

After the rot: Improving the Durability of Building Envelopes in Domestic Housing, New Zealand.

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Abstract

The issue of weathertightness of the external building envelope in domestic scaled timber frames continues to be an issue in New Zealand, some ten years after the results of a major cladding survey into the durability and weathertightness of the exterior cladding envelope carried out by the writer in the year 2000. The fallout from leaking buildings has estimated to have cost the country billions of dollars in lost production and expensive repair. The social impact on those caught up in the leaking home has been considerable, with often heart rending tales of stress and financial hardship the result.

This paper will explore the initiatives taken by the building industry and the Government since the issue became a major public concern. It will examine the influences, both positive and negative, that resulting legislation and changed building practices brought in as a result of this crisis, have had on the sustainability and affordability of the domestic dwelling in New Zealand.

1 Introduction

In 1996, five years after the introduction of the first nationally binding performance based New Zealand Building Code, a change was made to the NZ Standard NZ3602 to allow the use of untreated kiln-dried *pinus radiata* in timber house framing. This change, which was subsequently retracted in 2004,[1] has had significant and long term consequences for the NZ building industry.

The rapid uptake of new cladding materials in the 1980s saw a decrease in the use of the traditional weatherboard and brick construction here in NZ and increased use of both face sealed proprietary rigid sheet cladding systems and the once commonly used, but largely forgotten, traditional stucco cladding system. The upsurge in the use of these “new” cladding materials coincided with other changes in the building industry. The running down of the apprenticeship programme, a rise in the number of apartment buildings under construction and a corresponding move away from traditional fixed price contracts to other forms of construction procurement to meet the rapid growth in this particular corner

of the housing sector, all combined to create a period of uncertainty that saw many operators handling new systems and materials in complex building forms without the necessary background and training.

These societal factors had outcomes in terms of building performance. Deficiencies in the external building fabric continued to become apparent as inquiry and debate over the quality of construction intensified. In 2001 a report by the writer commissioned by the BIA [2] that surveyed some 287 pre-purchase reports indicated some 60% of the dwellings inspected let in moisture through the cladding to an unacceptable degree. Whilst buildings in New Zealand had always led to some degree (NZ is a coastal climate and capable of extreme climate variation) what was different and new and picked up by the survey, was the significant percentage increase in cladding systems letting in moisture compared to the number of cladding cases constructed in the period following these societal changes and the introduction of the National Building Code in the 1990s. (Fig. 1)

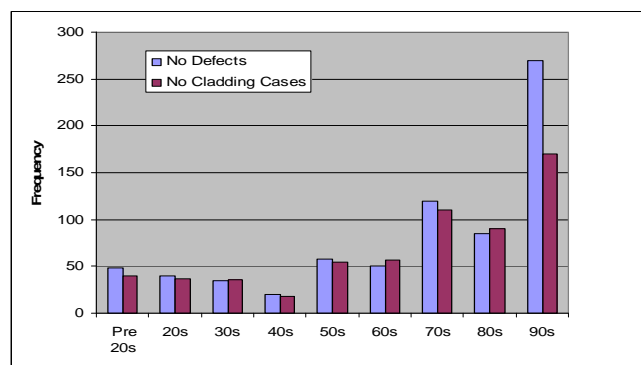


Figure 1: Defect v Cladding Cases

1.1 Hunn Report.

The Societal factors briefly outlined above were not the only reason for building deficiencies. Causes identified in the Hunn Report [3], a report commissioned by the Government in 2002 to investigate the causes of building failure due to moisture ingress, nominated a significant number of contributory causes including:

- Inadequacy in the Building Code and Approved Documents
- Inadequate documentation supplied for building consent.
- Insufficient checking at building consent stage.
- Inadequacy of building products, materials and components including evaluation of their suitability of fitness of purpose.
- Inadequate contract documentation
- Inadequate trade skills and supervision on site
- Lack of co-operation and sharing of responsibility on site.

1.2 Additional government initiatives.

The public reaction to the Hunn Report was such that Government felt compelled to put into place additional procedures designed to restore public confidence in the building industry. One of these was the Weathertight Homes Resolution Service Act 2002, which set up a framework for mediation and adjudication between owner, contractor and other stakeholders. This act was later replaced by the WHRS Act 2006, which came into force on 1st April 2007, creating in turn the Weathertight Homes Tribunal, a judicially independent Tribunal providing adjudication on matters of weathertightness.

Additional initiatives included the movement of the Building Industry Authority (BIA), a crown entity, from the Internal Affairs ministry to the more proactive Ministry of Economic Development. Not content with these changes, and facing strong criticism from the public and media over inadequacies over the BIA's role in the ongoing saga, the government in November 2004 established the Department of Building and Housing and transferred and absorbed the Building Industry Authority (BIA) functions to within that of the new Department. Government intentions to tighten up controls associated with Building and Construction were signaled in March 2003 through this ministry, culminating in the introduction of a major piece of new legislation, the Building Bill into Parliament on August 29th 2003. The Building Act 2004 came into effect in November 2004. [4]

1.3 Building Act 2004.

The Building Act 2004 repealed the Building Act 1991 and initiated the dissolution of the Building Industry Authority, by then a largely discredited governing body that had overseen and regulated the building industry under the initial 1991 Building Act. It remains, to this day, albeit in amended form, the legislation that governs the building industry in New Zealand, a long overdue attempt to tighten up many aspects of the regulatory framework and introduce heightened levels of scrutiny into the building consent and inspection process.

2 Changes to building practices and procedures post 2004

Analysis within this section is by necessity an overview based on a combination of anecdotal evidence including interview with key personnel within the building industry, analysis of Government statistical data and Government reports. In summarizing the writer's opinions within this section it has been found useful to discuss within the Hunn Report's 2002 summary of contributory deficiencies mentioned above:

2.1 "Inadequacy in the Building Code and Approved Documents".

The Hunn Report instigated two significant changes to the Building Code and the Approved Documents. The first was a change to the Acceptable Solution B2/AS1 affecting durability, the second a detailed expansion of the Acceptable Solution E2/AS1, covering external moisture.

2.1.1 Changes to Acceptable Solution B2/AS1

Many in the building industry would argue that more damage was done to building sustainability in NZ through liberalizing the timber durability requirements of the Code than by any other cause. The tightening of the regulations as a result of the submission process that commenced in June 2003 was a significant retreat for the BIA, which in 1996 permitted the use of untreated *pinus radiata* within all parts of the timber framed building.

The proposed changes ironically met strong resistance from some quarters, particularly from timber industry suppliers and millers who saw severe restrictions in the traditional use of the Douglas Fir species as a result of increased treatment requirements. There were other concerns, including environmental concerns, particularly amongst the users who were to handle the new levels of treated timber and others including Architects, who saw the move to more environmental friendly products as a step in the right direction.

There is nothing intrinsically wrong with using untreated timber, including untreated radiata pine, in any building or housing construction. ...[the only proviso would be that] if green or wet on installation, or if occasionally wetted after that, they should be allowed to dry out. [5]

On the other hand respectable research institutions like the Forest Research strongly supported a return to a comprehensive treatment regime for *pinus radiata*:

Forest Research believes that the risk of decay or insect attack during the 50 years of required durability is too high to support the use of untreated radiata pine in structural applications [6]

2.1.2 Changes to Acceptable Solution E2/AS1 External Moisture.

Revision of this Acceptable Solution within the Building Code was extensive and marked the first serious attempt to document in a prescriptive way standard domestic building practice since the Building Code was first introduced in 1991. Of particular note was the reintroduction to the building fraternity of the window flashing system, devices and systems largely lost to the industry since the introduction of the aluminum window in the 1970s and 1980s replaced the more traditional timber window profiles.

Also significant was an attempt for the first time to access the degree of exposure of a particular building on a site based on the complexity of the elevation profile and its exposure to the elements, and to prescribe levels of compliance for the cladding system based on the results, a procedure that has seen the introduction of the drained cavity as an almost permanent feature of the domestic building envelope

2.2 “Inadequate documentation supplied for Building Consent; Insufficient checking at building consent stage.”

Most architectural practitioners would firmly agree the building consent authorities have strengthened their procedures (some would argue excessively so) to the granting of a building consent in the years following the 2004 Act than would have been the case in the years preceding it, for the following reasons.

The pre building act environment traditionally saw inspectorate attention devoted to structural aspects of the building framework, typically the structural integrity of the flooring, walls (including bracing) and roof. Cladding integrity and the inspection thereof were not considered as important elements in the checking process. Cladding design and installation often followed well formulated design and build procedures using well known materials. By and large, for the more traditional brick and timber weatherboard structures, particularly where free of insulation, this approach was satisfactory.

The advent of more complex cladding systems, elevation profiles and larger, more complex structures within the domestic market in the 1980s and 1990s, along with the introduction of monolithic type face fixed cladding systems, cavity insulation and kiln dried chemical free timber studs meant this approach was no longer sufficient. Yet both designer and the local authority consent processor were slow to adapt and are now, along with the public owners of the leaking dwellings, suffering financially with the consequences of court action and damages for poor quality documentation and incorrectly signed off compliance certificates.

If the building consent authorities were slow off the mark, then recent processing systems generated by the Territorial Authority have more than compensated. A rigorous and comprehensive approval system has replaced the *laissez faire* attitude of yesterday. Encouraging this new approach is the accreditation

scheme regime for TAs instigated by the 2004 Act that rewards competent Authorities and potentially removes the right to process building consents from the less able. An increasing litigious environment that has exposed slack practices has also been a spur.

**2.3 “Inadequate trade skills and supervision on site;
Inadequate contract documentation.
Lack of co-operation and sharing of responsibility on site.”**

2.3.1 Building Surveyor.

The deficiencies noted in the Hunn Report above were certainly prevalent in the 1980s and 1990s and coincided with a shortage of apprentices and a shortage of competently trained trade persons able to deal with new and complex cladding systems. The growth of continuing professional training schemes for trades and the impending licensing system are signs of a response to this need to raise standards.

Equally interesting and in line with the growth in specialist recladding companies and systems has been the recent growth of the super inspector or professional building surveyor, a career professional probably known in more benign times as a “clerk of works” but now the product of specialist private training courses, usually at post graduate level, designed to meet the investigative and supervisory skills required for the expensive and complex re-cladding process. This specialist activity has been the cause of criticism, particularly in the extent to which their services are required by Territorial Authorities, and the resultant extent to which using their services adds to the substantive cost of the renovation process. Nonetheless, the use of the specialist has found favor with the risk averse Territorial Authorities and is becoming established as a part of any re cladding inspection process, an example being the Auckland City Council, where re-cladding consents must now have:

....Three additional inspections at key stages of the works. These inspections will be undertaken by specialist building officers and are known as “category one” inspections. The inspections are additional to the existing and final inspections that will be completed by other inspection staff...[7]

There is a touch of irony in the rigorous attitude of the TA “poacher now turned gamekeeper”, particularly as it is be the long suffering owner paying the additional fees for these additional recladding inspection, brought about in many cases by the same TA not taking dutiful care in the first instance!

2.3.2 Licensed Building Practitioner Scheme.

The introduction of the Licensed Building Practitioners scheme was introduced to redress the respective deficiency identified in the Hunn Report causes outlined above. It has signified a further turning away from the traditional egalitarian DIY culture that permeated NZ life up to the 1900s, where the amateur home grown renovator and builder have always been able to construct their dream alongside the qualified tradesman. Unfortunately in the post weatherboard and bungalow era, enthusiasm was not enough. Deficiencies in construction as a result of inadequate training and on site supervision were a listed as a notable contribution to the leaky building crisis.

The LBP scheme, introduced in 2004 with the new Act and modified in 2010 year is, for the moment, a competency based, and until March 2012, voluntary scheme that enables builders and trades people with a genuine track record “...to have their skills and knowledge formally recognized, whether they are trade-qualified or not. “ [8]

Come March 2010 the consequences surrounding licensing tighten, with persons not licensed restricted from undertaking and signing off responsibility for certain types of building work, including, as can be expected, work associated with the construction of the weathertight cladding system, the primary structure including foundations and framing, and the design of certain types of fire systems in small to medium sized residential apartments.

In 2015 this competency based system moves to a qualification based one, with applicants after this date required to have the appropriate trade qualification.

Given the number of home grown builders operating in the industry the government probably had little choice but to allow the competent unqualified person to continue to practice whilst this interim system is in place. Not to do so would have resulted in considerable dislocation to the building industry and caused a severe and abrupt shortage of qualified personnel to meet the needs of the industry.

2.3.3. Emergence of the Re-cladding Contractor as a specialist sub-trade.



Figure 2: Reliant Group. Before and After Re-cladding Examples [9]

The flow of contractors seeking work into what has become a lucrative source of income is inevitable, and to some extent desirable, if it means the fractured and ill-supervised nature of site supervision identified in the Hunn Report is to be reversed. Building firms suitably qualified, conversant with Territorial Authority requirements, the critical nature of the work and with a clear understanding of weathertightness principles are a desirable commodity for any building project, but particularly for the time consuming and expensive task of re-making a moisture prone building envelope waterproof in the semi tropical climate that is Auckland's.

How specialist is the “specialist.” Most rely on web promotion and advertizing with client references, membership of building organizations, testimonials and completed projects (Fig 2) to back up their claim as competent. The formation of a self monitoring collective or association of approved operators within which critical reflectance and a forum for continuing professional development can occur would be the logical next step in ensuring the body of knowledge gained in this specialist work continues to grow and be disseminated to as wide an audience as possible.

3 Conclusion

The liberalization of timber treatment was, in part, an attempt to introduce a more environmentally friendly regime of timber use and treatment to a world much more conscious of the harmful use of chemicals. It is a tragedy that the wholesale removal of building controls limiting untreated timber was poorly thought through and instigated without due regard to other influences impacting on the

effectiveness of this significant change. Poorly quality cladding products inadequately installed that allow water to penetrate a in a multitude of ways is no environment for a untreated *pinus radiata* framing system.

The extensive upgrade of E2/AS1 and the punitive environment surrounding an alternative solution, has unfortunately put standardized solutions to the fore at the expense of innovation and creativity in the detailed design field, aspects the original 1991 Building Code set out to encourage.

Building consent procedures and documentation requirements have been considerably tightened since 1990 levels, when most domestic consent applications were granted based on location drawings, bracing requirements and evidence of structural integrity alone. The Building Act 2004 has put in place for all stakeholders in the building industry levels of compliance unprecedented in the history of building in New Zealand. The current building consent application process has been criticized as being too heavy handed, risk averse and rigid, leading to standardized solutions in the treatment of the external fabric devoid of creativity. Yet, litigation outcomes have targeted Territorial Authorities severely, often as the “last person standing” in a situation where developer and contractor and long since vanished, and it is understandable these Authorities are taking all action necessary to discharge their duties in such a way as to minimize loss.

The licensing scheme, the rise of the building surveyor and the growth of the recladding “specialist” are all pointers to changes in the building environment brought about by poorly performing buildings, and are indicative of procedures that will hopefully result in better outcomes for the future home owners here in New Zealand.

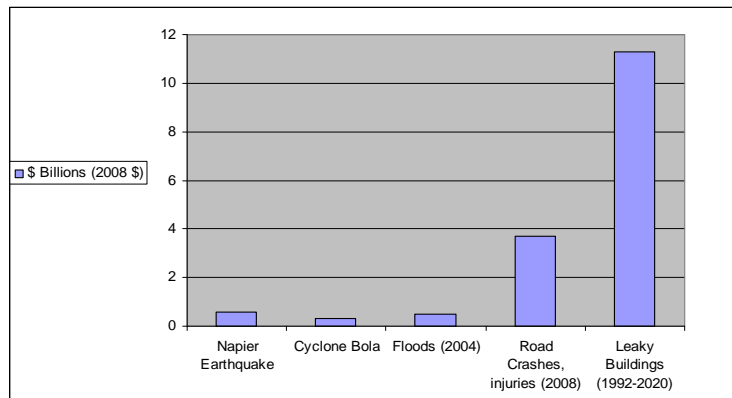


Figure 3: Covec Ltd. Cost Comparisons [10]

How successful this amended Act has been in terms of stopping the chronic decline in building standards is as yet hard to gauge. If it were to be judged based on estimates of the ever increasing cost to the economy of the ongoing social and physical costs of refurbishment, then it would be judged a distinct failure.

Table 1: Cost Estimate Comparison

Analysis Source	Year	Estimate no. homes with weather tightness issues	Estimated cost assessed in 2008 \$
PwC Report[12]	2009	42,000	\$11.3 Billion
PwC Report[12]	2005	12,000	\$1.1 Billion
CINZ [11]	2000	11,270	\$890Million.

To this end, the recently completed government initiated Price Waterhouse Cooper's report [12] on estimating the cost of the weathertightness problem paints a depressing picture of escalating numbers of effected buildings that dwarfs the estimates of earlier years. The recently completed Covec report has even compared the problem to a scale of disaster in 2008 terms on a par with the Napier earthquake. [10] (Fig 3, Table 1).

An assessment of the Amended Act's effectiveness based on money terms is of course unfair. The consensus indicates most of the damage has been done to buildings between the years 1992 leading up to the change in legislation in 2004. The PwC research report indicates some grounds for optimism in that rates on unsatisfactory and leaking building envelopes are on the decline.

Failure rates since 2006 appear to be much lower than in previous years, suggesting changes in the regulatory requirements and building practices have addressed the major problems identified in the past and reduced the incidence of weathertightness issues. [12]

If this is so, it marks further evidence that the many changes brought to the Building Act 2004 discussed in this paper have begun to bear results, and that is surely well overdue good news for the NZ building industry.

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