1.0 m beyond the lower stack, or
   ii) providing a *fire* rated barrier extending 1.2 m above the *intermediate floor* at its outermost edge

then the storage height may be taken as the greatest height of storage above or below the raised platform, rack or *intermediate floor*, or

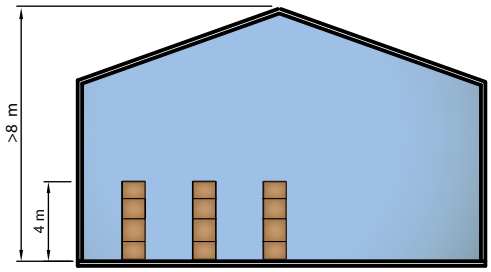
b) If the raised platform, rack or *intermediate floor* is not *fire* rated, or neither a) i) or ii) apply, then the storage height is taken as the height from the bottom of the lowest stack to the top of the uppermost stack.

Capable of storage: The Acceptable Solution uses the term 'capable of storage': this is generally taken to mean that designers should regard a *building* with a stud height of 6.0 m, for example, as capable of storage up to a height of about 5.0 m. It would usually be inconceivable that a warehouse with a stud height of 6.0 m would maintain a freeboard above the stack of, say, 3.0 m to 4.0 m, so that designers should design the *building* for the maximum future versatility (see Figure 2).

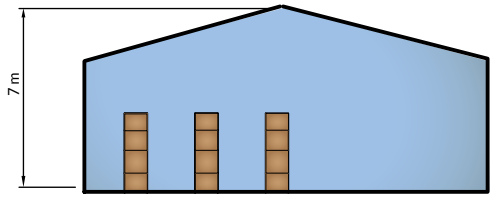
The height to which storage is capable will also be reduced by the presence of structural elements (roof structure) and building services (see Figure 2 c) and d)).

Risk group WB also includes smaller areas of storage (restricted to 4200 m^2 gross area) where the height to the apex of the *building* (to the underside of the roof cladding) is less than 8.0 m.

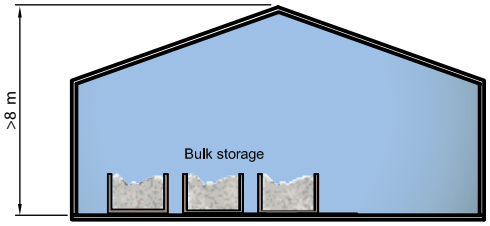
Figure 2: Capable of storage



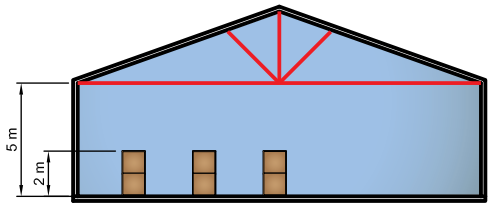
(a) Risk Group is WS despite only 4 m high racking as the apex of the building is greater than 8 m



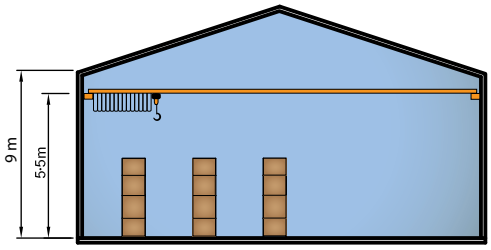
(b) Risk Group WB and firecell is <4200m²



(c) Risk Group is WS despite only bulk storage bins as the apex of the building is greater than 8 m



(d) Risk Group is WB (3 - 5 m) as building is "capable of storage" less than 5 m



(e) Risk Group is WB as overhead crane restricts storage to less than 5m

Where storage is above 3.0 m in height, there are additional *fire* safety requirements (for example, an increase in *property rating*). This recognises the fact that storage above this height may increase the *fire loads*, so additional protection should be afforded for *other property* etc.

C/AS6: Risk group WS *Risk group* WS applies if *buildings* have higher *fire loads* and if *fire* breaks out it will grow rapidly. It includes warehouses capable of storage at a height of 5.0 m or greater, and retail and trading centres where the stock is stored at a height of 3.0 m or greater. This reflects the fact that, while a warehouse would usually have a low *occupant load*, retail and trading centres would have a higher *occupant load* and this would also include people that were unfamiliar with the *building*.

The explanation above for C/AS5: *risk group* WB relating to storage height and stack height, and the comments on 'capable of storage', also apply to this *risk group* and associated Acceptable Solution.

C/AS7: Risk group VP Vehicle parking areas of *buildings*, car parking *buildings* and similar activities present particular challenges with regards to *fire* safety. For this reason all of these activities have been grouped in a dedicated *risk group*. As such areas usually have a low *occupant load* at any given time, this is reflected in the *fire* safety requirements.

For the most part, the requirements for this *risk group* are provided in C/AS5 for *risk group* WB. The requirements specified in this Acceptable Solution are those that are specifically for *risk group* VP in addition to, or as a replacement for, those specified for *risk group* WB.

Outside the scope of the Acceptable Solutions

1.1.2 If any aspect of the *building* and its features or systems cannot be designed entirely within the scope of the Acceptable Solutions, the Verification Method C/VM2 must be used. A designer using C/VM2 should be fully conversant with *fire* engineering principles and should preferably be a recognised *fire* design engineer such as a Chartered Professional Engineer.

The Acceptable Solutions cannot be used for *buildings* with any complex features, such as *buildings* with multiple mezzanine floors or more than 20 storeys high, or any complex systems such as smoke management systems or stair pressurisation systems. These exclusions are detailed further in Table 2 of this document.

Table 2: Building features or systems outside the scope of the Acceptable Solutions

Warehouse/storage *buildings* with a storage height of greater than 5.0 m that are not protected with automatic *fire* sprinklers
Buildings where *foamed plastics* are manufactured or processed, or *buildings* which are part of chemical processing plants
Prisons and district health board detention *buildings* where occupants are unable to evacuate themselves because of the *buildings*' security features
Treatment or care facilities where occupants require a stay in place strategy eg, general anaesthetic operations/procedures, delivery rooms, intensive care units, hyperbaric chambers etc.
Buildings incorporating an atrium, such as multi-floor shopping malls
Buildings with either *intermediate floors* that are larger than the limits specified in the Acceptable Solutions or with two or more *intermediate floors* in a *firecell*, or more than 100 people on the *intermediate floor*
Where smoke control is used
Buildings more than 20 storeys high from ground level
Stadiums or grandstands that provide tiered seating for more than 2000 people or that have a primary egress for more than 100 people above the level of the playing surface

Hazardous substances not covered by these Acceptable Solutions

1.1.5 Processing, manufacturing and storage of *hazardous substances* in *buildings*, particularly if those substances are flammable or explosive, creates particular problems for the design of the *building* including compliance with the HSNO Act 1996. The Acceptable Solutions for Protection from Fire do not constitute compliance with the HSNO Act. If the *building* is going to be used in such a way, you will need to refer to the HSNO Act and associated regulations as additional measures will be required.

1.2 Using these Acceptable Solutions

General approach

The activities carried out in a *building* or part of a *building* determine its *risk group* or *groups* and therefore which Acceptable Solutions will apply (refer to Table 1).

Buildings or parts of *buildings* are categorised further depending on:

- the vertical distance occupants would have to cover to descend/ascend to escape from *fire*, and
- the type and number of occupants in a *firecell*.

These factors will affect the specific requirements of the relevant Acceptable Solution.

Note that application of the Acceptable Solutions depends largely on basic measurements such as *building height*, floor plan areas, wall openings and distances to *relevant boundaries*. Users should determine those measurements as accurately as possible before using these Acceptable Solutions.

Future flexibility

It is very likely that a *building* will undergo one or more changes of use over its lifetime. Even under the same use, floor layout and furnishing will probably alter to accommodate changes in technology and occupant practices. At initial *construction* time, *owners* should therefore consider the advantages of providing *fire* protection and *fire safety systems* to suit alternative occupancies, as these could be difficult or excessively expensive to install at a later date.

Multi-unit dwellings

Multi-unit dwellings may be designed using either C/AS1 or C/AS2 depending on their characteristics.

If the units are in a *building* with no more than one unit above another (regardless of how many floors are within each unit) and each unit has its own *escape route* (ie, there are no corridors or stairs shared by other units) then that *building* can be designed using the requirements for *risk group* SH. These requirements also apply to houses that are detached from other *buildings*: such houses are referred to as detached dwellings or single *household units*.

If the units are in a *building* with more than one unit above another (for example, a three-storey apartment *building* where each apartment is only one floor) or there is a common corridor or *stairway* used by more than one of the units as an *escape route*, then the requirements for *risk group* SM are to be used.

If a single dwelling has more than one floor, that floor does not have to be a *fire separation* and the limitations for *intermediate floors* do not apply in that case.

Primary risk group

1.2.2 The Acceptable Solutions allow for a *building* to be divided up into one or more *firecells*. In turn, each *firecell* may have a number of different activities being conducted within it and these may be categorised into one or more *risk groups*. In order to assign an overall *risk group* to each *firecell*, you must ascertain which of the applicable *risk groups* would require the greatest protection. This then becomes the primary *risk group* for that *firecell*.

1.2.3 For example, a two storey *building* has three *firecells* (each floor is a single *firecell* and the *stairway* is a third *firecell*). The *building* is used as a medical centre and contains offices and a beautician on the upper floor and consulting rooms and outpatient surgical facilities on the ground floor. In this case, the greatest protection on the upper floor would be required by the beautician, so the primary *risk group* for this *firecell* would be *risk group* CA. The greatest protection on the ground floor would be required by the surgical facilities, so this would be *risk group* SI.

1.3 Alterations and changes of use to buildings

For the *fire* design of new *buildings*, the whole of the relevant Acceptable Solution or Solutions will apply.

If an existing *building* is being altered or its use is changed, the *building* is required to comply with all clauses of the *Building Code* 'at least to the same extent' as before the alteration or change of use. (Note that 'change the use' is specifically defined in the Building (Specified Systems, Change the Use and Earthquake-prone Buildings) Regulations 2005.)

In the context of design for *fire* safety, the *building* must:

- After an alteration, comply as closely as possible with the current requirements for *means of escape from fire*, and
- After a change of use, comply as closely as possible with the requirements for *means of escape from fire*, protection of *other property* and structural performance.

Therefore, when using the Acceptable Solutions a user should consider the requirements as follows:

- When considering an alteration to a *building* with no change of use, the design of the *building* including the alteration should comply with all but Part 5 of the Acceptable Solution, and
- When considering alterations and any other *building* work resulting from a change of use, all of the Acceptable Solution must be considered.

A more efficient process may result from using Verification Method C/VM2 for designs involving an alteration or change of use. The Verification Method will allow a comparison of a fully Code-compliant design against one which the designer is proposing as the actual solution. This provides the ability to demonstrate how close to compliance the actual design is and therefore allows a justification for whether or not it is 'reasonably practicable'.

1.4 Calculating occupant loads

1.4.1 The Acceptable Solutions require *occupant loads* to be determined for each *firecell*. To determine the *occupant load* for a particular space, apply the occupant density from Table 1.2 in the relevant Acceptable Solution to the gross floor area of that space. This includes any space occupied by furniture, fittings or internal partitions. If an activity is not specifically described in Table 1.2, select the one closest to the actual activity to determine the *occupant load*.

If there are a number of different activities in a *firecell*, it will be necessary to determine the *occupant load* for each part of the *firecell* where these occur. If a part of a *firecell* is to be used for different activities at different times, select the activity that has the greatest occupant density to determine the *occupant load*.

It will also be necessary to determine the *occupant load* for each floor of a multi-storey *building* so the required widths for vertical *escape routes* can be established.

It is not necessary to determine the *occupant load* for any spaces that may be occupied by the same people already accounted for in calculating *occupant loads* for another space. Examples are tea rooms, sanitary facilities and *exitways*. However, exercise some care if it is probable that the space may be used for a concurrent activity; for example, a meeting room in an office *building* that may be occupied by people from outside the office.

C/AS3: Occupant loads for risk group SI

Number of beds: In most situations, it is clear that the number of beds means the number of bed spaces provided. However, in some cases, people may be in care or undergoing treatment but may not actually be treated on, or recover in, a bed. In these cases, it is important to count these people as if they were on a bed.

Fixed seating

1.4.4 If a space has fixed seating, the *occupant load* can be taken as the number of seats. For churches and other similar venues using pew or bench-type seating, whether fixed or not, Table 1.2 allows for 0.45 linear metres per person of seating space. Take care if there is additional space over and above that allowed for *escape routes*, as this is more than likely to be used as standing space on occasions such as funerals where greater than normal attendance may occur.

Justification for exceptions

1.4.6 In some cases, the *occupant load* derived from Table 1.2 may be clearly more than that which would occur in practice. The stated *occupant load* may be reduced to more realistic levels, so that it is below a trigger point for a particular *fire safety system* (for example, if the *occupant load* is less than 1000, no sprinkler system is required). However, to do this, the proposal must be substantiated to the *building consent authority*.

1.4.7 In other cases, the *occupant load* may exceed the calculated amount. If so, justification for this will have to be provided to the *building consent authority* ensuring that the actual *occupant load* is the basis of the design followed for the Acceptable Solution. This may affect design elements such as *fire safety systems* and *escape route* widths.

Commentary on control of fire and smoke spread

Safeguards to control fire and smoke spread

In order to meet the performance requirements of NZBC C1 to C6, the Acceptable Solutions specify a number of safeguards to control *fire* and smoke spread. The most important are:

a) Internally, by:

   i) dividing a floor where people sleep and where the floor comprises more than one title into *firecells* to facilitate rescue and protect *household units* and *other property*
   ii) requiring floors to be *fire separations*, except where the floor is in a *household unit* or it is an *intermediate floor*
   iii) providing *fire separations* between *firecells* and *safe paths*, and
   iv) providing sprinklers within *buildings*, and

b) Externally, by:

   i) *constructing external walls* and aprons to avoid vertical *fire* spread outside the *building*, and
   ii) *constructing external walls* to limit horizontal *fire* spread by thermal radiation.

One or more of these safeguards will be required, depending on the *risk group*.

Precautions for protecting *other property* apply only to parts of a *building* which, if radiation or collapse occurred, would cause damage across a *relevant boundary*, or to an adjacent *household unit* or other sleeping space.

Control of internal fire and smoke spread

The extent to which internal *fire* and smoke spread must be controlled and the methods adopted will depend mainly on the *risk groups* and activities within the *building*. The time required for occupants to escape to a *safe place* must be controlled. Furthermore, the *Building Act 2004* section 4(2)(i) requires *household units*, other residential units and *other property* to be protected from the effects of the spread of *fire*.

This control can be achieved by one or more of the following:

a) Subdividing *firecells* into smaller *firecells* or *smokecells*
b) Separating high-risk activities from other activities, especially for sleeping *risk groups*
c) Ensuring the integrity of *construction* joints and closures in *fire separations* and *smoke separations*
d) Preventing the movement of *fire* and smoke through *concealed spaces* and services ducts
e) Using appropriate materials and *surface finishes*
f) Installing equipment which, when *fire* occurs, activates automatically to suppress *fire* and smoke spread.

Part 2: Firecells, fire safety systems and fire resistance ratings

Acceptable Solutions C/AS1 to C/AS7

2.1 Provision of firecells

Firecells

2.1.1 A *building* may comprise one or more *firecells* depending on the *fire hazard*. *Firecells* are required to contain a *fire* for sufficient time to allow safe evacuation, and to prevent *fire* spreading to other *firecells* or *adjacent buildings*.

Firecells may also be divided into *smokecells* to restrict the spread of smoke and hot gases during escape.

2.2 Fire safety systems

2.2.1 *Fire safety systems* within *firecells* are required so that:

a) Occupants, in the event of *fire*, have reasonable warning and protection while making their escape to a *safe place*
b) The spread of *fire* is restricted, and
c) Fire Service personnel have sufficient time to undertake rescue operations.

C/AS2: Fire safety systems for risk group SM

The requirements for *fire safety systems* for *risk group* SM vary depending on the *escape height* and whether the activity is classified as permanent accommodation, temporary accommodation or education accommodation.

C/AS3: Fire safety systems for risk group SI

The requirements for *fire safety systems* for *risk group* SI reflect that the occupants are largely incapacitated or prevented from self-evacuating. So early warning by smoke detection is required and the *building* needs to be protected with an automatic *fire* sprinkler system to provide additional time for an evacuation.

C/AS6: Fire safety systems for risk group WS

Buildings in *risk group* WS have to be protected with automatic *fire* sprinkler systems because of the high *fire load* or fast *fire* growth that is likely in the event of *fire*.

C/AS7: Fire safety systems for risk group VP

If a vehicle stacking system is used for either boats or cars, the *building* has to be protected with an automatic *fire* sprinkler system. This requirement recognises the increased risk of *fire* spread where *fire loads* associated with cars and boats are spaced in a vertical alignment close together. It also recognises the difficulty that firefighters would face accessing the source of ignition and extinguishing a *fire*.

More than one risk group on a floor

2.2.4 If a *building* has more than one *risk group*, regardless of the number of floors, the *fire* safety requirements will be dictated by the primary *risk group* within each *firecell*. With regard to alarm and sprinkler systems, if one *firecell* requires an alarm or sprinkler system the rest of the *building* shall be protected with the same system, except in the following cases:

a) If a Type 1 system is installed in *household units*, then the Type 1 system does not have to be installed in spaces that are not *household units*
b) If a *building* is required to be protected with a Type 4 system then any *household units* must be protected with a Type 5 system
c) If *household units* are protected with a Type 5 system, then the areas that are not *household units* must be protected with a Type 4 system, and
d) If a Type 4 smoke detection system is being used, this does not have to be extended into vehicle parking areas or any other areas where smoke detectors may instigate unwanted activations. However, the space will have to be protected with heat detectors instead; for example, in accordance with the requirements of NZS 4512.

If a *building* has multiple alarm or sprinkler systems, these must be interconnected so that activation in any part of the *building* will sound an alarm in all parts of the *building*, except in the following cases:

a) The local smoke component of a Type 5 system, and
b) For *risk group* SI, if the *building consent authority* is satisfied that *building* management systems allow for notification of management and staff for their action without notifying other occupants. In this case, management and staff will be required to carry out the evacuation, which will generally be to a *place of safety* within the *building* rather than to a *safe place*. There must be the ability to sound a general alarm as well.

2.3 Fire resistance ratings

To prevent *fire* spread or structural collapse, the Acceptable Solutions require *building* elements to have *fire resistance ratings* (*FRRs*). The level of *FRR* required depends on the *risk group* of the *building*.

Fire resistance tests: The only way to determine the *FRR* of *building elements* is by using the *standard tests* specified in Appendix C of the Acceptable Solutions.

FRR components

An *FRR* comprises three numbers: these give time values in minutes for *structural adequacy*, *integrity* and *insulation*. *Primary* and *secondary elements* required to have an *FRR* will, depending on their function, need to satisfy one or more of these three criteria as follows:

a) *Structural adequacy*: usually provided by *primary elements* within a *firecell*. These include *building elements* which are part of the structure, and those providing support to other elements with an *FRR* within the same or adjacent *firecells*. Examples are: columns, beams, floors and walls (which may also be *fire separations*). Paragraph 4.3 of the Acceptable Solutions describes special situations where *primary elements* need not have an *FRR*.
b) *Integrity*: usually provided by *secondary elements*. Examples are *fire separations*, which are internal partitions and floors, areas of *external walls* not permitted to be an *unprotected area*, and some areas of roofs when close to another *building* or crossed by an *exitway*. *Primary elements* forming an integral part of a *fire separation* are also rated for *integrity*.
c) *Insulation*: applies to *fire separations* and is required where the transmission of heat through the element may endanger occupants on the other side or cause *fire* to spread to other *firecells* or adjacent *buildings*. For example, *insulation* is necessary for *fire separations* between sleeping spaces, where protecting a *safe path* or through *external walls*.

FRR values

The values applied to each of the three components of the *FRR* depend on the function and location of the *building element* to which the *FRR* applies. In some cases, all three numbers (for *structural adequacy*, *integrity* and *insulation*) will be the same. In others, the numbers will differ and some may have a value of zero.

> For example:
> If a rating (eg, 45 minutes) applies to an isolated column in a *firecell*, the *FRR* is 45/-/-. However, if the column is integral with a *fire separation* wall having an *FRR* of 30/30/30, the column *FRR* is 45/30/30.

2.3.1 The Acceptable Solutions use *life* and *property ratings* to differentiate whether a *building element* needs to perform for a period to allow occupants to escape (*life rating*) or to protect *other property* and to protect firefighters where required (*property rating*). Each of the

Acceptable Solutions specifies the *life* and *property ratings* to be applied for that *risk group*. When an *FRR* is specified for a particular situation, the *life* or *property rating* requirement can be ignored.

C/AS3 and C/AS6: FRR values for risk groups SI and WS

The *FRR* specified for *risk groups* SI and WS takes into account the fact that the *firecells* are protected with an automatic *fire* sprinkler system. Therefore, no further reductions are allowed.

2.3.3 If there are *fire separations* between different *risk groups* on the same floor, the *FRR* of the *fire separation* will be dictated by the highest of the required *FRRs* of each *risk group*. That *FRR* will also apply to the separations surrounding common areas and *escape routes*.

General requirements for FRRs

When applying *FRRs* to *building elements* such as wall and columns, it is necessary to consider the face of the element that will be exposed to *fire*. For example, if a wall is situated between two *firecells* that will be normally occupied, it is necessary to apply the *FRR* to both sides of the wall. If a wall is situated between an occupied *firecell* and a *safe path*, the exposure would only be from the occupied *firecell* side so it is only necessary to apply the *FRR* to this side.

If the required *FRR* is different on each side of the separation, it will be necessary to apply the higher of the required ratings to both sides of the separation.

In the case of floors, it is only required to rate the floor on the underside, as it is not very common for *fires* to burn through a floor and spread downwards.

If a column or beam is part of a vertical separation, or if a beam is part of a floor, they must have at least the same rating as the separation or floor they form part of. This ensures that the separation or floor will have the required performance.

If an element such as a column or a wall is located within a space and a *fire* can attack the element on all sides, this element must be *constructed* with a one-way *fire* rating all the way around (in the case of a column) or on both sides.

Similarly, if a column, beam or wall supports another *building element* that is part of a *fire separation* (such as a wall or floor), it must have an *FRR* at least equivalent to the element that it supports. In addition, columns, beams and other structural framing elements must either:

- have the same *FRR* as the element they are attached to, or
- be designed so that, if they do collapse during a *fire*, this would not cause the collapse of the *fire* rated element.

For example, a beam attached to a *fire* rated wall may not itself need a *fire* rating as it is not providing support to any *fire* rated separation. However, it must either have the same rating as the *fire* rated wall or be designed so that, if it did collapse, it would not 'push' or 'pull' the wall down as a result of its failure.

Unprotected areas: In most cases, *external walls* only have to be rated from inside the wall. The exceptions are if the wall is closer than 1.0 m to the boundary or if the *building height* is greater than 10 m (it is important to note that it is the *building height* and not the *escape height* that is specified). In both these cases the wall must be rated from both sides. This is because the wall has to provide some protection from attack by *fire* either from across a boundary or from a *firecell* below the wall (it provides protection from vertical spread up the face of the *building*).

FRR values

Applying insulation component in FRR

2.3.12 *Insulation* ratings generally apply to all *fire separations* in unsprinklered *firecells* and *external wall* areas that are not part of the *unprotected area*. The *insulation* component is important as it prevents radiation from a *fire* from endangering escaping occupants or from spreading the *fire* by heating *building* contents to their ignition temperature. To protect escaping occupants, it is also important that the *insulation* component is applied to *external walls* close to any external *exitway* if this is the only way for people to escape. If there is an alternative route, you can assume that occupants will use this route instead.

2.3.13 *Fire* rated elements are not required to have an *insulation* rating if the *building* is sprinklered, as it is assumed that the sprinkler system will control the *fire* to the extent that radiation will not pass through the element.

Part 3: Means of escape
Acceptable Solutions C/AS1 to C/AS7

3.1 General principles

3.1.1 *Escape routes* consist of unprotected routes (*open paths*) and protected routes (*safe paths* or *smoke lobbies*).

The basic principles for the design of *means of escape from fire* are:

- There should be alternative *escape routes* from most situations, and
- If direct escape is not possible (such as from a multi-storey *building*), a place of relative safety such as a protected *stairway* must be available on the *escape route* from the *building*. It must not be necessary to leave a *safe path* to reach a *final exit* on the way to a *safe place*.

There is always the possibility of the path of any *escape route* being rendered impassable by *fire* or the products of *fire*. In most cases, occupants should be able to turn their backs on a *fire* and walk away from it to a *final exit*, whether or not that is via a *safe path*. In some cases, a *dead end* (single direction of escape) is allowed. Whether or not this is the case, and how far an occupant is allowed to walk without a choice of alternative routes, depends on the risk presented by the *building*. This risk is represented by:

- The activity
- The area and height of the *building*, and
- The numbers of occupants using the *dead end*.

The unprotected part or *open path* is limited in length so that occupants do not have to walk excessive distances before reaching the comparative safety of a *safe path* or a *final exit*. The horizontal portion of a *safe path* is also limited in length, because the structure does not give indefinite protection to the passage of *fire* or smoke. *Stairways* are mostly designed as *safe paths* and, as such, are designed to be virtually '*fire* sterile' areas.

The length of vertical *safe paths* is unrestricted because, once inside a vertical *safe path*, occupants can be considered to be out of immediate danger. However, in some *risk groups* and tall *buildings*, automatic *fire* sprinkler systems are required to increase the safety of people still further in the event of *fire*. So that *stairways* can be maintained free of hazards, the structure of stairs has to be robust enough to withstand flames and smoke for long enough for occupants to traverse the stairs and escape.

C/AS3: Means of escape for risk group SI: While the general principles for means of escape apply to *risk group* SI, the requirements of Acceptable Solution C/AS3 reflect the fact that, if a *fire* occurs, the occupants of these *buildings* will be delayed, will require assistance, will be moved to a *place of safety* before leaving the *building*, or may not leave the *building* at all. However, escape to a *safe place* outside and away from the *building* must be provided. This is because it is not sufficient to assume that people will be able to remain in the *building* as *fire* is a dangerous and unpredictable phenomenon. In spite of all mitigating measures taken during *fire* design and the actions of the Fire Service, it may be necessary to evacuate the *building* at any time during a *fire* event.

Accordingly, a high level of consultation with the *building* users should occur to ensure that the philosophy of the *fire* design is consistent with the *building*'s proposed use.

3.3 Height and width of escape routes

Width

3.3.2 Horizontal *escape routes* must be at least 850 mm in width. This width allows an *occupant load* of 121 (850 mm divided by 7 mm per person for *risk groups* other than SI) to use the *escape route*. If the *occupant load* exceeds this number, calculate the required width of the *escape route* by multiplying the *occupant load* by 7 mm per person.

For *stairways*, the *escape routes* must be at least 1000 mm in width. This width allows an *occupant load* of 111 (1000 mm divided by 9 mm per person) to use the *escape route*. If the *occupant load* exceeds this number, calculate the required width of the *stairway* by multiplying the *occupant load* by 9 mm per person.

In both cases, an alternative to providing wider *escape routes* would be to provide additional *escape routes*, each with a minimum width as required above.

In unsprinklered *buildings* the widths of *escape routes* must also provide for the case that one available route is blocked by the *fire*. Provision for a blocked *escape route* can be:

- Providing additional *escape routes*, or
- Providing the minimum number of *escape routes* required, but making these wider.

For example, if two *escape routes* are required and no additional *escape route* is provided, each *escape route* has to be sized for the required total width. If three *escape routes* are required and no additional *escape route* is provided, these must be wide enough to ensure that any two *escape routes* provide the required total width. This can be achieved by assuming the widest *escape route* of those provided is unusable.

If the *building* is protected with an automatic *fire* sprinkler system, it is assumed that the risk is low that a *fire* will grow to an extent that it is capable of blocking an *escape route*. Therefore, all of the *escape routes* can be regarded as *escape route* width.

Handrails and limitations to stairway widths

3.3.3 Where *handrails* are provided on both sides of a *stairway* and subdivide a wide *stairway*, each of the *handrails* may intrude into the *stairway* width by 100 mm. Therefore, the total obstruction would be 200 mm (maximum 100 mm each side). If there is a dividing *handrail* as well as the two side rails, the total obstruction would be 300 mm.

Obstructions

3.3.6 For d), note that door leaves may reduce the width of the *exitway* within which they are installed. Each door leaf and its furniture may reduce the *exitway* width by as much as 125 mm. Therefore, a double *doorset* may reduce the width by as much as 250 mm.

3.4 Length of escape routes

C/AS1: Travel distances for risk group SH

3.4.1 *Travel distances* for *risk group* SH can be extended by the installation of an automatic *fire* sprinkler system (Type 6 or NZS 4517 system) or a smoke detection and alarm system (Type 4 or 5 system) or both (Type 7 system). NZBC F7 requires single point smoke alarms (Type 1) to be installed for *risk group* SH. C/AS1 and F7/AS1 provide the requirements for their installation.

Open paths

3.4.2 The measurement of *open path* lengths can be very subjective when designing a new *building*. Typically, the finished layout of the *building* is not finalised, while the location of furniture and other contents that would obstruct direct passage to a door out of the *firecell* is unknown. For these reasons it is necessary to be conservative when determining the *open path travel distance*. To comply with the Acceptable Solutions, use the following method when the actual path of travel is unknown:

a) Start at the most remote point from an exit door. If this is a corner, the start point is 1.0 m away from the corner, in the direction of escape.
b) Follow a path that is located 1.0 m from the walls of the space.
c) At corners, make the path traverse a distance of 1.0 m from the corner.
d) Alternative paths may start at the same point.
e) Finish the *open path* length at a *final exit* door or a door to a *smoke lobby* or *safe path*.

Intermediate floors

3.4.3 On *intermediate floors* in circumstances where the Acceptable Solutions permit the actual measured length to be used for the *open path travel distances*, the alternative *escape route* required has to be out of the *firecell* at the *intermediate floor* level either straight to the outside (via an external *escape route*) or into a separate *firecell* (through a *fire separation*).

3.7 Special cases of open paths

C/AS4: Fixed seating for risk group CA

3.7.3 The Acceptable Solution specifies the arrangement of fixed seating in *theatres* and similar *buildings*. If the seating is tiered, the *open path travel distances* may be taken as the plan distance from the furthest seat to the *exitway*.

It is common to have multi-function spaces with seating that retracts to provide clear floor space. The requirements for seat spacing are the same in this form of seating when it is in use. When determining *travel distances*, treat the platforms upon which the seats are located as an *intermediate floor*. These platforms do not need to be *fire* rated.

3.9 Exitways

3.9.1 There are two types of *safe path*: a vertical *safe path* and a horizontal *safe path*. A vertical *safe path* is a *fire separated stairway*, while a horizontal *safe path* is usually a corridor that is *fire separated*. In most circumstances where both horizontal and vertical *safe paths* are required on an *escape route*, they must be separated from one another by a *fire* rated *doorset*.

Smoke lobby floor area

3.9.2 A *smoke lobby* that is provided in an *escape route* before a vertical *safe path* must have sufficient capacity to serve as a holding area for occupants who may be delayed by the movement of occupants from other levels using the *safe path*. Such a holding area is not required for occupants of the highest level served by a descending vertical *safe path*, or for occupants of the lowest level served by an ascending vertical *safe path*.

If a *smoke lobby* precedes a vertical *safe path*, the number of people that the *smoke lobby* should be designed to accommodate will be based on the number of people on the floor that are likely to use the vertical *safe path*. If the *smoke lobby* is part of a single means of escape, then the entire *occupant load* (100%) of the floor will have to traverse the *smoke lobby* to access the vertical *safe path*.

If there are more than two *escape routes* from the floor, it may be assumed that 70% of the *occupant load* of the floor will traverse the *smoke lobby*. Therefore, if there are two vertical *safe paths* each preceded by a *smoke lobby*, the combination of two *smoke lobbies* plus *stairway* and landings will accommodate 140% of the floor's *occupant load*.

Safe paths

3.10.1 *Safe paths* are the parts of an *escape route* that are separated by *fire* rated *construction* from other parts of the *building* such as office spaces, conference rooms and sleeping areas. Generally, the *safe path* will contain very little in the way of contents and should be regarded as a sterile space. However, the Acceptable Solutions allow some limited activities in *safe paths* under certain conditions.

3.15 Doors subdividing escape routes

In most circumstances, doors must be hinged and must open in the direction of escape. If the number of people using the door is fewer than 50, the door is permitted by the Acceptable Solutions to open inwards. However, this is not good practice and should be avoided if at all possible.

If a doorway leads to a corridor and the open door would present an obstruction to people escaping along that corridor, the doorway must be recessed into the room. The exception is if there are fewer than 50 people in the room, in which case the door may open inwards.

If the number of people using a door is less than 20, manual sliding doors are allowed. This is useful for small offices or other *building* spaces with sliding doors on a secondary *final exit* that would otherwise not be permitted. The restriction to 20 people using the door recognises that the door may be secured in such a way that is not quickly obvious to an occupant, and that the door latches and method of opening may cause a delay in escape.

Roller shutters and tilting doors must not be used on an *escape route* as they significantly delay the time to escape. The only situations they could be considered are:

a) A small storage area that would be intermittently occupied, in which the only access is via the roller shutter, and which would have the shutter door open when it occupied, therefore allowing free egress, and
b) Roller shutters on individual retail units for example in a shopping mall, where staff would occupy the units briefly at the start and end of the trading day with the roller shutter in the closed but not locked position. At all other times, while customers were present, the roller shutter would be in the open position.

Not barred or blocked: It is important that doors on *escape routes* are not barred or blocked when the *building* is occupied and that any locking devices are easily operated. The use of a key for unlocking is not allowed as the door can be locked and the key removed.

Door opening forces: The door opening forces described in the Acceptable Solutions as those able to be opened using one or two hands are those able to be applied by an average, able-bodied person.

Vision panels

3.15.6 Vision panels are required in doors where the opening of a door could block or injure another occupant. As doors in residential units and on hotel rooms open inwards, it is not necessary for a vision panel to be fitted to them despite the fact that they open into a *safe path*. This maintains the privacy of the occupants of these spaces.

Panic fastenings

3.15.12 Panic fastenings are required on doors in *buildings* where there are large numbers of people in the following circumstances:

a) For retail *building* uses, if there are at least 500 people in the *building*, and
b) For other crowd and assembly uses, if there are at least 100 people in the *building*.

The reason for the higher limit for retail use is that there is potentially more control of the people in such *building* uses. Retail activities are generally during daylight or early evening hours; and other social factors come into play.

Other crowd and assembly activities are more likely to be evening and night activities. In these cases there is likely to be less control over the people and many of the *buildings* will be serving meals and refreshments: these factors lead to a higher risk. Therefore, a lower limit has been set before doors have to be easily opened using panic fastenings.

If a *building* requires panic fastenings, these must be fitted on all doors on an *escape route* that have the potential to be used by a large number of people, and which would normally be locked or otherwise secure from one side of the door. For the most part, these doors would be at the *final exits* from the *building*. However, there will be circumstances that doors elsewhere on the *escape routes* need panic fastenings fitted. These could be doors to stairs that are not used during the *building*'s normal operation (emergency exit only) or doors to back-of-house areas that aren't normally used by *building* visitors.

Part 4: Control of internal fire and smoke spread
Acceptable Solutions C/AS1 to C/AS7

4.1 Firecells

4.1.1 If a *building* contains more than one *firecell*, each *firecell* must be separated from any other *firecell*. The *FRR* of the *fire separations* shall be determined by the ratings required for *risk groups* of the *firecells* either side of the *fire separation*. The higher of the required ratings will be the rating of the *fire separation*.

C/AS1: Internal spread of fire for risk group SH

Where there is more than one *household unit* in a *building*, each *household unit* must be separated from other *household units* by *fire separations* with *FRRs* of at least 30/30/30. The garage space for a *household unit* may be integral with it.

C/AS7: Service vehicle bays and unloading areas for risk group VP

C/AS7 allows service vehicle bays and unloading areas to be part of other support *firecells*. This allows some limited vehicle parking in the support *firecell* for a short time. However, the vehicle bay cannot be used for overnight parking or storage of other vehicles.

4.2 Glazing in fire and smoke separations

4.2.1 Glazing in *fire separations* must be fixed and not able to be opened. The glazing must also comply with the *FRR* of the *fire separation* in which it is installed, but it does not have to have a *structural adequacy* component as it does not generally take any load. Uninsulated *fire resisting glazing* is allowed in some cases where an *FRR* is required (for example, in sprinklered *buildings*) and in all cases where the glazing is in a *smoke separation*.

4.2.3 *Smoke separations*, including *smoke lobbies*, may be a 100% glazed area. Because there is no requirement to resist heat, non-*fire resisting glazing* may be used as long as it is toughened or laminated *safety glass.*

Fire doors and smoke control doors

4.2.4 If *fire doors* have any glazing other than a vision panel with an area less than 65,000 mm^2, this glazing must be *fire resisting glazing* with the same *integrity* and *insulation* value as the door. If the door requires an *insulation* value, an uninsulated vision panel up to the above specified area may be used without downgrading the *insulation* value of the door.

Glazing in *smoke control doors* must meet the same requirements as the *smoke separations.*

4.4 Fire stopping

4.4.1 It is essential that any holes or gaps in or around *fire separations* are effectively sealed to preserve the integrity of the *fire separation*. Where two *fire* rated walls meet or where a *fire* rated wall meets a *fire* rated ceiling system or roof, any gaps between them must be *fire* rated. If any *penetrations* for data cabling, plumbing or other services are put through the *fire separation*, these must be *fire stopped* using a system that is tested and designed for the size and type of *penetration* and for the *building* system through which it passes.

Proprietary systems are usually designed for a certain orientation (horizontal or vertical), for a particular size of *penetration*, and for a particular type of wall or ceiling (such as light timber frame or concrete masonry). It is important that the manufacturers' instructions are followed for the installation of any *fire stopping* system or material, particularly in relation to any support required for the *fire stopping* system.

The *FRR* of the *fire separation* must be maintained where the lining of the wall is penetrated for installation of *building* components such as flush boxes for electrical outlets, or telephone and data connections. In these cases, either the wall around the *penetration* can be recessed or a proprietary system used.

The Acceptable Solutions require that the system used to protect any *penetration* has an *FRR* determined by a *fire* resistance test with the *penetration* in place (AS 1530.4) or in accordance with AS 4072 Part 1 as appropriate.

4.5 Firecell construction

4.5.1 *Firecells* are bounded by *fire* rated separations, *external walls* and, in many cases, an unrated roof. The *FRR* of a particular *fire separation* will depend on the *risk group* of the *firecell* on either side of the separation. If it is an *external wall*, the distance from the *boundary* may mean that it can be completely (100%) unprotected and therefore not require an *FRR*. Full floors in multi-storey *buildings* must have an *FRR* (this does not apply to floors within *household units*) in accordance with the *life* or *property rating*. The *FRR* of the supporting elements of *intermediate floors* and the access stairs will depend on the *risk group* of the *firecell* where they are located.

Fire and *smoke separations* must be completely sealed. They can only have openings for doors, other closures (such as access hatches) and for glazing. These components must have the same performance against the passage of *fire*, smoke or both as the rest of the *fire* and *smoke separation*. Any *penetrations* must be *fire* rated as described in Paragraph 4.4 of the Acceptable Solutions on *fire stopping*.

Junctions of fire separations

4.5.5 Where two *fire separations* meet, this junction must be *fire* rated. The junction must also have the *FRR* of the highest rated separation if these differ.

Junctions with roof

4.5.7 If walls extend to a roof, the integrity of the *fire separation* within the *building* can be maintained either by extending the wall above the roof line by a distance of 450 mm or by constructing the wall up to the roof line and sealing the junction. The latter is difficult to achieve for profiled metal roofing with a profile of less than 40 mm and also maintain the moisture management system of the roof. In this case, the wall may be terminated as close as possible to the roof line without interfering with the netting, *fire retardant building* paper or other moisture management measures (see Figure 4.3 of the Acceptable Solutions).

Ceiling space firecells

4.5.8 An alternative method of dealing with separation at roofs is to construct a *fire* rated ceiling void that extends over more than one *firecell*. In this case, the ceiling becomes the *fire* rated separation up to which the walls extend and the junctions are sealed. The ceiling only has to have an *FRR* for exposure below it. This is on the assumption that the ceiling void will be unoccupied and not used for storage, that the risk of ignition is low and, if ignition does occur, the *fire* will vent through the roof and will not be a significant hazard to people escaping the *building*. The space between the ceiling and roof then becomes a *firecell*. Any *penetrations* in the ceiling would also need to be *fire* rated.

Sealing of gaps

4.5.9 Any gaps and *penetrations* in and between *fire* and *smoke separations* must be *fire* rated. Any system used to seal the gaps must have an *FRR* determined in a *fire* resistance test in accordance with AS 1530.4.

4.6 Specific requirements

4.6.1 C/AS2: Risk group SM

Group sleeping areas and suites

Group sleeping areas (GSAs) and *suites* are particular arrangements of sleeping accommodation used in temporary accommodation. Refer to the definitions of these terms to ensure that the correct requirements for these areas are satisfied.

Occupants of *GSAs*, unlike occupants of *suites*, are not assumed to have any feeling of mutual responsibility. Typically, *GSAs* will be arranged as bunkrooms or dormitories. Acceptable Solution C/AS2 requires that halls (such as community and school halls) and *wharenui* used at any time for sleeping should be designed as *GSAs*.

Suites are self-contained units that providing sleeping accommodation for a number of people with some degree of mutual connection. A *suite* is usually arranged with one or more separate sleeping spaces in addition to living, sanitary and kitchen areas.

Household units

Household units in *risk group* SM must be separate *firecells*. However, those units may have more than one floor that is not a *fire separation*, provided that the *travel distances* are within the maximum allowed distance for this *risk group*.

C/AS3: Risk group SI

Group sleeping areas, suites and special care facilities

For *risk group* SI, *GSAs* and *suites* are particular arrangements of sleeping accommodation used where care is provided. Refer to the definitions of these terms to ensure the correct requirements for these areas are met.

In particular, note that *GSA* requirements for *risk group* SI differ from the requirements in *risk group* SM. *GSAs* in this *risk group* may have 12 beds if they are *fire separated* from other *GSAs*. However, if there are two or more *GSAs* side by side, this allowance increases to 20. That is because the provision of an adjacent *GSA*, being a *firecell*, allows the movement of beds horizontally and this provides a temporary refuge while further evacuation is arranged.

Alternatively, the care situation may be designed as a *suite* with a limit of six beds. The *suite* can include other facilities that are shared between the occupants.

GSAs and *suites* are required to be separated from each other and from other spaces.

Acceptable Solution C/AS3 also provides the requirements for situations where, because of the nature of the procedures being carried out (such as sedation, chemotherapy etc), patient movement may be delayed even more than that expected for a general hospital ward.

4.10 Intermittent activities

Support activities

4.10.1 Intermittent activities that are directly supporting the primary activity of a *risk group* are deemed to be part of the main *risk group* activity. Therefore, they may be included in the same *firecell* as the *risk group* and do not require *fire* or *smoke separation*. The *fire safety systems* required for the *risk group* also apply throughout any separate spaces that contain the intermittent activities.

If the spaces are required to be a separate *firecell*, the *fire separations* have to have an *FRR* in accordance with the *life rating*.

Examples of spaces which provide support functions and which are occupied intermittently are: corridors, tea rooms, ironing rooms, laundries, waiting rooms, and kitchens in assembly halls.

Solid waste storage

4.10.2 When located adjacent to *occupied spaces*, solid waste storage areas must be enclosed and must be designed as their own *firecell* to protect occupants and provide them with time to escape.

If the solid waste storage area is in an intermittently *occupied space* such as a car park, it can be open to that space. This provides the opportunity for the alarm to be raised early if a *fire* does start, as the risk of large numbers of occupants being in the space is low. *Fire* spread should be contained by the *fire separations* around the intermittently occupied *firecell*.

Plant, boiler and incinerator rooms

4.10.3 Incinerators, plant, boilers or machinery which use solid fuel, gas or petroleum products as the energy source and that are large enough to require their own room all present a significant risk of ignition. Therefore, they must be contained in their own *firecell*. This requirement does not apply to domestic appliances such as water heaters or local heating. These plant and machinery rooms, no matter what level in the *building* they are located on, must also have an *external wall* with direct access from the outside. This is for ease of access if an incident does occur. In addition, if gas-powered plant or machinery is contained, the floor must be no lower than the ground level outside the room. This allows gases which are normally heavier than air to escape rather than accumulate low to the ground, as this creates a risk of ignition and rapid increase in pressures and flame spread. There may also be additional access from inside the *building*. However, the *building* must have a *smoke lobby* before entering the room and the lobby must contain at least a heat detector.

4.10.4 If the plant room is a completely separate *building*, it will have *external walls* and will most likely already have access direct from the outside. Therefore, the only relevant requirement is that, if gas-powered plant or machinery is used, the ground floor must be no lower than the ground outside.

4.11 Protected shafts

Lifts, conveyors and services

4.11.1 Lifts and other conveyances in a *building* can facilitate *fire* and smoke spread. Therefore, if they serve more than one *firecell* (eg, lifts in a multi-storey *building*), they need to be enclosed in a *fire separated protected shaft*. The *protected shaft* must have an *FRR* determined by the *FRR* of the *risk group* of the adjacent *firecell* and must be rated for exposure on both sides. This includes the top and bottom of the shaft if these terminate below the roof or above the lowest floor.

In addition, in an unsprinklered *building* where lift doors open into an *open path* or horizontal *safe path*, the landing must be *smoke separated* from the adjacent space. This can be achieved by having a *smoke lobby* between the landing doors and the open or horizontal *safe paths*. It is understood that some lift manufacturers have landing doors that have a smoke control capability. If so, this would negate the need for a *smoke lobby*. However, the lift doors would have to have a test certificate stating compliance with a medium temperature smoke test such as AS 1530 Part 7.

Openings in protected shafts

4.11.4 *Protected shafts* must be surrounded by *construction* with an *FRR*. Accordingly, any openings in the *protected shaft* must be protected to the same extent as the *protected shaft* itself. However, the Acceptable Solutions provide a list of exceptions to this rule, principally because it is impractical to close the opening completely and the risk of *fire* spread is deemed to be low despite the existence of the opening.

Solid waste and linen chutes

4.11.5 Solid waste and linen chutes are a specific type of *protected shaft*. The requirement to protect with sprinklers within the shaft is intended to guard against *fire* spread via the shaft should a *fire* occur in the solid waste or linen collection area at the base of the shaft. If these areas are themselves protected with a *fire* sprinkler system, the risk of such spread is low and therefore the 'in-shaft' protection is not required. Additional protection is provided by requiring that the ends of the chute cannot be in an *exitway*.

4.13 Floors

4.13.2 Floors have to be *fire* rated for exposure from below. There is a low risk of a *fire* in a space spreading downwards through a floor.

Intermediate floors

4.13.3 It is the intention of the Acceptable Solutions to allow for mezzanine floors or galleries within a *firecell* that are open to the *firecell* floor below, but with some limitations. *Household units* can have floors that are not *fire separations* provided that the requirements for maximum allowable *travel distances* are met. However, in other types of *building*, it is not the intention to permit upper floors to not be *fire separated* from the ground floor. The Acceptable Solutions limit the area of, and number of people on, any *intermediate floor* and specify that, if an *intermediate floor* is present in a *firecell*, the *escape height* of that *firecell* is the height from which occupants have to escape from the *intermediate floor*.

While the space on the *intermediate floor* is not required to be a *firecell*, the floor does have to be *fire* rated to allow occupants to escape and, to a lesser extent, to allow firefighters access to search and conduct firefighting operations. The Acceptable Solution specifies the *FRR* of the *intermediate floor*, its supporting structure and the access stair or stairs.

4.14 Subfloor spaces

4.14.1 Subfloor spaces that are not normally occupied can present a risk of *fire* starting undetected and then growing to the extent that it jeopardises the *occupied spaces* of the *building*. Therefore, the Acceptable Solutions require that the floor above a subfloor space has an *FRR* unless the design of the space complies with a number of conditions that reduce the risk of *fire* ignition and growth taking place.

One of these conditions is to extend the vertical *fire separations* and *external walls* down to ground level to enclose the space. In the case of the *external walls*, the extension to ground level must be solid *construction* rather than open *construction* such as trellis work.

4.15 Concealed spaces

4.15.1 *Concealed spaces* in *buildings* present the potential for unseen *fire* and smoke spread. This is mitigated by ensuring that *concealed spaces* are *fire* and *smoke separated* from *firecells* and that narrow *concealed spaces* are sealed at regular intervals to reduce the extent of any spread. If a space such as a ceiling void is not itself separated from the *firecell* below, then the vertical *fire separations* must be extended so that the ceiling void is separated from any other parts of the ceiling void that would be above other *firecells*.

4.16 Closures in fire and smoke separations

4.16.1 Closures in *fire separations* include shutters, *fire* and smoke curtains, access panels and doors. Because closures are not load-bearing, they do not need a *structural adequacy* rating. In the case of sprinklered *buildings*, they also do not need an *insulation* rating.

4.17 Interior surface finishes, floor coverings and suspended flexible fabrics

Walls, ceilings and ducts – surface finish requirements

4.17.1 In the 2009 version of Acceptable Solution C/AS1, interior *surface finishes* were required to comply with indices that were achieved using a *standard test* (AS 1530.3). Building Code Clause C3.4 specifies the requirements for surface finishes of walls and ceilings and the requirements for floor coverings. These requirements are now based on ISO Standards. The Acceptable Solutions replicate the requirements and reference the ISO *standard tests* (ISO 9705 and ISO 5660). These are more accurate at predicting the behaviour of products when exposed to *fire*. The old test method (AS1530.2) remains only for the calculation of the *flammability index* for suspended flexible fabrics.

The Acceptable Solutions specify the maximum permitted *Group Number* of a *surface finish* for locations within *buildings*. In some cases, the *Group Numbers* include an 'S' suffix. This indicates that there is a maximum smoke production rate of the material in that location as well as a maximum total heat release of the product. The smoke requirement does not apply to surface linings in sprinklered spaces.

The *Group Number* of a product is determined from criteria provided in Verification Method C/VM2 Appendix A. It is expected that manufacturers of products will have their products tested and will be able to provide specifiers with the results of the testing.

Note that for sprinklered *buildings, surface finishes* must be assessed however there are relaxed criteria for the provision of sprinklers.

Floor coverings are required to satisfy limits on a criterion known as critical radiant flux.

C/AS1: Risk group SH

If *foamed plastics* or fibrous plastics are used in any part of the wall, ceiling or roof, they must comply as specified in the Acceptable Solution. The *Group Number* is established by subjecting the material to an ISO *standard test* (the method of assigning *Group Numbers* is explained in Verification Method C/VM2 Appendix A). The Acceptable Solution provides an exemption to this requirement for certain fixtures, fittings and *building elements* where the limited surface area is deemed not to present a major hazard.

Wood and wood products in floors

4.17.5 This requirement is specified to mitigate possible downward spread from a *firecell* through a floor system which has only been tested from the underside. The requirement uses the charring rate of timber down through the floor material. If the timber is part of a flooring system that has the stated *FRR* with the flooring as the exposed side, this would also provide the required protection against the downward spread of *fire*. In most cases, a concrete slab floor with a thin timber overlay would satisfy the requirement.

Part 5: Control of external fire spread

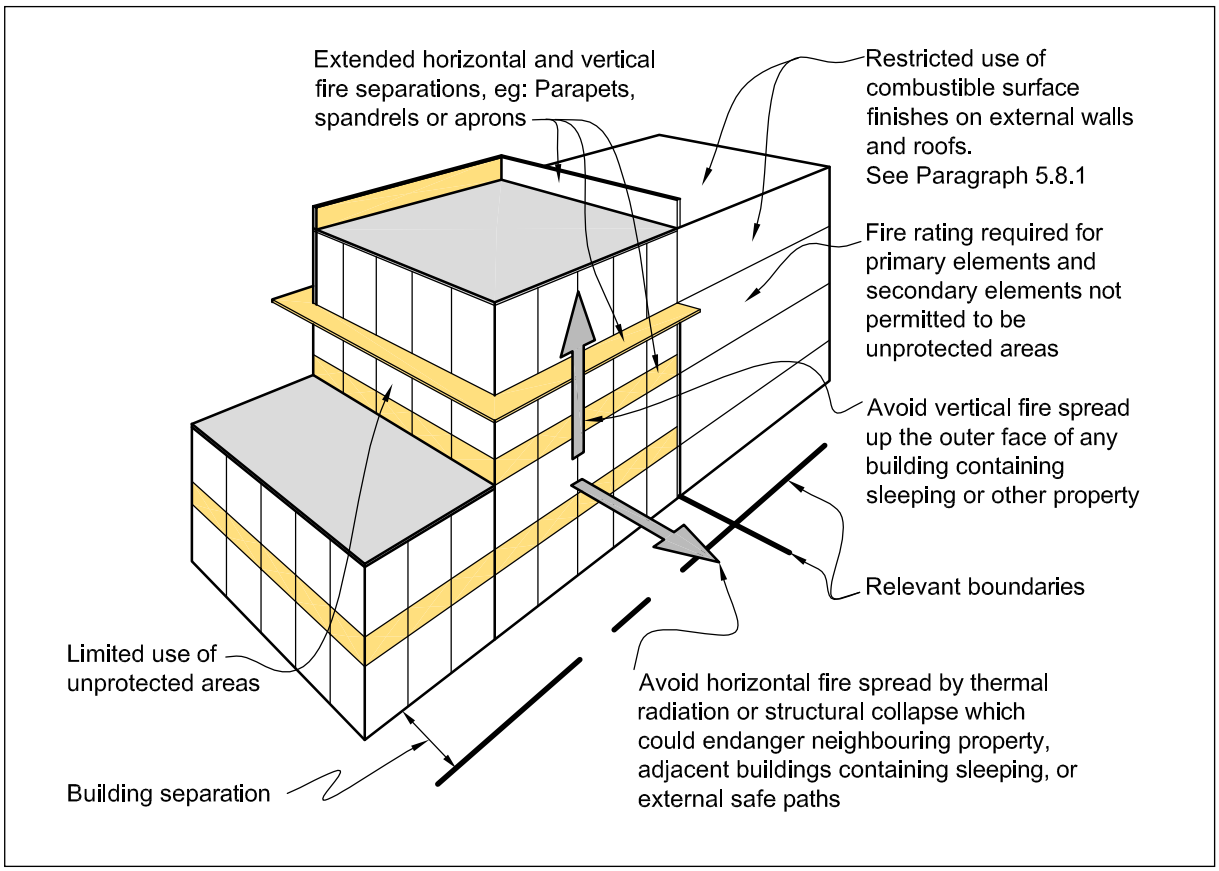
Acceptable Solutions C/AS1 to C/AS7

5.1 General principles

External walls and roofs (see Figure 3) must be *constructed* to avoid vertical and horizontal *fire* spread. Vertical spread up the outer face of the *external wall* of a *building* may occur as result of spread up an external cladding or through gaps between floors and walls which might exist in *construction* such as curtain walling.

Horizontal spread has to be prevented to protect *other property*, sleeping spaces in any adjacent *building* or external *safe paths* that may be present. Horizontal *fire* spread will occur as a result of either radiation from non-*fire* rated areas of a wall or from the collapse of part of the structure of a wall.

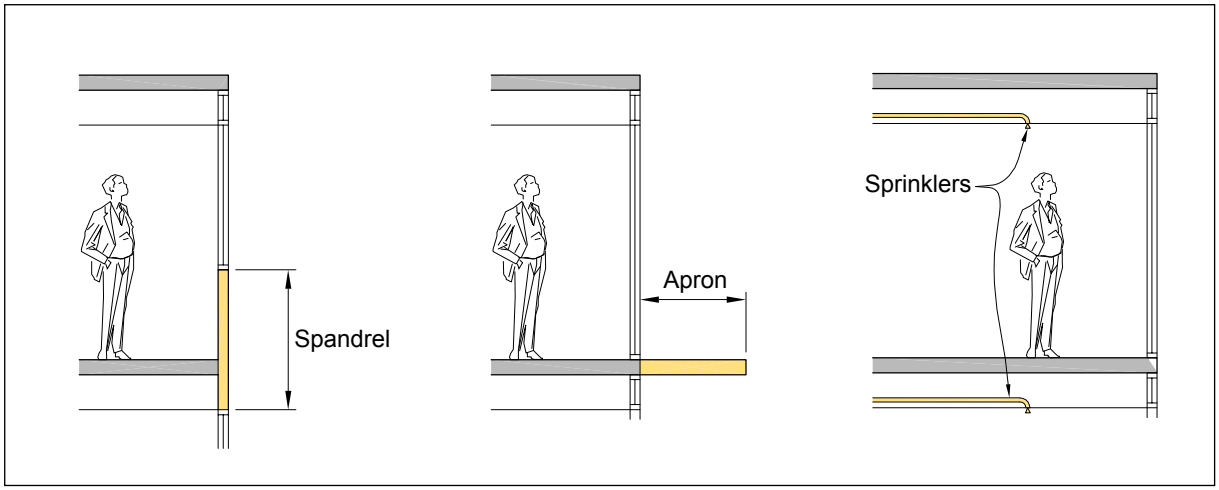
Figure 3: External walls and roofs



The necessary protection may be achieved by one or more of:

a) Separation distance between *buildings*
b) Using *building elements* that have an *FRR*
c) Restricting the use of *combustible surface finishes*
d) Limiting the areas of *external walls* and roofs that are close to a title *boundary* and that do not have an *FRR* (this includes unrated glazing and features such as roof lights)
e) Providing parapets, spandrels or aprons (see Figures 3 and 4)
f) Protecting the *building* with an automatic *fire* sprinkler system.

Figure 4: Spandrels, aprons and sprinklers



C/AS1: External spread of fire for risk group SH

Buildings in *risk group* SH must protect *other property*. This is achieved if these *buildings* are either 1.0 m or more from a *relevant boundary*. If they are within 1.0 m of the *boundary*, this can be achieved if the *building* has a two-way *FRR* of at least 30/30/30.

Note that eaves tend to extend closer to *boundaries* and that, if the *external wall* is required to be *fire* rated, this requirement also applies to any eaves. If the wall on its own is not required to be *fire* rated but the *building* has eaves that are wide enough to encroach within 650 mm of a *boundary*, both the eaves and the *external wall* must then be *fire* rated.

The Acceptable Solution specifies requirements for the *surface finishes* of *external walls* to reduce the possibility of the *surface finish* contributing to radiation across the *boundary*.

C/AS7: External spread of fire for risk group VP

Unit titled car park spaces and associated storage

The Acceptable Solutions allow unit titled car park spaces and any storage area within the parking area (up to given limits) to be open to *other property* such as a neighbouring car park space. In previous versions of the Acceptable Solutions, this situation required a waiver to the requirements of the *Building Code* to be issued.

5.2 Horizontal fire spread from external walls

5.2 The Acceptable Solutions provide the methods to achieve the required protection in this situation. These methods depend on the:

a) Distance from the *building* to a title *boundary* or another *building* on the same site
b) *Building height*, and
c) Width of a wall that faces a *boundary*.

For *buildings* other than those in *risk group* SH, *fire* spread horizontally across a *boundary* is mitigated by restricting the radiation that might be incident on property on the other side of the *boundary*. In the Acceptable Solutions, radiation is controlled by a combination of maintaining a distance from the *boundary*, reducing the area of wall that might potentially radiate heat from a *fire* across the *boundary*, and by sprinkler protection to reduce the potential for a *fire* to grow to a point where it will be a radiating hazard.

The methods used by the Acceptable Solutions to ensure that radiation is restricted depend on the distance between a wall facing a *boundary* and that *boundary*. If the wall is less than 1.0 m from the *boundary*, it must be almost completely *fire* rated. Small areas of the wall are allowed to be unprotected and *fire resisting glazing* on windows is also permitted, but within the limits specified in the Acceptable Solutions.

5.5 Table method for external walls

5.5 If the wall is 1.0 m or more from the *boundary*, then some of the wall may be allowed to be unrated. This allows windows and doors to be fitted in the wall without *fire resisting glazing*. How much of the wall has to be *fire* rated depends on a number of factors, including:

- The *risk group*
- Whether the *building* is sprinklered
- The width of the wall facing the *boundary*
- The angle that the wall makes with the *boundary* (in many cases, the *building* will not be on a rectangular title so that at least one of the walls will be at an angle to a *boundary*), and
- The distance of the wall from the *boundary*.

All of these factors were considered in developing Table 5.2 for each *risk group*. Table 5.2 can be used to calculate the proportion of a wall that is permitted to be unrated or to vary the distance between the *building* and the *boundary* so that all of the wall or a limited proportion of it can be unprotected.

If it is known what percentage of wall area will be glazed and therefore unprotected, the required distance between the wall and the *boundary* can be determined.

If the wall and the *boundary* are not parallel, take the distance to the *boundary* as the closest point between the wall and the *boundary*.

Note that if the wall is 1.0 m or more from the *boundary*, it may be rated from the inside only. If the wall is less than 1.0 m from the *boundary* it must be rated from both sides. This requirement recognises that, where the wall is closer than 1.0 m to the *boundary*, there is a responsibility for the wall to add to the protection of the *building* from any *fire* on the other side of the *boundary*.

5.6 Horizontal fire spread from roofs and open sided buildings

Open sided buildings

5.6.5 The Acceptable Solutions allow some relaxations where a *building* or part of a *building* is open-sided. These relaxations are allowed because there is a considerable area for any *fire* to vent and thus present a lesser hazard to neighbouring *buildings*.

For carports that are part of a residential *building*, it is acceptable for cars to be deemed as an insignificant *fire load*. However, distance requirements still apply.

The Acceptable Solutions specify the allowable distance between the roof and the *relevant boundary*.

C/AS1: carports and similar construction for risk group SH

Garages and carports are deemed to be part of a *household unit*: requirements for these are given in *risk group* SH. If the garage is a shared space where cars belonging to occupants of more than one *household unit* are parked, it must be separated from the rest of the *building* with *fire* rated *construction* so that the requirements to protect *other property* are satisfied.

This Acceptable Solution allows a carport to be closer than 1.0 m to the *boundary* without protection to *other property* provided that certain criteria are met. If the carport does not comply completely with any of the criteria, it must be protected as for an *external wall* (refer to Paragraph 5.2 above).

Part 6: Firefighting
Acceptable Solutions C/AS1 to C/AS7

6.1 Fire Service vehicular access

6.1.1 *Buildings* must be provided with access that allows Fire Service vehicles to reach a position that makes it convenient for firefighters to get into the *building* and to any Fire Service inlets. The nature of the occupants of *risk group* SI means that they are more likely to require rescue by Fire Service personnel. Therefore, additional requirements for this *risk group* allow for the larger size of aerial appliances and the need to get these close to tall *buildings*.

If a *building* has a large footprint (which is most likely to occur for a single-storey *building* such as a warehouse) and is not protected with *fire* sprinkler systems, access to two sides of the *building* is required. This allows the Fire Service the ability to access the *building* in a number of places and means that their travel within the *building* is minimised to reach any *fire source*.

6.2 Information for attending firefighters

6.2.1 The control panel of active *fire* protection systems must be in a place on the outside of the *building* that is easy and convenient for firefighters to locate.

6.2.2 If the *building* contains or processes any *hazardous substance*, signage in accordance with NZBC F3 must be displayed as a warning to anybody in or close to the *building*, including firefighters.

6.3 Access within the building for firefighting and rescue operations

6.3.1 The requirements for means of escape and provision of *fire safety systems* given in the Acceptable Solutions allow the Fire Service to access the *building* in addition to providing for the escape of occupants.

6.4 Firefighting facilities

Fire hydrant system

6.4.1 Any *building fire* hydrant system must comply with NZS 4510. Compliance with this Standard provides for the location of inlets and outlets of the system and for the protection of any firefighters using it.

A *building fire* hydrant system is not required if the distance from the Fire Service attendance point to any point in the *building* is less than 75 m. As long as each Fire Service attendance point complies with the requirements of the Acceptable Solutions, there may be more than one Fire Service attendance point from which the 75 m may be measured.

Fire Service lift control

6.4.3 If the *escape height* of a *building* exceeds 10 m and lifts are provided, these lifts must be provided with Fire Service lift control. This allows the Fire Service to take control and to manage the movement of the lifts to allow them quicker access to upper floors for the purposes of rescuing occupants and also for moving firefighters and equipment to the floor of operations. NZS 4332 Paragraph 25.6 sets out the requirements and method of operation of a lift in Fire Service control. If the area around the lift landing doors is required to be in a *smokecell* and the lift is required to have Fire Service control, the *smokecell* cannot be formed using smoke curtains, but must be formed with permanent *smoke separations* and a *smoke control door*.

Part 7: Prevention of fire occurring
Acceptable Solutions C/AS1 to C/AS7

7.4 Downlights

7.4.1 The requirements for downlights have recently been changed and there are different specifications for commercial and residential *buildings*. In residential *buildings* it is now necessary to install luminaires with the ratings as specified; all of these types of luminaire can be abutted with insulation and some (IC) may be covered, providing the insulation is also suitable for such use.

In commercial *buildings*, where luminaires not meeting the specifications in the Acceptable Solutions are installed, the default requirement is to maintain a distance of 100 mm from the luminaire and any *building element* that may not withstand the heating resulting from the luminaire. This includes the insulation.

Where insulation is being replaced or retrofitted, then it will be necessary to maintain the 100 mm clearance regardless of the type of *building* unless the rating of the luminaire is clearly identified as one listed in the Acceptable Solutions.

Appendix 1: Case Study

Appendix 1 provides an example of a report prepared to communicate the design of a building complying with the Acceptable Solutions.

The contents of the design report also follow the requirements of IPENZ Practice Note PN22, which is also Department guidance.

It is provided to illustrate the level of information required in a design report and is not intended to be used as a template for design reports.

FIRE ENGINEERING DESIGN REPORT

ONLINE WAREHOUSE BUILDING

123 INFERNO DRIVE, PYROTOWN

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Issue 1 (Building Consent)

15th September 2012

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1 Purpose

The purpose of this report is to show compliance with the New Zealand Building Code (NZBC) for Means of Escape from Fire and Spread of Fire as required by the Building Act 2004 for a new building. This report is based on the Acceptable Solution C/AS6 to meet the NZBC Protection from Fire clauses C1-C6.

This report addresses the requirements of the Building Act 2004 only and does not address owners or tenants property protection unless specifically referenced. This report is specific to the building and client, it is not to be used by any third party and no responsibility is taken for any third party who uses this report.

Issues that may arise under the Fire Safety and Evacuation Regulations 2006 should be discussed directly with the New Zealand Fire Service (NZFS).

This report does not examine any storage, ventilation or bunding requirements for hazardous substances as defined in the Hazardous Substances and New Organisms Act 1996 (HSNO) or Building Code Clause F3-Hazardous Substances and Processes, and in particular the Hazardous Substances (classes 1 to 5 controls) Regulations 2001. It is assumed that any hazardous substances not stored as required by the Regulations are in such small quantities as to have minimal effect on the fire load of the building. Building owners should contact an EPA Test Certifier for advice on compliance.

This fire engineering design is a performance document, intended to be used by the Architect and other consultants in implementing their detailed design and preparing their working drawings and specifications. The consultants whose documentation is required to incorporate the requirements of this fire engineering design are expected to have read this report, understood the implications as it affects their scope of work and have incorporated the relevant Protection from Fire requirements into their drawings and specifications.

To ensure the above co-ordination of the Protection from Fire requirements has been undertaken the resulting drawings, specifications and other documents should be reviewed by the author of this report and when satisfied the design coordination statement as required by IPENZ Practice Note PN22 will be provided.

2 Introduction

The building is a new distribution warehouse with a large amount of racking for storage of the online website products. The building height is between 11-14m. The racking in the warehouse cannot be accessed on upper levels and the racking layout is known and is also submitted for Building Consent. There is a small lean-to area attached to the warehouse that is used for product photography, studio, workshop, forklift recharge area and the sprinkler valve room. The offices are beside this lean-to area and above the offices is a small staff room.

This report is based on drawings by ABC Architects, sheets no. 100, 101 and 102, dated 29th November 2011 as attached in Appendix 2. The drawings at the rear of this fire report in Appendix 2 form the fire engineering documentation.

3 Occupancy

The building contains the following risk groups and storage and escape heights based on Table 1.1 of C/AS6.

Location	Risk Group	Storage Height	Escape Height (m)
Warehouse	WS	>5m	0
Offices/Staffroom	WB	<3m	3

The occupant numbers in the building are as follows based on Table 1.2 of C/AS6.

Location	Floor Area (m^2)	Occupant Density (m^2/person)	Number of Occupants
Warehouse	10860	100	109
Studio	195	10	20
Offices	275	10	28
Photography	186	10	19
Staff Lunchroom	266	5	53
TOTAL			**176**

Note: Occupant load in the lunchroom is not counted for the purposes of total occupant load of the building. But the occupant load of the space is required to ensure that sufficient escape routes are provided from this space.

4 Fire Safety Systems

The following table summarises the fire safety systems to be installed in the building as required by C/AS6/2.2.1.

6	Automatic fire sprinkler system with manual call points to NZS 4541:2007, NZS 4512:2010 and F7/AS1. This system is to be extended into the WB Risk Group as required by C/AS6/2.2.3.
18	Fire hydrant system to be installed in accordance with NZS4510.

An Early Suppression Fast Response (ESFR) automatic sprinkler system is being installed in the building. This is to be installed in compliance with NZS4541:2007 and NZS4512:2010. In-rack sprinklers are not being provided due to the use of the ESFR system. An onsite water supply is provided by a tank and diesel pump system. The fire protection engineer has undertaken a detailed fire sprinkler system design for the specifics of the building including specific storage issues. The building is designed for an 'all-out' evacuation scheme.

Emergency lighting is to be installed in the building in the locations and to provide the minimum Lux as required by F6/AS1. This report does not address Visibility in Escape Routes and it is therefore to be designed and detailed by others for compliance with clause F6 of the Building Code. Information in this report such as occupant load, escape routes and the location of EXIT signs will be required in order for the

electrical consultant to design adequate illumination. Note also that any escape routes marked on attached fire safety plans are not to be taken as 'specific escape routes' in terms of F6/AS1/1.3.2. However any 'exitways' are identified.

Fire hose reels and extinguishers are not required by C/AS6 for this building. However they are required by the sprinkler standard NZS4541 and are recommended and may be required by the NZFS under the Fire Safety and Evacuation of Buildings Regulations, 2006. Fire hose reels are to be installed in the building in compliance with NZS4503.

5 Means of Escape

5.1 No. Escape Routes

The building is required to be provided with a minimum of two means of escape (C/AS6/3.2.2). The escape routes are required to be separated by no less than 8.0 m (C/AS6/3.6.2). There are many escape routes throughout the warehouse and office. The higher than required number of escape routes are provided to meet the travel length requirements detailed in section 5.4 of this design report.

The lunchroom requires two means of escape as there are over 50 people in the space. Given that this is a full fire rated floor (not an intermediate floor due to its floor area) the stair is required to egress direct to outside or into a safe path stair then to outside. There are two internal stairs shown on the drawings– one into offices and other to warehouse. An additional external stair is to be provided from the lunchroom and the internal stair to the offices is to be fire rated as shown on the drawings in Appendix 2.

5.2 Width & Height of Escape Routes

The following table details the minimum widths of escape routes in the building.

Location	Horizontal Travel (mm)	Vertical Travel (mm)
All areas	850	1000

The escape routes in the building as shown on the drawings comply with this requirement. (C/AS6/3.3.2). The height of an escape route is to be a minimum of 2100mm, any doors are required to have a minimum clear height of 1955mm. (C/AS6/3.3.1)

5.3 Capacity of Means of Escape

The capacity of the means of escape is determined by the size of the doors and escape routes. By observation, the capacity is sufficient for the design occupant load given the number of doors available and relatively low occupant load.

5.4 Travel Distances

In accordance with C/AS6/Table 3.2, the maximum permitted and actual dead end and open path travel distances are:

Location	Allowable DEOP (m)	Allowable TOP (m)	Actual DEOP (m)	Actual TOP (m)
Warehouse worst case	50	120	48	120
Lunchroom	50	120	2	45
Studio	50	120	29	81
Offices	50	120	15	33

The travel distances are complied with as shown in the table.

5.5 Doors – swing and locking devices

Doors on escape routes are required to open in the direction of escape if there are more than 50 occupants using the doors. (C/AS6/3.16.3) The doors as shown on the drawings comply with this requirement.

All exit door locking devices should be clearly visible, located where such a device would normally be expected, designed to be easily operated without a key or other security device, and allow the door to open in the normal manner. (C/AS6/3.16.2)

Any doors that are electronically locked are required to unlock in the event of a fire alarm to allow people to escape. (C/AS6/3.16.7)

5.6 Signage

Fire exit signage shall be erected throughout the building in compliance with F8/AS1. Exit signage shall be internally illuminated as part of the emergency lighting system.

Signs are required on all stairwell and corridor smoke doors to identify them as smoke doors and that they are required to be kept closed.

5.7 Miscellaneous

Exit doors and exitways are to remain clear at all times. Exitways shall not be used for storage of goods, solid waste or solid waste containers, or for entry into solid waste chutes. (C/AS6/3.12.1)

Hold open devices are to be fitted to fire doors where the possibility for the door to be wedged open exists (eg. between the offices and stairs to the lunchroom). The hold open devices shall be released by the activation of adjacent smoke detectors, which are part of the fire alarm system and are to be located on both sides of the doorset (C/AS1/3.16.9).

6 Internal Spread of Fire

6.1 Fire/Smoke Separations

As per C/AS6/2.3 the life rating is 60 minutes. The life rating applies to all fire separations required for compliance with sections 3 and 4 of C/AS6. In accordance with C/AS6/2.1.1 the sprinklered building may have an unlimited floor area.

The building is split into the following firecells with a minimum 60 minute fire resistance rating:

- Warehouse
- Upper level lunchroom – the fire separation is provided at the first floor walls and at ground level around the stair that opens into the offices. The location of fire rating is shown on the drawings in Appendix 2.

Fire ratings are to extend to the underside of the floor slab or roofing as applicable and as detailed in C/AS6/4.5.7 and C/AS6/Figures 4.2 & 4.3. Doors in the fire separation to be -/60/- SM fire doors with hold open devices as detailed in section 5.7 of this report.

6.2 Intermediate Floors

The building has an upper floor lunchroom that cannot be considered a limited area intermediate floor as per C/AS6/4.13.5 & 6 as it is greater than 35m^2. Therefore the floor must be treated as a full floor firecell as detailed in section 6.1 of this report.

6.3 Service Penetrations

Any gaps in, or services that penetrate, through fire or smoke rated construction are to be fire rated using certified proprietary systems such as fire collars, fire wraps, intumescent systems etc. The systems are to be installed as required by the certification and manufacturer of the product. (C/AS6/4.4) Particular attention should be made to the selection of proprietary system to ensure that the system is suitable for;

1. the orientation of the building element which is being fire stopped
2. the type of construction through which the penetration passes (concrete masonry, light timber frame etc)
3. size of the gap being stopped
4. size of the hole through which the penetration passes
5. type of penetration (copper pipe, plastic pipe, data cabling etc).

7 External Spread of Fire

7.1 Property Rating

The Property Rating is specified in Paragraph 2.3.1 of C/AS6. For the WS risk group this is 180 minutes. The construction of the building near the boundary uses either 150mm concrete panels or 180mm concrete panels. These achieve 3 hours and 4 hour fire ratings respectively which meets or exceeds the property rating of 180 minutes.

7.2 Boundary Exposures

All of the exterior walls are further than 1m from the boundary. All of the walls have at minimum a 2.4m high wall at the bottom. The lean-to wall is completely fire rated to the boundary therefore fire spread is assessed from the warehouse wall above the rear wall of the lean-to. The walls greater than 10m in height

are to have a two way fire rating regardless of their distance to the boundary – this is achieved with the concrete construction.

The Northern external wall along gridline A is just over 5m to the boundary. It has been agreed that the neighbouring land will be purchased by the owners of this building. Therefore it has been discussed with the Council and owners of the land currently that an encumbrance on the title (under section 75-77 of the NZ Building Act) is to be placed on both titles. This encumbrance recognises the spread of fire risk from the new building to the adjacent title. This encumbrance is to be placed over both titles and is to be carried out by the lawyers of both properties.

C/AS6/Table 5.2 provides the unprotected area allowances based upon the firecell width and distance to the boundary. C/AS6/Table 5.3 details the largest unprotected area allowed in the external wall. The following table details the allowances for the walls close to the boundary that have not been discussed above:

Wall Elevation	Distance to Boundary (m)	Firecell Width (m)	Unprotected Area Allowed (%)	Single largest radiator allowed (m^2)
East - gridline 6 between E and J	2.5 (use 2)	>20	25	35
South Warehouse wall above lean-to roof line	7	>20	50	No restriction
South Gridline E between gridlines 6 & 8	10	>20	65	No restriction
Western Wall	>20	>20	100	-

The allowable unprotected areas in the table above have not been met in the South wall of the building and the concrete external wall must be extended up to a height as necessary to meet the areas in the table. The area in the East wall between gridline E and J that is unprotected is $95m^2$. As per C/AS6/5.5.6 this unprotected area can be measured over a 30m width. For this building this means a $60m^2$ unprotected area given the unprotected area is 2m high. This is too large as per Table 5.3 of C/AS6 and therefore the unprotected area must be split so that it meets the allowable $35m^2$ for a single largest radiator. The distance between the two unprotected areas must be at least 2.5m. Alternatively the fire rated wall height can be increased to enable a long strip of 1.1m high to be unprotected over the length of the wall.

7.3 Canopy

The canopy off the building is acceptable given that at least two sides are open to the environment and no part of the roof is closer than 1 m to the boundary.

8 Surface Finishes

Surface finishes within the building are required to meet the following requirements for sprinklered buildings: (C/AS6/6.20.5, C/AS6/Table 6.2) The manufacturers will need to provide information on what group number their product meets.

- Exitways and Internal ducts: - Group number 2
- All other occupied spaces: - Group number 3
- Suspended flexible fabrics - FI < 12 in exitways
  - FI < 5 in underlay where exposed to view in occupied spaces eg; building paper)

Flooring is required to meet the following requirements:

- Exitways = 2.2kW/m^2
- All other occupied spaces = 1.2kw/m^2 minimum critical radiant flux

Any foamed plastics in the wall, ceiling or roof of the building have separate requirements to comply with C/AS6. Foamed plastics are required to comply with C/AS6/4.17.2 which requires the foamed plastic to achieve a group number as detailed above and they shall comply with the flame propagation criteria as specified in AS1366.

There are no surface finish requirements for external walls given the building is sprinklered, the distances to the boundary are greater than 1m and the building height is less than 25m. (C/AS6/5.8)

9 Structural Requirements

Primary structural elements are to achieve the fire resistance ratings specified in this report unless specifically noted otherwise. Any external walls that are required to be fire rated are to meet the post-fire structural stability requirements of AS/NZS 1170 as amended by Paragraph 2.2.4 of B1/VM1, this must be designed by the structural engineer.

10 Fire Fighting

The needs of the New Zealand Fire Service need to be considered and are to comply with Part 6 of C/AS6. Fire Service vehicular access must be provided as per section 6.1.1 of C/AS6. A hard standing must be provided within 20m of entrance – this is provided at front of the building where the offices and canopy are located. The fire alarm panel and fire service inlet is to be located close to the NZFS attendance point. Approval for the locations is to be sought from the NZFS by the fire alarm contractor. A building fire hydrant system is to be provided in the building in accordance with NZS4510.

11 Conclusion

This report shows that the proposed new building for Online Warehouse at 123 Inferno Drive, Pyrotown will achieve compliance with the NZ Building Code as required by the NZ Building Act for Protection from Fire. This is subject to the assumptions and requirements being met within this report. The main requirements of the report are summarised below however the report needs to be read in its entirety to ensure all requirements are met.

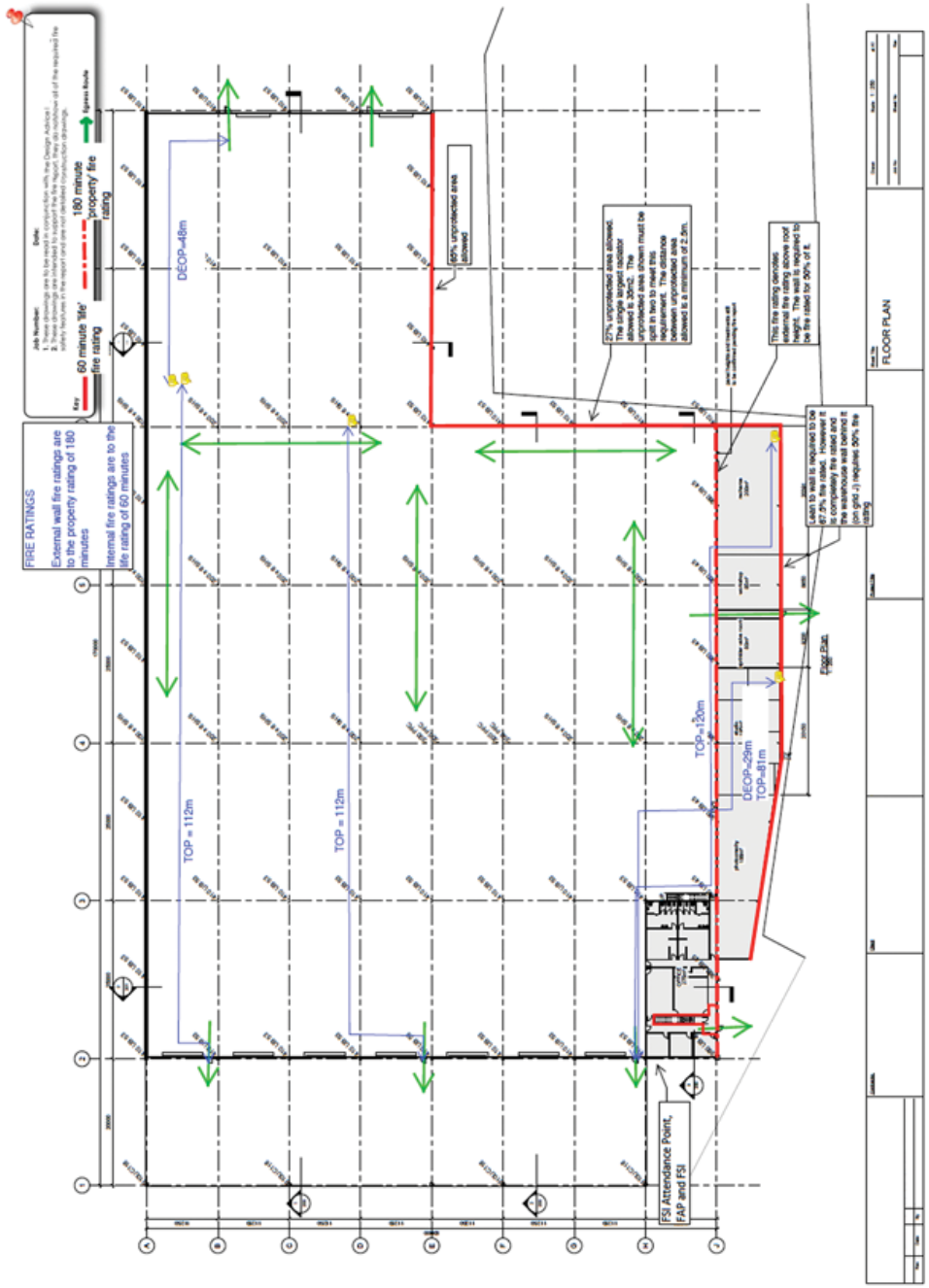
1. An Early Suppression Fast Response (ESFR) automatic sprinkler system is being installed in the building. This is to be installed in compliance with NZS4541.
2. A building fire hydrant system it to be provided in accordance with NZS4510.
3. Emergency lighting is to be installed in the building as required by F6/AS1.
4. Fire hose reels are to be installed in the building in compliance with NZS4503.
5. All exit door locking devices should be clearly visible, located where such a device would normally be expected, designed to be easily operated without a key or other security device, and allow the door to open in the normal manner.
6. Any doors that are electronically locked are required to unlock in the event of a fire alarm to allow people to escape.
7. Fire exit signage shall be erected throughout the building in compliance with F8/AS1. Exit signage shall be internally illuminated as part of the emergency lighting system.
8. Signs are required on all stairwell and corridor smoke doors to identify them as smoke doors and that they are required to be kept closed.

9. Hold open devices are to be fitted to smoke control doors where the possibility for the door to be wedged open exists (e.g. between the offices and stairs to the lunchroom). The hold open devices shall be released by the activation of adjacent smoke detectors, which are part of the automatic smoke detection system located on both sides of the doorset.
10. Fire separations are to be provided between the warehouse and upper floor lunchroom as shown on the drawings in Appendix 2. Fire separations are to extend to the underside of the floor slab or roof as applicable. Doors in the fire separation to be -/60/- SM fire doors with hold open devices as detailed in section 5.7 of this report.
11. Any gaps in, or services that penetrate, through fire or smoke rated construction are to be fire rated using certified proprietary systems such as fire collars, fire wraps, intumescent systems etc. The systems are to be installed as required by the certification and manufacturer of the product.
12. External wall fire ratings to the boundary have been assessed and the walls comply except in the South wall of the building - the concrete external wall must be extended up to a height as necessary to meet the areas in the table.
13. The area in the East wall between gridline E and J that is unprotected is too large as per Table 5.3 of C/AS6 and therefore the unprotected area must be split so that it meets the allowable 35m^2 for a single largest radiator. The distance between the two unprotected areas must be at least 2.5m. Alternatively the fire rated wall height can be increased to enable a long strip of 1.1m high to be unprotected over the length of the wall.
14. Surface finishes are to meet Section 8 of this report.
15. Structural requirements for fire rated elements are to achieve the fire ratings specified in this report – this includes the intermediate floor and any external fire rated walls.
16. NZFS requirements are provided in section 10 of this report.

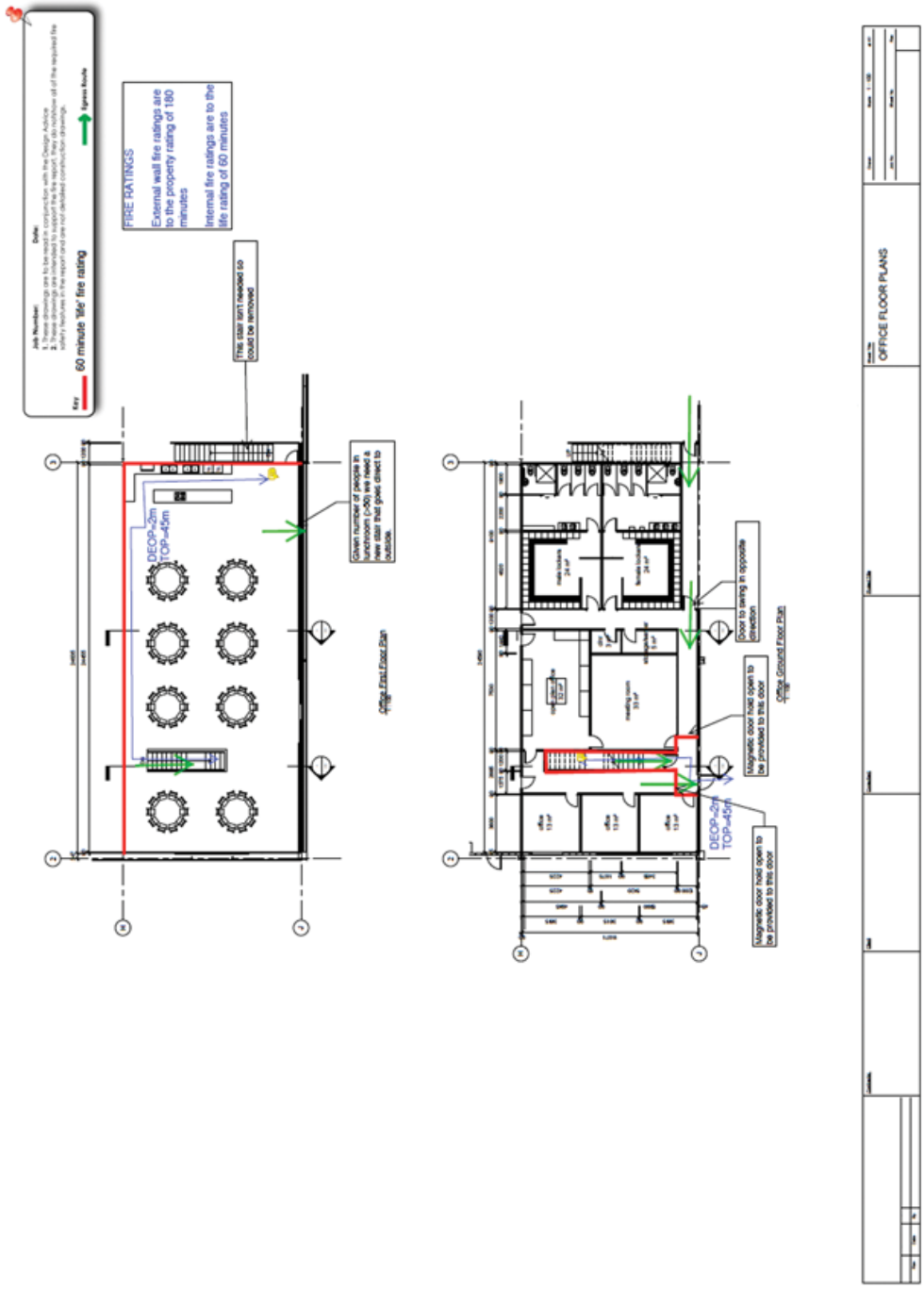
APPENDIX 1 – NZFS Correspondence

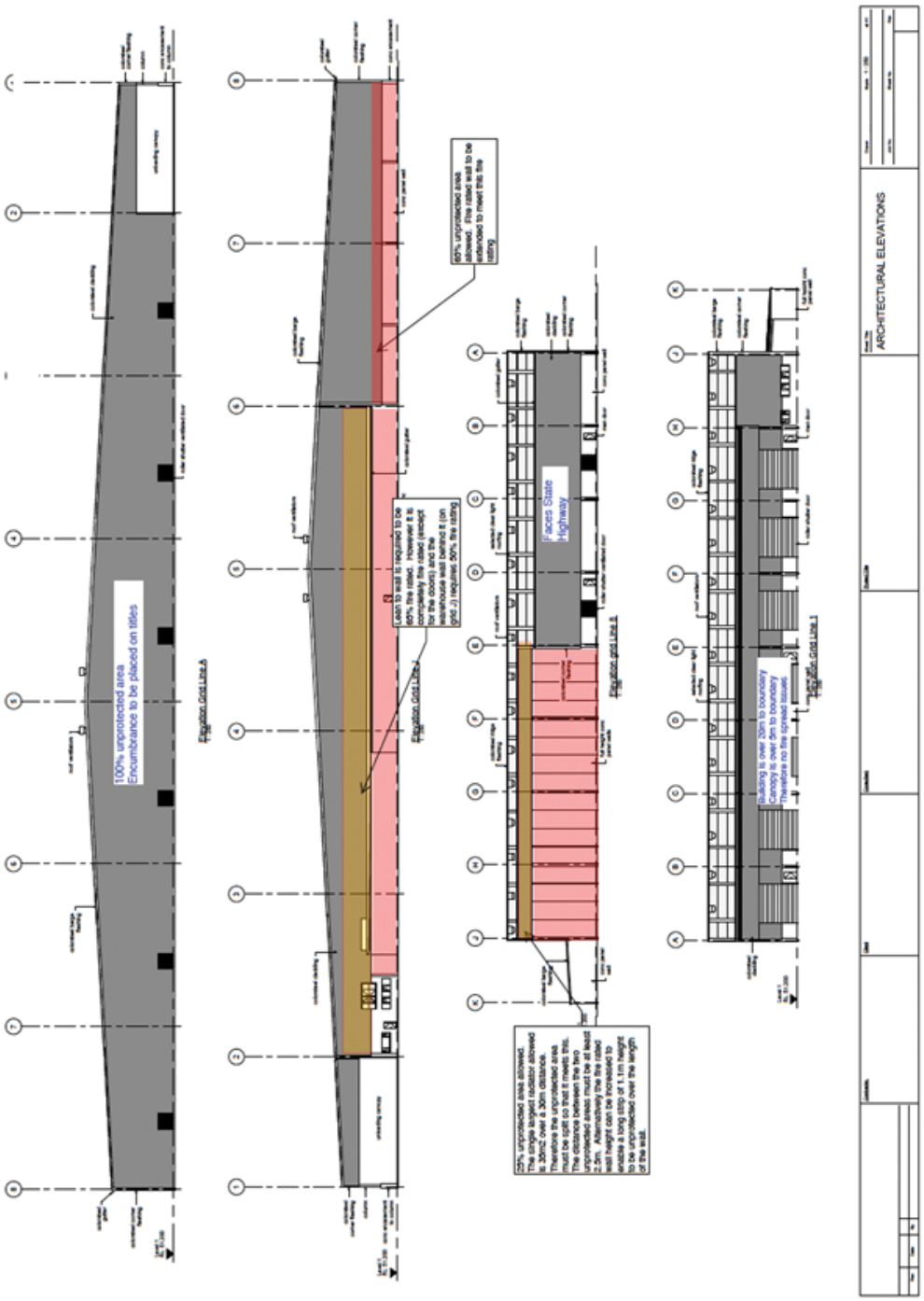
Deliberately left blank for this case study only

APPENDIX 2 – Drawings



15 September 2012


Key
60 minute 'life' fire rating
Egress Route
FIRE RATINGS
External wall fire ratings are to the property rating of 180 minutes
Internal fire ratings are to the life rating of 60 minutes
This stair isn't needed so could be removed
DEOP=2m
TOP=45m
Given number of people in lunchroom (>50) we need a new stair that goes direct to outside.
Office First Floor Plan
door to swing in opposite direction
Magnetic door hold open to be provided to this door
Office Ground Floor Plan
OFFICE FLOOR PLANS



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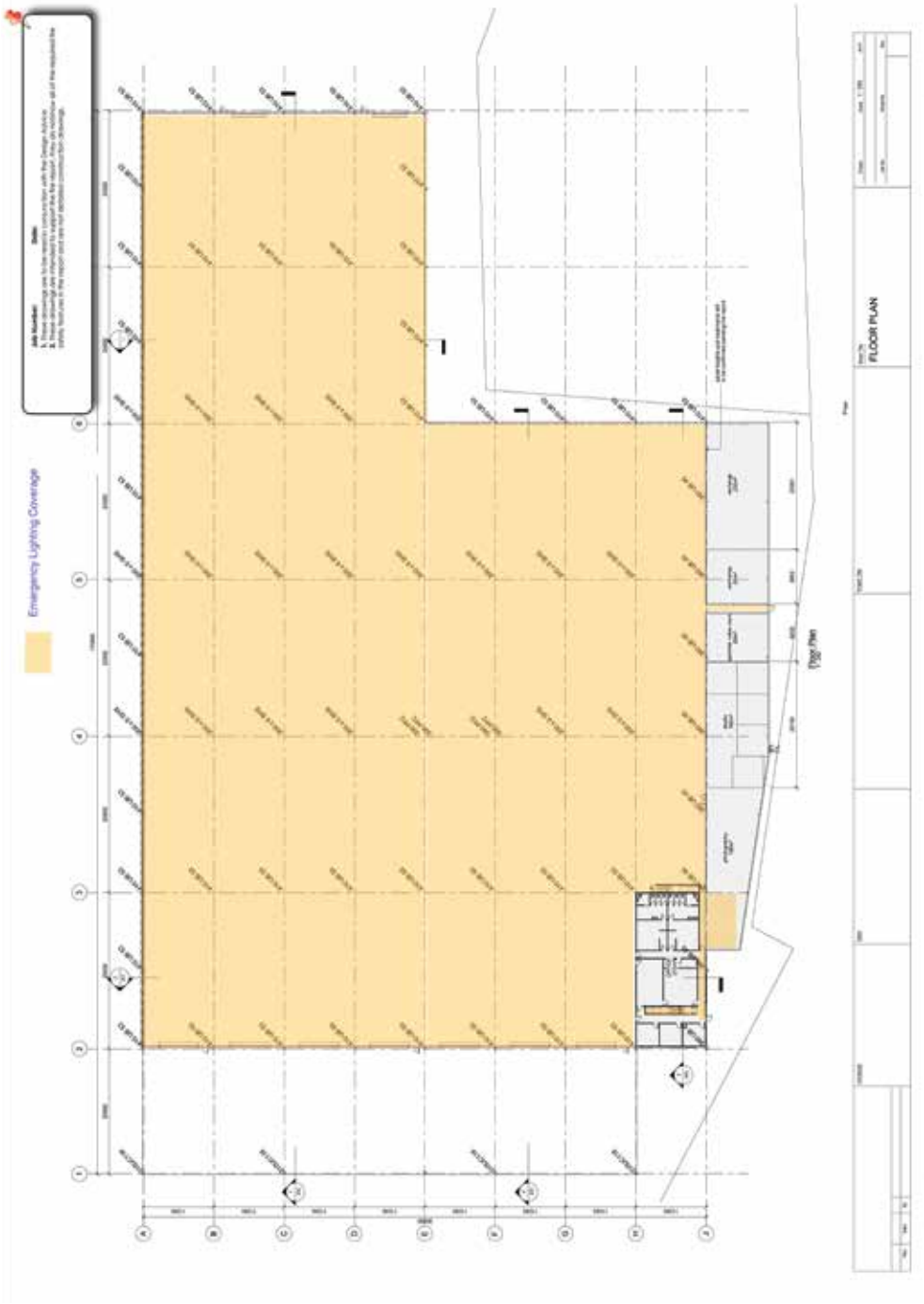

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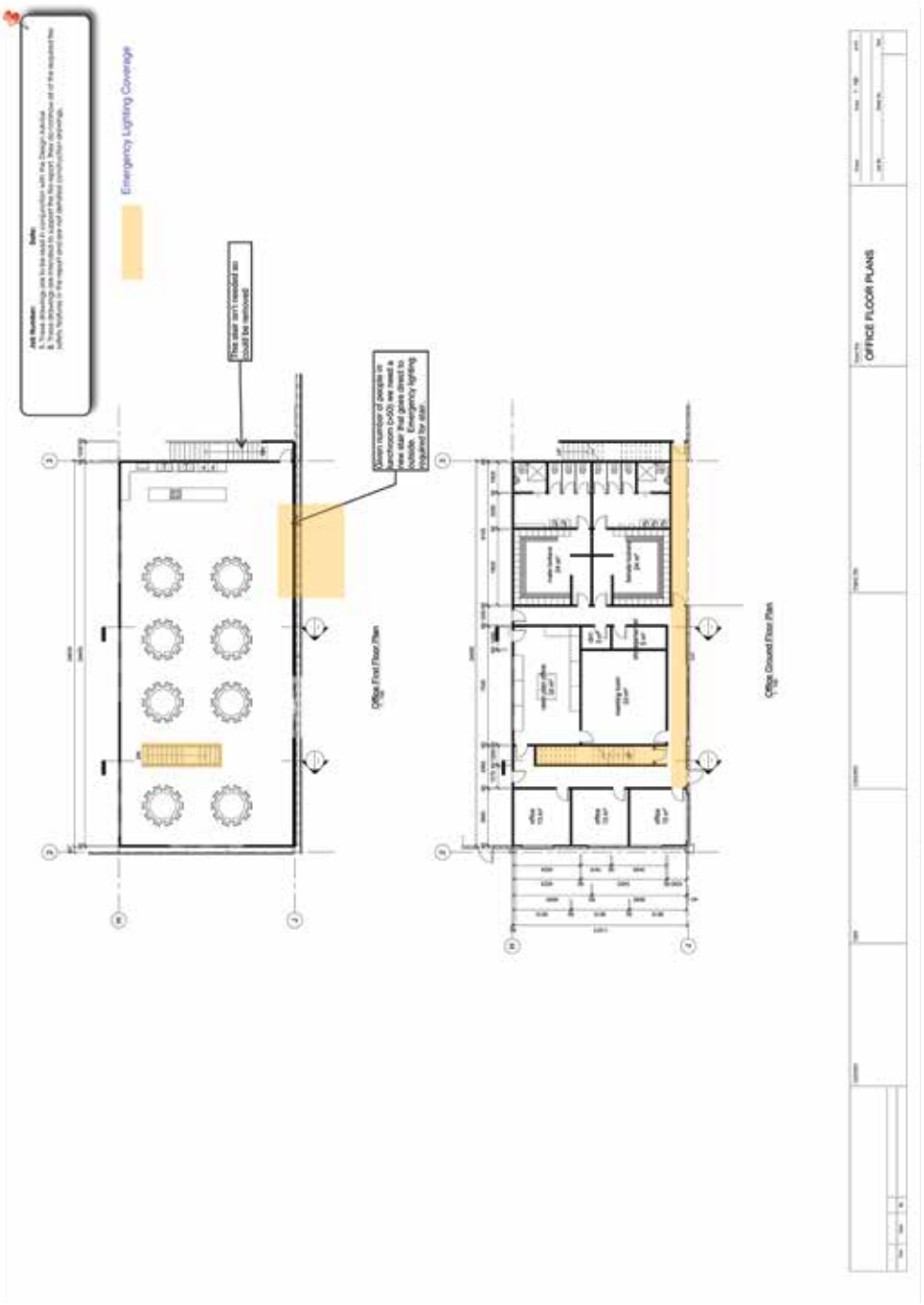

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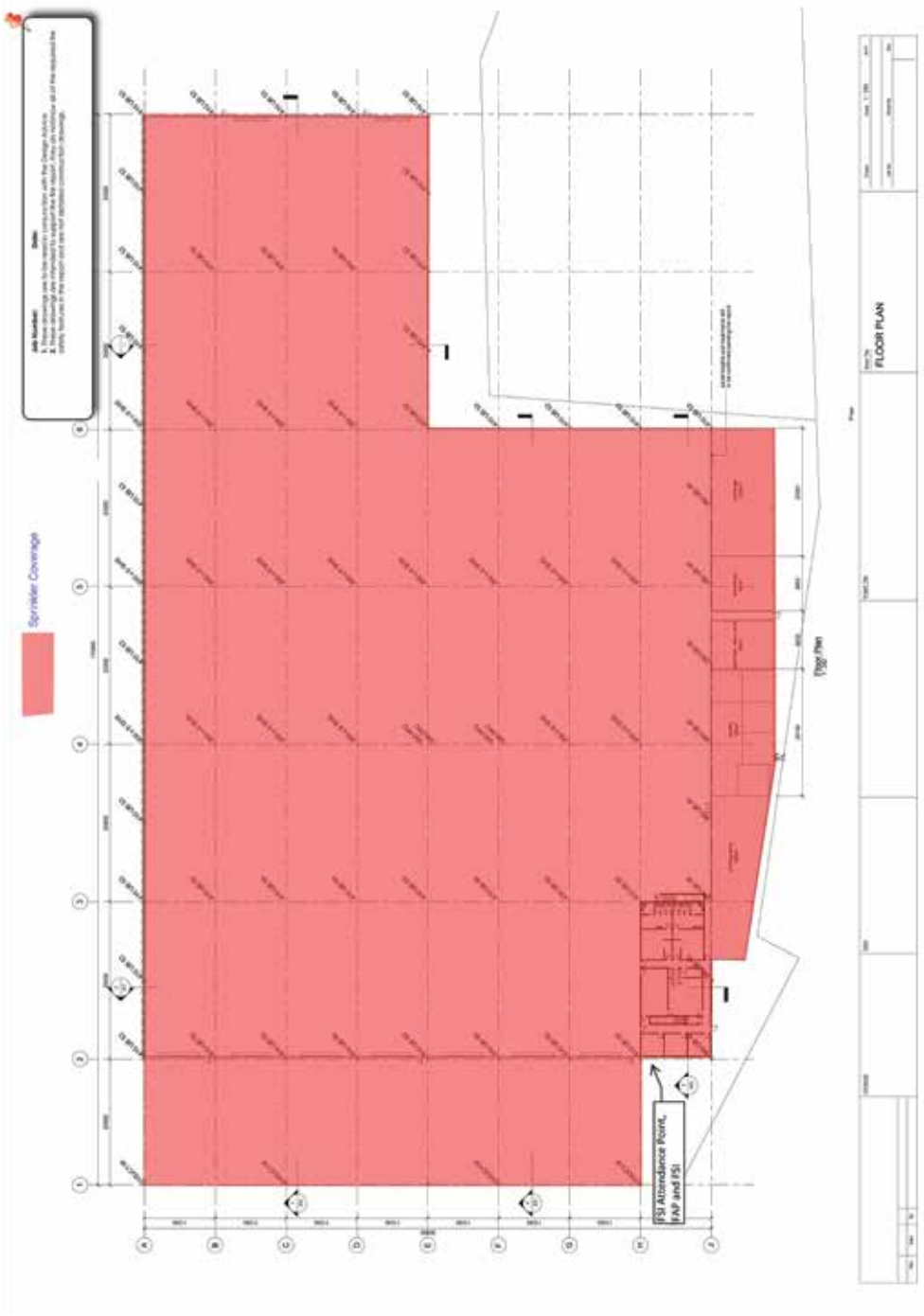

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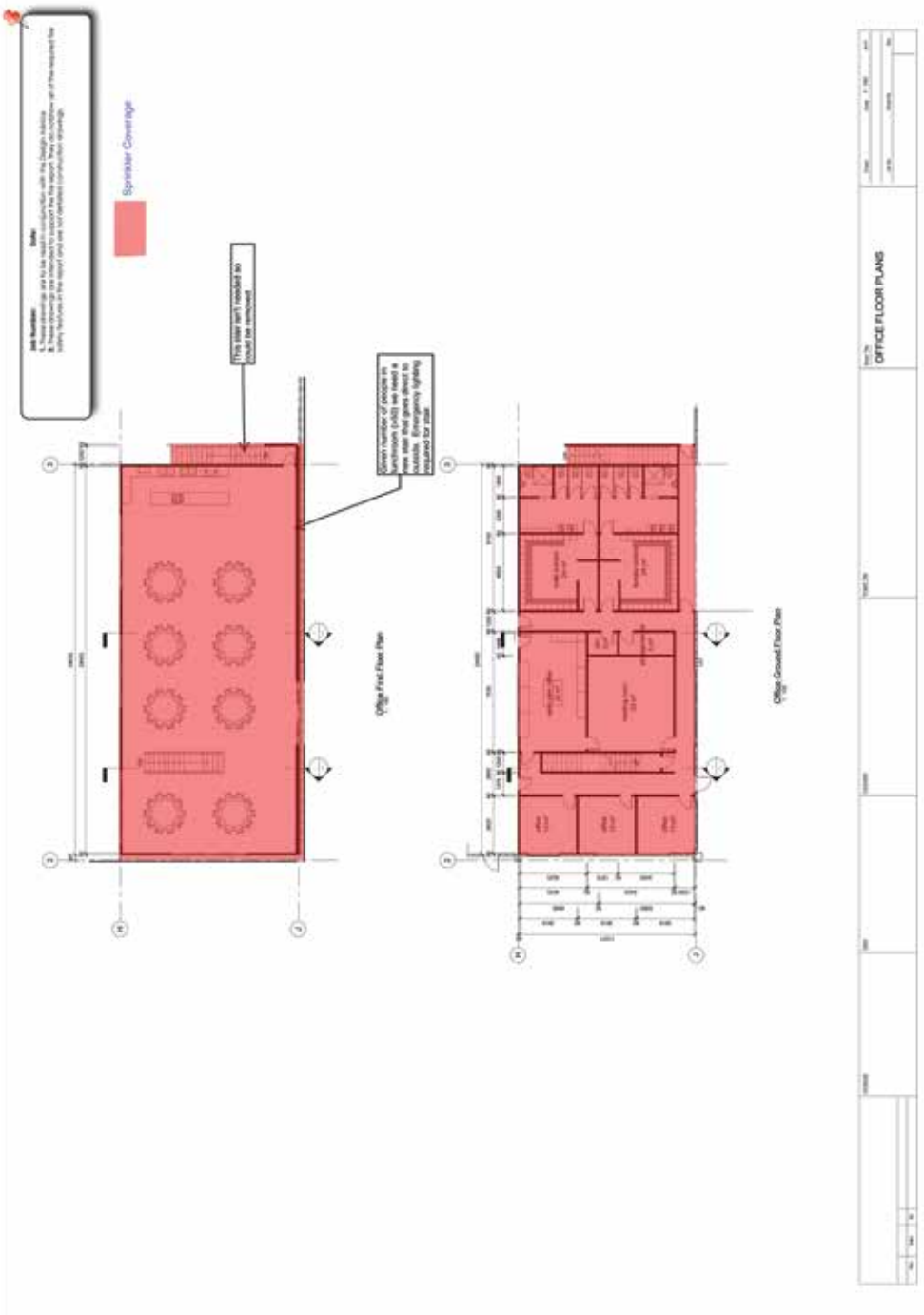

15 September 2012

APPENDIX 3 – Compliance Schedule Information

The list of 'Specified Systems' below are for this building as identified by this fire design. The Specified Systems identified below are not a comprehensive list of systems pertaining to the building. Please ensure that a comprehensive check of all possible systems is carried out when completing the Compliance Schedule.

The extent of coverage of the specified systems and where appropriate their location is identified on the attached plan (N.B. not included for the purposes of this case study). This should be included with the compliance schedule for the building.

SS	Specified System:	Performance Standard:	Maintenance:	Inspections:	New	Modify
1	Automatic systems for fire suppression Type: 6 sprinkler system	NZS 4541:2007	In accordance with NZS 4541:2007 Part 12	By IQP: **Weekly**: as necessary **Monthly**: in accordance with NZS 4541 Paragraph 1202.2 **Quarterly**: In accordance with NZS 4541 paragraph 1202.3 **Yearly:** In accordance with NZS 4541 Paragraph 1202.5 **Biennial Routine Inspection:** In accordance with NZS 4541 Paragraph 1203.	YES	
2	Manual emergency warning systems for fire or other dangers Type 2 manual alarm system	NZS 4512:2010	In accordance with NZS 4512:2010 Part 6	By IQP: **Monthly:** In accordance with NZS 4512 Paragraph 602. **Yearly:** In accordance with NZS 4510 Paragraph 603.	YES	
3	Electromagnetic doors	BS7273 Part 4: 2007	BS7273 Part 4: 2007	By owner/occupier **Weekly:** Check the local operation of release mechanism and closing of door on latch By IQP: **Monthly:** Check release of doors on operation of fire alarm and closing of door on to latch. **Yearly:** As for monthly plus maintain door, check closer for operation and latching of door.	YES	
4	Emergency lighting systems Including illuminated signs	AS 2293.3: 2005	AS/NZS 2293.2:1995 Section 3	By IQP **Six monthly**: In accordance with Paragraph 3.2 and Appendix B AS/NZS 2293.2 **Yearly** : In accordance with Paragraph 3.3 AS/NZS 2293.2	YES	
14	Signs relating to, a system or feature specified above.	Signs will be visible under all foreseeable conditions including interruption of mains power.	Ensure Emergency lighting systems illuminate any signs. Signs are clean and legible.	By owner/occupier **Monthly:** Ensure signs in place where required, they are legible and clean and are illuminated. Record in log book. By IQP. **Yearly:** As per monthly and complete report and required forms.	YES	

SS	Specified System:	Performance Standard:	Maintenance:	Inspections:	New	Modify
15 (2)	Final exits Details: Designated final exit doors	All final exit doors to be free of obstructions both sides of the door and not to be locked or barred. Any panic furniture or simple fastenings should operate freely to release door. Full opening of door width is required.	Maintained in a safe condition: free from obstructions, locking, blocking, barring, storage of combustibles and ease of opening at the final exit.	By owner/Occupier **Daily**: Check doors are not locked blocked or barred. **Weekly:** As daily plus ensure routes to final exits do not contain combustibles and any fastenings open easily and door swings to full width of opening. By IQP **Yearly:** As above, complete report to owner and complete required forms.	YES	
15 (3)	Fire separations Type: As shown on the drawings in the fire safety design report	All fire separations shall remain imperforate and any closures in the separation shall ensure they would prevent the passage of fire for the period given as the fire resistance rating.	All damage to fire separations (walls, floors, dampers, ceilings etc) shall be repaired as soon as practicable. Doors and other closures shall be checked for operation and security of closure.	By owner/Occupier **Weekly**: Check for damage to separations and operation of doors and security of other closures. Any damage/ failure of door operation or other closure to be repaired ASAP. Record inspection in log book. By IQP **Yearly:** As above. Complete report to owner and complete required forms.	YES	
15 (4)	Signs for communicating information intended to facilitate evacuation	Signs will be visible under all foreseeable conditions including interruption of mains power.	Immediate replacement or refurbishment of signs if missing, incorrect or illegible.	By owner/occupier **Monthly:** Ensure signs in place where required, they are legible and clean and are illuminated. Record in log book. By IQP. **Yearly:** As per monthly and complete report and required forms.	YES	

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