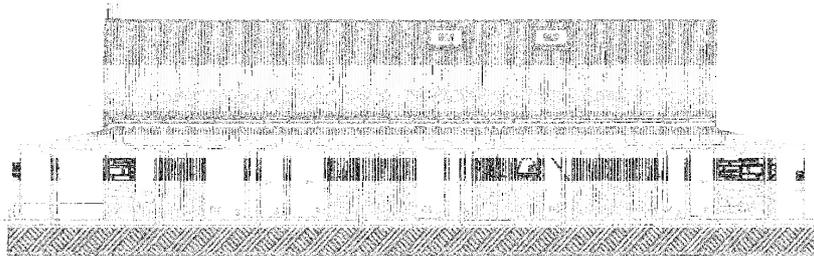




Determination 2013/038

The compliance of remedial work proposed for the skillion roofs of a house at 1134 Glenorchy/Paradise Road, RD1, Glenorchy



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 applicant is the Queenstown Lakes District Council (“the authority”)², carrying out its duties as a territorial authority or building consent authority. The other party to the determination is the owner of the building, R Taylor (“the owner”).

1.2.2 I consider the builder of the house (“the builder”) to be a person with an interest in this determination.

1.3 The reasons for this determination

1.3.1 The application for this determination arises from the following:

- The house was nearing completion in 2011 when water stains were observed on timber match lining beneath the skillion roof. The underlying construction was investigated and found to differ from the building consent drawings.
- Following negotiation during 2012, the builder submitted a proposal to the authority for approval for remedial work to be carried out as an amendment to the building consent (“the roof repairs”).

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 Including the authority’s contractor Lakes Environmental Ltd., which provides building regulatory services on behalf of the authority.

- The authority has sought a determination on whether the proposed roof repairs will comply with certain clauses³ of the Building Code (Schedule 1, Building Regulations 1992).

1.4 The matter to be determined⁴ is therefore whether the proposed roof repairs to the house comply with Clause B2 Durability, Clause E2 External Moisture and Clause E3 Internal Moisture of the Building Code.

1.5 In making my decision I have considered the parties submissions, including a report provided by a building surveyor (“the surveyor”) engaged by the builder to investigate the roof construction, and the other evidence in this matter.

2. The building work

2.1 The building work consists of roof repairs to a detached house, which is two storeys high in part and is situated on a large level rural site. A mezzanine level provides a master bedroom and ensuite within the roof slope.

2.2 Construction is generally conventional light timber frame, with concrete foundations and floor slab, vertical corrugated metal and stone veneer wall claddings, and aluminium windows. The 30° pitch gable roof is clad in corrugated steel; and the skillion roof is lined on the underside with timber tongue-in-groove match-lining.

2.3 The existing roof

2.3.1 The roof as constructed varies from the consent drawings (refer Figure 1, which also shows the amendments proposed for the roof). The constructed roof varies from the details in the consent drawings in the following ways:

- Detail A: the consent drawings
 - The roof framing drawing calls for 7mm thick plywood ‘over all roof rafters’ (although plywood is not shown in larger scale roof details).
 - Manufacturer’s information for the specified fibreglass insulation provides a ‘nominal stabilised thickness’ of 210mm, which should allow an air gap of about 30mm between the 240mm deep rafters.
 - Heavy weight self-supporting roofing underlay over 70mm x 45mm purlins at 900mm centres provides an air gap between the purlins.
- Detail B: the constructed detail
 - Plywood is fixed to the roof purlins.
 - Blocking is added above the rafters between the purlins, limiting cross-ventilation beneath the plywood.
 - Fibreglass insulation generally fills the cavity beneath the roof purlins.
 - Roof underlay is laid directly over the plywood, with no underlying air gap beneath the underlay.

³ In this determination, unless otherwise stated, “sections” are sections of the Act and “clauses” are clauses of the Building Code.

⁴ Under section 177(1)(a) of the Act

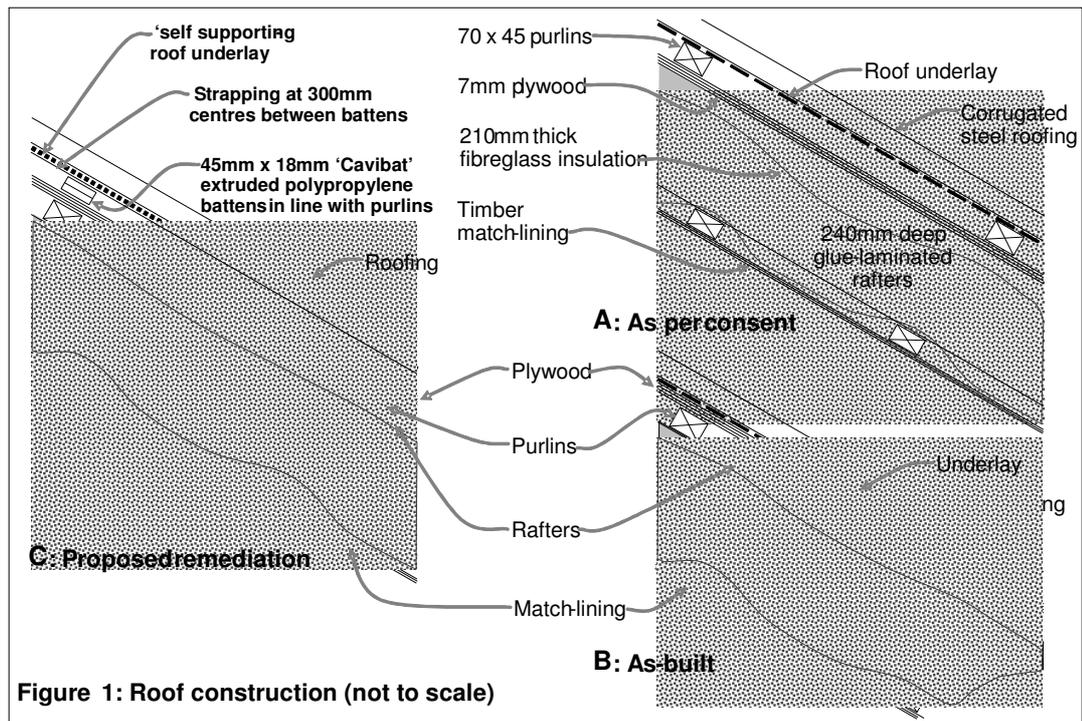


Figure 1: Roof construction (not to scale)

2.4 The proposed remedial work to the roof

2.4.1 The proposed roof detail is shown in Detail C; the work adds

- proprietary polypropylene battens, with an open ventilated structure, fixed over the plywood into the roof purlins
- new self-supporting roof underlay laid directly over the battens, with strapping at 300mm centres to prevent sag reducing the underlying air gap
- fixings to existing roof cladding to be 20mm longer to accommodate battens
- new ventilated ridge cappings installed to both gables
- new soffit vents installed to ensure ventilation.

2.4.2 The specification for the proposed roof repairs also includes

- removing all roofing, flashings and existing roof underlay
- inspecting plywood and replacing any sheets where mould is apparent
- for the upper half of the south roof; removing the ply and insulation to inspect and moisture test the roof cavity, replacing any damp or mouldy insulation.

3. Background

3.1 Building consent No. BC 100005 for construction of the house was issued on 12 February 2010 under the Building Act 2004. The authority carried out various inspections, including a pre-cladding inspection on 23 March 2011 and pre-wrap inspection on 2 May 2011.

3.2 When the house was nearing completion, water stains were observed on the underside of the timber lining to the south-facing skillion roof. The builder sought advice from the building surveyor and requested a site meeting with the authority. The authority inspected the roof with the builder and the surveyor on 20 October 2011, and the inspection record notes:

Portion of roof removed and ply cut out to expose roof space. Moisture content of purlin measured at 70% and ply sarking at 40% by [the building surveyor]. Not built as per design. To re-design and submit to [the authority] for approval.

3.3 The building surveyor's report

3.3.1 The surveyor provided a report to the builder dated 27 October 2011, which described his investigations and referred to the removal of roofing above water stained match lining during the site inspection on 20 October 2011.

3.3.2 The surveyor noted that his investigation included

- detailed visual inspection of the internal timber linings, with water staining observed to one localised area towards the ridge on the south roof
- thermal imaging of skillion roofs, which showed no 'thermal anomalies' or variance from moisture within the roof cavity or displaced insulation
- non-invasive and invasive moisture testing of timber ceiling linings, with readings between 8% and 10%
- the invasive investigation of the southern centre roof section during the site inspection, with the removal of a full length of roofing.

3.3.3 Commenting on his investigations, the surveyor noted that

- the ridge capping is tightly fitted and the underlay is continuous over the ridge line as detailed in the drawings, which results in an airtight ridge line
- there is no ventilation to the upper skillion roof cavity; the only air flow is via roof corrugations, which is blocked by the sealed roof ridge at the roof apex
- at the removed roof panel, dampness and mould growth was apparent to the top 25% of the plywood and the underside of the underlay, with very high moisture readings recorded, in contrast to lower plywood areas
- at a joint to the damp plywood, invasive moisture readings into the underlying roof purlins were extremely high
- plywood cut-outs allowed inspection of underlying construction, revealing that
 - the underside of the plywood was damp and moisture levels to the top of the rafters were elevated
 - the fibreglass insulation was about 230mm thick and completely filled the cavity between the rafters, with no clear ventilation under the purlins
 - insulation removal revealed water stains to the top of the match lining.

3.3.4 The surveyor considered that 'water tracking evidence' observed within the roof cavity indicated that the roof construction did not comply with Clause E3 of the Building Code as moisture was able to penetrate into the roof structure by

- condensing at significant levels during cold temperatures and being trapped in the top 25% of the south roof on the unventilated underside of the steel
- saturating roof underlay and tracking through onto plywood and into the joints
- penetrating plywood joints into timber purlins
- reaching the top of rafters and dropping through insulation onto the ceiling match lining, where it was able to track through the tongue-in-groove joints.

3.3.5 The surveyor concluded that the upper section of the skillion roof is particularly subject to the risk of condensation from the lack of ventilation in contrast to lower areas where some air flow is available from the gutter end, adding that:

The established and recommended good practice design in my view for skillion roof construction, especially in Central Otago locations such as this, should not have ignored the recognised recommendations for ventilation and condensing moisture control and that the resulting issues from the existing construction could have reasonably been expected.

3.4 The builder prepared a proposal for remediation based on advice from the surveyor, which was submitted to the authority on 30 January 2013 as an application for an amendment to the building consent (see paragraph 2.4).

3.5 After some discussions with the Ministry, the authority applied for a determination on 4 April 2013. The Ministry sought further information from the parties, with technical queries resolved by 29 May 2013.

4. The submissions

4.1 Within the application and in response to queries, the authority forwarded copies of

- the consent drawings
- the inspection summary
- the proposed roof amendment
- email correspondence with the owner
- technical information on proposed products.

4.2 In response to queries, the owner forwarded information that included

- relevant photographs of the exterior and interior of the house
- correspondence with the authority.

4.3 Copies of the information were provided to the parties, who made no further submissions in response.

4.4 A draft determination was issued to the parties for comment on 10 June 2013.

4.5 The parties accepted the draft without further comment.

5. Compliance of the proposed roof remediation work

5.1 The current roof construction

5.1.1 When considering the likely causes of the moisture damage to this skillion roof and the limited areas visibly affected to date, I make the following observations:

- Because the underlay is laid directly onto plywood, any condensation absorbed into the roof underlay is limited to dissipating only via the roof corrugations.
- Upper roof levels have no ventilation, as the existing roof underlay is wrapped over the ridge lining and the ridge capping is not ventilated.
- In regard to the restriction of visible water staining to one location on the match lining, I note that
 - this region experiences extremely cold temperatures and water staining of the match lining was observed after winter
 - visible damage is apparently limited to the upper level of the cold south roof, where temperatures may stay below freezing for extended periods
 - condensation may have accumulated and frozen on the underside of the steel roof cladding and then, as the temperatures rose, thawed and dripped onto the absorbent roof underlay
 - although condensation will have also occurred to the upper north roof, accumulation of ice is likely to have been limited by more frequent thawing, leading to smaller quantities of moisture to be dispersed
 - in the case of lower roof areas, I concur with the surveyor that air flow available at the gutters will have restricted the accumulation of moisture.

5.1.2 Although I have received no evidence of visible damage to internal linings in areas other than the upper section of the south-facing roof, I consider that the lack of ventilation within all areas of the skillion roof space is likely to reduce the durability of concealed elements.

5.2 The proposed roof repairs

5.2.1 In regard to the amendment to the building consent, I make the following observations about the proposed remedial work to the roof:

- Any other damage within the roof structure should be apparent during the specified preparatory inspections, and the specification also calls for any damaged materials to be replaced.
- Products and materials specified for the work appear appropriate for the purposes, and the specification calls for work to comply with the roofing code of practice⁵ and with product manufacturers' instructions.
- The specified roof underlay is a self-supporting absorbent underlay capable of spanning the 900mm maximum between the new battens, with additional support tape at 300mm centres to ensure that the underlying 18mm air gap remains unobstructed.

⁵ NZ Metal Roofing Manufacturers Inc. 'NZ Metal Roof and Wall Cladding Code of Practice' Version 2.1: 2012

- The specification calls for the installation of ridge and soffit vents and the specified battens have an open honeycomb structure. This combination should provide sufficient free air flow beneath the roof underlay to allow condensation moisture collected by the underlay to disperse to the outside.
- In regard to the reinstated roofing, the specification also calls for any roofing and flashings damaged during the remedial work to be replaced.

5.3 Conclusions

5.3.1 Based on the above and taking into account the building surveyor's report, I am satisfied that the investigations and remedial work proposed for this roof will

- identify and repair any significant damage suffered to date
- provide adequate control of condensation moisture to avoid damage recurring
- reinstate a weathertight roof to the house.

5.3.2 In the case of the roof remediation proposed for this house, the building surveyor's report and the other evidence have provided grounds for me to be satisfied that the proposed roof repairs will comply with Clauses E2, E3 and B2 of the Building Code.

6. The decision

6.1 In accordance with section 188 of the Building Act 2004, I hereby determine that the proposed roof repairs comply with Clause E2, Clause E3 and Clause B2 of the Building Code.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 9 July 2013.

John Gardiner
Manager Determinations and Assurance