

Determination 2005/71

Refusal of a code compliance certificate for a building with a “monolithic” cladding system: House 61

1 THE DISPUTE TO BE DETERMINED

- 1.1 This is a determination of a dispute referred to the Chief Executive of the Department of Building and Housing (“the Chief Executive”) under section 17 of the Building Act 1991 (“the Act”) as amended by section 424 of the Building Act 2004. The applicant is the owner and the other party is the territorial authority. The application arises from the refusal by the territorial authority to issue a code compliance certificate for a 3-year old house unless changes are made to its monolithic cladding system.
- 1.2 The question to be determined is whether on reasonable grounds the external monolithic wall cladding as installed to the walls of this house, (“the cladding”), complies with the building code (see sections 18 and 20 of the Act). By “external monolithic wall cladding as installed” I mean the components of the system (such as the backing sheets, the flashings, the joints and the plaster and/or the coatings) as well as the way the components have been installed and work together.
- 1.3 This determination is made under the Building Act 1991, subject to section 424 of the Building Act 2004. That section came into force (“commenced”) on 30 November 2004, and its relevant provisions are:
- “ . . . on and after the commencement of this section,—
- “(a) a reference to the Authority in the Building Act 1991 must be read as a reference to the chief executive; and
- “(b) the Building Act 1991 must be read with all necessary modifications to enable the chief executive to perform the functions and duties, and exercise the powers, of the Authority . . . ”

It should be noted that the new legislation does not amend the determination process set out under the 1991 Act, other than to transfer the power to make a determination from the Building Industry Authority (“the Authority”) to the Chief Executive.

- 1.4 This determination refers to the former Authority:
 - (a) When quoting from documents received in the course of the determination, and
 - (b) When referring to determinations made by the Authority before section 424 came into force.
- 1.5 In making my decision, I have not considered any other aspects of the Act or the building code.
- 1.6 The house itself is described in paragraphs 2.1 to 2.3, and paragraph 8 sets out the decision.

2 PROCEDURE

The building

- 2.1 The building is a two-storey detached house situated on a level excavated site in a medium wind zone in terms of NZS 3604: 1999 “Timber framed buildings”. The house is of conventional light timber frame construction on concrete block foundation walls. All the external walls are sheathed with monolithic cladding. The house is of a relatively simple shape with the roofs situated on two main levels, and the lower roofs have intersections with the cladding above. The roof is extended out 1000mm or 1800mm to form a veranda, which is supported on posts and beams to three elevations of the house. There is a balcony that is set into the lower level roof over the veranda, the deck of which is sheathed with a waterproof membrane over plywood sarking, with tiles laid over the membrane. The balcony has a timber-framed balustrade to the front and both ends, which is sheathed with the cladding on both faces and the level top. This differs from the plans, which show a timber capping. An open pergola is attached to the northern and western corners of the house. At the higher-level roofs there are two elevations without eaves and two elevations with 450mm wide eave projections. The lower-level roofs have no eaves to one elevation and the other elevations have either a 300 mm wide projection or are protected by the veranda overhangs.
- 2.2 The owner and the builder advised the expert engaged by the Authority that the framing in the external walls is treated. In addition, the approved plans specify H1 Boric treatment for this timber. While no further documentary evidence has been produced, I am prepared to accept that H1 Boric treated timber was used in the exterior walls.
- 2.3 The external walls of the building are clad with what is described as monolithic cladding. In this instance it incorporates fibre-cement backing sheets fixed through the building wrap directly to the framing timbers and finished with a textured plaster finish and an acrylic paint system. While the expert engaged by the Authority has

identified the type of backing sheet used, no evidence has been produced as to which jointing, sealing, plaster or paint systems have been applied on this house.

Sequence of events:

- 2.4 The territorial authority issued a building consent on 12 September 2000, and an amended building consent on 12 February 2001.
- 2.5 The territorial authority carried out various inspections during the course of construction, and inspected the house on 26 February 2004, sometime after it had been completed. In a letter, dated 9 March 2004, the territorial authority stated that it had inspected the house, regretted that it may not comply with the building code in a number of respects and described the territorial authority's current concerns as regards weathertightness problems involving monolithic clad buildings. The territorial authority attached a copy of a Notice to Rectify, dated 9 March 2004, to this letter.

The "Particulars of Contravention" attached to the Notice to Rectify noted that in regard to the cladding:

1. The following have not been installed per the manufactures [sic] specifications
 - Control joints at a maximum of 5.4 centres vertically are required. Vertical control joints have not been installed.
 - A 6mm gap (horizontally) is required between the back of the cladding and the foundation wall. This has not been achieved.
 - Horizontal surfaces are to be formed with sufficient fall to prevent water from ponding on them. The deck barriers have flat horizontal surfaces.
 - The junction between the window head flashing and bottom edge of the cladding is to be either
 - Left unsealed with a 5mm gap or
 - If sealed, the bottom edge of the sheet must be back sealed. A continuous 6mm x 10mm inseal strip must also be used to seal the back edge of the sheet. As the junction has been sealed, council must satisfy itself that the above mentioned seals have been installed.
 - The junction between the bottom edge of the window joinery and the wall cladding is to have a sill flashing installed and the junction is to remain open. This junction has been sealed and no sill flashing appears to have been installed.
 - Head flashings above windows to be taken 30mm past the edge of the window joinery. This has not been achieved.
 - The bottom edge of the cladding system is to finish a minimum of 100mm above the paved surfaces and 175mm above unpaved surfaces. The cladding has been taken closer than these measurements.
 - The minimum finished floor level to finished ground level is 150mm to paved surfaces. This clearance has not been achieved.

2. The following items have not been installed per the acceptable solutions of the building code, (no alternative solutions have been applied for)
 - The distance between finished floor level and finished paving of 150mm has not been achieved.
 - Two outlets are required to internal gutters/decks. The cross-sectional area of the outlet shall be not less than the cross sectional area of the downpipes serving the gutter/deck. The minimum internal diameter permitted is 63mm. The overflow outlet for the deck off the master bedroom is less than permitted.
3. The following items have not been installed per accepted trade practice
 - At the junction between horizontal surfaces (i.e. top of barrier) and a vertical surface (i.e. house wall) flashing (*sic*) are required. The deck barrier/house junction has no flashing installed.
 - Handrails and the like are not to penetrate top of barrier. Handrail penetrations into horizontal surface of the barrier have not been protected with rubber flanges.
 - A minimum clearance of 50mm is required between the cladding and adjacent surfaces. There is minimal clearance between the roof and wall flashings.
 - Penetrations through the cladding system shall be as waterproof as the cladding itself. There are a number of penetrations through the cladding that should be protected with rubber flanges and silicon.
4. Ventilated cavity system
 - The Council has recently received information which shows that monolithic cladding systems without a drainage plane/cavity, provision for adequate ventilation, drainage and vapour dissipation will, in the likelihood of leakage and/or the effects of residual moisture, cause irrevocable damage to the structural elements of the building.
- 5 Amended plans
 - There have been changes from the building consent plans to what has been built, without the benefit of an amendment to the building consent. For example the elevations shown on the plans do not match what has been built.

The territorial authority also noted:

The Council cannot be satisfied that the above building meets the performance requirements of Clauses B1 Structure, B2 Durability, E2 External Moisture, E3 Internal Moisture, G4 Ventilation and H1 Energy Efficiency Provisions of the Building Code...This is in breach of Sections 7(1), of the Building Act 1991...

Also that the owner was required to:

1. Provide adequate ventilation to the monolithic cladding and into the wall frame space by means of either a ventilated cavity or alternative approved system, and ensuring all issues related to the above are resolved.
2. Lodge with the council an application, within 28 days from the date of this notice, for an amended building consent, and provide all necessary information that may be requested to allow this consent application to be processed, alternatively.

- 3 Confirm to council, within 28 days from the date of this notice, your intention to apply to the Building Industry Authority for a determination in accordance with the Building Act 1991

The territorial authority also provided a set of photographs relating to the cladding.

- 2.6 The owner applied for a determination on 20 April 2004.

3 THE SUBMISSIONS

- 3.1 The owner made a submission, dated 24 May 2004, which made the following salient comments:

- The territorial authority inspected the house on 3 September 2003, and the cladding was passed subject to some minor remedial work, which was subsequently carried out;
- The territorial authority carried out a further final re-check on 3 September 2003, and the remedial work was passed, but the inspector informed the owner that the cladding could not be passed “because it did not have a cavity”;
- The house had been constructed in accordance with the approved building consent plans;
- The builder agreed to rectify the items raised by the territorial authority set out in parts 1 to 3 in their Notice to Rectify, but the requirement for a cavity was not required under the building consent, nor was this an issue raised during the territorial authority’s inspections.
- The owner was prepared to carry out the remedial work as listed by a consultant engaged by the owner; and
- The territorial authority was referring to the original consent plans when commenting that the house as built did not match them. However the revised consent matched what was built and passed on final inspection.

- 3.2 The owner attached a report from a consultant engaged by the owner to the above letter which stated that the consultant had inspected the house and noted the following:

- 1) Vertical control joints to exterior sheathing should be installed as per the attached plan.
- 2) Top floor deck to master bedroom requires new over flashing/handrail (as attached *detail 1*) including wall junction flashing (as attached *detail 2*). This deck also requires 80mm dia water outlet to be installed.
- 3) Window joinery flashings require remedial work as per attached manufacturer's details 21 and 24.

- 4) A 150m (*sic*) grate drain should be installed to the areas of paving that are less than 150m (*sic*) below floor level. This grate drain should connect to the stormwater line via a cess pit.
- 5) Ensure bottom edge of exterior cladding is in accordance with manufacturer's detail 13 as attached.
- 6) Seal all penetrations through the exterior sheathing, ie, meter box, tv cable etc.

On completion of items 1-6 above, it is my opinion that this building will meet the functional requirement of E2.2...

I believe this house to be well built and on my inspection to be free from any form of moisture penetration. The remedial work recommended is for long term preventative maintenance.

3.3 The owner also provided copies of:

- The building plans;
- The building consent;
- The Notice to Rectify;
- The consultant's report; and
- Correspondence with the territorial authority.

3.4 The territorial authority forwarded a lengthy submission. The bulk of the submission was a general comment on monolithic cladding, although some of the material related to this particular extension, and stated that

- The principle design and current construction methods for the wall assembly do not provide for ventilation and a drainage plane. In the event of a failure of any claddings deflection methods moisture will enter and accumulate in the wall framing hereby breaching (*sic*) the Building Act.
- Secondly the building materials in the wall assembly are inadequate to withstand moisture accumulation as there is no allowance or compensatory factors in the design to allow for the consequence of failure of the system components or the system as a whole. The inevitable failure to keep moisture out will wet the timber frame meaning conditions will exist in the wall likely to cause the timber and other materials in the wall to degrade and be incapable of lasting 50 years as required by the Building Act. This is part due to the design of the wall not having a drying mechanism other than the natural condition of drying by diffusion through paint coatings which experience shows is too slow to avoid mould growth. Where moisture ingress continues or is greater than the natural drying forces moisture accumulation occurs which affects the durability of the timber and plasterboard.
- The third failure of the cladding system is that it is inadequately designed to allow for the expected movement associated with timber frame construction, and thereby cracks will form and sealants tear letting water in. Work in excess of normal maintenance will be required to keep the FIBRE-CEMENT (FC) system, its jointing system and sealants watertight such that moisture will enter and accumulate in the framing, fibreglass insulation and plasterboard such that mould will grow.

- Fourthly the wall cladding is inadequately insulated and does not manage or control the climatic conditions expected this buildings location such that condensation can occur and breach (*sic*) the Code.
- The [territorial authority] points out that there are already numerous defects in the cladding envelop meaning the building is already in contravention of the Building Act and that even if these items were rectified the building will remain in breach (*sic*) of the code due to the above reasons. Attempts at rectification or directing responsibility to the homeowner under the title maintenance are in the Councils opinion unfair as these were not pointed out to Council when the permit issued.(*sic*)

- 3.5 The submission also included a copy of the Notice to Rectify and a set of photographs, illustrating some of the territorial authority's concerns.
- 3.6 The territorial authority felt that it must refuse to issue a code compliance certificate on the grounds that there was insufficient scientific evidence on the performance of these building elements.
- 3.7 The territorial authority in a letter to the Authority, dated 19 August 2004, elaborated on its original submission and stated that its areas of concern were those itemised in the Notice to Rectify and then listed them in detail. The territorial authority, using the risk matrix contained in the revised Acceptable Solution E2/AS1, calculated the weathertightness risk to the house to be moderate to high.
- 3.8 The copies of the submissions and other evidence were provided to each of the parties. The territorial authority in their submission noted that the remedial works set out in the consultants report differed from that set out in the owner's submission and the territorial authority was, therefore, unclear as to what work was to be undertaken.

4 THE RELEVANT PROVISIONS OF THE BUILDING CODE

- 4.1 The dispute for determination is whether the territorial authority's decision to refuse to issue a code compliance certificate because it was not satisfied that the cladding complied with clauses B2.3.1 and E2.3.2 of the building code (First Schedule, Building Regulations 1992) is correct. The relevant provisions of the building code provide:

Clause B2—DURABILITY

B2.3.1 Building elements must, with only normal maintenance, continue to satisfy the performance requirements of this code for the lesser of the specified intended life of the building, if stated, or:

- (a) The life of the building, being not less than 50 years, if:
- (i) Those building elements (including floors, walls, and fixings) provide structural stability to the building, or
 - (ii) Those building elements are difficult to access or replace, or
 - (iii) Failure of those building elements to comply with the building code would go undetected during both normal use and maintenance of the building.

(b) 15 years if:

(i) Those building elements (including the building envelope, exposed plumbing in the subfloor space, and in-built chimneys and flues) are moderately difficult to access or replace, or

(ii) Failure of those building elements to comply with the building code would go undetected during normal use of the building, but would be easily detected during normal maintenance.

Clause E2—EXTERNAL MOISTURE

E2.1 The objective of this provision is to safeguard people from illness or injury, which could result from external moisture entering the building.

E2.2 Buildings shall be constructed to provide adequate resistance to penetration by, and the accumulation of, moisture from the outside.

E2.3.2 Roofs and exterior walls shall prevent the penetration of water that could cause undue dampness, or damage to building elements.

4.2 There are no Acceptable Solutions that have been approved under section 49 of the Act that cover this cladding. The cladding is not accredited under section 59 of the Act. I am therefore of the opinion that the cladding system as installed can be considered to be an alternative solution.

4.3 In several previous determinations, the Authority has made the following general observations, which in my view remain valid in this case, about acceptable solutions and alternative solutions:

- Some acceptable solutions cover the worst case, so that in less extreme cases they may be modified and the resulting alternative solution will still comply with the building code.
- Usually, however, when there is non-compliance with one provision of an acceptable solution, it will be necessary to add some other provision to compensate for that in order to comply with the building code.

5 THE EXPERT'S REPORT

5.1 The Authority commissioned an independent expert ("the expert") to inspect and report on the cladding. The expert inspected the building and furnished a report. It stated that the quality of finish is good, and both the plaster coating, which has been evenly applied, and the painting are of a good standard, except where noted otherwise in the expert's report. The expert noted the following specific faults that had been identified during the inspection:

- No head flashing is installed over the garage door;

- The sheet cladding is brought hard down against the head flashing, the backing sheets are not back-sealed at this junction and no in-seal strip is inserted behind the sheet;
- There is evidence that the bead of sealant that is placed down the side of the exterior joinery unit jambs has failed, and there are no in-seal strips at these locations. In some instances, silicone has been applied as a fillet to the window edges, which is not considered to be an effective weathering method. Clear silicone, which does not meet durability requirements, has been used to repair the many cracks around the windows;
- A bead of silicone is placed on the bottom edge of the exterior joinery units; and no sill flashings or in-seal strips have been installed;
- Handrails are top fixed into the horizontal surface of the balcony balustrade and the water proof membrane has been penetrated;
- No slope has been formed on the top horizontal surface of the balustrade;
- No saddle flashings have been installed between the house and the barrier of the balcony, and cracking has appeared around this junction;
- The overflow from the balcony is undersized by approximately 30mm, and its passage has been restricted by the cladding on the inside face of the balustrade;
- Almost all sheet joints on the upper floor have cracks, the cladding has cracked at the junction of the canopy to the house, and cracks have formed along the top edge of the barrier of the balcony;
- The vertical control joints, which are specified on the approved plans, have not been installed on either level;
- A small section of wall on the northern elevation requires a horizontal control joint;
- There is only a 5mm to 10mm clearance between the bottom edge of the cladding and the roof cladding, whereas a 50mm minimum clearance is required;
- Ground clearance at the area either side of the garage door opening is too low;
- No flashings have been installed around the gas and electrical meters; and
- Neither the downpipe bracket fixing screws, nor the gas meter power supply control switch are sealed.

5.2 The expert took 13 moisture readings of the external wall cavities through the internal wall linings throughout the house and obtained only one reading over 18 %. This was in the family room where 20 % was recorded. The expert then used an invasive type moisture meter to investigate 5 locations, and 2 readings of 24.2% and 25.7% in the area of the family room, exceeded 18%. Moisture levels above 18%

recorded after cladding is in place generally indicate that external moisture is entering the structure. The expert listed possible causes for the moisture ingress, but was unable to define what was actually contributing to the leaks at these points.

- 5.3 Copies of the expert's report were provided to each of the parties. Neither party made a submission in response to the expert's report.

6 DISCUSSION

General

- 6.1 I have considered the submissions of the parties, the expert's report and the other evidence in this matter. The approach in determining whether building work complies with clauses B2.3.1 and E2.3.2, is to examine 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.

Weathertightness risk

- 6.2 Recent New Zealand data and experience indicates that the impact of weathertightness problems in monolithic clad houses can be minimised if good and effective design and construction practices are followed.
- 6.3 The installation of exterior cladding to manufacturer's specifications and to accepted good trade practice is an important but not the only requirement to ensure good weathertightness performance.
- 6.4 The next priority is to reduce the ability of moisture to get through the cladding by using design measures that minimise the effects of the rain impacting on the walls:
- 6.5 I consider that the important matters for consideration are:
- Data shows a strong relationship between the width of the eaves and the incidence of wall leaks. An effective deflection mechanism, such as eaves greater than 600 mm wide, has been shown by Canadian data to manage more than 90% of rain incidence;
 - While most reported leaks are substantially caused by defects in the cladding that require little or no wind pressure differential, it is believed that homes in high and very high wind zones (as defined by NZS 3604) are likely to experience wind pressure differentials and thus a higher risk of water ingress;
 - Taller buildings result in an effective increase in the catchment area of the wall. Available data suggests a clear correlation between higher number of storeys and an increased incidence of leaking;
 - Complex roofs and overall envelope shapes where the roofs frequently intersect with the walls on upper floors create opportunities for leaks to directly penetrate into the wall; and

- Recent data also shows that decks and balconies that are exposed in plan and/or cantilevered from the external walls are the most frequent location for water leaks.

6.6 Any likely penetration of moisture through the cladding can then be countered by a combination of effective drainage, ventilation of the drainage cavity and moisture tolerance in the external wall framing timber. In particular:

- The structure should allow water that has penetrated the cladding to drain out as quickly as possible. It is believed that generally a drainage cavity should be provided behind the outer cladding barrier in monolithic construction;
- The design of the outer walls should allow walls to dry to the outside once moisture penetrates the cladding and the moisture barrier. If walls do not dry, decay fungi can become established in as little as 3 months. Until scientific data on the optimum depth and configuration of the ventilation mechanism in New Zealand conditions is available, I consider that the drainage cavity should be not less than 20 mm deep; and
- The external walls should have some degree of decay resistance or moisture tolerance to allow for situations when moisture circumvents the cladding and moisture barriers and moisture levels in the timber rise to more than 18%.

6.7 In relation to these characteristics, I find that this house:

- Has 300 or 450 mm wide eaves projections to some elevations and veranda overhangs, which provide some protection to the cladding. However, some elevations at both the lower and upper elevations have no projections and accordingly, no protection at all;
- Is built in a medium wind zone;
- Is two stories high;
- The jambs and sills lack flashings and in seal strips, and are inadequately sealed.
- Has an overall envelope that is relatively simple on plan, with roofs at the two main levels with intersections and junctions with the cladding;
- Has a balcony, set into the lower level roof;
- Has lower level roof spaces that can assist in the ventilation of the wall cavities;
- Has an open pergola to two elevations of the house; and
- Has external walls constructed with H1 Boric treated timber, which is reasonably effective in delaying the onset of decay.

Weathertightness performance

- 6.8 I find that the cladding in general does not appear to have been installed according to good trade practice and to the manufacturer's instructions. As a result, there are a large number of identified defects, which are set out in paragraph 5.1 and in the expert's report, which have contributed to the penetration of the moisture already evident in several areas.
- 6.9 I observe that the head flashings to the exterior joinery units extend 20mm beyond the opening, whereas 30mm is required by the manufacturer's instructions. However, I consider that this is not an issue that would affect the weathertightness of the house.
- 6.10 I note that one elevation of the building demonstrates a high weathertightness risk rating and the remaining elevations a medium weathertightness risk rating as calculated using the E2/AS1 risk matrix. The matrix is an assessment tool that is intended to be used at the time of application for consent, but must be supplemented at the time of issuing a code compliance certificate by careful inspection of the building as actually built.
- 6.11 I agree that effective maintenance of monolithic claddings is important to ensure ongoing compliance with clause B2 of the building code. That maintenance is the responsibility of the building owner. The code assumes that the normal maintenance necessary to ensure the durability of the cladding is carried out. For that reason clause B2.3.1 of the building code requires that the cladding be subject to "normal maintenance". That term is not defined and I take the view that it must be given its ordinary and natural meaning in context. In other words, normal maintenance of the cladding means inspections and activities such as regular cleaning, re-painting, replacing sealants, and so on.

7 CONCLUSION

- 7.1 I am satisfied that the performance of the cladding is inadequate because it has not been installed according to good trade practice. In particular, it demonstrates the key defects listed in paragraph 5.1. I have also identified the presence of a range of known weathertightness risk factors in this design. The presence of the risk factors on their own is not necessarily a concern, but they have to be considered in combination with the significant faults identified in the cladding system. It is that combination of risk factors and faults that indicate that the structure does not have sufficient provisions that would compensate for the lack of a drained and ventilated cavity. Consequently, I am not satisfied that the cladding system as installed complies with clause E2 of the building code.
- 7.2 In addition, the building is also required to comply with the durability requirements of clause B2. Clause B2 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 house to remain weathertight. Because the cladding faults in the house are allowing the ingress of moisture, the house does not comply with the durability requirements of clause B2.

- 7.3 I find that because of the apparent complexity of the faults that have been identified with this cladding, it is unable to conclude, with the information available to it, that remediation of the identified faults, as opposed to partial or full recladding, could result in compliance with clauses B2 and E2.
- 7.4 In the circumstances, I decline to incorporate any waiver or modification of the building code in its determination.
- 7.5 I note that the original plans show construction plywood installed under the tiled roofing, and that this constituted the required roof bracing. The roofing eventually installed on the house does not include this plywood, and the I recommend that the issue of roof bracing be thoroughly investigated to ensure that this element is code compliant.

8 THE DECISION

- 8.1 In accordance with section 20 of the Building Act 1991 I hereby determine that the cladding system as installed does not comply with clauses B2 and E2 of the building code and accordingly confirm the decision of the territorial authority decision to refuse to issue a code compliance certificate.
- 8.2 The territorial authority has issued a Notice to Rectify requiring a ventilated cavity or an alternative approved system. Under the Act, a Notice to Rectify can require the owner to bring the house into compliance with the building code. The Authority has already found in a previous determination (2000/1), that the Notice to Rectify cannot specify how that compliance can be achieved. A new Notice should be issued that requires the owner to bring the cladding into compliance with the building code, without specifying the features that are required to be incorporated. It is not for me to dictate how the defects listed in paragraph 5.1 are to be remedied. How that is done is a matter for the owner to propose and for the territorial authority to accept or reject, with either of the parties entitled to submit doubts or disputes to the Chief Executive for another determination.
- 8.3 The cladding has now been in place for 3 years, and its 15-year durability performance requirement will start once the code compliance certificate is issued. Continuing maintenance of the cladding will therefore be required to ensure its continuing building code compliance.

Signed for and on behalf of the Chief Executive of the Department of Building and Housing on 19 May 2005.

John Gardiner
Determinations Manager