Determination 2005/06

Refusal of a code compliance certificate for a building with a "monolithic" cladding system: House 5

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 as amended by section 424 of the Building Act 2004 ("the Act"). The applicant is a consultant acting on behalf of the owner (referred to as "the owner"), and the other party is the territorial authority ("the TA"). The application arises from the refusal by the TA to issue a code compliance certificate ("CCC") for an altered and extended existing 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 monolithic wall cladding as installed on the majority of the external wall areas ("the cladding") on this house complies with the building code (see sections 18 and 20 of the Act). By "monolithic 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 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 2.4, and paragraph 8 sets out the decision.

2 PROCEDURE

The building

2.1 The building is a two-storey detached house, which results from the major refurbishment of, and extensions to, an existing dwelling. The house is situated on an excavated slightly sloping section in a wind zone that has been described by the Authority's expert as moderate to high in terms of NZS 3604: 1999 "Timber framed buildings". However, I note that the TA in applying a risk severity matrix has placed the house in a low wind zone. The building is of conventional light timber frame construction and the majority of the external walls are sheathed in a monolithic cladding. The remainder of the external walls are sheathed in Cedar weatherboards. Both of the external claddings are also fixed in part to small areas of the external walls of the existing structure. The building is of a relatively complex shape and has a total of seven roofs of varying pitch and at differing levels, all of which are covered with clay tiles fixed over an underlay. A small roof covered with a waterproof membrane has minimum falls, parapet up stands to the two external edges, and is constructed over the garage. There are several roof/wall intersections and a chimney that passes through a lower-level roof onto the side of an exterior wall and then is inset into the upper-level roof. There are two cantilevered external balconies covered with tiles laid over a waterproof membrane. In some areas the timber fascias and bargeboards are fixed directly to the cladding. Where there are eaves, the widths of these vary from 350 mm to 1000 mm. A small plantroom with Cedar weatherboard wall cladding and a corrugated coloured steel roof is built adjoining the Lounge. A set of concrete steps and a landing have been cast directly against the exterior cladding on the eastern elevation.

2.2 According to the invoices for the house as supplied by the owner, the framing in the external walls is HI treated timber, with the exception of the bottom plates, which are shown to be H3 treated. However, neither the TA, nor the expert has verified this.

2.3 The cladding is known as a monolithic cladding system. It incorporates rigid backing sheets of 12.5 mm thick H3 treated plywood fixed through building wrap directly to framing timbers and finished with a solid plaster coating system. The plaster is applied in 3 coats over a continuous mesh reinforcing, spaced off the backing sheets.

2.4 The plaster applicator provided a Producer Statement in relation to the plaster coating dated 27 April 2004, and also his National Certificate for Solid Plastering as issued by NZQA on 28 September 2001.

Sequence of events

2.5 It appears that the TA issued a building consent in 2002, although I have not seen a copy of the consent.

2.6 The TA made various inspections in the course of construction. Based on the TA's "Plastering Check Lists", there were at least 3 inspections of the stucco plaster. The last one of these was on 17 June 2003 and the plastering was given a "Pass" classification.

2.7 The TA issued a Notice to Rectify on 15 March 2004. The "Particulars of Contravention" attached to the Notice to Rectify noted that:

The following items have not been installed per the manufactures [sic] specifications

- The distance between finished floor level and finished paving of 150mm and unprotected ground of 225mm has not been achieved.
- Claddings are to finish a minimum of 50mm below floor level and a 100mm above paved ground. There measurements have not been achieved.
- Two outlets are required to internal gutters/decks. The cross sectional area of the outlet shall be no less than the cross- sectional area of the down pipes serving the gutter/decks. The minimum internal diameter permitted is 63mm. The overflow outlet for the top floors decks; (off bedroom one and the rear bedroom) are less than permitted. The rear bedroom nib is lower than the floor level, however the mortar between the tiles attached to the nib is cracked and will allow moisture ingress.
- A 12mm gap (horizontally) is required between the back of the cladding and the foundation wall. This has not been achieved.
- Horizontal clearance is required between the decks, steps and the like. The rear concrete stairs have been poured up against the cladding.

The following items have not been installed per accepted trade practice

- At the junction between the horizontal surfaces (ie. top of barrier) and a vertical surface (i.e. house wall) flashing(s) are required. The deck barrier/house junction has no flashing installed.
- All flashings are to be installed in such a way as to direct water away from the building, and prevent ingress of moisture. The junction between the roof and wall on the deck adjacent to the stair will allow water ingress/
- A minimum clearance of 50mm is required between the claddings and the flashings. There are minimal clearance{s) between the roof and the 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, and in the case of the meter box, extractor fan outlet and steel beams flashings have not been installed to direct moisture from behind the cladding.
- Clearance of between 35mm and 50mm is required at the junction of wall claddings and decks. These clearances have not been met.

It also included a statement that the TA:

- 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.

2.8 The owner applied for this determination on 29 April 2004.

3 THE SUBMISSIONS

3.1 The owner did not provide a submission.

3.2 The owner provided copies of:

- The consent drawings and specifications of the building;
- The TA's "Plastering Check Lists;
- The producer statement and National Certificate from the plasterer; and
- The invoice from the timber supplier dated 19 August 2002, which lists the treatment to the bottom plates as H3 and to the external frames as HI.

3.3 The architect provided a set of elevations of the house that had the position of the cladding control joints set out on them. These were accompanied by a covering letter from the architect stating:

> The Plasterer has confirmed that the joints were constructed using galvanized proprietary [Organisation] approved T sections and used paint able silicon from the T section to the outer surface of the plaster.

3.4 The TA made a submission dated 1 July 2004, which repeated the items listed on the Notice to Rectify In addition, the TA put forward some of its views regarding the issues surrounding weathertightness and stated that "the only way of achieving a no or a very low risk type policy with minimal cost is by way of a cavity". Based on the two alternative weathertight risk matrices published for consultation in Acceptable Solution E2/ AS 1, the TA arrived at the conclusion that the building in question was "high risk". The second of these matrices relates closely to the risk matrix issued with the final Acceptable Solution E2/AS1. I agree with the TA's numerical assessment of the risk level of this house, but consider that the house is in the "medium" risk category.

3.5 Copies of the submissions, and other evidence were provided to each of the parties. The owner did not make any further submissions. The TA did comment on the Producer Statement included in the information supplied by the owner. The TA pointed out that in this instance the plasterer was not on its register of persons able to issue Producer Statements for solid plastering.

4 THE RELEVANT PROVISIONS OF THE BUILDING CODE

4.1 The dispute for determination is whether the TA's decision to refuse to issue a CCC on the grounds that 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 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 current Acceptable Solutions that have been approved under section 49 of the Act that cover this cladding. The current Acceptable Solution, E2/AS1, allows for rigid backing sheets, but requires that they be fixed on battens to create a 20mm cavity between the sheet and the framing. The previous acceptable solution E2/AS1, which was in force when this consent was issued, allowed for mesh reinforced solid plaster to be applied over a minimum 4.5 mm thick rigid backing that is face fixed to the framing. Both versions of E2/AS1 noted the importance of properly fixing the mesh to the backing sheets to counter the considerable weight of the plaster acting as a cantilever on the fixing. The cladding is not currently 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 made the following general observations, which in my view remains 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 stated that the cladding is constructed to a good standard and in a workmanlike manner but in small areas has been let down by a lack of attention to detail. Apart from the window to the study and embedded sill flashings, the majority of the flashing requirements, which were adequately detailed on the drawings, have been carried out correctly. The builder, acting on the instructions of the expert, removed an area of plaster to examine the junction between the jamb and the sill flashing of the study window. The expert chose this area because of the two high moisture readings recorded there. In this respect, as there are no other areas of high moisture content, I am of the opinion that the sill flashings to the remaining windows have been correctly installed. The expert's report made the following specific comments on the as-built cladding details:

- The sill tray at the study window is out of level and falling backwards

and the joint where the sill tray had been cut and turned up at its end, and the rear section of the tray had not been sealed;

- There are a number of windows where the bottom edge of the sill tray flashing is buried within the plaster coating;
- There are areas where the paving or ground level is above the bottom edge of the plaster;
- No saddle flashings are fitted at the junction between the parapet and main wall cladding;
- The lead flashing over the rear entry door is buried in the plaster surface;
- The concrete platform and adjoining steps are cast directly against the cladding, without any provision for drainage or an air gap nor is there sufficient ground clearance; and
- As regards the two balconies:

  a) There is cracking occurring in the grout joints between the tiles and the junction with the balcony upstands,

  b) Additional sealing is required, particularly to the southern end of the balcony leading from the first floor landing, and

  c) A deflector flashing is required adjacent to the patio overflow.

5.2 The expert also noted that some remedial work is already taking place in regard to some of the items raised in the expert's report and originally raised by the TA.

5.3 The expert used a moisture meter applied to the internal face of external walls to detect areas of moisture ingress. The two areas showing higher meter readings were in the vicinity of the study window. These were re-tested using intrusive probes, and readings of 30.9% and 42.4% were recorded. Moisture levels above 18% recorded after the cladding is in place generally indicate that external moisture is entering the structure. The expert also carried out a water test where the plaster had been cut away at the study window and water was seen to run through the back of the flashing into the plaster substrate.

5.4 Copies of the expert's report were provided to each of the parties.

5.5 The Architect subsequently provided marked up elevations of the house showing the positions of the horizontal and vertical controls joints that were called up in the specification. He also provided details of the control joint itself.

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 to determining whether building work complies with clause 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 the Architect'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 Some important matters for consideration are that:

- 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, I believe 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 stories 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. 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 this house:

- Generally has 350 mm wide eave overhangs. However, there are areas where the fascia and barge boards are fixed directly to the cladding and do not effectively shield the cladding;

- Is in a low wind zone (In this respect, I accept the TA's definition);

- Is two storey;

- Has two small cantilevered balconies, and one small balcony supported on 3 sides, none of which are build over habitable areas;

- Has a set of concrete steps and a platform built against the cladding. I note that the designer has undertaken special care with the waterproofing in this area and that no high moisture readings were recorded. However it feels that the detail presents an unacceptable risk of future moisture ingress;

- Has an overall envelope that is relatively complex in shape and a series of roofs at different levels;

- Has control joints installed in appropriate locations;

- Has flashings to the heads, jambs and sills of the exterior joinery;

- Has one small flat roof situated over the garage;

- Has face-fixed cladding with no drainage cavity; and

- Has external walls that even if they have been constructed from HI LOSP treated timber, have little initial protection from decay.

Weathertightness performance

6.8 Apart from the defects, which are set out in paragraph 5.1, and that are likely with time to allow the ingress of moisture behind the cladding, the cladding

appears to have been installed according to good trade practice. It can, therefore, be considered to be reasonably effective in preventing the penetration of water. Although the overall system is not a proprietary one, it does follow the details in the superseded E2/AS1 for solid plaster over a rigid backing sheet. I do not have details of the fixing method used, the size of the mesh or the details of the slip layer. However, taking into account the expert's report, I accept that the mesh and the way it has been installed, and the presence of a slip layer, are in accordance with the details in the superseded Acceptable Solution.

6.9 Notwithstanding the fact that the backing sheets are fixed directly to the timber framing, thus inhibiting ventilation behind the cladding sheets, I find 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;
- The house generally has eaves and is in a low wind zone;
- There are flashings to the heads, jambs and sills of the exterior joinery; and
- The moisture level readings do not indicate any undue moisture ingress behind the cladding at this time.

6.10 I consider 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 I note the importance of the owner's responsibility for ongoing maintenance to the cladding. The code assumes that normal maintenance necessary to ensure the durability of the cladding is carried out and thus clause B2.3.1 of the building code requires that the cladding be subject to "normal maintenance". That term is not defined, so that 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 accept that the expert's report establishes that the cladding generally complies with the Architect's specification and the details of the superseded E2/AS1. However, as there is evidence of external moisture entering the building, I find that the cladding on this particular building does not comply with clause E2.

7.2 I also find that when the cladding faults have been satisfactorily rectified this house should be able to remain weathertight and will thus comply with clause E2. It is essential that all the required items of rectification, which are detailed specifically in paragraph 5.1, be competently carried out to ensure such compliance.

7.3 It is emphasised 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.

7.4 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, I determine that the house does not comply with clause E2. Accordingly, I confirm the TA's decision to *refuse* to issue the CCC.

8.2 I find that because of the compensating factors in this case, the lack of a drained cavity behind the cladding is not, on its own, sufficient grounds to withhold a CCC.

8.3 I, therefore, find that once the items of non-compliance that are listed in paragraph 5.1 are rectified to the approval of the TA, 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.

8.4 How the cladding is to be brought to compliance with the building code is a matter for the owner to propose and for the TA to accept or reject, with either of the parties entitled to submit doubts or disputes for another determination.

8.5 I consider that the cladding on the building will require on-going maintenance to ensure its continuing building code compliance.

Signed for and on behalf of the Chief Executive of the Department of Building and Housing on 1 February 2005.

John Gardiner
Determinations Manager