Determination 2004/76

Refusal of a code compliance certificate for a building with a "monolithic" cladding system: House 59

1 THE DISPUTE TO BE DETERMINED

1.1 This is a determination by the Building Industry Authority ("the Authority") of a dispute referred to it under section 17 of the Building Act 1991 ("the Act"). The applicant is the owner of the building 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 new house unless changes are made to its monolithic cladding system.

1.2 The Authority's task in this determination is to consider whether it is satisfied on reasonable grounds that the external wall cladding as installed ("the cladding") on the house complies with the New Zealand building code (First Schedule, Building Regulations 1992) ("the building code") in terms of 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 plaster and/or the coatings) as well as the way the components have been installed and work together.

1.3 In making its decision, the Authority has not considered any other aspects of the Act or the building code.

1.4 The house itself is described in paragraphs 2.1 to 2.3, and paragraph 9 sets out the Authority's final decision.

2 PROCEDURE

The building.

2.1 The building is two-storey house constructed on a gently sloping and partially excavated site, which is in a low wind zone and a sea spray corrosion zone in terms of NZS 3604: 1999 "Timber framed buildings". The house is of conventional light timber frame construction on a concrete block foundation wall. It is of a relatively simple shape but has several separate flat roofs at three different levels. The roofs are lined with a waterproof sheet membrane over construction plywood sarking, have low-level parapet walls at the external perimeters and are drained by internal gutters formed in the membrane. The uppermost roof has a timber-framed balustrade and timber decking secured to battens fixed over the membrane. The house has a balcony at the upper level, constructed as for the roofs but with lightweight tiles adhered to the membrane, and a timber-framed balustrade. The balustrades are lined on their faces with a plywood cladding and capped with a metal flashing. The plans show a spiral stair situated on the balcony giving access to the upper roof area, but this has not yet been installed. A timber-framed canopy is situated over the

main entrance and continues as a 550 mm wide capping over the garage door. The canopy is supported on three timber columns faced with the cladding. The canopy has a membrane covering, the soffit is lined with timber boarding, and the fascia is plastered. There are wall/roof intersections where the membrane roofing adjoins the main walls or the balustrades. Apart from a small area at the front entry and the garage, there are no eaves projections.

2.2 The framing in the external walls is not treated.

2.3 The external walls of the building are clad with what is described as monolithic cladding. In this instance it incorporates fibre-cement backing sheets fixed through the building wrap directly to the framing timbers and finished with a 25 mm thick stucco sand and cement plaster reinforced with chicken mesh. The plaster in turn is finished with a dark colour acrylic paint system.

Sequence of events:

2.4 The territorial authority issued a building consent on 28 January 1998. The Special Conditions attached to this consent did not make any reference to the cladding.

2.5 The territorial authority made various inspections in the course of construction and the backing sheets passed inspection on 12 May 1998, and on 15 June 1998, the stucco plaster and mesh also passed an inspection. A series of pre-code compliance certificate inspections were carried out in early 2004, and the house failed a Final Inspection on 8 March 2004.

2.6 On 7 May 2004, a consultant employed by the owner inspected the house and prepared a report dated 10 May 2004.The particular comments relating to the cladding were;

- The exterior plaster correctly finishes off the ground paving and roofing;
- Metal cap flashings have been installed to all handrails and parapets;
- The external plaster walls have expansion joints in the correct locations;
- Sealant was required to sides of aluminium joinery, to control joints, to certain parapet and handrail cap flashings and to the cladding junction with a masonry wall;
- A hairline crack above the garage door required re-sealing and re-painting; and
- The pvc overflow pipes needed to be extended past the face of the plaster.

The consultant also carried out moisture tests to 17 locations and obtained readings varying from 11% to 17%.

2.7 The territorial authority wrote to the owner on 12 May 2004, stating that it had inspected the house, regretted that it may not comply with the building code in a number of respects and described the territorial authority's current concerns about weathertightness problems involving monolithic clad buildings The territorial authority attached a copy of a Notice to Rectify dated 11 May 2004 to this letter.

The "Particulars of Contravention" attached to the Notice to Rectify noted that

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

- Horizontal control joints at floor joist level are required. Horizontal control joints have not been installed.

- A 6mm gap (horizontally) is required between the back of the cladding and the foundation wall. This has not been achieved.

- The bottom edge of the cladding is to finish a minimum 100mm above paved surfaces and 175mm above unpaved surfaces. The cladding has been taken closer that these measurements.

2. The following items have not been installed per the acceptable solutions of the building code, (no alternative solutions have been applied for)

   - Buildings shall have claddings that are waterproof, there appears to be some cracking around the side garage door.

   - Two outlets are required to internal gutters/decks. The cross-sectional area of the outlets shall be no less than the cross-sectional area of the downpipes serving the gutter/deck. There are a number of roofs and decks, which have no overflow outlet.

   - The minimum finished floor level to finished ground level is 150mm to paved surfaces, and 225mm to unprotected ground. This clearance has not been achieved.

3. The following items have not been installed per accepted trade practice

   - At the junction between horizontal surfaces (i.e. top of deck barrier) and a vertical surface (i.e. house wall) flashing are required. The deck barrier/house junctions and parapet/house junctions have no flashings installed.

   - Cap flashing fixings and the like are not to penetrate top of barriers and horizontal surfaces. There are fixings into horizontal surface of the barrier and parapets.

   - A minimum clearance of 35mm is required between the cladding and adjacent surfaces. There is minimal clearance between the roof and wall claddings and wall cladding and terraces.

   - 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, and extractor fan flashings have not been installed.

   - The junction between the window head flashing and bottom edge of the cladding should be left unsealed with a 20mm gap. This junction has been sealed.

   - Sill flashings are to be taken 30mm past the edge of the window joinery. This has not been achieved.

   - All flashings are to be installed in such a way as to direct water away from the building, and prevent ingress of moisture. Horizontal flashings should be returned down the face of the plaster system. This has not been achieved.

4. Ventilated cavity system

   - The Council 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.

The territorial authority also noted:

> The Council cannot be satisfied that the cladding system meets the performance requirements of Clauses B1 Structure, B2 Durability, E2 External Moisture, E3 Internal Moisture, G4 Ventilation and H1 Energy Efficiency Provisions of the Building Code…This is in breach of Sections7(1), of the Building Act 1991…

Also that the owner was required to:

1. Provide adequate ventilation to the monolithic cladding and into the wall frame space by means of either a ventilated cavity or alternative approved system, and ensuring all issues related to the above are resolved.

2. Lodge with the council an application, within 28 days from the date of this notice, for an amended building consent, and provide all necessary information that may be requested to allow this consent application to be processed, alternatively.

3. Confirm to council, within 28 days from the date of this notice, your intention to apply to the Building Industry Authority for a determination in accordance with the Building Act 1991

2.8 The owner applied for this determination on 25 May 2004.

3 THE SUBMISSIONS

3.1 The owner in a covering letter to the Authority, dated 26 May 2004, set out the sequence of events that led up to the request for a determination. The owner also stated that skilled tradesmen had constructed the house, that the plaster was painted with specialist paints, and that the plastering company had been in business for over 40 years. In addition, all penetrations were sealed, all parapets flashed and sealed and the windows have top and bottom flashings.

3.2 Under the "Matter of Dispute" the owner stated that:

> [The territorial authority] refuses to issue a code of compliance (*sic*) "as they are not satisfied the house satisfies Clause E2 External Moisture of the Building Code based on the fact the plaster/stucco finish does not have a cavity"
>
> The applicant [Named person] disputes this and has facts to prove that the house does satisfy Clause E2 (and B2) of the building code based on:
>
> - Independent building inspection invasive moisture readings (min 10% max 17% - average 13%) prove that the house satisfies Clause E2 of the building code.
> - [The Territorial authority's] "plaster inspection" was visual only. They did not perform any moisture test or any other test to prove the house does not satisfy Clause E2 (and B2) of the building code.
> - The house was constructed as per the permit (*sic*) plans, building specification and [territorial authority's] requirements in 1998.
> - The house was built by skilled tradesmen to a high standard.
> - The house is 6 years old and has not suffered any leaks or areas of moisture. Any leakage or failure of the plaster/stucco finished (sic) would have occurred by now.
> - The plaster/stucco finish has not suffered any cracking.

- Regular maintenance and inspections have been carried out, including repainting.

3.3 The owner also supplied copies of:

- The plans and specification;
- The consent documentation;
- The territorial authority's inspection reports;
- The territorial authority's letter of 12 May 2004 and the attached Notice to Rectify; and
- An inspection report from an independent consultant who was employed by the owner.

3.4 The territorial authority forwarded a lengthy submission. The bulk of the submission was a general comment on monolithic cladding, although some of the material related to this particular house and stated that:

- The principle design and current construction methods are the primary failure in the stucco wall system comprising stucco, backing boards building paper, timber frame, fibreglass insulation (batts) and plasterboard in that it is defectively designed as in Auckland conditions it results in a RH (relative humidity) in the timber 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 maintenance 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 the water entry points were eliminated.
- The third failure of the stucco system is that it is an inflexible cladding and does not allow for the expected movement associated with timber frame construction, and thereby cracks form and sealants tear letting water in.
- Fourthly the building materials in the wall assembly 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.
- The [territorial authority] points out that there are already numerous defects in the cladding envelop and even if all these were repaired this will not alter the four principle failures identified above and the building will remain in contravention of the Building Act.

3.5 The submission also included a copy of the Notice to Rectify and a set of photographs, illustrating some of the territorial authority's concerns.

3.6 The territorial authority felt that it must refuse to issue a code compliance certificate on the grounds that there was insufficient scientific evidence on the performance of the building elements in this house.

3.7 The territorial authority in a letter to the Authority dated 30 June 2004, elaborated on their original submission. They stated that their areas of concern were those itemised in the Notice to Rectify and then listed them in detail. They advised that the weathertightness risk, as measured by the E2/AS1 risk matrix, was high. The territorial authority also took issue with the owner's statement that the territorial authority had refused to issue the code compliance certificate because the cladding does not have a cavity. The territorial authority

stated that the lack of a cavity is only one reason why the territorial authority had refused to issue the code compliance certificate as outlined in the Notice to Rectify.

3.8 The copies of the submissions and other evidence were provided to each of the parties. In a letter to the Authority, dated 27 July 2004, the owner commented on the territorial authority's submission. In general terms, the owner stated:

- The house has control joints where required and the courtyard wall encloses a large amount of joinery within 300mm of the floor joist height that provides for expansion;
- The house was constructed with the required 6 mm gap between the backing sheet and the foundation, but as the foundation wall was plastered at a later date, the gap is no longer achieved;
- There are only small areas where the bottom edge of the cladding is too close to the paving or unprotected ground;
- The cracking adjacent to the garage door was caused by an impact, and is inside the building when the door is closed;
- The roof drainage was considered to be adequate, and over a period of 6 years has performed satisfactorily;
- While there are no flashings between the parapets and the house, they have been sealed;
- The top fixing to the parapet cappings and penetrations through the cladding have been adequately sealed and regularly inspected;
- The house was built according to the permit (*sic*) issued by the territorial authority. It has also passed all inspections, has not suffered any leaks, and the moisture content is low showing that the house meets the requirements of the relevant building code clauses. If a cavity was required, then the "pre plaster" inspection should not have been passed;
- All the items that had failed the final inspection were rectified and subsequently passed inspection, with the exception of "monolithic [cladding] without cavity outstanding";
- Areas that the territorial authority had referred to as requiring resealing had been attended to as part of routine maintenance; and
- The territorial authority's inspection was a 45-minute visual one, without any scientific test of any kind being undertaken by them.

3.9 In response to the owner's letter of 31 August 2004, the territorial authority wrote to the owner on 10 September 2004, noting that a cavity was the preferred option to provide ventilation and drainage. However, if an alternative method was shown to be effective, the territorial authority would also consider this.

4 THE RELEVANT PROVISIONS OF THE BUILDING CODE

4.1 The dispute for determination is whether the territorial authority's decision to refuse to issue a code compliance certificate because it was not satisfied that the cladding complied with clause E2.3.2 of the building code (First Schedule, Building Regulations 1992) is correct. Those provisions of the building code provide:

> **Clause B2 DURABILITY**
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> **B2.3.1**
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> 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:
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> (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**
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> **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 current Acceptable Solution, E2/AS1, allows for solid plaster systems with fibre cement 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 to fibre cement backing sheets that were face fixed to the framing. The cladding is not currently accredited under section 59 of the Act. The Authority is therefore of the opinion that the cladding system as installed must now be considered to be an alternative solution.

4.3 In several previous determinations, the Authority has made the following general observations about acceptable solutions and alternative solutions:

- Some acceptable solutions cover the worst case, so that in less extreme cases they may be modified and the resulting alternative solution will still comply with the building code.

- Usually, however, when there is non-compliance with one provision of an acceptable solution, it will be necessary to add some other provision to compensate for that in order to comply with the building code.

5 THE EXPERT'S REPORT

5.1 The Authority commissioned an independent expert ("the expert") to inspect and report on the cladding. The expert inspected the building and furnished a report that found the plaster to have been applied in accordance with good trade practice and the exterior finish is of good quality, apart from some minor damage where the plaster has chipped or cracked. There are flashings installed to all perimeters of the exterior joinery units, except over the garage door. The cladding is painted black, which the expert considers will result in more thermal expansion and a greater risk of cracking of joints. The expert attributes the current surface cracking to the dark colour. The expert noted the following specific faults that had been identified during the inspection:

- There is surface cracking evident in the cladding in several locations;

- There is cracking at the garage door frame;

- Control joints are required at 4 metre centres, both vertically and horizontally and these are lacking in most instances. Those that have been formed are not entirely in accordance with NZS3604 or the manufacturer's instructions;

- The bottom edge of the backing sheet around the roof and the deck areas has not been painted or sealed;

- There is minimal clearance between the bottom of the cladding and finished floor levels at the garage and front entrance area, at the balconies, and at the roof level;

- There is no clearance between the capping and cladding at various junction points around the house;

- The balcony membrane turn-up has been punctured by the mesh fixings;

- The metal capping on the parapets and balustrades have been faced fixed into the top surface and the capping has not been formed in a manner that sheds water away from the cladding. As a result, the underside of the capping is corroded and the plywood has started to deteriorate;

- No flashings have been provided at the junction of the metal capping and the wall cladding;

- The membrane roof at the opening to the upper deck has not been installed in a manner to prevent moisture ingress;

- Several fences, walls and brackets have been fixed to the cladding;
- An external block wall is hard up against the cladding;
- Sill flashings to the external joinery units are buried in the cladding where they extend past the openings;
- Head flashings have not been installed in accordance with good trade practice and do not allow water to drain properly;
- Electrical cables penetrate the cladding in several places;
- The meter box has not been flashed;
- Penetrations such as ducting vents, lights, plumbing pipes, downpipe bracket fixings, TV aerials, etc, lack flashings and are reliant on sealant only. There is evidence of leaking at some of these penetrations;
- The downpipes discharge a concentrated flow of water onto the roofing and spreaders have not been fitted; and
- Overflows have not been installed in a manner that will ensure water does not penetrate the cladding.

The expert was of the opinion that the question of an air gap raised by the territorial authority was not an issue as it had been originally provided, but the bottom edge of the plaster against the footing had been sealed and painted, and the block foundation wall is a minimum of 300 mm above the ground at this point. Otherwise, the expert agreed in part with the comments regarding rectification that the territorial authority made on its Notice to Rectify.

5.2 The expert took moisture readings of the external wall cavities through the interior linings around the skirting line and under joinery units, using a non-intrusive meter. The readings recorded ranged from 13.3% to 18.5%. The expert then used an invasive type moisture meter to investigate 11 at-risk locations, and 7 readings exceeded 18%. These latter readings were

- 20% and 30% at the balcony off the TV room;
- 20% and 30% at the parapet over the bathroom;
- 21% to the TV room wall
- 25.5% to the bedroom 1 wall and
- 29% to the bedroom 2 wall

Moisture levels above 18% recorded after cladding is in place generally indicate that external moisture is entering the structure.

5.3 Copies of the expert's report were provided to each of the parties. The territorial authority responded by letter on 30 August 2004, and stated that in general the territorial authority agreed with the expert's report. The territorial authority claimed that the "three Ds" did not

exist in this house and was of the opinion that without a cavity or other means of protection the house would continue to leak and ultimately, timber degradation will occur.

5.4 The owner responded with comments in a letter dated 13 August 2004. The owner stated that it was important that the remedial issue had been identified and it was the owner's intention to carry out the required work irrespective of the obtaining of a code compliance certificate. The owner had engaged external consultants to work with the territorial authority to design solutions and carry out remedial work to the satisfaction of all the parties concerned. The owner again referred to the expert's report in a letter of 18 August 2004, raising questions as to the dark colour paint used, the gate fixings, the balcony, and the parapet.

5.5 The owner reiterated his arguments in a further letter to the Authority, dated 31 August 2004, and stated that the identified leaks were minor and that no rotting timber was identified. In addition, the owner disputed what are described as the territorial authority's "generalised statements" and considered that the territorial authority had to take responsibility for the house.

6 THE HEARING

6.1 The owner requested a formal hearing, which was held before a committee of the Authority ("the Tribunal"), duly appointed to act for and on behalf of the Authority in respect of this tribunal. The owner and the territorial authority spoke and called evidence at the hearing.

6.2 The owner made a written submission for the hearing attached to a covering letter dated 27 October 2004. The owner also used a "Powerpoint" presentation at the hearing, which elaborated on the issues raised in the written submission. This presentation raised a number of points and the Authority in reviewing it has identified the owner's key concerns. In doing so, it has restricted its comments to those that relate to the question of code compliance and not to other circumstances, including the proceedings between the owner and the territorial authority that have led to this determination.

The main concerns raised by the owner are as follows:

- Rather than addressing monolithic cladding situations on a case-by-case basis, the territorial authority had a blanket policy that if there was no cavity, then a code compliance certificate would not be issued;
- The cladding is installed in accordance with what the owner described as an "Acceptable Solution" as issued by the cladding manufacturer and confirmed by an appraisal and has backing sheets of [Named product] and not fibre-cement. The expert had pointed out that the exterior finish was "generally of a high standard;
- Ten control joints had been formed, as illustrated by the owner during the presentation, and a further three have been added since the expert's inspection. The courtyard area wall, which did not have a control joint, was mainly infilled with windows and doors that provided an alternative means of control;
- There was only 5 metres length of cladding where there was insufficient ground clearance and this location was under a 700mm wide eaves and a drainage channel was adjacent to it;

- There were two correctly dimensioned overflows to the roof areas;
- A gate catch, not the fencing was attached to the cladding and there was a gap where the block wall adjoined the cladding;
- The finishing of the plaster to the exterior joinery units' head flashings was in accordance with the manufacturer's instructions at the time of installation;
- The owner will rectify the exterior joinery units' sill flashing and the base clearance of the balcony balustrade cladding. However, while prepared to provide a 6mm gap over the head flashings, the owner was concerned that this would worsen rather than alleviate the moisture ingress problem;
- The owner has carried out other remedial work in addition to the control joints. This includes completely reforming the parapet and balustrade cappings, sealing the bottom edge of the sheets, fixing a small area of roofing, and resealing of penetrations. Since the remedial work has been carried out, the current moisture readings are much lower than those described in the experts report.

6.3 The owner also considered that the expert's report disagreed with six out of eight issues raised by the territorial authority in its Notice to Rectify. The owner also believed that the determination should address the question of what should happen with regard to rectification, once the determination has been issued. The owner also pointed out that the house had passed numerous territorial authority inspections, including the pre-plaster checks.

6.4 The territorial authority made a one page written submission for the hearing, but the Authority did not receive this within the imposed time limit. At the hearing, the owner objected to its presentation as it was out of time and the owner would need time to consider it. The Authority ruled that that the territorial authority could not table the material, but could give a verbal explanation of it, but only in relation to relevant evidence. The owner was not comfortable with this approach but agreed to proceed on this basis.

6.5 The main points raised at the hearing by the territorial authority in response to the owner's submission, were as follows:

- The only issue was whether the house complied with the building code, and in this respect, the territorial authority considered each building on a case-by-case basis and not as a blanket policy;
- The manufacturer's instructions and the appraisal were not Approved Documents and the backing is a fibre-cement board;
- The territorial authority was concerned that there was no horizontal control joint that would accommodate floor joist shrinkage and building movement. In addition, A vertical control joint was required on the north western elevation, and in addition, as the territorial authority had not inspected any of the installed joints it was unable to verify their compliance;
- While accepting that jamb and sill flashings were installed, the territorial authority had concerns about the head and sill flashings being buried in the plaster;
- The joint between the block wall and the cladding had not been properly formed;

- The sealant to penetrations though the cladding was not permanent and required a backing element; and

- The territorial authority had no problem with the main roof outlets, but the small skirt roof required at least 2 and only 1 was installed.

6.6 The territorial authority also commented on some aspects of the expert's report as follows:

- Applying the findings of the Overview Group on the Weathertightness of Buildings (the Hunn Report), the territorial authority was still of the opinion that the building will leak at some stage, and if it does there would be disastrous consequences

- While maintenance undertaken by the owner was a big issue, the territorial authority did not wish to be involved, apart from an interest in, and an expectation of, maintenance to be undertaken by the owner.

- Even if all the non-compliant items are rectified, the territorial authority would still have a problem with the house as none of the issues concerning, deflection, drainage, drying and resistance to decay had been addressed.

6.7 The territorial authority reiterated that the owner would be given a fair hearing in any discussions as to rectification of the house.

6.8 At the hearing, the owner attended and the territorial authority was represented by one of its officers. Three staff members of the Authority were also in attendance. Evidence from those present enabled the Authority to amplify or correct various matters of fact that were not adequately identified in the draft.

7 THE AUTHORITY'S VIEW

General

7.1 The Authority has considered the submissions of the parties, the expert's report and the other evidence, including that presented at the hearing, in this matter. The Authority's approach in 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

7.2 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.

7.3 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.

7.4 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:

7.5 Important matters 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 incidence;

- While most reported leaks are substantially caused by defects in the cladding that require little or no wind pressure differential, the Authority believes that homes in high and very high wind zones (as defined by NZS 3604) are likely to experience wind pressure differentials and thus a higher risk of water ingress;

- Taller buildings result in an effective increase in the catchment area of the wall. Available data suggests a clear correlation between higher number of storeys and an increased incidence of leaking;

- Complex roofs and overall envelope shapes where the roofs frequently intersect with the walls on upper floors create opportunities for leaks to directly penetrate into the wall; and

- Recent data also shows that decks and balconies that are exposed in plan and/or cantilevered from the external walls are the most frequent location for water leaks.

7.6 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. 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%.

7.7 In relation to these characteristics, the Authority finds that this house:

- Has, apart from a small area at the front entry and the garage, no eaves projections that could reasonably protect the cladding and the parapets surrounding the roofs have the potential to admit moisture;

- Is in a low wind zone and is also within a sea spray zone;

- Is two stories high;

- Has flashings to the perimeters of the exterior joinery units, except over the garage door, which has an eaves projection above it. However, the head and sill flashings are buried in the plaster and as a consequence do not operate effectively;

- Has wall/roof intersections;

- Has an overall envelope that is relatively simple on plan, but has membrane lined flat roofs at varying levels, which contain internal gutters;

- Has 2 balconies at the upper level and the uppermost one in the form of a roof, which is designed to serve as a future balcony, and both of these are built over living spaces;

- Has an external canopy supported on timber columns;

- Has no drainage cavity where the cladding is face fixed;

- Has external walls constructed with untreated timber, which is ineffective in preventing the onset of decay; and

- The plaster is finished in a dark colour, which contributes to heat gain and consequential thermal stress.

Weathertightness performance

7.8 The Authority finds that the cladding in general does not appear to have been installed according to good trade practice and to the manufacturer's instructions. As a result, there are a number of defects set out below (and listed in more detail in the expert's report) that have contributed to the penetration of the moisture already evident in several areas:

- The window flashings are installed incorrectly and water is not draining properly;

- The lack of control joints and the consequent cracking that is evident in the cladding;

- The bottom edge of the backing sheets has not been sealed, and there is insufficient clearance at some areas;

- The parapet and balustrade cappings are ineffective;

- There are problems with the membrane roof and balcony coverings;

- There is no clearance between the capping and the cladding at various junctions; and

- Some penetrations and fixings are not sealed appropriately and some items are fixed hard up to the cladding.

7.9 The Authority finds that the design of this house lacks sufficient design factors that could compensate for the lack of a drained and ventilated cavity.

7.10 The Authority notes that two elevations of this building demonstrate a high weathertightness risk rating as calculated by the E2/AS1 risk matrix.

7.11 The Authority has carefully considered the principal points in the territorial authority's main submission (and outlined in paragraph 3.2).

7.12 The Authority notes the territorial authority's view that daily heating and cooling cycles will generate high relative humidity (RH) levels within face fixed fibre cement cladding and that those high RH levels will cause timber decay to start even when the wall is completely sealed against external moisture.

7.13 The Authority notes that despite some notable weathertightness failures, there are a large number of face-fixed fibre cement clad buildings that are meeting the performance requirements of the code. In other words, they are remaining dry and are not subject to decay. The Authority believes that if the territorial authority's premise was true, it could expect to see a more universal failure of face-fixed fibre cement claddings, particularly in high humidity climates. The Authority has seen no evidence of this happening in practice. The Authority believes that, in the majority of cases, decay in external timber frames can be attributed to moisture ingress, which in turn is due to discrete failures in the external cladding. It believes that these failures can usually be attributed to poor design and installation of the cladding and that the risk of cladding failure increases with increasing design and overall shape complexity – in other words, the weathertightness risk factors.

7.14 The Authority therefore does not agree with the territorial authority's claim that the lack of a drained and ventilated cavity in this case will result in high relative humidity levels and cause decay in the absence of any external moisture ingress.

7.15 The Authority agrees that effective maintenance of monolithic claddings, and especially stucco and fibre cement 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 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 inspections and activities such as regular cleaning, re-painting, replacing sealants, and so on. The Authority considers that it is possible to maintain stucco cladding to the required standard and therefore finds that the territorial authority cannot conclude that this cladding is not code compliant solely because it will require maintenance in the future.

7.16 The Authority notes that the performance of stucco cladding questioned in the territorial authority's submission has been established through successful use in practise over many years. However it acknowledges that the building science surrounding such successful use is not so well known, or established. It therefore considers that the use of stucco cladding should be based on its established performance in building work to-date in New Zealand, with additional margins of safety to reflect known uncertainties. The acceptable solution on external moisture, E2/AS1, reflects this approach and outlines acceptable details for stucco cladding. This document has been reviewed by appropriately qualified parties with experience across the building industry, and has been subject to the public consultation process as required by Section 49 of the Act. The Authority therefore finds that the use of stucco cladding is, in itself, not a reason for withholding a code compliance certificate.

7.17 The Authority wishes to comment on some of the specific issues that were raised by the parties at the hearing.

- As set out in paragraph 4.2, the Authority confirms that the cladding system is not an Acceptable Solution in terms of the Act. Accordingly, the Authority accepts the territorial authority's submission that the cladding system as applied to this house is not included in an Approved document that has been issued by the Authority. Rather,

the backing sheet has been subject only to an appraisal by an independent testing body and the plaster is covered by a new Zealand Standard;

- The cladding backing sheet is a fibre-cement product;
- The Authority accepts that the overflows are adequate where installed to the main roof areas, and that an additional overflow is required to the small skirt roof;
- It is not the Authority's role to comment on issues such as what transpired between the owner and the territorial authority that lead up to this determination, nor to rule on how and to what extent any remedial work is to be carried out. The Authority is restricted to considering whether the building work in question complies with the requirements of the building code.

7.18 The owner confirmed during the hearing that remedial work had been undertaken, or was in the process of being carried out. While the Authority understands the owner's interest in promptly addressing these defects, it is concerned that the rectification has been undertaken without any involvement from the territorial authority. The owner in the letter to the Authority of 13 August 2004, described in paragraph 5.4, set out the owner's intention to carry out such work, and a copy of this letter was forwarded to the territorial authority. The owner also claimed that other approaches to the territorial authority had not resulted in any involvement by the territorial authority in the rectification process. The owner thus decided to proceed with remediation without territorial authority approval of the proposal or territorial authority inspection of the work.

7.19 The Authority is concerned at the previous lack of engagement between the parties during the rectification process and the apparent reluctance of the territorial authority to participate in the process. It notes that resolution of these complex questions requires an effective and meaningful dialogue between the territorial authority and the owner. However, the Authority is pleased to note the assurance from the territorial authority that it will now engage in a dialogue with the owner concerning the rectification items, and that the owner would be given a fair hearing in this respect. This is the approach that the Authority recommends in these circumstances. Accordingly, as the territorial authority has not verified or inspected the current remedial work, this, and any further rectification work, must be carried out in full consultation with the territorial authority.

8 CONCLUSION

8.1 The Authority finds that at the time of this determination there is evidence of external moisture entering the building, and, therefore, the cladding on this particular building does not comply with clause E2.

8.2 The Authority finds that because of the apparent complexity of the faults that have been identified with this cladding, it is unable to conclude, with the information available to it, that remediation of the identified faults, as opposed to partial or full recladding, could result in compliance with clause E2. The Authority considers 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.

8.3 In the circumstances, the Authority declines to incorporate any waiver or modification of the building code in its determination.

9 THE AUTHORITY'S DECISION

9.1 The Authority is satisfied that the performance of the cladding has been reduced because it has not been installed according to good trade practice. In particular, it demonstrates the key defects listed in paragraph 7.8. The Authority has also identified the presence of some weathertightness risk factors in this design. 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 drained and ventilated cavity. Consequently, the Authority is not satisfied that the cladding system as installed complies with clause E2.3.2 of the building code.

9.2 The territorial authority has issued a Notice to Rectify, dated 11 May 2004. Under the Act, a Notice to Rectify can require that the owner bring the cladding into compliance with the code, but the Authority has already found in a previous determination (2000/1) that the Notice to Rectify cannot specify how that compliance is to be achieved. The Authority considers that this Notice to Rectify should therefore be put aside. A new Notice should be issued that requires the Owner to bring the building into compliance with the code without specifying the features that are required to be incorporated.

9.3 The Authority is also aware that the owner has carried out some remedial work after receipt of the expert's report. Accordingly, the Authority has based its decision on the state of the house prior to this rectification, despite the fact that this work may have improved the weathertightness of the house.

9.4 The Authority considers that the cladding will require on-going maintenance to ensure its continuing code compliance.

Signed for and on behalf of the **Building Industry Authority** on 29 November 2004.

John Ryan

Chief Executive