

Refusal of a code compliance certificate for a building with a “monolithic” cladding system: House 18

1 THE DISPUTE TO BE DETERMINED

- 1.1 This is a determination by the Building Industry Authority (“the Authority”) of a dispute referred to it under section 17 of the Building Act 1991 (“the Act”). The applicant is the owner. 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 new house unless changes are made to its monolithic cladding system.
- 1.2 The Authority’s task in this determination is to consider whether it is satisfied on reasonable grounds that the external wall cladding as installed (“the cladding”) on this house complies with the building code (see sections 18 and 20 of the Act). By “external wall cladding as installed” we mean the components of the system (such as the backing sheets, the flashings, the joints, the plaster and/or the coatings) as well as the way the components have been installed and work together.
- 1.3 In making its decision, the Authority has not considered any other aspects of the Building Act or the building code.
- 1.4 The house itself described in paragraphs 2.1 to 2.3, and paragraph 9 sets out the Authority’s final decision.

2 PROCEDURE

The building.

- 2.1 The building is a two storey detached house on a level site in a medium wind zone in terms of NZS 3604: 1999 “Timber framed buildings”. The house is of conventional light timber frame construction, and apart from a small area of stonework veneer under a ground floor bay window, the external walls are entirely clad with a monolithic cladding. The building is of a relatively simple shape in plan, but has a more complex roof structure, with several roof/wall junctions. It has no eaves projections and no parapets. There is a canopy over the main entrance and a pergola over one window, both of which are connected directly to the building.
- 2.2 The external walls are framed in untreated kiln-dried timber.
- 2.3 The building is clad with what is described as monolithic cladding. As detailed in the manufacturer’s technical data (“the data sheets”), it incorporates 60 mm thick expanded polystyrene backing sheets (EPS) fixed directly through the building wrap onto the timber framing. The backing sheets are finished with a thin polymer modified cement-based

plaster that is reinforced with fibreglass mesh. The plaster is then finished with two coats of external 100% acrylic paint system. The manufacturer details the sheet joints, sheet terminations and flashings at various junctions. The jointing and finishing systems are described in detail. The plaster in this instance has a sponge finish.

- 2.4 The manufacturer has provided both a materials components guarantee and a workmanship guarantee, which were issued to the builder, and confirmed that a licensed contractor installed the complete cladding system.

Sequence of events:

- 2.5 The territorial authority issued a building consent on January 2002. The consent was subject to “Conditions 1-17 for the Issue of Building Consent”. None of these conditions related to the cladding.
- 2.6 The territorial authority made ten inspections in the course of construction including both the building pre-line and post-line inspections. On 5 March 2004 the territorial authority carried out a final building inspection and on 9 March 2004 completed a final recheck. Officials of the territorial authority signed off all these inspections. The Authority assumes that in the absence of any other submissions, the inspection sign-offs were not qualified in any way.
- 2.7 The territorial authority issued a document headed “Completed Monolithic Dwellings without a Cavity” dated 12 March 2004, and subtitled “Weathertightness Issues”, This is in effect a post inspection report in which the territorial authority commented on various aspects of the cladding: In particular, the condition of the plaster/paint system was recorded as being “Excellent”. The territorial authority concluded by saying “[t]his cladding looks excellent - no evidence of cracking from ground level. It is owned by a builder and was clad by an excellent contractor. However, the cladding is face fixed”.
- 2.8 In a letter to the owner dated 12 March 2004, the territorial authority stated:

As your building is faced fixed (monolithic) construction with no cavities we are unable to verify that it fully complies with the Building Code requirements, manufacturer’s details application at the time and that it will remain durable for the required period. Council also have undertaken no inspections of wrap, polystyrene, fixings and flashings, and are unable to ascertain control joints and sealing of attached pergola for weatherproofing.

There has been recent information and knowledge that faced sealed cladding systems without an adequate drainage and ventilation cavity will cause irrevocable damage to structural elements in the event of leakage and/or the effects of residual moisture.

Council cannot be satisfied therefore that the cladding system as installed on the above building will meet the functional requirements of Clause E2 External Moisture of the New Zealand Building Code and is therefore unable to issue a code compliance certificate.

- 2.9 The territorial authority did not issue a notice to rectify as required by section 43(6).
- 2.10 The owner applied for this determination on 2 April 2004.

3 THE SUBMISSIONS

3.1 The owner provided:

- The building consent application documentation which consisted of 3 construction drawings, a project specification, and engineering calculations on wind bracing, lintel beams and the stairway support structure;
- A list of the inspections made by the territorial authority in relation to the property. The Authority was not provided with the contents of those inspection reports;
- The territorial authority letter of 12 March 2004; and
- Copies of the materials and workmanship guarantees that were provided by the cladding manufacturer as set out in paragraph 2.4.

3.2 The territorial authority forwarded the following documentation in support of its decision not to issue a code compliance certificate. This included copies of:

- The plans and specifications;
- The building consent documentation;
- Details of the territorial authority's site inspection record sheets;
- The "Completed Monolithic Dwellings without a Cavity" document; and
- The territorial authority's letter to the owner of 12 March 2004.

3.3 The copies of the submissions and other evidence were provided to each of the parties and neither had any further comment to make.

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 clause E2.3.2 of the building code (First Schedule, Building Regulations 1992) is correct. Those 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 sub floor 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. The Authority is 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 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.
- 5.2 The expert stated that the plaster had a smooth even finish and the paintwork appeared sound and evenly applied with no evidence of chalking, flaking or staining. The expert also noted that the overall cladding thickness indicated that 60 mm polystyrene had been applied. There were no control joints evident in the cladding but these were not a manufacturer's requirement in this instance. Furthermore, apart from two small areas adjoining the entrance doors, there was no evidence of cracking. The expert also made the following observations:
- The windows have head and sill flashings in all instances and jamb flashings are visible in some windows and doors. The head flashings do not follow the manufacturer's details in all respects, but in the opinion of the expert what had been installed was an improvement on the recommended detail;
 - Some ground clearances are less than the manufacturer's requirements in certain areas. However, the only real areas of concern are the corners of the garage door openings;
 - The gas water heater brackets and wall light fittings had not been sealed;

- The junction between the pergola and the cladding is finished with a silicone sealant that was performing adequately. However, the future performance of this junction is dependant on proper maintenance;
- The entrance canopy and cladding junction is similar to that of the pergola but in this instance, parts of the joint between the polycarbonate overhead glazing and the wall has failed and requires replacing;
- Both the pergola and the entrance canopy have been fixed directly through the plaster into timber blocks that are set into the polystyrene and fixed to the framing; and
- There is evidence of repaired cracks on either side of the entrance to a narrow band of cladding under the upper floor windows. This is probably due to the combination of the narrowness of the cladding and the apron flashing termination behind it. The cracking appeared to have been in place for some time, as compounds leached from the plaster had stained the face of the plaster. There was no evidence of high internal moisture levels behind these cracks. The expert stated that these corner areas are likely to require periodic maintenance or alteration to prevent a recurrence.

The expert also had some minor concerns relating to the small area of stone veneer under the front window. The Authority was not asked to consider this cladding in this Determination, but is satisfied that the stone veneer will adequately allow any moisture behind it to drain away.

- 5.3 The expert noted also that the pergola and a timber framed fibre-cement lined garden wall were not shown on the consent drawings. He noted that the garden wall had been built into the ground and accordingly, this raised concerns as to durability. The expert could not determine the level of treatment of the wall framing. Because the garden wall abuts the main cladding but is not part of it, the Authority has not considered this wall as part of this Determination.
- 5.4 The expert used an invasive moisture meter applied through the external face of external walls to detect areas of moisture ingress. The figures indicated that moisture levels were between 8.5% and 16.3%. In addition, the expert used a non-invasive moisture meter internally and did not obtain any readings within the “damp” range. While a moisture reading of less than 18% does not of itself indicate that the cladding is code compliant, it is indicative of the efficiency of the cladding in preventing moisture ingress to date.
- 5.5 Copies of the expert’s report were provided to each of the parties. The territorial authority did not provide a response but the owner did comment on the report. The comments that the Authority considers to be relevant can be summarised as:
- The owner did not think it necessary to install a metal flashing at the junction of the pergola with the cladding, as there was no moisture ingress evident at present;
 - The cladding to the garden wall is not built into the ground as evidenced by the photograph taken of the fence; and
 - The house has been occupied for 2 years and any moisture getting into the building would have been apparent by now.

The Authority has taken note of these comments in its deliberations.

6 THE AUTHORITY'S VIEW

General

- 6.1 The Authority has considered the submissions of the parties, the expert's report and the other evidence in this matter. The Authority's approach to determining whether building work complies with clauses 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 and its installation.

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 a fundamental 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 The main areas 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 incidents;
 - While most reported leaks are substantially caused by defects in the cladding that require little or no wind pressure differential, the Authority believes 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 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. The Authority believes 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, the Authority believes 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, the Authority finds that this house:

- Has no eaves projections and thus there is no shielding of the cladding;
- Is constructed with a well flashed verge detail and has no parapets;
- Is in a medium wind zone;
- Is constructed to two levels;
- Has several wall/roof intersections and an overall roof configuration that is moderately complex;
- Has head, jamb and sill flashings to the external joinery;
- Has an entrance canopy and a pergola fixed directly to the cladding;
- Has face-fixed cladding with no drainage cavity; and
- Has external walls constructed from untreated timber, which will not delay the onset of decay.

Weathertightness performance

6.8 Generally the cladding appears to have been installed according to good trade practice and to manufacturer's instructions. It can be considered to be reasonably effective in preventing the penetration of water. There are, however, defects that will, with time, allow the ingress of moisture behind the cladding. These include ground clearances, sealing to some wall penetrations, the cracked areas to the narrow band under the window over the entrance and the seal at the canopy/cladding junction. All these items will need to be rectified to ensure ongoing weathertightness.

6.9 Notwithstanding the fact that the backing sheets are fixed directly to the timber framing, thus inhibiting ventilation behind the cladding sheets, the Authority finds that there are compensating provisions that assist the performance of the cladding in this particular case. These are:

- The cladding appears to have been generally installed according to good trade practice and to the manufacturer's specifications;
- Although there are no eaves, the verge flashing is effective in preventing moisture ingress along the top of the exterior gable walls;
- The building does not display to any significant extent any of the weathertightness risk factors. The roof has no eaves, but has a simple a simple gable structure. The different levels of the various roofs increase the roof complexity;
- There are flashings to the heads, sills and jambs of the exterior joinery; and

- The moisture level readings do not indicate any undue moisture ingress behind the cladding at this time.
- 6.10 The Authority considers that these other provisions adequately compensate for the lack of a drainage cavity and can allow the house to comply with the weathertightness and durability provisions of the building code.
- 6.11 The Authority also notes that the statement made by the territorial authority as set out in paragraph 2.8, appears to describe a policy on monolithic claddings. However, the territorial authority has informed the Authority that this is not the situation, and that each assessment is made on a case-by-case basis.
- 6.12 The Authority notes that the cladding has not been constructed with any vertical or horizontal control joints. The manufacturer's instructions and the relevant [Named] appraisal allow for up to 20 metres between joints in this cladding, although not all other similar systems are specified with a panel size of up to 20 metres. The Authority is advised that correctly installed thin plaster polystyrene systems have a greater ability to respond to movement caused by heat gradients or ground movement than other more rigid fibre cement systems. Although the panel sizes in this house are large, the Authority finds that the lack of control joints is not of itself a reason for non-compliance.

7 CONCLUSION

- 7.1 The Authority accepts that the expert's report establishes that the cladding on this particular building complies in most respects with the manufacturer's instructions. At the time of this determination there is no evidence of external moisture entering the building and the Authority therefore considers that the cladding complies with clause E2.
- 7.2 While the building does not show any signs of water ingress at the present time, this building will also have to comply with the durability requirements of clause B2. B2 requires that a building continues to satisfy all the objectives of the code throughout its intended life, which includes the requirement for the building to remain weathertight. Because the cracked cladding adjacent to the entrance is likely to allow the ingress of moisture in the future, the building will not achieve the durability requirements of B2.
- 7.3 It is essential that all the following items of rectification be competently carried out to ensure compliance:
- The ground clearance at the corner of the garage door opening is to be established in accordance with manufacturer's instructions;
 - The gas water heater brackets and wall light fittings are to be sealed;
 - The cracked area of cladding at the entrance is to be remediated in an effective manner; and
 - The pergola and entrance canopy framework junctions with the cladding should be properly flashed to remove the long-term reliance on silicone sealants.
- 7.4 The Authority also finds that this building will comply with the durability requirements of B2 when the cladding faults have been satisfactorily rectified. As the exterior framing is constructed in untreated timber, it is essential that all items of rectification are competently carried out to ensure such compliance. In addition, clause B2.3.1 of the building code requires "normal maintenance". That term is not defined, so that the Authority takes the view that it must be given its ordinary and natural meaning in context. In other words, normal maintenance of the cladding means such inspections and activities such as regular cleaning, re-painting, replacing sealants, and so on.

- 7.5 The Authority emphasises that each determination is conducted on a case-by-case basis. Accordingly, the fact that a particular cladding system has been established as being code compliant in relation to a particular building does not necessarily mean that the same cladding system will be code compliant in another situation.
- 7.6 The Authority has not included the garden wall referred to in the expert's report in this Determination, as there is doubt that it was part of the original consent. However, whatever its consent status may be, the Authority finds that it should be fully inspected by the territorial authority and any areas of non-compliance including ground clearance and timber treatment requirements should be rectified.
- 7.7 The Authority declines to incorporate any waiver or modification of the building code in its determination.

8 WHAT IS TO BE DONE?

- 8.1 It is not for the Authority to decide exactly how the cladding is to be brought to compliance with the building code. That 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 Authority for another determination.

9 THE AUTHORITY'S DECISION

- 9.1 In accordance with section 20 of the Building Act, the Authority determines that the building is weathertight now and therefore complies with clause E2. However, as there are a number of items to be remedied to ensure it remains weathertight and thus meet the durability requirements of the code, the Authority finds that the house does not comply with clause B2 of the code. Accordingly, it confirms the territorial authority's decision to refuse to issue the code compliance certificate.
- 9.2 The Authority finds that because of the compensating factors in this case, the lack of a ventilated cavity behind the cladding is not, on its own, sufficient grounds to withhold a code compliance certificate.
- 9.3 The Authority, therefore, finds that once the items of non-compliance that are listed in paragraph 7.3 are rectified to the approval of the territorial authority, together with any other instances of non-compliance that become apparent in the course of rectification, the cladding as installed on the house will comply with the building code, notwithstanding the lack of a drainage cavity.
- 9.4 The Authority considers that the cladding will require on-going maintenance to ensure its continuing code compliance, and this maintenance programme should be undertaken after consultation with the territorial authority.

Signed for and on behalf of the **Building Industry Authority**
on 28 June 2004



John Ryan
Chief Executive