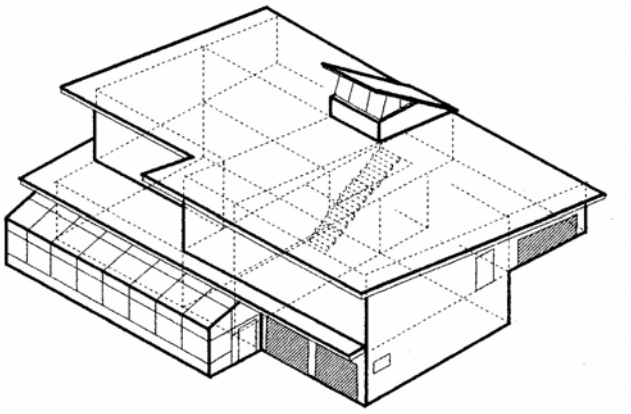
Determination 2007/101

Determination regarding a building consent for a house with an earth-covered roof at 245 Hossack Road, Waikiti Valley



1. The matter to be determined

1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004[1] ("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 the Rotorua District Council ("the territorial authority"), and the other party is the designer and one of the joint owners of the property Mr M Moore ("the owner").

1.2 This determination arises from the decision of the territorial authority to refuse to issue a building consent for a proposed house because it is not satisfied that the building work will comply with the following clauses of the Building Code[2] (First Schedule, Building Regulations 1992):

- B1 Structure
- E1 Surface water
- E2 External moisture

[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.

- E3 Internal moisture
- F4 Safety from falling
- G7 Natural light (refer paragraph 1.3)
- H1 Energy efficiency

1.3 I note that the territorial authority's submission as outlined in paragraph 4.1 refers to clause G6 Airborne and Impact Sound, which does not apply to this proposal. I assume that the reference is incorrect, and is intended to be clause G7 Natural Light. This determination is therefore based on that assumption.

1.4 I note that the building consent application includes a detached implement shed that appears to be a generally conventional structure. In its submission, the territorial authority has raised no specific issues related to this structure that appear to require determination (refer paragraph 4.1). While the Department has discussed several minor structural amendments relating to clause B1 with the owner, I consider that these and any other matters related to the implement shed are outside the scope of this determination. I therefore limit this determination to matters related to the house.

1.5 In making my decision, I have considered the submissions of the parties and the other evidence in this matter. I have evaluated this information using a framework that I describe more fully in paragraph 5.1.

1.6 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 proposed building

2.1 The proposed building work consists of a 2-storey detached house situated on a north-sloping site that is part of a large rural property. The building is set into the contours of the site, with the rear wall fully buried, and front wall exposed from ground level, and grassed earth extended over the 6o pitch concrete roof. The house shape is simple in plan and form with a 35o pitch "pop-up" clerestory roof projecting beyond the main roof at the centre rear of the building. The main roof has eave projections of about 1800mm to the north and verge projections of 1500mm to the east and west.

2.2 The house is sited at the end of a spur, with the low south edge of the roof about level with the top of a hill that drops away to the east and west. At the east and west walls of the house, earth is intended to be sloped down in steep banks, with an upper floor garage accessible from a driveway at the south end of the west elevation, and another garage area in the north basement.

2.3 The design is a specifically engineered reinforced concrete shear wall structure on a concrete slab and foundations, with precast concrete slabs (with concrete topping) to the first floor and the roof. The concrete shear walls are 200mm thick, except for the 250mm rear retaining walls, and the front north wall is reinforced lightweight pumice concrete, which is also used as an insulating "cladding" layer over the east and west

exterior concrete walls and the roof. The primary shear walls divide the structure into three main parts, with a central hall/staircase running full depth of the building and the side areas divided by further shear walls and timber partitions.

2.4 The first floor slab extends to form a deck, with a tiled surface and open metal balustrades, which sits partly above basement areas. The deck extends along the north wall and returns along part of the east elevation, with the pumice concrete covered with a bitumen emulsion membrane that extends 300mm up the exterior walls.

2.5 The main roof has a 200mm insulating layer of pumice concrete over the slab, with a damp proof membrane of bitumen emulsion, applied in 2 coats to a thickness of about 4mm and covered with 0.25mm polythene sheeting that is overlapped and sealed with a bituminous adhesive strip applied at joints and edges. The grassed earth cover to the roof appears to be about 300mm thick and is intended to be bounded by an electric stock fence and locked gate to the south. One drawing indicates a 400mm high concrete block nib and pipe fence at the north edge of the roof, although the intent is unclear (refer paragraph 5.5.3).

2.6 The small clerestory roof above the staircase provides sloping glazing to the north. A lean-to conservatory extends to the north from the basement, with the upper edge of the glazed roof panels fixed to the underside of the concrete deck above.

2.7 A chartered professional engineer ("the design engineer") has provided structural design calculations and a producer statement (PS1 – Design) dated 30 April 2007, which states that the house design meets the requirements of clause B1 of the building code, subject to verification that the soil strength exceeds 100 kPa and to the specified proprietary products meeting with the relevant provisions of the code.

3. Background

3.1 The territorial authority received a building consent application (No 60241) on 5 May 2007 and, in a letter to the owner dated 25 May 2007, advised that the proposal did not fully comply with the building code and that the processing of the application would be suspended pending the receipt of further information about, and amendments to, the house design.

3.2 The owner responded to the territorial authority with a report entitled "Responses to queries" dated 29 May 2007, which provided written answers and attached:

- insulation calculations
- concrete compression test reports from Opus International Consultants Ltd
- sketch details of the conservatory to house junction
- sketch details of the clerestory glazing.

3.3 According to the owner, the territorial authority did not respond to or discuss the matters covered in the report and wrote to the owner on 21 June 2007, stating that it was seeking a determination as the proposal did not meet some of the requirements of the building code.

3.4 The Department received an application for a determination on 25 June 2007. Additional information was sought which was received on 2 July 2007.

4. The submissions

4.1 In a statement accompanying the application, the territorial authority stated:

> The Plans and Specifications as submitted only go part of the way towards meeting the requirements of the Building Code and we believe that it fails to meet the requirements of B1, E1, E2, E3, F4, [G7], H1 and is a totally alternative solution.

The territorial authority described the project, and raised the following issues:

- The owner plans to undertake all work with help from neighbours
- The owner has engineering experience but is at present unregistered
- The roof is proposed to be tanked and grassed
- The concrete is intended to be batch mixed rather than sourced as certified concrete from normal concrete suppliers

The territorial authority concluded:

> Council believes that because of the alternative solutions that are involved and the way in which it is proposed to be constructed, that the project is beyond the normal Building Code requirements and even the normal Building Consent requirements.
>
> We believe this type of construction needs to be undertaken by persons experienced in this type of construction as we believe that the owner/builder will not be able to complete the concrete work involved in this project and as such, his Building Consent has been refused and referred for a Determination.

4.2 The territorial authority forwarded copies of:

- the consent documentation
- the territorial authority's correspondence with the owner.
- the owner's report "Responses to queries" dated 13 June 2007.

4.3 The owner made a submission in the form of a report dated 30 June 2007, which set out the background to and aims of the house design, including thermal performance, environmental impacts, structure and ease of construction. The owner also responded in general terms to the territorial authority's concerns, including the following points:

- The territorial authority is not specific about how the design does not fulfil code requirements, as earlier queries were responded to in detail and we received no indication how and why these responses were inadequate.
- The owner has a degree in Civil Engineering (while the co-owner has a degree in Chemical Engineering), with experience in a variety of power scheme, roading and building projects, together with local building experience.

- Farming neighbours include a qualified electrician, agricultural contractors and engineers and a plumber so professional construction experience and assistance is not lacking and will be paid for under contract as necessary.
- A large concrete mixer will be used to batch mix the concrete on-site to control the quantity, quality and timing of mixes, as the distance of the site from local concrete suppliers makes adequate control unmanageable and uneconomic.
- Concrete mix design and testing has been carried out over some time with Opus International Consultants Ltd's local laboratory, and a compression test programme will be designed to suit both the territorial authority and the owner's requirements.
- Although pumice concrete is not a new material, local concrete suppliers do not supply pumice mixes, so on-site production and testing equipment is needed for this and can also be used for the standard concrete.
- The proposed structure is covered by those parts of the building code that relate to concrete structures, and the proposal is fairly simple and conventional, except for the use of lightweight pumice concrete as an insulating cladding.
- The design has been a long time in the planning and is based on self-building, with precast panels that simplify floor and roof construction, limited types of materials, and simplified structural elements and dimensions.

The owner concluded:

> It is our belief that it is not the Council's place to prejudge what we are or are not personally capable of but to ensure that our home is constructed to the required standards. We are happy to develop a programme of testing and inspection and we are certainly capable of employing skills and labour as we need it. The Minister [of Building and Construction] has assured the public that DIY building is not being discouraged by new regulations and wants to promote innovation, more environmentally sustainable and energy efficient houses – well that's what we are doing.

4.4 The owner forwarded copies of:

- concrete mix design and test results
- various statements and articles on sustainable housing.

4.5 In response to various queries from the Department, the owner made a further submission in the form of a report titled "Response for determination" dated 15 July 2007, which provided various attachments and detailed descriptions relating to:

- waterproofing system for the roof
- weatherproofing of the external joinery
- construction joints in the concrete structure
- location and extent of the retained earth (was called "earth retaining lines")
- properties of the pumice concrete
- roof safety (safety from falling).

4.6 Copies of the submissions and other evidence were provided to each of the parties. Neither party made any further submissions in response to the submission of the other party.

4.7 A draft Determination was sent to the parties for comment on 22 August 2007. The territorial authority accepted the draft without comment.

4.8 In an email to the Department dated 29 August 2007, the applicant accepted the draft but requested that the determination identify the matters that were now acceptable to the Department as being code compliant, and that the decision be amended to reflect the view that the consent documentation was incomplete rather than the building did not comply with the building code. I have amended the determination as appropriate.

5. Evaluation for code compliance

5.1 Evaluation framework

5.1.1 I have evaluated the code compliance of this house by considering the following five broad categories of the building work:

- The structure of the building (clause B1)
- The surface water requirements (clause E1)
- The weathertightness of the building (clause E2)
- The safety from falling off the roof (clause F4)
- The remaining code requirements referred to in the territorial authority's application (clauses E3, G7 and H1).

5.1.2 In evaluating the design of a building and its construction, it is useful to make some comparisons with the relevant Acceptable Solutions[3], which will assist in determining whether the structure and features of the building work are code compliant. However, in making this comparison, the following general observations are valid:

- Some Acceptable Solutions are written conservatively to cover the worst case, so that they may be modified in less extreme cases and the resulting alternative solution will still comply with the Building Code.
- Usually, when there is non-compliance with one provision of an Acceptable Solution, it will be necessary to add one or more other provision to compensate for that in order to comply with the Building Code.

5.2 Evaluation of structure for B1 compliance

5.2.1 Professional engineers employed by the Department have examined the consent documents and the design calculations, and have communicated with the design engineer on various aspects. Based on the examination of the consent documents and the design calculations, together with subsequent submissions in response to

[3] 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.

queries, I have concluded that the proposed design of the house generally complies with the requirements of clause B1 of the code.

5.3 Evaluation of surface water for E1 compliance

5.3.1 The soil type and the depth of the water table, together with the contours of the building site and surrounding farmland appear to minimise the likely impact of surface water on the building. I also note that the rear retaining walls appear to be adequately drained, although intentions as to disposal appear conflicted and not yet fully resolved.

5.3.2 While the proposed house generally appears to comply with the requirements of clause E1, the system for disposing of drainage water from the retaining walls needs to be more clearly specified and detailed in the consent drawings as the detail shown is too small to be clear:

5.3.3 The design as proposed by the documents supplied with the application does not therefore provide reasonable grounds for me to confirm compliance with building code clause E1.

5.4 Evaluation of external building envelope for E2 compliance

5.4.1 The approach in determining whether building work is weathertight and durable and is likely to remain so, is to apply the principles of weathertightness. This involves the examination of the design of the building, the surrounding environment, the design features that are intended to prevent the penetration of water, the cladding system, its installation, and the moisture tolerance of the external framing. The Department and its antecedent, the Building Industry Authority, have also described weathertightness risk factors in previous determinations[4] (for example, Determination 2004/1) relating to cladding and these factors are also used in the evaluation process.

5.4.2 The consequences of a building demonstrating a high weathertightness risk is that building solutions that comply with the Building Code will need to be more robust. Conversely, where there is a low weathertightness risk, the solutions may be less robust. In any event, there is a need for both the design of the cladding system and its installation to be carefully carried out.

5.4.3 All elevations of this house demonstrate a low weathertightness risk rating when evaluated using the E2/AS1 risk matrix.

5.4.4 I note that the drawings show that the window openings in the concrete walls have sloping sills and rebates, and the owner has stated that the system will be manufactured, flashed and fitted to WANZ standards using details for concrete panels.

[4] Copies of all determinations issued by the Department can be obtained from the Department's website.

5.4.5 I also note that the owner has described the damp proofing system intended for the roof, the tanking and tiling intended for the deck areas and the sealing and coating of the exterior pumice concrete surfaces.

5.4.6 Based on the examination of the consent documents, together with subsequent submissions in response to queries, I consider the proposed design of the house generally appears to comply with the weathertightness requirements of the building code.

5.4.7 The following matters need to be resolved and incorporated into the consent documents (detailed, specified, and referenced as necessary):

- The sealing and coating system for the pumice concrete cladding. (The applicant submitted acceptable details for the proposed mix design but the concrete sealant needs to be specified.)
- Specific details of the clerestory glazing, including all junctions and flashings. (Additional details are required.)
- Specific details of the conservatory glazing, including all flashings and junctions with the concrete walls and slabs of the main building. (Additional details are required.)

5.4.8 The following matters have subsequently been clarified by the applicant and are now considered to be code compliant:

- The damp proofing systems for the roof and deck areas, including the perimeter details.
- The method and details for finishing the perimeter of the soil and grass area, including at the clerestorey, together with the clear definition of the extent of soil cover to the roof at the east and west elevations.
- Window/door installation details and materials.
- Details and locations of control and construction joints.

These matters are to be incorporated into the consent documents (detailed, specified, and referenced as necessary).

5.5 Evaluation of the roof safety for F4 compliance

5.5.1 Clause F4 of the building code requires that buildings shall be constructed to reduce the likelihood of accidental fall of over 1.0m, and that roofs with permanent access shall have appropriate barriers provided.

5.5.2 In the case of this house, the roof area is potentially accessible and safety must therefore be ensured by either:

- a barrier to the east, north and west edges of the roof, or

- a barrier that restricts access to the roof.

5.5.3 The consent application drawings of the house indicated a partial barrier at the north end of the roof, although the details of this were not clear. The owner has stated that a permanent fence at the perimeter of the roof would be an unnecessary eyesore and believes that it is not necessary in this situation as access is prevented by the use of the electric fence and gate.

5.5.4 As outlined in paragraph 5.5.2, the restriction of access to the roof will result in compliance with clause F4, but the following must be attended to:

- Detailing of the barrier and gate to demonstrate compliance with clause F4.
- The position and extent of the barrier, in relation to the house, clearly indicated in the drawings.

5.5.5 The design as proposed by the documents supplied with the application does not therefore provide reasonable grounds for me to confirm compliance with building code clause F4.

5.6 Evaluation of the remaining disputed code requirements

5.6.1 Taking into account the drawings and other information submitted, I am satisfied that the proposed house complies with the requirements of clauses E3, G7 and H1.

6. Discussion

6.1 I am able to conclude; the proposed house will comply with the requirements of the Building Code if it is build in accordance with amended consent documentation which satisfactorily resolves the non-compliant matters described in paragraphs 5.3.2, 5.4.7, and 5.5.4 and fully incorporates the compliant matters described in paragraph 5.4.8.

6.2 The amended consent documentation (the plans, specification and any other supporting documentation) should contain;

1. The additional information since provided by the applicant to the department by the owner.

2. Information about matters outlined in paragraphs 5.3.2, 5.4.7, and 5.5.4 which are to be addressed.

The documentation must clearly set out how compliance with the relevant clauses of the Building Code is to be achieved. I suggest reference be made to guidance information the Department has published on this matter[5].

[5] The booklet "Guide to applying for a building consent (simple residential buildings)" can be obtained from the Department's website.

6.3 The ability of the proposed work to meet the requirements of the Building Code will be determined by the adequacy of the consent documents, provided the building is built in accordance with the consented plans and specification. While the owner may well be capable of building the structure as is proposed, I consider that the structural aspects, including the concrete materials, batching and testing, requires the owner to propose a production control and monitoring regime that will satisfy the territorial authority that code compliance will be achieved.

6.4 While it is not for me to decide how the building should be built and monitored, the key stages of the construction might be subject, to one, or a mix of all three, of the following methods:

- Oversight by an independent and suitably qualified engineer.
- Onsite (or offsite) batch testing.
- Specific site inspections by the territorial authority's own staff.

6.5 The territorial authority sought a determination from the Department because it believed that the work, in part, was an alternative solution, and as a consequence, questioned whether this would meet the requirements of the building code. While I accepted the application as a determinable matter, I observe that the territorial authority could have exercised the option of having the proposed building work reviewed by a suitably qualified person at the owner's expense.

7. The decision

7.1 In accordance with section 188 of the Act, I determine that insufficient detail is shown in the consent documentation to demonstrate the building will comply with clauses B1, E1, E2, and F4 of the Building Code, and accordingly confirm the territorial authority's decision to refuse to issue a building consent until the matters outlined in paragraphs 5.3.2, 5.4.7, and 5.5.4 are resolved to the satisfaction of the territorial authority.

Signed for and on behalf of the Chief Executive of the Department of Building and Housing on 5 September 2007.

John Gardiner
Manager Determinations