

Refusal of a code compliance certificate for a building with a “monolithic” cladding system: House 14

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 building 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 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 and the coatings) as well as the way the components have been installed and work together.
- 1.3 The house itself described in paragraphs 2.1 to 2.4, and paragraph 9 sets out the Authority’s final decision.

2 PROCEDURE

The building.

- 2.1 The building is a detached house with two floor levels on a level site in a high wind zone in terms of NZS 3604: 1999 “Timber framed buildings. The building is of conventional light timber frame construction and is of a relatively complex shape. Eaves overhangs are generally 570 mm wide, with the spoutings extending a further 120 mm and there are several complex wall/roof intersections. There is an enclosed balcony at first floor level, which is constructed over a living space. A glazed aluminium canopy is situated at the main entrance and there is a pergola to one elevation.
- 2.2 The owner submitted invoices for the framing timber, which indicated that the framing in external walls is treated to an H3 LOSP level.
- 2.3 The building is entirely clad with what is described as monolithic cladding. As specified in its manufacturers instructions, it incorporates expanded polystyrene (EPS) backing sheets fixed through building wrap directly to framing timbers

and finished with a 3 to 6 mm cement plaster reinforced with fibreglass mesh. The plaster is finished with a 100% external acrylic paint system. The EPS sheets used on this building incorporated a system of grooves or corrugations on its inner face that are designed to facilitate drainage of moisture from behind the sheets and the movement of air to allow the back of the sheets to dry out if they get wet. The coating system used comprises a fibreglass mesh reinforced adhesive render basecoat covered with a medium sponge finish top plaster coat

- 2.4 The Authority notes that the cladding system as fixed to the house differs from that shown on the consent documentation. The consent drawings call up a different EPS system and also require areas below the ground floor windows to be clad in masonry veneer rather than monolithic cladding.
- 2.5 The manufacturer of the cladding system has issued a material component's guarantee and the paint and texture applicator has issued a producer statement relating to the supply and installation of these elements.

Sequence of events:

- 2.6 The territorial authority issued a building consent on 26 November 2002. The consent was subject to "Building Consent Requirements". These included the following:
- 1B Installation of external cladding system shall comply with the manufacturer's specifications, and recommendations, including correct fixing, jointing, flashing, penetration and function details, type and colour of coating system where applicable etc. Recommendations of appraisal certificate shall be adhered to...
- Producer Statements – Construction (PS3) are required from licensed contractors for installation of cladding and application of coatings. In lieu of a producer statement from a licensed installer a Producer Statement – Construction Review (PS4) from a registered engineer is required certifying installation.
- A guarantee is required from the manufacturer for the product and components including construction details.
10. The owner/builder must ensure that the standards for moisture content of timber framing are met prior to requesting a preline inspection. This can be achieved by either using kiln-dried framing or by allowing wet assembled timber frames to dry in situ.
- 2.7 The territorial authority carried out a series of inspections during the construction of the house. The "Inspectors Field Inspection Sheet", dated 26 November 2002 noted "[Cladding] by [Manufacturer] installation OK except curved window head flashing. Discussed with [builder] and plasterer – to remedy".
- 2.8 The territorial authority submitted a document headed "Completed Monolithic Dwellings without a Cavity" dated 22 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: The territorial authority concluded that: "[It] appears [to be] a good job, [there are] good eaves overhangs; [the] Pergola/clothesline fixing and minimal slope to deck barrier top [are the] only cladding issues" and there is "H3 external framing".

- 2.9 The territorial authority sent a letter to the owner on 26 March 2004, which stated

As your building is face fixed (monolithic) construction with no cavities we are unable to verify that it fully complies with the Building Code Requirements...

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.

If you still wish to seek a code compliance certificate, you may request a determination from the Building Industry Authority...

- 2.10 The territorial authority has not issued a notice to rectify as required by section 43 of the Act.
- 2.11 The owner applied for this determination on 30 March 2004.

3 THE SUBMISSIONS

- 3.1 The owner provided a submission, which included:
- The plans and specifications for the building;
 - The building consent documentation; and
 - The guarantee and producer statement set out in paragraph 2.5
- 3.2 The Authority acknowledges the comprehensiveness of the consent drawings submitted by the owner.
- 3.3 The territorial authority forwarded the following documentation in support of its decision not to issue a code compliance certificate. This included copies of:
- The specification;
 - The building consent documentation;
 - Details of the territorial authority's site inspection record sheets;
 - The "Completed Monolithic Dwellings without a Cavity" document;
 - The cladding manufacturer's "Technical Data Sheets";
 - The territorial authority's letter to the owner of 26 March 2004; and
 - A set of photographs showing the exterior of the building.
- 3.4 Copies of the owner's submissions and the expert's report were provided to each of the parties. Neither the applicant, nor the territorial authority, made any further submissions in response to the submissions of the other parties.

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 on the grounds that 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. 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 to inspect and report on the cladding. The expert stated that the plaster had a bagged finish and that the paintwork appeared sound and evenly applied with no evidence of chalking, flaking, or staining. The expert's report made the following specific comments on the as built cladding details:

- Head and sill flashings could be seen at all windows and doors, and jamb flashings could be seen whenever close inspection was possible;
- No vertical or horizontal control joints had been fitted;
- The plaster finish was applied closely to the jambs of the exterior joinery and the silicone bead detailed in the manufacturers instructions was either not applied or positioned behind the jamb flange. The resulting detail however is considered satisfactory because the jamb flashing extrusion projection will prove to be an adequate drainage channel;
- The ends of 2 glazing extrusions to the canopy roof have not been sealed to the cladding;
- There were no vertical or horizontal control joints in the cladding, contrary to the manufacturers instructions for walls of these dimensions. However, despite the lack of these joints, there is no evidence of cracks or other damage in the cladding, apart from a hairline crack at the bottom of an upper floor window;
- The ground clearances to the cladding are consistently lower than those required by the manufacturer's instructions and Approved Document clause E2/AS1.4.2. However, this failing could be mitigated by the shelter provided by the canopy, the eaves of the low level roofs, and the free draining paving strip around the house perimeter;
- While the current silicone sealant to the top and bottom of the pergola bearer adjoining the cladding and around the gas meter and water heater is functioning correctly, it is not durable and its future performance is dependent on proper future maintenance;
- The pergola bearer is fixed through the plaster coat into timber blocks which lie within the polystyrene sheet and are fixed to the timber framing;
- The balcony balustrade wall has a horizontal top surface which can allow moisture ingress. The presence of cap or saddle flashings could not be determined;
- The balcony overflow pipe is unsealed when it passes through the cladding;
- The balcony deck waterproofing membrane has been installed to manufacturers instructions, but the fall on the deck is less than that specified on the drawings and the upstand of the door threshold that opens up onto the balcony is only 52mm; and
- The manufacturers instructions for the balcony membrane require ventilation to the joist space.

- 5.2 The expert also used an invasive moisture meter applied to the external walls to detect areas of moisture ingress. The readings varied between 9.4% and 13.5%. The expert also took further readings inside the house using a non-invasive meter and found no readings within the “damp” range.
- 5.3 Copies of the expert’s report were provided to each of the parties. Neither party commented on the report.

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 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 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 utilising 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 out from the external walls are the most frequent location for water leaks.

6.6 Any penetration of moisture through the cladding can then be addressed by a combination of effective drainage, ventilation of the drainage cavity and moisture tolerance in the external wall framing timber. These factors are:

- 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 eaves, that together with the spouting extension, total 690 wide, and which are considered to be effective in shielding the cladding;
- Is in a high wind zone;
- Is constructed to two levels;
- Has several wall/roof intersections and has an overall envelope that is relatively complex in shape;
- Has one balcony constructed over a living space;
- Has a glazed entrance canopy and a pergola fixed directly to the cladding;
- Has face-fixed cladding with no drainage cavity; and
- Has external walls that are constructed from H3 LOSP-treated timber, which is effective in delaying the onset of decay.

Weathertightness performance

6.8 The house has not been constructed with the control joints specified by the manufacturer, which are that no section should be longer than 6m or more than 14 sq m in area. Notwithstanding this omission, the cladding installer has supplied a producer statement certifying that the cladding complies with the code. The cladding manufacturer has also supplied a materials component guarantee on the cladding. The Authority notes that other similar systems are

specified with a panel size of up to 20m. 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 more rigid fibre cement systems. Although the panel sizes in this house are large, the Authority notes that there is no sign of overall cladding failure because of a lack of control joints, and thus finds that the lack of control joints is not of itself a reason for non compliance.

- 6.9 The Authority believes that more extensive research is required before a full understanding of the behaviour, in a New Zealand context, of the water transport, internal drainage and drying mechanisms in polystyrene-based monolithic cladding systems is available. Until that level of understanding is reached, a conservative approach is required when assessing adequate drainage and ventilation mechanisms.
- 6.10 The Authority believes that the grooves or corrugations cut into the back of these panels could be able to drain away moisture that has come through the external cladding. The Authority, however, has not seen sufficient justification to conclude that the grooves provide adequate ventilation to allow the framing to dry out in all situations.
- 6.11 Given that the waterproofing membrane applied to the balcony has been applied according to good trade practice, and the overflow pipe has been installed to an appropriate invert, well below the level of the door threshold, the Authority finds that the lack of fall on the balcony is not, in itself, a reason for non compliance. For the same reasons, the Authority agrees with the expert's assessment that the height of the threshold to the balcony door is adequate.
- 6.12 The expert recommends the use of venting to the joist space under the membrane to allow trapped moisture to escape. The appraisal on this product states that venting is not necessary when the membrane is used over relatively dry areas such as domestic living areas. The Authority accepts this view and finds that the lack of venting to the space under the membrane is not in itself a reason for the building to not comply with the building code.
- 6.13 The Authority agrees with the expert's assessment on the adequacy of the gaps between the bottom of the cladding and the concrete perimeter paths
- 6.14 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:
- Eaves that are effectively 690 wide;
 - Generally, the cladding appears to have been installed according to good trade practice and to manufacturer's specifications;
 - There are flashings to the heads sills and jambs of the exterior joinery;
 - The moisture level readings do not indicate any undue moisture ingress behind the cladding at this time; and
 - The external wall framing is H3 LOSP treated.
- 6.15 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.

- 6.16 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. The closures to two canopy roof extrusions, the sealants to the pergola bearer, and balcony overflow pipe, and the horizontal top to the balcony parapet wall. All these items will need to be addressed to ensure ongoing weathertightness, together with all necessary remedial work to the balcony decking.

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. 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 continue to satisfy all the objectives of the code throughout its intended life and that includes the requirement for the building to remain weathertight. Because the cladding faults in this building are likely to allow the ingress of moisture in the future, the building will not achieve the durability requirements of B2. However the Authority also finds that when the cladding faults have been satisfactorily rectified this house should be able to remain weathertight and will thus comply with clause B2.
- 7.3 It is essential that all the following items of rectification be competently carried out to ensure such compliance:
- Seal and close the ends of 2 glazing extrusions to the canopy roof to the cladding;
 - Provide adequate ground clearances to the cladding;
 - Provide a durable flashing detail to the top of the pergola bearer and the washing line fixing bearer where they adjoin the cladding;
 - If the presence of appropriate cap and saddle flashings on the balcony cannot be demonstrated, either reconstruct the balustrade to provide a sloping top to the balcony wall horizontal top, or install appropriate flashings; and.
 - Seal the balcony overflow pipe to the decking.
- 7.4 Furthermore, 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 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 fibre cement panels 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 11 June 2004



John Ryan
Chief Executive