

Determination 2008/87

15 September 2008

Determination regarding the durability of Macrocarpa exposed rafters at 49 Highfield Way, Whangarei



1. The matter to be determined

- 1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004¹ (“the Act”) made under due authorisation by me, John Gardiner, Manager Determinations, Department of Building and Housing (“the Department”), for and on behalf of the Chief Executive of that Department. The applicant is Whangarei District Council (“the authority”) carrying out its duties as a territorial authority or building consent authority, and other party is the owners, A and S Gell (“the owners”).
- 1.2 This determination arises from the concerns of the authority that the exterior rafters supporting sloping eaves over part of a deck may not comply with Clause B2 of the Building Code² (First Schedule, Building Regulations 1992).

¹ The Building Act 2004 is available from the Department’s website at www.dbh.govt.nz.

² The Building Code is available from the Department’s website at www.dbh.govt.nz.

- 1.3 Therefore the matter for determination is whether the exposed timbers of the rafters (“the exposed timber”) comply with Clause B2 “Durability” of the Building Code. By “the exposed timber” I mean that part of the rafters which project from the edge of the roof and are bolted to the deck posts.
- 1.4 In making my decision, I have considered the submissions of the parties and a report from an expert on timber decay resistance. I have evaluated this information using a framework that I describe more fully in paragraph 5.
- 1.5 In this determination, unless otherwise stated, references to sections are to sections of the Act and references to clauses are to clauses of the Building Code.

2. The building

- 2.1 The building work consists of a detached two story house with a basement garage and a partially covered deck. The construction of the house is conventional light timber frame, with a concrete slab to the garage, and suspended timber flooring. The house is reasonably complex with a boomerang outline in plan. The deck is supported by 125x125mm square section posts.
- 2.2 The deck extends around the north, east and west walls. The deck is approximately 2metres wide with the roof extending 1 metre from the walls and supporting the eaves projection. The 150x50mm rafters are installed as pairs and are spaced at 2.9m centres, and are built into the wall framing and bolted each side of the posts. 150 x 50 purlins span between the rafter pairs, supporting the roof cladding and the gutter. The top surface of the rafters, and the eaves cladding slope downwards at approximately 12° to the horizontal. The posts (125mm square) support the rafter pairs at their outer limit and also support the deck framing below the roof.
- 2.3 The rafters are indicated on the drawings as macrocarpa. However, the owners have advised that they have observed signs of borer in one or more of the rafters. As noted in the expert’s report these signs may indicate that the rafters contain sap wood.

3. Background

- 3.1 On 19 May 1999, the authority issued a building consent (No. 35313) for a new dwelling. The authority carried out inspections during construction and a Code Compliance Certificate was issued on 22 January 2000.
- 3.2 Subsequently the decking timber showed signs of decay. Arrangements were made between the developer and the authority to replace the deck. However, the authority was unsure as to whether the deck rafters supporting the eaves projection should also be replaced
- 3.3 The authority applied to the Department for a determination which was received on 24 June 2008.

4. The submissions

4.1 The authority noted in the application that the matter for determination was whether “... *the macrocarpa rafters only (partially exposed) satisfy Clause B2 of the New Zealand Building Code 50 years durability*”. In a letter dated 9 June 2008 the authority confirmed the determination concerned only the rafters.

4.2 The authority supplied copies of:

- the consent drawings
- the application for the building consent
- the building consent
- the code compliance certificate
- a summary of previous determinations regarding the use of macrocarpa³ .
- a series of photographs showing details of the deck and areas of decayed timber.
- A letter dated 28 July stating the determination was for the rafters only which they had inspected but could find no evidence of decay.

4.3 Copies of the submission and other evidence were provided to the other parties, who made no submissions in response.

4.4 The draft determination was sent to the parties for comment 11 August 2008. The authority accepted the draft, the owner accepted the draft with a minor amendment. The developer/builder was forwarded a copy as an interested party. He submitted the timber was heart Cupressus lustianica (Mexican cypress), although there could have been a small amount of sap wood. They noted that after 8 years there was no sign of decay. I accept both these points but these do not conflict with the opinion of the expert as noted in paragraph 7.2.

5 Evaluation for code compliance

5.1 Evaluation framework: durability of exposed timbers

5.1.1 The relevant provision of Clause B2 of the Building Code requires that building elements must, with only normal maintenance, continue to satisfy the performance requirements of the Building Code for certain periods (“durability periods”) “from the time of issue of the applicable code compliance certificate” (Clause B2.3.1).

5.1.2 In the case of the exposed timbers, this durability period is:

- the life of the building, being not less than 50 years, if the building elements provide structural stability to the building, or are difficult to access or replace, or failure of those elements would go undetected during both normal use and maintenance.

³ Macrocarpa is one of the Cypress species (named Cupressus macrocarpa) which also includes Lawson Cypress and Mexican Cypress, NZS 3602 “Timber and Wood-based Products for Use in Building” considers them as one group (Cypress species) for the purpose of the Standard.

- 5.1.3 In evaluating the design of a building and its construction, it is useful to make some comparisons with the relevant Acceptable Solution⁴, in this case B2/AS1, which cites NZS 3602⁵ as an acceptable solution for meeting the durability requirements of timber used in the building. NZS 3602 specifies H3.2 treated Radiata pine for posts and beams exposed to exterior weather conditions and dampness but not in ground contact. The exposed heart macrocarpa timber rafters in this house must therefore be assessed as an alternative solution.
- 5.1.4 The approach in determining whether the exposed timbers are durable involves an examination of their positions within the building, the surrounding environment, the design features likely to limit water penetration into the timber, and the moisture tolerance of the timber used for the rafters. The consequences of an element exposed to exterior weather conditions but demonstrating a low risk of consequential of moisture penetration and damage is that such elements comply with the Building Code while being less robust than those exposed to average or higher risk.

6 Durability Risk

6.1 In relation to the risk characteristics, I note the following:

(a) With respect to the construction features:

- The exposed rafters are visible and accessible.
- The rafters are protected in part by the overhang of the roof.
- The rafters are connected to and provide stability to the upper parts of the posts which in turn support the deck framing at the lower level.
- The rafters are 45 mm thick.

(b) With respect to the use of the timber in this instance:

- With the exception of the exposed sections of the rafters, the timber is protected from the weather.
- The timber is able to dry out if it becomes wet.
- The framing contains joint areas where water can be trapped, or not able to dry out
- The top surface of the rafters slopes at 12° to the horizontal with some ability to shed water.

(c) With respect to the durability of this timber species:

- Heart cypress is a moderately durable timber but being only 45 mm thick is the equivalent of pinus radiata treated to H3.1, according to table 1 of NZS 3602.
- There is some doubt as to whether all of the timber incorporated into the rafters is in fact heartwood

⁴ An Acceptable Solution is a prescriptive design solution approved by the Department that provides one way (but not the only way) of complying with the Building Code. The Acceptable Solutions are available from The Department's Website at www.dbh.govt.nz.

⁵ New Zealand Standard NZS 3602:2003 Timber and wood-based products for use in building

7 The expert's report

- 7.1 As mentioned in paragraph 1.5 I submitted details of the construction and timber relating to the deck and rafters in the building to an expert on timber decay. The resulting report contained an overview of the natural durability of the cypress species of which macrocarpa is a member and specific comments on the photographs supplied.
- 7.2 With respect to the rafters the expert noted *inter alia*:
- In these situations cypress heartwood is likely to have a quite variable and often relatively short service life i.e., occasional failures are likely within 5-15 years and significant decay could be expected in many of the joints or contact areas within 15-20 years.
 - Away from ground contact, but fully exposed to the weather, the average life of 50mm thick cypress heartwood is 15-25 years.
 - This will be strongly influenced by exposure conditions, the amount of rainfall or sunshine, and how quickly joint and contact areas dry out after wetting .
 - Horizontal, upward facing surfaces, end grain and joint areas where water can be trapped are most susceptible to decay
 - ...there is usually more service life variability of naturally durable timbers than of treated radiata pine sap wood

8 Discussion

- 8.1 I consider that having regard to the function of these rafters they require a durability of no less than 50 years or the life of the house.
- 8.2 I take the view that the evidence, when considered together with the particular risks and circumstances as outlined in paragraph 6, has established that the exposed rafters in this house will not achieve the durability required by NZS 3602.
- 8.3 The expert has expressed a view that it is unlikely, in this application that surface treatment with preservatives would significantly extend the useful life of the existing timber. I am also concerned that the rafters may not be heart wood.
- 8.4 Previous determinations (2004/71 and 2007/135) with respect to Macrocarpa have recognised;
- In Determination 2004/71 (which considered the durability of 200mm square posts with some protection from the weather and in a reasonable drying situation), that heart Macrocarpa is equivalent to radiata pine with H3.2 preservative treatment i.e. a 50 year life
 - In Determination 2007/129 (which considered the durability of 100mm square posts) that heart Lawson Cypress posts which could not drain and dry would not meet the durability requirements of the code and would be required to be treated with preservative.

8.5 I emphasise that each determination is conducted on a case-by-case basis. The fact that particular timber elements have been established as being code compliant in relation to a particular building does not necessarily mean that the same timber elements will be code compliant in another situation. I consider this installation to differ in significant ways from those described above, and my decision on the durability of Cypress species timber in this application is framed accordingly

9 The decision

9.1 In accordance with section 188 of the Building Act 2004, I hereby determine that the exposed rafters to this building do not comply with Clause B2 of the Building Code.

Signed for and on behalf of the Chief Executive of the Department of Building and Housing on 15 September 2008.

John Gardiner
Manager Determinations