Determination 2005/04

Refusal of a code compliance certificate for a building with a "monolithic" cladding system: House 3

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 trustee 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 a new dwelling 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 to all the external walls of the house ("the cladding"), complies with the building code (see sections 18 and 20 of the Act). By "the monolithic wall cladding as installed" I mean the components of the system (such as the backing sheets, the flashings, the joints and the plaster and/or the coatings) as well as the way the components have been installed and work together.

1.3 This determination is made under the Building Act 1991 subject to section 424 of the Building Act 2004. That section came into force ("commenced") on 30 November 2004, and its relevant provisions are:

> ". . .on and after the commencement of this section,—
>
> "(a) a reference to the Authority in the Building Act 1991 must be read as a reference to the chief executive; and
>
> "(b) the Building Act 1991 must be read with all necessary modifications to enable the chief executive to perform the functions and duties, and exercise the powers, of the Authority . . . "

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

1.4 This determination refers to the former Authority:

(a) When quoting from documents received in the course of the determination, and

(b) When referring to determinations made by the Authority before section 424 came into force.

1.5 In making my decision, I have not considered any other aspects of the Act or the building code.

1.6 The house itself is described in paragraphs 2.1 to 2.4, and paragraph 8 sets out my decision.

2 PROCEDURE

The building

2.1 The building is a single story detached house situated on an elevated building platform that has been described by the Authority's expert as a high wind zone in terms of NZS 3604: 1999 "Timber framed buildings". The building is placed on a low ridge saddle and surface water drains away from the building along both sides. The building is of conventional light timber frame construction and the external walls are sheathed in a monolithic solid plaster (stucco) cladding. The building is of a relatively complex shape with 2 lean-to style pavilions complimented by verandahs and chimneys. All door and windows are protected by the verandahs or are deeply recessed into the external walls. There are no eaves projections and the main roof and verandahs have external gutters formed in the roofing membrane with low height perimeter upstand parapets.

2.2 Timber treatment is not noted on the plans but the owner's agent advised all framing to external walls is HI treated timber, with the exception of the bottom plates, which are specified as H3 treated. The owner's agent also advised that all external faces of the framing timber were brushed with a copper based timber preservative.

2.3 The cladding is known as a monolithic cladding system. It incorporates rigid backing sheets of 4.5 mm thick fibre-cement sheet, with a double wrap of building paper each side of the rigid backing sheet. The plaster system is a sponge finish two- coat cement and sand solid plaster 25mm thick incorporating a waterproofing additive over a steel mesh. The plaster is finished with a primer coat and two coats of 100% water-based acrylic polymer.

2.4 The plasterer issued a statement saying that their work was completed to the building codes and the surface coating supplier issued a 7-year warranty.

Sequence of events

2.5 The TA issued a building consent on 25 October 2001. The TA imposed special conditions on the consent that required two inspections for the exterior stucco. The first of these was to be undertaken at completion of the mesh

fixings, and the second after application of the first plaster coat. Construction commenced early 2002 and the external plastering was completed in mid 2003.

2.6 The TA made various inspections in the course of construction. The first plastering check list noted that the backing sheets are fixed "OK", openings are flashed, the mesh is partially installed, but details are required for the base of column and ground clearance is to be confirmed. A "stucco post line" inspection was passed on 17 March 2003. The TA's final inspection record notes: "Final Inspection – Fail due only to cladding system employed – No cavity".

2.7 In a letter dated 29 January 2004, the TA wrote to the owner stating that they had recently carried out an inspection of the house. However, based on recently received data, the TA could not be satisfied that the cladding met the requirements of clause E2of the building code. The TA attached a Notice to Rectify to the letter. The "Particulars of Contravention" attached to the Notice to Rectify noted that:

The following items have not been installed per the NZ Building Code & with the manufacturers technical information.

- The cladding system has not been packed off the concrete base 6 mm.
- The walls cladding system has not been finished a minimum 100mm or 175 mm above paved ground or clear landscaped ground respectively. Where the patio is covered a minimum 50mm clearance between the bottom of the cladding system and the patio paving has not been achieved.

It also included a statement that the TA:

- Has recently received information which shows that monolithic cladding systems without a 20mm cavity, provision for adequate ventilation will, in the likelihood of leakage and/or the effects of residual moisture, cause irrevocable damage to the structural elements of the building.

With respect to the first point, I take this to be a reference to the finishing detail of the plaster at the base of the walls.

2.8 The owner applied for this determination on 14 April 2004.

3 THE SUBMISSIONS

3.1 The owner's project manager provided a submission in response to the TA's details of contravention. This included responses to the requirement for a cavity, resistance to moisture penetration and also stated that there was no moisture present at the completion of the building. The project manager also made specific responses to items of contravention raised by the TA in relation to the cladding. These were:

- That the cladding system has not been packed off the concrete base by 6mm; and

- That the wall cladding is not finished to 100 or 175 mm above paved ground or landscaped ground.

3.2 The owner provided copies of:

- The consent drawings and specifications of the building;
- The TA's "Building Consent Inspections", Plastering and Final Check Lists;
- The producer statement and National Certificate from the plasterer;
- The Special Conditions to the consent for plastering;
- Response to councils advice of contravention from the Project manager;
- Details of bottom edge of cladding details;
- Producer statements and coating warranties;
- The column to slab detail requested by the TA;
- Jamb flashing details; and
- Notice to rectify and particulars of contravention.

3.3 The architect who supervised the job also supplied extra details of the head and jamb flashings as they were installed. These were accompanied by a covering letter from the architect stating:

> The window /door details were examined on site with the Architect, Builder and Plasterer to ensure no water penetration would occur. You will note there are double flashings used on this project as an insurance against water penetration.

3.4 The architect in a letter to the Authority, dated 14 May 2004, stated:

> To assist the determination I wish to confirm that the design and construction of the building using the "monolithic" cladding system complied until recently with NZSS 1900, City Council permitting division and [Named organization] approvals. I have used these systems of construction on at least nine buildings I have designed and built over the last ten years. All these have received compliance and had no water leakage problems.

3.5 The owner also responded to the 2 faults referenced in the TA's particulars of contravention, by noting that:

> It was pointed out that the average overhang was 3 to 4mm and was to allow for block line variation and clear cladding over hang as in the accompanying diagrams
>
> The paved areas already are stepped 100mm plus above ground level. It also raises a minimum gradient of 30 mm up to where cladding begins as seen on accompanying diagrams. It also has a clear 5 mm silicon filled break between the tile and claddings aluminium base.

> In response to the 175 mm above clear ground, we have a complete full depth chase through the plaster and into the block, which is also silicon filled using approved silicon. The plaster has a waterproofing agent therefore no wicking occurs. Also the house, being on a ridge has fall away from all four sides, so no ponding against the house is possible.

3.6 The TA forwarded a lengthy submission. The bulk of the submission was a general comment on face fixed monolithic cladding and related to fibre cement, stucco and EIFS systems, and it summarised the main points as follows:

- The principle design and current construction methods are the primary failure in the stucco wall system comprising stucco, backing boards, building paper, timber frame, fibtrreglass insulation and plasterboard in that it is defectively designed as in Auckland conditions it results in a RH (relative humidity) in the trimber wall cavity sufficiently high for mould and rot to grow. Current construction methods do not provide for ventilation and a drainage plane.

- The secondary failure is that work in excess of normal mainatenance is required to keep the stucco and wall elements of sufficiently low moisture content to prevent the effects of the primary failure from reoccurring even if all water entry points are eliminated.

- The third failure of the stucco system is that it has an inflexible cladding and does not allow for the expected movement associated with a timber frame construction, and thereby cracks form and sealants tear letting water in.

- Fourthly the building materials in the wall are inadequate and there is no allowance for the consequence of failure of the system components or the system as a whole. Especially the timber frame the end result means the timber will degrade and be incapable of lasting 50 years as required by the building regulations.

3.7 The TA's submission effectively questions the technical basis of a number of the benchmarks for assessing the likely code compliant performance of timber-framed construction in New Zealand contained within the new acceptable solution covering timber treatment (B2/AS1) and the draft acceptable solution on external moisture (E2/AS1), which covers weathertightness detailing, and proposes that an alternative (and more conservative) benchmark be used to assess likely building code compliance for monolithically-clad buildings within its jurisdiction.

3.8 The specific comment on this house in this submission included the Notice to Rectify, comments (in appendix B) elaborating on the reasons why the faults listed in the Notice to Rectify were considered to be non compliant with clause E2 of the code, an “Exterior Cladding/Site Risk analysis”, a check sheet on the details of the cladding completed by the TA inspectors, and a set of photographs showing the areas of concern outlined in the Notice to Rectify.

3.9 In its initial submission, the TA concluded by stating that it must refuse to issue a CCC on the grounds that there was insufficient scientific evidence that the performance of these building elements met the requirements of the Building Code.

3.10 The TA elaborated on their original submission in a letter to the Authority dated 30 June 2004. In this letter the TA clarified their original submission by

stating that their areas of concern with this house were those itemised in the Notice to Rectify. In the letter, the TA also stated that they had changed their mind on acceptable weathertightness risk and now disagree with the use of a low risk category in the new E2/AS1 acceptable solution, which is shortly to be into force. The letter also included the TA's assessment that the weathertightness risk of this house was high. I note that in reaching that decision, the TA has used one of 2 alternative risk assessment methods that were issued with the consultation documents on E2/AS1. This method was not adopted in the final acceptable solution.

3.11 Copies of the submissions, and other evidence were provided to each of the parties. The owner did not make any further submissions.

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 exterior finish is of very good quality. No post painting cracking had occurred, even on the most exposed building faces. Plaster coating and painting is of a good standard, good quality products have been used and there has been no deterioration of the paintwork since applied. The building is well built with good attention to those details that affect weathertightness. The expert made specific comments as follows:

- Plaster control joints were observed in suitable positions but there were two triangular walls approximately 6000 mm long varying in height from 0 to 1.3 meters high that did not have control joints but there were no signs of cracking;

- Ground clearances around the building were observed. The position of the building on a hill removes much of the threat of ground water entering the building by draining water away by natural ground surface. Unpaved ground levels are generally 200mm below finished floor level;

- Plaster cladding around the building continued down to ground level. A specially formed plaster break with silicon sealer approximately 200 up from ground level was used to keep moisture out of the structure. There is no evidence of moisture penetration;

- Clearance between the plaster and the stone paving at the base of the verandah columns and other cladding under the verandah directly abuts the floor tiles. Another specially designed detail utilising an aluminium end plate to the plaster, and a sealant bead encased in flexible sealant. The detail also required H4 treatment of the plate timber and specific waterproofing of the fibre cement under the plaster.

- Much of the perimeter joinery is protected by the constructed verandah, which varies in depth from 1.9 to 2.9 metres. The joinery that occurs in wall elevation not protected by verandahs is recessed into the wall by approximately 300mm. In the verandah situations, the step down from the finished floor to external tile was approximately 100mm. He noted that protection from the verandah was considerable and the external tile surface falls away from the building. There was no sign of any water penetration; and

- The roof and associated flashings were well installed with good trade practice evident. Butyl gutter and flashings appeared to have good upstands and joints/folds were tidy. Glazed panels were provided over

outdoor living areas. These rely on silicon sealant at miters and joins but any leakage here would present little risk as the panels are over outdoor areas.

5.2 The expert used a moisture meter applied to the internal face of all external walls to detect areas of moisture ingress. No excess moisture was detected with a maximum reading being 14%. Given those observations, the absence of any evidence of moisture penetration and the quality of the workmanship, no invasive or destructive testing was deemed necessary.

5.3 Copies of the expert's report were provided to each of the parties. The Architect subsequently provided additional details of how the jamb flashings were installed to the openings.

6 DISCUSSION

General

6.1 I have considered the submissions of the parties, the expert's report, council inspection records 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 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, I 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, I find that this house:

- Lacks eaves but the window and door openings are protected by verandahs and deep recesses;

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

- Is single storied;

- Has an overall envelope that is relatively complex in shape with a roofline that includes a series of pitched lean-to planes that fall to gutters lined with membrane;

- Has control joints installed in appropriate locations;

- Has specially designed flashings to the heads, jambs and sills of the

exterior joinery;

- Has specially designed waterproofing details for the bases of the cladding where it interfaces with the concrete decks and natural ground
- Has face-fixed cladding with no drainage cavity; and
- Has external walls that have been constructed from untreated timber, which may have received some protection from decay by application of preservative and for bottom plates, which I accept the advice given that they are treated to H3.

Weathertightness performance

6.8 The cladding appears to have been installed according to good trade practice. It can, therefore, be considered to be 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 any details of the fixing method used or the size of the mesh. However, taking into account the expert's report and council inspection records, 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 installed to a high standard and according to good trade practice. The at risk details required in this building have been carefully planned and designed;
- The house generally has wide verandahs and recessed windows;
- There are flashings to the heads, jambs and sills of the exterior joinery;
- The moisture level readings do not indicate any undue moisture ingress behind the cladding at this time; and
- The natural ground slope will minimize the possibility of water ingress into the building.

6.10 I note that this building is in the high-risk category as measured by the E2/AS1 risk matrix. However I also acknowledge that the architect has recognized this risk status and has specifically designed key details to ensure that weathertightness is preserved. The extensive set of consent drawings reflects the extent of the specially designed details.

6.11 I accept the expert's conclusion that the designed details relating to the base of the cladding where it meets, or is close to the ground or paved areas will

prevent the ingress of moisture at these points.

6.12 I note that vertical control joints have been installed in various locations. I find that even though the spacings between these joints are sometimes greater than 4000 and in some instances, extend to 6000, the control joint layout is appropriate for the various wall panels involved. In reaching this conclusion I note that the joint layout has controlled crack propagation so far, and that the concrete slab and foundation system will reduce foundation movement in the future.

6.13 I note the TA's comments on the high maintenance requirements of solid plaster. I find that maintenance required to ensure that the cladding remains code compliant is the responsibility of the owner, and not in itself a reason that solid plaster cladding is not compliant with clause E2.

6.14 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 I must 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. In this case maintenance will also involve ensuring that exterior ground levels all remain not less than the specified 125mm below the horizontal.

7 CONCLUSION

7.1 I accept that the expert's report and council inspection records establish that:

- The cladding generally complies with the Architect's specification and the details of the superseded E2/AS1;
- There is no evidence of external moisture entering the building.

I conclude that even though the design of this house is high-risk, it is extremely well detailed and constructed and the weathertightness details have been subject to specific design whenever appropriate. Accordingly, I find that the cladding on this particular building complies with clause E2 of the building code.

7.2 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.

7.3 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 cladding complies with clause E2. Accordingly, I reverse the TA's decision to refuse to issue the CCC.

8.2 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