



Determination 2015/058

Regarding the refusal to issue a building consent for a proposed apartment block with a single means of escape in a retirement complex at 25 Graham Street, Petone, Lower Hutt.

Summary

This determination discusses the compliance of a proposed block of apartments in a retirement village with respect to the limit provided for the numbers of people with disabilities likely to be present on any given floor when using the Acceptable Solution C/AS2. The determination sets out a method of calculating the numbers of people with disabilities for a known population by age.

1. The matter to be determined

- 1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004¹ (“the Act”) made under due authorisation by me, John Gardiner, Manager Determinations and Assurance, Ministry of Business, Innovation and Employment (“the Ministry”), for and on behalf of the Chief Executive of the Ministry.
- 1.2 The parties to the determination are:
 - the owner of the property, Ryman Healthcare Ltd (“the applicant”), acting through its fire engineer as an agent (“the fire engineer”)
 - Hutt City Council (“the authority”), carrying out its duties as a territorial authority or building consent authority.
- 1.3 This determination arises from the decision of the authority to refuse to issue a building consent for the proposed apartment block. The refusal arose because
 - the consent application cited the Acceptable Solution C/AS2 as the means of compliance and a single means of escape is proposed
 - the authority was not satisfied that the building work complies with the C Clauses² of the Building Code (First Schedule, Building Regulations 1992); in particular in regard to the numbers of occupants with disabilities on any given floor being more than 10 as described in paragraph 3.13.1 of C/AS2.
- 1.4 I have provided the New Zealand Fire Service Commission (“the NZFS”) with the determination documentation for comment by way of consultation under section 170 of the Act.

¹ 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.

² In this determination, references to sections are to sections of the Act and references to clauses are to clauses of the Building Code.

- 1.5 The matter to be determined³ is whether the authority was correct in its decision to refuse to issue the building consent. In deciding this matter, I must consider whether the proposed apartment building complies with the C Clauses of the Building Code.
- 1.6 In making my decision, I have considered the submissions from the parties, including the fire report provided by the fire engineer, the reports of the two independent experts commissioned by the Ministry to provide advice on the matter, and the other evidence in this matter.
- 1.7 No other aspects of the proposed building work or other clauses of the Building Code have been considered in this determination. The relevant sections of the Act, clauses of the Building Code, paragraphs from relevant Acceptable Solutions and related commentary document⁴, and relevant paragraphs of the New Zealand Standards are set out in Appendix A.

2. The proposed building work

- 2.1 The apartment block is a four level building to be built as the second stage in the construction of a large retirement complex. The complex includes a separate care facility on site with a Risk Group SI⁵.
- 2.2 The apartment block consists of car parking in the basement level, and apartments on the remaining three floors. The apartments are a mix of one to three bedrooms.
- 2.3 Each floor has a gross floor area of approximately 2000m² or less and is fire separated from the other floors. The apartments are all separate firecells, and the stairs are also fire separated. The fire engineer's report sets out the following sprinkler, smoke detection and alarm systems:
- Type 7 sprinkler and smoke detection system throughout Levels 1, 2, and 3.
 - Type 5 enhanced smoke detection and alarm system for the apartments (the fire alarm signal resulting from smoke detection is not directly transmitted to the fire service).
 - Type 6 sprinkler system in the basement level.
- 2.4 The Risk Groups for the purposes of the Acceptable Solution are VP for the car parking level and SM for the remaining floors of apartments. The apartments are not unit titled and are intended to be leased under a licence to occupy. The applicant describes the apartment block as providing 'independent living'.

3. Background

- 3.1 The building consent application (no. BC140812) was lodged with the authority on 12 August 2014. The supporting documentation included floor plans for each level of the apartment block and a fire report dated 5 August 2014 produced by the fire engineer.
- 3.2 At some point the issue of compliance by way of C/AS2 and the numbers of people with disabilities that may be on any given floor was raised between the parties. The authority considered that 'due to the use of the complex for the associated age demographic, [the number of persons on any floor being no greater than 10] is

³ Under sections 177(1)(b) and 177(2)(a) of the Act

⁴ Commentary for Acceptable Solutions C/AS1 to C/AS7 (*Ministry of Business, Innovation and Employment*) December 2013

⁵ Risk Groups are established under Table 1.1 of the Acceptable Solutions C/AS1 to C/AS7

considered unmanageable and unrealistic to achieve', therefore paragraph 3.13.1 of C/AS2 could not be met to allow a single means of escape.

- 3.3 During October 2014 both parties continued to correspond, and each separately approached the Ministry for advice. In a response from the Ministry to the authority on 20 October 2014 it was noted:

...the rationale for the requirements of 3.13.1 c in C/AS2 is that where there are a large number of people with disabilities the evacuation time for the building will be longer.

Where there is a longer evacuation the likelihood of an escape route being blocked becomes greater. Therefore there is a requirement for an alternate exit for the occupants.

In an independent living age care facility it could be reasonably expected that a high proportion of the occupants would have some form of disability and evacuate slower than the average population.

- 3.4 In a further email from another officer of the Ministry to the fire engineer, it was noted that there is no calculation method in the Acceptable Solution or the commentary document to determine how many people are likely to have disabilities that would restrict their ability to self-evacuate. The email went on to set out two differing 'options', namely that the population of the apartment block would not match the average demographic and would be slower to evacuate, or that given the stated occupant load, the ratio of those with disabilities would fall within the limit allowed for under the Acceptable Solution.
- 3.5 By email on 4 November 2014, the authority also corresponded with a representative of Barrier Free New Zealand Trust ("Barrier Free"), noting that it had received information from the NZFS which the authority stated indicated that the figures for people with disabilities in the age group envisaged as occupants in the apartments could be 21% and as high as 59% for over 69 years of age, and requesting further information Barrier Free might have on this issue.
- 3.6 Barrier Free responded on 11 November 2014, noting its concerns regarding the calculation in the Acceptable Solution and how that would be 'policed' in use, particularly if 'the maximum number of people with disabilities was reached' whether through visitors, an occupant having a temporary disability, or increasing numbers of occupants becoming disabled as part of the ageing process. The concerns extended to how that would be managed in terms of occupant's rights and the rights of people with disabilities, either occupants or visitors.
- 3.7 In an email to the applicant on 26 November 2014, the authority advised that it would not issue a building consent for the apartment building with a single means of escape. A further email from the authority on 27 November 2014 clarified that the issue related to compliance by way of C/AS2 and in particular paragraph 3.13.1 (c).
- 3.8 The Ministry received an application for a determination on 11 February 2015.

4. The submissions

- 4.1 With the application for determination, the fire engineer provided a submission dated 11 February 2015, a fire report for the apartment block dated 5 August 2014, and copies of correspondence between the parties. The fire engineer submitted that the matter in dispute centred around paragraph 3.13.1(c) of C/AS2 in regards to the number of people on any given floor with a disability.

4.2 In the submission, the fire engineer stated that the average occupancy rate for other retirement apartments owned by the applicant is less than two people per apartment, but that it had been agreed with the authority to use two people per apartment for the purposes of establishing occupant load. The fire engineer then calculated the occupant load for each of the apartment levels as follows: Level 1 (30), Level 2 (30), Level 3 (24).

(I note that the fire engineer's occupant load then reverted to 1.5 per apartment in the table relating to fire safety systems and fire resistance ratings as follows: Level 1 (23), Level 2 (23), Level 3 (18).)

4.3 The fire engineer submitted that the fire safety systems to be installed exceed the requirements of C/AS2, and will allow the occupants extra time to get to the stairs. The proposed fire safety systems include:

- a Type 7 sprinkler and smoke detection system throughout levels 1, 2 and 3, in accordance with NZS 4541⁶ and NZS 4512⁷
- for the apartments, a Type 5 enhanced smoke detection and alarm system as per NZS 4512 (the fire alarm signal resulting from smoke detection will not be directly transmitted to the fire service)
- a Type 6 sprinkler system in the car parking level, as per NZS 4541 and NZS 4512
- a Type 18 building fire hydrant system as per NZS 4510⁸
- emergency lighting as per F6/AS1
- a fire resistance rating of 30 minutes to control fire and smoke spread for each apartment, the stairs, and corridor.

4.4 The fire engineer went on to submit the following (in summary):

- With the limited occupant load (30 per floor) and limited number of floors, there is little benefit to the occupants to provide a second stair. In order for the stair to reach untenable conditions, three separate elements of the fire safety system would need to fail.
- The definition of people with disabilities, as set out in the Act and Building Code, is broader than just those disabilities that would impact on self-evacuation.
- The sprinkler system will control the fire, 'allowing lots of extra time for the occupants to travel to the stairs before being exposed to untenable conditions'.
- In a previous Determination (2002/2⁹) it was noted 'no account need be taken of the fact that a significant portion of the current residents are said to be elderly, with some needing assistance to escape. That is a situation that could well occur in any house or apartment building, ...'
- The only information in the Building Code on determining the number of people with disabilities is with regard to accessible units for hotels (under

⁶ New Zealand Standard NZS 4541:2007 Automatic fire sprinkler systems

⁷ New Zealand Standard NZS 4512:2010 Fire detection and alarm systems in buildings

⁸ New Zealand Standard NZS 4510:2008 Fire hydrant systems for buildings

⁹ Determination 2002/2 Alterations to an apartment building's means of escape from fire in response to a "dangerous building" notice (*Building Industry Authority*) 9 April 2002 Design for Access and Mobility – Buildings and Associated Facilities

NZS 4121¹⁰ which is cited in section 119 of the Act and referenced in the Acceptable Solution D1/AS1), and based on those requirements each floor would require two accessible units – that would be less than 10 people per floor.

- 4.5 The fire engineer concluded that the information provided to the authority with regard to the number of occupants with disabilities was sufficient to demonstrate it would be less than 10 persons on any given floor, and that the fire design as provided and using the Acceptable Solution C/AS2 complies with the Building Code.
- 4.6 The authority acknowledged the application for determination in an email received by the Ministry on 12 February 2015 but made no submission in response to the application.
- 4.7 A draft determination was issued to the parties for comment on 22 May 2015. (Refer paragraph 6 for the submissions made in response to the draft determination)

5. The experts' reports

5.1 The first expert

- 5.1.1 As noted in paragraph 1.6, I engaged an expert to assist me (“the first expert”). The expert is a member of the New Zealand Institute of Architects. The expert was engaged to review the documentation and provide a report assessing the occupant load¹¹ and the application of paragraph 3.13.1(c) of C/AS2. The expert provided a report dated 1 April 2015, a copy of which was sent to the parties on 25 May 2015.
- 5.1.2 The first expert noted that the owner’s website describes similar apartment situations as being for ‘residents who wish to retain a significant level of independence’,
- ... the independent living residents are typically 78-79 years of age on entry, while assisted living residents are typically 84+ years of age. The resthome and hospital residents are typically 85 years of age on entry.
- 5.1.3 The expert commented that his interpretation of ‘a significant level of independence’ was to mean to the same extent as if that person was living in an apartment elsewhere, and accordingly that the apartment should be assessed as if it were an apartment building containing private household units, except that the residents will be elderly.
- Occupant load*
- 5.1.4 Based on the plans provided, the expert calculated the occupant load as follows Level 1 (44), Level 2 (45), Level 3 (35).
- (I note here it appears that the calculation has been made using the number of bed rooms rather than bed spaces – see paragraph 5.2.2).
- 5.1.5 The expert observed that the commentary for the Acceptable Solutions C/AS1 to C/AS7 notes that exceptions to the way the occupant load is calculated can occur (refer Appendix A.4) , with two conditions to be met:
- that the occupant load derived from the Acceptable Solution is clearly more than that which would occur in practice, and

¹⁰ New Zealand Standard NZS 4121:2001 Design for Access and Mobility – Buildings and Associated Facilities

¹¹ Occupant load in the Acceptable Solutions C/AS1-C/AS7 is the greatest number of people likely to occupy a particular space within a building.

- the proposal must be substantiated to the building consent authority.

5.1.6 The expert referred to the fire engineer’s statement that the occupancy rate was typically less than two persons per apartment, but noted that it was also reasonable to expect visitors staying overnight on a regular basis, such as children and grandchildren of the residents, or friends of the residents who would be of a similar age. The expert considered it reasonable to assume that a third (being 5) of the single bedrooms might be occupied at any one time. Given the typical occupancy at 1.5 per apartment, and with the addition of overnight visitors, the expert recalculated the occupancy load for Level 2 (being the level with the highest occupancy) as 35. The expert did not consider that any home-help would include live-in care.

Number of people with disabilities

- 5.1.7 The expert referred to the fire engineer’s reference to NZS 4121 in regards to establishing the number of people with disabilities (refer paragraph 4.4); the expert did not consider this an appropriate method of calculation because NZS 4121 was in terms of accessible accommodation available to the general public, and the proportion of people with disabilities in the general public would be significantly less than the proportion within the elderly population.
- 5.1.8 The expert referenced the New Zealand 2013 Disability Survey¹² (“the disability survey”) as being the most applicable, noting that the data was broken down by age group¹³ and accordingly the proportion of people with disabilities within the expected age group of the occupants could be determined.
- 5.1.9 Given the typical age at entry of independent living residents as stated on the applicant’s website, the expert considered the age group of 65+ from the survey as the most representative for the purposes of calculating the numbers of people with disabilities on any given floor. However, the survey included persons living in ‘care’; accordingly the expert adjusted the figures to remove that group and concluded that the proportion of persons with a disability in the occupants of the apartments would be 53%.
- 5.1.10 The expert applied that proportion to the various calculations of occupant loads as follows:

Table 1: Calculation of the number of people with disability in the occupants of the apartments (first expert)

	Occupant load (Level 2 being highest)	Proportion with disability	Number of people with disabilities
C/AS2 (by total number of bed spaces)	49*	53%	26*
Expert’s revised calculation (1.5 per apartment + visitors at 1/3 of spare/single beds)	35	53%	19
Fire report (1.5 per apartment, no visitors)	23	53%	12

* Figures corrected (see occupant load calculation at paragraph 5.2.2)

- 5.1.11 The first expert concluded that paragraph 3.13.1 (c) of C/AS2 had not been met, in that there would be more than 10 people with disabilities on any given floor, and so

¹² Disability Survey: 2013 *Statistics New Zealand* (ISBN 978-0-478-42902-2) 17 June 2014

¹³ Disability Survey: 2013 Tables 1.01 and 1.02

C/AS2 cannot be used to provide a single means of escape. The expert went on to note that the fire safety systems proposed in the fire report were well in excess of those required by C/AS2, and that the consent application should have been made on the basis of an alternative solution.

5.2 The second expert

5.2.1 Given the conclusion of the first expert, I commissioned a fire engineer (“the second expert”) to assist me; the second expert is a Chartered Professional Engineer with specialist expertise in fire safety. I requested the expert carry out an assessment of the proposed fire safety systems in respect of the proposed use of a single means of escape. The expert provided a report dated 12 May 2015. A copy of the report was provided to the parties for comment on 25 May 2015.

Occupant load

5.2.2 The second expert calculated the occupant loads based on the floor area for the basement carpark and the number of beds for each level; the highest level of occupancy was Level 2 (49). I have summarised the calculated occupancy loads in the table below:

Table 2: Calculated occupant load as per C/AS2 (second expert)

		Area	Occupant density (car park)			Total
Basement carpark		2000m ²	50			40
Level		2x Double + single (5 people)	2x Double only (4 people)	Double + single (3 people)	Double only (2 people)	
1	No. of Apartments	2	2	8	3	
	Occupancy	10	8	24	6	48
2	No. of Apartments	3	1	8	3	
	Occupancy	15	4	24	6	49
3	No. of Apartments	2	2	5	3	
	Occupancy	10	8	15	6	39
Building total						136

Calculating the number of apartment occupants with disabilities

5.2.3 The second expert referred to the disability survey and stated that based on the percentages set out in that survey:

- for the general population the largest floor occupancy (based on the calculated occupancy: level 2 with 49 people) the numbers of people on that floor with a disability would be 11.76.
- given the older population expected to live in this complex, the expert applied the survey value for the age group over 65 years (59% - not adjusted for those included who were in care) and calculated the number of people with disabilities at 28.9.

- 5.2.4 The expert then applied the percentage of disability to the occupancy load based on 1.5 people per apartment as set out in the fire engineer's report; achieving for level 2 5.5 people with disabilities for the general population and 13.6 people with disabilities for the over 65 age group.

Compliance by way of C/AS2 (being the means of compliance cited in the consent application)

- 5.2.5 The second expert noted items outside of the single stair issue that do not comply with the relevant Acceptable Solution:

- The basement entrance to the stair is not preceded by a smoke lobby (refer paragraphs 3.5 and 3.13.1(f) of C/AS2).
- No hold-open device on the fire door between the basement and the stair (refer paragraph 3.15.9 of C/AS2).
- Occupant loads do not match with those calculated; though this may be justified by the client's expected building use.

Compliance by way of C/VM2

- 5.2.6 The second expert assessed the proposed apartment block using the verification method C/VM2. Not all scenarios were assessed, as some were either not related to the matter being determined or compliance by way of the Acceptable Solution had been shown in the fire report. I have summarised the conclusions for each of the scenarios in table 5.

- 5.2.7 The expert noted that C/VM2 does not detail specific travel speeds for occupants with disabilities and a 'general' occupant travel speed (1.2m/s for horizontal travel) can be used, and that by omission the verification method is silent on the treatment of travel speeds for specific user groups. The expert referred to horizontal travel speeds for persons as set out in the SFPE Handbook¹⁴ and a BRANZ study report¹⁵ regarding accessible emergency egress. The expert did not use details or speeds from this study, but followed the verification method according to the inputs given in C/VM2, concluding that 'the default input travel speeds still provide a good basis to determine the matter of the single means of escape.'

- 5.2.8 I have summarised the second expert's comments on the design scenarios in the table below:

Table 5: Design scenarios

Design scenario Application	Expert comment
(BE) Fire blocks exit Escape routes serving more than 50 people, or with a single direction of travel	Direction of travel distance is less than the maximum permitted. Provision of single escape route acceptable.
(UT) Unknown threat Rooms or spaces that can hold more than: 50 occupants with only a manual alarm system, or 150 occupants with automatic detection and	Does not apply.

¹⁴ Society of Fire Protection Engineers Handbook

¹⁵ BRANZ Study Report SR 318 (2014) Accessible Emergency Egress: Investigating accessibility of emergency egress in the context of New Zealand buildings. A literature review and scoping study. AP Robbins and NR Buckett. (2014)

alarm.	
(CS) Concealed Buildings with rooms hold more than 50 occupants and with concealed spaces. Does not apply if the concealed space has no combustibles and no more than two dimensions greater than 0.8m	Does not apply. Would comply due to the installation of sprinklers throughout the building in accordance with NZS 4541 and the installation of smoke detection throughout apartment levels in accordance with NZS 4512.
(SF) Smouldering fire Slow smouldering fire that causes threat to sleeping occupants; assumes active and passive fire safety systems perform as intended.	Complies due to automatic detection and alarm system installed through the building including smoke detection in sleeping areas, designed and installed to NZS 4512.
(HS) Horizontal fire spread Fire leading to high levels of radiant heat exposure across a relevant boundary, potentially igniting the external walls of a neighbouring building, or leading to fire spread to other property, sleeping occupancies and exitways	Not assessed as fire report based on the Acceptable Solution assessed horizontal fire spread as compliant.
(VS) External vertical fire spread Applies to: a) All multi-level buildings with a building height of more than 10m, and b) Any other multi-level buildings with upper floors i) where people sleep, or ii) are defined as other property, or iii) that have external exitways with an external walls, and c) Where there is a lower roof exposure to a higher external wall within the same or adjacent building, where firecells behind the higher external wall house sleeping occupancies, exitways or other property	Complies due to the building being fully sprinklered, being further than 1.0m from the boundary, and having a building height of less than 25m.
(IS) Rapid fire spread involving internal surface linings	Not assessed as interior surface finishes specified in the fire report to comply with C/AS2 4.17 and C/AS7 4.17.
(FO) Firefighting operations	Building is fully sprinkler protected and provided with a fire hydrant system. Not assessed further as not relevant to matter being determined.
(CF) Challenging fire	Only tenability criteria required to be assessed is FED (CO) ¹⁶ because the building is fully sprinkler protected and has less than 1000 people. C/VM2 specifies a failure criterion of 0.3 FED. It was not considered 'worst case' to model any challenging fires

¹⁶ Fractional effective dose of carbon monoxide. FED is based on a log-normal distribution of the general population, with an FED of 1.0 representing untenable conditions to 50% of the population.

(RC) Robustness check	<p>Requires the tenability criteria to be FED (CO) with some 'failures' to key fire safety systems. Considered as 'worst case' safety systems.</p> <p>Two assessments undertaken:</p> <ol style="list-style-type: none"> 1. Failure of a key fire safety system (two doors without automatic hold-open devices; the basement stair door, and an apartment door) where more than 50 people in a sleeping occupancy have the potential to be exposed. Assessment criteria is FED_{CO} 2. All key fire safety systems act as intended where sleeping occupants in a sprinklered building must egress through a single vertical safe path stair. An assessment criterion is maintaining visibility to at least 5m within the vertical safe path stair for the duration of the RSET¹⁷.
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5.2.9 In regards to RC assessment 1, the expert noted

An argument could be made that it isn't possible to expose more than 50 people in a sleeping occupancy in this building and therefore assessment to part 1 isn't required. Although this building has more than 50 people sleeping, there are many fire separations and the potential to expose more than 50, although there, isn't likely.

5.2.10 The expert carried out the assessments with two fire locations: a fire in a level 2 apartment and a fire in the basement car park. I have summarised the results set out in the expert's report that are relevant to the second assessment as follows:

Fire in apartment B1 – stair visibility assessment

- Visibility maintained for the duration of the RSET – complies with the requirements of C/VM2.

Fire in basement – FED assessment

- Tenability was maintained for all occupants of the building for the duration of the RSET – complies with the requirements of C/VM2.

Stair visibility assessment

- Visibility maintained within the stair at levels 2 & 3 for duration of RSET.
- Visibility momentarily (around 15 seconds) dropped below 5m within a small area of the stair at Level 1 where the basement stair connects with Level 1; however, this occurred before any occupants from L1 to L3 would enter the stair but would be considered a failure under C/VM2 as it is during the period of RSET.
- The addition of a smoke lobby preceding the stair at basement level, or the addition of a second stair would resolve this issue. (A smoke lobby is a requirement if complying by way of the Acceptable Solution C/AS2 – refer paragraph 5.2.5 above.)

¹⁷ Required safe egress time

- 5.2.11 The expert went on to note that although C/AS2 has the requirement for a second stair where there are more than 10 people with a disability, the verification method C/VM2 does not have a comparable requirement. In addition, providing a second stair doesn't significantly impact on the compliance of the proposed apartment block with the Building Code because the corridor is the issue rather than the stair.

Conclusion

- 5.2.12 The second expert concluded:
1. The Acceptable Solution C/AS2 does require a second stair for compliance with C/AS2/3/13 ...
 2. The Verification Method C/VM2 does not require the addition of a second stair to provide [compliance with Clause C1-C6] however the following could be provided to show compliance...
 - a. Provide a smoke lobby at the basements stair entry
 - b. Provide automatic hold open devices on the apartment doors

6. Submissions in response to the draft

6.1 The authority

- 6.1.1 The authority provided a submission by letter dated 9 June 2015, accepting the draft with the following comment (in summary):

- The second expert's report did not quantify why the default speed is a good basis to determine the matter of the single means of escape.
- It is the authority's view that the data available on travel speeds for persons with diverse capabilities 'should be considered appropriately in a C/VM2 assessment'.
- The authority considers that the data in the BRANZ report regarding pre-movement times should not be ignored in a C/VM2 assessment.
- The decision to choose the pre-travel activity time should only be made following discussions with the relevant stakeholders as part of any Fire Engineering Brief process.
- It may be feasible under a C/VM2 assessment in this case to demonstrate that default travel speeds and pre movement times are acceptable; however discussions with relevant stakeholders as part of any Fire Engineering Brief process is required to fully justify / demonstrate there are adequate safeguard provisions for occupants. This may be in the form of a Personal Emergency Evacuation Plan, which would require support by the site's management and staff members.

6.2 The NZFS

- 6.2.1 The NZFS provided comment by letter dated 18 June 2015. The NZFS considered the methodology used by the first expert for determining the number of disabled persons present offered an evidence-based avenue by which to assess the vulnerable occupant load in the short term. However, it must be noted that the Office for Disability Issues notes that the projects for numbers of disabled in that age range will approximately double between 2001 and 2061. This suggests that re-assessment

should be undertaken periodically to ensure the figures used reflect reality to a reasonable extent.

6.2.2 The NZFS also noted what it considered shortcomings in the Verification Method (as opposed to its application in this case), noting:

- the travel speed of 1.2m/s is the maximum global figure permitted under the methodology and is not supported by evidence of the capabilities of the population within the proposed development.
- C/VM2 requires the Available Safe Egress Time (ASET) to exceed the Required Safe Egress Time (RSET); however, this margin may be as little as 1 second and still achieve compliance with the methodology. Designers are alerted to the issue in the comment prior to paragraph 3.2.1 in C/VM2 and, in the commentary in paragraph 3.2.5 of that document, are referred to the SFPE Handbook.
- The SFPE Handbook includes consideration of occupants with disabilities, and occupant capabilities are to be considered as valid modifiers of the proposed travel speeds.
- In the BRANZ Study report the only mean speed to exceed 1.2m/s is that for disabled persons without mobility disability – the remainder are all below the maximum permitted speed in C/VM2. In addition, significantly less than one quarter of the persons with mobility disabilities achieved more than 1.1m/s and significantly fewer than half of older people without apparent disability achieved 1.2m/s.
- The assumed reaction times are also a matter for debate; the assumption in C/VM2 is less likely to be valid where occupants are under the influence of medication, are less agile, or have sensory impairments that are not compensated for.

6.2.3 The NZFS went on to recommend that

the capabilities of the intended occupancy are specifically considered when an assessment is undertaken under C/VM2. In this case, given the indicated age range ... consideration of the modifying factors is of more critical importance than in a younger population. While the NZFS accepts that the second expert's report has been carried out in accordance with the strict requirements of C/VM2, it nevertheless suggests that the analysis should be reviewed so as to address this issue.

6.2.4 The NZFS also submitted that management arrangements could mitigate the disparity between assumptions applicable to a general population and the conditions apparent with an elderly occupancy or one with a high proportion of people with disabilities; however there is currently no mechanism for enforcing the maintenance of such arrangements. The NZFS recommends the use of Personal Emergency Evacuation Plans (PEEPS) and similar management arrangements and holds the view these should be specifically included in the classification of Specified Systems¹⁸, making them eligible for inclusion on a Building Warrant of Fitness as an auditable method of mitigating any identified difference between the capabilities of occupants compared to the implicit assumptions in C/AS2.

¹⁸ Specified Systems are set out in Schedule 1 of the Building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005

6.3 The fire engineer

- 6.3.1 The fire engineer responded to the draft on behalf of the applicant by letter dated 14 August 2015. The fire engineer agreed that not more than 50 people would be exposed by a fire in an apartment, and that the addition of a smoke lobby for the stair in the basement would resolve stair visibility.
- 6.3.2 The fire engineer commented on aspects of the fire modelling by the second expert in relation the C/VM2 assessment that the fire engineer disagreed with, namely:
- The exposure time of occupants to the smoke.
 - The second expert modelled the doors as fully open rather than half-open (C/VM2 2.02.1(f)).
 - The sprinkler activation time used by the second expert was excessively onerous.
 - The longer sprinkler activation time created a larger fire than was warranted which can affect the outcome of the modelling.
- 6.3.3 The fire engineer also commented on the authority's submission (refer paragraph 6.1.1), noting that the Verification Method should be looked at as a complete document and the values given in C/VM2 should not be arbitrarily changed by individuals other than the Ministry.

6.4 Clarification from the second expert

- 6.4.1 Given the points raised by the fire engineer in response to the draft determination, I requested the second expert provide clarification of the reasons for the inputs that were used in the C/VM2 modelling.
- 6.4.2 The second expert responded on 25 August 2015, noting that the assessment wasn't a full fire engineering design to support a building consent which would require the whole C/VM2 process be undertaken including Fire Engineering Brief and input of stakeholders. The modelling undertaken was conservative, in part because the full VM2 process was not followed for the purpose of the determination, and also because the given Robustness Check scenario would not strictly apply.
- 6.4.3 The second expert's clarification was forwarded to the parties on 28 August 2015.

6.5 The second draft determination

- 6.5.1 The draft determination was amended to record the submissions received and the clarification and the discussion in paragraph 7.4 amended as I consider appropriate. The second draft determination was issued to the parties for comment on 2 September 2015.
- 6.5.2 By email on 3 September 2015 the fire engineer commented on the design being able to comply using the Verification Method, and also that the Robustness Check involving visibility in the vertical escape route does not require the door to be fully open for the fire duration.
- 6.5.3 By email on 4 September 2015, the authority accepted the second draft without further comment.
- 6.5.4 In a response received on 15 September 2015, the fire engineer did not accept the second draft and noted that a copy of the NZFS comment on the first draft had not

been received. The fire engineer noted two minor typographic errors (that have since been corrected) and also:

- It is not clear what the results of the occupant load calculations would be for only those with disabilities that would affect a person's ability to self-evacuate (refer paragraph 7.3.12).
- The travel speeds used in C/VM2 are appropriate in the context of that compliance document, and as noted in paragraph 7.4.5 the verification method is a "complete system design" and to be used as such.

6.5.5 In response to the query regarding occupant load calculations for only those people with disabilities that would affect a person's ability to self-evacuate: I note here that this is addressed for the circumstances in this particular case in paragraph 7.3.13. While the determination is specific to the circumstances in this case, I am of the view that the discussion in paragraphs 7.3.1 to 7.3.15 sets out a methodology and factors for consideration that may be useful when addressing this issue in other similar situations.

6.5.6 The NZFS provided comment by letter dated 16 September 2015, requesting some changes to the wording of the summary of its comments on the first draft (refer paragraph 6.2.2) to better reflect the intended message, and also a typographic error. I have amended the determination accordingly.

7. Discussion

7.1 The Legislative requirements

7.1.1 Under section 49(1) of the Act an authority must 'grant a building consent if it is satisfied on reasonable grounds that the provisions of the building code would be met if the building work were properly completed in accordance with the plans and specifications that accompanied the application.' Section 19 of the Act sets out various means of establishing compliance with the Building Code that must be accepted by the authority, with the list including compliance with an Acceptable Solution or a Verification Method.

7.1.2 It is important to note that the Acceptable Solution (in this case C/AS2) is one way, but not the only way of achieving compliance with the Building Code.

7.1.3 The relevant clauses of the Building Code in relation to fire safety are the C Clauses, and the issue at the centre of this determination is compliance with Clause C4 – Movement to a place of safety.

7.2 Establishing the occupancy load

7.2.1 Establishing occupancy load is required for use in both the Acceptable Solution and the Verification Method, and there has been some discussion on this issue between the parties. Paragraph 1.4.5 of C/AS2 states that the occupant load shall be taken as the number of bed spaces, with the comment noting that for example a double bed counts as two beds. The second expert calculated the occupant loads, based on the floor area for the basement carpark and the number of beds for each level, as follows: carpark (40), Level 1 (48), Level 2 (49), and Level 3 (39).

- 7.2.2 Paragraph 1.4.6 of the Commentary for Acceptable Solutions C/AS1 to C/AS7, states that in some cases the calculated occupant load may be clearly more than that which would occur in practice, and notes that the stated occupant load may be ‘reduced to more realistic levels’ as long as the proposal is substantiated to the authority.
- 7.2.3 In this case the applicant requested the authority accept an occupancy load of 1.5 people per apartment, based on the average occupancy in other similar apartments owned by the applicant. The authority and the applicant then agreed to use an occupancy load of 2 people per apartment – which is still less than that calculated using C/AS2.
- 7.2.4 While I consider it reasonable to accept the applicant’s statement regarding typical occupancy in similar apartment buildings, I note that this does not take into account the use of ‘spare’ beds in the larger apartments, whether by friends and family or carers¹⁹ on either a short term or longer stay (refer Table 2, paragraph 5.2.2). Accordingly, although I accept the typical occupancy of residents would average 1.5 per apartment, I am of the view that the ‘realistic level’ of occupancy may well fall somewhere between the 1.5 per apartment and the calculated occupant load.

7.3 Applying C/AS2 and calculating the numbers of people with disabilities

- 7.3.1 The application for building consent was made on the basis of the proposed design complying by way of the Acceptable Solution C/AS2. The issue in dispute between the parties centres on paragraph 13.3.1(c) of C/AS2 which states that a single means of escape may be used provided that a set of conditions are met; one of those conditions being that ‘the number of people with disabilities on any floor is not greater than 10’. The proposed apartment block has been designed with a single means of escape.
- 7.3.2 In the submission with the application for determination (refer paragraph 4.4), the fire engineer put forward the view that the nature of occupancy as part of a retirement complex does not mean it should be treated any differently to an apartment block constructed for occupation by the general population in terms of establishing the number of people with disabilities for the purposes of C/AS2. In support of that view, the fire engineer referred to Determination 2002/02.
- 7.3.3 In that determination, I stated:
- 8.6.1.1 The [Ministry] considers that in comparing the proposal with the acceptable solution, no account need be taken of the fact that a significant proportion of the current residents are said to be elderly, with some needing assistance to escape. That is a situation that could well occur in any house or apartment building, and the [Ministry] takes the view that section 7(2) of the Building Act means that it must be assumed that the acceptable solution allows for the situation. In fact, as regards the balconies, the residents concerned are unlikely to be severely limited in their abilities to walk and to use stairs because they live in upper floor apartments not served by lifts and use the balconies and stairs whenever they come and go from their apartments. Even if some of them could not travel at more than half the assumed speed, that would only increase the time to escape to approximately 83 s, still well short of the minimum estimated 360 s to flashover.
- 7.3.4 I do not consider that the statement made in that determination applies in this case. It was considered in that determination that the Compliance Document that was current at that time²⁰ allowed for the likelihood of an apartment block where a significant

¹⁹ Various organisations providing elderly care services also offer live-in care or companionship as part of their services, extending an elderly persons ability to live in their own home, or an independent living unit, for longer.

²⁰ Approved Document for New Zealand Building Code Fire Safety Clauses C1, C2, C3, C4 (*Building Industry Authority*) December 2000 and effective from 1 June 2001

proportion were elderly. The current version of C/AS2 clearly contemplates differences in the ability to self-evacuate in paragraph 13.3.1(c) as it sets a limit on the number of people with disabilities on any given floor if there is to be a single means of escape. In addition, the residents in the building discussed in 2002/02 were considered unlikely to be limited in their mobility as the upper floor apartments were not served by lifts; that is not the case in the proposed apartment block where all levels are served by a lift.

- 7.3.5 There is no stated means of calculating the number of people with disabilities in either the current Acceptable Solution or the related commentary.
- 7.3.6 I am of the view that data from Statistics New Zealand used by both experts is reliable and is an appropriate means of establishing the likely percentage of people with disabilities for the purposes of paragraph 13.3.1 of C/AS2. I also accept the view of the NZFS, that it is reasonable to use figures provided in the most recent survey available as updated from time to time to inform the calculation of the number of disabled persons present.
- 7.3.7 In this particular case, and given the applicant's statement as to the intended occupation of the apartment block as part of a retirement complex, the occupants of the proposed apartment block are going to be elderly and I consider the age group 65+ in the survey to be the appropriate age bracket to use from the statistics provided in the disability survey.
- 7.3.8 The first expert took the disability percentage from Table 1.01 of the survey (58% of the total in the 65+ age bracket) and reduced this by the percentage of that age group in the survey that were in 'care facilities', bringing the percentage of people with disabilities in the 65+ age bracket down to 53%. I accept that approach is reasonable as it relates to the circumstances in this case.
- 7.3.9 In the following table I have set out the calculated number of people with disabilities on the level with the highest occupancy, using three occupant loads discussed in paragraph 7.2 above:

Table 3: Calculation of number of people with disabilities on Level 2

Occupant load		No. with disability (53%)
C/AS2	49	26
2 per apartment	30	16
1.5 per apartment	23	12

- 7.3.10 In each of the occupant loads noted in the table above the calculated number of people with disabilities are greater than 10, putting them outside the provision for a single means of escape in C/AS2.
- 7.3.11 However the applicant has also noted that not all disabilities, as the term is defined in the Act and Building Code, would impact on an occupant's ability to self-evacuate.
- 7.3.12 Although C/AS2 does not discriminate as to the type of disability considered in paragraph 13.3.1(c), I hold the view that for the purposes of compliance with the C Clauses of the Building Code it is those disabilities that affect a person's ability to self-evacuate that should be considered relevant for that purpose.
- 7.3.13 The disability survey does provide data by impairment type for people 65 years old and over. However, in this case I consider that a further reduction in the percentage

used in the calculation above (being 53%) to take account of the various types of disabilities would not be warranted as

- the occupant load is less than that calculated in C/AS2, and
- the rate of 53% reached in the survey includes an age group up to 10 years younger than the typical entry age for this apartment block
- as residents of the apartment block age during their occupancy, there is an increased likelihood of an increase in disability over time both for individuals and as a proportion of the number of people within the apartment block.

7.3.14 Given the discussion above, I consider that the number of people with a disability on any given floor of the proposed apartment block falls outside the 10 person limit provided for in paragraph 13.3.1 (c) of C/AS2. I note also that the second expert identified other aspects of the design that do not currently comply with C/AS2 (refer paragraph 5.2.5); namely the lack of smoke lobby at the basement entrance to the stair, and the lack of hold-open device on the fire door between the basement and the stair.

7.3.15 In regards to the information the authority had before it at the time that it made its decision to refuse to grant the building consent, I consider the authority correctly exercised its powers of decision in refusing to grant the consent on the basis that it considered there would be more than the 10 people with disabilities provided for in C/AS2.

7.4 Use of the Verification Method

7.4.1 I have also considered whether the proposed apartment block could comply with the Building Code by way of the Verification Method C/VM2 in respect of a single means of escape.

7.4.2 I have considered the argument put forward that the first assessment in the Robustness Check scenario isn't required. I agree that given the fire separations proposed it is unlikely that more than 50 people would be exposed to untenable conditions, and accordingly the first assessment is not required.

7.4.3 The second expert's stair visibility assessment for the second assessment in the Robustness Check scenario showed a period of time during the RSET in which visibility dropped below 5m. I accept the expert's finding in this respect. I note the expert's comment regarding the time being momentary and that 'this occurred before any occupants from L1 to L3 would enter the stair'; however I consider that the location of occupants at the relevant time cannot be presumed.

7.4.4 I note that if the owner proposes to establish compliance by way of the Verification Method, as opposed to C/AS2 cited in the consent application, the full process set out in C/VM2 would need to be carried out to support the building consent application.

7.4.5 The NZFS questioned the use of global travel speed where occupants are known to be of an older age group and potentially with a disability or a combination of disabilities. I note the following information on the Ministry's website²¹ with regard to the inputs to C/VM2:

The Verification Method C/VM2 method is a complete design system with interrelated inputs and design parameters that result in an acceptable level of risk.

²¹ Protection from Fire Frequently asked questions: 2. Verification Method C/VM2 interpretations 2.6 Can any of the design inputs into C/VM2 be varied? <http://www.building.govt.nz/changes-to-c1-c6-faq#aid2.6> (accessed 2 September 2015)

Therefore it is not appropriate to vary the inputs and design parameters when using the C/VM2 method.

C/VM2 inputs cannot be replaced with elements from Acceptable Solutions C/ASx or specific design. Using other inputs can have significant effect on the outcome.

Should a designer wish to vary the design inputs other than listed in C/VM2 the design is an Alternative Solution and all design inputs must be justified.”

8. The decision

- 8.1 In accordance with section 188 of the Building Act 2004, I hereby determine that the authority correctly exercised its powers of decision in refusing to grant building consent for the proposed apartment block and I confirm the authority’s decision.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 23 September 2015.

John Gardiner
Manager Determinations and Assurance

Appendix A

A.1 Relevant sections of the Building Act 2004 discussed in this determination:

Section 7 - Interpretation

person with a disability means a person who has an impairment or a combination of impairments that limits the extent to which the person can engage in the activities, pursuits, and processes of everyday life, including, without limitation, any of the following:

- (a) a physical, sensory, neurological, or intellectual impairment:
- (b) a mental illness

A.2 Clauses of the Building Code discussed in this determination:

Clause A2 – Interpretation

people with disabilities people whose ability to use buildings is affected by mental, physical, hearing or sight impairment

Clause C4—Movement to place of safety

Functional requirement

C4.1 Buildings must be provided with:

- (a) effective means of giving warning of fire, and
- (b) visibility in escape routes complying with clause F6.

C4.2 *Buildings* must be provided with means of escape to ensure that there is a low probability of occupants of those *buildings* being unreasonably delayed or impeded from moving to a *place of safety* and that those occupants will not suffer injury or illness as a result.

Performance requirement

C4.3 The *evacuation time* must allow occupants of a *building* to move to a *place of safety* in the event of a *fire* so that occupants are not exposed to any of the following:

- (a) *fractional effective dose* of carbon monoxide greater than 0.3:
- (b) a *fractional effective dose* of thermal effects greater than 0.3
- (c) conditions where, due to smoke obscuration, visibility is less than 10 m except in rooms of less than 100 m² where visibility may fall to 5 m.

C4.4 Clause C4.3(b) and (c) do not apply where it is not possible to expose more than 1 000 occupants in a *firecell* protected with an automatic *fire* sprinkler system.

C4.5 Means of escape to a *place of safety* in *buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety systems*.

A.3 Paragraphs of the Acceptable Solution discussed in this determination

C/AS2 Definitions

People with disabilities People whose ability to use buildings is affected by mental, physical, hearing or sight impairment.

Occupant load The greatest number of people likely to occupy a particular space within a *building*. It is determined by:

- a) dividing the total floor area by the m² per person (occupant density) for the activity being undertaken, or
- b) for sleeping areas, counting the number of sleeping (or care) spaces, or
- c) for fixed seating areas, counting the number of seats.

1.4 Calculating occupant loads

Occupant load

1.4.1 The occupant load shall be determined from the risk group and number of people in each space of the building. The occupant load may need to be evaluated not only for each risk group but also for:

- a) A space or open floor area involving one or more activities, and
- b) A floor containing more than one risk group, and
- c) A single firecell, and
- d) Each floor within a firecell.

...

Risk group SM

1.4.5 The occupant load shall be taken as the number of bed spaces.

Comment:

1. In this Acceptable Solution, the term 'beds' is used to denote the number of people expected to be sleeping in the firecell. Therefore, a double bed counts as two beds, and a tier of three single bunks (one above another) counts as three beds.

2. The number of beds depends on the individual layout in every case. Clearly dormitories will have a far greater number of beds within any given area than single bedrooms in a hospital or an old people's home, which may have individual lounge areas, toilets and kitchenettes attached. During use, the number of bed spaces must not be increased beyond that initially provided for unless a new building consent is obtained.

3.13 Single escape routes

3.13.1 Single escape routes shall only be permitted if:

- a) The open path length does not exceed the limits specified in Table 3.2, and
- b) The total occupant load from all firecells on each level served by the escape route is no greater than 50, and
- c) The number of people with disabilities on any floor is not greater than 10, and
- d) The escape height is no greater than:
 - i) 10 m if unsprinklered, or
 - ii) 25 m if sprinklered, and
- e) In buildings with two or more floors, the vertical safe path is preceded by a smoke lobby on all floors except the topmost floor (refer to Paragraph 3.9.2 for sizing of the smoke lobby), and
- f) There are no more than two basement levels below ground and the vertical safe path from the basement levels is preceded by a smoke lobby (see Figure 3.11).

A.4 Paragraphs from the Commentary for Acceptable Solutions C/AS1 to C/AS7

Justification for exceptions

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

A.5 Definition of ‘people with disabilities’ in New Zealand Standard NZS 4121: 2001 Design for Access and Mobility – Buildings and Associated Facilities

1.5 Definitions interpretation

1.5.1 Definitions

PEOPLE WITH DISABILITIES means people whose ability to be freely mobile or to access and use buildings is affected by mental, physical, hearing or sight impairment, such as:

- (a) An inability to walk;
- (b) Walking difficulties;
- (c) Reliance on walking aids;
- (d) Partial sightedness or total blindness;
- (e) Hearing disabilities;
- (f) Lack of co-ordination;
- (g) Reaching disabilities;
- (h) Manipulation disabilities;
- (i) Lack of stamina;
- (j) Difficulties in interpreting and reacting to sensory information;
- (k) Extremes of physical size;
- (l) Learning difficulties.