From: Michael Belsham
Sent: Thursday, 3 November 2016 2:05 p.m.
To: Edwin Claridge
Subject: VM Proposed Amendments Tall Buildings Nov 16 Version 4 [UNCLASSIFIED]
Attachments: VM Proposed Amendments Tall Buildings Nov 16 Version 4.docx

When you get some time between sunning yourself today you might like a look over this. Be interested whether this is on the right path.

Verification Method Amendments for Tall Buildings

Structure

2.4.1 Modifications to the design FLED

For assessing the *fire* resistance of structural and non-structural elements, the design *FLED* from Table 2.2 used for the *design fire* shall be modified by multiplying the *FLED* by the applicable **F_m** factor from Table 2.3.

Revised Table 2.3	**F_m factors to be applied to FLED**	
Height of the top occupied storey above access level	F_m for sprinklered firecells	F_m for unsprinklered firecells
≤ 10m	0.5	1.0
> 10m and ≤ 25m	0.75	1.5
> 25m and ≤ 60m	1.0	2.0
> 60m and ≤ 100m	1.25 for columns 1.0 for floors, beams & fire separations	2.5
> 100 m	1.5 for columns 1.25 for floors, beams & fire separations	3.0

Note: the Fm factor does not apply to the fire rating of doors in fire separations

Commentary

The time equivalence formula currently does not allow for any height risk to account for robustness and redundancy required for tall buildings longer escape times and Fire Service operation. To be consistent with other countries and UK Annex to Eurocode Table 2.3 is to be changed to include height factors. Table 2.3 is an adaptation of BS9999 Table 26 height factors.

In large firecells the fire will be a travelling fire. This means that local structural fire severity may be higher due to migrating fire conditions which restrict ventilation to the fire during its movement around the firecell due to only partial breakage of the external openings.

1. The height bands are based on those used in the Compliance Document C/AS1-7 and reflect slight differences in New Zealand and UK conditions around fire safety and fire fighter capability
2. The Fm values between 25m and 60m heights relate to the 30 to 60m height band from BS9999 and are based on no reduction in the design FLED for sprinkler protected firecells.
3. The values > 1.0 for heights above 60m is consistent with the values in BS9999 and in the previous C/AS1. They multiply the design FLED reaching approx. 95% FLED for Fm = 1.5.
4. These values take into account the following beneficial factors:

a. All multi-storey buildings have to be designed and detailed for structural resilience under severe earthquake loading. This ductile detailing significantly increases the fire resistance of the structure by ensuring that dependable deformation under inelastic action can occur. This requirement is greatest for buildings up to around 100m height; above that the extent of ductile detailing required for earthquake is less as the response is typically governed by wind loading or lateral stiffness.

b. The requirements of Paragraph 4.10 for robustness of sprinkler systems will increase their reliability of operation for these height bands

5. The differentiation between Fm for columns and Fm for other structural or fire separating elements for heights above 60m is based on:

   a. Floors and beams which are designed and detailed for dependable severe earthquake response can undergo load sharing and controlled deformation, thereby making the fire resistance of the floor system significantly greater then the fire resistance of an individual element of the floor in the Standard Fire Test.

   b. A single column can be impacted on by severe local fire generated by high local FLED in the vicinity of the column, to a greater extent than will apply to a floor system.

   c. The fire resistance from the Standard Fire Test is a lower bound of the fire resistance for an individual floor or beam element that is part of a complete building, whereas the fire resistance of an individual column in the SFT may be greater than in the building, due to the influence of restrained thermal expansion on the column behaviour in the building lowering the fire resistance obtained from the SFT.

   d. Floors which are fire separations will be governed by the structural stability rating. Fire separations which are non-structural walls will be subjected to accelerating failure do to the deformation of the supporting structure under the fully developed fire, which is greater than what they have been subjected to in the SFT, and their reliability will be compromised. There is no benefit therefore in designing these for a higher structural fire severity than that for the floor system into which they are attached.

Escape

4.9 Design scenario (CF): Challenging fire

Method

For purposes of NZBC C4.4 firecells with design occupancy of over 1000 people shall be designed such that visibility is not less than 10 m for the duration of the evacuation.

Vertical escape routes that have a capacity of more than 1000 people shall be designed such that the visibility is not less than 5 m for the duration of the evacuation. Visibility shall be monitored within the stairwell on floor above the fire floor.

Comment: The additional check for visibility is expected to introduce staged or phased evacuation allowing fire affected floors to enter the stairwell before other floors evacuate.

3.3 Requirements for delayed evacuation strategies

Delayed evacuation shall include a voice communication system incorporated into the building fire alarm system. This system shall provide variable tone alerting devices, the facility to deliver voice messages to occupants, and to allow two-way communication between emergency services personnel.

Means shall be provided to limit smoke ingress to all firecells where evacuation is delayed.

This can be provided by one or more of the following:

- Install smoke dampers where ventilation ductwork passes through a fire separation the firecells
- Install a pressure differential system to provide negative pressure to the fire cell of origin and positive pressure to all other firecells
- Demonstrate that tenability is retained throughout the evacuation period in firecells where evacuation is delayed if smoke could be transported through the ventilation system

Where evacuation is delayed means shall be provided for safe evacuation of persons with disabilities.

Comment: For tall building consideration may be given to utilise firefighting lift for evacuation purposes.

Fire Fighting

For the purposes of NZBC C5.5, water shall be provided from either:

a) A pumping appliance parked close to the *building* such that any point within the *building* may be reached within 75 m (~3 hose lengths) of the pumping appliance, or

b) An internal hydrant designed and installed to NZS 4510 or as approved by the National Commander of the New Zealand Fire Service.

Internal hydrants shall be located in enclosures that provide safe access for fire fighter and fire separated from all other parts of the building that are designed to resist fire spread until burnout

The arrangement of fire-fighting features and access shall be determined in consultation with the New Zealand Fire Service through the FEB process and justification can be assisted with Fire Brigade Intervention Model (FBIM).

C. For buildings with an escape height >60 m above ground or >10m below ground:

Fire-fighting at height presents additional risks to fire fighters. To assist fire-fighting and rescue operations at height additional features are required to safe guard fire fighters and to limit fatigue in operations. To allow for safe access for fire fighters to tall buildings to safely carry out search and rescue and firefighting operations the following shall be provided.

Communication

Means shall be provided for two way communication between floor wardens and the main emergency evacuation panel at every entry to the vertical escape routes. Communication shall allow for automatic calls to the emergency evacuation panel.

Fire Control Centre

A facility shall be provided for Fire Service use which shall:

a) Be readily accessed from street level and adjacent to the Fire Service attendance point and,
b) Be protected from the effects of fire including debris falling from an upper floor and,
c) Contain all control panels indicating the status of fire safety systems installed in the building, together with all control switches.

Fire Fighter Vertical Transportation

Means shall be provided for fire fighters to transport equipment to upper floors as quickly as possible. Transportation shall capable of being used under the direct control of the Fire Service.

Vertical transportation shall be *fire separated* from all other parts of the *building* that are designed to resist *fire* spread until *burnout.*

Comment: Factors to consider for vertical transportation are co-location with stairs, minimum dimensions for lift car, protection against ingress of water and self-rescue.

Ventilation

The build-up of smoke and heat within firefighting access routes can seriously inhibit the ability of the Fire Service to carry out search and rescue and fire-fighting operations within a building.

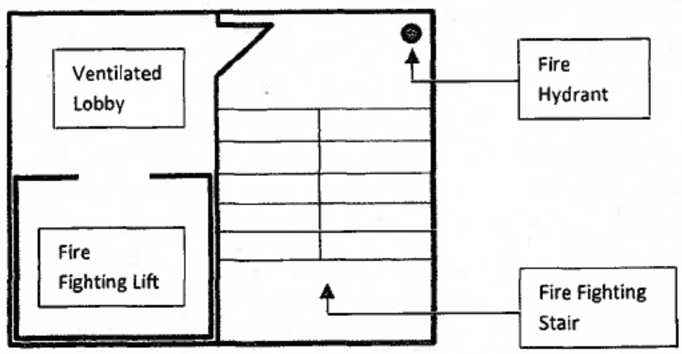
Access to upper/lower floors within the building shall be clear of smoke for fire fighter access. Means shall be provided to limit the passage of smoke into the stairwell and vertical transportation used for fire-fighting. This can be provided any one of the following:

- Stairwell and lift pressurisation systems at 2 m/s airflow through open stair and lift doors
- Pressurise a protected lobby to stair and lift at 1 m/s air flow through open lobby door
- Protected lobbies to the fire-fighting stair and lift entry with manually operable external walls vents of $1.5m^2$ area in each lobby and stairwell vent of $1.0m^2$ at top of the stair.
- Ventilated protected lobbies to stairwell and lift and maintain an air exchange rate of 30 air changes per hour in the lobby on the fire storey
- Pressure differential system to exhaust 6 air changes per hour from the fire floor and provide 20Pa positive pressure to all other floors
- Any other system shown to provide minimum visibility 10m in the stairwell from the period of Fire Service arrival with a door leakage of 100mm opening into the stair to allow for door being held open for fire hoses.

Protected lobbies shall be minimum of $5m^2$ and maximum of $20m^2$ in floor area and enclosed fire rated construction to full burnout. Natural ventilation shall be protected from wind effects.

Comment: Useful references for design of ventilation systems for fire-fighting are:

- AS 1668.1 The use of ventilation and air conditioning in buildings - Part 1: Fire and smoke control in buildings
- BS EN 12101-6 Smoke and heat control systems — Part 6: Specification for pressure differential systems — Kits
- BS 9999 Code of practice for fire safety in the design, management and use of buildings
- NFPA 92A: Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences
- Fire Engineering Design Guide Chapter 10 Mechanical Smoke Movement



Reliability of Systems

4.10 Design scenario (RC): Robustness check

For buildings exceeding 60m in height the key fire safety systems shall include the town's main water and municipal power supply to the building. Fire safety systems shall be shown to continue to operate without the primary water and power supply.

Comment: This will generally require an independent water supply for the fire sprinkler system and emergency power supply for smoke ventilation and fire-fighting lifts.

Buildings exceeding 100m in height shall also allow for failure of the main sprinkler riser.

External Cladding

4.5 Design scenario (HS): Horizontal fire spread

Table 4.1	Acceptable heat release rates for external wall cladding systems for control of horizontal fire spread	
Building height	Distance to boundary < 1 m	Distance to boundary 1 m or more
< 7 m	A	-
>= 7 m and < 25 m	A	B
>= 25 m and < 100 m	EW	A
>= 100 m	EW	EW

Note EW – may be used instead of 'A' or 'B'

Table 4.2	Acceptable heat release rates for external wall cladding systems for control of vertical fire	
Building height	Sleeping uses or *other property* on an upper floor	No sleeping uses nor *other property* on an upper floor
< 10 m	-	-
>= 10 m and < 25 m	A (sleeping care or detention) B (other property)	-
>= 25 m and < 100 m	A	B
>= 100 m	EW	A

Appendix C – Test Methods

AS 5113 requires full scale fire testing to either ISO 13785-2 or BS 8414. These tests include a vertical section of wall assembly 6 m high x 3 m wide including an opening to a fire compartment containing a fuel source of wood cribs. External flaming from the opening exposes the façade wall above. The test configuration includes a re-entrant corner projecting at least 1.2 m from the face of the façade.

The performance criteria are given in AS 5113 and include temperatures above the opening and within the wall system, flaming of the specimen above the opening, flame spread beyond the confines of the specimen, and falling debris from the specimen. Specimens that pass all the test criteria are assigned a classification index of EW.

An entire wall assembly that has been tested at full scale in accordance with NFPA 285 and has passed the test criteria also achieves classification index of EW.

Out of Scope

From: Michael Belsham
Sent: Thursday, 29 September 2016 10:48 a.m.
To: 'Ed Claridge'
Subject: RE: VM Proposed Amendments [UNCLASSIFIED]
Attachments: VM Proposed Amendments Tall Buildings Sept 16 Version 1.docx

Ed,

I've made some changes following your comments and others. Fire-fighting has been pulled back to more performance level to allow options for standards and methods interested in your thoughts on that.

Kind Regards,

Michael Belsham
FIRE ENGINEER

Building System Performance Branch | Building Resources & Markets
Ministry of Business, Innovation & Employment
Level 5, 15 Stout Street, PO Box 1473, Wellington 6143

BUILDING PERFORMANCE

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT

From: Ed Claridge [mailto:ed.claridge@aucklandcouncil.govt.nz]
Sent: Monday, 26 September 2016 5:50 p.m.
To: Michael Belsham
Subject: RE: VM Proposed Amendments [UNCLASSIFIED]

Some initial comments in track changes.

I'll probably look at this again.

Regards

Ed Claridge | Principal Fire Engineer
Ph (09) 353 9372 | s 9(2)(a)
Auckland Council, 35 Graham Street, Auckland
Visit our website: www.aucklandcouncil.govt.nz

From: Michael Belsham [mailto:Michael.Belsham@mbie.govt.nz]
Sent: Tuesday, 20 September 2016 4:02 p.m.
To: Ed Claridge
Subject: Fwd: VM Proposed Amendments [UNCLASSIFIED]

Regards,

Michael Belsham
Fire Engineer

Begin forwarded message:

From: Michael Belsham <Michael.Belsham@mbie.govt.nz>
Date: 16 September 2016 at 17:14:15 NZST
To: s 9(2)(a)

Cc: Mike Cox <Mike.Cox@mbie.govt.nz>
Subject: VM Proposed Amendments [UNCLASSIFIED]

Working Group,

Please find attached rough first draft of proposed amendment for C/VM2 with tall buildings.
Comments all welcome.

Have a good weekend.

Kind Regards,

Michael Belsham
FIRE ENGINEER

Building System Performance Branch | Building Resources & Markets
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Verification Method Amendments for Tall Buildings

Structure

2.4.1 Modifications to the design FLED

For assessing the *fire* resistance of structural and non-structural elements, the design *FLED* from Table 2.2 used for the *design fire* shall be modified by multiplying the *FLED* by the applicable F_m factor from Table 2.3.

Revised Table 2.3	F_m factors to be applied to FLED	
Height of the top occupied storey above access level	F_m for sprinklered firecells	F_m for unsprinklered firecells
≤ 10m	0.5	1.0
> 10m and ≤ 25m	0.75	1.25
> 25m and ≤ 60m	1.0	Not used
> 60m and ≤ 100m	1.25 for columns 1.0 for floors, beams & fire separations	Not used
> 100 m	1.5 for columns 1.25 for floors, beams & fire separations	Not used

2.4.2 Openings for full burnout fires

For the purposes of calculating A_v (the total area (m^2) of vertical windows and doors) in full *burnout design fire* calculations it shall be assumed that doors in *external walls* are closed. Wall areas clad in sheet metal shall not be included in the area A_v. Av is calculated on basis of 100% glazing failure. However for large firecells or floors connected by atria within a firecell Av shall be adjusted as per Table 2.4

Table 2.4	Factors applied to Av	
	Firecell Floor Area ≤ 500m2	Firecell Floor Area > 500m2 or Floors connected via atria
	1.0 Av	0.5 Av

Explanation: The time equivalence formula currently does not allow for any height risk to account for robustness and redundancy required for tall buildings longer escape times and Fire Service operation. To be consistent with other countries and UK Annex to Eurocode Table 2.3 is to be changed to include height factors. The table is adaptation of BS9999 Table 26 height factors. Time equivalence also does not allow for travelling fires where local fire severity can be higher due to partial breaking of glazing.

Escape

4.9 Design scenario (CF): Challenging fire

Method

Firecells with design occupancy of over 1000 people shall be designed such that visibility is not less than 10 m for the duration of the evacuation.

Vertical escape routes that have a capacity of more than 1000 people shall be designed such that the visibility does is not less than 5 m for the duration of the evacuation.

Comment: The additional check for visibility is expected to introduce smoke management features and/or phased evacuation allowing fire affected floors to enter the stairwell before other floors evacuate.

3.3 Requirements for delayed evacuation strategies

Delayed evacuation shall include a voice communication system incorporated into the building fire alarm system. This system shall provide variable tone alerting devices, the facility to deliver voice messages to occupants, and to allow two-way communication between emergency services personnel.

Air handling systems shall be shut down automatically on detection of smoke where there is a delayed evacuation strategy.

Fire Fighting

For the purposes of NZBC C5.5, water shall be provided from either:

a) A pumping appliance parked close to the *building* such that any point within the *building* may be reached within 75 m (~3 hose lengths) of the pumping appliance, or

b) An internal hydrant designed and installed to NZS 4510 or as approved by the National Commander of the New Zealand Fire Service.

No point on the storey should be more than 60m from the fire main outlet measured along an unobstructed route for laying a fire hose.

C. For buildings with an escape height >60 m above ground or >10m below ground:

The following fire-fighting features shall be provided:

- Two way communication to floor wardens
- Centralised fire control centre
- Vertical transportation of fire fighters & equipment to upper floor levels
- Clear smoke zones within lifts and stairwells

Additional features are required for safe access and fire fighting for tall buildings. The arrangement of these features shall be determined in consultation with the New Zealand Fire Service and assisted with Fire Brigade Intervention Model (FBIM).

Communcation

Means shall be provided for two way communication between floor wardens and the main emergency evacuation panel at every entry to the vertical escape routes. Communication shall allow for automatic calls to the emergency evacuation panel.

Fire Control Centre

A facility for Fire Service use which shall:

a) Be readily accessed from street level and adjacent to the Fire Service attendance point and,
b) Be protected from the effects of fire including debris falling from an upper floor and,
c) Contain all control panels indicating the status of fire safety systems installed in the building, together with all control switches.

Fire Fighter Vertical Transportation

Means shall be provided for fire fighters to transport equipment to upper floors as quickly as possible. Transportation shall capable of being used under the direct control of the Fire Service.

Vertical transportation shall be *fire separated* from all other parts of the *building* that are designed to resist *fire* spread until *burnout* and against ingress of smoke to maintain smoke free environment (minimum visibility 10m).

Ventilated stairwell

The build-up of smoke and heat as a result of a fire can seriously inhibit the ability of the fire service to carry out rescue and fire-fighting operations within a building.

Means should be provided to provide smoke free environment within the fire-fighting stair (minimum visibility 10m for duration of burnout). Natural ventilation shall be protected from wind effects.

Reliability of Systems

4.10 Design scenario (RC): Robustness check

For buildings exceeding 60m in height the key fire safety systems shall include the main water and power supply to the building. Sprinkler systems and essential fire safety systems shall be shown to continue to operate without mains water and power supply.

Buildings exceeding 100m in height shall also allow for failure of the main sprinkler riser.

External Cladding

4.5 Design scenario (HS): Horizontal fire spread

Table 4.1	**Acceptable heat release rates for external wall cladding systems for control of horizontal fire spread**	
Building height	Distance to boundary < 1 m	Distance to boundary 1 m or more
< 7 m	A	-
>= 7 m and < 25 m	A	B
>= 25 m and < 100 m	EW	A
>= 100 m	EW	EW

Note EW – may be used instead of 'A' or 'B'

Table 4.2	**Acceptable heat release rates for external wall cladding systems for control of vertical fire**	
Building height	Sleeping uses or *other property* on an upper floor	No sleeping uses nor *other property* on an upper floor
< 10 m	-	-
>= 10 m and < 25 m	A (sleeping care or detention) B (other property)	-
>= 25 m and < 100 m	A	B
>= 100 m	EW	A

Appendix C – Test Methods

AS 5113 requires full scale fire testing to either ISO 13785-2 or BS 8414. These tests include a vertical section of wall assembly 6 m high x 3 m wide including an opening to a fire compartment containing a fuel source of wood cribs. External flaming from the opening exposes the façade wall above. The test configuration includes a re-entrant corner projecting at least 1.2 m from the face of the façade.

The performance criteria are given in AS 5113 and include temperatures above the opening and within the wall system, flaming of the specimen above the opening, flame spread beyond the confines of the specimen, and falling debris from the specimen. Specimens that pass all the test criteria are assigned a classification index of EW.

Verification Method C/VM2 General Amendments

1.0 Introduction and Scope

1.1 Purpose

This is a Verification Method for the specific design of *buildings* to demonstrate compliance with NZBC C1 to C6 Protection from Fire. It is suitable for use by professional fire engineers who are proficient in the use of fire engineering modelling methods.

Compliance with Clause C2 Prevention from Fire is within Acceptable Solutions C/AS2-6 Part 7. Compliance with C6 for structural stability in fire is within Clause B1.

Explanation: The Verification Method currently does not provide compliance for Clause C2 and C6. This clarifies that C2 is within the Acceptable Solutions and structure also requires compliance with B1.

4.1 Design scenario (BE): Fire blocks exit

Scenario Description

This scenario addresses the concern that an *escape route* may be blocked due to proximity of the *fire source*.

This design scenario has three requirements:

- Any horizontal escape routes (including horizontal exitways) that serves more than 50 people requires a second exit.
- The vertical safe path shall serve no more than 150 people in a non-sprinklered building or 250 people where the building is sprinkler protected. If there is more than one stair or exit available providing an alternative means of egress than this restriction does not apply.
- The maximum horizontal travel distance along the escape route to reach the vertical safe path shall be no more than 90m with sleeping use, 110m if occupants are familiar or 155 m if occupants are not familiar with the *building*. There is no requirement to limit travel distance within vertical safe paths.

For buildings where one stair provides a single means of escape from some floors but not others the stair shall be designed such that the maximum capacity is not exceeded assuming occupants are distributed evenly amongst all of the exits available to them when considering a total building evacuation.

Explanation: This provides clarity of when Blocked Exit scenario applies and where there is more than one stair. Travel distances are sourced from C/AS2-6 for maximum distances open and safe paths with Type 7 system and prevents unlimited length corridors.

Method

In order to be regarded as alternative *escape routes*, the routes shall be separated from each other and shall remain separated until reaching a *final exit*. Separation shall be achieved by diverging (from the point where two *escape routes* are required) at an angle of no less than 90° until separated by:

a) a distance between closest parts of the openings of at least 8.0 m when:

i) up to 250 occupants are required to use the *escape routes*, or

ii) more than 250 occupants are requiring escape through more than two *escape routes* and at least 20 m when more than 250 occupants are required to escape through only two *escape routes*, or

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

As an alternative to separation of escape routes, an ASET/RSET calculation showing that occupants can move past a burning object at the exit or alternative exit using Equations 3.7 & 3.8. Maximum radiant heat must not exceed 2.5kW/m2 at escape route. Location of burning object shall be established in the FEB.

Explanation: Provide an option to calculate the separation of exits using radiant heat calculations.

4.5 Design scenario (HS): Horizontal fire spread

Design fire

The *design fire* for this scenario comprises an assumed emitted radiation flux from *unprotected areas* in *external walls* of the *fire source building* (assuming no intervention). This shall be taken as for all storage occupancies:

FLED	Emitted Radiant Heat Flux From Unprotected Areas	
	Without Sprinklers	With Sprinklers
<400 MJ/m2	83 kW/m2	58 kW/m2
400 – 800 MJ/m2	103 kW/m2	72 kW/m2
>800 MJ/m2	144 kW/m2	101 kW/m2

Emissivity of *fire* gases shall be taken as 1.0.

~~In a *firecell* not containing a storage occupancy or a storage occupancy with a capability to store to more than 3.0 m, and which is protected with an automatic sprinkler system,~~ The calculation for maximum permitted *unprotected area* may use:

Explanation: There is currently no design radiant heat flux for storage buildings and the above provides radiant heat levels for storage buildings with or without sprinklers. This aligns with international codes that permit a reduction in radiant heat for storage buildings with conservative factor of 0.7.

4.5 Design scenario (VS): Vertical fire spread

Scenario Description

c) Where there is a lower roof exposure to a higher *external wall* within the same or an adjacent *building on the same title*, where *firecells* behind the higher *external wall* house sleeping occupancies, *exitways* or *other property*.

Comment: The building code is concerned with fire spread to the relevant boundary not between buildings on separate titles. This requirement does not apply to existing lower roofs on separate freehold title. However separate titles on the same property (eg. unit titles) need to address exposure of lower roofs. This also does not apply to exitways in upper level on a separate title as neighbouring building is not required to evacuate for fire within an adjacent property.

Explanation: Emphasis that lower roofs only need to be addressed when these are on the same title and no requirement to protect from lower roofs on a separate property. New external wall needs to comply with C3.6 and C3.7 for protection to the relevant boundary within Design Scenario HS. New roof needs comply with C3.6 following Design Scenario HS – Horizontal fire spread from roofs. An alteration or change of use to Unit Title Plan requires the whole plan to be updated for spread of fire.

<u>4.9 Design Scenario (CF) Challenging Fire</u>

(move text from Design Scenario (RC) Robustness Check)

Check of vertical escape Routes

~~In addition to the above, a robustness check applies to sprinklered sleeping occupancies as follows:~~

~~For a *building* served by a single vertical *escape route*, visibility in the vertical *escape route* shall not be less than 5.0 m for the period of the *RSET*.~~

In the following cases, visibility within at least one vertical *escape route* shall not be less than 5.0 m for the period of the *RSET*.

a) For sleeping occupancies where vertical escape route serves more than 50 occupants whom are neither detained nor undergoing some treatment or care, or

b) For any *building* served by a single vertical *escape route*,

For a *building* where the vertical *escape routes* serve more than 250 people in a sleeping occupancy, visibility shall not be less than 5.0 m in more than one vertical *escape route* for the period of the *RSET*.

This check assumes that all ***fire safety systems*** are operating as designed.

Explanation: This is not a robustness check but an additional check for sleeping occupancy with single escape route so should be within design scenario CF to clarify the check is required. Note that unsprinklered buildings are also included in this check now.

Special Fire Risk

Areas of special fire risk such as plant areas shall comply with Acceptable Solutions C/AS2-6 Paragraph 4.10.3 or alternatively by fire risk analysis established in the FEB process.

Risk analysis shall address probability and consequence of the source of fire and recommend measures to mitigate the risk with firecells, fire safety systems and means of escape and fire fighting for the whole building.

Comment: Such areas include gas powered plant, car stacking systems, chemical manufacturing and processing, feed mills, flour mills etc. There are a number of internationally recognised documents that provide guidance on design of special hazard areas including the National Fire Protection Association, British Standards and the Society for Fire Protection Engineers.

Explanation: There is currently no requirement to address areas of special hazard

4.8 Design scenario (FO): Firefighting operations

In relation to NZBC C5.5 due to limitations of fire service external fire-fighting capability all buildings over 25m in height must have an automatic fire sprinkler system throughout the building.

Explanation: For some VM designs it is possible to design a high rise building without sprinklers. This would not comply with C5.5 for fire-fighting at height so prescriptive requirement is required to ensure all tall buildings have sprinklers.

Out of Scope

3

From: Michael Belsham
Sent: Wednesday, 20 July 2016 1:50 p.m.
To: 'Ed Claridge'
Cc: Chris Rutledge
Subject: RE: tall building guidance [UNCLASSIFIED]

Ed,

A requirement of using C/VM2 is that FEB process is run. Without an FEB the application is an Alternative Solution.

This also appears to be an existing building. The guidance didn't anticipate assessment of existing buildings.

Kind Regards,

Michael Belsham
FIRE ENGINEER

Building System Performance Branch | Building Resources & Markets
Ministry of Business, Innovation & Employment
Level 5, 15 Stout Street, PO Box 1473, Wellington 6143

BUILDING PERFORMANCE

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT

From: Ed Claridge [mailto:ed.claridge@aucklandcouncil.govt.nz]
Sent: Tuesday, 19 July 2016 4:20 p.m.
To: Michael Belsham
Subject: tall building guidance

Michael,

So we have had the first test of the guidance and here is the response:

- The compliance document which is relied on to demonstrate compliance with the Building Code is C/VM2. The fire engineering assessment is not an alternative solution (notwithstanding Ed's comment about not following Council process).
- Ed and I have had discussion on this subject in connection with a similar, but different project. Ed's view is that the calculation method for burnout fire severity in C/VM2 is not robust and sufficiently resilient for a building of this height. Ed makes reference to the MBIE Guidance document issued on 13th July. The Fire Engineering Strategy lodged for consent is dated 3rd May, which pre-dates the MBIE advice by a couple of months. Notwithstanding this, the MBIE advice is not quantitative – it outlines the importance of structure fire resistance to withstand full burnout, which is the same basis as the calculations submitted. Ed proposes

that the calculation method in C/VM2 for burnout did not take into account buildings of this height. s 9(2)(b)(ii) notes that the building was completed (in early 2000) more than a decade before C/VM2 was first published, so it is unlikely that the calculation methods in C/VM2 were prepared without any awareness that buildings of this height could be designed in Auckland.

So there is no FEB and guess what the structural design not only relies on C/VM2 but doesn't work unless they assume 100% ventilation is available!

Regards

Ed Claridge | Principal Fire Engineer
Ph (09) 353 9372 | s 9(2)(a)
Auckland Council, 35 Graham Street, Auckland
Visit our website: www.aucklandcouncil.govt.nz

Out of Scope

4

From: Michael Belsham
Sent: Monday, 9 May 2016 4:43 p.m.
To: 'Ed Claridge'
Subject: RE: Tall building structural proposal - confidential [UNCLASSIFIED]

Was. Now it's all the same! ☺☺

What's your where about's Friday, will we see you at all?

Kind Regards,

Michael Belsham
FIRE ENGINEER

Building System Performance Branch | Building Resources & Markets
Ministry of Business, Innovation & Employment
Level 5, 15 Stout Street, PO Box 1473, Wellington 6143

BUILDING PERFORMANCE

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT

New Zealand Government

From: Ed Claridge [mailto:ed.claridge@aucklandcouncil.govt.nz]
Sent: Monday, 9 May 2016 4:39 p.m.
To: Michael Belsham
Subject: RE: Tall building structural proposal - confidential [UNCLASSIFIED]

Of course, I was looking at an apartment building of this height, so clearly sleeping is less risk than an office☺

Table 4.1/5: Fire safety precautions for sleeping purpose group firecells
Occupant load 40 maximum

Purpose Group	FHC	Escape height: 0 m (or single floor)	<4 m (or two floors)	4 m to <10 m	10 m to <25 m	25 m to <34 m	34 m to <46 m	46 m to <58 m	over 58 m
SC SD	1	F0	F30	F30	F30	F30	F45	F45	F60
		7 16 18c	7 16 18c	7 16 18c	7 9 15 16 18	7 8 9 13 15 16 18 20	7 8 9 13 15 16 18 20	7 8 9 13 15 16 18 20	7 8 9 13 15 16 17 18 19 20
SA (Note 5)	1	F0	F45	F45	F45	F30	F45	F45	F60
		5af 16 18c	6f 16 18c	5 14 16 18c	5 14 15 16 18	7e 8 9 15 16 18	7e 8 9 13 15 16 18 20	7e 8 9 13 15 16 18 20	7e 8 9 13 15 16 17 18 20
SR (Note 7)	1	F0	F45	F45	F45	F30	F45	F45	F60
		1 16	1 2af 16	1 2f 16	5 14 16 18	7e 15 16 18	7e 15 16 18	7e 15 16 18 20	7e 13 15 16 18 20
Column		1	2	3	4	5	6	7	8

Regards

Ed Claridge | Principal Fire Engineer
Ph (09) 353 9372 | s 9(2)(a)
Auckland Council, 35 Graham Street, Auckland
Visit our website: www.aucklandcouncil.govt.nz

From: Michael Belsham [mailto:Michael.Belsham@mbie.govt.nz]
Sent: Monday, 9 May 2016 4:36 p.m.
To: Ed Claridge
Subject: RE: Tall building structural proposal - confidential [UNCLASSIFIED]

PS old C/AS1 would require F90 for this building

Table 4.1/2: Fire safety precautions for active purpose group firecells Occupant load 101 to 500

Purpose group	FHC	Escape height: 0 m (or single floor)	<4 m (or two floors)		4 m to <10 m		10 m to <25 m		25 m to <34 m	34 m to <46 m	46 m to <58 m	over 58 m
CS	1	F0	F45		F45		F45		F30	F45	F45	F60
(Notes	2	F0	F60		F60		F60		F45	F45	F60	F90
6,7)	3	F0	F60		F60		F90		F45	F60	F60	F90
		3f 16 18c	3f 16 18c		3b 9 16 18c		4 9 16 18		6 9 13 15 16 18	7 9 13 15 16 18	7 9 13 15 16 18	7 9 13 15 16 17 18 19 20
CM	2	F0	F60		F60		F60		F45	F45	F60	F90
(Note 5)	4	F0		F30		F30		F45	F45	F60	F60	F90
		3f 16 18c	3f 16 18c	6 16 18c	3b 9 16 18c	6 9 16 18c	3b 9 15 16 18	6 9 15 16 18	6 9 13 15 16 18	7 9 13 15 16 18 20	7 9 13 15 16 18 20	7 9 13 15 16 17 18 19 20
WL	1	F0	F45		F45		F45		F30	F45	F45	F60
WM	2	F0	F60		F60		F60		F45	F45	F60	F90
WH	3	F0	F60		F60		F90		F45	F60	F60	F90
(Note 5)	4	F0		F30		F30		F45	F45	F60	F60	F90
		3f 16 18c	3f 16 18c	6 16 18c	3b 16 18c	6 16 18c	3b 15 16 18	6 15 16 18	6 15 16 18	6 9 15 16 18	7 9 13 15 16 18	7 9 13 15 16 18 19 20

Kind Regards,

Michael Belsham
FIRE ENGINEER

Building System Performance Branch | Building Resources & Markets
Ministry of Business, Innovation & Employment
Level 5, 15 Stout Street, PO Box 1473, Wellington 6143

BUILDING PERFORMANCE

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT

New Zealand Government

From: Ed Claridge [mailto:ed.claridge@aucklandcouncil.govt.nz]
Sent: Monday, 9 May 2016 3:10 p.m.
To: Michael Belsham
Subject: RE: Tall building structural proposal - confidential [UNCLASSIFIED]

Hi Michael,

So this is part of the problem we now have in NZ as there is no easy way to derive an equivalent. This comes back to the old argument about the Acceptable Solutions where used as a benchmark etc. if we revert back to the Old AS, which some people keep doing then we would arrive at 60 minutes! I haven't practised much in Australia, but I know the BCA code says:

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This recognises height and risk so is similar to B1 in this regard. With regards to their prescriptive requirement it's a bit harder to nail down a single figure but here is an excerpt from the BCA which I think would be applicable:

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EXTERNAL WALL (including any column and other building element incorporated therein) or other external building element, where the distance from any *fire-source feature* to which it is exposed is—				
For *loadbearing* parts—				
less than 1.5 m	90/ 90/ 90	120/120/120	180/180/180	240/240/240
1.5 to less than 3 m	90/ 60/ 60	120/ 90/ 90	180/180/120	240/240/180
3 m or more	90/ 60/ 30	120/ 60/ 30	180/120/ 90	240/180/ 90
For non-*loadbearing* parts—				
less than 1.5 m	- / 90/ 90	- /120/120	- /180/180	- /240/240
1.5 to less than 3 m	- / 60/ 60	- / 90/ 90	- /180/120	- /240/180
3 m or more	- / - / -	- / - / -	- / - / -	- / - / -
EXTERNAL COLUMN not incorporated in an *external wall*, where the distance from any *fire-source feature* to which it is exposed is—				
less than 3 m	90/ - / -	120/ - / -	180/ - / -	240/ - / -
3 m or more	- / - / -	- / - / -	- / - / -	- / - / -
COMMON WALLS and FIRE WALLS—	90/ 90/ 90	120/120/120	180/180/180	240/240/240

So certainly there is some redundancy built in here and we should acknowledge sprinkler and glazing concessions. But ultimately it is difficult to work out what sensitivity is associated with these and the other big inputs such as FLED, ventilation and applicability of some questions to bear steel etc. one problem I have is that there remains no discussion between the relationship and height. i.e. the design fire they propose would still be relevant for a 1,2,10,20,30,40,100 storey building? There will keep being the pressure to accept that the design fire won't change irrespective of where it occurs but of course what becomes acceptable in terms of 'risk' does change with height.

Possibly worth looking also at other codes as a comparison which we can do if necessary?

Regards

Ed Claridge | Principal Fire Engineer
Ph (09) 353 9372 | s 9(2)(a)
Auckland Council, 35 Graham Street, Auckland

Visit our website: www.aucklandcouncil.govt.nz

From: Michael Belsham [mailto:Michael.Belsham@mbie.govt.nz]
Sent: Monday, 9 May 2016 1:48 p.m.
To: Ed Claridge
Subject: RE: Tall building structural proposal - confidential [UNCLASSIFIED]

I'm having trouble explaining what the equivalent fire time would be for this design. The high challenge looks to be no more than te of 60 minutes?

I see they've graciously used 50% glazing fracture. I recall London requiring 25% fracture.

Big question is how much redundancy is enough. So they've got sprinkler failure and 50% glazing for a high challenge. Would you have the Aus requirement to hand for this height?

Kind Regards,

Michael Belsham
FIRE ENGINEER

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Ministry of Business, Innovation & Employment
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BUILDING PERFORMANCE

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT

From: Ed Claridge [mailto:ed.claridge@aucklandcouncil.govt.nz]
Sent: Friday, 6 May 2016 1:01 p.m.
To: Michael Belsham
Subject: Tall building structural proposal - confidential
Importance: High

Hi Michael,

Here is the proposal which includes the 'piecemeal' approach to the approvals. The project are not yet aware that I have sent this to you so I would appreciate this being treated with confidence. Also we have not completed our review so I do not wish to make any assertions about its acceptability or not which may influence your thinking. It would be appropriate to inform the project that I have sent this to you but perhaps I do that when

a) if you wish to take this further following review and
b) if we council get into any dispute regarding matters that would benefit from MBIE's involvement.

My initial thoughts are that splitting this into 2 parts and seeking approval for this prior to the FEB process being initiated is problematic and potentially inappropriate. The proposal may be sufficiently robust and conservative that it may not need to be viewed in the context of an holistic design, but that would be contrary to robust engineering practice and what they are trying to achieve I believe in terms of rationalising the structural fire design and value engineering. At the moment I have not seen much to indicate that the proposal considers any consideration of risk with regards to building height. Council will need to complete its review but I expect that we will need to have a number of discussions regarding these issues as well as how, for example, they propose to demonstrate the fire related requirements of B1.

Regards

Ed Claridge | Principal Fire Engineer
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Auckland Council, 35 Graham Street, Auckland
Visit our website: www.aucklandcouncil.govt.nz

From: s 9(2)(a)
Sent: Wednesday, 4 May 2016 8:25 p.m.
To: Ed Claridge; s 9(2)(a)
Cc: 's 9(2)(a)
Subject: FW: s 9(2)(b)(ii) structural fire engineering: design fires
Importance: High

Ed,s 9(2)(a)

As discussed and agreed at meeting of Thursday 14 April 2016, s 9(2)(b)(ii) will provide the s 9(2)(b)(ii) Structure (L03 to top) Fire Engineering Brief in following Parts, with associated timeframes:

- Part 1 "Design Fires for Structural Fire Engineering" = Imminent
- Part 2 "Analysis of Structure in Response to Structural Design Fire" = Deliverable 2 weeks following resolution/ agreement with Auckland Council of Part 1 above.

Please find **attached** Part 1 referenced above, as dated 29 April 2016.

We note that scope of this review is proposed to be to office levels (being level 09 to 38) only, however we wish to continue dialogue re ability/ merit in extending this analysis to other levels of the tower also (L03 to L07). We also note that some Project elements referenced within attached are under review by the Project Team, reflecting current status of Design (being start of Detailed Design period).

As you are aware, Council's independent structural fire design regulatory reviewer is s 9(2)(b)(ii) Council has engaged s 9(2)(a) direct as regulatory reviewer, with Council directing and managing any review scope required of s 9(2)(a), independent of s 9(2)(b)(ii) Council has advised that s 9(2)(b)(ii) can liaise direct with s 9(2)(a) to action and complete this scope of works – a sensible approach which is appreciated. Please can you issue attached Part 1 document to s 9(2)(a), to allow his review of and agreement to same to commence - which will ultimately (we hope) lead to s 9(2)(b)(ii) producing Part 2 noted above.

Should s 9(2)(a) have any queries in relation to attached, we would encourage communication direct between s 9(2)(a) and s 9(2)(b)(ii) (s 9(2)(a))

As discussed at meeting of Thursday 14 April 2016, following resolution/ agreement of both Part 1 and Part 2 of Tower (L03 to top) Fire Engineering Brief documents noted above to a state suitable to Auckland Council and s 9(2)(b)(ii) will proceed with balance of scope required of s 9(2)(b)(ii) to complete this Fire Engineering design for s 9(2)(b)(ii)

We look forward to Council response.

Kind regards

s 9(2)(a)

9(2)(a)

From: s 9(2)(a)
Sent: Friday, 29 April 2016 1:09 PM
To: s 9(2)(a)
Cc: s 9(2)(a)
Subject: s 9(2)(b)(ii) structural fire engineering: design fires
Importance: High

s 9(2)(a)

Please find enclosed our updated advice for the structural design fires for structural fire engineering for the s 9(2)(b)(ii) structure.
This covers the design fires for the office levels, which is the part of the structure where the bulk of fire engineering analysis is directed.

Regards,

s 9(2)(a)

My preferred communication medium is email or txt message. If you have trouble contacting me by phone please try these other methods.

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5

Out of Scope

From: Michael Belsham
Sent: Monday, 9 May 2016 3:21 p.m.
To: 'Ed Claridge'
Subject: RE: Tall building structural proposal - confidential [UNCLASSIFIED]

Thanks,

Aus is not great example of risk as anything over 4 storey is Type A!

Table C1.1 TYPE OF CONSTRUCTION REQUIRED

Rise in storeys	Class of building 2, 3, 9	Class of building 5, 6, 7, 8
4 OR MORE	A	A
3	A	B
2	B	C
1	C	C

Current stance is we should put out guidance as a final warning to do right thing.

Don't want to rush into new VM method. We'll need a working group and you'll probably be on it!

It would probably include height factor or ventilation factor or both something like PD 6688.

Current argument is very weak with probability of fire starting and investment in sprinklers. NZS4541 does not address height with Type A over 25m.

Table B.2 Height associated with multiplication risk factors

Occupancy	Height associated with multiplication risk factor m					
	0,65	1,0	1,35	2,0	2,65	3,3
Residential (dwelling)	-	0–5	5–18	18–30	>30	-
Residential (institutional)	-	-	0–5	5–18	18–30	>30
Residential (other)	-	0–5	5–18	18–30	>30	-
Office	0–5	5–18	18–30	>30	-	-
Retail	0–5	5–18	18–30	>30	-	-
Assembly (high)	0–5	5–18	18–30	>30	-	-
Assembly (med)	0–5	5–18	18–30	>30	-	-
Assembly (low)	0–5	5–18	18–30	>30	-	-
Industrial (high)	0–5	5–18	18–30	>30	-	-
Industrial (low)	0–5	5–18	18–30	>30	-	-

Kind Regards,

Michael Belsham
FIRE ENGINEER

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3 m or more	90/ 60/ 30	120/ 60/ 30	180/120/ 90	240/180/ 90
For non-loadbearing parts—				
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To: Ed Claridge; s 9(2)(a) ||
Cc: s 9(2)(a)

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Importance: High

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To: s 9(2)(a)

Subject: s 9(2)(b)(ii) structural fire engineering: design fires
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