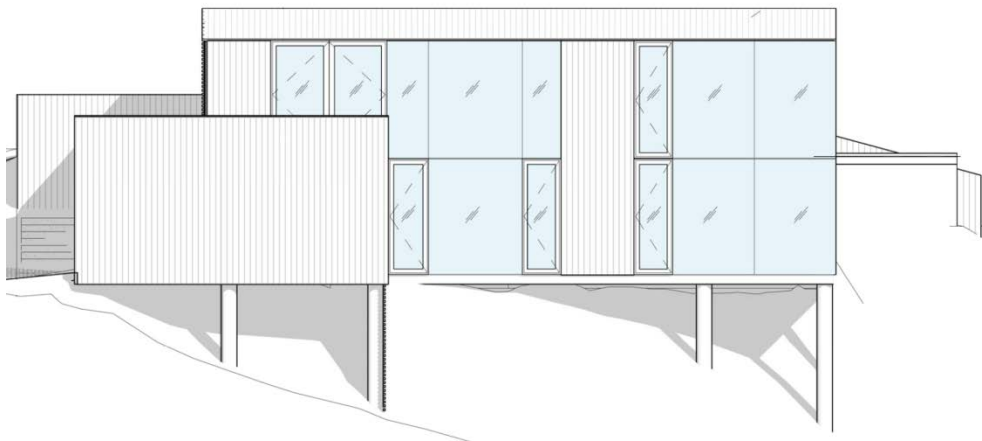




Determination 2018/040

Regarding the refusal to issue a building consent in respect of a fixed glazing system at 6 Island Bay Road, Beach Haven, Auckland



Summary

This determination considers whether the authority correctly exercised its powers in refusing to issue a building consent for a new house with a fixed glazing system.

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, Katie Gordon, Manager Determinations, 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 building, C Walls (“the applicant”)
 - Auckland Council (“the authority”), carrying out its duties as a territorial authority or building consent authority.
- 1.3 The determination arises from the authority’s request for further information regarding the compliance of fixed glazing panels, and purported refusal to issue the building consent. The authority is not satisfied the proposed building work complies with certain clauses² of the Building Code (First Schedule, Building Regulations 1992) in particular the structural integrity and weathertightness of the fixed glazing panels.

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.

- 1.4 The matter to be determined³ is whether the authority correctly exercised its power of decision by purportedly refusing to grant the building consent in respect of the original fixed glazing system's compliance with Clauses B1 Structure and E2 External moisture. In deciding this matter, I must consider whether adequate information had been supplied to the authority to establish compliance with the Building Code.
- 1.5 In making my decision, I have considered the submissions of the parties, and the reports of the experts commissioned by the Ministry to advise on this dispute, and the other evidence in this matter.

2. The building work

- 2.1 The proposed building is a two storey house located in an Extra High wind zone⁴. The house is proposed to be clad with vertical shiplap cedar weatherboards and fixed glazing panels. The structure comprises cross-laminated timber walls and floors on the first floor. The foundations consist of concrete piles, and concrete retaining walls to the ground floor, which are already under construction.

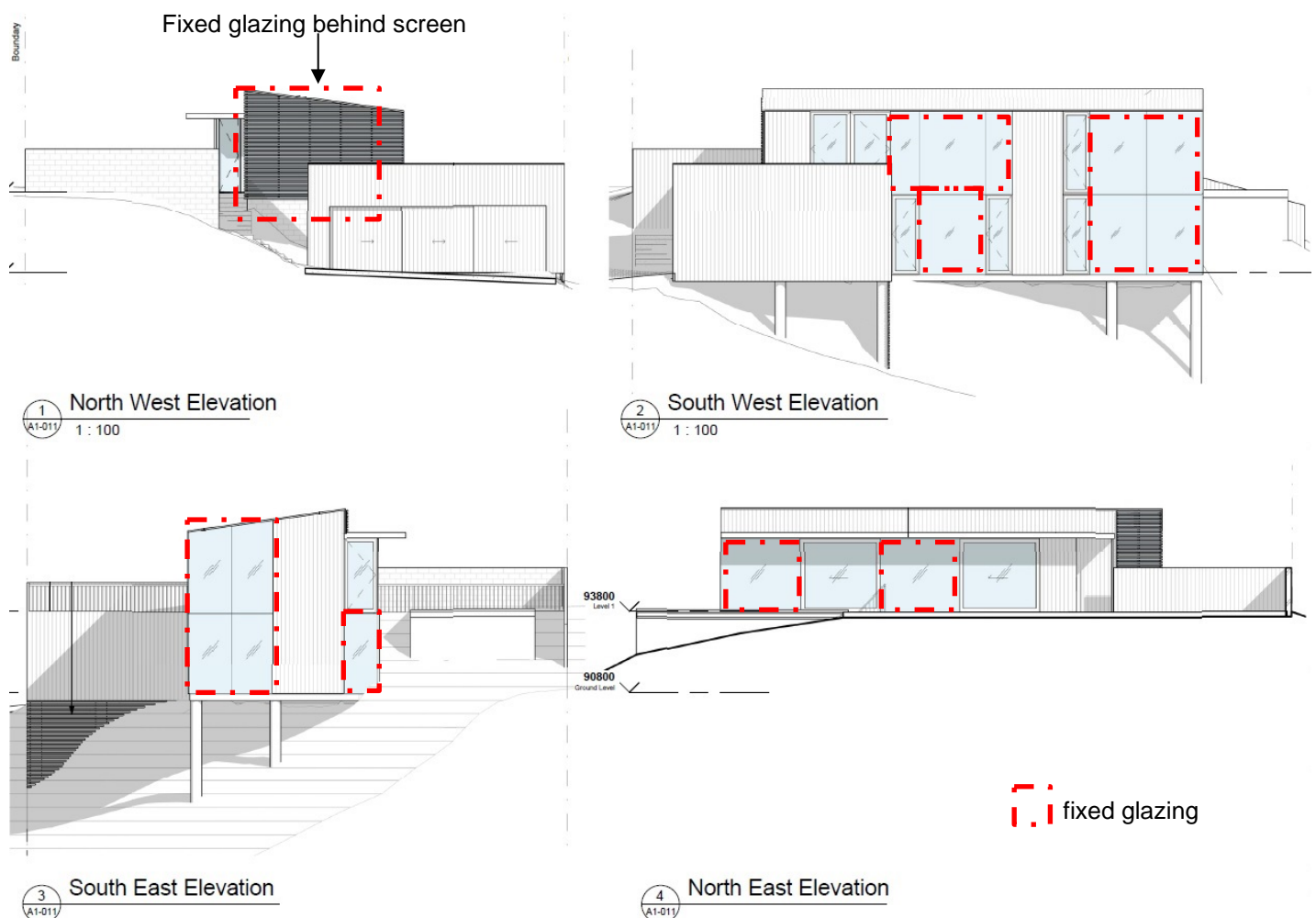


Figure 1: Elevations showing location of fixed glazing (not to scale)

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

⁴ Wind zones as defined in NZS 3604:2011 Timber-framed buildings.

2.2 The original fixed glazing system

2.2.1 The original fixed glazing system is intended to be installed on all elevations of the house, and range in height from 3.0m to 3.8m, and widths of 1.0m to 2.4m (refer Figure 1). The glazing manufacturer designed the type and thickness of double glazed insulated units, as well as the size of the structural sealant bite⁵. The applicant designed the remainder of the original fixed glazing system, which included the joinery and fixings.

2.2.2 The producer statement (PS1) provided by the glazing manufacturer in respect of the glazing units states the fixed glazing panels have double sided structural tape and structural silicone sealant (“structural sealant”), with a weatherseal (“waterproof sealant”) from a single named manufacturer. Structural sealant is used to secure the glass in place. The consent drawings detail the “typical glazing unit sealing” as:

6mm min. continuous [proprietary] silicon sealant on PEF^[6] rod all round to outside and continuous [proprietary] silicon sealant to inside.

2.2.3 The original fixed glazing system comprises:

- Double glazed insulated units. The units comprise 8mm toughened⁷ glass, 16mm air gap, 10mm toughened glass, with a total thickness of 34mm). The consent drawings show low E laminated glass⁸.
- Structural sealant and double-sided structural tape that fix the double glazed insulated units to the aluminium joinery sections (although I note this is not shown in the consent drawings).
- Aluminium joinery sections. The aluminium sections are various aluminium angles and T sections, some are dimensioned, and one section is referred to as a “T6 PC” glazing section.
- Various screws and anchors that fix the aluminium joinery sections to the cross-laminated timber and concrete structure.

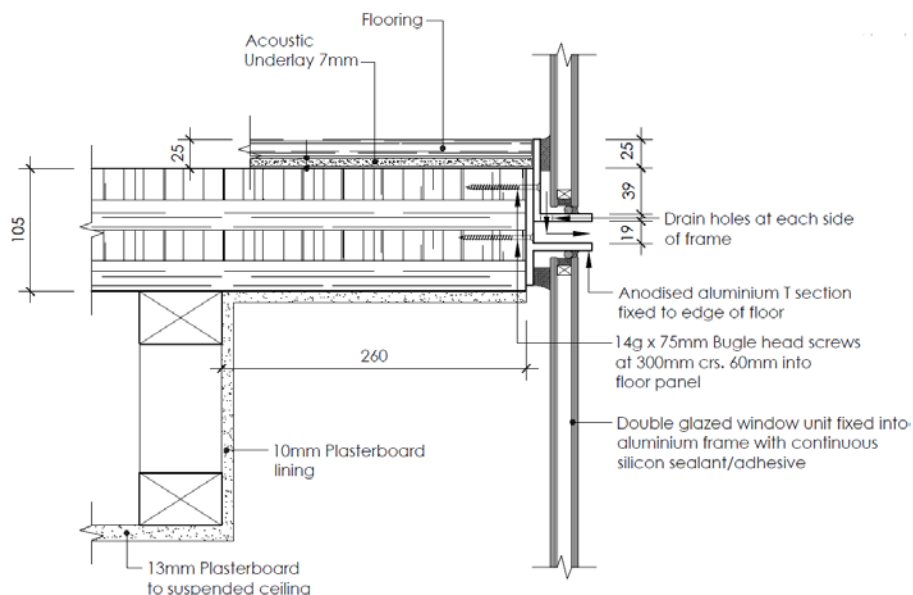


Figure 2: Head and sill detail of the original fixed glazing system (not to scale)

⁵ The “bite” refers to the depth of the structural sealant

⁶ Polyethylene foam

⁷ Toughened glazing is a type of safety glazing that has been strengthened by treating it with either chemicals or heat.

⁸ Low E is a type of coating that is applied to glazing to minimise the amount of infrared light and ultraviolet light that passes through.

Laminated glazing is a type of safety glazing that has a polyvinyl butyral interlayer between two or more sheets of glass, which have been laminated together by heat and pressure.

2.3 The modified fixed glazing system

2.3.1 Following the issue of a draft determination the original fixed glazing system was amended to the modified fixed glazing system. The modified design included substantive alterations to the aluminium joinery sections and structural sealant as shown in Figures 3 and 4 below.

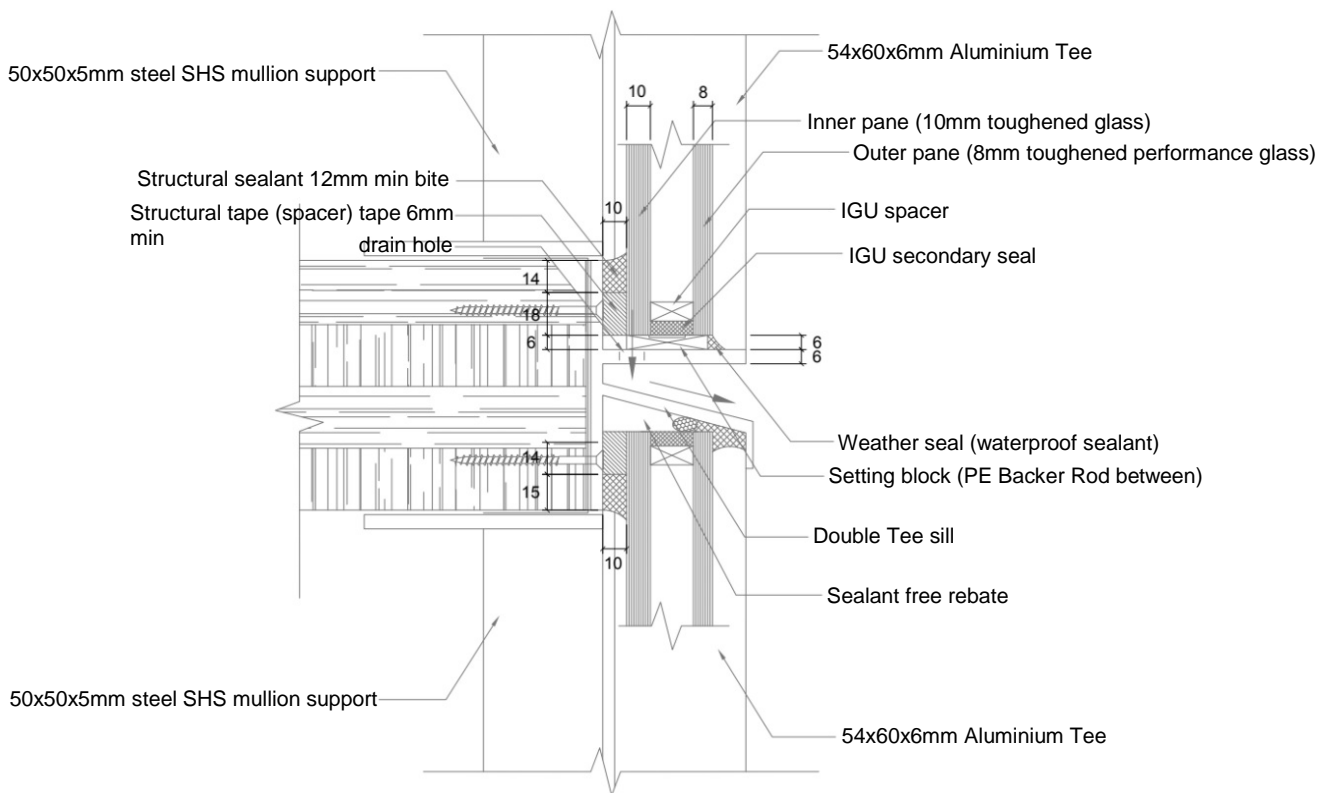


Figure 3: Typical sill detail of the modified fixed glazing system (not to scale)

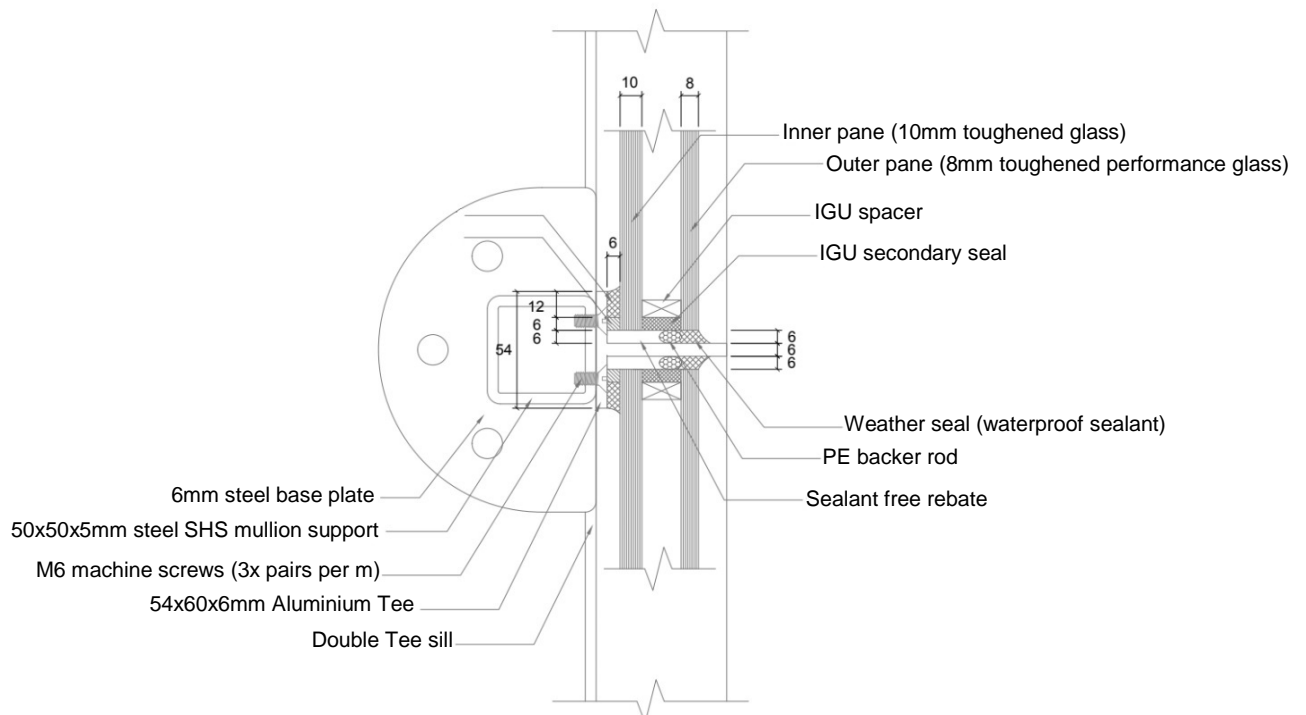


Figure 4: Typical section of the modified fixed glazing system (not to scale)

- 2.3.2 The applicant engaged a structural engineer (“the applicant’s structural engineer”) to review the fixed glazing system. The alterations are as follows:
- new 50x50x5mm steel SHS mullion support, which is attached to a 6mm steel base plate
 - revised aluminium joinery design, with 54x60x6mm aluminium tee and a double tee sill
 - M6 machine screws into the SHS⁹ mullion support
 - additional structural sealant and the inclusion of waterproof sealant.
- 2.3.3 After the expert’s report was sent to the parties, the applicant submitted another revision of the documentation that mostly consisted of drawing revisions to ensure consistency (see paragraph 5.9). The details in Figure 3 and 4 were unaffected by the second revision.

3. Background

- 3.1 The proposed building is being constructed over two stages. The first stage “Stage 1” for the foundations and retaining walls has been consented by the authority. The building consent application for “Stage 2” to construct the remainder of the building was submitted to the authority in October 2016.
- 3.2 It is my understanding further information was requested by the authority and there was correspondence between the applicant and authority. However, I have not been provided with this correspondence.
- 3.3 In a letter dated 4 August 2017, the authority sent a request for information letter which, among other items, stated its concerns regarding the aluminium joinery sections. The authority stated apart from the WANZ¹⁰ “Quality Assurance and Diagnostic water leakage field check in accordance with AAMA 501.2” (“the WANZ test”) no further information had been provided to demonstrate compliance with the Building Code. It noted a standard the applicant could use to test the fixed glazing system was NZS 4211¹¹, noting it tested more than weathertightness.
- 3.4 The authority also recommended the proposed alternative solution¹² should be peer reviewed, or alternatively the applicant could apply for a determination.
- 3.5 On 9 August 2017 the applicant responded seeking clarification regarding the specific information the authority required. The applicant also stated it could view the test window used in the WANZ test in person.
- 3.6 On 10 August 2017 the applicant sent additional information to the authority responding to its request for information. The applicant also stated all information requested by the authority had been provided, testing has been carried out and there was no other “facet of the design that needs to be considered unless you can inform me otherwise”, and listed the following information that had been supplied:
- specification of glass
 - specification of structural sealant

⁹ Square hollow section

¹⁰ Windows Association of New Zealand.

¹¹ New Zealand Standard NZS 4211:2008 Specification for performance of windows.

¹² An alternative solution is all or part of a building design that demonstrates compliance with the Building Code, but differs completely or partially from the Acceptable Solutions or Verification Methods.

- structural sealant manufacturer’s approval
- glazing manufacturer’s calculations and PS1 (I note this specifically excludes any aluminium joinery sections, and specifies the minimum “bite size” and “glue line” dimensions for the double-sided structural tape and structural sealant as both 12mm)
- applicant’s structural engineer’s calculations and PS1 (I note this did not include the aluminium joinery sections supporting the glazing)
- the WANZ test results
- “Certificate of design work” provided by a licensed building practitioner, for work including ‘fixed window joinery’ (i.e. the fixed glazed panels).

3.7 The applicant also stated the following had been taken into account in the design of the fixed glazed system:

- Seismic moment
- Safety from falling
- Extra High wind zone
- Live and static loads considering flooring deflection
- Required site conditions specified for install
- Watertightness
- Maintenance
- Joinery drainage and water deflection

3.8 In a letter dated 21 August 2017 the authority responded there were considerations other than weathertightness that the window joinery needed to satisfy. It suggested the applicant consider the requirements set out in NZS 4211.

3.9 The Ministry received an application for a determination on 23 August 2017.

4. The submissions

4.1 The applicant included a submission that stated (in summary):

- the benefits and detractions of the fixed glazing system
- the authority continues to request additional information without clarifying the specific information required
- the window frames are a “simple” alternative solution
- the design is similar to other glazed joinery, with a different shape for the aluminium to limit thermal bridging and allow for the use of “off-the-shelf” extrusions
- the applicant designed the fixed glazing system under the guidance of a licensed building practitioner¹³: Design 1.

4.2 The applicant provided copies of the following documents:

- the building consent application - Stage 2
- specifications for the structural sealant

¹³ I note the licensed building practitioner’s licence was suspended at the time of the determination application.

- structural engineer’s calculations, and Producer Statement (PS1)
 - the licensed building practitioner’s Certificate of design work
 - glazing manufacturer’s calculations, drawing, and PS1
 - the consent drawings of the proposed building work
 - examples of proprietary structural glazing systems
 - watertight results test report for the original fixed glazing system.
- 4.3 On 5 September 2017 I requested additional information regarding the structural sealant, the applicant’s response to the authority’s requests, and any information supporting the alternative solution proposal for the original fixed glazing system.
- 4.4 On the same day the applicant responded with the information supplied to the authority. The applicant stated the joinery was “supported by the structure of the building”, and use of the structural sealant was covered by the glazing manufacturer’s PS1.
- 4.5 The authority acknowledged the determination application but made no submission at that time.
- 4.6 A draft determination was issued to the parties for comment on 10 November 2017.

4.7 Responses to the draft determination

- 4.7.1 On 24 November 2017 the authority responded that it accepted the draft determination with non-contentious amendments.
- 4.7.2 On 1 February 2018 the authority provided the following comment:
- E2/VM1¹⁴ is not a test of the joinery but of the junction between the joinery and the cladding.
- 4.7.3 Later that same day the applicant made a submission in response to the draft. The original fixed glazing system had undergone testing, which the applicant stated was in accordance with AS/NZS 4284¹⁵ and E2/VM1. The test report stated as follows:
- The test sample was constructed at a smaller scale, at approximately 710mm wide by 970mm high but using the same components as proposed in the building consent documentation.
 - The test on the sealant was to E2/VM1 paragraph 1.4.1, 1.4.2, and 1.4.3. The sequence was repeated after parts of the external sealant and inner sealant were removed as stated in AS/NZS 4284 paragraph 8.10.
 - The cladding junctions at the head, sill, or jambs were not tested.
 - The sample has been subjected to the pressures and sequences from E2/VM1, although drilling 6mm holes in the sealant was not possible. So, instead the seal degradation test from AS/NZS 4284 paragraph 8.10 was used.
 - The sample was exposed to the preconditioning test from E2/VM1 paragraph 1.4.1. Then the following series of tests were undertaken:

¹⁴ Verification Method E2/VM1.

¹⁵ Australian/New Zealand Standard AS/NZS 4284:2008 Testing of building facades.

Test	Test description	Sample condition	Observation
Preconditioning	N/A	N/A	No visible damage or deformation
Series 1 Static Pressure water penetration and Cyclic Pressure Water Penetration	N/A	Pane 1 – no sealant degradation	No water penetration
Series 2	Panes 1 – 3 areas of weather sealant removed from both jambs and in the middle of the seal approximately 30mm by 2-3mm wide by 30mm in depth. Series 1 tests were repeated.	Pane 1 – outer sealant degraded	No water penetration
Series 3	Pane 1 – 30mm long section of inner structural sealant was removed and water tests repeated.	Pane 1 – outer and inner sealant degraded	Significant water penetration
Series 4	Pane 2 – inner structural sealant only was removed in a similar manner as before and Series 1	Pane 2 – inner sealant degraded	No water penetration

4.7.4 In his submission the applicant outlined the following:

- The original fixed glazing system had passed its testing.
- A proposal to undertake the WANZ test on the as-built system as part of a condition on the consent.
- The drawings had been revised by inserting additional flashings and correcting the errors and inconsistencies.
- The structure supporting the glazing had been verified by the applicant's structural engineer.
- A maintenance schedule for the building had been created.
- The compatibility testing is performed on samples of the material that will actually be used for the specific project. To perform this test on any other material would be unnecessary.
- Design approval from the sealant manufacturer had been received and the glazing manufacturer's PS1 has been revised. The sealant manufacturer also confirmed the type of structural sealant that is appropriate to use in wet areas and in contact with tiles.

4.7.5 The applicant also included copies of the following documents:

- the PS1 and calculations from the applicant's structural engineer for "Window Fixings & Supports New Dwelling"

- revised PS1 and drawings ‘approved’ by the glazing manufacturer
- the test report
- drawings ‘approved’ by the structural engineer
- revised drawings.

4.7.6 On 13 February 2018 the applicant provided comment comparing E2/VM1 and NZS 4211.

5. The expert’s report

5.1 General

5.1.1 As mentioned in paragraph 1.5, I engaged two independent experts to assist me after the draft determination was issued. The first expert is a Registered Architect (“the expert architect”) and the second expert is a Chartered Professional Engineer (“the expert engineer”). The report was written by the expert architect and included the review provided by the expert engineer.

5.1.2 The experts reviewed the modified fixed glazed system documentation, including the drawings and calculations. The experts were engaged to provide comment on the compliance of the fixed glazing system, particularly in relation Clauses B1 – Structure and E2 – External moisture.

5.2 Site fixing structural glazing

5.2.1 The proposal for four sided structural glazing relies entirely on the structural sealant to glue the heavy glass units onto the building. The expert architect noted the usual method is to attach glazing units to the joinery in a factory. The units are then mechanically fixed to the building on site and this creates a seal between the joinery. This process is to enable the critical operation of applying the structural sealant to be carried out in a clean and controlled environment.

5.2.2 The expert architect considered specific and onerous quality assurance procedures are required to ensure a clean and controlled environment during glazing to comply with the Building Code. He noted these procedures were not clearly specified in the application.

5.3 Revised documentation

5.3.1 The expert architect reviewed the modified drawings, provided 11 February 2018, and made the following observations:

- the modified drawings did not consistently show the 50x5x5mm SHS mullion supports
- the glazing manufacturer’s PS1 identified one type of structural sealant, but the drawings referred to a different type of structural sealant
- references to structural sealant being applied over backing rod should be amended to specify it over the structural glazing tape
- the specification for the structural glazing tape had not been provided
- the revised drawings had not been updated to incorporate the applicant’s structural engineer’s calculations

- there is no detail indicating how the SHS mullion supports would be fixed to the top and bottom of cross laminated timber floor panels
- the structural glazing tape seemed to be inadequately sized
- there was a lack of details describing the connection or sealing of vertical elements of the aluminium joinery to the horizontal joinery.

5.4 Tolerance

5.4.1 The window joinery is shown as fixed to the floor structure with no provision for adjustment to accommodate the building tolerances. The applicant advised the expert architect the concrete slab edge had been surveyed and found to be straight. Also, the cross-laminated walls will be accurately cut with a CNC¹⁶ cutting machine and he expected the support elements to be fixed within a 2mm tolerance. The expert raised some concerns regarding the accuracy required.

5.4.2 The expert architect was of the view the documentation should reflect how “normal” building tolerances are to be achieved.

5.5 Structural glazing tape

5.5.1 Based on the proposed design the available width for the structural glazing tape is 4.5mm. The expert architect noted suitable tapes appear to be 10.5mm wide or more, and it is unclear whether a 4.5mm wide tape would provide sufficient fixing for the glass while the structural sealant is curing.

5.6 Clause E2 weathertightness test

5.6.1 The expert architect reviewed the additional weathertightness testing results provided by the applicant. The sample was tested under E2/VM1 paragraphs 1.4.1, 1.4.2 and 1.4.3 (see Appendix A). The expert architect raised the following issues:

- The procedures of AS/NZS 4284 (required by paragraph 1.1 of E2/VM1) were not all followed. The report did not include a full description of the sample, rate of water applied etc.
- The sample size was 710mm x 970mm high, whereas a minimum sample size of 2400mm x 240mm is required in paragraph 1.3 of E2/VM1.
- The Verification Method is for determining compliance of cladding systems and associated window and door junctions only. He noted the authority is concerned with the performance of the windows and the aluminium joinery.

5.6.2 However, the expert architect considered the tests carried out were similar to tests in AS/NZS 4284 and AS/NZS 4211¹⁷. Therefore, these tests could be used as evidence of the performance of the windows as an alternative solution.

5.6.3 The expert architect contacted the testing facility who provided the following comments:

- The sample was delivered to them and installed in their pressure chamber.
- The cladding junctions were not tested because the purpose of the test was to evaluate the glazing. Also the weatherboards were “tacked on” rather than being fixed as they would be on site.

¹⁶ Computer numerical control

¹⁷ New Zealand Standard NZS 4211:2008 Specification for performance of windows.

- Water was applied to the sample during the test using six nozzles with a distribution as shown in NZS 4211 (Figure B1). The entire sample and junctions were wetted. However, it was not a requirement to test the junctions so the building wrap and flashings were not removed to examine for signs of leakage. The rate of application of water was not metered or recorded.

5.6.4 The expert architect compared the test undertaken with the requirements of NZS 4211 for windows, which if followed, would be deemed to comply with Clause E2 (based on paragraph 9.1.10 in E2/AS1¹⁸). He concluded the tests, in conjunction with the applicant's structural engineer's calculation of deflection, appeared to indicate the sample satisfies NZS 4211 (and E2/AS1), and therefore complies with Clause E2. However, the expert architect identified two outstanding issues:

- the sample was too small to represent the larger windows
- the rate the water was sprayed onto the windows was not recorded.

5.6.5 Therefore, the expert architect considered the proposed WANZ testing (see paragraph 4.7.4), if done under pressure, would provide adequate evidence of the performance if the fixed glazing system passed.

5.7 Clause B1

Structural calculations and drawings

5.7.1 The expert engineer reviewed the calculations and revised drawings. His review identified additional calculations and alterations necessary to establish compliance with Clause B1, including:

- the drawings needed to be amended to clarify 50x50x5mm SHS posts will be fitted behind all mullions
- new fixing details and calculations are required where the SHS posts will be fixed to the bottom and top of the cross-laminated timber floor
- the edge fixing distances required increasing
- a calculation check of the sill joinery, noting the joinery is subject to bending
- the calculations need to take into account that the fixings are subject to shear force due to the weight of the glazing, and in some instances also subject to tension
- a calculation of the structural bite to determine the length of the sealant
- an alteration to the mullion design to allow sufficient width for both the glazing tape and structural sealant as specified.

Glass manufacturer

5.7.2 The expert architect reviewed the PS1 provided by the glass manufacturer and made the following comments:

- The PS1 requires three drain holes in accordance with NZS 4666¹⁹ and the drawings indicate two drain holes.

¹⁸ An Acceptable Solution is a "deemed-to-comply" solution. A proposal that satisfies an Acceptable Solution must be accepted by a building consent authority as complying with the Building Code.

¹⁹ Australian/New Zealand Standard AS/NZS 4666:2012 Insulating glass units.

- The approval of the structural sealant manufacturer should be provided before the building consent is issued to ensure the proposed “bite and glue line sizes” are accurate.
- The adhesion testing should be obtained before building consent is issued to ensure any special provisions, e.g. primer requirements, are identified.
- The PS1 notes two types of glazing. The drawings should clearly identify the interior and the exterior glass type.
- A note regarding the structural sealant and the glazing manufacturer’s requirements, as stated in the PS1, should be included in the building consent documentation.

5.7.3 The expert architect noted the PS1 had a limitation requiring a review and approval by the sealant manufacturer, which did not appear to have been carried out. He noted the process of review could generate changes and so should be carried out before building consent was sought.

5.8 Conclusion

5.8.1 The experts reached the following conclusions:

- Compatibility tests and a review of the structural sealant glazing details required by the sealant manufacturer should be carried out and results submitted before the consent is issued.
- The testing was carried out using methods intended for window junctions rather than windows themselves, and provided incomplete evidence of the reasonable performance of the sample. The sample tested was considerably smaller than the proposed window sizes and not fully representative. However, if the proposed onsite WANZ testing includes pressure testing, and is successful, this would provide adequate evidence of performance.
- Additional structural calculations are required, specifically the edge distance of some fixings needed to be increased, amongst other issues identified in paragraph 5.7.1 of this determination.

5.8.2 The experts also noted the following amendments were required to clarify issues:

- all mullions are to have 50x50x5mm SHS sections behind them and this should be reflected in the drawings
- framing junction details where vertical and horizontal members meet
- specification provided or notes added to the existing drawings regarding the construction process of the fixed glazing system
- revised drawings as per paragraph 5.3.1 of this determination.

5.9 Response to the expert’s report

5.9.1 On 5 April 2018 the applicant responded to the expert’s report with revised documentation and the following submission (in summary):

- The applicant’s engineer’s calculations are already provided for fixing SHS mullions into cross-laminated flooring.
- Design approval has been received from the sealant manufacturer, as the glazing manufacturer would not issue its PS1 until the approval was received.

- In regard to adhesion compatibility testing, this is performed on material samples taken from the “actual ‘run’ of material” for the specific project. The test’s purpose is to prove the adhesion of the structural sealant to the coating on the aluminium joinery. It would be unusual to require this before building consent has been issued.
- The mullion size has been increased to 54mm to allow for additional tape and sufficient structural sealant. The structural tape does not provide “long term structural qualities”, instead it is a “spacer” that determines the structural sealant thickness.
- The structural sealant size calculations were carried out by the glazing manufacturer as stated in its PS1.
- The laboratory is accredited and audited as required in E2/VM1.
- The laboratory provided confirmation the water is applied at 5L/min per nozzle which exceeded the required 0.05L/m²/sec. It was noted the junctions between the four glazing panels were the focus of the testing, rather than the junction between the timber cladding and glazing joinery. It also noted there was “no practical or meaningful method” to include the 6mm defect holes as outlined in E2/VM1. Instead, sections of the sealant were removed as per the NZS 4284 seal degradation test sequence and the results were recorded.

5.9.2 The applicant also included copies of the following documents:

- specification for the structural sealant, including the various manufacturers’ documentation
- letter of accreditation for the laboratory
- the WANZ test procedure
- correspondence from the glazing manufacturer
- engineering calculations and PS1 in regard to the wind speed
- revised drawings.

5.9.3 The applicant noted the following revisions were made to the drawings:

- all drawings revised to show mullion supports
- amended text error referring to backing rods
- increased edge distance of sill fixings into the cross-laminated panels to 21mm
- sill drain holes shown as specified
- additional mullion to frame details to clarify sealant and connection details.

5.10 Review of the additional modified design

5.10.1 The expert engineer reviewed the second revision of the modified fixed glazing system. As part of the review, he contacted the applicant’s structural engineer in regard to their documentation. The applicant’s structural engineer adjusted the wind pressure calculations and re-checked the mullions and stiffeners for the increased

wind loads. The SLS²⁰ deflection limits were increased from span/200 to span/250 in accordance with AS/NZS 1170²¹.

- 5.10.2 This increase resulted in the proposed system no longer satisfying the SLS deflection limits. The applicant's structural engineer then proposed two options to strengthen the system to satisfy the deflection criteria:
- a. Increase the size of the steel stiffener for the 50x60x6 aluminium T mullion from 50x5 SHS to 65x5 SHS
 - b. Increase the size of the aluminium T mullion from 50x60x6 to 100x50x6 and leaving the [mullion support] at 50x5 SHS
- 5.10.3 The expert engineer considered if the second revision of the drawings was amended to include one of the above options, he would be satisfied the fixed glazing system would comply with Clause B1.

6. Discussion

6.1 The relevant legislation

6.1.1 Section 49 states:

A building consent 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.

- 6.1.2 The matter turns on whether adequate evidence had been provided to the authority to establish the original fixed glazing system would comply with the Building Code as an alternative solution proposal.

6.2 Did the building consent documentation meet the section 49 test?

- 6.2.1 The following sections consider whether the evidence provided in the building consent application to the authority by the applicant, namely the WANZ test, technical information, and the consent drawings, were sufficient to provide the authority with reasonable grounds the original fixed glazing system would comply with the Building Code.
- 6.2.2 The original fixed glazing system needed to show evidence of complying with Clauses B1 Structure, B2 Durability, E2 External moisture, and F2 Hazardous building materials. The clauses that appear to be in dispute are Clauses B1 and E2. I therefore make no comment on the original fixed glazing system's compliance with Clauses B2 or F2.
- 6.2.3 I note sections 6.1 to 6.6 of this determination assess only the original building consent application and not the modified fixed glazing system design submitted by the applicant during the determination process.

6.3 Evidence provided for Clause B1 Structure

- 6.3.1 The original fixed glazing system is required to satisfy Clause B1.3.3:

Account shall be taken of all physical conditions likely to affect the stability of buildings, building elements and sitework, including:

- (a) self-weight,

²⁰ Serviceability limit state (SLS)

²¹ Australian/New Zealand AS/NZS 1170.2:2011 Structural design actions – Part 2: Wind actions

- (b) imposed gravity loads arising from use,...
- (d) earth pressure,
- (e) water and other liquids,
- (f) earthquake,...
- (h) wind,....
- (j) impact,

6.3.2 The applicant provided the glazing manufacturer's testing and structural sealant specification as evidence of the original fixed glazing system's compliance with Clause B1.

The glazing manufacturer's information

6.3.3 The glazing manufacturer carried out testing using NZS 4223.4²², which is cited in B1/AS1²³, to check the proposed thickness for the glazing units was adequate to resist various loadings, and ensure any deflection would not exceed the maximum allowed by the Standard.

6.3.4 The glazing manufacturer has issued a PS1 for the double glazed insulated units but excluded the aluminium joinery sections and flashings in respect of Clauses B1 and E2.

Structural sealant information

6.3.5 The applicant has supplied information for two different structural sealants and did not specify which one would be used in the consent drawings. Both sealants are manufactured by the same company and both are suitable for structural glazing and waterproofing, and can adhere to glass and anodized aluminium.

6.3.6 The applicant noted the structural sealant manufacturer would provide a site-specific 20 year adhesion warranty for the use of the sealant. This warranty is noted by the applicant as evidence the fixed glazing system will comply with the Building Code. However, the warranty is dependent on a number of conditions:

- full print review
- testing of samples for compatibility
- deglazing of at least two units on site to check the quality of the silicone
- dust free environment.

6.3.7 I see no reason why the review by the structural sealant's manufacturer and compatibility testing was not carried out before the building consent application was submitted to the authority. I consider the review could then have been supplied with the building consent application as evidence the fixed glazing system will comply with Clause B1.

6.3.8 The glazing manufacturer's design is also dependent on the approval by the structural sealant manufacturer. Redesign could be required should approval not be given by the structural sealant manufacturer.

6.3.9 No information was provided to establish whether the structural sealant could be used in wet areas and in direct connection to tiles.

²² NZS 4223.4:2008 Glazing in buildings – Part 4: Wind, dead, snow, and live actions.

²³ Acceptable Solution B1 Structure.

Other evidence

- 6.3.10 The applicant has stated the factors he took into account in design of the original fixed glazing system (see paragraph 3.7), and I note some do overlap with Clause B1.3.3. However, I have not seen any testing or calculations to show how the design of the aluminium joinery sections or fixings has taken into account those factors.
- 6.3.11 The double glazed units are proposed to be sealed to “off-the-shelf” aluminium joinery sections and angles. I have not seen any manufacturer’s information or calculations that indicate the proposed sizes and extrusions are appropriate for the proposed use (I note only a few sections are dimensioned on the consent drawings).
- 6.3.12 The applicant has stated his design was undertaken with supervision of a licensed building practitioner. One measure of establishing compliance through an alternative solution with the Building Code is to provide expert evidence. This could be a peer review of the proposed solution or opinions obtained from credible organisations²⁴. The supervision of the licensed building practitioner does not meet the threshold of expert evidence. I have seen no evidence to show the licensed building practitioner has the appropriate knowledge and experience of this type of fixed glazing system. Therefore, I conclude the supervision of the licensed building practitioner cannot be used as expert evidence to support the compliance of the original fixed glazing system.
- 6.3.13 Only one facet of the design appeared to have been designed by the applicant’s structural engineer, although no calculations were provided in the building consent documentation. The support bracket at the roof/gutter junction is shown in the “steelwork details” as part of the structural engineering design for the house.

Conclusion: Clause B1

- 6.3.14 I am of the view the glazing manufacturer’s information was adequate to provide reasonable grounds the double glazed insulated units were likely to comply with Clause B1. However, there was a lack of information regarding the design of the aluminium joinery sections, the experience of the applicant and licensed building practitioner with this type of design, and the outstanding issues regarding the structural sealant.
- 6.3.15 Accordingly, I consider inadequate evidence had been provided to the authority for it to be satisfied on reasonable grounds the fixed glazing system will comply with Clause B1.3.3.

6.4 Compliance with Clause E2 External moisture

- 6.4.1 Clause E2.3.2 states:

Roofs and exterior walls must prevent the penetration of water that could cause undue dampness, damage to building elements, or both.

- 6.4.2 There are certain risk factors that can increase the likeliness of water penetrating the exterior walls. In this instance, the lack of eaves and its location within an Extra High wind zone increase the risk of moisture penetration, and there are few mitigating features in the design.

²⁴ Alternative solutions for compliance with the Building Code <https://www.building.govt.nz/building-code-compliance/how-the-building-code-works/different-ways-to-comply/alternative-solutions/> (MBIE) accessed November 2017.

- 6.4.3 The applicant needed to provide sufficient evidence for the authority to be satisfied on reasonable grounds the original fixed glazing system would comply with Clause E2.
- 6.4.4 The applicant chose to carry out testing of the original fixed glazing system using the WANZ test as evidence of compliance with Clause E2.
- 6.4.5 I note this test is designed to check installed curtain walls to evaluate whether “joints, gaskets and sealant details” will remain permanently closed and watertight. The photographs provided of the test being undertaken show a scaled version of the proposed fixed glazing system with vertical timber cladding installed along each side of the glazing.
- 6.4.6 The test results indicated the fixed glazing system did not leak. However, I note the purpose of the test is for “on-site testing of the weathertightness of window or façade element installations”²⁵. The test is not designed to assess façade prototypes.
- 6.4.7 Also, included in the test results it states “[t]he procedure is not intended to test the rated or specified water performance representative of a wind driven rain event”.
- 6.4.8 Rain in New Zealand is often accompanied by wind, which increases the presence and pressure of water on exterior walls. In this instance there has been no mitigating factors (such as eaves) proposed to protect the surface and junctions of the original fixed glazing system from wind-driven rain, noting the house is located within an Extra High wind zone. It takes very little water on the face of a junction to start the process of water entry, if the detailing is flawed and water movement is possible.

Conclusion: Clause E2

- 6.4.9 I consider it was critical for the applicant to establish whether the original fixed glazing system would prevent the penetration of water in wind-driven rain events. This is a core principle of weathertightness design.
- 6.4.10 Subsequently, I do not consider the testing provided by the applicant is appropriate by itself as evidence the original fixed glazing system would prevent the penetration of water.
- 6.4.11 Accordingly, I consider inadequate information was provided and the authority could not be satisfied on reasonable grounds the original fixed glazing system would comply with Clause E2.3.2.

6.5 Consent drawings

- 6.5.1 The applicant provided multiple details showing the original fixed glazing system junctions at head, sill and jamb. I make the following comments regarding the consent drawings submitted to the authority:
- The consent details identify a non-structural sealant instead of one of the proposed structural sealants. The specified non-structural sealant is used to seal joints to prevent the penetration of water, but is not intended to support double insulated glazing units, and the specification specifically states it must not be used “[w]ith structural glazing or floor joints.”
 - As well as the lack of structural sealant, the details in the consent drawings also vary from the glazing manufacturer’s detail. No structural tape is identified and significantly less structural and waterproof sealant is proposed to the sill and

²⁵ <http://www.wanz.co.nz/testing-water-penetration-of-installed-windows> accessed November 2017.

head junctions than what is shown in the glazing manufacturer's detail. I note a jamb junction was not provided by the glazing manufacturer.

- The sizing of the aluminium joinery appears to vary and only some details clearly identify the specific size of the joinery.
- The glazing manufacturer's PS1 specified toughened glazing whereas the consented drawings instead specify low E laminated glazing.

6.6 Conclusion

6.6.1 I am of the view the consent drawings do not accurately reflect what has been proposed, considering that manufacturer information is either missing or when provided has not been reflected in the consent drawings.

6.6.2 I am of the view the original fixed glazing system as detailed in the building consent documentation is unlikely to comply with Clauses B1 and E2. The authority was justified to request additional information to establish compliance with the Building Code.

6.7 The modified fixed glazing system

6.7.1 The applicant provided a modified set of drawings and additional documentation in response to the draft determination and then the expert report. I have provided the following comments on the modified fixed glazing system to assist the parties.

Compliance with Clause B1

6.7.2 In respect of the issues raised during the draft determination and the expert's report, I note the following:

- The applicant has revised his drawings and documentation to specify one type of structural sealant.
- The glazing manufacturer's PS1 has been revised to identify one structural sealant option, and confirmed it could be used to "seal glass to tiles in wet areas". The glazing manufacturer "approved" the modified fixed glazed system drawings.
- The structural sealant manufacturer has carried out a review of the modified fixed glazing system (I have not seen the results of this review). The condition on the glazing manufacturer's PS1 regarding the review has been removed.
- The glazing manufacturer designed the thickness of the structural sealant bite.
- The applicant has provided structural calculations, drawings and a PS1 from his structural engineer. This documentation has been reviewed by the expert engineer, and he is of the view the fixed glazing system will comply with Clause B1.3.3, provided one of the options is adopted as outlined in paragraph 5.10.2.

Compliance with Clause E2

6.7.3 I note the following information has been provided to address the previous issues raised:

- Weathertightness test results were provided for the original fixed glazing panels. The expert architect considered as the tests were similar to AS/NZS 4284 and AS/NZS 4211, and provided the proposed on-site WANZ testing passed, he considered there should be adequate evidence to establish

compliance as an alternative solution. (I note the laboratory has since confirmed the water pressure applied to the sample).

- The original fixed glazing system rather than the revised design was tested. However, I am of the view the test results are still relevant because the modified fixed glazing design is a more robust solution than the original design, which passed the additional testing.

Consent drawings

- 6.7.4 The applicant has now revised the drawings to be consistent with the structural drawings and calculations provided, as well as the glazing manufacturer's design. Also, the applicant has revised the drawings to rectify the issues noted in the draft determination and by the experts. However, the drawings will need to accommodate the necessary revisions to the structural design of the fixed glazing system, as identified by the applicant's engineer.

7. Conclusion

- 7.1 I am of the view should this information be provided to the authority, after any changes as a result of the structural alterations are resolved to the parties' satisfaction, there should be reasonable grounds on which to be satisfied the modified fixed glazing system will comply with Clauses B1 and E2.

8. The decision

- 8.1 In accordance with section 188 of the Building Act 2004, I hereby determine the authority correctly exercised its power of decision by purportedly refusing to grant the building consent (BCO10030652-2) in respect of the compliance of the original fixed glazing system with Clauses B1 Structure and E2 External moisture, based on the insufficient information it had at the time.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 30 August 2018.

Katie Gordon
Manager Determinations

Appendix A – Verification Method

A.1 Relevant sections of E2/VM1:

1.4.1 Preconditioning

Apply a preconditioning loading to the external face of the test sample for a period of 1 minute of positive pressure, followed by a period of 1 minute of negative pressure (suction). The loading shall be 1515 Pa...

1.4.2 Series 1 Static Pressure Water Penetration

The water penetration test by static pressure shall be conducted in accordance with Clause 8.5 of AS/NZS 4284 and at the maximum test pressure of 455 Pa.

1.4.3 Series 1 Cyclic Pressure Water Penetration

The water penetration test by cyclic pressure shall be conducted in accordance with Clause 8.6 of AS/NZS 4284 and to the cyclic pressure of 455 – 910 Pa at the prescribed Stage 3, with the Stage 1 and Stage 2 tests deleted.