Wood durability and the leaky home

A Scion Impact Statement 2007

Scion has played a major role in developing rapid timber treatment testing protocols to secure timber framing market and address the leaky building syndrome.

Houses represent the largest single asset most New Zealanders will ever own. In 2000, the confidence many New Zealanders had in the security and value of their homes vanished overnight. To add insult to injury many New Zealanders discovered that their homes were also a hazard to their personal health.

The 'leaky house syndrome' had hit the press and over 15,000 homes were believed to be affected with aggregate repair bills estimated at over $1billion[1]. By December 2006, that repair bill was estimated to be in the range of between $5 billion and $10 billion[2]

The construction industry and the Government urgently engaged Scion whose 30 years of experience in timber treatment and light timber frame construction were needed to find a solution, before the damage to New Zealand's housing industry and timber framing market became irreparable.

What had gone wrong? Many of the homes built in New Zealand over the period from the late 1990s onward were showing signs of decay in the timber framing. This put the structural integrity of the building at risk and also provided a breeding ground for *Stachybotrys* whose spores could affect the health of the inhabitants. With building activity at an all-time high the issue had the potential to escalate out of control.

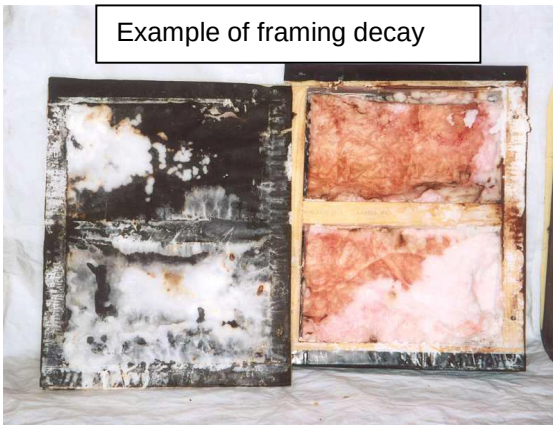
Typical house framing

Investigations into the cause of the leaky building syndrome attributed the causes to two main factors: (1) changes in the building standards and the Building Code in 1995 which allowed the use of untreated kiln-dried radiata pine as framing, and; (2) the use of monolithic cladding to create the "Mediterranean" look with complex designs, many junctions in the building envelope, limited roof overhangs and large exposed balconies. The building boom coupled with few skilled tradesmen exacerbated the problem. However, even for experienced builders, the combination of complex design and new materials made it difficult to achieve complete weathertightness. The monolithic outer skin on a flexible frame enhanced the possibility of small cracks being created in the outer building skin. Water ingress raised moisture contents, exposed the untreated framing to moisture which then became subjected to decay.

The flow-on implications of this issue were enormous. Estimates of the value of residential building stock are about $559 billion and this represents some 90% of New Zealand

[1] New Zealand Herald, 26 August 2007 "Half a billion to plug leaky homes".
[2] New Zealand Herald; 8 December 2006 "Leaky homes law change keeps time limit but fast tracks claims".

households' net worth[3]. The vast majority of New Zealand's residential houses are constructed using radiata pine framing. The value of this timber framing market is estimated at about $1billion per annum, and is a critical part of the New Zealand forestry and wood processing industry.


Example of framing decay

While there was scope to improve building methods it was clear that timber and radiata pine in particular, needed to be treated to ensure an acceptable level of durability. There was no requirement in the Building Code at the time for framing timber to withstand wetting associated with building leaks, and timber was not required to offer resistance to decay for periods sufficient for leaks to be detected and rectified (potentially for up to 10 years).

In recognition of this problem, manufacturers of Exterior Insulated Finishing Systems (EIFS) products – exterior monolithic claddings largely associated with leaky buildings proposed that all framing to which their products were attached should be preservative treated to confer decay resistance. They proposed "H1Plus" for this level of treatment, leaving Scion staff and preservative suppliers to determine what types of treatment might be appropriate.

Suppliers of timber treatment formulations now needed to develop formulations that could supply the required need. There was one very significant challenge; although the fungicidal activity of new formulations could be determined in laboratory decay tests, such tests were unlikely to give any indication of the expected performance of the treated system in service[4]

The research challenge given to Scion was to develop accelerated testing protocols that allowed treated systems to be evaluated in short time frames. The outcomes could then inform the wood processing and wood treatment industries and form the base of new standards for New Zealand. Funding support came from the wood treatment industry (50%) and from a redirection of a part of the FRST funded programme "Wood Products for the Future". This work was also managed in conjunction with the *Weathertightness Steering Group* – a BRANZ led initiative.

The research programme was initiated in mid 2000 with 2.5 Full Time Equivalent researchers. Scion developed a standardised technique that could compare numerous treatments in a period of 25 weeks, which was a substantial reduction from the typical test period of 12 months or more[5].

The technique involved developing a procedure for infecting timber simultaneously with two types of decay fungi (*Coniophora puteanea* and an unidentified brown rot), and exposing the infected and wet wall structure to high temperatures and humidity. The procedure was sufficiently standardised so that a variety of treatments could be tested in separate experiments and compared.

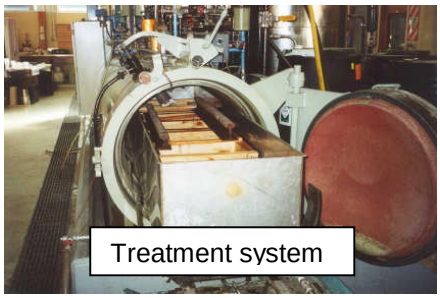
Using these methods Scion was able to test seven timber treatment options in a relatively short time, including the three approved treatment methods, to determine which conferred framing timber resistance before, during and after construction. The primary objective of the "after

[3] Reserve Bank of New Zealand http://www.dbh.govt.nz/built-environment-index
[4] Hedley, M 2003. Support document for submission by Forest Research to the New Zealand Building Industry Authority on proposed changes to clause B2/AS! Durability. Forest Research unpublished report.

construction" phase was conferring decay resistance for a limited period of time to allow any building leakages to be identified and problems of weathertightness rectified.

Scion's tests confirmed that two treatments practiced at that time and allowed under the Building Code did not provide the decay resistance proposed under the H1 PLUS standard of treatment[5]. However the research was able to support the use of two light organic solvent preservatives (TBTO and TBTN) and a boron preservative.

Outcomes


Treatment system

As a result of Scion's novel testing protocols the Building Authority introduced new treating requirements. As a first step the preservation standard MP 3640 1992 was completely revised and the informal "H1Plus" was formalised within the hazard Class system operating in the standard as H1.2. The standard was published in 2003 as NZS 3640:2003. This in turn allowed the necessary amendments to NZS 3602 "Timber and wood based products for use in building". The new standards were then referred to in the 2004 revision of the Building Code B2/AS1 as being acceptable solutions to durability requirements in building. With these revisions the building industry received the guidance to indicate what type of timber product to use. The industry could then provide new home owners, and those undertaking expensive repairs on existing homes, with greater certainty in the use of building products and on how their assets could be protected in a cost effective way.

These changes ensured that buildings could not be built exclusively with untreated timber. It allowed the timber industry to arrest the damage suffered by timber in the market for building products as a result of the leaky homes syndrome, and prevented loss of market share to other products such as steel and concrete. The increased use of preservative treatments in timber was a relatively minor cost compared to those involved with the use of energy-intensive and less environmentally-friendly alternatives.

Preservation of timber (mostly radiata pine in New Zealand) is a critical competency at Scion and is the source of independent and authoritative advice to the wood products and preservation industries for over 30 years. This accumulated knowledge and capability was essential to respond to this national issue and to develop techniques for informing practical solutions.

With some 20,000 to 25,000 new homes being built in New Zealand each year and a very large structural lumber industry (about $1 billion of sales per annum) impacted by this industry any delayed solution would have created a cost to New Zealand of several hundreds of millions of dollars.

In 2007 the building standards are well embedded in industry practice, underpinned by sound scientific data. Timber continues to be the framing material of choice and building practice has improved to provide New Zealanders with security about the integrity and value of their largest single asset.