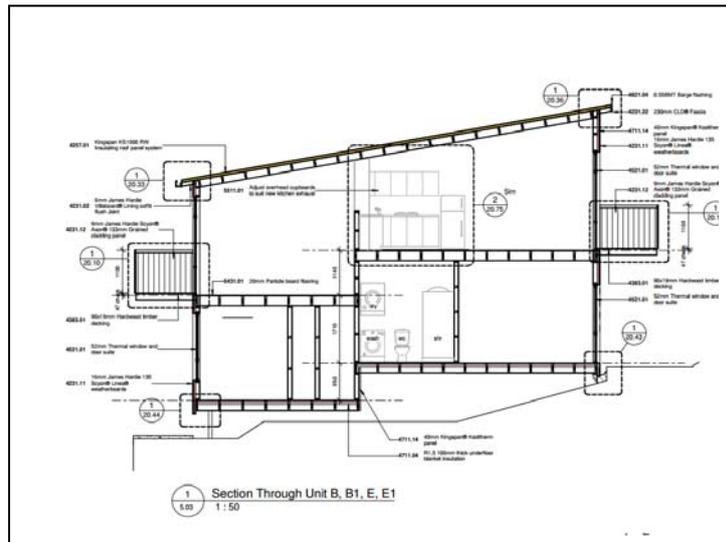




Determination 2015/057

Regarding the refusal to issue a building consent for Stage One of remediation to an apartment complex at 716 Frankton Road, Queenstown



Summary

This determination discusses the code compliance of proposed wall and roof repairs in respect of interstitial condensation. The analysis took into account the expected occupancy of the units and factors affecting ventilation, the site and location, the past history of damage to the buildings, and the provisions proposed for reducing the risk of condensation.

1. The matters 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

1.2.1 The parties to the determination are:

- Beechwood Body Corporate 303953 (“the applicant”) representing the owners of Units 25 to 29, acting via the project managers for the building work (“the project manager”)
- the Queenstown Lakes District Council (“the authority”), carrying out its duties as a territorial authority or building consent authority.

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.

1.2.2 I consider that the following are persons with an interest in this determination:

- the architectural designer of the remedial work (“the designer”)²
- the owners of the remaining 70 units in the apartment complex.

1.3 The reasons for this determination

1.3.1 The application for this determination arises from the following:

- The apartment complex was originally completed in 2001 and suffered timber damage resulting in part from moisture condensing within the walls and roof structure. Design work for remediation of the units started in 2014.
- The project manager applied for a building consent in February 2015 for the first stage of remediation work and in response to requests from the authority provided clarifications, test results and other information about certain aspects.
- Despite the provision of further information, the authority was unable to be satisfied that the proposed building work would comply with certain clauses³ of the Building Code (First Schedule, Building Regulations 1992).
- The authority’s concerns about the compliance of the building work relate to the risk of interstitial condensation recurring, given the complex’s history, the lack of automatic ventilation and the type of occupancy of the units.

1.4 The matter to be determined⁴ is therefore the authority’s exercise of its powers of decision in refusing to issue the building consent for Stage One of the remediation work. In deciding this matter, I must consider whether the proposed roof and wall repairs to the units will comply with Clause E3 Internal Moisture of the Building Code.

1.5 The matter includes consideration of compliance with Clause B2 as it relates to Clause B1, due to the structural implications associated with condensation moisture within the walls and roof.

1.6 Matters outside this determination

1.6.1 The authority has given its reasons for the refusal as being the potential for future condensation (Clause E3). Correspondence during the consent process indicates that other code requirements are either resolved or in the process of being resolved and this determination is therefore limited to the matter outlined above.

1.7 In making my decision, I have considered:

- the submissions by the parties
- reports commissioned by the applicant from the:
 - thermal performance specialists (“the thermal consultant”)
 - insulation panel supplier (“the supplier”)
- the report of the independent expert commissioned by the authority to review the documentation (“the peer reviewer”)
- the other evidence in this matter.

² A firm of architectural designers provided the plans and specifications; the documentation does not indicate one individual as being the licensed building practitioner concerned with the relevant building work and accordingly the designer is not included as party to this determination.

³ 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.

⁴ Under sections 177(1)(b) and 177(2)(a) of the Act

2. The building work

2.1 The building work consists of major remedial work to two buildings within a 75-unit apartment complex on a steeply south-sloping site. The subject building work is Stage One of remediation proposed to all of the buildings in the apartment complex.

2.2 The complex

2.2.1 Figure 1 shows the general site plan of the complex with the subject buildings outlined in red:

Figure 1: Site plan of complex



2.2.2 The complex consists of a mix of detached, semi-detached and terraced housing as shown in Table 1, with each building type similar in design, form and construction:

Table 1: Units in apartment complex (Stage One shown shaded)

Units	Building names	Building type
Unit 1 to Unit 24	Block 1 to Block 4	6-unit terrace
Unit 25 to Unit 28	Block 5	4-unit terrace
Unit 29	Unit 29	Detached building
Unit 30 to Unit 33	Block 10	4-unit terrace
Unit 34 to Unit 57	Block 6 to Block 9	6-unit terrace
Unit 58 to Unit 63	Unit 58 to Unit 63	Detached building
Unit 64 to Unit 75	Unit 64 to Unit 75	2-unit semi-detached

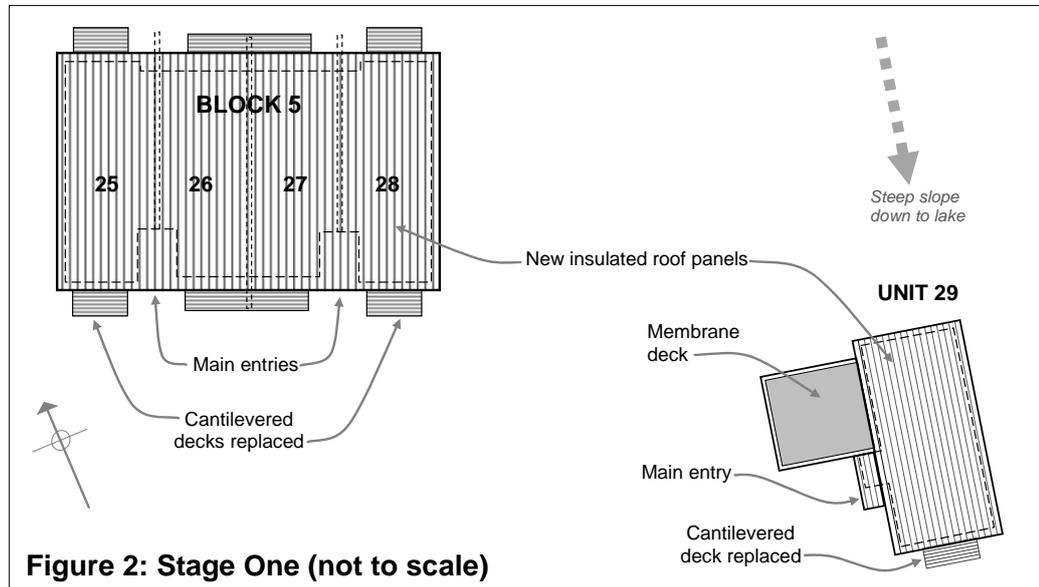
2.3 The subject buildings

2.3.1 Construction is generally conventional light timber frame, with pile foundations and timber-framed floors. The consent documents call for:

- removal of all wall claddings, building wraps, joinery, wall and roof insulation, roofing and underlays, with internal linings removed sufficiently to allow investigation and repairs to damaged framing
- removal and replacement of cantilevered decks and balustrades to all units
- (for Unit 29) removal of deck membrane and plywood substrate, investigation and repairs to damaged framing, new balustrades, membrane, substrate and insulation

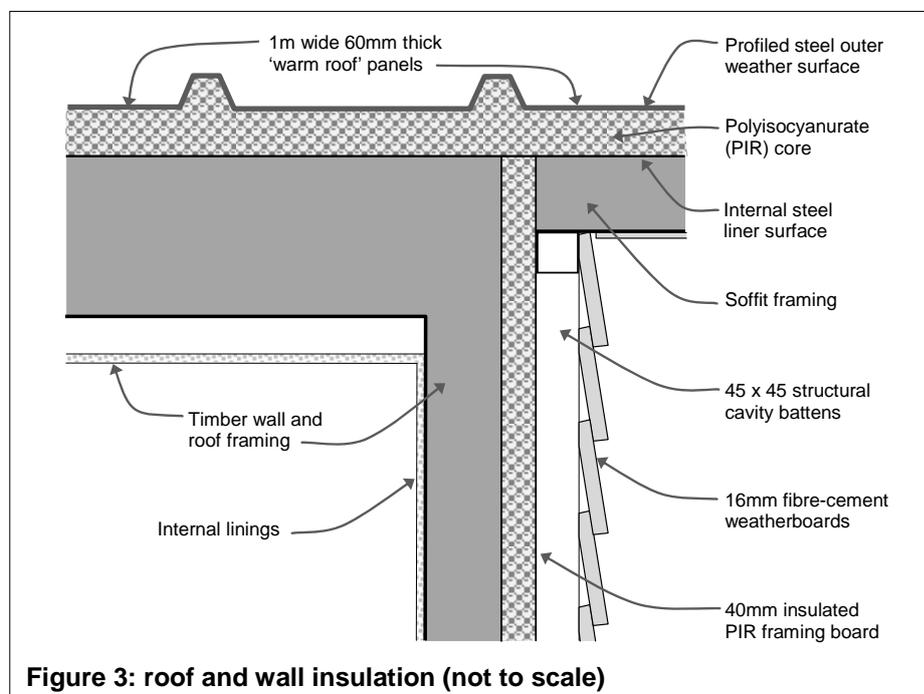
- new fibre-cement weatherboard wall claddings, new windows and doors – all installed over a drained cavity.
- for the sloping skillion roof areas, new insulated roof panels.

2.3.2 The two subject buildings are shown in Figure 2:



2.4 The insulation panels

2.4.1 The remedial work includes the installation of insulated roof panels to create a 'warm roof', with insulation board to walls as shown in Figure 3:



- 2.4.2 The sloping skillion monopitched roofs are clad in proprietary insulated roof panels. The 60mm thick proprietary roof panels have a polyisocyanurate (“PIR”) core with colour-coated steel to both faces. Walls will be insulated with 40mm thick foil-faced PIR insulation board fixed directly to the outside of the wall framing.
- 2.5 Heating and cooling is provided via heat pumps and the specification allows for ventilation of moisture sources in the form of:
- kitchen range hoods ducted to the outside
 - shower domes installed over existing cubicles
 - in-line fans to all bathrooms connected to light switches
 - exhaust grilles to dryers.

3. Background

- 3.1 The apartment complex was originally completed early in 2002 and most units were marketed to investors as managed holiday accommodation. The first indication of moisture problems were reported in the first year of occupation.
- 3.2 It appears that external moisture and condensation problems continued, with damage to wall and roof framing resulting. I have not seen when or what investigations were carried out, but it appears that repairs were carried out to some of the units.
- 3.3 The owners and Body Corporate sought compensation for the damage and necessary repairs to the complex; settlement was reached in 2014 and design work for the remediation commenced.
- 3.4 Concept designs for the project were prepared using specialist thermal performance consultants (“the original thermal consultants”), who apparently recommended⁵ that the design should allow for either a heating and ventilation system with provision for air exchange, or trickle vents to exterior joinery in bedrooms.
- 3.5 The original thermal consultants were unable to complete the work and a second thermal consultant (“the thermal consultant”) was engaged for completing the developed design. The consent documentation for Stage One was subsequently prepared and the project manager applied for a building consent on 24 February 2015.

3.6 The thermal consultant’s first report

- 3.6.1 The consent documentation included a ‘project report’ dated 4 December 2014 prepared by the thermal consultant , which included:
- thermal modelling of the proposed roof and wall construction to investigate potential for condensation, heating and thermal comfort levels – and to compare the results to those for conventional fibreglass insulation
 - steady state condensation calculations for two moisture load conditions, allowing for nine occupants:
 - high load included cooking, showering and clothes drying with no moisture extraction at source
 - low load excluded moisture from cooking, showering and clothes drying.

⁵ In a memo to the project manager that I have not seen

- compared to conventional fibreglass insulation, the proposal demonstrated that:
 - the risk of condensation would be significantly reduced
 - any moisture on the insulation panels would not affect materials
- the potential for condensation to glazing could be controlled in part by:
 - reducing moisture production via occupant density or source extraction
 - improving ventilation
 - raising indoor temperatures.

3.6.2 The thermal consultant concluded:

As condensation, both interstitial and internal has been indicated, we heavily recommend further dynamic hygro-thermal analysis.

The most successful combination is to:

- Choose the [proprietary] option for the external envelope constructions
- Reduce the moisture generation
- Ventilate well
- Maintain a warm internal temperature.

3.7 The building consent processing

3.7.1 While checking consent documentation, the authority requested additional information on a number of items and also expressed concern about the lack of automatic mechanical ventilation systems. Further information was provided by the thermal consultant and some amendments were made to the documents.

3.7.2 In letters and emails to the project manager, the authority noted (in summary):

- weathertightness had been appropriately resolved in terms of cladding types
- damage to some units had resulted from condensation forming within framing
- the original construction had been based on G4 Acceptable Solutions, using the opening of windows and some mechanical ventilation
- despite using these conventional methods, buildings did not meet performance requirements of Clause E3
- the level of condensation was believed to be largely due to:
 - ...a failure of the inhabitants of the building to actually use the windows and doors to properly ventilate the property, to address the volume of internal moisture present
- the thermal consultant's report was limited and general in nature, relying on comparing the proposed construction with conventional fibreglass insulation
- results relied on reducing moisture generation, good ventilation and maintaining temperatures (see paragraph 3.6.2) but the documentation was not clear as to how these factors are addressed
- the report also recommended further analysis, which has not been provided
- there was no producer statement for moisture control features and performance
- the information provided did not clearly show how the proposal will comply with the performance requirements of Clause E3.

3.7.3 The applicant provided further information, including (in summary):

- amended drawings and clarifications from the designer
- clarification from the thermal consultant that:
 - the modelling showed no condensation within the roof construction
 - any condensation in the wall was within the drainage cavity
 - the best result for condensation control was one air change per hour
- recommendation from insulation board supplier to add a vapour barrier between the wall board and the framing to protect against extreme conditions (I note it is not clear whether such a membrane has been incorporated)
- an undated specification from the mechanical engineer, revised to include heat pumps which would provide temperatures of about 20°, bathroom fans with run-on timers, kitchen and drier extracts.

3.7.4 In a letter to the authority dated 12 May 2015, the applicant confirmed that the Body Corporate would implement the following measures (in summary):

- occupancy rules and an inspection regime
- a 10-year residential building warranty would be taken out to cover any structural or weathertightness issues arising from the building work
- the ‘Long Term Maintenance Plan’ required under the Unit Titles Act would include an annual internal investigation to identify any deterioration
- where problems were identified, the owner would be notified and expected to address matters to satisfaction of the Body Corporate and its insurer
- the conclusion that the above approach was expected to be sufficient to protect ...owners, mortgagees, insurer and those undertaking and certifying the remedial project against the poor practices of one, or a few owners and their tenants.

3.8 The authority’s refusal to issue the building consent

3.8.1 In a letter dated 21 May 2015, the authority formally refused to issue the building consent, because the information provided in support of the application was not sufficient to allow it to be ‘reasonably satisfied that the building in its intended use’ would comply with the performance and functional requirements of Clause E3.

3.8.2 The authority identified factors it considered acceptable, noting (in summary):

- the ‘warm roof’ approach is a good system and better for condensation control
- it is a sensible approach to control some internal moisture at its sources
- the designed heating system has the potential to appropriately heat units
- the openable windows and doors comply with G4/AS1.

3.8.3 However, the authority could not be satisfied that the units, with the combination of ventilation and heating provided, would actually operate and perform satisfactorily due to the following factors (in summary):

- Thermal modelling to date relies totally on the interiors maintained at 20° and 58.6RH constantly, with expected outside conditions then applied. No modelling reflects variable indoor temperatures or lack of ventilation.

- The basic problem is how those internal conditions are maintained, as you cannot control how people heat and manually ventilate indoor areas. In reality, the temperature range is likely to fluctuate during the day and seasonally, with predominantly tenant occupants ventilating variably.
- Although the Body Corporate opted not to provide forced mechanical ventilation, a guaranteed heat recovery air change system would likely provide sufficient comfort that buildings would meet E3 to allow the authority to issue a building consent.
- The authority had sought advice from industry and BRANZ, and the feedback supported its concerns at a general level.

3.8.4 The authority noted that it had arranged for a peer reviewer to assess the appropriateness of its refusal to issue the building consent, given the particular building design and information provided, but added it ‘has to remain clear though that our current decision is to refuse to grant the building consent as it stands’.

3.8.5 The authority acknowledged the applicant’s wish to proceed with the rebuilding work and noted the options available were to choose to either:

- A. Provide more complete information to show why the current design does meet those performance requirements of the building code by satisfying the concerns raised above
- B. Amend your design to include alternative design solutions such as but not limited to forced mechanical ventilation
- C. Apply to MBIE for a determination either about our decision to refuse consent, or whether the design solution you propose meets the minimum requirements of the building code...

3.9 The thermal consultant’s second report

3.9.1 Following the authority’s refusal, additional information was provided by the thermal consultant, including a ‘project report’ dated 28 May 2015, which included the results of additional modelling carried out using ‘Thermal Analysis Simulation software’ (“TAS”) under the following additional sets of conditions:

- changing indoor temperatures
- changing air changes per hour
- changing occupancy
- moisture extracted at source in all cases.

3.9.2 The TAS modelling allowed for worse case scenarios with greatest potential for diffuse water vapour to be identified and then used as parameters for steady state analysis. Modelling resulted in:

- no evidence of condensation within unventilated spaces within walls and roofs
- any potential for condensation occurred outside the structural building line.

3.10 The peer review

3.10.1 As outlined in paragraph 3.8.4, the authority provided the relevant documentation to the peer reviewer, who reported to the authority on 10 June 2015, noting that the review had been carried out against the objectives, functions and requirements of Clause E3 of the Building Code.

3.10.2 The peer reviewer noted that some independent consultants engaged by the applicant had made recommendations that could demonstrate compliance of the proposal, but these recommendations were not reflected in the documentation. The report included the following comments (in summary):

- TAS software used for moisture modelling has limits on two dimensional analysis capabilities, so the data generated may not fully account for effect of moisture diffusion properties of insulating panels⁶.
- The steady state analysis showed condensation may form on the inner face of the external metal skin of roof panels, and this can significantly decrease overall thermal performance.
- The TAS modelling focused on the projected dew point location and the prevalence of condensation, rather than the effect of internal moisture on construction elements, building surfaces, and other items given the lack of vapour diffusion through the wall and roof insulation panels.
- The habitable spaces within the units are expected to sometimes reach more than 70%RH, which would be conducive to mould growth and/or decay regardless of condensation. This is particularly concerning during winter with high internal temperatures and occupants not wanting to open windows.
- Documentation included a memo in June 2014 from the original thermal consultants, which recommended the inclusion of a HVAC system to provide air changes to address moisture, or the provision of trickle vents (passive ventilators) to windows in bedrooms. Neither recommendation was included.

3.10.3 The report concluded that, having reviewed the documentation provided:

...it is the opinion of this company that if constructed as reviewed there will be inadequate provision for dealing with the volume of internal moisture likely to be generated as a result of the occupancy of the units.

Accordingly I conclude that [the authority] has acted appropriately in its decision to decline issue of a Building Consent until such time as the applicant has demonstrated an effective means of meeting the performance criteria of NZBC clause E3.3.1.

3.11 It appears that approval was given to commence demolition work; and the applicant reports that cladding has been removed from the units, with the assessment of the timber damage completed and expected to be reported on by 29 June 2015.

3.12 The applicant applied for a determination on 26 June 2015.

4. The submissions

4.1 In a letter to the Ministry dated 23 June 2015, the applicant set out the background to the situation, noting that ‘initial investigations indicated that the roof and wall framing of the units had deteriorated as a result of water entering from the exterior of the building and condensation being trapped inside the wall and roof cavities.’ A timber assessor had noted evidence of moisture damage in places where there is no evidence of external penetration. Damage was within walls, where condensation moisture was trapped within fibreglass insulation, and within roof spaces, where

⁶ The report suggested WUFI as a more appropriate modelling tool for the materials and conditions. (WUFI was developed in Germany but is also adapted for local conditions in a number of countries, including in New Zealand. The program analyses heat and moisture changes over time in building envelopes and predicts when condensation will occur and how much within wall or roof assembly over a period of time; identifying potential moisture problems caused by design, or material use.)

moisture had condensed on the underside of the roofing and underlay, and penetrated into framing timbers.

4.2 The applicant noted that removing the possibility of condensation within walls and roofs were key aspects of the remedial design; noting the following (in summary):

- The thermal consultant identified the location of the dew point as the primary cause of interstitial condensation. The original construction resulted in dew points within wall fibreglass insulation board and on the underside of roofing.
- The proposed approach is to use ‘warm wall and warm roof construction which places the insulation outside the framing’, and modelling revealed no condensation in the roof structure, and any moisture in walls within the drainage cavity.
- In addition, the design focuses on managing moisture generation at source. Although forced ventilation was considered at concept design stage, thermal modelling showed this was unnecessary by managing moisture at sources.
- As many units are tenanted, some for short periods over the ski season, there can be no assurance that occupants will in fact use mechanical ventilation. The proposed source management is less dependent on occupant intervention.
- Although owners accept that cost cannot be a factor when considering compliance, they would like to avoid additional, unnecessary costs. The Body Corporate has committed to a warranty that will involve an inspection regime.

4.3 The applicant forwarded copies of:

- the consent drawings and specifications, including amendments
- relevant correspondence with the authority
- reports and correspondence from the thermal consultant
- the peer review report dated 10 June 2015
- technical information on proposed products.

4.4 Copies of the submission and information were provided to the authority, which made no further submissions in response.

4.5 The submissions in response to the draft determination

4.5.1 A draft determination was issued to the parties for comment on 7 July 2015.

4.5.2 No response was received from the owners of the other remaining units, or from the designer, despite reminders being provided to do so.

4.5.3 In emails on 16 July and 20 July 2015 respectively the authority and the project manager accepted the draft without further comment.

4.5.4 In a letter dated 27 July 2015, a consultant also acting on behalf of the applicant requested a number of amendments to the determination and clarification of certain points (in summary):

- The references to ‘short term holiday accommodation’ in the determination should be altered. Many units are rented to seasonal workers, but the units are not rented to holiday makers.

- The decision not to provide forced ventilation was based on advice received by the Body Corporate (refer paragraph 3.8.3).
- The designer still holds the view that the solution ‘required by [the authority] exceeds the minimum requirements of the Building Code, stating that ‘We have demonstrated there is no possibility of condensation forming in the framed roof and wall cavities’.

4.5.5 In an email on 30 July the authority provided a response to the consultant’s letter, accepting minor changes to wording regarding the type of accommodation provided, but disputing that the designer had demonstrated ‘no possibility’ of condensation. The authority noted the designer’s analysis showed reduced potential and was based on certain conditions and steady state assumptions with the anticipated use of manually operated extract fans.

4.5.6 The agent for the applicant emailed on 4 August 2015, also agreeing with the minor changes to wording regarding the type of accommodation provided.

5. Compliance of the proposed remediation work

5.1 Many of the units in the complex are used as rental accommodation during the ski season, and wall and roof details have been specifically designed to allow for very cold conditions. The repairs therefore do not incorporate conventional insulation materials and methods covered in the Acceptable Solution E3/AS1. The commentary to paragraph 1.1.3 of E3/AS1 states

Surface condensation can be a problem where vapour barriers are needed for ... buildings in a very cold environment such as ski lodges and mountain huts.

These situations are not covered by this Acceptable Solution and require specific design.

5.2 I note that the commentary is in respect of surface condensation, however I consider the same would apply in respect of interstitial condensation. Accordingly I have considered the proposed building work only in terms of the performance requirements of Clause E3.

5.3 I note that the parties are in agreement that, under these particular circumstances, the proposed insulation materials and methods are expected to be more effective in mitigating condensation than the more conventional methods used in the original construction. I accept that view.

5.4 Although the proposed construction details demonstrate reduced condensation risk in comparison with the original construction methods, the overall proposal must also demonstrate that condensation risk is reduced to a level sufficient to comply with the performance requirements of Clause E3, taking into account expected thermal conditions and occupancy.

5.5 The clause requirements

5.5.1 In regard to the subject building work, Clause E3.2 requires that building work must avoid the likelihood of fungal growth or damage to building elements being caused by the presence of internal moisture. In order to achieve those functional requirements, E3.3.1 requires that:

An adequate combination of thermal resistance, ventilation and space temperature must be provided to all habitable spaces, bathrooms, laundries, and other spaces where moisture may be generated or may accumulate.

5.5.2 In the case of these units, the matter in dispute is whether the generation of moisture within the units, under anticipated occupancy, will be adequately controlled to avoid the risk of condensation generated causing fungal growth and damage to building elements within concealed spaces.

5.5.3 In order to consider that question, I must take into account:

- the occupancy expected in many of the units
- the past history of damage to the buildings
- the provisions proposed for reducing the risk of condensation in the units.

5.6 The site and the original construction

5.6.1 When considering the background and circumstances that gave rise to the major remediation work proposed for the apartment complex, I make the following observations on the matter in dispute based on the information available to me:

- The parties agree that damage to timber wall and roof framing resulted in part from the entrapment of condensation moisture within the framing, and investigations to date have confirmed that to be the case.
- The original construction used conventional insulation and methods, with ventilation apparently in compliance with the Acceptable Solution G4/AS1. However that combination has proved inadequate.
- This region experiences extremely cold temperatures, which may stay below freezing for extended periods. Condensation may have accumulated and frozen on the underside of the steel roof cladding and within wall cavities, then, as temperatures rose, thawed and dripped onto underlying framing.
- This complex has south-sloping monopitched roofs and is built on a steep south-facing slope, resulting in a situation where the lack of sun means that temperatures are likely to stay below freezing for extended periods during winter months; so increasing the accumulation of condensation in the form of ice.
- A similar design and construction in the same climatic conditions but with a north-facing site and roof would likely have suffered fewer problems because accumulation of ice would have been limited by more frequent thawing, leading to smaller quantities of moisture to be dispersed.
- Following completion of the complex in early 2002, many units were let as managed seasonal rental accommodation, with the problems reported following the first winter when units were rented during the ski season. The pattern of occupancy in combination with the climatic and site conditions continued over the following years, with significant damage as a result.

5.7 The proposed provisions for reducing condensation risks

5.7.1 The authority maintains that the provisions for ventilating the units by managing moisture generation at the sources is inadequate, given the volume of internal moisture likely to be generated as a result of the occupancy of the units.

5.7.2 On the basis of the information provided, the peer reviewer accepted the authority's concerns and considered that habitable spaces would sometimes reach high levels of relative humidity, in particular during winter with high internal temperatures and when occupants are less likely to open windows.

5.7.3 The applicant maintains that providing forced ventilation is unnecessary because moisture generation is managed at its sources, which is less dependent on occupants. Maintenance of the complex will also include annual inspections.

5.7.4 I make the following observations about the proposed remedial work:

- Products and materials specified for the work appear appropriate for the purposes and the specification calls for work to comply with the relevant standards and manufacturers' instructions. These are not in dispute.
- Given the location of the complex, short-term occupancy during the ski season will continue for the foreseeable future. Management of condensation risks must therefore continue in order to protect the wall and roof structure of the buildings for a minimum of 50 years, which is well past the 10 years anticipated for a warranty and inspection regime.
- Clothes driers are ducted and bathroom ventilation is 'automated', so moisture from ablutions will be extracted. However other habitable spaces rely on intervention by occupants; with extreme temperatures combined with the lack of winter sunshine making it unlikely that occupants will open windows to reduce humidity levels. It is also likely that during the ski season items of wet clothing and ski equipment that cannot go into a drier will increase internal moisture levels.
- Short term occupants during the ski season are also likely to include those from warmer locations both nationally and internationally – where higher temperatures are normal and high humidity levels may not be considered unusual or a reason for intervening by ventilating the dwellings.
- Short term/seasonal tenants are also expected to be away from the units during the day, with no provision for automatic ventilation of the internal spaces via automatic ventilation or passive ventilators to windows.

5.8 Conclusions

5.8.1 Based on the above, and taking into account the particular circumstances of the units, their occupancy and location; I am not satisfied that the ventilation measures proposed for the units will adequately manage the generation of internal moisture during the coldest months of the year. I am therefore not satisfied that the proposed remediation work will comply with Clause E3 of the Building Code.

5.8.2 In addition, the required durability period for the underlying wall and roof structures is a minimum of 50 years. Because the lack of automatic ventilation measures may allow condensation moisture into the framing, the building work also does not protect the framing adequately for it to comply with the durability requirements of Clause B2 insofar as it applies to Clause B1.

6. The decision

- 6.1 In accordance with section 188 of the Building Act 2004, I hereby determine that there is insufficient evidence to establish on reasonable grounds that the proposed building work would comply with Clause E3 of the Building Code and accordingly, I confirm the authority's refusal to issue a building consent.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 7 September 2015.

John Gardiner
Manager Determinations and Assurance