Determination 2005/09

Refusal of a code compliance certificate for a building with a "monolithic" cladding system: House 8

1 THE DISPUTE TO BE DETERMINED

1.1 This is a determination by the Chief Executive of the Department of Building and Housing ("the Chief Executive") under section 17 of the Building Act 1991, as amended by section 424 of the Building Act 2004 ("the Act"). The applicants are the two joint owners (referred to throughout this determination as 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 4-year old house unless changes are made to its monolithic cladding system.

1.2 My task in this determination is to consider whether I am satisfied on reasonable grounds that the external monolithic wall cladding as installed ("the cladding"), to the walls of the house, and also to the feature tower and the terrace roof support columns, 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 No other aspects of the Act or the building code have been considered in this determination.

1.6 The house itself is described in paragraphs 2.1 to 2.5 and paragraph 8 sets out the decision.

2 PROCEDURE

The building

2.1 The building is a two-storey house with a single-storey attached family room, situated on a sloping 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. The walls of the building are lined with a monolithic cladding. The house is of a relatively complicated shape, with a complex system of either flat roofs or curved pitched roofs set at varying levels, that have numerous junctions with the wall cladding. The curved roofs are covered with either fibreglass/asphalt shingles or proprietary tanking, and both finishes are laid over 12 mm thick plywood, and the flat roofs are lined with a bituminous rubber membrane laid over12 mm thick plywood. The independent expert commissioned by the Authority to inspect and report on the cladding ("the expert"), noted that plywood installed on the flat roofs had been reduced from the 17mm thickness indicated on the plans to 12 mm, and the butyl-rubber membrane from a 2mm thickness to 1mm. The flat roofs have 600mm cantilevered gutter extensions, with the roof membrane dressed into them, and a similar gutter is extended from the south elevation roof along one external wall of the family room. The pitched roof eaves and verge projections are 600mm wide.

2.2 One lower level curved roof of the house is extended past the building line on one elevation to form a porch, and this is supported on 100 mm diameter timber posts encased in 250 diameter polystyrene. The lower level flat roof over the family room is also extended on two elevations over a tiled concrete terrace slab, and is supported by five columns each formed from two 100 x 100mm timber posts clad with 7.5 mm fibre-cement sheets that are finished with a thin coat of plaster. The flat roof to the south elevation of the family room is extended over the rear entry porch and is supported on a 250 mm diameter polystyrene clad corner column. A small balcony is set into a curved roof at first floor level and this has a deck lined with tiles that are fixed over a bituminous rubber membrane laid on 17 mm thick plywood. A timber-framed balustrade constructed to 2 sides of the balcony is lined with the cladding on both faces and the top is finished with a rebated timber capping.

2.3 The external northwest corners of the garage and bedroom 1 above it are extended to form a large feature tower that extends above, and is set into, a high-level pitched roof. The face and both ends of the tower are clad with a fibre-cement backing sheet with a thin coat of plaster applied to it. A veneer of individual stones is stuck on to all of this cladding, apart from the rear of the tower above the main roof, which is monolithic clad only. The roof of the tower is timber framed,

covered with tiles and plywood as for the pitched roofs, and the exposed reverse slopes are plywood-lined. I note that the consent drawings show that tiles were to be fixed to the feature tower, not the stones that were actually applied.

2.4 The owner has informed the expert that timber in the exterior walls of the house is untreated.

2.5 The cladding system is what is described as monolithic cladding. As specified in the manufacturer's technical information sheets ("the manufacturer's instructions"), the cladding to the main walls of the house incorporates 40 mm thick expanded polystyrene (EPS) backing sheets fixed through the building wrap directly to the wall framing and finished with a fibreglass mesh reinforced textured sponge finish. The manufacturer's instructions include details for flashings at various junctions and require PVC flashings to the heads, jambs and sills of exterior joinery units. I note that the system installed differs from that noted on the consent drawings and that a 60mm thickness of polystyrene has been used, rather than the 40 mm indicated in the manufacturer's instructions. The monolithic cladding to the feature tower and the terrace roof support columns consists of 7.5 mm fibre-cement backing sheets finished with a thin coating of plaster.

Sequence of events

2.6 The territorial authority issued a building consent on 28 February 2000.

2.7 The territorial authority made various inspections during the course of construction, and passed the "Preline" inspection on 13 July 2000. A final code compliance certificate inspection took place on 1 March 2004. The territorial authority's "Field Sheet" for the latter inspection included: "5/Monolithic Cladding (Polystyrene)Cavity NTR".

2.8 The territorial authority issued a Notice to Rectify, dated 1 March 2004, and the "Particulars of Convention" were:

> Monolithic cladding systems without a 20 mm cavity, provision for adequate ventilation, drainage, and vapour dissipation will, in the event of leakage and/or the effect of residual moisture, cause irrecoverable damage to the structural elements of the building
>
> You are required to:
>
> - Provide adequate ventilation to the monolithic cladding and into the wall frame space by means of either a ventilated cavity or alternative approved system; or
> - Remove the monolithic cladding and replace with an approved cladding, system; and
> - Lodge with Council an application for and amended building consent and provide all necessary information that may be requested to allow this consent application to be processed."

2.9 The owner applied for a determination on 30 July 2004.

3 THE SUBMISSIONS

3.1 The owner stated that the "Matter of Doubt or Dispute" was "code of compliance will not be issued by [the Territorial authority] because the exterior cladding of our home does have a 20mm air gap. When we built 4 years ago this was not part of our original consent and not a requirement by the Council". The owner also pointed out that apart from a leak in the garage that had since been repaired, there had been no experience of dampness or leaking.

3.2 The owner provided copies of:

- The building plans;
- An undated invoice/statement from the plasterer describing the plaster used, and stating that 60 mm thick polystyrene was used in lieu of the 40mm thick polystyrene as specified, and it had been fixed with nailing and adhesive to the territorial authority's specification, that was current at the time;
- A letter from the labour-only contractor, dated 14 June 2004, which set out the builder's qualifications and experience, and noted that all work, including that of the subcontractors was in accordance with good trade practice, and with the plans, specifications and regulations that were in force at the time. As far as the builder was concerned, all relevant inspections were carried out;
- A letter from a firm of building contractors, dated 12 July 2004, who had taken a series of moisture readings from the interior of the exterior walls with a surface reading meter. Apart from an area within the master bedroom, the readings were of an acceptable level. Removal of the interior linings in the bedroom revealed that the timber framing was completely dry, and that there were no visible signs of dampness. The contractors were satisfied that the building did not appear to have a moisture problem; and
- The mineral plaster manufacturer's technical information.

3.3 The territorial authority made a submission in the form of a letter, dated 6 August 2004, which confirmed that a building consent had been issued for the cladding and also stated:

> The work was undertaken during the period March 2000 to March 2004
>
> Construction of the cladding was not the subject of the changed inspection procedures implemented by this Council as a consequence of a [Named] adjudication.
>
> In the absence of the additional inspections implemented as a consequence of those changed inspection procedures, and in the absence of a cavity as a first line of defence, the Council does not believe it is able to be satisfied, on reasonable grounds, that the cladding applied to this dwelling will achieve the functional requirements of Clause E2.2, or the performance requirements of E2.3.2, of the Building Code…

3.4 The territorial authority also submitted copies of:

- The building consent;
- The Notice to Rectify; and

- Some of the territorial authority's inspection sheets.

3.5 I assume that the house was substantially complete, including the cladding by late 2000 and that only minor work was carried out between 2000 and 2004. No reasons were given for the delay in carrying out the final inspections.

3.6 The copies of the submissions and other evidence were provided to each of the parties and neither party made a further response.

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. 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 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 about acceptable solutions and alternative solutions, which in my view remain valid in this case:

- 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; and
- 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 expert inspected the building and furnished a report. It noted that the general impression was at best "average" trade practice in terms of the cladding. The expert was of the opinion that, in accordance with manufacturer's details, no control joints were required to any of the walls of this house. The expert cut away two sections of the cladding at window sill/jamb junctions in order to check the flashings and sealants used. The flashings used channelled any ingress of water down to the sill flashing where it was then deflected out towards the front of the polystyrene, where it may diffuse out through the permeable plaster layer. However, this would only be effective for small volumes. The expert's report made the following specific comments on the cladding:

- While vertical control joints are not required in the walls, additional mesh reinforcement is required for "stress crack prevention" and this had either been omitted or was ineffective in some areas;
- Some perimeter sections of the cladding are not efficiently secured;
- There are cracks in the faces of the cladding at various locations, particularly over the main entrance and adjacent to some windows. There are also other cracks that have been repaired;
- The base mould to the cladding is breaking away due to a lack of reinforcing mesh in some locations;
- There is no efficient sealing of the junctions between the top of the cladding and the soffit of the cantilevered gutter projections and there are large cracks at several of these junction locations. The expert was of the opinion that large volumes of driving rain would run down onto the junctions that faced the sea;
- The junction between the top of the cladding and the timber lined roof soffit over the master bedroom is not flashed and the lower roof butyl-rubber upstand stops short of the soffit lining at this location;

- The top of the cladding does not meet the plywood-clad soffit of the capping to the stone-faced tower, there is no flashing installed at this location, and the wall framing is exposed. The plywood has a weathered appearance and the fixing nails are severely rusted;

- There is insufficient clearance between the apron flashings and the base of the cladding at some locations;

- There is an exposed section of wall framing at the junction of the top of the cladding and the soffit lining and fascia at the main entrance;

- The ends of the timber fascias penetrate the cladding and the large gaps at these junctions are not sealed. The dark colour of the fascia stain and the unsealed areas at the junctions allow for considerable thermal movement of the timber relevant to the cladding;

- The top of the wall between the rear porch and the garage is a high-risk feature and the timber fascia is buried in the cladding at this location;

- The end of the gutter and fascia is buried in the cladding outside bedroom 2 and the roof apron flashing extends through the cladding and building wrap and penetrates the wall framing cavity. The soffit of the cladding projection below this location did not have a drip edge and there were lime stains on the cladding indicating that water had exited at this area;

- There is insufficient clearance between the base of the balcony balustrade cladding and the butyl-rubber deck cladding;

- A small section of polystyrene is exposed at one corner at the base of the cladding above the roof over the rear porch;

- There is no sealant between the between the jamb and sill flashings and the frames of the exterior aluminium doors and windows, nor at the junctions between the jamb and sill flashings;

- There are large unsealed gaps where the corner flashing between the bedroom 2 windows penetrates the plaster beneath it;

- The cladding is fitted hard against the timber garage door jambs and head and there is no head flashing installed;

- The base of the cladding is buried in the paving to most of the west elevation of the house. However, there are wide overhanging roofs at these locations;

- The concrete garage floor slab is less than 50 mm above the path concrete and the cladding is buried in the paving, making the bottom plate highly vulnerable to moisture ingress; and

- The bases of the 5 terrace roof support columns are buried in the external pavings.

5.2 The expert took moisture readings throughout the house both at the interior linings and to the exterior of the external walls using a non-intrusive meter The expert also took further readings with an intrusive meter, and the readings over 18% were as follows:

- A reading of 18.0% at the bottom plate behind the stone cladding of the tower;
- Readings of 20.0% and 22% under the bedroom 3 window;
- A reading of 24% at the bottom plate of the garage;
- Readings of 24.0% and 32.0% (two) at the base of the terrace roof support columns; and
- A reading of 32.0% at the underside of the wall projection outside bedroom 2.

Moisture levels above 18% recorded after cladding is in place generally indicate that external moisture is entering the structure. The expert also observed evidence of moisture ingress at the garage bottom plates.

5.3 Copies of the expert's report were provided to each of the parties. The territorial authority did not respond. The owner in fax to the Department dated 13 January 2005 stated that the timber to the columns supporting the terrace roof was treated. However, the owner considered that it would be difficult at this late stage to obtain confirmation of this from the timber supplier. The owner also attached an invoice that verified the type of membrane applied to the curved roofing.

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 International and local research 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 Important matters for consideration are:

- Data show 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, I believe that buildings 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 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. I believe 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 believe 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 the house:

- Has 600mm wide eaves and verge projections and roof overhangs that provide good protection to the cladding areas below them. However, the

cantilevered flat roof projections accelerate the flow of driven rain onto the cladding on the exposed elevations of the building and their junctions with the cladding are not sealed;

- Is in a medium wind zone;
- Is two storeys high;
- Is of a relatively complicated shape on plan, with a correspondingly complex roofing system;
- With the exception of the garage door, has flashings to the heads, jambs and sills of the exterior doors and windows, but there are no sealants to the jambs or sills or to the flashing junctions;
- Has numerous wall and roof junctions;
- Has one high level balcony set into a curved roof;
- Has a stone-clad feature tower extending past the height of the building; and
- Has external wall framing that is not treated and therefore will not prevent decay if it absorbs and retains moisture.

Weathertightness performance

6.8 I find that the monolithic cladding in general does not appear to have been installed according to good trade practice. As a result, there are a number of identified defects, which are set out in paragraph 5.1 and in the expert's report, which have contributed to the levels of moisture penetration already evident in locations of the external walls of the building. The main areas of concern are the inadequate fixings to some locations, the cracks in the face of the cladding, the lack of reinforcing mesh at critical areas, insufficient ground and roof clearances, the cladding being buried in the paving, the lack of jamb and sill sealing strips to the exterior windows and doors, the unsealed flashing junctions, the inadequately sealed junctions of the cladding with other building elements, and the buried gutters and fascias. In addition, the external wall framing timber is not treated, and thus unable to delay the onset of decay if it gets wet.

6.9 The expert has noted that the flashing system applied to the external windows and doors may only be effective for small volumes of intrusive moisture. I recommend that these flashings be further investigated, in addition to the inclusion of effective sealing systems previously described, to ensure that they remain weathertight under all conditions.

6.10 While it does not form part of this determination, I am also concerned that the stone cladding to the feature tower may not be adequately secured to the structure or have an appropriate foundation. Accordingly it does not comply with NZS 3604 and does not appear to have been subject to a specific design. If this is indeed the case, then it constitutes a present danger to the public. Accordingly, I request that the territorial authority urgently investigate this matter and that any necessary remedial work be carried out without delay. I am also disturbed that changes from the consented plans such as that to the tower cladding, and to the

flat roofing plywood and membrane thicknesses, have not been noted by the territorial authority during its inspection procedures.

6.11 I note that two elevations of the building demonstrate a medium weathertightness risk rating, and two elevations of the building demonstrate a high weathertightness risk rating when calculated by 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.

7 CONCLUSION

7.1 I am satisfied that the performance of the monolithic cladding is inadequate because it has not been installed according to good trade practice. In particular, it demonstrates the key defects listed in paragraphs 5.1. I have also identified the presence of numerous known weathertightness risk factors in this design and elevated moisture readings. 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 ventilated cavity. Consequently, I am not satisfied that the cladding system as installed complies with clause E2.3.2 of the building code.

7.2 I find that because of the apparent complexity and widespread distribution of the faults that have been identified with this cladding, I am unable to conclude, with the information available to me, that remediation of the identified faults, as opposed to partial or full recladding, could result in compliance with clause E2. I consider that any final decisions on whether code compliance can be achieved by either remediation or recladding, or a combination of both, can only be made after a more thorough investigation of the cladding. This will require a careful analysis by an appropriately qualified expert as to the correct remedial option to be followed. Once that decision has been made, it should be submitted to the territorial authority for their comment and approval. If the territorial authority chooses to reject the proposal, then the owner is entitled to seek a further determination that will rule on whether the proposed remedial work will comply with the requirements of clauses E2 and B2.

7.3 I note 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. I recognise that a territorial authority does not have any statutory responsibility for the ongoing maintenance of a building. However, the maintenance programme adopted by the owner could be undertaken after consultation with the territorial authority, bearing in mind that

the nature of the advice, and the basis on which it is provided to the owner, are for the territorial authority to decide.

7.4 In the circumstances, I decline to incorporate any waiver or modification of the building code in its determination.

8 THE DECISION

8.1 In accordance with section 20 of the Building Act 1991, I hereby determine that the monolithic cladding system as installed does not comply with clause E2.3.1 of the building code and accordingly confirm the decision of the territorial authority to refuse to issue a code compliance certificate.

8.2 I note that the territorial authority has issued a Notice to Rectify requiring provision for adequate ventilation, drainage and vapour dissipation. 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 described 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 Finally, I consider that continuing maintenance of the cladding will 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 25 February 2005.

John Gardiner
Determinations Manager