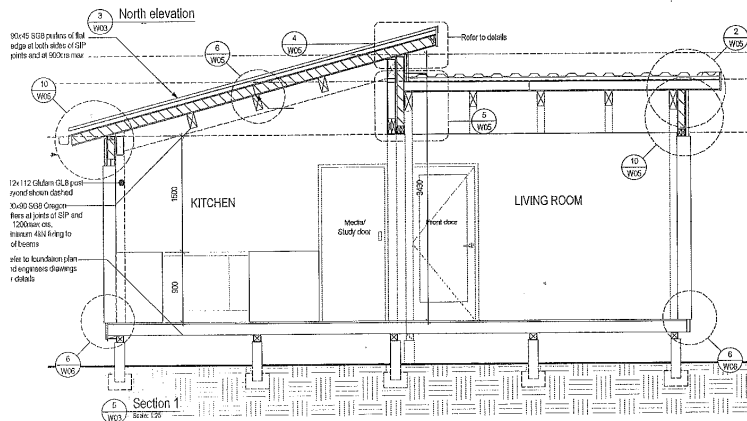




Determination 2013/032

The refusal to grant building consent for a prefabricated building



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 are

- the owner of the prefabricated building, A Clark (“the applicant”)
- Clutha District Council (“the authority”), carrying out its duties as a territorial authority or building consent authority.

1.3 This determination arises from a decision by the authority to refuse to grant building consent for the proposed transportable building, because the authority considered it had received insufficient information in the supporting documentation to be satisfied that the proposed building would comply with certain clauses² of the Building Code (Schedule 1, Building Regulations 1992).

1.4 The matter to be determined³ is therefore whether the authority was correct to refuse to grant the building consent. In deciding this, I must consider:

¹ The Building Act, Building Code, compliance documents, past determinations and guidance documents issued by the Ministry are all available at www.dbh.govt.nz or by contacting the Ministry on 0800 242 243.

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

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

1.4.1 Matter 1: The authority's refusal

Whether the authority correctly exercised its powers in refusing to grant building consent for the proposed building work, based on the documentation provided in the application for building consent.

1.4.2 Matter 2: The compliance of the proposed building work

Whether there is sufficient evidence to conclude on reasonable grounds that the proposed building work will comply with the Building Code.

1.5 Matters outside this determination

1.5.1 This determination is restricted to the specific concerns identified by the authority in its letter to the applicant dated 11 February 2013 (see paragraph 3.6.3); and I leave any remaining matters and code clauses to the parties to resolve as part of the routine processing of documentation.

1.5.2 I also note that this consent is for the proposed construction of a building intended to be transported to another site. The foundations, service connections and other matters related to location of the building on a specific site will be the subject of a separate application for building consent: site-specific matters are therefore not considered in this determination.

1.6 In making my decision, I have considered the submissions from the parties and the other evidence in this matter.

2. The building work

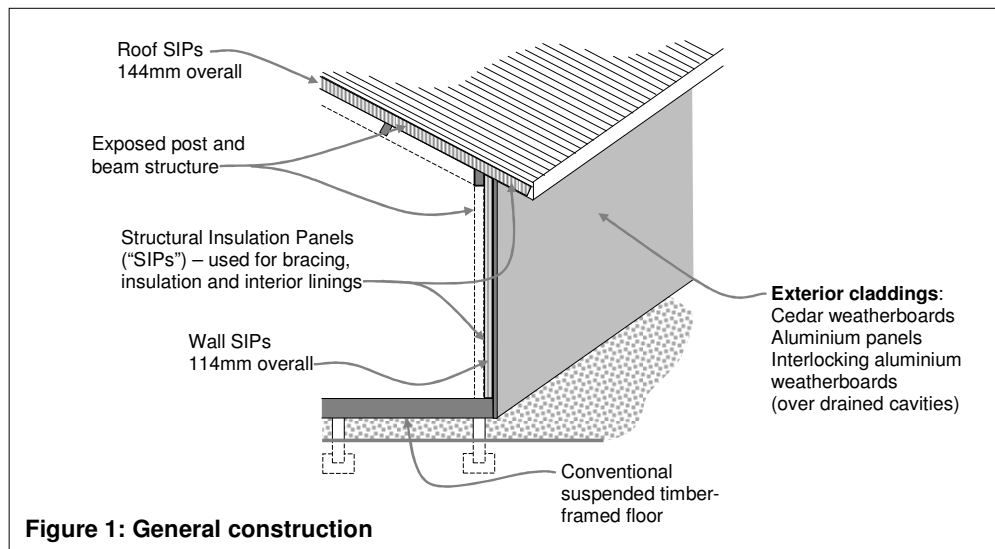
2.1 The building work consists of a single-storey detached dwelling that is simple in plan and form and under 80 square metres in area. The building is designed to be constructed off-site and then relocated onto an undetermined site assumed to be in a high wind zone maximum for the purposes of NZS 3604⁴. Elevations assume a certain orientation of the house and this determination uses the same references.

2.2 The T-shaped plan accommodates a central kitchen/laundry/bathroom core, with a 'study/family/media room' to the west and a bedroom to the east; forming the long top of the 'T' below a 15° monopitched roof to the south. A 10° gable roof extends to the north above a dining/living area. Roof projections vary from about 450mm to 600mm overall.

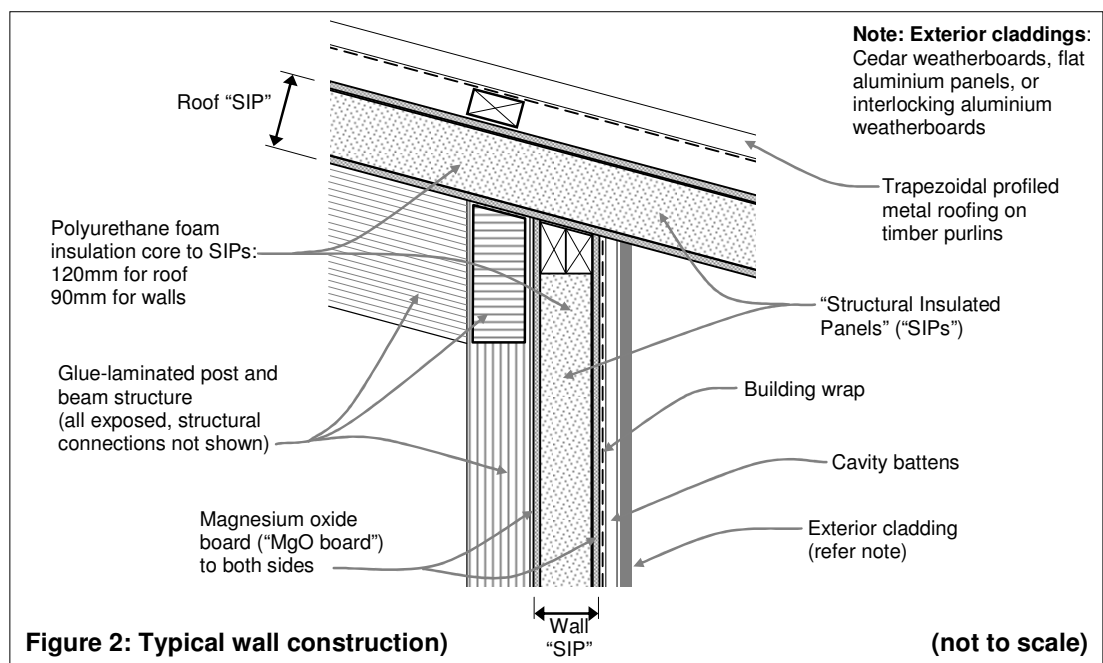
2.3 Construction

2.3.1 Construction consists of a specifically engineered post and beam structure with conventional light timber frame internal partitions and floor, three different types of wall claddings, pressed metal roofing and double-glazed aluminium windows. The proposed general construction is shown in Figure 1:

⁴ New Zealand Standard NZS 3604:1999 Timber Framed Buildings



- 2.3.2 The exposed glue-laminated posts and beam structure of the house consists of 112mm x 112mm posts spaced at about 3.6m, which support 240mm x 90mm roof beams, with intermediate 190mm x 90mm rafters between. Bracing is provided by 'structural insulation panels' ("SIPs") as sketched in Figure 2.



2.4 The structural insulated panels

- 2.4.1 The drawings and specification are not clear as to the material used for the core of the SIPs, with information submitted on similar products which use expanded polystyrene. However the applicant has stated that the insulation core of the subject SIPs is intended to be polyurethane foam.
- 2.4.2 The SIPs are prefabricated panels formed from a core of polyurethane foam insulation ("foam") sandwiched between 12mm thick magnesium oxide board ("the MgO board"), which is adhered to both sides. 90mm thick foam is used for wall

panels and 120mm foam for roof panels. Panels are 1220mm x 2440mm with MgO board with edges to accommodate top and bottom plates and specific joints. The SIPs are intended to be manufactured in New Zealand using imported MgO board.

2.4.3 Similar proprietary systems incorporate a ‘box spline’ provided by the manufacturer at panel joints. In the case of this proposed building, the panels provide bracing to the post and beam structure and joints and junctions are therefore specifically designed and detailed by the engineer. A ‘standard’ proprietary joint is compared to typical panel joints for this building in Figure 3:

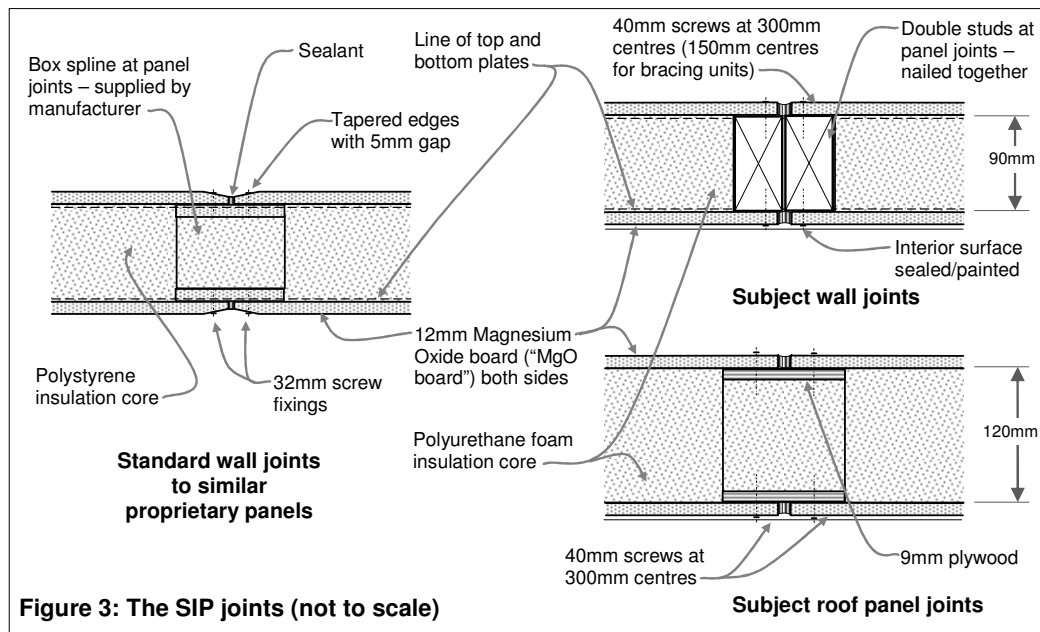


Figure 3: The SIP joints (not to scale)

2.4.4 The SIPs are faced with MgO board as shown in Figures 2 and 3. The MgO board is sealed at vertical joints; providing a rigid air barrier beneath the building wrap, while interior faces act as ceiling and wall linings. MgO board is further described in paragraph 2.5.

2.4.5 A similar SIP system using an EPS insulation core has a current appraisal⁵, which states that the system will comply with Clauses B1, B2, E2, E3, F2 and H1 as an alternative solution, providing the system is ‘designed, used, installed and maintained’ according to the conditions described in the certificate. The scope of that appraisal includes the following conditions likely to be relevant to the use of panels within the walls of this building:

- Buildings to be within the scope of E2/AS1.
- The panels to be installed by trained personnel licensed by the manufacturer and installed in accordance with instructions.
- Panels not to be left exposed to the weather for more than 6 months.
- Drawings to show pertinent structural, electrical and service pipe information.
- Adequate ventilation for spaces where moisture may be generated.

⁵ BEAL Appraisal C 1130 [OCT 2012]

2.4.6 Subject to the above conditions, the appraisal certificate concludes that the installed SIP system will

- have a serviceable life of at least 50 years
- provide a barrier to the passage of water vapour and not increase the risk of moisture damage resulting from condensation
- not present a health hazard to people
- provide a high degree of insulation.

2.5 The MgO board

2.5.1 Most MgO board is produced in China for exterior use as backing sheets or claddings (with appropriate coatings); or for interior use as backing sheets for tiled areas, pre-finished linings or linings able to be finished in a similar fashion to plasterboard linings. All forms contain Magnesium Oxide as the base, with other magnesium-based components added. Fibreglass reinforcing, other additives and modifiers may be added to specific products.

2.5.2 In the case of this building, the MgO board to interior faces of SIPs provides ceiling and wall linings to interior rooms, including wet areas. The primary component of the proposed board is magnesium oxide, with added magnesium chloride, fibreglass, and various other additives and modifying agents. The MgO board proposed to be used in this building has been tested against specified standards⁶ for various qualities; including for resistance to water permeability.

2.5.3 A similar MgO board is marketed in New Zealand; and BRANZ test results are available for its performance as a bracing element along with the product's fire, moisture and impact resistance. International tests have also been carried out for other MgO board products available locally.

2.5.4 In the case of the board specified for this building, the Chinese manufacturer has provided a copy of a 'Test Report No. 201120179' issued on 25 February 2011 certifying the results of tests carried out on the board. The report was issued by the National Research Centre of Testing Techniques for Building Materials', which is registered by CNAS⁷.

2.6 The exterior wall claddings

2.6.1 The house incorporates three different types of wall claddings as follows:

- Horizontal cedar bevel-backed weatherboards to
 - the north gable end wall of the living room
 - a south panel between the kitchen door and bathroom window.
- Interlocking aluminium weatherboards to the high north wall of the east/west wing, including to the clerestorey wall above the living room gable.
- Flat aluminium panels ("the aluminium panel cladding") to all other walls.

⁶ Chinese industry and national standards issued by the Standardization Administration of China (SAC)

⁷ The Certification & Accreditation of the People's Republic of China, which administers the conformity assessment system on Certification and Accreditation. CNCA is recognised by most other countries.

- 2.6.2 The claddings are all fixed through 20mm cavity battens and the building wrap into the SIP panels. The drawings call for battens to be spaced at 400mm centres, implying that every third batten could be fixed into timber members at panel edges, with remaining battens fixed into the MgO board and polystyrene core of the SIP. Fixings of battens into the SIPs have been specified by the engineer.

2.7 The aluminium panel cladding

- 2.7.1 The primary wall cladding is a proprietary aluminium panel curtain wall cladding system. The flat panels are 1200mm wide x 2400mm high and are formed from 3mm thick aluminium alloy and finished with a four-coat coloured coating system. Panel edges are folded to provide 20mm returns, with stiffeners between the returns and attached brackets to provide fixings. Battens are positioned behind panel joints, which are sealed with an exterior grade sealant backed with a closed cell backer rod.
- 2.7.2 The panel manufacturer has provided a copy of the 'Quality Management System Certificate', which certifies that production of the aluminium panels complies with ISO 9001:2008. The certificate was issued by the Xingyuan Certification Centre⁸ on 31 March 2010 (with an expiry date of 30 March 2013) and is registered by CNAS.

2.8 The aluminium weatherboards

- 2.8.1 The horizontal aluminium weatherboards are a proprietary interlocking powder-coated weatherboard system designed to be used over a drained cavity on light timber framed buildings. The system includes purpose-made flashings to windows, edges and other junctions.
- 2.8.2 The aluminium weatherboard system has an appraisal certificate⁹. The appraisal is current and states that the system will comply with Clauses B1, B2, E2 and F2, providing the system is 'designed, used, installed and maintained' according to the conditions described in the certificate. The scope of the appraisal includes the following conditions relevant to the cladding use in this building:
- Buildings to be within the scope of E2/AS1.
 - Cladding to be installed over a 20mm nominal drained cavity.
 - Cladding to be installed horizontally on vertical flat surfaces.
 - Joinery to have head sill and jamb flashings.
 - Cladding to be installed in accordance with the manufacturer's instructions.
- 2.8.3 Subject to the above conditions, the appraisal certificate concludes that the installed membrane system will
- provide good resistance to impacts expected in normal residential use
 - prevent the penetration of moisture that could cause undue dampness or damage to building elements
 - have a serviceable life of at least 25 years

⁸ Member of the International Accreditation Forum, Inc. (IAF). IAF members accredit certification bodies that issue certificates attesting that an organization's management, products or personnel comply with a specified standard (called conformity assessment).

⁹ BRANZ Appraisal No. 550 (2007)

- not present a health hazard to people.

3. Background

- 3.1 The applicant lodged an application for a building consent for the building work (No. BLD/2012/14795) on 15 November 2012. In a letter to the applicant dated 5 December 2012, the authority listed nine items requiring clarification before a building consent could be issued.
- 3.2 In a letter dated 10 December 2012, the applicant responded to the authority's list and attached revised drawings, 'Building Specifications' and some other information. Following a conversation on 12 December 2012, the applicant wrote again to the authority including information on a locally appraised comparable product in support of the proposed aluminium panel cladding.
- 3.3 In a further letter to the applicant dated 18 December 2013, the authority outlined the following concerns (in summary):
- For the aluminium panel cladding:
 - panels are curtain wall panels only
 - flashings to be specifically designed by a weathertightness expert
 - a rigid wind barrier required
 - appraisals on similar panels require trained installers.
 - Apron flashing details required.
 - Inter-cladding flashing details required.
 - NZ appraisal certificate required for MgO board.
 - Flashing detail required for reverse soffit.
- 3.4 The applicant responded on 3 January 2013, attaching further information and noting the authority had made no reference to the aluminium panel cladding in previous correspondence. The applicant clarified some apparent confusion and referred to some details showing flashings at junctions.

3.5 Subsequent correspondence

- 3.5.1 In a further letter to the applicant dated 10 January 2013, the authority required the following additional information (in summary):
- A 'peer review from a suitably qualified' engineer due to 'the complexity of the structure and the cladding systems'.
 - Detailed fixings of battens.
 - NZ appraisal certificates 'for all alternative solutions for SIP panel, the aluminium panel, MGO board'.
- 3.5.2 The applicant responded on 14 January 2013, noting local appraisal certificates could not be supplied for 'every product in a building' and all information had been provided both in the original application and since then.

- 3.5.3 The authority responded the same day, stating the applicant was responsible for providing all required information, and adding that alternative solutions ‘automatically require full information including an appraisal certificate to be considered for compliance’.
- 3.5.4 The applicant responded on 15 January 2013, objecting to the authority’s stance and noting that new requirements had been continually added since the original request for further information. The applicant also noted his intent to seek a determination.

3.6 The authority’s final response

- 3.6.1 The authority responded in a letter to the applicant dated 11 February 2013; stating it had carried out a review to consider concerns raised by the applicant, and describing the proposal and code clauses relevant for considering compliance.
- 3.6.2 The authority noted that the application for building consent had identified only three alternative solutions and had provided supporting information, comparisons with similar systems and appraisals on these. However, the authority considered that:
- It is important that care is taken when reviewing this application as it is likely the entire proposed building will need to be considered as an alternative solution to many Code clauses not currently identified in the application.
- 3.6.3 The authority listed specific clauses it considered included alternative solutions, outlining additional information needed (refer Table 1 below), and noted that it was appropriate to consider the entire building as an alternative solution rather than separate isolated components and materials. The authority recommended the engagement of ‘a building surveyor or weathertightness expert to provide a review of the proposed building.’
- 3.6.4 The applicant responded to the authority’s list of required information, and I have included the authority’s request for information and the applicant’s response in the following table (in summary):

Table 1: The authority’s request for information and the applicant’s response:

Clause	The authority’s information request	The applicant’s response
Clause B2 (as it relates to B1) for SIPs and associated components	Durability be included in the engineer’s PS1 for specifically designed elements needing 50-year durability.	The engineer cannot provide a general cover of B2 within the PS1.
Clause E2 for cladding systems	Specific systems specifications for intended products.	All necessary fixing and flashing details at inter-cladding junctions are provided in the drawings.
	Fixing and flashing details at inter-cladding junctions.	Fixings of aluminium panels are specified by engineer, with joints sealed.
	Review suggested by weathertightness expert.	Details for aluminium weatherboards approved by manufacturer.

Clause	The authority's information request	The applicant's response
Clause E3 for wet area linings	Complete detail for all proposed surface finishes.	Test results for MgO board (and two other similar products) all show very low moisture absorption. Joints and junctions to be sealed, with walls painted.
Clause F2 for imported products	Complete details of material properties	Test results for MgO board (and two other similar products) show no hazardous substances. Other components use common building products.
Clause G4 related to moisture resistance of materials	Details of moisture management as the materials used 'may not allow for vapour diffusion ... (See G4.3.1 and G4.2'.	Materials are moisture resistant. An extract fan to be installed in kitchen. Mechanical ventilation system shown in electrical drawings.
Clause G9 for electrical wiring	Details for wiring installation, so 'the electrician can issue a electrical certificate of completion'.	Cables to be run internally via exposed PVC conduit to allow flexibility All wiring and other items are covered in electrical drawings.
Clauses G12 and G13 related to SIPs and claddings	Installation of waste pipes and venting and penetration through the cladding.	Pipes enter and leave the building through the floor.
Clause H1 in relation to SIP	Actual construction values for materials.	The envelope exceeds requirements.

3.7 The Ministry received an application for a determination on 22 February 2013 and accepted the application on 4 March 2013.

4. The submissions

4.1 I have taken the applicant's response to the authority's request for information, as outlined in Table 1, as representing the applicant's position in this matter. With the application for determination the applicant provided copies of

- the original drawings dated September 2012
- the engineer's structural drawings dated October 2012
- the engineer's PS1 and inspection schedule dated 1 November 2012
- correspondence with the authority
- various other drawings, calculations, appraisals and other information.

4.2 The authority acknowledged the application but made no submission in response. I have taken the letter outlined in paragraph 3.6 as representing its position in this matter. The authority submitted copies of

- the original consent application, with drawings and other information

- amended drawings stamped 10 December 2012 and other information
- other correspondence from the applicant, with supporting information.

4.3 A draft determination was issued to the parties for comment on 3 May 2013. The authority accepted the draft on 14 May 2013.

4.4 In a letter to the Ministry dated 13 May 2013, the applicant commented on the draft determination. I have considered those comments and have amended the draft where I consider appropriate. In particular, the applicant stated that the insulation core of the SIPs is intended to be polyurethane foam and not EPS as assumed in the draft determination, and that detail has been corrected.

4.5 The applicant also considered that the determination should provide specific examples and details of deficiencies in documentation. In the applicant's view the determination should also provide 'a defined list of things required' and not leave this to the authority. However, the detailed examination of construction details for weathertightness remains the responsibility of the authority and not the Ministry.

5. Evaluation framework

5.1 General

5.1.1 The matter for determination is whether the authority correctly exercised its powers of decision when it refused to grant building consent, and whether the proposed building work as documented will comply with the Building Code.

5.1.2 Section 49 of the Act requires '[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.'

5.1.3 In considering this matter, I must consider whether there was sufficient evidence provided in the building consent application for the authority to conclude on reasonable grounds that the building work would comply with the Building Code to the extent required by the Act.

5.1.4 The authority has provided copies of the documentation originally submitted and also some of what was provided in response to its subsequent requests for information. I have considered the adequacy of the drawings and specifications supporting the consent application and I address that matter in paragraph 6.4.

5.2 Assessment of compliance

5.2.1 In order to form a view as to compliance of the proposed building work with the Building Code, I need to consider the evidence that is available, which includes

- the available construction information on the proposed building, including
 - the architectural drawings and a limited specification
 - the engineer's detailed drawings, calculations and fixing specifications
 - various other explanatory statements from the applicant

- the electrical drawings, including the mechanical ventilation system
 - available technical information on various components and elements, including technical information on comparable products and systems
 - the history of use of some similar comparable materials.
- 5.2.2 With regard to joinery installation details and other external junctions, I consider that the metal and timber weatherboard claddings proposed for this house are commonly used materials. For the aluminium panel cladding, which is not commonly used in residential construction, the details provided can be assessed for likely compliance.
- 5.2.3 With regard to interior finishes, I consider that there is generally sufficient information provided to allow assessment of the lining used in wet areas. Although MgO board has been used in some countries for some time, I note that it is not yet commonly used within New Zealand.
- 5.2.4 Taking into account the further information that has been made available to date, I have also concluded on the likely code compliance of the more unusual materials and elements.

Matter 1: The authority's refusal

6. Discussion

6.1 General

- 6.1.1 The Act allows the authority to set reasonable requirements for the documentation that accompanies applications for building consents. The authority is entitled to set minimum requirements to ensure that the proposed building work is clearly documented and to require the applicant to clearly demonstrate and document how compliance is to be achieved for those areas it considers unclear.
- 6.1.2 Plans and specifications submitted in support of a consent, or alterations to a consent, must show a compliant solution and also be sufficiently clear to describe how that solution is to be achieved through the construction process.
- 6.1.3 I acknowledge that the applicant will be the builder of the work, however, the documents supporting the building consent application must still provide sufficient detail to show how compliance is to be achieved, and must also enable the authority to appropriately inspect any completed work and assess that work against the design described in the approved consent documentation.

6.2 The drawings and specifications

- 6.2.1 The structural drawings appear to be competently and professionally presented, the architectural drawings generally appear adequate, and the electrician-prepared plans should be sufficient for the purposes.
- 6.2.2 However, there is little cross-referencing between isolated sections of the drawings and specifications in the way that information is provided; leading to some items that are unclear, confusing or very difficult to locate. In particular, the extremely simplistic 3-page specification is clearly deficient. It is insufficient in clarity,

coherence and specifics to allow an understanding of the scope of the intended work to be completed as part of this consent and of specific materials to be used for that building work.

6.2.3 I therefore conclude that the consent documentation is inadequate in a number of areas, including

- the inadequate specification; for example, the lack of
 - a clear scope of the work to be covered in this particular consent
 - defined work not covered in this consent (related to a future undefined site and purpose such as foundations, finishes, service connections etc)
 - schedule of linings/finishes and/or a clear reference to exclusion from the scope of this building consent
 - inclusion of information currently scattered in various statements (e.g. electrical conduits, sealing of sanitary fixtures/fittings etc)
 - clarity on specific products to be used (references to similar products are confusing)
 - cover of all of the trades involved and the elements within the building work, as a single properly indexed coherent document
- the lack of clarity, detail and errors in architectural drawings, for example:
 - lack of a legend for hatching to floor plan and sections
 - lack of cross referencing from architectural to structural drawings
 - lack of cross referencing from architectural to other trade drawings
 - clear reference needed to work excluded from this building consent
 - the north elevation on WO3 is difficult to read
 - cavity batten fixings are buried within handwritten calculations
 - the lack of top plates to details 1, 2 and 3 on WO5
 - the lack of a specific detail for the aluminium panel joint (copy of a detail for a similar product is not sufficient)
 - references to R-values that imply the use of EPS insulation in SIP's
 - various other errors, omissions, conflicts and lack of cross referencing within the drawings and to other drawings.

6.3 Conclusions

6.3.1 Until shortcomings in the drawings and specification are satisfactorily resolved, the authority is entitled to refuse to issue a building consent on the basis that without adequate documentation it cannot be satisfied on reasonable grounds that the provisions of the Building Code will be met if the proposed building work is completed in accordance with the plans and specifications that accompanied the application for the consent.

6.3.2 I note that there are significant deficiencies in presentation and communication resulting from information being provided in a piecemeal fashion in response to requests from the authority. An examination of the drawings and specification leads me to conclude that the documentation for the proposed building is inadequate in a number of respects.

- 6.3.3 I note that the building is a relatively simple structure with a low weathertightness risk. I consider some of the information sought by the authority is not consistent with the level of risk the building represents, such as the requirement for a peer review of the structure, and the need for a rigid air barrier to the cladding when this is clearly provided by the SIPs.
- 6.3.4 I do not accept the authority's stated position that an alternative solution automatically requires the system or product concerned to have a New Zealand appraisal. Systems, such as the aluminium panel system proposed, use commonly available components and materials irrespective where the product is manufactured.

Matter 2: The compliance of the proposed building work

7. Discussion

- 7.1 Setting aside the reasons for the authority's refusal to grant consent, I must now consider the compliance of the proposed building work, given the information now available, before I can confirm, modify, or reverse that decision. I have therefore assessed the building consent application together with further information received.

7.2 Clauses B1 Structure and B2 Durability

- 7.2.1 The structure of the building is required to comply with the durability requirements of Clause B2, which requires that a building continues to satisfy all the objectives of the Building Code throughout its effective life, and that includes the requirement for the structure to continue to perform for a minimum period of 50 years.
- 7.2.2 The authority has concerns about the durability of the wall and roof SIPs, taking into account their function as bracing elements in the building. The engineer has provided a comprehensive set of drawings, together with a producer statement for the design and an inspection schedule which includes fixings and connections of the panels during installation and prior to closing in the building.
- 7.2.3 In regard to the likely durability of the SIP's, I note the following:
- The engineer will inspect SIP installation, which is expected to be included in a producer statement for construction review on completion as compliant with Clause B1. After installation, panel joints are sealed to provide a moisture and air barrier in the form of the moisture-resistant MgO board.
 - On the outside further protection will be provided by the building wrap, drained cavities and the external claddings. On the inside paint finishes provide additional protection against internal moisture.
 - Given normal maintenance there is little likelihood of deterioration and damage of the panels and their capacity to continue to perform adequately as bracing elements in the building.
- 7.2.4 Taking the above into account, I have reasonable grounds to conclude that the house structure will comply with Clause B2 Durability insofar as it applies to Clause B1.

7.3 Clause E2 External Moisture

- 7.3.1 With regard to the likely weathertightness of the proposed wall system, I make the following observations on the proposed construction of this building:
- The building has a low weathertightness risk and simple in shape and form.
 - Wall claddings are installed over drained cavities and building wrap.
 - The building wrap is located over the sealed SIPs, which provide a rigid air barrier and an additional moisture barrier. The SIP itself can be used as an external cladding.
 - Most windows and doors are sheltered below 600mm deep eaves overall, with the more exposed joinery installed within metal or timber weatherboards.
 - Inter-cladding junctions are generally simple vertical intersections which can be readily assessed for compliance.
- 7.3.2 The total information finally provided for this determination indicates that the exterior claddings, if installed in accordance with the drawings, the various manufacturers' specifications and good trade practice, are likely to be weathertight and durable. However, I have also addressed the inadequacies in the documentation and these deficiencies need to be satisfactorily resolved, together with any other areas raised by the authority as part of its routine checking processes. Penetrations for services, etc, also need to be appropriately documented.

7.4 Clause E3 Internal Moisture

- 7.4.1 The authority's concerns about compliance relate to potential deterioration of the SIPs from the transmission of water vapour into the structure. However, Clause E3 is primarily concerned with preventing liquid water from entering concealed spaces and not transmission of water vapour. The management of water vapour is handled through adequate ventilation and thermal resistance (Clauses G4 and H1).
- 7.4.2 In regard to the compliance of the wet areas with Clause E3, I note that in conventional timber framed construction appropriately finished plasterboard is routinely expected to meet the requirements of Clause E3. Test results and other information on MgO board indicate that this material has moisture resistance in excess of that of plasterboard.
- 7.4.3 Provided the MgO board is coated with an appropriate paint system, and sanitary fixtures, etc, are adequately sealed to wall surfaces, it seems unlikely that compliance with Clause E3 will not be achieved.

7.5 Clause F2 Hazardous Materials

- 7.5.1 I have seen no information that leads me to believe that the MgO board presents a hazard in terms of compliance with Clause F2 of the Building Code. As for any other building material, the manufacturer's instructions should be followed when handling the material.

7.6 Clause G4 Ventilation

- 7.6.1 The dwelling has no opening windows, and exterior doors cannot be considered a means by which normal ventilation will be provided.
- 7.6.2 While information has been provided showing the ventilation of the building using a heat recovery system, no information has been provided detailing the equipment that will be installed and the minimum air change rates that will be achieved, or any related information on the sealing of penetrations, etc.
- 7.6.3 While I consider a system of this type is likely to provide a solution that meets the requirements of Clause G4, I consider insufficient information has been provided to show this.

7.7 Clause G9 Electricity

- 7.7.1 The electrician has provided drawings showing the proposed electrical services and the proposed mechanical ventilation system and is expected to provide a certificate of compliance on completion. Drawings and/or specifications should detail penetrations, etc, through the wall and roof SIPs in respect of compliance with Clauses E2.
- 7.7.2 Electrical work under Clause G9 is self-certifying. The provision of an energy works certificate at the completion of the job will provide sufficient evidence to the authority that compliance with G9 has been achieved.

7.8 Clause G12 and G13

- 7.8.1 The applicant has stated that service pipes will enter the building via the sub-floor space and I note that the interior partitions are conventional timber framing. The consent documents appear to contain little or no information in relation to Clauses G12 and G13. The authority therefore has no basis on which to be satisfied that compliance with Clause G12 and G13 will be achieved (either by this consent or by a future consent once the building is installed on its intended site).

7.9 Clause H1 Energy Efficiency

- 7.9.1 The authority considers that it has insufficient information to verify that the building will comply with Clause H1 and I consider that the drawings and specification lack clarity on the material proposed for the core of the SIPs. I note that information was submitted on similar products which use an EPS core and the drawings also provide R-values for the building envelope components which are consistent with EPS cores.
- 7.9.2 However the applicant has stated that the insulation core of the subject SIPs is intended to be polyurethane foam and ALF¹⁰ calculations based on that material were submitted to the authority. The applicant maintains that thermal performance will significantly exceed minimum requirements and I note that R-values for polyurethane foam are considerably higher than those for EPS.

¹⁰ Annual loss factor

- 7.9.3 To generally verify compliance, I have assessed the building envelope against the schedule method set out in H1/AS1, as the glazing area of the proposed building is within well the limits set for the use of that method. R-values for polyurethane foam generally vary from about 0.04 to 0.06/mm and I have taken the lower of that range.
- 7.9.4 Using conservative R-values estimates for the envelope elements, I have compared these with the minimum R-values required for Climate Zone 3 and I note the following (the relevant R-values in Table 2(a) of H1/AS1 are shown in brackets):
- Roof panels are 120mm thick SIPs with an estimated R-value of about 4.8 for the foam core. Taking into account the lack of bridging at panel joints, compared with that expected in conventional ceiling framing, the total R-value is likely to be at least R5.0 (compared to R3.3).
 - Wall panels are 90mm thick SIPs with an estimated R-value of about 3.6 for the foam core. Taking into account the significantly reduced thermal bridging of timber at panel joints and edges (compared to conventional timber framing), the total R-value is likely to be at least R3.9 (compared to R2.0).
 - Drawings specify a proprietary 60mm floor insulation, which has an R-value of R1.4 according to the manufacturer's information (compared to R1.3).
 - Aluminium windows are thermally-broken and double-glazed, so the R-value specified in drawings of R0.36 appears reasonable (compared to R0.26).
- 7.9.5 Based on the above, I consider it likely that the proposed building will significantly exceed the minimum R-values provided in Table 2(a) of H1/AS1 for Climate Zone 3. I am therefore satisfied that the proposed building work complies with Clause H1. (I also note that panels using EPS cores would also result in compliance with H1/AS1.)
- 7.9.6 The methodology above could have been applied by the applicant to verify compliance with H1 would be met. I also note that, given the nature of the construction, the likely compliance with H1 should also have been evident to the authority.

7.10 Conclusions

- 7.10.1 I am satisfied that the proposed work will comply with Clauses B1, B2, and H1. However, I am not satisfied that sufficient information has been provided to show that compliance will be achieved in respect of Clauses E2, G4, G12, and G13.
- 7.10.2 I am therefore satisfied that the plans and specification for the proposed building work as presented to the authority in support of the application for building consent were not adequate for the purposes of section 49 of the Act.
- 7.10.3 It is emphasised that each determination is conducted on a case-by-case basis. Accordingly, the fact that particular products and systems have been established as being code compliant in relation to specific clauses of the Building Code for a particular building does not necessarily mean that the same products and systems will be code compliant in another situation.

8. What is to be done now?

- 8.1 I suggest that the applicant should now modify the building consent application with the assistance of an appropriately experienced person, taking into account the findings of this determination, together with any other items noted during that process or raised by the authority as part of its checking process. If remaining details cannot be agreed with the authority, any items of disagreement can be referred to the Chief Executive for a further binding determination.

9. The decision

- 9.1 In accordance with section 188 of the Act, I hereby determine that
- the authority was correct in the exercise of its powers in refusing to grant building consent as the application information was insufficient to show that compliance would be achieved
 - I consider insufficient information has been provided to establish compliance with Clauses E2, G4, G12, and G13
- and accordingly I confirm the authority's decision to refuse to grant building consent.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 12 June 2013.



John Gardiner
Manager Determinations and Assurance