MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HIKINA WHAKATUTUKI

Determination 2018/064

Regarding whether the fire safety design of a proposed 185m high mixed-use tower building at 71-77 and 87 Customs Street East, Auckland complies with Clauses C1-C6 by means of C/VM2

Summary

This determination considers the fire safety design of a proposed tall building and whether compliance with Clauses C1-C6 has been established by means of Verification Method C/VM2. The determination discusses the scope of the Verification Method, how compliance is established by way of the Verification Method, and the compliance of the proposed design – in particular the lack of isolated interconnection between the lobby containing the designated fire fighters lift and the stair that is the means of egress and which firefighters use to access the floor of fire origin.

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Common terms used in this determination:

The Building Act 2004, referred to herein as "**the Act**"

Fire and Emergency New Zealand, previously the New Zealand Fire Service, is referred to herein as "**FENZ**". FENZ has a number of roles in the building consent process that are relevant to this determination:

- Section 46 of the Act requires building consent authorities to send certain building consent applications to FENZ for comment. The engineering unit of FENZ reviews these applications and provides a memorandum back to the authority. The authority must take regard of this memorandum in deciding whether to grant a building consent under section 48 of the Act.
- FENZ is a stakeholder in the Fire Engineering Brief (FEB) process as the organisation responsible for firefighting operations.
- Under the Fire and Emergency Act 2017, FENZ must consider whether to approve the evacuation scheme.

Unless context otherwise requires, I refer to the organisation in each of these roles simply as FENZ.

"The fire engineer": the Chartered Professional Engineer responsible for the fire safety design for this project and who was the author of the Fire Engineering Report.

Unless otherwise stated, all references to the **Verification Method "C/VM2"** are to the version that was current at the time the building consent was lodged (Amendment 4, effective from 1 July 2014 until 23 November 2017).

References to **"Amendment 5"** are to C/VM2 (Amendment 5) effective from 24 November 2017.[1]

"Practice Advisory" or **"PA18"**: Practice Advisory 18: Fire safety design for tall buildings published by the Ministry in 2016 as guidance under section 175 of the Act.

Fire Engineering Brief ("FEB"): The FEB process is described in a number of internationally recognised process documents. The International Fire Engineering Guidelines[2] describe it as "a documented process that defines the scope of work for the fire engineering analysis and the basis for analysis as agreed by stakeholders". Stakeholders are typically the building consent authority, FENZ, design fire engineer, peer review fire engineer, architect / designer, and building owner. The fire engineering brief is the documentation of that process.

Fire Engineering Report ("FER"): Unless otherwise stated, the version of the FER referred to in this determination is revision 10 dated 14 August 2017 which incorporates changes identified by the fire engineer in a letter on 20 July 2017.

[1] The changes to the scope of the Verification Method in amendment 5 mean the proposed building would fall outside the scope of Amendment 5 if the building consent application was lodged on or after 24 November 2017.
[2] International Fire Engineering Guidelines, Edition 2005

"The first expert": The engineering and related consultancy company with specialist expertise in fire engineering and tall buildings engaged on 30 October 2017. The first expert reviewed the available documentation and provided a report with respect to compliance with Clause C5.6 by means of C/VM2 and benchmarking against international best practice based on other internationally recognised codes and guidance.

"The second expert": The consultancy company with specialist expertise in fire engineering and tall buildings engaged on 31 May 2018 to review the FER and available documentation and provide a report with respect to compliance with Clauses C1-C6 by means of C/VM2 and to provide comment on the consideration of PA18.

Various terms such as "tall", "very tall" and "high-rise" have been used by the parties and in the first expert's report to describe the building that is the subject of this determination. Also included in the first expert's report was a table setting out the different terms and criteria used in international codes and guidance. Unless quoting directly from those sources, for consistency and simplicity this determination uses the term "**tall**".

Various terms have been used by the parties and the first expert to describe the direct or fire isolated interconnection between the lobby containing the designated firefighters lift[3] and the stair that is the means of egress and which firefighters use to access the floor of fire origin. In this determination these lobbies are referred to as "**connecting lobbies**" or **"interconnecting lobbies"**. Connecting lobbies provide a preventative buffer zone to avoid smoke entering the stairway which is a safe path, and are used as a staging area[4] by firefighters. Typically in multi-unit buildings these areas are maintained as common property.

Available safe egress time **"ASET"** as defined in C/VM2:
Time available for escape for an individual occupant. This is the calculated time interval between the time of ignition of a fire and the time at which conditions become such that the occupant is estimated to be incapacitated (ie, unable to take effective action to escape to a place of safety).

Required safe egress time "**RSET"** as defined in C/VM2:
Time required for escape. This is the calculated time period required for an individual occupant to travel from their location at the time of ignition to a place of safety.

[3] The lifts are designed to comply to BS EN 81-72
[4] A staging area is the location where firefighters report to before ascending to the floor of fire origin and where an 'equipment pool' is established.

1. The matter to be determined

1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004[5] ("the Act") made under due authorisation by me, Katie Gordon, Manager Determinations, Ministry of Business, Innovation and Employment ("the Ministry"), for and on behalf of the Chief Executive of the Ministry. The decision under section 184 of the Act to make this determination was made by the previous Manager Determinations.

1.2 The parties

1.2.1 The parties in this determination are:

- the owner, Shundi Customs Limited ("the applicant"); acting through a legal advisor ("the applicant's solicitor") and the fire engineer
- Fire and Emergency New Zealand ("FENZ")[6], as a party under section 176(g) of the Act
- Auckland Council carrying out its duties and functions as a territorial authority or building consent authority ("the authority").

1.2.2 As this determination concerns fire safety and fire-engineering practice I am also required to consult with FENZ under section 170 of the Act.

1.3 The dispute

1.3.1 This determination arises from a disagreement between the parties as to whether the proposed design of a tower building complies in respect of the fire safety Clauses C1 to C6 of the Building Code (First Schedule, Building Regulations 1992).

1.3.2 The original application requested a determination on whether the fire design complies with the Verification Method C/VM2, and in accordance with section 19(1)(ba)[7] is therefore deemed to comply with Clauses C1 to C6 of the Building Code.

1.3.3 The fire engineer is of the view that the fire design complies by way of C/VM2 and is therefore deemed to comply with Clauses C1 to C6. FENZ and the authority are of the view that this type of building (tall building) is outside the scope of Verification Method C/VM2, and the compliance of the fire design for tall buildings such as this one cannot be assessed against the Verification Method alone. During the processing of the building consent application the authority also raised concerns with regard to particular features of the fire design and did not accept the peer review of the fire design (refer paragraph 3.4).

1.3.4 In preparing the first draft of this determination I considered the matter before me turned on whether or not this particular building was within the scope of Verification Method C/VM2 and whether the fire design must be accepted as establishing compliance with the Building Code if it satisfies the Verification Method (see paragraph 7.3).

[5] The Building Act, Building Code, compliance documents, past determinations and guidance documents issued by the Ministry are all available at www.building.govt.nz or by contacting the Ministry on 0800 242 243.
[6] References to FENZ include the preceding New Zealand Fire Service (NZFS)
[7] In this determination, unless otherwise stated, references to sections are to sections of the Act and references to clauses are to clauses of the Building Code.

1.3.5 In correspondence subsequent to the application for determination (see Appendix C.1) the fire engineer identified a particular matter of compliance that remained in dispute, being 'the absence of a direct or fire-isolated interconnection between the apartment lift lobby and the upper west stair servicing levels 41 to 55' (refer Figures 1 to 4). FENZ expressed its concern regarding compliance with Clause C5.6[8] as 'the failure to provide lobbies as appropriate staging areas, or direct access between stairs and lifts … above level 46'.

1.3.6 The second draft of this determination therefore considered:

- whether the building was within the scope of C/VM2, and
- whether Verification Method C/VM2 must be accepted as a means of establishing compliance with Clauses C1 to C6, and
- whether the proposed building without connecting lobbies on Level 47 and above complies with Clause C5.6.

1.3.7 In submissions from the parties in response to the second draft determination (refer Appendix C.5) it was apparent there were other outstanding matters in dispute that required resolution before the authority would consider granting the building consent. A meeting was held with the parties to establish what further matters were in dispute that might need to be resolved by way of determination.

1.3.8 The authority had stopped work on the building consent once the determination had been lodged and therefore did not identify any concerns during the meeting beyond the matters considered in the second draft of the determination[9]. The applicant continued to seek a determination that the fire design complied in all respects with the fire safety Clauses C1 to C6 of the Building Code.

1.3.9 The outcomes of the meeting were an agreement to broaden the scope of the matter to be determined and an agreed process whereby the Ministry would engage a second expert to undertake a technical review of the fire design as described in the FER.

1.4 The matter to be determined

1.4.1 The matter to be determined[10] therefore is whether the proposed building, based on the fire design as described in the FER revision 10, will comply with Clauses C1 to C6 of the Building Code by means of Verification Method C/VM2.

1.4.2 In agreeing to this broader matter to be determined (refer paragraphs 1.3.2 and 1.3.9), I advised the parties that the Ministry reserves its opinion on whether the scope of this determination is within the provision in section 177(1)(a) 'whether particular matters comply with the building code'.

1.4.3 It is important to record that the determination process is not a substitute for the building consent process. Rather it is intended to deal with 'particular matters' or discrete issues that arise during the regulatory building process. The Building Act 2004 made some changes to the provisions in the 1991 Act that define when the determination power arises. Under section 17 of the 1991 Act the determination power was predicated on the existence of a 'doubt or dispute' about whether particular matters complied with the Building Code or about specified decisions by the territorial authority.

[8] Clause C5.6 concerns access and safety for firefighters to reach the floor of fire origin and search the general area of fire origin, and protection of their means of egress.

[9] In response to my request for a list of the authority's concerns, the authority provided a submission on 1 June 2018 outlining matters it considered needed to be addressed in the technical review and /or as part of the determination (refer Appendix C.5).

[10] Under section 177(1)(a) of the Act

1.4.4 The 2004 Act removed the references to 'doubt or dispute' but continues to apply the determination power in more or less the same two sets of circumstances, namely; determining whether particular matters comply with the Building Code and determining questions about specified decisions of building consent authorities and territorial authorities.

1.4.5 I do not consider that the change in language was intended to bring about any significant change to the scope of the determination power. There is nothing in the parliamentary debates that would suggest a substantial change was intended.

1.4.6 In any event the term 'particular' means specific, distinct or isolated. It contrasts with the term general. Accordingly, in my view, the reference in both statutes to determining whether 'particular' matters comply with the Building Code makes it clear that the power is intended to apply to discrete issues rather than the more general question of whether a building should be granted a consent. In addition, the legislation contemplates a process where parties to the determination put to the Chief Executive their arguments about the particular matters that are at issue.

1.4.7 In this case, I have agreed to determine the broad question of whether the fire design as described in the FER complies with the fire safety Clauses C1 to C6 of the Building Code by means of Verification Method C/VM2 because of the lengthy delays that have already occurred in this case and the need to bring the matter to a conclusion. However, this should not be seen as a precedent.

1.4.8 In order to make this determination I needed to obtain a technical review of the fire design to replace the kind of review that would ordinarily be carried out by the authority carrying out its building consent authority function. With the agreement of the parties I appointed an independent technical expert ("the second expert') to carry out that review. One of the features of this determination has been that the fire engineer has continued to revise the fire design throughout the determination process. The second expert's review is of revision 10 of the FER (see paragraph 6).

1.5 The process of the determination

1.5.1 In making my decision, I have considered the submissions of the parties, the report of the independent technical experts (the first and second experts) engaged by the Ministry to assist in this matter, and the other evidence.

1.5.2 I have not considered any other aspects of the Act or of the Building Code, nor have I considered any other aspects of the design other than those relating to the fire design as described in the FER.

1.5.3 In this determination, I have referred to the following legislation, the relevant parts of which are included in full in Appendix A:

- The Building Act 2004 ("the Act")
- First Schedule, Building Regulations 1992 ("the Building Code").

1.5.4 A large number of submissions have been received during this determination. Those submissions are recorded in Appendix C and summarised in paragraph 4.

2. The proposed building work

2.1 The proposed tower building is approximately 185m in height and is a mixed-use building consisting of:

- five basement levels of car-parking and plant (B5 – B1)
- seven levels of mixed-use podium containing retail, hospitality, car parking/storage, and commercial tenancies (GF – L7)
- forty-one levels of residential apartments (L8 – L52)
- two levels of service plant at the apex (L53 – L55)

(Note: the numbering convention excludes Levels 4, 14, 24, 34, 44 and 54. There are 55 levels in total including ground floor and basement levels.)

2.2 Fire safety features incorporated in the design include:

- Two stairs servicing Level 40 and below to Ground Floor ("West Stair" and "East Stair"), with the East stair also serving the basement levels.
- A single pressurised stair ("Upper West Stair") serving the apartments on Levels 41 to 52, with a connecting stair for plant Levels 53 and 55.
- Pressurisation[11] of the Upper West Stair from Levels 39-52.
- Type 7 fire alarm system. That is an automatic fire sprinkler system to NZS 4541[12] with smoke detectors and manual call points to NZS 4512[13]. The sprinkler system is to have two water supplies independent of each other.
- Type 5 smoke detection in apartment units: smoke detection in an apartment will sound a local alarm whilst smoke detection in a common area will sound a general alarm on the relevant levels.
- Type 9 smoke detection in air handling systems.
- Type 18 fire hydrant system in the stairs (East stair for B1 to L39, and West stair for GF to L51) to comply with NZS 4510[14].
- A fire control room and warden intercom point handsets (WIP phones).
- Emergency lighting to F6/AS1[15], illuminated exit signs to F8/AS1[16], and emergency generator.
- Designated firefighter lifts (southeast apartment lift serving Levels B5-52 but not Levels 5 and 6, and goods lift serving Levels B1-40), complying with BS EN 81-72 (BSI, 2015)[17].

2.3 A number of the fire safety features are specified systems that will be subject to a compliance schedule and building warrant of fitness.

[11] Pressurisation is to AS/NZS1668.1:1998 The use of ventilation and air conditioning in buildings - Fire and smoke control in multi-compartment buildings
[12] New Zealand Standard NZS 4541 Automatic fire sprinkler systems
[13] New Zealand Standard NZS 4512 Fire Detection and Alarm Systems in Buildings
[14] New Zealand Standard NZS 4510 Fire hydrant systems for buildings
[15] Acceptable Solution F6/AS1 Visibility in Escape Routes
[16] Acceptable Solution F8/AS1 Signs
[17] British Standard BS EN 81-72: Safety rules for the construction and installation of lifts. Particular applications for passenger and goods passenger lifts. Firefighters lifts.

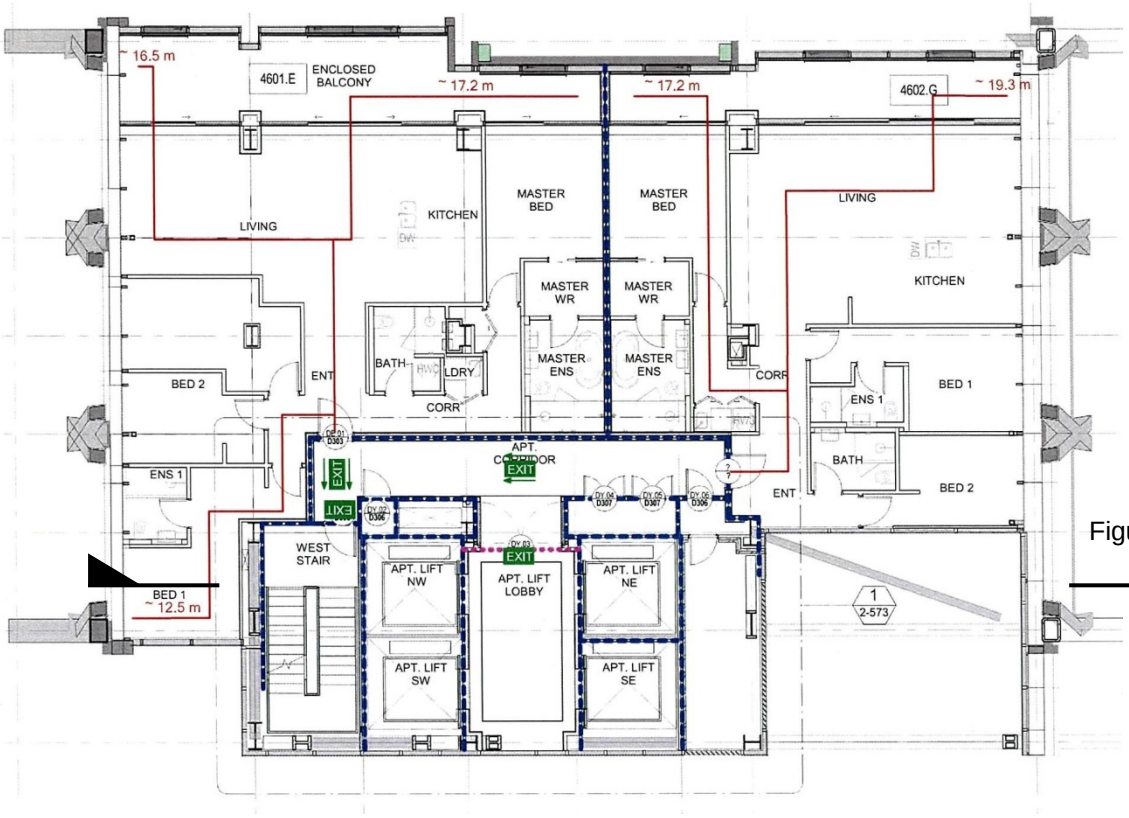

Figure 1: Plan L46 – showing 'half floor' apartments with connecting lobby between the lifts and West stair (not to scale)

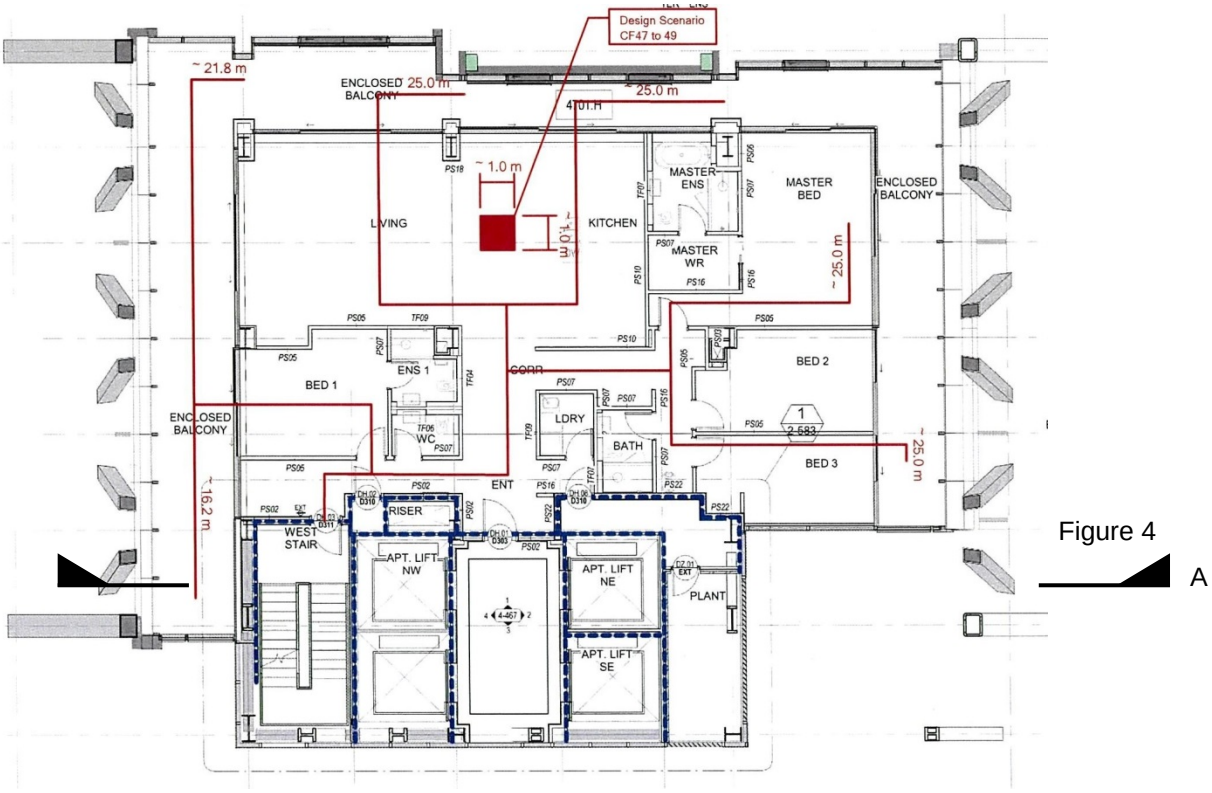

Figure 2: Plan L47 – showing 'full floor' apartment with no connecting lobby between the lifts and West stair (not to scale)

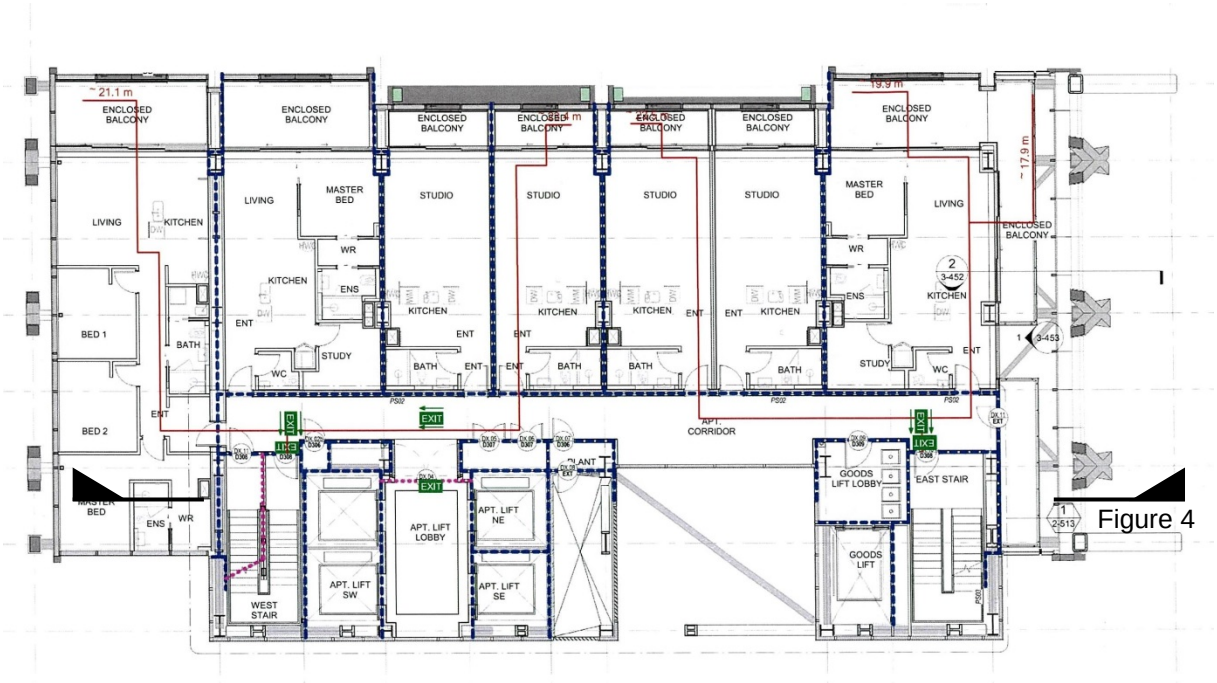

Figure 3(a): Plan L39 showing transition corridors from Upper West Stair (not to scale)

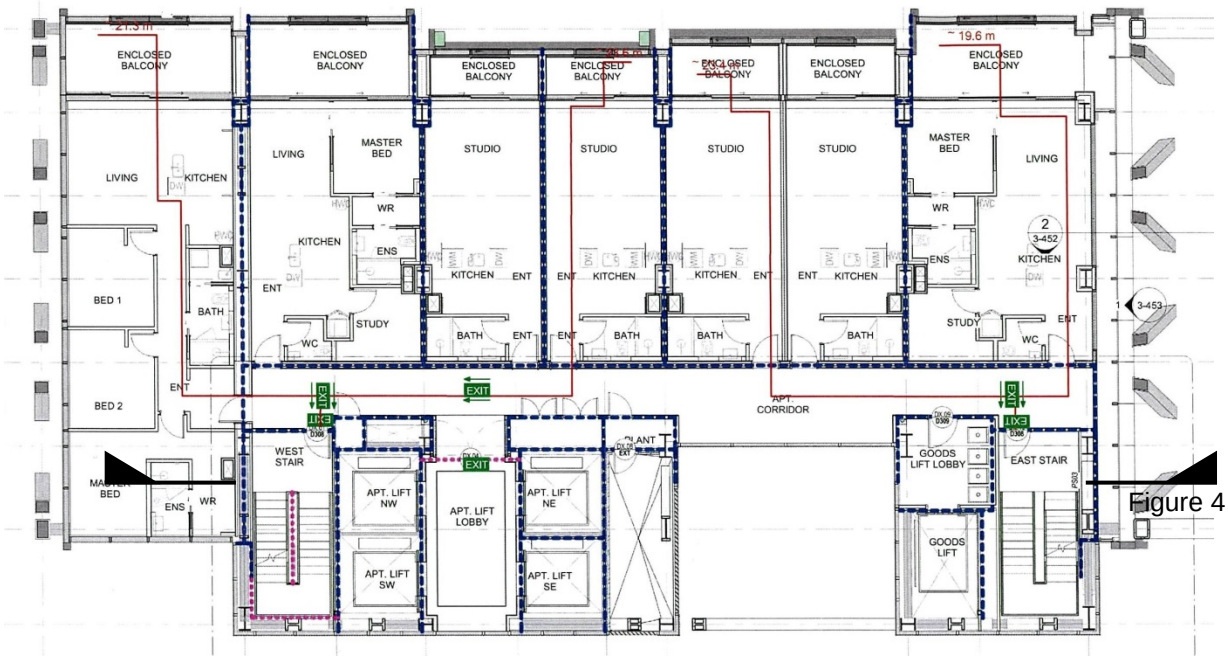

Figure 3(b): Plan L40 showing transition corridors from Upper West Stair (not to scale)

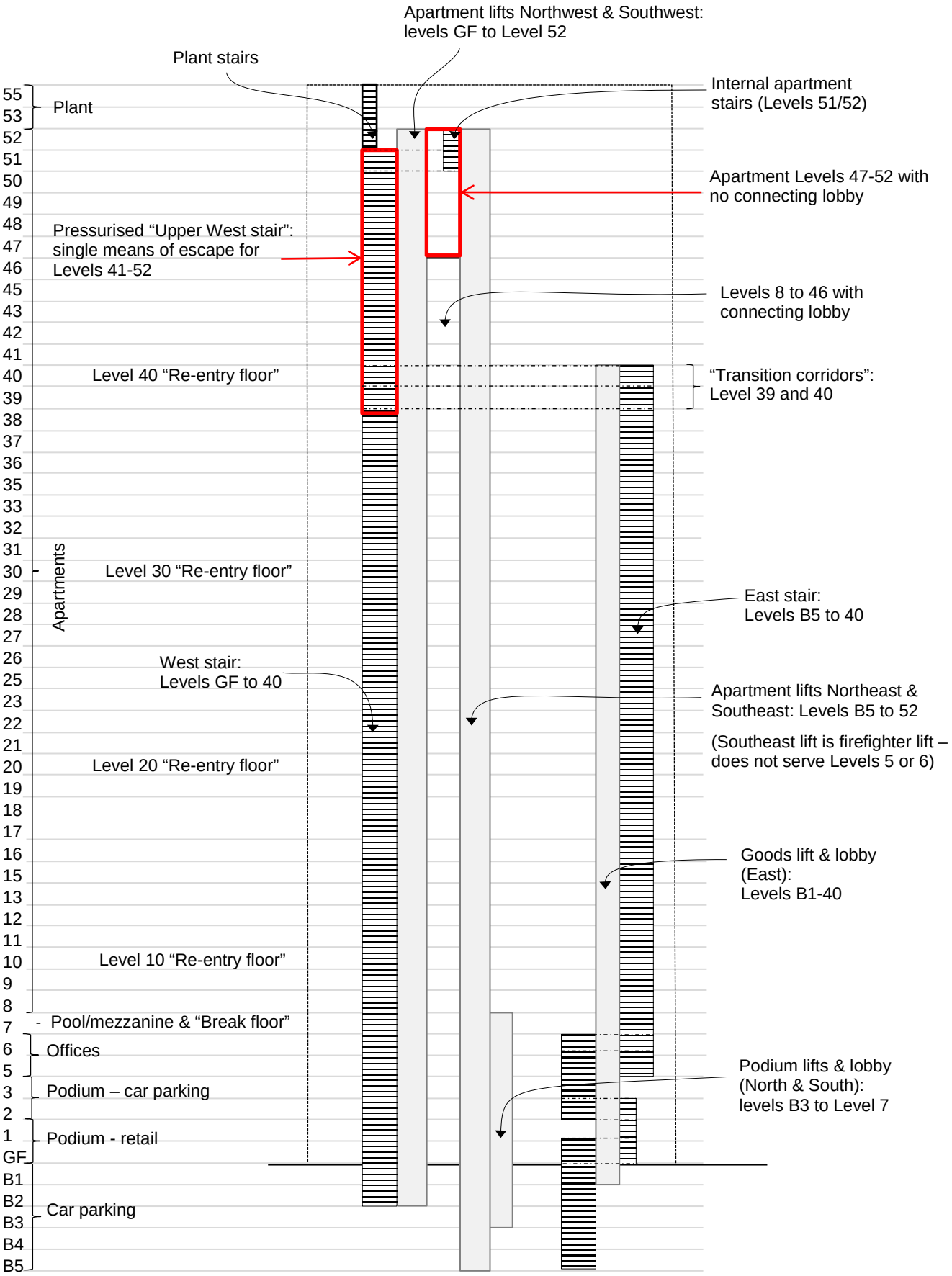

Figure 4: Schematic of lifts and stairs: Elevation A-A

2.4 Evacuation strategy

2.4.1 The building evacuation strategy is managed through a 'cascading alarm sequence'. The first stage is:

- if the floor of fire origin is a basement level, all floors of the basement
- GF to Level 7 if the fire origin is on any of these levels
- if the fire origin is on any level from Levels 8-40, one floor below and two above the floor of fire origin (referred to in the table below as 'pod of 4')
- Levels 41-55 if the fire origin is on any of these levels.

2.4.2 The stages of alarm sequencing are shown in the simplified evacuation matrix below (the FER includes a detailed fire alarm matrix):

Table 1: Fire alarm matrix

		Floor of origin			
Zone	**Levels**	**L41 – L55**	**L8 – L40**	**GF – L7**	**B5 – B1**
A	L41 – L55	Stage 1	Stage 2	Stage 2	Stage 3
B	L8 – L40 'pod of 4'	Stage 2	Stage 1	Stage 2	Stage 3
	L8 – L40 (remainder)	Stage 2	Stage 2	Stage 2	Stage 3
C	GF – L7	Stage 3	Stage 3	Stage 1	Stage 2
D	B5 – B1	Stage 4	Stage 4	Stage 3	Stage 1

2.4.3 The proposed evacuation strategy and design provides for the occupants of apartments in Levels 40-52 to escape via the pressurised Upper West Stair, exiting at either Level 40 or 39 and then continuing down the West stair or transitioning via a safe path corridor to the East stair.

2.4.4 There is separation of rising and descending stairs at Level 39, meaning that occupants descending the Upper West Stair from levels above Level 39 encounter a wall at the landing on Level 39 'and must exit into the safe path corridor', electing then to either re-enter the West stair by way of an adjacent door or transition across to the East stair.

2.4.5 Stair doors unlock in fire alarm mode allowing re-entry from the stairs to corridors at any level from Level 46 down. The fire engineer has stated that Levels 10, 20, 30 and 40 are designated "re-entry levels", with the intention of occupants clustering on those levels to rest if necessary and to allow efficient use of the goods lift to assist with evacuation.

2.5 Occupant levels

2.5.1 Occupant numbers have been calculated using Table 3.1 of C/VM2, resulting in the following for Levels 41-55 (the levels for which there is a single means of escape):

Table 2: calculated occupant numbers Levels 41–55

Level		**Bedrooms**	**Occupants**
55 53	Plant		
52 51	Master penthouse	5	10
50	Full floor penthouse	3	6
49	Full floor penthouse	4	8
48	Full floor penthouse	4	8
47	Full floor penthouse	4	8

46	Half floor penthouse	4	8
	Half floor penthouse	3	6
45	Half floor penthouse	4	8
	Half floor penthouse	3	6
43	Half floor penthouse	4	8
	Half floor penthouse	4	8
42	Half floor penthouse	4	8
	Half floor penthouse	4	8
41	Half floor penthouse	4	8
	Half floor penthouse	4	8
Total calculated for Levels 41-55			**116**

2.5.2 The pressurised Upper West Stair continues down to Level 39. Occupant numbers for those levels are calculated as follows:

Table 3: calculated occupant numbers Levels 39 and 40

Level		**Bedrooms**	**Occupants**
40	7 x Apartments	3	6
		1	2
		1	2
		1	2
		1	2
		1	2
		1	2
39	7 x Apartments	3	6
		1	2
		1	2
		1	2
		1	2
		1	2
		1	2
Total calculated for Levels 39-40			**36**

2.5.3 The building houses a total number of 221 apartments and seven levels of mixed-use (retail, hospitality, car parking/storage, and commercial tenancies). The calculated total occupancy in the FER is as follows:

Table 4: calculated occupant numbers total

Levels		**Calculated occupancy**
8 - 55	Apartments & plant	792
GF - 7	Podium – mixed use	1158
B5 – B1	Basement	120
Total calculated for building		**2070**

2.6 C/VM2 Design Scenarios

2.6.1 The proposed fire design uses the Design Scenarios in C/VM2 (Amendment 4) as a means of establishing compliance with the Building Code.

2.6.2 The FER concluded that the Design Scenarios were satisfied as follows:

Table 5: FER summary of compliance with C/VM2 Design Scenarios

Design Scenario	FER Summary of compliance
Fire blocks exit (BE)	Levels 8-40 based on two stairs being provided.
	Levels 41-55 'is obviously prone to the Design Scenario BE', but *'…BE is not applicable to the Residential Tower because above L41:* *There are less than 50 people per floor. …* *The maximum single direction of travel to the West Stair is less than 50 m* *The single stair serves 116 people. This is less than 250-person limit. A transition [can occur] at L40. Should L40 be the area of fire origin, then occupants can continue to L39 where a forced transition occurs with the rising and descending flights of the West Stair are (sic) physically separated.* *… the upper West Stair from L39 to L56 (sic) is to be pressurised as per AS/NZS1668.1:1998.'*[18] The FER concluded that the design is within the stated criteria for those levels served by a single stair taking into account the occupant numbers and travel distances.
Fire in normally unoccupied room threatening occupants of other rooms (UT)	Not applicable to tower Levels 8-52 due to occupant numbers. Satisfied through installation of automatic fire sprinkler system for GF to Level 7 and B5 to B1, with the exception of substation which will have automatic fire detection and an *'FRL of greater than -60/60'.* [19]
Fire starts in concealed space (CS)	*'Concealed spaces are to be treated by traditional solutions of cavity barriers and/or fire detection'.*
Smouldering fire (SF)	Satisfied through use of automatic fire sprinkler system.
Horizontal fire spread (HS)	C3.6: The sprinkler system is to have two independent water supplies, one of which is not dependent on town mains' water supply.
	Cladding not specified – FER describes relevant standards for cladding system to meet.
External vertical fire spread (VS)	Cladding not specified – FER describes relevant standards for cladding system to meet.
	Fire plumes spreading vertically up external wall via openings – satisfied through installation of automatic fire sprinkler system.
	Fire plumes spreading fire from a lower firecell through an unprotected lower roof to an adjacent higher external wall via unprotected areas – satisfied through installation of automatic fire sprinkler system in buildings to the East and West.

[18] Australian/New Zealand Standard AS/NZS 1668.1:1998 The use of ventilation and airconditioning in buildings – Fire and smoke control in multi-compartment buildings
[19] FRL Fire Resistance Level

<table>
<tr><td>Rapid fire spread involving internal surface linings (IS)</td><td>List of material group numbers and critical radiant flux measures required for various surface materials, noting that these do not apply within household units.</td></tr>
<tr><td>Firefighting operations (FO)</td><td>Stated minimum FRR[20] to accommodate full burnout (time equivalent):
- Tower (60)/60/60
- Podium (60)/60/60
- Basement (90)/90/90
- Substation enclosure Level B1 (120)/120/120.</td></tr>
<tr><td>Challenging fire (CF)</td><td>
<table>
<tr><th>Fire scenarios analysed:</th><th>ASET</th><th>RSET</th></tr>
<tr><td>Basement car parking (B5 East)</td><td>600s</td><td>577s</td></tr>
<tr><td>Podium retail (East)</td><td>300s</td><td>200s</td></tr>
<tr><td>Podium lobby</td><td>300s</td><td>198s</td></tr>
<tr><td>Podium retail (L1 restaurant)</td><td>873s</td><td>704s</td></tr>
<tr><td>Podium offices (L5)</td><td>600s</td><td>581s</td></tr>
<tr><td>Apartment (L15)</td><td>900s</td><td>657s</td></tr>
<tr><td>East shoulder garden (L37)</td><td>820s</td><td>816s</td></tr>
<tr><td>Penthouse apartment (L47)</td><td>473s Note 1</td><td>145s Note 2</td></tr>
<tr><td>Master penthouse (L51/52)</td><td>765s Note 1</td><td>711s Note 3</td></tr>
</table>
Note 1: within apartment
Note 2: to Upper West Stair
Note 3: to Gore St Lane
</td></tr>
<tr><td>Robustness check (RC)</td><td>
<table>
<tr><th>Fire scenarios analysed:</th><th>FED[21] / Visibility</th></tr>
<tr><td>Basement car parking (B5): key system failure</td><td>FED Remains below 0.3 for period exceeding the RSET</td></tr>
<tr><td>Podium retail (L1 restaurant): vertical escape route visibility</td><td>Visibility remains above 5m in the West stair indefinitely</td></tr>
<tr><td>Podium offices (L5): vertical escape route visibility</td><td>Visibility remains above 5m in both stairs indefinitely</td></tr>
<tr><td>Apartment (L15): key system failure</td><td>ASET 660s Note 4
RSET 657s Note 5</td></tr>
<tr><td>Apartment (L15) – vertical escape route visibility</td><td>Visibility remains above 5m in both East and West stair indefinitely</td></tr>
</table>
Note 4: total accumulated from time 0 s to 660 s
Note 5: last L15 occupant not of the apartment of fire origin to Gore Street Lane
</td></tr>
</table>

2.6.3 In relation to Design Scenario (FO), the FER states the scenario is satisfied because:

> The building will be sprinkler-protected and the sprinkler system will have a Grade A *(sic)* water supply
>
> Fire vehicular access is available from Customs Street East
>
> A fire control room is provided [co-located] with the security control room and directly accessed from the street level

[20] FRR Fire resistance rating
[21] FED Fractional effective dose

> A fire hydrant system is proposed with outlets at each level within a fire isolated stair (exitway) with all areas reached within a 40 m arc
>
> Fire fighters are provided with access to all floors within the building that are not directly accessible from street level by having stairway(s) designed as exitways, fire separated from all other parts of the building, that are designed to resist fire spread until burnout …
>
> Designated lifts are also available for fire fighter use
>
> Fire fighters and others are protected at ground level and within the building by designing the load-carrying structure and floor systems (excluding intermediate floors) to resist collapse and prevent fire spread between floor levels until burnout
>
> Similarly, intermediate floors and supporting structure to resist collapse until burnout.

3. Background

3.1 C/VM2 and the Design Scenarios

3.1.1 C/VM2 sets out ten fire Design Scenarios with predetermined characteristics that must each be considered and designed for, and design fires are specified for each scenario. The Verification Method anticipates that the Fire Engineering Brief (FEB) is an integral part of its methodology. Through the FEB process the stakeholders provide input to ascertain the building-specific fire design requirements; for example agreement of variables, justification of subjective inputs, and establishing the acceptance criteria (for simplicity in this determination I refer to these collectively as "variables"). The output of each fire scenario analysis is evaluated against a set of quantified performance criteria for life safety of occupants, protection of firefighters and protection of other property.

3.1.2 A brief description of the fire Design Scenarios that are discussed in further detail in this determination is provided in Appendix B.

3.2 Prior to the consent application

3.2.1 The fire engineer submitted that meetings were held with the Operations Team of FENZ on 4 August 2015 and 25 November 2015. FENZ raised questions on 23 December 2015, which were responded to on 25 January and 30 March 2016.

3.2.2 In June 2016 the fire engineer proceeded with producing an FER[22] and having it peer reviewed.

3.3 Practice Advisory 18

3.3.1 On 6 July 2016, in response to the advent of tall building developments in Auckland, some of which were at heights not seen before in New Zealand, the Ministry published Practice Advisory PA18 as guidance under section 175 in relation to specific considerations for designing tall buildings.

3.3.2 The Practice Advisory highlights the unique challenges for fire safety design in tall buildings and identifies specific issues that need to be worked through during the FEB process. Tall buildings require special consideration of particular characteristics, such as: restricted access for firefighting; the time taken for occupants to descend and disperse and for firefighters to ascend; options for avoidance strategies being constrained; occupant behaviour where occupants are

[22] The Producer Statement – PS2 – Design Review issued by the peer reviewer on 13 December 2016 records the FER as revision 8 dated 01 December 2016

remote from the fire source and remote from cues to a fire originating; higher occupant numbers feeding into the fire egress; and constraints on egress and firefighter access.

3.3.3 In tall buildings there are also complexities for firefighting operations at height and the potential for firefighters' egress to be compromised. In this case there is also mixed use of the building, meaning parts of the building are occupied at different times of the day or night.

3.3.4 The Practice Advisory states 'reduced tolerance for an adverse consequence in a fire event needs to be matched by providing more reliable and effective fire safety systems'. Under the title 'scope and application' it states:

> The C/VM2 framework does not explicitly highlight additional considerations for buildings taller than what has been the current norm in New Zealand. MBIE, in partnership with the Society of Fire Protection Engineers (SFPE) is undertaking a review of the Verification Method C/VM2[23] to make it clear and explicit that these issues are addressed …
>
> In the interim, specific consideration of structural stability, fire severity for full burnout, firefighting facilities, evacuation procedures and resilience of the fire systems should be included during the FEB process.

3.3.5 The Practice Advisory notes that the Society of Fire Protection Engineering Guide 'Fire safety for very tall buildings' provided a useful reference for identifying appropriate fire safety measures for tall buildings. In regard to firefighting access and facilities, the advisory states:

> Specific facilities to support fire service operations may be needed, such as fire-protected lift systems to facilitate firefighter access and operations, resilient firefighting water supply systems and smoke protected lobbies.

3.3.6 The Practice Advisory also states that 'the fire safety issues relating to tall buildings referred to in the advisory should be considered in the FEB process so they can be included in the building consent documents'.

3.4 The building consent application

3.4.1 On 16 August 2016 FENZ provided the fire engineer with a draft of a document titled "NZFS Requirement for Tall High Rise Buildings", which noted:

> Tall High Rise Buildings [those above 60m] require more consideration than what is being offered in the NZ Building Code Approved Documents – specifically V/M2. *(sic)*

Under the heading "Fire Service Access" FENZ stated

> In the event of an incident at a [tall high rise] building, firefighting operations require a large number of resources and equipment to be taken into the building along with multiple firefighting crews. …
>
> For internal access in [tall high rise] buildings, occupants and firefighters rely on safe stairs and lifts. [FENZ] will utilise dedicated lifts to move equipment and personnel to higher levels. …
>
> Firefighters will use a combination of (dedicated) firefighter lifts and safe path stairs in [tall high rise] building fires. Therefore [FENZ] expects 2 pressurised safe path stairs as well as the dedicated firefighting lifts to access to all levels. …

[23] The Ministry carried out the consultation on the proposed amendment to C/VM2 as required under section 29 of the Act and the Verification Method was amended effective from 24 November 2017 (Amendment 5)

3.4.2 The building consent application was submitted to the authority on 20 December 2016 and was supported by:

- a Producer Statement Design (PS1) in respect of Clauses C1 to C6 for all of the building, stating that the design had been prepared in accordance with C/VM2
- a Producer Statement Design Review (PS2) in respect of Clauses C1 to C6 and Clauses F6 to F8[24] as they apply to fire design for all of the building, stating that the design had been prepared in accordance with C/VM2
- an FER dated 1 December 2016 (revision 8)
- fire engineering drawings and architectural drawings
- a peer review dated 19 October 2015. (The peer review is of a draft FER dated 24 September 2015.)

3.4.3 On 17 March 2017 the authority requested further information from the architect and attached a memo from the engineering unit of FENZ[25] provided under section 47 of the Act. The authority requested a response and details of the fire design to be amended to address issues identified by FENZ. Under a sub heading 'Firefighting operations', item #2.7 of the FENZ memo noted:

> ***Fire service access to stairs*** – for safe and effective firefighting operations, a protected lobby shall be provided to connect the firefighting lift to the stair (to access the hydrants). Currently this does not exist.

3.4.4 The fire engineer responded on 10 April 2017 and provided an amended FER (revision 9).

3.4.5 On 18 April 2017 the authority requested a further revised FER, and on 21 April 2017 the authority made a further request for information concerning a number of matters regarding the fire design that the authority considered had not been resolved. These items included (in summary):

- lack of specification of firefighting lifts
- fire alarm and evacuation sequencing (the proposal at that time was a 'defend in place strategy'[26])
- various FENZ approvals
- lack of connecting lobbies
- standard cited for compliance of mechanical systems
- carpark ventilation
- clarification of the extent and operation of the continuous power supply
- occupant numbers.

3.4.6 For clarity, I note again that the version of the FER considered in this determination is revision 10 dated 14 August 2017, which was provided as part of the determination process in correspondence between the parties and the Ministry regarding the scope of the matters to be determined and for the purpose of this determination. I also note

[24] Clause F6 Visibility in escape routes, Clause F7 Warning systems, Clause F8 Signs.
[25] Then "NZ Fire Service Fire Engineering Unit"
[26] In defend-in-place strategies occupants are relocated to a safe location (referred to as a refuge area) rather than being evacuated. It is a strategy used mainly for buildings where occupants are unable to leave the building, such as hospitals, healthcare institutions, and prisons. The "refuge area" is a location in a building designed to hold occupants during a fire or other emergency, where occupants can wait until rescued or relieved by firefighters.

this revision of the FER was not reviewed by the authority or FENZ (under section 46 of the Act) prior to it being provided to the Ministry. The amendments in this version included changes to the communication systems to be used by FENZ in a fire event, altering the 'defend in place' evacuation strategy to a staged evacuation with a cascading evacuation alarm, and confirmation of the standard for the firefighters lift.

4. The submissions

4.1 Over the course of the determination I received many submissions by the parties, including submissions about the determination process. The information provided and a summary of the submissions made by the parties that are relevant to the matter to be determined is recorded in Appendix C as follows:

C.1 The initial application and correspondence

C.2 Documentation provided in support of the determination application

C.3 Record of the initial submissions received

C.4 Record of submissions in response to the first draft determination issued on 6 October 2017

C.5 Record of submissions subsequent to the first expert's report and second draft determination issued on 15 December 2017

C.6 Record of submissions subsequent to the second expert's report, issued to the parties on 13 August 2018, and in response to the third draft determination issued on 4 September 2018.

4.2 I have summarised below the submissions made by the parties under the following common themes:

- Table 6: The scope of the Verification Method – whether tall buildings of this type fall outside the scope of C/VM2 (Amendment 4)
- Table 7: Establishing compliance of the proposed building (generally)
- Table 8: Compliance with Clause C5.6.

Table 6: The scope of the Verification Method

The scope of the Verification Method
FENZ
• FENZ recognises the limits on application of C/VM2 and considers that the code-compliance of the fire design turns on a first principles assessment against the requirements of the Building Code, informed by the Practice Advisory 18 for tall buildings and other similar guidance. • Guidance material can be used to help interpret the limits on application of Verification Methods, as part of their interpretation, and FENZ maintains the view there are limitations of C/VM2 when applied to tall buildings. • FENZ disagrees that the requirement of section 19 of the Act is met in full; FENZ considers that C/VM2 is subject to limitations in practice that mean it is not determinative of whether the fire design for the building will satisfy the requirements of the Building Code. • The code-compliance of fire design for tall buildings cannot be assessed against C/VM2 alone and the Verification Method was not drafted with the challenges posed by a tall building in mind. • While the scope of C/VM2 states that it can be applied to fire designs for 'all buildings', the

comment in paragraph 1.2 added in July 2014 excluded some types of buildings. The examples given for the exclusions are two types of buildings that are relatively uncommon in New Zealand and that are likely to have fire performance characteristics that differ from more common buildings.

- The examples are not an exhaustive list but mean that C/VM2 is not regarded as an appropriate compliance pathway for all types of buildings. FENZ is of the view that 'unusually tall buildings' are a class of building that should be excluded from the application of C/VM2, and that this is supported in the Practice Advisory, Amendment 5, and the list of factors set out in the first expert's report.
- PA18 can be used to help interpret the limits on application of C/VM2 and helps to demonstrate that C/VM2 does not exhaustively apply to all buildings. Buildings that have characteristics that bring them within PA18 are sufficiently different from the norm to be excluded from the scope.
- Both PA18 and the later Amendment 5 recognise the limitations of C/VM2 when applied to tall buildings. Those limitations translate into material and legitimate uncertainty as to whether compliance with C/VM2 will result in compliance with the Building Code for tall buildings.
- The building would be excluded from the scope of Amendment 5, however it does not follow that it was within the scope of C/VM2. Communication from the Ministry concerning the lack of transition period for Amendment 5 stated that 'the changes clarify [the Verification Method's] intended and appropriate use' – FENZ interprets this as an indication that Amendment 5 is intended to better articulate the existing scope and operation of C/VM2.
- FENZ does not accept the conclusion in the first draft of the determination (refer Appendix C.4) that the building is not outside the scope of C/VM2.

- Section 19(1)(ba) has exceptions and limitations. For example, it does not mean that a building consent will be issued for a design which is compliant with a Verification Method but which specifies a product that is subject to a warning or ban.
- Section 19(2)(b), under which authorities may have regard to guidance published by the Ministry under section 175, provides a similar limitation on the application of Verification Methods.

Authority

- The authority had been in discussion with the Ministry for some time regarding known concerns with the application of C/VM2 for tall buildings and the authority understood C/VM2 would not be withdrawn or limited but that this was on the grounds that specific guidance had been provided by way of the Practice Advisory.
- The comment on the scope of C/VM2 exists to provide a failsafe mechanism to allow for displacement of C/VM2, and it is reasonable to do so in this instance. This is supported by the fact C/VM2 is in the process of being replaced for tall buildings because it is unsuitable.
- If the fundamental principles of section 3(a)(i) and (iii)[27] are to be fulfilled, prior to the issue of the amended version of C/VM2 the fire design should be assessed from first principles.

Fire engineer / applicant's solicitor

- The first draft of the determination confirmed the building is within the scope of C/VM2 and that C/VM2 must be accepted as a means of establishing compliance – an independent review was unnecessary because the fire design complies with the Verification Method.
- The authority is wrong to suggest that the provisions of the Act can be displaced in favour of assessing the fire design from first principles – there are no clear or certain 'first principles' of fire design.

[27] Section 3 of the Act sets out the purposes of the Act

Table 7: Establishing compliance of the proposed building (generally)

Establishing compliance of the proposed building (generally)
Fire engineer / applicant's solicitor
• Although the building is tall it is not complex and not particularly large, and because Levels 8 to 52 are luxury apartments the building does not have a particularly high number of occupants, and the level of fire risk is greatly reduced due to the proposed installation of automatic fire sprinklers and alarm systems. • Sufficient information has been provided to demonstrate compliance by means of C/VM2. • As C/VM2 must be accepted as a means of compliance under section 22(2) of the Act, and as the FER complies with C/VM2, the design must therefore be accepted by the authority under section 19(1)(ba) as having complied with the provisions of the Building Code that relate to fire safety. • C/VM2 is an objective assessment and does not require agreement of all stakeholders in the FEB process. If one party refuses to participate in the FEB process, this should not prevent compliance being demonstrated by way of C/VM2, otherwise not acting in good faith could be adopted as a strategy to effectively hold the design to ransom. • The FEB process was comprehensive and addressed the FEB in detail. Both FENZ and the authority provided substantial comments, and the peer reviewer and FENZ continued their involvement. Areas which were unresolved involved issues that are in excess of the requirements of C/VM2. • The additional features over and above those required by C/VM2 incorporated in the design meet the intent of Practice Advisory 18. • PA18 is 'irrelevant' to the assessment of compliance with C/VM2. • It should not be inferred that the fire design is pre-emptive of Amendment 5 – consultation on the proposed amendments did not open until May 2017. • The questions raised by the authority in its letter of 21 April 2017 were answered in the fire engineer's response to the Ministry on 12 June 2017. The fire engineer later presumed the Ministry's letter of 27 June 2017 meant the response was satisfactory. • The authority's reference to an outstanding request for information (RFI) is irrelevant to the determination.
The FER revision 10 dated 14 August 2017 states: 'This report has been prepared following: - The methodology of the 'Verification Method: Framework for Fire Safety Design' or C/VM2 (MBIE, 2014), informed by 'MBIE Practice Advisory 18: Fire safety design for tall buildings' (MBIE 2016) - The process of the International Fire Engineering Guidelines or IFEG (ABCB, 2005). The FER process is the second stage of the IFEG's two-step process. - The policies of [the authority]' Regarding changes to the FER revision 10 (in summary): • Clause 3.1 of C/VM2 allows that in cases where the occupant load derived from Table 3 is clearly more than that which will occur, the basis of any proposal for a lesser occupation load must be substantiated to the authority. During the FEB stage the fire engineer proposed to use the method of CIBSE Guide D (CIBSE 2005)[28] on the basis that the apartments were 'luxury' apartments and therefore unlikely to be occupied at capacity, however this approach was rejected by the authority. • The previous versions of the FER proposed a 'defend in place' evacuation strategy, and this has

[28] Chartered Institution of Building Services Engineers Guide D: 2005 Transportation systems in buildings

been amended at the insistence of FENZ to the current 'cascading' evacuation strategy. • AS/NZS1668.1:1998 is cited in the Ministry's compliance documents; these have not been updated to AS/NZS 1668.1:2015 which was approved on 31 August 2015. There are also issues with the 2015 version in regards to referenced Standards.
Regarding FER revision 11 (provided after the second expert's report): • Additional information and a revised FER (revision 11) includes additional modelling and clarifications to establish compliance. • Issues raised by the second expert have been addressed and additional information included in the documents provided to the determination. • The additional fire safety systems and features in FER rev 11 are relatively minor. (For more detail on changes in FER rev 11, see Appendix C.6.)
Design Scenario HS has been satisfied: non-combustible materials are being used for exterior cladding and this satisfies the requirements of Clause C3.7, and the presence of a sprinkler system with dual water supply satisfies Clause C3.6 in relation to the apartments on Levels 37–40 overlooking the east shoulder garden.
FENZ
• Subject to clarification of some matters FENZ agrees that the fire design is likely to satisfy the requirements of C/VM2 considered in isolation. • FENZ agrees that the fire design incorporates elements that are beyond what would otherwise be required by C/VM2, but having regard to the considerations in Practice Advisory 18 FENZ does not consider the additional elements are sufficient to result in compliance with the Building Code. • The design is effectively a form of alternative solution that uses the C/VM2 methodology as a material part of the analysis.
Regarding the FEB process in the context of C/VM2: • the FEB process is a mandatory component of C/VM2 which manages regulatory risk, but agreement does not need to be reached on all aspects ; the level of agreement proposed in the third draft is too high and is unlikely to be practical; there needs to be scope for disagreement even on fundamental matters • there can be legitimate differences in views, and when not reconciled it is for the relevant building consent authority to consider as part of its consent processing • there is a need to identify some sort of threshold to assess whether an FEB process has been legitimately conducted, eg whether reasonable effort has been made to identify and resolve the parts of C/VM2 that hinge on professional judgement or rely on stakeholder input.
Authority
• The authority has not received a response to its RFI dated 21 April 2017 (see paragraph 3.4.5); the submitted design documents were inconsistent and the authority has not accepted the PS2. • The RFI remains outstanding and the authority is of the view that the consent application is incomplete. The authority 'had not yet been able to determine compliance with C/VM2' due to the outstanding information. • The design presents challenges with regards to: the single stair; the lift, lobby and stair configuration; and supporting specifications for services. The authority is processing and has granted building consents for a number of buildings of similar height as the subject building, but 'none of those have been undertaken in such as manner as this design'. • The authority's previous comments regarding the validity of the original peer review remain extant; a further detailed review of the design, plans, specifications and associated calculations is required. • The second expert's conclusion is the fire report does not establish compliance and this is consistent with the authority's initial concerns.

Table 8: Compliance with Clause C5.6

Compliance with Clause C5.6
FENZ
• A comparison of firefighting operations for the upper levels of this building against buildings of up to 20 levels designed in accordance with C/AS2 is not valid. There are additional time delay factors associated with stair-mounted search and rescue and fire attack operations for the upper levels, and C/AS2 designed buildings incorporate other additional fire safety features. • Standard firefighting procedures in tall buildings rely on the provision of direct access between lift and stair to ensure that firefighters can reach the floor in a timely manner, with the appropriate equipment, and without unduly exerting themselves so that they can perform any action that may be required of them. • As the topmost stair lobby is on Level 46 (stairs and lifts on floors above this level do not open into lobby areas, but rather direct into the penthouse-style apartments), this is the level from which firefighting operations will be mounted for a fire on any of the floors from Level 47 upwards. • Given the resulting vertical and horizontal travel distances from the lobby location on Level 46 to the higher floors, the length of hose carried by attack crews, the duration of standard breathing apparatus, air used while ascending and minimum air required to return to the entry control location, the air supply in standard breathing apparatus will not allow firefighters to reach the floor of origin, carry out meaningful operations on the fire floor, and retreat. • Consequently FENZ considers that the fire design does not comply with Clause C5.6 of the Building Code. The failure to provide lobbies as appropriate staging areas, or direct access between stairs and lifts, means that firefighting operations above Level 46 of this building will not be able to be safety and effectively conducted.
Fire engineer / applicant's solicitor
• The fire engineer disagrees with the statement in the first draft of the determination that the Verification Method 'does not specifically cover all FENZ operational considerations for firefighting in Design Scenario (FO)'. The Verification Method provides a means of compliance for all of the C (fire safety) Clauses, and FENZ's operational considerations are irrelevant given the only question is whether the fire design complies with C/VM2. • The lack of interconnecting lobbies above Level 47 is not relevant to compliance with Design Scenario FO; there is no requirement in C/VM2 that necessitates connecting lobbies, and to impose this would have the effect of an amendment to the Verification Method. • The requirements of C/VM2 for Design Scenario FO have been achieved and must be accepted as having complied with the provisions of Clause C5.6. The second expert confirmed compliance of the design with Design Scenario FO, and therefore with C/VM2. • The concerns raised by the second expert are based on PA18, which is irrelevant to compliance with the Building Code and imports irrelevant considerations into the assessment of compliance by means of C/VM2. The departure from the ideal anticipated by PA18 is forced by the geometry of the building and is for functional reasons. • The fire design of the upper levels complies with the requirements given 'the Acceptable Solution [C/AS2] allows for designs where firefighters ascend 20-storey buildings by stairs'. The ascent above Level 46 lobby is only 6 occupied levels + 2 plant levels for a maximum rise of 24.5m. • C/AS2 allows for a sprinkler-protected building with an escape height of 24.5m with a single stair and that stair would not need to be pressurised, and it follows that as the firefighters would not be using breathing apparatus in the lift to Level 46 in this case they can be expected to be able

to ascent up to eight floors.

- Concerns raised by FENZ of large horizontal travel distances are overstated because the floor plate is smaller as the building tapers sharply.
- FENZ Standard Operating Procedure is to ascend two levels – in this case Level 46 +2, and therefore this issue only concerns three occupied levels and two plant rooms. Fire separated lift lobbies are detailed on all floors from Levels 47-51 and firefighters can don breathing apparatus equipment at any level and traverse the 6m from lift lobby to the upper west stair through apartments above Level 46.
- Titles can be encumbered on Levels 49-51 to keep a direct passage from the lift lobby to the stair 'unaltered'.

Authority

- The upper level plant rooms on Level 53 and Level 55 appear to be largely ignored in the second draft determination for the purpose of code-compliance and firefighting operations.
- In regards to the comparison of staging firefighting operations from Level 46, and in relation to buildings up to 20 levels designed in accordance with C/AS2:
  - this highlights the inadequacy of C/AS2 in meeting firefighting needs
  - a building in excess of 10m in height is required by Clause D1 to have a lift for access, so a compliant 20-storey building would require a lift
  - C/AS2 places a requirement for Fire Service lift control on buildings with an escape height that exceeds 10m.
- Necessitating that firefighters climb this number of stairs to reach the floor of fire origin will more than likely result in firefighters being at increased risk of physiological effects and the health, safety and well-being of any responding firefighters is likely to be decreased for this building.
- The provision of features that go 'beyond' an inadequate Verification Method is meaningless if they do not also reach the standard of features recognised in tall building design guidance, and the authority accepts the first expert's conclusion that the design does not meet the performance requirements of Clause C5.6.

5. The first expert's report

5.1 As described in paragraph 1.3.5, a particular matter in dispute between the parties initially centred on whether the proposed building without connecting lobbies on Level 47 and above complies with Clause C5.6 of the Building Code.

5.2 In relation to this matter, and as noted in paragraph 1.5.1, I engaged an engineering and related consultancy company with specialist expertise in fire engineering and tall buildings to assist me. In this section I refer to the author simply as "the expert"; in all other sections of this determination I use the term "the first expert" to describe this expert.

5.3 I requested the expert review the available documentation and provide a report with respect to compliance with Clause C5.6 by means of C/VM2 and benchmarking against international best practice based on other internationally recognised codes and guidance.

5.4 The expert provided a report dated 15 December 2017, which was forwarded to the parties on 15 December 2017 along with the second draft of this determination.

5.5 C/VM2

5.5.1 For compliance with Clause C5.6 by means of the Verification Method, under the FO Design Scenario the requirements for buildings with an escape height >10m are:

- the provision of stairway(s) designed as exitways
- stairways to be fire separated from all other parts of the building; with the fire rating designed to resist fire spread until burnout.

5.5.2 The expert concluded that the design described in the FER fulfils the requirement of the Verification Method, viz. exitways are provided in the building for firefighting access. However, the expert considered that even though the proposed building complies with the Verification Method 'in isolation', it 'does not address the access challenges faced by firefighters in a tall building' and does not comply with the performance requirement Clause C5.6 of the Building Code.

5.5.3 The expert noted there were no additional requirements in the Verification Method specifically for tall buildings; for example: protection of stairways from smoke ingress, firefighting lifts, pressurisation systems, or lobbies linking the lift and stairway.

5.5.4 The expert discussed what in its opinion are the limitations with applying the Verification Method in isolation, and the features of tall buildings that affect their fire safety, noting:

- if the Verification Method is used in isolation even a 100-storey building with stairs that met the requirements in the Verification Method but without firefighting lifts would be deemed to comply, and
- tall buildings are similar to tunnels (which are excluded from the scope of the Verification Method) in that they both face challenges in the greater distances for evacuation of occupants and firefighting access.

5.5.5 The expert considered that PA18 identified the limitations of using the Verification Method in isolation, and noted Amendment 5 has limited the application of C/VM2 to buildings less than 60m or 20-storeys in height.

5.6 Firefighting in tall buildings

5.6.1 The expert referred to correspondence from FENZ[29] that described standard firefighting procedures for tall buildings. That procedure involves firefighters using the lift to access one or two floors below the fire floor, setting up a staging area in the stair/lift connecting lobby, and accessing the fire floor using the stairway. In regards to compliance with Clause C5.6, the expert considered it is reasonable to assume that the standard training received by firefighters for tall buildings is in line with the standard procedures.

5.6.2 The expert concluded that the provision of a connecting lobby between the lift and the west stairway, to serve as the staging area, supports those procedures.

5.6.3 In regards to this building, the expert noted in the event of a fire on Level 49 or above that for the firefighters using their standard procedures they would have to traverse across private apartments to access the stair from the lift. The expert commented:

[29] FENZ to the Ministry, 12 July 2017 (summarised in Table C.3)

> The availability of this route is not guaranteed because the internal layouts of the apartments may change. … Without a connecting lobby, fire fighters who are expected to set up their staging area one or two floors below the fire floor (as per their standard training for high-rise building) may have difficulties in reaching the stair from the lift lobby to continue their firefighting activities.
>
> For firefighters to attend to a fire on L49 or above in this building, the staging area would be on L46, which could be more than 2 floors below the fire floor (as many as 8 floors). This is a non-standard firefighting procedure (for high-rise building) that is not in line with the training received by firefighters and could cause delay to firefighting activities …

5.6.4 The expert considered that if firefighters were to continue to adopt their standard procedures for tall buildings in the event of a fire in the upper levels of this building, 'there are possibilities that the firefighters may be delayed or impeded from reaching the floor of fire origin and then assisting in rescue operations and performing firefighting operations.' The expert noted that even though timely arrival at the floor of fire origin is not explicitly stated in Clause C5.6, it is good practice to provide firefighting access that would not cause delay to firefighting activities. The expert concluded that 'the FER also fails to demonstrate compliance with the performance requirements of Clause C5.6 due to the lack of agreed mitigation measures (with FENZ) to address the non-standard firefighting procedures'.

5.6.5 The expert reviewed various international codes and guidance in relation to requirements for connecting lobbies between the lift/stair in tall buildings for the purpose of supporting firefighting operations. The expert observed that many of these consistently recommend the provision of connecting lobbies on all floors across the building.

6. The second expert's report

6.1 Reasons for a second expert's report

6.1.1 As noted in paragraph 1.3.6 to 1.3.9, after issuing the second draft of this determination which considered whether the proposed building was within the scope of C/VM2, and if so, whether the proposed building complied with Clause C5.6 of the Building Code, it was apparent there were other outstanding matters in dispute. At the conclusion of a meeting with the parties a process was agreed whereby the scope of the matter to be determined would be broadened (see paragraph 1.4.7) and this required me to engage a fire engineer to carry out a full scope review of the fire design.

6.1.2 The consultancy company I engaged has specialist expertise in fire engineering within tall buildings, and the author of the report is a New Zealand registered Chartered Professional Engineer with expertise in fire engineering. In this section I refer to the author simply as "the expert"; in all other sections of this determination I use the term "the second expert".

6.2 The second expert's conclusions

6.2.1 I requested the expert review the available documentation and provide to me a report with respect to compliance with Clause C1 to C6 by means of C/VM2 and comment on the considerations highlighted in PA18. The expert provided a report dated 10 August 2018, which was forwarded to the parties on 13 August 2018.

6.2.2 The report listed the documentation that the expert had reviewed and a summary of the expert's understanding of the proposed fire safety design for the building. The

expert provided details of his assessment of the compliance of the proposed design by means of C/VM2 as well his considerations in relation to PA18.

6.2.3 The expert was of the opinion that insufficient evidence had been presented to demonstrate compliance of the design by means of C/VM2, and further that the fire safety systems and features currently proposed are insufficient to enable compliance to be demonstrated. The expert summarised the main areas of concern as follows:

- The occupant load assessment is incomplete and inconsistent, which consequently impacts on the ASET and RSET modelling. The podium GL to L2 firecell could feasibly be occupied by more than 1,000 people, which substantially changes the ASET assessment criteria to the extent that the expert did not consider occupants will be able to safely evacuate before conditions are deemed untenable.
- The delay in system activation for the pressurisation of the Upper West Stair though mitigating for false activations will mean there is no system activation preventing smoke spread to the stair where apartments open directly into the stair. Based on extrapolation of the robustness checks presented in the FER, the expert did not consider the design currently complies with Design Scenario RC in relation to visibility in the Upper West Stair dropping below 5m during the period of evacuation.
- It is not clear how Design Scenario HS is satisfied for the four apartments (on Levels 37-40) overlooking and opening into the shoulder garden when notional boundaries between the apartments (sleeping occupancies) and the shoulder garden (common area) are not fire rated. It is also not clear what the proposed cladding system is or which standards it will comply with, and therefore how the overall façade system complies with the other aspects of Design Scenario HS.
- In relation to Design Scenario BE, insufficient evidence has been provided regarding the use of the podium levels to determine whether the number and location of exits is compliant.
- For the purpose of establishing compliance with Design Scenario CS, the performance statement in the FER is not considered to be sufficient information – ie the actual means of compliance needed to be demonstrated.
- In relation to Design Scenarios CF and RC, insufficient evidence has been provided to demonstrate compliance. In all Design Scenarios the occupants considered within the RSET analysis are only those included within the first stage of evacuation, but in order to demonstrate compliance with C/VM2 the RSET should be taken as the time to completely evacuate the building and the fire scenario modelling should demonstrate that escape routes are maintained tenable for this period.
- In relation to Design Scenario CF, the sprinkler activation and smoke detector times for each scenario are stated in the FER but no specific detector or sprinkler activation calculations have been provided for any scenario.
- In relation to Design Scenario RC, in the expert's opinion the Podium retail scenario (vertical escape route visibility) did not represent a credible worst case fire on Level 1 in this instance.
- Further robustness check scenarios are appropriate, primarily relating to robustness of the Upper West Stair (as noted above).

6.2.4 The expert also noted concerns regarding:

- availability of egress for occupants of the L1 balcony and L1 restaurant via the west stair where access to the stair is through management facilities or the western retail tenancy
- inputs to some of the modelling (including occupant loads as noted above, open doors, pre-travel activity time, horizontal travel speed) and the volume and occupants used in the ASET/RSET analysis
- a revised plot of the output data for the apartment level fire scenario (vertical escape route visibility) which shows visibility in both stairs drops below 5m during RSET and therefore does not demonstrate compliance.

6.2.5 The expert considered the proposed design in the context of guidance in PA18, and concluded that the design 'has taken limited cognisance of the guidance information in Practice Advisory 18' with the exception of provision of what the expert described as 'quasi-firefighting/evacuation lifts' and a fire control centre at Level B1. The expert considered the following would be appropriate for inclusion into the building design taking into account PA18:

- Increased fire resistance rating of the building structure and escape routes to incorporate a greater factor of safety in relation to the total calculated evacuation time of 57.5 min.
- Provision of at least one firefighting shaft designed fully in accordance with BS 5588-5[30] or equivalent, and incorporating firefighting lifts that: are lobby protected at all accommodation levels; are accessible directly from a safe place at fire service access level; service all levels; and with connection between the firefighting lift and fire-rated stair.
- Installation of a dual supply hydrant system to increase the resilience of the existing system, and consideration of a secondary hydrant in the upper portions of the East stair (GF and above) to provide additional coverage.
- Provision of evacuation lifts for mobility impaired people, incorporating refuge points at every level with a communication system linked to the fire control centre.

6.2.6 Although the façade cladding system was not specified, the expert also noted that it should be constructed from non-combustible materials.

7. Discussion

7.1 The legislation

7.1.1 Section 17 of the Act provides all building work must comply with the Building Code to the extent required by the Act.

7.1.2 Section 19 of the Act provides various means by which compliance with the Building Code can be established:

> (1) A building consent authority must accept any or all of the following as establishing compliance with the building code: …
>
> (ba) compliance with a verification method: …

[30] BS 5588-5:2004 Fire precautions in the design, construction and use of buildings. Access and facilities for fire-fighting

7.1.3 Section 22(2) of the Act provides:

> (2) A person who complies with an acceptable solution or a verification method must, for the purposes of this Act, be treated as having complied with the provisions of the building code to which that acceptable solution or verification method relates.

7.2 Verification Method C/VM2 and section 19 of the Act

7.2.1 The relevant Verification Method in this case is C/VM2 Framework for Fire Safety Design (Amendment 4, effective from 1 July 2014) which was current at the time the building consent was lodged. The methodology uses a set of Design Scenarios that must be considered and designed for, where appropriate, in order to demonstrate compliance with Building Code Clauses C1-C6 Protection from Fire. In applying the methodology, the concept fire design is trialled using building-specific fire design requirements that are ascertained via the FEB process.

7.2.2 I have considered first whether a design for a tall building that is compliant with the Verification Method C/VM2 is deemed to comply with Clauses C1 to C6 of the Building Code under section 19(1)(ba). I have also considered the status of the Practice Advisory PA18 in terms of section 19(2)(b).

7.2.3 Section 19(1) is unequivocal in its wording: 'A building consent authority **must** accept [(ba) compliance with a Verification Method] as establishing compliance with the building code' (my emphasis). This is further reinforced in the wording of section 22(2), that 'a person who complies with an acceptable solution or a verification method **must** … be treated as having complied with the provisions of the building code …' (my emphasis).

7.2.4 Section 19(1)(ba) has exceptions and limitations. For example, it does not mean that a building consent will be issued for a design that complies with a Verification Method if the specifications include a product that is subject to a warning or ban. Section 19(1)(ba) is subject to limitation by section 19(2)(a): a design that complies with a Verification Method cannot be accepted as complying with the Building Code if there is a warning or ban issued under section 26.

7.2.5 FENZ contends guidance issued by the Ministry under section 175 'can be used to help interpret the limits on application of Verification Methods, as part of their interpretation'.

7.2.6 Section 19(2)(b) provides:

> In considering whether something complies with the building code, a building consent authority …
>
> (b) may have regard to any guidance information published by the chief executive under section 175.

7.2.7 The effect of section 19(2)(a) is that a design that complies with a Verification Method is deemed to comply with the Building Code unless there is a warning or ban under section 26 applying to some aspect of the design. A warning or ban under section 26 involves a finding by the Chief Executive that use of a building product or method is likely to result in a failure to comply with the Building Code.

7.2.8 The language and effect of section 19(2)(b) stands in contrast with the preceding provision because it is not unequivocal: a building consent authority *may* have regard to guidance information, but is not required to. I am of the view that while guidance published under section 175 can be used to assist in determining whether something complies with a Verification Method, where there is inconsistency between the

guidance and the Verification Method, the latter takes precedence. Guidance under section 175 can expand on, clarify, or assist in interpreting the means of compliance set out in the Verification Method, but does not have the effect of an amendment to the Verification Method.

7.2.9 In reference to C/VM2, the Practice Advisory states:

> The C/VM2 framework does not explicitly highlight additional considerations for buildings taller than what has been the current norm in New Zealand. MBIE[31], in partnership with the Society of Fire Protection Engineers (SFPE) is undertaking a review of the Verification Method C/VM2 to make it clear and explicit that these issues are addressed. …
>
> In the interim, specific consideration of structural stability, fire severity for full burnout, firefighting facilities, evacuation procedures and resilience of fire systems should be included during the FEB process.

7.2.10 When it was issued the Practice Advisory notified building consent authorities and the industry generally that the Ministry was reviewing C/VM2 in respect of fire design for tall buildings. This suggests that the Ministry's view at the time was that tall buildings were not excluded from the scope of C/VM2. The result of the review could have been an amendment to the scope of C/VM2 or amendment to the content of the Verification Method to incorporate the special considerations for tall buildings. The purpose of this Practice Advisory is to highlight the specific considerations for designing tall buildings to achieve the fire safety performance requirements of the Building Code, and accordingly it should inform the FEB process for designs of tall buildings (see also paragraph 3.3.2). This is discussed further in paragraph 7.4.

7.2.11 Notice of an amendment to the Verification Method was gazetted on 17 November 2017, and the amended version (Amendment 5) came into effect on 24 November 2017. Under Amendment 5, buildings over 60m in height are outside the scope of the Verification Method and the Verification Method cannot be used as a means of establishing compliance with the Building Code. This change does not apply to building consent applications lodged prior to 24 November 2017 and accordingly it is the version of the Verification Method current at the time the building consent was lodged (Amendment 4) that must be considered for the purpose of this determination.

7.3 Scope of the Verification Method

7.3.1 FENZ submitted that the proposed design cannot be assessed using C/VM2 alone because the Verification Method was not drafted with tall buildings in mind; tall buildings were relatively uncommon in New Zealand at the time C/VM2 was drafted and have different fire performance characteristics. FENZ also noted the scope of C/VM2 provides for exclusions of some types of buildings and the examples provided in the comment to paragraph 1.2 of the Verification Method are not an exhaustive list of exclusions from C/VM2.

7.3.2 The scope of the Verification Method is set out in paragraph 1.2 of C/VM2 as follows:

> 1.2 Scope
>
> This Verification Method can be applied to *fire* designs for all *buildings*.

[31] The Ministry of Business, Innovation and Employment, referred to in this determination as "the Ministry"

> Comment
>
> … There are some minor exceptions to 'all *buildings*', for example tunnels and open air stadia. Users should refer to the Commentary to this Verification Method for further information.

7.3.3 The Commentary for Building Code Clauses C1-C6 and Verification Method C/VM2[32] (herein referred to as "the commentary document") does not provide any comment on or assistance with the interpretation of the scope of C/VM2 in regard to exceptions.

7.3.4 I accept the point made by FENZ that the examples of types of buildings excluded from the scope of C/VM2 are not an exhaustive list. I also note the first expert's opinion that tall buildings are similar to tunnels in that they both face challenges relating to greater distances for evacuation of occupants and firefighting access.

7.3.5 The issue is not a straightforward one. On one analysis while there are some similarities in regards to the greater distances and constraints on firefighting and evacuation, arguably tall buildings are not sufficiently similar to tunnels and stadia to be within the exclusions to the scope of C/VM2 on that basis. Tall buildings have a number of other features that differ from the likes of tunnels and open air stadia and are more akin to conventional multi-storey buildings. I note also that the Verification Method incorporates building height ranges in some of the parameters used in the design challenges (<7.0m, ≥ 7.0m and <25m, and ≥ 25m) but does not prescribe upper limits to its application.

7.3.6 Against that, it was clearly intended to signal that the Verification Method was not suitable for certain types of buildings without exhaustively listing them. The first expert indicated that it would be readily apparent to professional fire engineers that the Verification Method was unsuitable for very tall buildings and could not be intended to apply to them. When interpreting the commentary document there is clearly a need to interpret it conservatively where matters of life safety are at issue.

7.3.7 The Verification Method was subject to amendment (Amendment 5 effective from 24 November 2017) with the effect that a variety of buildings are now clearly excluded from its scope. The commentary to the scope now states 'Examples of buildings outside the scope include hospitals, care house, stadia, principal transport terminals, large shopping malls …., tall buildings (greater than 60 metres or 20 storeys in height) or tunnels'.

7.3.8 I note the arguments made by FENZ and the authority regarding the scope of the Verification Method, and I have a great deal of sympathy for these arguments. One could expect a conservative interpretation where matters of life safety may be at issue.

7.3.9 However, on balance and on the basis of the information before me, I conclude that the proposed building is not outside the scope of the version of C/VM2 that was current at the time the building consent was lodged. On this basis compliance with the Verification Method, if it can be demonstrated, must be accepted as a means of establishing compliance with the Building Code.

7.4 The Verification Method as a means of establishing compliance

7.4.1 In preparing the first and second drafts of this determination I considered that the matter before me turned on whether or not this particular building was within the

[32] Issued as guidance under section 175 of the Act in April 2012 and last amended in December 2013

scope of C/VM2 and whether the fire design must therefore be accepted as having met the Building Code if it satisfied the Verification Method.

7.4.2 As discussed in paragraph 1.3 (particularly 1.3.4), the matter that I must now determine is whether the fire design of the proposed building complies with the fire safety Clauses C1 to C6 of the Building Code by way of Verification Method C/VM2.

7.4.3 Verification Methods provide a means of establishing compliance with the Building Code (see discussion in paragraph 7.2). The methodology set out in C/VM2 relies heavily on professional judgement and requires engagement with stakeholders during the design process (through the FEB process) to agree variables and to establish subjective inputs and acceptance criteria. For simplicity, in this determination I refer to these judgement rich elements of the methodology as "variables".

7.4.4 The adequacy of a design using the methodology, and hence resulting compliance with the Building Code, hinges on the appropriateness of these variables. In this respect C/VM2 does not prescribe completely, in the manner that other Verification Methods or Acceptable Solutions do, how to comply with the relevant requirements of the Building Code.

7.4.5 When using C/VM2 the initial design concept is informed by the judgement of the project fire engineer. The peer review and engagement with stakeholders through the FEB process provides input to and challenges the variables used by the project fire engineer.

7.4.6 The matter of whether the FEB process is a mandatory requirement of C/VM2 was considered in Determination 2017/040[33]. That determination concerned an alternative solution that was based on the principles of C/VM2, and stated at paragraph 10.1.7:

> In my view an FEB must be carried out as part of C/VM2. However, I note that this does not necessarily mean agreement must be reached on all issues – and it may well be that some parameters need to change as the fire design is developed.

7.4.7 I agree with the view set out in that determination: that an FEB must be carried out as part of C/VM2 and agreement on all issues does not necessarily need to be reached during the FEB process in order for compliance to be achieved by way of the Verification Method. This however leaves the question of what level of agreement needs to be reached or how compliance by way of C/VM2 is established when there is disagreement during the FEB process on matters that affect the output of the methodology.

7.4.8 In the third draft of this determination I stated my opinion that satisfactory completion of the FEB process for the purpose of establishing compliance through C/VM2 is the resolution of those areas of the Verification Method that hinge on professional judgement or rely on stakeholder input, in particular where those judgements or inputs concern matters fundamental to life safety.

7.4.9 FENZ and the applicant both disagreed with this approach, on the basis that it would not be practical to achieve this level of agreement, and stakeholders could in effect set the standard for the design and increase the performance requirement by withholding agreement.

7.4.10 FENZ submitted that a more pragmatic measure to satisfy C/VM2 is 'reasonable effort' by the applicant and the other contributing parties in the FEB process 'to

[33] Determination 2017/040 Regarding the refusal to grant a building consent for proposed supermarket alterations (16 June 2017)

identify and resolve the parts of C/VM2 that hinge on professional judgement or rely on stakeholder input'. FENZ also suggested that where the professionals involved are unable to reconcile differences, the matter is then for the relevant building consent authority to consider as part of the consent processing activities.

7.4.11 As C/VM2 is a means of compliance cited in section 19(1)(ba), I consider it must first be established that the Verification Method has been satisfied before the compliance pathway under section 22(2) can be applied and the building consent authority accepts the design as compliant with the Building Code. The consenting authority's consideration of whether the Verification Method has been satisfied is distinct from its acceptance under section 22(2) of the Act. In order to establish whether the Verification Method has been satisfied, consideration must be given to whether the variables used are appropriate having regard to the intended use of the building.

7.4.12 I acknowledge the parties' views that a threshold for the level of agreement that is set too high could frustrate the use of the Verification Method as a compliance pathway. However, it is also clear to me that a lack of rigour in the FEB process or the use of variables that are not appropriate can also result in the outcome of the methodology being less robust and potentially resulting in a fire design that is not compliant with the performance requirements of the Building Code.

7.4.13 The Verification Method and associated commentary document set out a number of aspects which require agreement. The Verification Method states that approval from FENZ is required where provision of water for the purpose of compliance with Clause C5.5 is not by the means set out in the Verification Method[34]. The commentary document also sets out other instances where agreement is required, including that:

- the number and suitability of cases for ASET/RSET analysis being appropriate for the size and complexity of the building are agreed with the building consent authority during development of the FEB
- the locations where the challenging fires will be evaluated should be agreed upon by all parties during the FEB process
- in the event of unusual solutions being proposed for firefighting and rescue operations that were considered 'out of the ordinary' these are 'discussed in detail with and agreed to by FENZ in advance'.

7.4.14 Clearly then, agreement is required on these particular matters at the least. Where there is disagreement that involves matters other than those described above, the question of whether the Verification Method has been satisfied will be for the building consent authority to consider, based on the information presented to it. In this regard I agree with FENZ that reasonable effort in the FEB process to resolve matters during the FEB process will reduce the risk to the project.

7.4.15 It is the documentation of the FEB process that will bring to the building consent authority's attention any lack of resolution, through clearly identifying the unresolved matters and describing the process undertaken and the differing views of those involved. Where this circumstance arises, the relevant building consent authority will need to consider the significance of the differences in views and the potential impact on the outcome of the Verification Method.

[34] The means set out in C/VM2 are 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

7.4.16 When the FEB process has not been adequately resolved and the relevant building consent authority considers the Verification Method has not been satisfied, it does not necessarily follow that the fire design does not comply with the Building Code. The Verification Method is one means, but not the only means, of establishing compliance. An applicant may present the design as an alternative solution for the building consent authority to consider, albeit one based on the principles of the Verification Method.

7.5 Compliance of the proposed design by means of C/VM2

7.5.1 As discussed in paragraph 7.4, I must consider the unresolved issues outstanding from the FEB process in order to reach a view on whether C/VM2 has been satisfied, in particular in respect of the variables that affect the outcome of the methodology.

7.5.2 In considering this matter I have taken into account the submissions of the parties, and the technical review of the fire design undertaken by the second expert along with additional information or clarification subsequently provided by the fire engineer in support of the FER. I have not considered changes to the design after the second expert's review, including revision 11 of the FER, nor have the additional models or re-run models been reviewed (see paragraph 1.4).

7.5.3 The review by the second expert raises questions regarding the chosen scenarios and some of the variables underpinning the FER. These variables could affect the outcome of the methodology and consequently the robustness of the fire safety design of the proposed building. The expert's concerns related to: occupant numbers used in the ASET/RSET analysis for all Design Scenarios and specifically occupant numbers and firecells used in a number of challenging fire Design Scenarios; additional robustness checks relating to egress via the pressurised Upper West Stair; and Design Scenario HS (horizontal spread of fire) in relation to the east shoulder garden and the adjacent and overlooking apartments.

7.5.4 In my opinion the FER did not provide sufficient grounds to conclude that the Verification Method has been satisfied in relation to:

- the number and suitability of cases for ASET/RSET analysis, in particular in respect of:
    - occupant numbers used for ASET/RSET analysis and associated acceptance criteria
    - Design Scenario RC in relation to the single means of escape for upper levels via the pressurised West Stair
    - Design Scenario RC in relation to vertical escape route visibility
    - Design Scenario HS in relation to the apartments adjacent to and over-looking the enclosed common garden and the use of Design Scenario CF
- the solution proposed for firefighting and rescue operations for Levels 49-55 (where there are no connecting lobbies) which is not in line with FENZ standard operating procedures, because the solution has not been agreed to by FENZ.

7.5.5 I have discussed various aspects of the number and suitability of cases for ASET/RSET analysis below.

ASET/RSET analysis: whole of firecell / occupant numbers

7.5.6 The second expert noted that for all Design Scenarios the FER considered only the occupants in the first stage of the evacuation within the ASET/RSET analysis. The

expert considered the fire scenario modelling should demonstrate that escape routes remain tenable for the time taken to completely evacuate the building.

7.5.7 The fire engineer submitted that occupants not evacuated in the first stage are in a location that meets the definition of a 'place of safety'[35] (through the provision of fire and smoke rated construction) and therefore C/VM2 was satisfied.

7.5.8 The second expert subsequently clarified his views that where occupants are in different firecells from the fire origin the provision of fire and smoke rated construction is sufficient; but where occupants are in the same firecell as the fire origin, tenability should be considered throughout the entire firecell and this was not shown in the FER. I concur with the second expert in this matter.

7.5.9 I note that the fire engineer has re-run Design Scenario CF models for the Basement (B5), Ground floor podium retail and Ground floor podium lobby, and has run a new model for Level 1 podium retail. As noted earlier, these additional models have not been reviewed as part of this determination.

L1 Podium West Balcony: occupant numbers

7.5.10 The second expert considered further clarification was required in relation to the number of occupants on the L1 Podium West Balcony. The expert's concerns related to the lack of clarification of the use and occupant numbers of the balcony and the adjacent spaces (marked as 'retail' and 'management facilities' on the plans). The fire engineer subsequently clarified the approach taken in the FER was that the balconies do not contribute to the calculation of the occupant load because the occupants using the balcony have been included in the calculation of the adjacent indoor spaces in the FER.

7.5.11 I am of the view the second expert has raised a valid point regarding the uses of the balcony and adjacent spaces. Using the lesser number of occupants in this case is likely to restrict the uses the balcony and the adjacent indoor tenancy can be put to. I note also that uses included in the general description 'retail' include a wide range of occupant densities.

7.5.12 A change in occupant numbers and associated acceptance criteria would alter the outcome of the methodology. For that reason I am of the opinion that whether or not these limitations on use have been considered in the fire design, they should be specifically noted in the FER so that they are clearly stated for the purpose of subsequent building consent applications that relate to the adjacent tenancies.

RC Upper levels: Vertical escape route visibility

7.5.13 For a sprinklered building containing sleeping occupancies that are served by a single vertical escape route (which applies in relation to Levels 41 and above in this case), C/VM2 requires the Robustness Check scenario show that visibility in the vertical escape route will not be less than 5m for the period of RSET.

7.5.14 The second expert raised a concern regarding the alarm configuration in relation to the activation of the pressurisation system in the Upper West Stair. The expert was of the view that visibility in the escape route would likely drop below 5m, meaning it would not meet the acceptance criteria for this scenario.

7.5.15 I accept the second expert's opinion in this matter and conclude that the FER does not have sufficient information to establish compliance by means of the Verification Method in respect of the vertical escape route serving Levels 41 and above. I note

[35] As defined in C/VM2

the fire engineer has subsequently amended the design in regards to the alarm configuration, which he considers will be effective in addressing this concern.

7.5.16 I am of the view additional Robustness Checks are required to confirm whether the acceptance criteria would now be met for this scenario. I am also of the view that given the particular features of this building it would be prudent to fail the pressurisation system in the Upper West Stair as a Robustness Check scenario.

RC Typical apartment: Vertical escape route visibility

7.5.17 For a building where the vertical escape routes serve more than 250 people in a sleeping occupancy, C/VM2 requires the Robustness Check scenario show that visibility will not be less than 5m in more than one vertical escape route for the period of the RSET. The second expert noted the output data for one of the Robustness Check scenarios showed visibility in both stairs drops below 5m during RSET, and therefore compliance had not been demonstrated. However, the drop in visibility below 5m was not shown in the FER.

7.5.18 The fire engineer clarified that the figure in the FER was based on a five second running average of the data, and in his view this was consistent with the commentary document which allows for five second sampling. The fire engineer also noted that a conservative approach had been taken in relation to door opening times that would affect this scenario.

7.5.19 The commentary document states that for the purposes of the Verification Method C/VM2, Δt should be taken as not longer than five seconds, and Δt is defined in C/VM2 for the purpose of calculating FED(CO) as the 'time increment between successive readings of concentration in minutes'. I do not accept the fire engineer's contention that the commentary document provides for the sampling to be based on running averages; while the commentary document allows for five second sampling this is in respect of data points being recorded at intervals not exceeding five seconds.

Enclosed common garden and over-looking apartments (Clauses C3.6 and C4.2)

7.5.20 The second expert was of the opinion that insufficient evidence had been presented in the FER to demonstrate compliance of the design with Clause C3.6 by means of C/VM2. The experts concerns related to the apartments on Levels 37-40 overlooking and opening into the enclosed common garden when notional boundaries[36] between the apartments (sleeping occupancies) and the garden (common area) are not fire rated.

7.5.21 The fire engineer contends Design Scenario HS, which is the relevant Design Scenario for this clause, is satisfied through the provision of a sprinkler system with dual water supply, with one of the means of supply not dependent on town mains.

7.5.22 The description of what must be satisfied in Design Scenario HS concerns 'horizontal fire spread across a notional boundary to sleeping occupancies and exitways in buildings under the same ownership', and the required outcome requires 'calculating the radiation from unprotected areas in the external wall to the closest point on an adjacent boundary…' and 'control horizontal fire spread across a notional boundary to sleeping occupancies and exitways in buildings under the same ownership'.

[36] The term 'notional boundary' is not defined in either C/VM2 or the related commentary document; however it is a common term used throughout the Acceptable Solutions for the C (fire safety) Clauses of the Building Code

7.5.23 In this case:

- because the common area (the garden) is not open space[37], the relevant boundaries are the boundaries shown on the unit plan between the enclosed common garden and each of the apartments (sleeping occupancies) adjacent to and over-looking it, and
- the compliance issue relating to Clause C3.6 is horizontal fire spread across the boundaries to the sleeping occupancies (the apartments), and
- the compliance issue relating to Clause 4.2 is the evacuation of people in the apartments to a place of safety in the event of a fire.

7.5.24 The Design Scenario as described in C/VM2 is as follows (my emphasis in bold):

> A fully developed fire in a building exposes the external walls of a neighbouring building (other property) or firecell (sleeping occupancy, exitway or other property).
>
> This scenario addresses a *fire* in a *building* that leads to high levels of radiation heat exposure across a *relevant boundary*, potentially:
>
> 1) Igniting the *external walls* of a neighbouring building, or
>
> 2) Leading to *fire* spread to *other property*, sleeping occupancies and *exitways*.
>
> **An exception to 2)** above is if a sprinklered unit-titled *building* is subdivided, the protection between any title and areas in common need not be *fire* rated for the protection of *other property* unless required for separation of *escape routes*, to separate sleeping occupancies, or by the FO scenario.
>
> 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 supplied by two independent water supplies, one of which is not dependent on town mains, there are no restrictions on the amount of unprotected area and the fire engineer does not need to assess the external fire spread to the boundary.
>
> …

7.5.25 The comment to this Design Scenario states:

> Comment:
>
> The performances specified in NZBC C3.6 are deemed to be achieved in *buildings* with an automatic sprinkler system with two independent water supplies, one of which is not dependent on town mains and not used for storage above 3.0 m.
>
> The performance requirements of C3.6 are also to be applied to limit the radiation at the *notional boundary* to sleeping occupancies and *exitways* in *buildings* under the same *ownership*. This partially contributes to the achievement of the functional requirement C4.2.

(Clause C4.2 concerns movement to a place of safety, hence the regard for separation of escape routes as well as sleeping occupants.)

7.5.26 The building is protected with an automatic sprinkler system supplied by two independent water supplies, with one supply not dependent on town mains. Given the exception stated in C/VM2 (refer paragraph 7.5.24, exception in bold) fire-rating between the apartments and the enclosed common garden is not required for the purpose of satisfying Design Scenario HS, unless it is otherwise required for separation of the sleeping occupancies or by the FO Design Scenario.

[37] Clause A2 of the Building Code defines 'open space' as 'land on which there are, and will be, no buildings and which has no roof over any part of it other than overhanging eaves'.

7.5.27 Whether fire separation is required in relation to the sleeping occupancies adjacent to or overlooking the enclosed garden, is established through Design Scenario CF, which concerns evacuation time for occupants to move to a place of safety in the event of a fire. I have therefore considered the relevant Design Scenario CF in regards to separation of sleeping occupancies.

7.5.28 The second expert observed that there were inconsistencies in the FER regarding provision of smoke detectors to the underside of the balconies in this area. As an aside I note FER revision 11 now includes smoke detectors to the underside of balconies on all levels overlooking the enclosed garden.

7.5.29 The second expert also noted that the FER did not consider smoke spread to Level 40 or evacuation of Level 40 occupants. The fire engineer has clarified that Level 40 is smoke separated from the enclosed garden area and revised the smoke detection activation for the purpose of evacuating occupants of the Level 40 apartment.

7.5.30 I am of the view that the smoke separation detail should be included in the building consent documents, which in conjunction with the revision of smoke detection activation is likely to satisfy this concern. I am of the view that confirmation in regards to evacuation of occupants for all apartments adjacent and overlooking the enclosed garden should be confirmed through a Challenging Fire scenario.

Other

7.5.31 The second expert raised concerns regarding Podium L1, in relation to the Western retail tenancy and the egress route for East retail and restaurant tenancies. The fire engineer has amended the FER and included a performance statement that tenancy doors on escape routes must unlock under general fire alarm mode. The second expert considered this 'unlikely to be practical as it represents a security risk to the tenancy'.

7.5.32 The second expert also noted that no specific detector or sprinkler activation calculations had been provided for any Design Scenario. The fire engineer subsequently advised that the information was contained in superseded files and provided a description of the properties used. Given my conclusions, and because the fire engineer has also re-run some Design Scenario CF models and has modelled an additional challenging fire (refer paragraph 7.5.9) which are not reviewed in this determination, I consider this matter can be addressed alongside the review of the re-run and additional models.

7.5.33 I note also the FER defers to a number of other documents to be provided in support of the building consent application, includes a number of performance specifications, and relies on 'contract instructions' and coordination statements from others. I note for completeness that the authority would require adequate and consolidated documentation to support these aspects of the FER in order to satisfy section 49(1) of the Act and grant the building consent.

7.6 Compliance with performance requirement Clause C5.6

7.6.1 The parties identified a particular matter concerning compliance of the proposed building without connecting lobbies on Level 47 and above with Clause C5.6 of the Building Code.

7.6.2 Clause C5.6 of the Building Code provides:

> C5.6 *Buildings* must be designed and constructed in a manner that will allow firefighters, taking into account the firefighters' personal protective equipment and standard training, to:

(a) reach the floor of fire origin,

(b) search the general area of fire origin, and

(c) protect their means of egress.

7.6.3 The lack of connecting lobbies on the upper levels is a matter that requires consultation as part of the FEB process as it concerns firefighters' ability to reach the floor of fire origin and carry out a search of the general area of fire origin. Consultation through the FEB process with FENZ, as the organisation responsible for firefighting operations, is necessary as part of the methodology in relation to firefighters' personal protective equipment and standard training.

7.6.4 I note also the commentary document for Building Code Clauses C1-C6 and Verification Method C/VM2, under the heading "Commentary to Code Clauses C1 to C6 Protection from Fire", states:

> Clauses C5.3, C5.4, C5.5, C5.6 and C5.7 facilitate firefighter and rescue operations using methods that are conventional and easily anticipated by the Fire Service. It is not expected that performance-based design would be carried out in relation to the systems provided here. It would be expected that, in the unusual event of any solutions being proposed for firefighting and rescue operations that were considered 'out of the ordinary', these would be discussed in detail with and agreed to by the Fire Service in advance.

7.6.5 As the issue of the lack of connecting lobbies on upper levels of the building was not resolved during the FEB process I have considered it as a particular matter of compliance in this determination separate from the more general issue of compliance of the overall design by means of C/VM2 discussed in paragraph 7.5 above.

7.6.6 FENZ has advised the standard procedure for firefighting operations is for a staging area to be located one or two floors below the floor of fire origin in clean air either in a lobby or on the floor plate directly outside the stair, and hydrant connections are usually made on the floor below the fire floor. Standard training dictates that firefighters forward of the staging area must use their breathing apparatus. The predicted duration of each air cylinder is typically 20-25 minutes, though this time can be significantly reduced if the wearer is carrying out physically demanding activities.

7.6.7 Due to the lack of connecting lobbies on Level 47 and above, in the event of a fire above Level 47 in this building FENZ has advised the staging area would be established in the connecting lobby on Level 46. Firefighters would then ascend via the Upper West Stair and would be required to use their breathing apparatus as they do so. Depending on which is the floor of fire origin, firefighters may also have to carry hose and other equipment up the stairs to a forward operating point (the hydrant connection on the floor below the fire floor) before commencing firefighting operations.

7.6.8 FENZ contends that with the resulting possible vertical and horizontal travel distances from the lobby on Level 46 and the length of hose carried by attack crews and the duration of standard breathing apparatus, air supply will not allow the firefighters to reach the floor of origin and carry out meaningful operations on the fire floor and return.

7.6.9 The duration of firefighters' standard breathing apparatus and the fact that their standard training requires them to be using that breathing apparatus once they enter the west stairs from Level 46 must be taken into account when considering whether the design has met the performance requirements of Clause C5.6. In this I am guided by the submission by FENZ, in summary:

- in the event of a fire above Level 47 the staging area would be in the connecting lobby on Level 46, and
- standard training dictates that firefighters entering the stair from this point must use their breathing apparatus, and
- given resulting possible vertical and horizontal travel distances from the lobby on Level 46 in this building and the length of hose carried by attack crews and the duration of standard breathing apparatus, air supply will not allow the firefighters to reach the floor of origin and carry out meaningful operations on the fire floor and return.

7.6.10 I conclude that the fire design for the proposed building does not comply with performance requirement C5.6 of the Building Code.

7.6.11 I note that in a submission received in response to the second expert's report, the fire engineer proposed firefighters use the lifts from the staging area to one or two floors below the floor of origin, and that titles for apartments on Levels 49 to 51 can be encumbered to keep a direct passage from the lift lobby to the stair 'unaltered'. This is an unusual solution for firefighting and rescue operations that is out of the ordinary and would require discussion and agreement with FENZ.

7.7 Conclusion

7.7.1 In summary:

- the FEB process was unresolved in relation to matters that affect the outcome of the methodology and in relation to firefighting operations
- I conclude that Verification Method C/VM2 has not been satisfied (refer paragraph 7.5.4) and the fire safety design cannot therefore be accepted as a compliant solution
- the fire safety design of the proposed building does not achieve compliance with Clause C5.6 of the Building Code in relation to the lack of connecting lobbies between the lobby containing the designated fire fighters lift and the stairway on Levels 49 and above.

8. Decision

8.1 In accordance with section 188 of the Building Act 2004, I hereby determine that, the proposed building, based on the fire design as described in the FER, does not comply with Clauses C1 to C6 of the Building Code by means of Verification Method C/VM2.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 18 December 2018.

Katie Gordon
Manager Determinations

Appendix A: The legislation

A.1 The relevant sections of the Act discussed in this determination:

17 All building work must comply with building code

All building work must comply with the building code to the extent required by this Act, whether or not a building consent is required in respect of that building work.

19 How compliance with building code is established

(1) A building consent authority must accept any or all of the following as establishing compliance with the building code: …

(ba) compliance with a verification method: …

(2) In considering whether something complies with the building code, a building consent authority or, as the case may be, a regional authority—

(a) must have regard to any relevant warning issued, and ban declared, under section 26(2); and

(b) may have regard to any guidance information published by the chief executive under section 175.

22 Acceptable solution or verification method for use in establishing compliance with building code

(1) The chief executive may, by notice in the Gazette, issue an acceptable solution or a verification method for use in establishing compliance with the building code.

(2) A person who complies with an acceptable solution or a verification method must, for the purposes of this Act, be treated as having complied with the provisions of the building code to which that acceptable solution or verification method relates.

(3) Subsection (2) is subject to any regulations referred to in section 20.

26 Chief executive may issue warning about, or ban use of, building methods or products

(1) This section applies if the chief executive considers on reasonable grounds that the use of a building method or product has resulted, or is likely to result, in a building or building work failing to comply with the building code.

(2) The chief executive may—

(a) issue a warning about the building method or product; or

(b) declare a ban on the building method or product.

(3) The chief executive must publicly notify—

(a) the warning or ban; and

(b) the date on which the warning or ban comes into force; and

(c) in the case of a ban, whether the ban applies to building work for which a building consent has been issued before the date on which the ban comes into force; and

(d) whether the procedure in section 29 has been followed in relation to the warning or ban.

…

27 Offence to use building method or product in breach of ban under section 26

(1) A person must not use a building method or product if doing so breaches a ban under section 26.

(2) A person commits an offence if the person fails to comply with subsection (1).

(3) A person who commits an offence under this section is liable on conviction to a fine not exceeding $200,000.

28 Limits on certain powers of building consent authority in cases involving bans under section 26

(1) A building consent authority must not exercise any of the powers specified in subsection (2) if doing so results, or could result, in a person breaching a ban under section 26.

(2) The powers are—

(a) to grant a building consent for building work; …

29 Procedural requirements for acceptable solutions, verification methods, warnings, and bans

(1) This section applies if the chief executive proposes to— …

(b) amend or revoke an acceptable solution or a verification method; …

(2) Before doing any of the things referred to in subsection (1), the chief executive must— …

(c) publicly notify a statement of proposal; and

(d) give persons an opportunity to make submissions on the statement of proposal; and

(e) consider those submissions.

(3) For the purposes of subsection (2)(c), the chief executive must notify—

(a) where copies of the statement of proposal may be obtained; and

(b) that submissions on the statement of proposal may be made to the chief executive by a specified date (which date must not be less than 10 working days after the date of the public notification).

…

(5) The chief executive is not required to comply with subsection (2) if the chief executive is satisfied that— …

(b) the acceptable solution, verification method, warning, or ban needs to be amended urgently; …

175 Chief executive may publish guidance information

(1) The chief executive may publish information for the guidance of—

(a) any of the following persons to assist them in complying with this Act:

(i) territorial authorities:

(ii) building consent authorities:

(iii) owners:

(iv) persons who carry out building work; …

(2) Any information published by the chief executive under this section—

(a) is only a guide; and

(b) 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.

A.2 The particular clauses of the Building Code discussed in this determination:

C5.6 *Buildings* must be designed and constructed in a manner that will allow firefighters, taking into account the firefighters' personal protective equipment and standard training, to:

(a) reach the floor of fire origin,

(b) search the general area of fire origin, and

(c) protect their means of egress.

Appendix B: C/VM2 fire Design Scenarios

B1. The following provides a brief description of the particular fire Design Scenarios in C/VM2 that are discussed in this determination. The remaining Design Scenarios are as listed in Table 5 of this determination.

(BE): Fire blocks exit

This Design Scenario addresses the situation where an escape route may be blocked due to proximity of the fire source. In that event, sufficient exits must still be available. The Verification Method states this scenario does not apply in sprinkler protected buildings to vertical stair enclosures servicing not more than 250 people fire separated from all other parts of the building. The building in this case has an automatic Type 7 fire sprinkler system with smoke detectors.

(CF) Challenging fire

The challenging fires are intended to represent credible worst case scenarios in normally occupied spaces that will challenge the fire protection features of the building. The designer must demonstrate that the occupants have sufficient time to evacuate the building before being overcome by the effects of fire.

This scenario requires the use of design fires in various locations within the building and uses an ASET/RSET analysis of the impact on all building occupants of the design fires.

The fire engineer is expected to calculate the fire environment in the escape routes over the period of time the occupants require to escape and assess the fire environment based on the fractional effective dose and visibility at the location of the occupants.

(RC) Robustness check

This scenario applies where failure of a key fire safety system could potentially expose a certain number of people to untenable conditions.

This particular scenario focuses on the ASET/RSET life safety calculations performed as part of the Design Scenario: CF Challenging fire. The robustness of the design is tested by considering the design fire with each key fire safety system rendered ineffective in turn.

If ASET cannot be shown to be greater than RSET when each key system fails, then the design must be altered until the requirements of this scenario can be satisfied.

(FO): Fire-fighting operations

This scenario tests the safe operation of firefighters in a building. In simple terms, for buildings that have an escape height >10m C/VM2 (FO) requires the following to establish compliance with Clause C5.6:

- provision of access for firefighters to all floors by way of stairways designed as exitways, and that these be separated from all other parts of the building and design to resist fire spread until burnout
- design structure and floor systems to resist collapse and prevent fire spread between floor levels until burnout
- design intermediate floors and supporting structure to resist collapse until burnout (dependent on occupant load, escape height and there being an open firecell below).

Appendix C: The submissions received

C.1 The initial application and correspondence regarding the application

30 April 2017 Ministry	Application for a determination received from the fire engineer[38].
25 May 2017 Fire engineer	Payment of fee completed.
8 June 2017 Ministry	Further information sought regarding the review process, coordination process, C/VM2 assessment, reliability of fire and life safety systems, and evacuation procedures.
12 June 2017 Fire engineer	Responded to Ministry's request for information.
27 June 2017 Ministry	Setting out the Ministry's view of the framework for the determination and confirming the Ministry's understanding of the facts, and requesting confirmation from the authority and FENZ regarding their views on the compliance of the proposed building.
20 July 2017 Fire engineer	Provided clarification and proposed design changes to reduce the number of matters in disagreement.
28 July 2017 Ministry	Requesting confirmation of parties current views in regards to unresolved issues, noting that the fire engineer had identified the outstanding issue as 'the absence of a direct or fire isolated interconnection, between the lobby containing the firefighters lift and the stair above level 46'.
3 August 2017 FENZ	It considered the Ministry accurately captured FENZ views at that stage, and noting that FENZ had not evaluated the adjustments proposed to the fire design.
4 August 2017 Authority	Confirmed that the absence of a direct or fire isolated interconnection between the lobby containing the fire fighters lift and the stair above Level 46 remains a matter of disagreement. The authority noted however that the RFI remains outstanding and a thorough review of the design was still required.
9 August 2017 Fire engineer	Advised that amendments had been made to the fire design to reduce the matters of disagreement raised by FENZ, and confirmed that the one outstanding matter of disagreement is "…the absence of a direct or fire-isolated interconnection, between the lobby containing the firefighters' lift and the stair above Level 46.
9 August 2017 Applicant (owner)	The applicant, who is the building owner and was identified by MBIE as a party under s176 who could apply for the determination, confirmed that they were the applicant and the fire engineer would act on their behalf for the purpose of the determination.

[38] The fire engineer made the initial application as a party under section 176(d) as the licensed building practitioner concerned with the relevant building work (being a Chartered Professional Engineer), and on 9 May that application was accepted. On 20 June 2017 the parties were notified by the Ministry that the fire engineer did not meet the definition of a party under section 176(d) of the Act and therefore was not able to apply for the determination. The application was revised and resubmitted, with the building owner (who is a party under section 176(c)) named as the applicant.

C.2 Documentation provided to the determination

30 April 2017 Fire engineer	The building consent application dated 20 December 2016. Producer Statement Design (PS1) dated 1 December 2016, and Producer Statement Design Review (PS2) dated 13 December 2016. FER revision 8, dated 1 December 2016 and fire engineering drawings (rev 4 & 4A) Architectural drawings (rev 1). Peer review report dated 13 December 2016, and statement of relevant experience from the peer reviewer. A table setting out the peer review comments and fire engineers response, dated 19 October 2015. Various correspondence between the parties, including RFIs.
14 June 2017 Authority	A copy of an RFI which noted that the authority was not satisfied that the design complies with C/VM2 and the authority expected Practice Advisory 18 would be followed. The RFI listed items to be addressed, including: • car-park ventilation, continuous power supply, occupant numbers/occupant density • specification of firefighting lifts • amendment to the fire alarm and evacuation strategy, and consideration of merging flows within egress stairs • obtaining agreement from FENZ in regards to facilities and features supporting firefighting • clarification with regard to features in compliance with AS/NZS 1668.1:5015 • compliance with Clause C5.6 in regards to upper floors lacking 'protected access from the lift'.
14 August 2017 Fire engineer	Fire engineer provided an updated FER (revision 10, dated 14 August 2017) for the purpose of the determination.

C.3 Initial submissions

The applicant (including the fire engineer as agent for the applicant)	
30 April 2017	Covering letter to the determination application setting out the background events and the fire engineer's views.
12 June 2017	Fire engineer's comment on the legal test/use of C/VM2 for establishing compliance.
	The additional features over and above those required by C/VM2 incorporated in the design meet the intent of Practice Advisory 18.
14 August 2017	FER dated 14 August 2017 provided, including comment regarding the changes to the FER.
FENZ	
9 May 2017	FENZ advised it would make a submission in response to the application for determination.
12 July 2017	In response to the letter of 27 June 2017 (see Table B.1 Initial applications and submissions) including a schedule recording various views expressed by the parties and comments from FENZ.
	FENZ view on the scope of C/VM2 and section 19.

	The submission also set out the views of FENZ in respect of the following issues in regard to the additional design features (with associated clauses in brackets): communications (C5.1), evacuation strategy and in particular of the upper levels served by the single stair (C4.3 and C4.5), and lift specifications (C4.3 and C5.6) – these issues appear to have been resolved in the FER revision 10 dated 14 August 2017.
The authority	
14 June 2017	Responding to the application for determination. The authority had not received a response to its request for information (RFI) dated 21 April 2017; the submitted design documents were inconsistent; and the authority had not accepted the PS2.
11 July 2017	The authority 'had not yet been able to determine compliance with C/VM2', and also has concerns with the application of C/VM2 for tall buildings. The design presents challenges with regards to: the single stair; the lift, lobby and stair configuration; and supporting specifications for services.

C.4 Submissions received in response to the first draft determination

6 October 2017	First draft of this determination issued to parties. The draft concluded the proposed building is not outside the scope of C/VM2 and the Verification Method must be accepted as a means of establishing compliance with the Building Code; however confirmation by independent technical review required to establish compliance with C/VM2 in relation to Clause C5.6.
The applicant (including the applicant's solicitor and the fire engineer as agent for the applicant)	
12 October 2017 (solicitor)	The determination confirms the fire design is not outside the scope of C/VM2, and C/VM2 must be accepted as a means of establishing compliance.
12 October 2017 (fire engineer)	Based on the correspondence in relation to the initial application, the fire engineer has been working on the assumption that the only outstanding issue is compliance of the design with Clause C5.6.
19 October 2017 (solicitor)	The scope being limited to compliance with Clause C5.6. was not accepted and the applicant sought a statement in the determination that the fire design [in its entirety] complies with C/VM2. An independent technical review is unnecessary given the fire design 'had been reviewed by six fire engineers, including an independent peer reviewer'. C/VM2 does not require connecting lobbies.
19 October 2017 (fire engineer)	The first draft confirmed the design is within the scope of C/VM2; references to Amendment 5 should not imply that the fire-design is pre-emptive of that amendment. PA18 is 'irrelevant' to the assessment of compliance with C/VM2. The building is ~185m in height, and consistency with PA18 and ICC/SFPE the building should be described in the determination as either "tall" or "very tall". The Verification Method provides a means of compliance for all of the C Clauses, and FENZ's operational considerations are irrelevant given the only question is whether the fire design complies with C/VM2. There is no requirement in C/VM2 for connecting lobbies, and to impose this would have the effect of amendment the Verification Method. The departure from the ideal anticipated by PA18 is forced by the geometry of the building and is for functional reasons. The technical review is unnecessary given earlier statements on compliance. It is incorrect to say that smoke from a fire originating on a lower level will

	migrate up the shaft and directly into the occupied floors above as the lifts are contained in fire / smoke lobbies.
27 October 2017 (solicitor)	The first draft confirmed that the building can be designed in accordance with C/VM2, and there is clearly no requirement in C/VM2 that necessitates connecting lobbies.
31 October 2017 (solicitor)	The authority is wrong to suggest that the provisions of the Act can be displaced in favour of assessing the fire design from first principles – there are no clear or certain "first principles" of fire design. The authority's reference to outstanding RFIs is irrelevant to the determination.
9 November 2017 (solicitor)	The independent review is unnecessary on the basis that the draft confirmed C/VM2 applies, the building is within the scope of C/VM2, and the fire design complies with the Verification Method.
27 November 2017	The RFI of 21 April 2017 was answered in the fire engineer's response to the Ministry on 12 June 2017.
FENZ	
18 October 2017	Reserving comment until the expert's report and 2nd draft are available.
25 October 2017	Guidance material can be used to help interpret the limits on application of Verification Methods, as part of their interpretation. FENZ does not accept the conclusion that the building is not outside the scope of C/VM2.
The authority	
30 October 2017	The comment to the scope of C/VM2 allows for displacement, and it is reasonable to do so in this instance. This is supported by Amendment 5 which confirms it was unsuitable for tall buildings. To uphold the principles in section 3, prior to the issue of the Amendment 5 the fire design should be assessed from first principles.
14 November 2017	The authority does not consider C/VM2 to be satisfied on the information supplied by the applicant.
24 November 2017	The matters in the RFI of 21 April 2017 remain outstanding, meaning the application for building consent is incomplete. The authority does not agree that the only matter to be resolved is compliance with Clause C5.6 with regard to the lack of smoke lobbies on Level 47 and above.

C.5 Submissions received subsequent to the second draft determination

15 December 2017	Second draft of this determination issued to parties. The draft took account of the first expert's report, and concluded: • the proposed building is not outside the scope of C/VM2 and the Verification Method must be accepted as a means of establishing compliance with the Building Code; • the proposed design without connecting lobbies in Levels 47 and above complies with C/VM2 Design scenario FO and is therefore deemed to comply with Clause C5.6 of the Building Code.

FENZ	
22 December 2017	Does not accept that the building is not outside the scope of C/VM2 and does not accept the conclusion. This building would be excluded from the scope of Amendment 5, but it does not follow that the design is within scope of Amendment 4, noting communication from the Ministry regarding a transition period for Amendment 5 not being necessary stated 'the changes clarify its intended and appropriate use' and FENZ interprets this as Amendment 5 is intended to better articulate the existing scope and operation of C/VM2, without substantive change to the status quo. Comparison with open air stadia and tunnels is the wrong approach in considering the limits on application of C/VM2, rather the determination should consider whether there is something about a particular category or class of buildings that means the application of C/VM2 is inappropriate on building performance grounds. 'There is very clear evidence that the application of C/VM2 is inappropriate. That is reflected in the existence of PA18 [which FENZ submits can be used to interpret the scope of C/VM2], Amendment 5 to C/VM2, and the extensive list of factors discussed in the [expert's] report and set out at paragraph [3.3.2 to 3.3.5] of the second draft determination.'
	FENZ does not consider that the comparison of the upper levels with buildings up to 20 levels designed in accordance with C/AS2 is a valid comparison: - There are additional time delay factors associated with stair-mounted search and rescue and fire attach operations from the 46th storey of a building, compared to similar operations mounted from ground level. - A C/AS2 design incorporates a number of additional fire safety features that are not an essential part of a C/VM2 compliant design; eg A minimum of two escape paths.
	FENZ remains of the view that it will be prevented from reaching some of the floors above Level 46 and carrying out its operations and does not accept the conclusion reached in the second draft determination.
28 February 2018	Clarification regarding the use of lifts in buildings designed in accordance with C/AS2: FENZ would consider using lifts to access upper floors though it would depend on the available information on the location and spread of fire and a risk assessment involving evidence of smoke or water in the lift shaft and whether the lift has a firefighter recall function.
	The primary additional time delays for a scenario in this building where staging occurs on Level 46 relate to the transfer of equipment and personnel from GL to Level 46, from Level 46 to a remote separate stair and then up to a forward operating point. The delays would not be limited to initial set-up but would affect all arriving crews and equipment.
	C/VM2 Design Scenario FO only gives a very brief overview of the intended performance outcomes, and detail is expected to be covered during the design development including through engagement with FENZ as part of the FEB process.
	In regards to standard breathing apparatus: the predicted duration of each air cylinder is typically 20-25 minutes, but this can be significantly reduced when the wearer is carrying out physically demanding activities.

	Standard procedure dictates that firefighters forward of entry control must be under air. Entry control must be set up in a suitable staging area and this is typically one or two floors below the floor of fire origin – meaning firefighters have to progress up a maximum of two floors by stair before they begin search and rescue or firefighting. In this building, there may not be a suitable staging area for entry control to be set up above Level 46. A worst case scenario would be firefighters carrying equipment having to ascend seven floors by stair and under air before beginning search and rescue or firefighting. Taking into account air used while ascending and the minimum air required to return to the entry control location, firefighters will not have sufficient air to carry out meaningful operations on the fire floor.
	If conditions allow, it would be possible for firefighters to use the stairs to establish a forward operation location 1-2 floors below the fire floor. This would still require equipment to be carried up the stairs from Level 46 to the forward operating location, which would typically be done in relays of 3-4 floors. Firefighters would likely be diverted from other tasks to assist with this process and it may also impede people descending the stair.
The applicant (including the applicant's solicitor and the fire engineer as agent for the applicant)	
19 January 2018 (solicitor)	Requests the determination be that the design complies with C/VM2 and therefore complies with Clauses C1 to C6 of the Building Code (not just C5.6).
	In regards to the expert's report, the applicant requests that the determination: record that the applicant objected to the appointment of the expert on the basis of apprehension of bias; record that the Chief Executive is not bound by the expert's report; and remove criticisms that are based on counterfactuals with reference to international codes and standards.
	In response to FENZ submission on the scope of C/VM2: Amendment 5 cannot be used as evidence to support excluding tall buildings from C/VM2 as Amendment 5 was not in existence at the time the building consent was lodged. Requests that references to Amendment 5 (paragraph 7.3.6) be deleted as it is unnecessary and confuses the matter.
16 January 2018 (fire engineer)	The rejection of the expert's conclusion by the determination was correct, and the fire engineer requests the determination clarify this within the paragraphs containing the summary of the expert's report. Some comments made by the expert appear outside the scope of the Ministry's brief and should be deleted. Given the expert reached an erroneous conclusion about the Building Code the fire engineer questions how the Ministry can have confidence in the conclusions regarding international comparisons.
	Regarding the expert's conclusion that international guidelines "consistently recommend" interconnecting lobbies: Australia, USA and UK are comparable jurisdictions for NZ. Australia – there is no requirement for interconnecting lobbies USA – under ICC/SFPE there is no requirement for interconnecting lobbies UK – BS999:2017 there is a requirement for interconnecting lobbies, but fire sprinkler systems are uncommon and therefore firefighters are afforded additional protections.
	The focus of the determination is on a single minor departure from C/VM2

	supplemented by PA18, and has resulted in a disproportionate emphasis on its relevance. (Note also that firefighter's lifts are non-standard.) The lack of interconnecting lobbies on Levels 47-51 has no impact on the means of escape and will necessitate a minor departure from FENZ standard operating procedures for a fire on Levels 49-55.
	The building has the following features in addition to those required by C/M2: a generator, firefighter's lifts, fire control room, independent water supply, increased fire resistance ratings, enhanced intercommunication, and pressurisation of the upper West Stair. The design vastly exceeds Building Code requirements.
30 June 2018 (fire engineer)	Information provided in response to questions raised by second expert.
The authority	
19 January 2018	Disagrees about the scope of the matter to be determined. Considers fire compliance issues to be broader.
	Notes the technical report is limited in scope and does not include review of all relevant documents such as plans and specifications related to the proposed fire safety systems. Technical report assumes design and associated calculations have been verified by peer review. The authority has previously commented on the validity of the original peer review, and is of the view that a further detailed review of the design, plans, specifications and associated calculations is required.
	Upper level plant rooms on Levels 53 and 55 appear to be largely ignored for the purpose of code-compliance and firefighting operations.
	In regards to the comparison of staging firefighting operations from Level 46 and buildings up to 20 levels designed in accordance with C/AS2: - This highlights the inadequacy of C/AS2 in meeting firefighting needs - A building in excess of 10m in height is required by Clause D1 to have a lift for access, so a compliant 20-storey building would require a lift - C/AS2 places a requirement for Fire Service lift control on buildings with an escape height that exceeds 10m.
	It is unclear how the Ministry has reached the view that the building is not unsafe or dangerous. Necessitating firefighters climb this number of stairs to reach the floor of fire origin will more than likely result in firefighters being at increased risk of physiological effects and the health, safety and wellbeing of any responding firefighters is likely to be decreased for this building.
	The provision of features that go "beyond" an inadequate Verification Method is meaningless if they do not also reach the standard of features recognised in tall building design guidance.
	The authority notes the lack of connecting lobbies is a concern of FENZ as well as Council and the expert.
1 June 2018	The RFI of 21 April 2017 remains outstanding. It is unclear how the second expert's review and the determination can conclude compliance where the Verification Method requires FENZ approvals as no approvals have been received. It is unclear in the report how compliance of the following is to be achieved: - Fire hydrant standard and proposed system to NZS 4501

	- Fire alarm standard and the proposed system to NZS 4512 - Fire sprinkler standard and the proposed system to NZS 4541. Coordination of the fire control room has not yet occurred. Confirmation is required for the following: - location of and air velocity leaving fans within the basement and coordination with sprinkler design - that air velocity at any sprinkler head is not greater than 1.8m/s when the fans are operating - location and appropriate approvals for the fire fan control panel and its design basis - that jet fans will shut down on detection of a fire in the car park, and how - that the compliance schedule is final and complete. Specification allows for no smoke rated dampers within ventilation ductwork through fire walls – confirmation required of acceptability of smoke leakage through the dampers/ductwork. Travel distances do not appear to be measured correctly and do not reflect travel down stairs and vertical components of the escape routes. Means of egress from Levels 53 and 55 not addressed in report. The authority does not accept design of the mechanical systems to 1998 version of the standard. There are inconsistencies in labelling throughout the documents in relation to the evacuation strategy, and it is unclear how the stair pressurisation system has accounted for revised evacuation configuration, and the release of four floors in sub-stages for Tower Levels 8-40 appears contradictory to the strategy discussed as being only four zones. Fire safety sketches finish at Level 52. The FER lacks information on the 'general requirements that apply to escape routes'. The FER does not justify how the design has met Clauses C6 and B1 and it is unclear at what stage this assessment is to be undertaken.

C.6 Submissions received subsequent to the second expert's report and the third draft determination

13 August 2018	Second expert's report sent to parties. See paragraph 6.2 for a summary of the report.
4 September 2018	Third draft of this determination, taking into account the second expert's report, issued to the parties. The draft concluded: • the proposed building is not outside the scope of C/VM2 and the Verification Method must be accepted as a means of establishing compliance with the Building Code; • as the FEB process was unresolved in relation to matters concerning life safety, the Verification Method C/VM2 has not been satisfied; • there is insufficient information in the FER to demonstrate compliance by means of C/VM2; • the design of the proposed building does not achieve compliance with

	Design Scenario HS of C/VM2; • the proposed design without connecting lobbies in Levels 47 and above does not comply with Clause C5.6 of the Building Code.
The authority	
11 September 2018	Advised it had no submission to make.
FENZ	
19 September 2018	Accepted the overall conclusion. Remains of the view expressed in earlier submissions regarding the scope of C/VM2 and its application (or otherwise) to tall buildings.
	Regarding the FEB process in the context of C/VM2, FENZ: - agrees with the approach set out in Determination 2017/040 that the FEB process is a mandatory component of C/VM2, and recognises that agreement does not need to be reached on all aspects considered by the designer and stakeholders during the FEB process - regards the FEB as a regulatory risk management document; the greater extent of agreement reached the greater the extent of risk managed - the third draft determination set the bar too high in regards to level of agreement necessary to satisfactorily 'complete' the FEB process; it is unlikely to be practical, and could force an applicant to accept the position of other stakeholders or to redesign or select a different compliance pathway - there needs to be scope for disagreement even on fundamental matters; views of reasonable design and engineering professionals can legitimately differ and when not reconciled they should be able to advance to the BCA for consideration as part of its consent processing activities – this is the regulatory risk to an applicant as the BCA may form a view that compliance has not been demonstrated - recognises there is a need to identify some sort of threshold to assess whether an FEB process has been legitimately conducted, and suggests the key question is "whether the applicant and the other contributing parties have made (objectively) reasonable efforts to identify and resolve the parts of C/VM2 that hinge on professional judgement or rely on stakeholder input".
The applicant's solicitor	
19 September 2018	Disputes the conclusions in the third draft, and contends: - sufficient information has been provided to demonstrate compliance - C/VM2 is an objective assessment and does not require agreement of all stakeholders - the FEB process does not need to be resolved - Design Scenario HS has been satisfied.
	FEB: The FEB process was comprehensive and addressed the FEB in detail. Both FENZ and the authority provided substantial comments, after which the FEB

	was revised and reissued. The issues that were not resolved are in excess of the requirements of C/VM2. The third draft in effect says that all issues must be resolved; however Determination 2017/040 says that all issues do not need to be resolved.
	Additional information and a revised FER (revision 11) has been provided which includes additional modelling and clarifications.
	In relation to Design Scenario HS and the apartments on Levels 37-40 overlooking the east shoulder garden: non-combustible materials are being used and this satisfies the requirements of Clause C3.7, and the presence of a sprinkler system with dual water supply satisfies Clause C3.6.
	The lack of interconnecting lobbies above Level 47 is not relevant to compliance with Design Scenario FO. The second expert confirmed compliance of the design with Design Scenario FO and therefore with C/VM2. The concerns raised by the second expert are based on PA18, which is irrelevant to compliance with the Building Code and imports irrelevant considerations into the assessment of compliance by means of C/VM2.
The fire engineer (agent for the applicant)	
19 September 2018	Copies of the following provided: - L1 Podium retail set out plan, showing: additional smoke control doorsets and revised escape path for east balcony - Interior finishes schedules (Podium, Basement, Tower) - FER revision 11 - Updated Q&A workbook (10) - Submission in response to the second expert's report.
	C/VM2: Issues raised by the second expert have been addressed and additional information provided (documents listed above). The additional fire safety systems and features in FER rev 11 are relatively minor and can be handled through contract instructions, and include: - An additional hydrant outlet in the East Stair to serve L1 - Designated and new smoke control doorsets between Podium Lobby and Retail West - Additional smoke detectors to be installed to the balconies of apartments overlooking the East Shoulder Garden. - Fire alarm system to be programmed to address activation of Upper West Stair pressurisation system.
	PA18: Referred to earlier submission that outlined how the broad themes in PA18 were addressed in the fire design; these are largely unchanged in the current design with the exception that the evacuation strategy was modified to reduce the matters of disagreement with FENZ. Does not accept the second expert's interpretation of the intent and scope of PA18.
	FEB: If one party refuses to participate in the FEB process, this should not

	delegitimise compliance by means of C/VM2, otherwise not acting in good faith could be adopted as a strategy to effectively hold the design to ransom. The peer reviewer and FENZ continued their involvement in this case. Areas which were unresolved involved issues that are in excess of the requirements of C/VM2.
	Compliance: Design Scenario HS: Clause C3.6 is satisfied via the sprinkler system with dual supply, and Clause C3.7 is satisfied via non-combustible external walls. Compliance: C5.6 The ascent above Level 46 lobby is only six occupied levels plus two plant levels for a maximum rise of 24.5m. Concerns raised by FENZ of large horizontal travel distances are overstated because the floor plate is smaller as the building tapers sharply. C/AS2 allows for a sprinkler-protected building with an escape height of 24.5 with a single stair, and that stair would not need to be pressurised; it follows that as the firefighters would not be using breathing apparatus in the lift to Level 46 in this case they can be expected to be able to ascend up to eight floors. FENZ Standard Operating Procedure is to ascend two levels – in this case Level 46 +2 – and therefore this issue only concerns three occupied levels and two plant rooms. Fire separated lift lobbies are detailed on all floors from Levels 47-51 and firefighters can don breathing apparatus equipment at any level and traverse the 6m from lift lobby to the Upper West Stair through apartments above Level 46. Titles can be encumbered on Levels 49-51 to keep a direct passage from the lift lobby to the stair 'unaltered'. The requirements of C/VM2 for Design Scenario FO have been achieved and must be accepted as having complied with the provisions of Clause C5.6.
The authority	
19 October 2018	The expert's conclusion is the fire report does not establish compliance and this is consistent with the authority's initial concerns. The current building consent application remains on hold and the authority is unable to process the consent further until the determination is complete. Even if the determination as sought by the applicant was issued, the authority must consider all other aspects of the Building Code, including the need to update all other remaining aspects of the design to address the ongoing iterations of the Fire Engineering Report.