ISSUE 31

SCOPE

NZ METAL ROOFING MANUFACTURERS INC.

Below is a brief introduction to the 2012 executive of The Metal Roofing Manufacturers Inc.
It is intended that Scope be representative of the industry and therefore material of interest is welcomed from all sectors of the building industry be it design, research, manufacture or construction.

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Rod Newbold: Commercial Manager Steel & Tube Roofing Products.
John D'Arcy: General Manager Calder Stewart Roofing
Gary McNamara. Marketing & Business Development Manager Metrotile Roofing

If you would like to submit material please contact any member of the executive or the publisher.
Visit our website at:
www.metalroofing.org.nz

SCOPE

ISSUE 31 DECEMBER 2012

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Published by ICG Limited.
57 Glendhu Road, Glenfield, Auckland. Telephone: 09 444 2424.
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INNOVATIVE DESIGN – AGILE LEARNING

Hingaia Peninsula School is New Zealand's first school to be built to meet Green Star Built specifications. It is rated 5 Star Green Star Certified by the New Zealand Green Building Council (NZGBC).

This Karaka school has also taken a lead nationwide with its fresh approach to design. Based on the concept of learning spaces rather than classrooms, the school has multi-functional studios, providing collaborative, creative and agile learning spaces.

Each studio is approximately 290m² with five ‘nooks’ surrounding a central teaching space. With three teachers to each studio, the spaces cater for a variety of different learning styles to suit the needs of each child. In this environment children have the opportunity to work creatively, both individually and in groups, and to personalise their learning space to suit their needs.

Set on 4.4 hectares, this new Y0-8 Auckland school opened for all levels in February 2012. With a start-up roll of 46 foundation pupils, the school has been designed in stages and will cater for 240 pupils, eventually growing to 520 when all the staged works are complete.

Architects Brewer Davidson partnering with NZ Strong Construction were awarded the Design/Build contract and were closely involved throughout with the Ministry of Education, the Hingaia School Board of Trustees, the principal Jane Danielson and the community. The work involved master planning, design development, documentation and supervision – as well as complying with the Green Star Rating – all within strict budgetary and time constraints.

Initiated in July 2010, Stage 1 of the project had to be completed by the end of 2011 for new enrolments in 2012: a total of 18 months. Stage 1 included two ‘learning studios’ to house Y0-3 and Y4-8; an administration building; library; project rooms and interactive technology spaces; a large multi-purpose hall – and landscaped grounds.

The school opened on time and within budget.

A unique design feature is the all-encompassing timber construction low-slope roof which provides shelter to students as they move between learning studios and all the other areas of the school. The COLORSTEEL® Endura™ rooflines rise and fall along the perimeter of the building, creating an interesting architectural detail as well as providing a variety of light into the studios and adjoining areas where the high roof line enhances the sense of space.

With assistance from its team of experienced subcontractors Brewer Davidson incorporated Environmentally Sustainable Design, applying the Green Star suite of rating tools in the three-stage process to match the three key phases in a building life cycle of design, build and performance The tools assess the environmental impact that is a direct consequence of a building’s site selection, design, construction, and maintenance. The framework has eight separate environmental impact categories which include factors influencing aspects like indoor air quality, applied coatings, timber, walls and partitions, flooring and floor coverings, joinery, insulation and concrete. Required to comply are materials like paint, vertiface acoustic wall covering, linoleum, vinyl, stains, tiles and fabrics.

Points are credited within each of the categories based on the building’s environmental merits and they take into consideration the unique development requirements and impacts of each sector. Points are then weighted and an overall score is calculated, determining the project’s Green Star rating.

By following the Green Star – Education 2009 Design and Built rating tool which evaluates the environmental initiatives of school buildings and their fitout, the project partners were able to both minimise the environmental impacts of this project and receive recognition for their design initiatives.

NZGBC’s 5 Star Green Star Rating signifies a score of between 60 and 74, making Hingaia Peninsula School a campus of ‘New Zealand Excellence’.

BREWER DAVIDSON

Established in 1993 as a partnership between Kevin Brewer and Peter Davidson. Since its inception Brewer Davidson has won over a dozen NZIA awards. Brewer Davidson’s design expertise spans the architectural spectrum including commercial, hotel, retail, public, corrections, residential, urban design, sustainability and of course educational projects. The company now consists of three Directors, Kevin Brewer, Peter Davidson and Alec Couchman.
Brewer Davidson is experienced in partnering educational projects with a detailed knowledge of Ministry of Education (MoE) protocols and design guidelines with a history of providing innovative and cost effective award winning education buildings. The most recent awards being the 2010 NZIA Auckland Architecture Award for the Art & Maths Block at Auckland Girls’ Grammar and the 2011 NZIA Auckland Architecture Award for the Te Kura Kaupapa Maori o Te Kotuku in Ranui.

Client:
Hingaia School Board of Trustees

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Roofing Cladding:
COLORSTEEL® Endura™
Colour: Ironsand
Profile: ST900

Roofing Installer:
Project Roofing Hamilton
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www.projectroofing.co.nz

A LITTLE PIECE OF HISTORY

Without the generosity of Metalcraft Roofing the restoration of the Whitford' Pony Club's iconic old brickworks workers' cottage might never have happened. The cottage provided accommodation for workers at one of the first brick foundries in Auckland which was established on a 640-acre block of land by John Granger in 1898 and has become, arguably, the most important historic landmark in the Whitford region.

On numerous occasions The Whitford Pony Club tried to raise funds for the restoration, without any success, and when the Historic Places Trust controversially decided it wasn't worth classifying for preservation, the future of this 100 year old historic building looked bleak.

In recent years the cottage had become in dire need of repair. The original roof was becoming a dangerous hazard and the timber trusses were rotting away, as too were the windows. Recognising the significance of the cottage to the local community, Metalcraft Roofing contacted the Whitford Pony Club and offered to support the restoration project.

COLORSTEEL® Endura™ in Pioneer red was donated by New Zealand Steel and Metalcraft Roofing kindly donated the manufacturing, supply and installation of the Corrugate roofing. However before the new roof could be installed the trusses had to be replaced, Akarana Timbers donated the necessary materials for this and provided additional timber for a new fence around the cottage. Finally, the project was completed with the installation of new joinery that Metalcraft Roofing also contributed. Both Metalcraft Roofing and Akarana Timbers are part of the United Industries Group, based in East Tamaki Auckland.









SCOPE NEWS AND VIEWS

NZMRM 2012 Annual Conference

The NZMRM Annual Conference was held in Queenstown 13 to 18 September 2012 and was attended by a record 110 people, which is up some 20% on the numbers that would typically attend an offshore conference. The Conference was held at the Hilton Hotel and the social highlights included an Industry Dinner, sponsored by NZ Steel and Pacific Coil Coaters, at the Gibbston Valley Winery and an All Blacks vs South Africa Gala Dinner at the Hilton Hotel.

The Conference sessions, held over three days, included a Systems Warranty presentation and workshop, a presentation from Chapman Tripp on the Building Amendment Act 2012 and a presentation from AJ Park on Intellectual Property Protection. In addition to the Supplier presentations there were also presentations from MBIE (formerly the DBH), BOINZ, BRANZ, and RANZ.

At the Annual General Meeting the Members voted to increase the NZMRM coil levy in support of the various Technical and Marketing projects being undertaken the NZMRM, including SCOPE magazine and the technical and financial support of the new RANZ "How to Work" on site booklet. SCOPE magazine, which is the market "voice" of the NZMRM, is published three times a year and is now being sent out to over 10,000 Architects, Designers, Builders and Roofers.

The Annual General Meeting also voted to hold an offshore conference in 2013 and an onshore conference in 2014.

The 2011 / 2012 Executive were all re-elected unopposed for coming term, apart from Scott Duncan from AHI Roofing who chose not to stand for re-election.

Roofing Industries expansion.

Strategic growth continues for Roofing Industries Ltd, with the launch recently of a new website and a marketing tag describing the company as "the only national 100% New Zealand owned and operated longrun metal roofing and cladding manufacturing company."

Recent expansion has included the purchase of Franklin Metal Folding which is now a division of Roofing Industries Ltd. Also in the mix has been re-location of Hamilton's offices and factory, the opening of a new Wellington branch at Grenada North (Tawa), while in the South Island, Roofing Industries has enhanced its Christchurch operation to include ridging and rainwater goods machinery along with the recent addition of a Multirib® machine at the Upper Riccarton branch. Since the launch of its Multirib® profile in 2007, 3,000,000 sq m of Multirib® has been installed in many of this country's major commercial projects.

Accompanying this expansion Roofing Industries has a new website www.roof.co.nz . This has addressed some of the common issues and everyday problems put to Roofing Industries on a regular basis. There is particular focus on architects and specifiers who will find answers using a Project Solutions link, advice on consent application issues and other queries about products and product composition. Roofing Industries prides itself on its extensive range of CAD drawings - available in three formats via the website.


Metrotile Appoints Rob McMahon as Training & Technical Manager

In 2008, Metrotile made a strategic decision to develop a robust Domestic arm in support of its Export focused business.

As a result of actively investing in a wide range of new product, manufacturing and marketing initiatives Metrotile has seen a four fold increase in its New Zealand market share over the last two years.

In support of this growth Metrotile is pleased to announce the appointment of Rob McMahon as its Training and Technical Manager.

Rob has been roofing for over 26 years and has been supporting Metrotile on a contract basis for the last 12 months. Prior to joining the Metrotile team, Rob McMahon ran his own Auckland based roofing business, Lightweight Roofing, for over 18 years.

Rob is an experienced LBP qualified roofer and is in a unique position, as a Manufacturers Representative, to provide practical "hands on" support to Metrotile's Distributor, Builder and Specifier customer base across a wide range of areas including Installer Training, Business Management support, New Product Development, Installation Efficiency projects and Technical Support.

Metrotile Roofing Systems
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CORROSION

The NZMRM Corrosion Project.
Stuart Hayman & Stuart Thomson

In 2012 the NZMRM Technical Committee launched a most challenging, expensive and exciting piece of research into the causes of corrosion of metal roof and wall cladding systems and how to minimise its effects. The MRM consider that they have a duty of care to prove, by testing, that the solutions published in the MRM Code of Practice and its recommendations are correct and applicable. This article provides the background to this test project, the methodology adopted, the expected outcomes and details of what has been done to achieve these outcomes.

Metal roof and wall cladding is widely used in New Zealand and Australia for all types of buildings while the rest of the world has tended to restrict the use of metal cladding to farm, industrial and commercial buildings. In New Zealand 70-80% of housing is clad with metal roofs of long run or metal tiles, made, supplied and often installed by members of NZMRM. This is one of the reasons why the NZMRM executive agreed to invest a significant amount of money, time (4-6 years) and effort to investigate the specific causes for the deterioration that can occur when metal claddings are used in corrosive areas (predominantly by the sea) and determine how this can be avoided.

Steel itself, while lightweight and strong, has little corrosion resistance and as dipping of steel sheets in moulten zinc offers good protection from corrosion this became the normal protection of steel sheet for roof and wall cladding for most of its history (150 years). In recent decades the search has been on for ways to improve the metallic coatings which protect the base steel.

Several mixtures of zinc and other metals have been assessed for use to replace zinc alone, and in 1969 the development of 55%/45% aluminium/zinc metallic coating (80%/20% by volume) became pretty much the leader of the zinc alternatives (although there are others on the world market). This product is (perhaps confusingly) called Zincalume® in Australasia, and Galvalume in the US and, more correctly, Aluzinc in Europe. Its manufacture is controlled tightly by the inventors (Bethlehem Steel) and all licensed world manufacturers make to the same standard.

This product was taken up by BHP Steel in Australia, and subsequently in 1993 by New Zealand Steel (then a BHP) subsidiary), and called Zincalume®.

Zincalume® protects the steel by a different mechanism than plain zinc, relying on the inert aluminium oxide film rather than the sacrificial zinc loss of galvanised coating. If undamaged this aluminium/zinc coating will last almost indefinitely in non-extreme environments but unfortunately cutting the edge and drilling holes and fixing screws breaks the metallic coating which can lead to corrosion in more adverse environments.
Aluminium/zinc coated and painted steel ("COLORSTEEL®" or "Colorcote") performs very well on its own, even in very corrosive places, provided it is rain or manually washed.
Unwashed areas, like walls or under a soffit, do not fare so well if not manually and regularly washed.
Aluminium cladding has been used to replace coated steel in more severe environments, at significantly greater expense. While it does not rust, it does pit, so even aluminium has some corrosion issues.

The fixing of the sheets to the building created its own problems. Lead-headed plain nails, and hot-dipped galvanised nails and screws have gone out of fashion, or been declared environmentally unfriendly, and subsequently there has been continuing research into a range of coatings to replace the older systems. Currently screws are mechanically zinc plated and then coated with various proprietary metallic paint systems.
One problem is that in severe environments the zinc/paint coated screws used now tend to show rust on the heads well before the cladding and that causes corrosion around the screws. Stainless steel screws, which don't themselves rust, can damage the cladding more than protected steel screws and although this is not a Building Code failure it ends up as an aesthetic failure of the system.

Typical damage to the cladding from screws – painted and stainless.

The generic failure of zinc coated fasteners has been detrimental to the installation of profiled metal roof and wall cladding in extreme environments and a major part of this project is to assess various combinations of metal, screw coatings and isolation techniques to solve these fastening problems.

Unfortunately many of New Zealand cities contain areas that are close enough to the sea to be classified as "marine" and many people choose to build in these desirable but more severe environments.

While several surveys conducted during the early 2000s confirmed these issues, none provided any useful solutions.

Since 2009 NZMRM has been working on a programme to investigate all of these factors with the aim of providing the optimum cladding system designs and installation methods for designers, builders and roofers and to provide the best possible solutions for use of metal roofing products.
While metallic coated steel and aluminium manufacturers, fastener manufacturers and paint manufacturers have all been carrying out research into their own products, there has been no coordinated attempt to look overall at the factors involved and their interactions. Meanwhile new substrates and fasteners have been developed so that while the delays in launching the project have been frustrating, the upgrade to involve new materials would not have occurred had the project started in 2009.

The programme's outcome has thus changed from being the best method of using existing materials to that of finding the best possible methods under various conditions of all materials likely to be available in the foreseeable future.

Issues for the project to look at now included:-

- Need to have fastener/substrate system in which neither corrodes
- Understanding the factors leading to aluminium roof corrosion
- Effect of different paint systems on metallic substrates
- Effect of underlay and spacing/ventilation on underside corrosion
- Benefits of new substrates and new fasteners

The expected outcomes:

- The ability to use stainless steel fasteners with metallic coated steel either by isolation or with new fastener coatings
- How to best use new metallic coating materials to improve performance.
- Acceptance of new class 5 coated steel fasteners for use in very severe environments
- Determining the necessity for the use of underlayment and scribed metal flashings to avoid corrosion at the gutter line and determine the effect of synthetic underlays
- Methods to prevent aluminium pitting corrosion
- Determining the effect of paint as an inhibitor to the natural oxidisation of aluminium or metallic coatings in extreme environments

The first decision to be made was what materials, combinations and systems to expose (which created an increasing number of possibilities).
Laboratory testing has been undertaken in the last couple of years to eliminate what clearly doesn't work in severe environments.
It is important to note that this project is not intended to confirm what doesn't work, as we know that already from earlier assessments, but to determine what does work best in different conditions.

The next decision was where to locate test panels and how many sites we could manage. In selecting sites there was a fine line between being too extreme and not extreme enough as all exposure testing is a balance between these two. When looking at building products with a consumer expectation of decades of life a "normal" life span is too long to assess different materials. However, if the exposure site is too extreme it becomes unrealistic.
The third decision then was to sort out a balance between these extremes of too mild or too severe, and this is assessed by the characterisation of each of the sites to determine just how corrosive they actually are. This has been done using two different internationally recognised methods described below.

The design of the test building and panels, what was to go onto them, and the method of exposing these in a realistic manner to the weather at each site was necessarily complicated. The number of permutations presented a logistical puzzle that was solved only by compromising the design so the test shed sheeting was never intended to be an 'as built' design. The test shed size was restricted to 10m2 as being the largest 'shed' that can be built without going through a building consent process.

The Project.

Members of the project team were:

Stuart Hayman	Manager
Stuart Thomson	Designer
Alistair Fleming	Planner
Rod Newbold	Procurement
Ross Simpson	Installation

The $100,000 plus project was financed by the NZMRM with contributions from each of the partners.

Partners with MRM in this project include both the coil suppliers – NZ Steel and Pacific Coil Coaters – and the major fastener manufacturers – Hylton Parker, Ramset and Bremick, and other fastener and underlay suppliersl. The intention is that this is a roofing industry project aimed at producing the best outcomes for the NZ building industry, not just promoting specific products.

The Sites.

Six exposed coastal sites around New Zealand were chosen based on availability, assessed severity of environment and where security and access could be assured. These were:

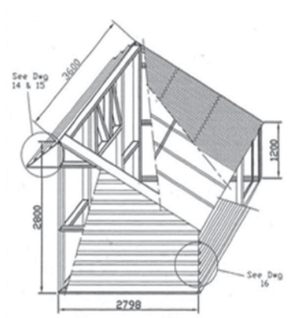
1. House at Bell Block NP
2. Waipu Golf Club
3. Invercargill Gun Club
4. Nelson Boulder Bank (Cawthron Institute)
5 Taharoa NZ Steel mine site
6. Muriwai Golf Club (AKZO/PCC Site).

The Shed.

The sheds were designed by Stuart Thomson and built at the factory of Roll Forming Services in East Tamaki who manufactured the galvanised steel framing from Z450 g/m2 and also provided a lot of logistical assistance. After an initial test assembly, these were made up as kitsets, transported to the sites and erected by Ross Simpson on a previously poured concrete slab. The intention was that the land owners would be able to use the sheds for their own purposes during and after the trials so that each of the sheds had a slightly different design.

The sheds were all oriented to the prevailing wind with the lee side having the openings and a canopy overhang to provide an 'unwashed" area for exposing fasteners on the horizontal wall cladding. This 5-rib wall cladding doubled as the wind bracing for the buildings.

The 30˚ pitch roof of each test shed consisted of nine prefabricated panels (1.2m x 1.2m x 18mm of untreated plywood) with four different metallic and paint coated corrugated profile sheets on each panel.



Test shed design and frame under construction

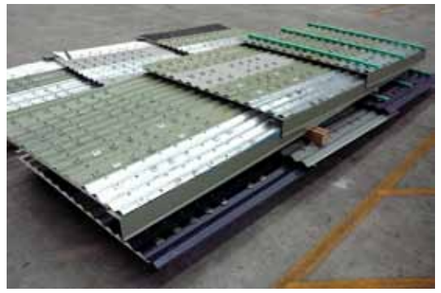
The roof sheets

Each of the sheets was water cut to provide four exposed corrugations and included aluminium, ZAM, Zincalume®, a new metallic coated product (currently called Zincalume® Activate, Type AM in AS 1397:2011) and galvanised steel. Combinations of painted and unpainted sheets and some water borne paint coatings provided 12 different options.

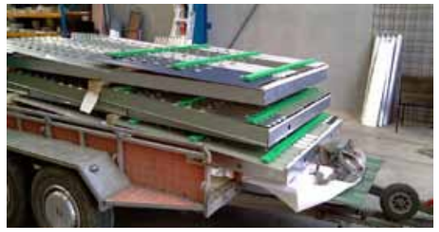
The fasteners

The screws were sourced from three main suppliers;
Bremick, Buildex, Hylton Parker, (plus some others),
The screws and load spreading washers included:

Typical Roof Panel Assembly showing complexity



Kitset ready to go to site



First shed Under construction

First shed finished

- Class 4 metal plated, painted and unpainted
- Class 5 (B8) metal plated painted and unpainted
- Stainless steel painted and unpainted
- Aluminium painted and unpainted

The test consisted of 10 different fasteners with each of these driven through the sheet and also through a 9mm oversized hole and fitted with a load spreading washer. This provides a test of the fastener/substrate combination in contact and also tests the shank of the screw. The screws are staggered across the roofs so that all combinations of substrate and screw are exposed. Although this cuts down the number of replicates there are still 1440 fasteners exposed on each shed.
The aim was to have 100 samples of each fastener as the AS/NZS 3566 standard requires a 95% pass rate from 100 exposed screws.

The Gutter Details

As many variants as possible were used including kraft and synthetic underlays as well as underlayment, different tapes, aprons and scribed metal flashings all with the intention of minimising corrosion at the gutter line. Some plastic fillers were used as well as safety mesh (as distinct from wire netting) and different underlay fixings such as "little grippers" and staples.

Corrosivity assessment

There are two methods for this, different in means and slightly different in objective.

Zinc coupons

Method 1 – is to expose zinc coupons on the shed and measure the rate of loss of zinc (or actually growth of zinc corrosion products). These are measured at 6 month or annual intervals and after a certain loss of zinc has occurred the fasteners and substrates are examined. This method is taken from the Australian standard AS 3566.2 for the durability of screws. Both Stuart Thomson and Alistair Fleming are on the 3566.2 committee looking at the revision of this standard and were able to provide expert advice on what to use. The composition of the zinc is critical, and a zinc alloy known as Zintane 83 is being used as the method of determining the corrosivity of the site. MRM was able to import this material from the manufacturers in France.
The coupons have been coded to each site and are numbered to provide traceability over the four plus year test period, and they are periodically exchanged and weighed to provide the zinc loss data.
This method is to assess the performance of the exposed items after a certain loss of zinc.
It is basically to calibrate the exposure of the samples, and the speed of corrosion is also a measure of the site.

Salt Candle

Method 2 – Salinity and time of wetness. Time of Wetness (TOW) is described as the period during which a metallic surface is covered by adsorptive or liquid film capable of causing corrosion. This method complies with ISO 9223 and is the method used internationally to assess the corrosivity of exposure sites. It has several parts:
a) The salinity is measured by the "salt candle" method. A bottle of water with an exposed wick supported on a "candle" is exposed at the site on a specifically designed stand for 30 days. The liquid in the bottle is measured for its chloride content and this is expressed as mgms chloride per m² per day. This is repeated monthly on a continuing basis during the trial.

Zinc coupons new and after 6 months

Zinc coupons mounted

Salt candle in position (Muriwai)

b) The humidity and temperature is measured continuously by a data logger mounted near to the candle this provides a measure of how much time the site would actually be damp for on a daily basis (TOW).
c) The local weather data (from a nearby NIWA site) is checked to see that it agrees with the TOW measurements.
d) The time of wetness and the salinity together provide a measure of the corrosive atmosphere at the site on a time basis – i.e. for how long it and how corrosive it is.

The first set of six-monthly examinations is being undertaken during November and December 2012 and will determine the future programme.

This is a summary of the MRM corrosion project to date.

Once the programme is completed information will become available that can be published in the MRM COP and used with confidence by designers.

SWIMMING POOL COMPLEX

"I've got a small job for you."

A chance airport meeting led Queenstown designer Graham Roebeck to one of the most challenging and rewarding projects to date, enclosing an existing pool and water feature in a slate tiled courtyard.
The hilltop pool is sheltered by landscaped walls and trees from the prevailing southerly, but the short Otago summers meant the pool, which is heated from rooftop solar collectors, also has a short operating season.

Background

Graham had worked in civil contracting for some years in Queenstown before commencing full time study toward an architectural qualification as a mature student.
On graduation and having worked for McDowell Architects in Invercargill he returned to Otago to work for Steve Mullan, director of Coast & Country Projects Ltd, This provided the opportunity to work on site on the large post & beam home that housed the pool and water feature. "There was nothing being built like this at the time," say Graham, "and the chance to work on this project was an opportunity to good to miss. I've always been amazed that truckloads of materials arrive on site and are transformed by builders and tradesmen into a building. Working for (architect) Neil McDowell was wonderful, but understanding the building continuum and trades cooperation was a gap in my knowledge I needed to fill by seeing with my own hands."

As a mouse pusher, labouring on site, Graham was welcomed by the carpenters and subbies - with a bit of good natured ribbing - the overwhelming sentiment being it should be compulsory for draughtsmen and architects to spend 3 or 6 months on the tools to learn the "real world" feasibility of drawn details. Steve became Graham's mentor in the complex construction of the house; a hybrid of ancient carpentry, light commercial construction and high tech home automation.

The scribing of rustic rafters in beams and beams into posts, all sawn from recycled Australian hardwoods, was a revelation to Graham; that "off square" timber members with rounded gouges and other defects could be housed in without leaving a discernible gap.

Another eye opener was the lack of detailed drawings tradesmen often have to deal with- either for construction or aesthetics on architectural houses, with the myriad of complex junctions, angles and setouts for specified fittings.

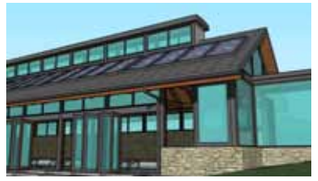
"I gained a lot of respect for tradesmen, their love of the craft, and of building. That's what makes a building beautiful, a team who bring their dedication to the project, that transcends a well designed or well built building. From the designer's side, it makes it clear why some builders have preferred subcontractors – not just the subbies with a competitive tender."

So some years after the house was finished, Graham was invited to complete the 'small job.'

Design

"The task wasn't easy, with services below the tiled courtyard and concealed pool infrastructure, so the first step was to identify the locations and design a grid for the post & beam structure that would work with these and the tiled planters" says Graham.

Since designing this building, some 5 years ago, several alternatives for solar heating have been developed. Creating unwashed areas is not recommended by MRM. Please refer to the article by Stuart Hayman, in Scope 29, on preferred installation of solar panels. http://metalroofing.org.nz/frontend/issues_scope.cfm



Steve Mullan said tech project and models proved invaluable but were so accurate they took away the sense of discovery as the building unfolded. The owner said "just like the model."

The owner wanted an asymmetric clerestory roof to match the existing house, but Graham thought a symmetrical form with indirect light spilling from a lantern monitor directly over the pool would unite the materials of stone, water, glass and wood more effectively. Graham credits Steve Mullan with assisting the design of the water feature annex.

"I made a cultural assumption that the clients would want a bold architectural statement, so had a much more dominant roof line that I thought would bring in the mountains and light more effectively- but it's form was quite aggressive and Steve knew the clients wouldn't buy into it. That's the reality of some projects- because of the longer time frame on large projects and ease of access the owners often get to know the builder far better than they get to know the designer and you need to respect these relationships.

Both options were presented at the concept stage and Steve's insight proved correct and from here we were all on the same page."

Graham says, "the project was a joy to work on, and simplified by several factors."

- having worked with post & beam construction of the existing house under master carpenter Steve Mullan, knowing the properties of the hardwoods and the architectural language of the house and being entrusted with the design by the owners.
- a great working relationship with engineer Bernard Whitham
- having a 3D program (SketchUp Pro) to design the structure and each bracket around the 3 axes
- a great resource of Otago schist and recycled hardwoods and having experience in detailing these
- a great construction team who brought their own flair and ideas to the finished building
- Structural Integrity Ltd completed all documentation for the project from Resource and Building Consents through to shop drawings for the brackets and electronic files for plasma cutter.

Materials

The exterior cladding is glazed aluminium joinery, plaster & stone with all the exposed timber posts & beams wrapped in COLORSTEEL® sheet metal on cavity battens for a maintenance free finish. A photo voltaic array is fixed to the north face of the roof.

The interior has the South African slate tile flooring continuous from the courtyard, Smartwood aluminium joinery, exposed steel brackets, local schist and water. The timbers are those used in the

existing house, salvaged Australian hardwoods resawn from South Island piers, bridges and telephone poles. The sarking and soffits are kiln dried Fijian Kauri and all timbers are treated with Dryden's Wood Oil chosen for its aesthetics, performance and fungicidal properties. The stains was chosen to match those used in the existing house, and unified the raw colours of the sawn beams, which varied from straw yellow to deep red.
The hardwoods were all sourced exclusively from Carl Livingstone at Ironwood, whose passion for this great resource has improved the architectural language of the Southern Lakes region.

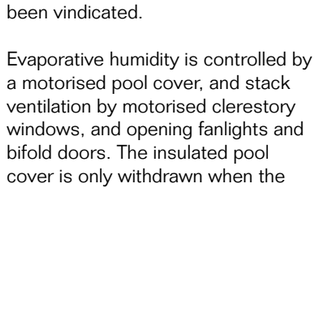
Drainage

The existing drain is inside the pool house envelope, so a new strip drain was installed in front of the doors with sills raised on Cavibat plinths to allow them to open out against the fall, to allow any overflow to run harmlessly beneath to the existing drain and provide continuous trickle ventilation.

Brackets

Designing the brackets and connections in conjunction with engineer Bernard Whitham took weeks of designing and refining to find aesthetic solutions that would perform.
There are 202 hardwood members in the pool house connected by 432 brackets of 40 different types of between 8,10 &12mm thicknesses. These were all plasma cut to shop drawings and cutting lists prepared by Structural Integrity, and fabricated by Shotover Engineering Ltd.

Builder Steve Mullan used the SketchUp 3D model to identified each bracket and location, and the whole thing went up 'like a Meccano set.' Each of the 202 rustic hardwood members varied slightly in size, shape and appearance and required considerable skill and an artist's eye to fit together.



Skillion Roof & Ventilation

A skillion roof over a heated swimming pool in an alpine area required serious research, expert advice and detailing. There was conflicting information by industry authorities, experts and published data over whether the roof should be ventilated or not.
Internal moisture is completely excluded from the envelope by a damp proof membrane behind the sarking. In the event that a roof leak or unidentified puncture of the membrane should introduce moisture into the skillion roof, a decision was made to ventilate the roof. Cavibat battens between the purlins and plywood roofing substrate allow air from discrete vents at the soffit and apex to ventilate the roof. In the 5 years since construction the expert opinion has aligned toward skillion roof ventilation and our decision has been vindicated.

Evaporative humidity is controlled by a motorised pool cover, and stack ventilation by motorised clerestory windows, and opening fanlights and bifold doors. The insulated pool cover is only withdrawn when the pool is in use. The system works so well there is a problem not with humidity and condensation but with tangential timber shrinkage from further drying.

Roof Installer

Pavel Pecinka Craftsman Roofer fitted the roof. A Czech national, Pavel comes from a family of roofers and his knowledge of detailing and flashing has made him the roofer of choice for many builders of quality homes in Queenstown. His advice on improving the performance and aesthetics of flashings and routinely doing the unachievable in sheet metal, opened eyes and minds of designers and tradesmen alike.

The 30 degree roof of 0.55mm COLORSTEEL® Standing Seam & Cap on Thermkraft 354 Building Paper fixed to 12.5mm H3.2 plywood substrate on Cavibat battens. Purlins are fixed to rafters w/ 50x50 Bowmac brackets, thru Protecto Wrap AntiFracture Membrane gaskets.
Sisalation 425 double sided foil vapour barrier is used over Fijian Kauri sarking fixed to 200x75 hardwood rafters. R5.0 batts.

Ceiling penetrations were forbidden.

Photovoltaics

The 80 solar photovoltaic (PV) panels have a concealed fixing method designed and installed by Coast & Country Projects Ltd. The system was designed by Jason Campbell of Campbell Electric and not only supplies the house with its energy needs, with battery and generator backup in the event of power outage, but is a net generator of electricity and feeds surplus electricity back into the grid. The design and construction by Steve & Jason won an award by the Sustainable Electricity Association of New Zealand (SEANZ) for the Best Installation award of 2009.

Structural Integrity Ltd

An award winning boutique design & collaborative architectural practice in Queenstown, founded in 2005. Graham Roebeck is the principle designer working with architects and other consultants on a project by project basis. Current and previous work includes sculpture, film set design, contract 3D modelling, light commercial buildings, significant residential alterations, new builds, and Jack's Point residences.
Structural Integrity clients are equal mix of Queenstown locals and remote national or international clients and accordingly their projects vary in the vastly different historic locations of Arrowtown and Zanzibar.

Design projects have included spacecraft and historic buildings for a heritage architect; co- designing a modern church, blue sky design competitions for Guggenheim NY and a tropical island treehouse resort.

Graham Roebeck designed the iconic Beehive chair, which has received international recognition and is made to order by David Trubridge's workshop in Hastings.

On sustainability Structural Integrity take a more holistic approach. Our role has always been to try to find a response that honours the site for generations to come, using the best technology available to find the best efficiencies, using quality materials with a low environmental impact.
We achieve sustainability by good stewardship, careful analysis and ongoing improvement.

"Architecture… is no less a weaving and a fabric than the trees are. There must be some kind of house that would belong to that hill, as the trees and the ledges of rock did, as Grandfather and Mother had belonged to it in their sense of it all." – FRANK LLOYD WRIGHT

Design: Structural Integrity Ltd
Queenstown
Graham Roebeck
Structural Integrity Ltd
Telephone : 0800 3D HOUSE
0800 33 46 87
www.structuralintegrity.co.nz

Roofing Manufacturer:
Roofing Solutions (Dunedin)
Part of the Freeman Group

Roof Profile:
Standing Seam by Roofing Solutions
Greyfriars COLORSTEEL®®

Roofing Installer:
Pavel Pecinka Craftsman Roofer
Telephone: 021 868 626

Builder: Coast & Country Projects Ltd
Steve Mullan
Telephone: 021 616 752

Engineer: B.F. Whitham Ltd
Telephone: 03 474 1633

Hardwood supplier:
Carl Livingston
www.ironwood.co.nz

Photo courtesy Steve Mullan.

Design Competition- Successful submission for Invercargill ecclesia by Graham Roebeck & Neil McDowell. 2009 Entry for NZ Wood Awards.

RE-THINKING HOME BUILDING

Thinking outside the square has always been natural for John Donovan, an Xpat Kiwi, who has returned to New Zealand after 25 years abroad. A clean green lifestyle close to family members in Auckland was the primary goal. The house he designed and built is definitely green, and certainly not square.

John and partner Sharon bought land in West Auckland overlooking the seaside village of Huia and then went about looking for an eco-design house in which to live out their baby-boomer golden years.

Given generous time to research and think about the design, a new type of dwelling emerged from the landscape and appealed to John's love of big trees. "We looked at straw bale, mud brick, rammed earth, and then whole logs became our focus for building...but not in the usual log cabin style."

John did a log building course primarily to understand the methodology, and hired a young draftsman to interpret his early drawings. An A-frame style log -walled studio looked promising enough to inspire final working drawings. Eventually the conventional log walls were axed and a 'log frame' house he named 'Tehuia Twin Peaks' became a reality.

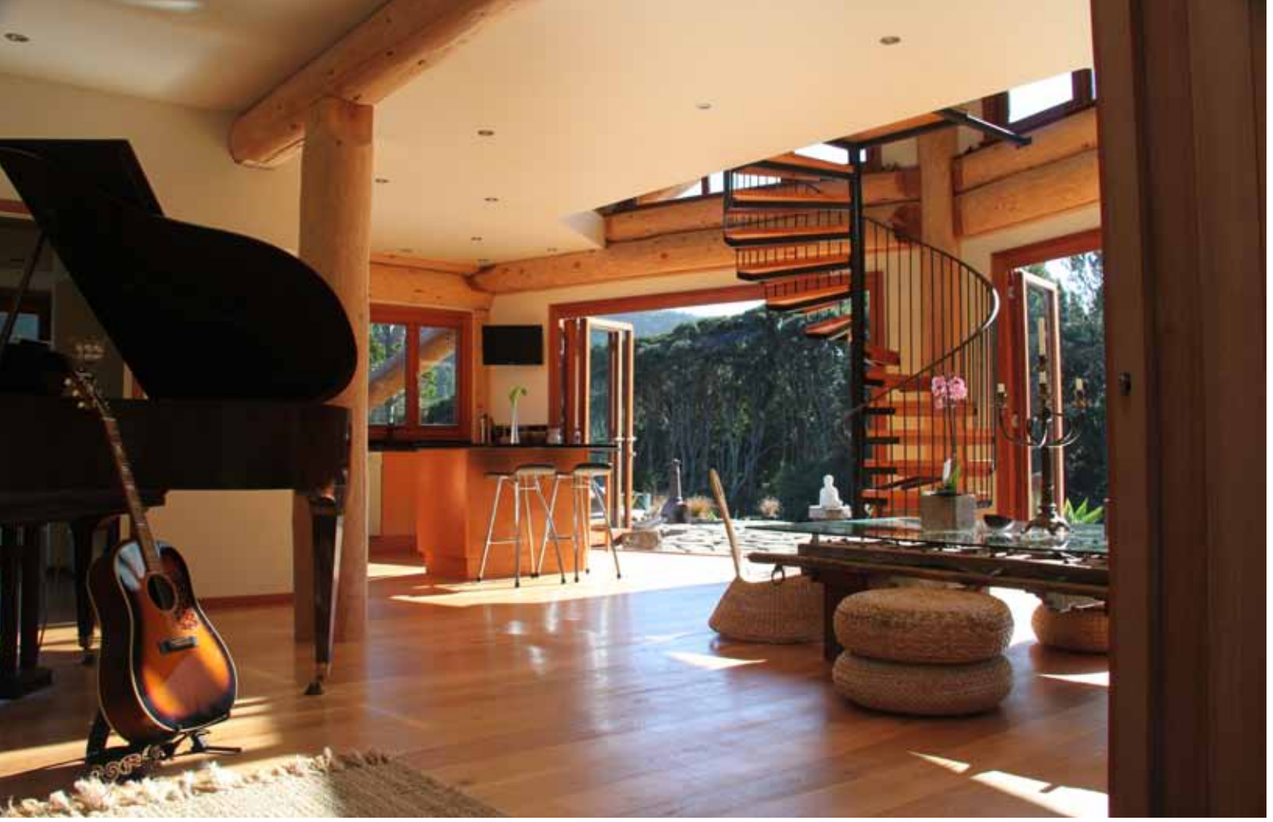
This 200 sq.m open-plan studio/ show home situated in a very private three-acre wild meadow, surrounded by a Kauri forest, national park and the peaks of the Waitakere Ranges, has inspired a lot of public interest. Tehuia Log Homes Ltd was founded to provide those interested with consultation and Twin Peaks log frames.

The company was founded according to principals called 'The Hanover Principals'. Being a sustainable company in the building industry and keeping as much as possible to strong Green principles may seem problematic, but John is adamant that the only successful future for New Zealand is clean and green.

"That means we walk the talk," says John. "Trees grow very well here, but most commercial forests are soft Pine, sent offshore for cheap packing crates and pulp. We can do much better for our country by value-adding good timber here in New Zealand. There are many excellent tree types that have been used for building in Europe and Asia over thousands of years. Why not here?"

John selects the logs he needs from a living Douglas Fir forest. Then, in collaboration with Jason Cruze of Draftworks, they fell and use draught horses to bring the logs out of the forest with minimal impact on the forest. Big draw-knives are used to de-bark the logs with virtually no waste. Age old and well-proven log building techniques he calls 'slow building', are used to shape the notches, saddles and tenons which tightly lock the log frame together.

Hand crafting the first Twin Peaks log frame this way was a highly-skilled, time and labour-intensive journey but lessons learned are now being applied to a commercially viable 'log kit frame'. The frame is delivered on a logging truck and re-erected on the client's site in a few days.



Once the frame is erected, truly organic materials like straw bale or mud brick can be installed between each of the huge outer log frame posts and then finished with cob and earth plaster. Or as in the Tehuia show-home, a conventional more modern and contemporary look can be achieved.

The show-home has untreated Douglas Fir rafters and joists milled by John in his own mill. Macrocarpa ship-lap weather boards are painted black and macrocarpa tongue and groove eves are clear stained.

The house is packed with eco-wool insulation under Gib-board. A natural stone and lime-wash paint on the interior gives an attractive earth plaster look and feeling of warmth. Unlike normal log walls, the plaster board allows more scope for interior decoration and highlights the log frame structure. Big log beams feature on the interior and exterior - what you see is what you get - strength and integrity from sun-grown building materials of natural beauty.

The words ‘sustainability’, ‘eco home’, ‘passive solar’, are used a lot these days but this house actually achieves all three. The low arc winter sun dives under the spectacular northern peak, deep into the house, to heat the concrete slab, and the outer black-painted macrocarpa siding accumulates wall heat.

John chose a COLORSTEEL® iron roof for its impressive low carbon footprint and economical cost. In Karaka Green, it fits the country aesthetic and eco house credentials. Marcus Bond of the Metalcraft Group supervised an efficient crew that delivered an excellent product on time and on budget. It cleanly collects rainwater and very simply works to protect the building and people from the elements.

An open plan, with a void to the upstairs level, allows warm air in winter to circulate the entire house so there’s no need to artificially heat rooms or fan force air through ceiling ducts.

To test and prove his passive solar design, John did not connect the Bosco wood burner to its chimney this first winter. Amazingly, at least in the Auckland region, this house does not need any extra heat source other than the sun. In fact, the only heat source, other than the sun, exists under the bathroom tiles on timers for early morning and evening comfort.

The engineered downstairs oak floor and wool carpets upstairs add insulation and ambient feeling of natural warmth. The joinery is Western Red Cedar with German hardware that can be tilted open at the top, for risk-free ventilation, or opened normally.

Twin Peaks has huge expanses of glass: bi-folds and french doors and huge windows upstairs and down, double-glazed with no window coverings or blinds. Once again this validates the effectiveness good passive solar design.

The downstairs bi-folds open to a space that flows out onto the 23 tonnes (so far) of handpicked stone that is gradually being added to the patio and surrounds of the house. Warmed by the sun, these stones hold heat well providing warmth when the sun goes down and the cooler winds of the West Coast blow off the Tasman Sea.

Manuka wood smoke from cooking in the stone fire-pit completes the scene for this earth, wind and fire house.

The kitchen is cedar and black granite to reflect the cedar joinery and black outside walls. Bi-fold windows and doors open the kitchen to the outdoor living areas in the North and West and in the East the kitchen’s central granite bench contrasts with the natural honey coloured refrectory table made from off-cuts from the timber mill.

Upstairs, accessed via a spiral staircase, is a large master bedroom, ensuite and personal loft space with views out under eves through the beautifully- crafted cedar joinery. Here the sloping ceilings and proximity to huge posts and ridge logs create an intimate space for quite relaxation.

Water is heated primarily by a heat-pump designed and built here in New Zealand. It extracts heat energy from the air temperature and heats the hot water far beyond what is needed. The savings in electricity from this keeps running costs very low as there is no heating other than a small amount of under-floor in the bathrooms.

The open plan downstairs is essentially one big room, which opens up in the North, South, East and West. A small laundry/ utility/entrance way and bathroom in the West make a simple room divider between the kitchen and media room. Sound and light play beautifully off the big log beams and candlelight really accentuates the natural beauty and patterns of draw-knifed Douglas Fir.

Smart wiring for data, cable TV, video and sound plus LED lighting make this house suitable for a modern 21st Century lifestyle or simple organic living off the grid. Either way, the Tehuia Twin Peaks walks the talk. An authentic Kiwi design for a sustainable future.

The Hannover Principles

1. Insist on rights of humanity and nature to co-exist
2. Recognise interdependence.
3. Respect relationships between spirit and matter.
4. Accept responsibility for the consequences of design.
5. Create safe objects of long-term value.
6. Eliminate the concept of waste.
7. Rely on natural energy flows.
8. Understand the limitations of design.
9. Seek constant improvement by the sharing of knowledge.

Client/ Owners: John Donovan & Sharon Antunovich

Designer & Project Manager:
John Donovan
Tehuia Log Homes Ltd
Telephone: 09 8118 144
www.tehuia.co.nz

Roofing Manufacturer:
Metalcraft Roofing
Roofing profile:
COLORSTEEL® MC760 0.55mm
Endura® Colour: Karaka

Roofing Installation:
Marcus Bond, Fixing Supervisor
Metal Line Roofing Ltd T/A
Metalcraft Roofing
Paul Hooper, Manager
Telephone: 09 444 1813

Draftwood Timber: Jason Cruze
Telephone: 021 576 576

Wall Framing:
Derek Mollooly
Telephone: 027 496 6313

Kitchen manufacture:
Eugene & Acushla Scott
www.wood-tech.co.nz

Joiner: Heirloom Joinery
Sam Burgess
www.heirloomjoinery.co.nz

Hot Water Heatpump: David Senn
www.econergy.co.nz

Engineered Oak Floor:
www.floorex.co.nz

Exterior Paint
www.Timbakote.co.nz
Interior Paint
www.porterspaints.co.nz

Plastering
www.grw.co.nz

MAKING A MARK

When it comes to building showhomes, Landmark Counties has taken a somewhat novel approach compared to other group home builders.
Instead of building a showhome using one of their range of standard plans, in this instance, they started from scratch and created this striking one-off designer home specifically for the site.
And the feedback has been nothing short of phenomenal…

"The street appeal is amazing and people driving by come in and tell us that they can't help themselves, they just have to come in," says Sarah McMullin from Landmark Homes in Pukekohe.

Franchise partner Stephen Tordeich is equally delighted with the enthusiastic reception.

"As a showhome, it has attracted so much attention that we have now included it into our range of available plans. The overall aesthetics of the exterior and the combinations of colour, textures and materials have proven to have the street appeal our designers set out to achieve."
The level site in Karaka, Auckland, is within walking distance to the sea and allows corridors of seascape views. The seaside location was influential in the design and choice of materials.

"It's a true town and country design, compact enough for city sites but substantial enough to suit lifestyle or rural locations," says Landmark Homes' franchisor Debbie Clarke. "We designed it for the site to maximize the corridors of view which are very impressive, and the sun."

She says the design is suitable for both urban and rural locations, offering a "sense of space and light and a connection to the outdoor surrounds."

The atrium also provides access to the office/study and bedroom on the ground floor, with good separation from the family living area.

The designers say a key objective of the design was to create a generous sized three bedroom home that would offer flexibility for a growing family.

The 258 sq meter design features a ceiling height of 2.7 meters with large windows and doors to enhance the sense of grandeur. The atrium entry to the home further accentuates the feeling of space and spans both levels opening to the landing above.

Water resistant Secura tongue-and-groove floor panels are used in the bathroom areas. Secura panels require no underlay so tiles can be laid directly onto the surface.

The bedroom on the ground level can be directly accessed from the entry, with a large bathroom close

Two of the bedrooms, including the master bedroom, are situated on the upper level. The ensuite to the master bedroom can be accessed by the occupants of the second bedroom without causing disturbance.

by. The enclosed family living space is generous by any standard, and both the dinning and family spaces open onto sheltered, covered deck areas providing excellent indoor/outdoor living flow.

every aspect, and that the roof in particular received special attention as it forms such a dominant part of the overall look.

"The roof (Gerard Rockport Shingle) essentially sets the tone for the overall design and style of the home, and the close proximately to the coastal environment was an important factor too."

"People are very aware of it," says Sarah. "Not only can you see the sea from the windows, you can smell it in the air – but we know a Gerard roof will stand up to it."

The protective coatings on Gerard roof tiles include a special combination of aluminium and zinc, which provides up to eight times the corrosion resistance of alternative steel roofing products.

The kitchen is state of the art and features an island bench, which connects the family area and allows easy access to both family and dining spaces.

For those occasions when privacy and quiet are required, the formal lounge provides a haven with outdoor options close to the dining area.

Stephen Tordeich regards the new home design, known as the Lincoln, as a "superb combination of intelligent design and construction." He says that being at the "coal face", Landmark homes people have a unique opportunity to listen to, and act upon, the concerns and aspirations of home buyers.

"Now, more than ever before, potential homeowners are interested in sustainable building," he says. "The recent tragedies in Christchurch have created a greater concern and awareness of the need to build homes that are safe, using materials that are strong, durable and environmentally sensitive.

Stephen emphasises that the material choices that go into a project such as the Lincoln home are carefully considered from

Available in a range of colours, Gerard Roofs Rockport Shingle tiles also come with the benefit of a peace-of-mind, 50-year pro rata warranty. The tiles have a textured surface, made from natural stone – giving the roof a warm, soft appearance.

.

The interlocking fixing system used on a Gerard roof increases the integrity of the roof structure to a point where it can easily withstand hurricane force winds.

Sarah says the fact that Gerard is rated as a lightweight roof was another factor in their choice.

"Because of what happened in Christchurch, people are very aware of the safety factors. It also means you don't have to have extra strong framing in the roof and that can mean a cost saving.

"From an aesthetic perspective, the profile, texture and colour of the Gerard Rockport Shingle tile offered us the unique look we wanted and it works particularly well in conjunction with the Linea weatherboard cladding."

The interior of the home is designed for maximum comfort and features "noise control" internal walls between family living areas and bedrooms.

Overall, this home is well considered in every aspect and offers many striking features. However, Landmark Homes stress the importance of taking time and researching all the options available.

"Besides the many attractive features that go into a Landmark home, our greatest strength is our ability to tweak our designs to meet the needs of our clients," says Sarah.

"A central part of Landmark's process is not to rush decisions. A house that truly lives up to your vision takes time to think through."

Design: Landmark Homes
Telephone: 0800 477 110
www.landmarkhomes.co.nz

Roofing Manufacture: Gerard Roofs
Telephone: 0800 104 868
www.gerardroofs.co.nz
Profile: Gerard Rockport Shingle
Colour: Charcoal

Roof Installer:
Harvey Roofing Centre
Telephone: 0800 244 737

METROTILE THE PERFECT SOLUTION

The Bardell's, from Dannemora in Auckland, had installed an Asphalt Shingle roof on their new home and after 8 years were becoming increasingly frustrated by the asphalt tiles failing, lifting from the roof, and ending up in their gutters and garden. After 8 years, as a result of the lifting shingles, they were no longer confident that their Asphalt Shingle roof would remain watertight over the longer term.

Following a visit to the Metrotile Stand, at the Auckland Home Show in 2010, the Bardell's decided to contract SH Roofing to install the Metrotile Shingle tile over the original Asphalt Shingles in February 2012.

At the time the Bardell's were looking for a low profile, low maintenance roofing product, which could be installed on a "no fuss" basis and would compliment the existing style of their home. A home the Bartell's were passionate about having designed it themselves as a result of their travels in North America.

However they didn't know where to start until they visited the Auckland Home Show. Several factors influenced their decision to use the Metrotile Shingle profile. The first being the replacement product had to compliment the original style of the house and the low profile of the existing Asphalt Shingle roof.

The Metrotile Shingle profile is unique in the New Zealand market as it is the lowest profile pressed metal tile available. The Metrotile Shingle tile was originally developed by Metrotile in the Unites States to target Asphalt Shingle re-roof opportunities and utilizes a unique "clip lock" installation system. As a result there are no exposed fastenings and the nose of the Metrotile Shingle tile is only 10mm's high which results in a very flat profile. The flat profile of the Metrotile Shingle tile is complimented by its Low Profile Ridge Trim which fully replicates the look of Asphalt Shingles.

In addition the Metrotile Shingle tiles have a natural stone textured finish that provides for a low glare roof, which does not adversely effect neighbouring homes in the area.

After the Bardell's experiences, with their original Asphalt Shingle roof, maintenance and longevity was a priority. Their home is built in a high wind, high sunlight location and they needed a product that could "last the distance" and would be supported by the Manufacturer. The fact that the Metrotile Shingle tile is manufactured in New Zealand by an established family owned business was imperative. The 50 year pro-rata Weather Proof warranty and 20 year pro-rata Surface Coating Warranty was an added bonus and helped validate their decision.

Whilst not needing to collect potable water from the roof the Bardell's were interested to hear that potable water could be collected from their Metrotile Shingle roof, which is not the case with all light weight shingle substrates, some of which include or have historically included bitumen and asbestos in the manufacturing process. There is an increasing environmental awareness in New Zealand of the opportunity to harvest water, rather than waste it. In many instances having the choice is important to home owners.

Scott Harris from SH Roofing was referred to the Bardell's by Metrotile. SH Roofing is an independent specialist roofing company who are based in South Auckland and service the Greater Auckland market with longrun and metal tiles. Scott Harris, the principal of SH Roofing has been roofing for 20 years and has owned his own roofing company for 15 years. Scott has actively worked with Metrotile in the trialing of their new products and profiles and specializes in high end metal tile roof installations. SH Roofing is one of the few Roofing Companies in Auckland that can quickly and expertly install the Metrotile Shingle tile. Scott's expertise was put to the test in roofing the Bardell home which is a particularly steep, complex and highly visible feature roof.

The re-roof of the Bardell house was a relatively complex and highly visible project that involved liaison with "torch on" and builder sub-trades. In addition to the roofing, the installation of custom flashings on multiple sky lights, which are

The installation process involved laying building paper over the existing Asphalt Shingles and screwing the Metrotile Shingles directly onto the ply. Aside from the scaffolding of their property the re-roofing of their house did not impact on the Bardell family.

The finished result looks stunning and as on many new and re-roof projects throughout the country is approved in coastal environments and is manufactured by a company that stands by its products.

The Bardell's are very happy with their re-roof and have entered it into the RANZ Metal Tile Award program, which recognises professionalism in the installation of metal tiles.

Roof Installer: SH Roofing Ltd
Roofer: Scott Harris
Telephone: 021 424 542
e-mail: scott@shroofing.co.nz

Roofing Manufacturer:
Metrotile Roofing Systems
Telephone: 09 299 9498
e-mail: info@metrotile.com
www.metrotile.com

Product Details;
Tile: Metrotile Shingle
Finish: Textured
Colour: Charcoal

HOBSONVILLE POINT PRIMARY SCHOOL

The release of government owned land near the Hobsonville Airbase in Auckland's North-West, has allowed for the development of Hobsonville Point as one of Auckland's newest satellite communities.

Numerous projects have been approved and are in the process of being constructed, including an extensive number of residential homes, a primary and secondary school, a wharf and ferry terminal and other buildings that make up a new community.

Dimond has been involved in providing a wide range of products for the Primary school partnering with Kiwi Roofing (Installer) and Ampelite (Natural Lighting supplier).

Products included 7500 LM of roofing product (Dimondek 630 up to 47m runs), 1500 LM of customised natural lighting product, 2000 LM of cladding (Dimondek 630) as well as customised aluminium window flashings and custom gutters with brackets to suit.

The job began in June this year and is due for completion in December, Kiwi Roofing have had up to 15 staff on site at anyone time and has been a major project for them.

Paul Connell Director of Kiwi roofing noted that one of the real features of this job was the custom designed skylight systems which consisted of a multi-layered Natural lighting solution developed specifically for the use on Hobsonville Primary School. Working with ASC Architects, Hawkins Construction and Auecon mechanical engineers this ThermRline skylight system makes a great addition to the Durolite range.

The project had a very specific design requirements, as follows:

- To provide maximum light transmission.
- Reduce the noise coming through from rain.
- Provide minimum thermal energy loss.

The solution was using a Durolite sheet formed from a Dimond 3 ribbed Styleline profile, with modified side ribs to lap to the Dimondek 630. over a second layer of matching polycarbonate sheet. Light wells including further layers of flat plastic sheet were constructed below the skylight to disperse the light and minimise rain noise.

The lighting strip widths were critical to the floor plan layout to provide natural light exactly where it was needed. The top natural lighting strips run from ridge to eave and are blanked out with building paper in areas not requiring natural lighting The Natural lighting strips have been placed in each of the classrooms so that the children's desks are exposed to maximum amount of natural light. The technical teams from Dimond, Ampelite and Kiwi joined together developing a novel solution to meet the stringent requirements of the consultants

Other features of the job included the use of Dimondek 630 for wall cladding and the use of architecturally designed aluminium flashings as well as a unique gutter with custom made brackets, all of which has galvanised the team to forge the right solutions for the site. The secondary school job, which is twice the size of the primary school, is due to begin early next year with a similar specification to the primary school, plans are already in place to organise the required coil and machinery to get the job done. Kiwi Roofing have again been confirmed as the fixer and are keen to take advantage of the experience gained from the primary school and produce a top quality job within the required time frame.

Dimond is proud to have been associated with this job and are looking forward to the challenges the secondary school will bring next year.

Architect: ASC Architects

Main Contractor:
Hawkins Construction

Manufacturer: Dimond,
Telephone: 0800 DIMOND
E-mail: Dimond@dimond.co.nz
www.dimond.co.nz
Profile: Dimondek 630
Skylights: ThermRline skylight

Installer: Kiwi roofing Ltd.
Auckland
Telephone: 09 263 9988
E-mail: paul@kiwiroofing.co.nz
www.kiwiroofing.co.nz

COOL ROOFS HOT TOPIC

By Stuart Thomson

Do you think that colour has gone out of your life recently? Is it just a matter of getting older or is it a fact? Does everything look black and white to you? What colour car do you drive? If it is black, grey or silver then you join the 60 % majority of New Zealanders who probably do not know that they are also driving the most dangerous coloured cars. Haven't we taken the 'All Black' theme a bit far? Looking out a plane window years ago Wellington was dotted with Barn red and Steelite green roofs but now everything seems to be a paler shade of black. Gull Grey, Grey Friars, Thunder Grey, Shale Grey, Elephant Grey, Battleship Grey, Sandstone Grey…….

Do roofs get caught up in the fashion of the day like the black suit uniform that both men and women wear like some deathly shroud? Do designers really get the choice? Or is it a question of, women choose and men pay?

However the implication of the colour of a roof has just got a lot more serious than the aesthetic contribution it makes to the building. Building control authorities and energy agencies worldwide are now taking an interest in roof colour as a means of energy-saving.

This article started out to be a simple answer to a simple question. There have been a number of recent enquiries asking 'Just what is meant by a 'dark coloured roof' in the NZMRM CoP 4.1.5 and 4.1.6?'

The cool roof is not a new idea as the Greeks thought of it a long time ago.

4.1.5 TEMPERATURE RANGE

Ranges of temperature likely to be experienced in N.Z. by different steel cladding are:

Max/Min Roof Temp °C No Wind				
Insulated	Light colour	+60° -15°	=	75°
Insulated	Dark colour	+80° -15°	=	95°
Uninsulated	Light colour	+50° -10°	=	60°
Uninsulated	Dark colour	+65° -10°	=	75°

The NZMRM Code of Practice has put a figure on roof temperature range but this is based more on anecdotal than scientific evidence. With the range of temperatures now encountered in well insulated, unvented roofs it is also little wonder that the noise problem has been exacerbated.

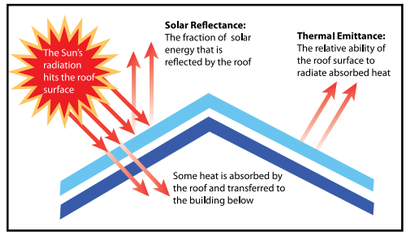
What was thought to be a simple question has now become a hot topic – more correctly a 'cool' one. This article therefore has become a complicated answer to a complicated question of just how relevant coloured roofs are to New Zealand's energy consumption. The white roof project in the USA has caught media attention recently. US.Secretary of Energy, Dr. Steven Chu is sold on the benefit of white roofs and has mandated that all new roofs on Energy Department buildings be either white or reflective He says if 85% of all air-conditioned buildings in the US had white roofs the saving in energy costs would be US$735 million per year.

However, like global warming worldwide there are a number of detractors who claim that painting roofs white is not a simple answer. This probably is true for New Zealand because the savings claimed for overseas are for air-conditioned buildings and the closest we get to residential a/c is the use of heat pumps for cooling in summer. Cool roofs are not a priority if you are not using much energy for cooling.

Like many other aspects of building, just how relevant cool roofs are for New Zealand is the purpose of this article. While it is not necessary to understand fully the laws of Thermo dynamics (it helps though) or to understand the difference between a absorption and adsorption, designers should be aware of the implication following the decisions that they make in choosing the type and colour of a roof for their buildings. Do you have to know what reflectance and absorptance are- yes. Do you have to know what emissivity and reflectivity are – yes.

For these reasons some definitions and descriptions are needed.

Solar reflectance SR is a measure of a material's ability to reflect solar energy back into the atmosphere, including the visible, infrared and ultraviolet wavelengths. (Sometimes referred to as TSR



Total Solar Reflectance) Of the total energy striking the earth's surface, infrared is the largest at about 55%, visible light is about 40% while UV amounts to only 3%. Solar reflectance is measured-on a scale of 0 to 1.0 where 1.0 represents total reflectivity, while 0 indicates that the surface absorbs all solar radiation and is expressed as a %. e.g. a surface that reflects 55% of sunlight has a solar reflectance of 0.55. Most light coloured roof materials reflect 55 to 90% while dark roof materials reflect only 5 to 20%

A mirror may reflect 98% of the energy that strikes it while absorbing 2%; whereas a blackbody surface is the opposite, absorbing 98% of the energy and reflecting only 2%

The US Environmental Protection Agency -EPA Energy Star rating specifies an Solar reflectance value of 0.65 or higher for roofs <10° and a minimum 0.25 for steeper slopes >10° .(which seems a pretty big jump!).

Sunlight that is not reflected is absorbed as heat and is known as Solar Absorbance (the value). Absorbance (the process) should be the reciprocal of Reflectance but sometimes things get in the way and one of these is emissivity or Thermal emittance.

Thermal Emittance TE describes how efficiently a surface cools itself by emitting thermal radiation. It is measured on a scale of 0 to 1, where 1 indicates a perfectly efficient emitter. Unpainted Zincalume and unpainted aluminium cladding have a low emissivity of 0.1. but a relatively high total solar reflectance, 0.6 to 0.8 however the reflectance and emittance of bare metals are very sensitive to the smoothness of the surface and the presence or absence of surface oxides, oil film or dirt. Usually, bare metals are not very cool in the sun. Rough surfaces also cause the light to be deflected at different angles according to the surface profile resulting in a scattering of light away from the angle of reflection. This causes the object to appear dull or matte. The higher the degree of surface roughness, the greater the scattering of light occurs which results in a lower gloss level. Painted roof cladding is a different story as even a thin coil coated white coating "hides" the low emittance of the metal underneath, and the thermal emittance increases in most cases, to more than 0.8, regardless of the colour.

Emissivity also changes with temperature as the hotter it gets the better the emitter. Many years ago our school caretaker could not be persuaded that his painting of our matt black hot water radiators silver was not a good idea! Emittance is the critical measurement for municipalities and folk who are concerned with global warming because of the phenomenon known as the "Urban Heat Island" effect. Their research has shown that cities are at least 3° C warmer during the day and 12° C warmer at night than the suburbs.

Many of the overseas codes, standards and programmes that specify cool roofing requirements reference an additional calculated value called the Solar Reflectance Index (SRI).

Solar Reflectance Index SRI combines the actual measured solar reflectance and thermal emittance values into a single value (1-100) by determining how hot a surface would get relative to standard black (reflectance 0.05, emittance 0.90), being 0 and standard white (reflectance 0.80, emittance 0.90) which is 100.
The Solar Reflective Index is derived from ASTM 1980
SR x E (Emissivity) = SRI.

Although black roof cladding has a high emittance value 90% it has a low reflectance value 5% and becomes hot because even though the emittance is high, there isn't enough reflectance to help cool the roof.
Like solar reflectance and thermal emittance, the higher the Solar Reflectance Index value, the cooler the roof.
While Solar Reflectance Index is an excellent indicator of solar reflectance for materials with a high infrared emittance, this value is very sensitive to a number of environmental conditions e.g. insolation, convection, roof thermal resistance air temperature, sky temperature, and inside air temperature.

For unoxidized metallic surfaces that have low infrared emittance, the Solar Reflectance Index calculated varies significantly with these variables and therefore this value is not recommended to be used for bare (unpainted) metallic surfaces

LEED- Leadership in Energy and Environmental Design is a green building rating system developed by the U.S. Green Building Council (USGBC) to provide a suite of standards for environmentally sustainable construction. The Solar Reflectance Index is used to determine compliance with LEED requirements and is calculated according to ASTM E 1980. A roof cladding must have an index of 29 or higher for roofs >10° and 78 or higher for roofs <10°.

Having defined the terminology for measuring colour for roof and wall cladding we should now put

these values into the New Zealand perspective. While accepting that overseas Building Control Authorities hang their hat on these values to restrict or reward designers accordingly, NZ has not reached that stage – yet. What doesn't inspire confidence is the various methods of assessment in different states of USA, Europe and Australia and also the different published values for the same colour.

The theoretical values of solar absorbance and reflectance measure a flat surface so corrugated profile values cannot be so easily determined. They do not take into account internal reflections that occur as the angle of the sun changes during the day or the year and also they cannot take account of the deteriorating surface finish that occurs over time as the paint or material ages or it is affected by the environment and becomes faded or dirty. These calculated values however can be a good indicator of comparative performance between different colours.

While acknowledging that there has to be a colour benchmark, there are a lot of other factors that have to be considered in the overall assessment of thermal efficiency of buildings including their orientation, roof pitch and insulation.

Over the last decade, paint companies world-wide have developed IR (Infrared) pigments which considerably improve the solar reflectance value of dark colours and lighter colours to a lesser extent.
In New Zealand both our coil coating companies have been researching IR (infrared reflective) pigments for some time and back in 2010 PCC announced that they were making a number of colours that use solar thermal absorption reflectivity pigments called Whitestar, Monolith, Dusk and Attic. Their stated intention was to introduce IR pigments into their standard NZ colours over time. New Zealand Steel have just released a statement about their use of IR pigments in popular colours and the good news is that they will be available from P.C.C. and NZS at no extra cost. The improvement of SRI appears to average about 12 %. With this new paint technology, cool metal roofs do not have to be white or near white as they can be of a darker hue when IR pigments are used.

Although the amount of infrared energy that is reflected is a function of the colour this new technology allows for darker colours to reflect more solar energy. As a result the solar reflectance value is higher with a corresponding lower surface temperature. Up till this time there has not been a great demand in fact there has been a 'lukewarm reception' because New Zealand does not have the climate or incentives to follow the US model. One could say 'cool reception' but the youth have taken that word and turned its meaning upside down so now that could mean 'hot'!
One downside of the new technology is that the reflectance values have to be judged after three years in service as dirt affects its efficacy which means that it is a extra good idea to wash your roof down regularly particularly the unwashed area.

Knocking white roofs for New Zealand residences will probably draw serious noises from the eco movement but then what's new?. Passive and active ventilation of the attic space- particularly roofs of skillion or Cathedral construction can be as efficient as white roofs in reducing over heating in the summer but has the added advantage of removing excessive moisture in the winter.

Also adding insulation to a higher R value is another economic way to control summer heat but unlike Australia we do not place it directly under metal claddings.

Perhaps the most prevalent misconception concerning cool roofing is that specifying the highest possible Solar Reflectance and Infrared Emittance properties is a universal answer for energy saving worldwide. It isn't.
Did you know we have a 'white roof society in New Zealand? The Sylvia Park Shopping Centre, Pak 'n Save stores and the Auckland Airport already all have white roofs but then you don't see them very often. 75% of all Commercial and Industrial buildings built in Auckland in the last 20 years have roofs <10˚ which are all shades of white. Architects and designers like colour and when it comes to residences, but white is not a favourite designer colour.

To evaluate roof energy efficiency and heating and cooling costs, to use only roof cladding material properties, such as Solar Reflectance Index and reflectivity and emissivity, will not tell the full story. The heat gain, heat loss, cooling load, and energy usage and the performance of the whole building must be examined
The ability of the roof to re-radiate absorbed solar infrared radiation back to the atmosphere takes place at all times, but mostly at night. The MRM COP 4.2.4. calls this night sky radiation.

The light reflectance value (LRV) of a colour is measured by a spectrophotometer which measures how much of the visible spectrum of light is reflected by a particular colour. NZ Steel publishes LRV values (0-100) and TSR for different paint colours within their colour range (see table).

ENERGY STAR is an international standard for energy efficient consumer products originated in the United States of America. It was started in 1992 by the US Environmental Protection Agency and the Department of Energy and since then, New Zealand, Australia, Canada, Japan, and the European Union have adopted the program. ENERGY STAR is New Zealand's mark of energy efficiency, typically awarded to the top 25% most energy efficient products by category which generally use 20%–30% less energy. Energy Star uses Solar reflectance but does not include metal emissivity in its assessment of colour. It does however include a 3 year ageing for SR. Only light colours (L) can be used for roofs < 10˚, and medium colours (M) can be used for roofs > 10˚.

The U.S. Department of Energy (DOE) uses the low sloped cool roof definition but defines steep sloped cool roofs as those with a 3-year aged Solar Reflectance Index of 29 or greater. The reason appears to be because the majority of low slope roofs in the US are membrane and do deteriorate over a 3 year period. The result of all this is that these figures can only be used as a broad classification which is probably all that is needed for our purpose.

New Zealand has favourite colours for roofs and NZ Steel and Pacific Coil Coaters both reported recently that six colours (in order of popularity) accounted for over 50% of painted roof cladding in New Zealand. It is presumed that Titania was predominately supplied for commercial and industrial roof cladding

Product NZS Maxx with CoolColours NZ favourite colours #**	Energy Star D/M/L	Solar Reflectance SR	Thermal Emittance TE (W=weathered)	Solar Reflectance Index SRI	LEED Y/N L =<10˚
# Ironsand**	D	0.26	0.8	21	N
#Grey Friars**	D	0.26	0.8	21	N
#Titania**	L	0.65	0.8	76	N
#Karaka**	D	0.25	0.8	21	N
#Sandstone Grey**	D	0.38	0.8	38	Y
#Indigo**	D	0.26	0.8	21	N
Energy Star Y > 10˚					
Stone	M	0.36	0.8	36	Y, L=N
Straw **	M	0.46	0.8	49	Y, L=N
Desert Sand	M	0.50	0.8	55	Y, L=N
Gull Grey	M	0.52	0.8	58	Y, L=N
Ivorie**	M	0.58	0.8	65	Y, L=N
Bone White	M	0.57	0.8	65	Y, L=N
Energy Star Y < 10˚					
Titania**	L	0.65	0.8	76	N
Smooth Cream	L	0.68	0.8	81	Y
Cloud	L	0.68	0.8	81	Y
Foam**	L	0.70	0.8	83	Y
Bare Zincalume	NA	0.65	0.15 (W 0.25)	NA	
Bare, galvanized steel	NA	0.61	0.23 (W 0.88)	46	
Bare Aluminium	NA	0.61	0.09 (W 0.30)	56	

So how do they stack up the 'white roof' policies of the rest of the world.

Australia likes to be different, as we know, and as a measure they have chosen absorbance over reflectance as the rest of the world has done. The values given to absorbance in Australia use the basis of calculations by the BCA (Building Code of Australia 0-1.0) and BASIX (NSW Building and Sustainability Index) to provide a rating for each coloured metal roof described as light, medium and dark; however they are both different! The NSW BASIX requirements include not only the roof Solar reflectance but building solar orientation, cross ventilation, insulation as well as rainwater tanks and grey water.

There are other various methods for determining reflectance values and although NZ Steel and P.C.C. may present them in different ways they generally fit the Eco template.

It is pretty obvious to any who have tramped in the hills at dusk in misty rainy conditions that the brighter the colour the greater the relief on discovery!

In some visually sensitive environments in NZ, (Waitakere and Islands in the Hauraki Gulf) there are town planning requirements which dictate that darker colours must be used which must be below 40% reflectance (Queenstown 35%) even though this is not required for compliance with the N.Z.B.C.

The man from the Council says, "In our District Scheme your hut is not at all PC, I want it painted green."

Solar reflectance and glare are not the same if you measure Total Solar reflectance. Glare can only come from the visible light spectrum.
There seems to be a great tug-of-war going on about colour.

There is a conflict of interest here between the eco movement who are all for green (sorry white) roofs and those people who have to put up with the glare associated with white or plain Zincalume roofs. The basis for colour comparison is BS5252 and greyness is classified A- E with D & E being bright and generally unacceptable.

On the left is the white team consisting of the advocates for white roofs and on the right the green team those that prohibit their use. While there are good reasons for each, the designer has to know about both. While there is no law governing these at the moment, there are Local Authorities that have the power under their District Scheme or Resource Consent process to tell the owner or designer what colour you can and can't use. They also have jurisdiction over glare as a measure of nuisance to individual neighbours or the public at large.

The method adopted by Auckland Council and Queenstown District has been to designate not only the reflectance value but the 'greyness' of the pigment. New Zealand manufacturers offer a wide pallet of colours to choose from albeit that they are somewhat subdued 'earthy' ones due to the fact that they are inorganic pigments as most bright organic pigments are subject to excessive fade.

What this has meant is that there is now group of colours known as 'Natural', Habitat' 'Neutral' or 'Recessive' available which take the kick out of the colour.

There is no such surface as a non-reflective one because you would not be able to see it! So glare as a nuisance is a relative thing. Queenstown have decreed that any colour >35 solar reflectance is a no-no and 35 metres is the 'distance' so if you have a neighbour whose roof is white and glarey but 36 meters away – tuff. Such conflict of interests does not make for good neighbours so check out the houses around you and talk to your neighbours! One thing most TA's (in NZ & Aus) are agreed on is that any unpainted Zincalume roof > 10° is a potential glare nuisance.
Glare is related to gloss level but one mitigating factor is that it will get less over time.

Paint manufacturers like high gloss paints because they last longer!

There are many arguments that glare only occurs at some time of the day or some time of the year but designers should be aware that litigation has forced owners to repaint their coil coated roofs another colour which unfortunately voids the manufacturers warranty.

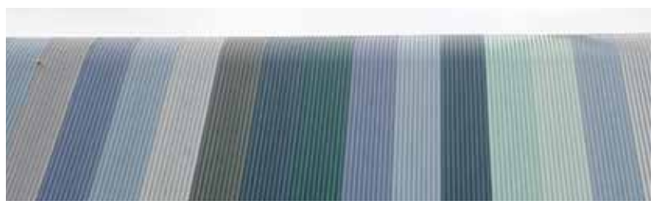
Colour makes a big difference to expansion and noise of metal roof cladding, however that is another subject for another day.

Designing white roofs for industrial and commercial buildings makes sense because if the building is air conditioned it will save energy, if it is not then the surface temperature of the underneath of the cladding will be lower and result in less radiation to the people working inside it. Because these types of building have generally long length cladding, a major plus is that the stress on the cladding and the structure will be minimised due to less expansion
which will result in less noise and expansion problems.

Well-designed residences are a different story as in New Zealand the heating cycle is more than twice the length of the cooling one
The designer's roof colour choice and the use of IR pigmented colours should be considered holistically along with energy efficiency, as well as environmental colour, roof construction, roof orientation and passive ventilation of the attic space.

A challenge to all designers -bring back colour to New Zealand roofs!

Opinions expressed in Scope do not necessarily reflect the views of the NZ Metal Roofing Manufacturers Inc., it's executive, committee members or publisher unless expressly stated.



Nelson City had no objection

Flo Fickle, who lived in Torbay changed her mind every day If you need any proof just look at her roof.

The streets of Buenos Aires do not have any Resource consent colour restrictions.

FRENCH BAY YACHT CLUB

By Graham Hepburn

One of west Auckland's iconic buildings, the French Bay Yacht Club's clubhouse is also a testament to community spirit.

The modernist-style building hugging the shoreline of the Manukau Harbour is part of the scenery for those who drive down the hill from Titirangi but it took a huge effort to get it built.

When French Bay Yacht Club was founded in 1956, it operated out of an old building – also on the shoreline – but by 1964, with membership growing, a sub committee was formed to begin planning a new clubhouse.

Above: Before the new roof went on. Below: Two thirds of the building is suspended over the water.

One of the four people on that committee was local architect Brian Northcott, who was also a keen sailor and was president of the club at one stage. Brian's son Martin says, "On that committee the planets aligned because there was not only my father but also a structural engineer from Fletchers [Bob Foster], and one of their foremen."

Martin, who has his own architectural practice in Titirangi, says his father was determined that the clubhouse would be "a building that stood the test of time".

"If my father hadn't been involved it would have been a box – but it would have been much cheaper of course," says Martin.

"My father was a practical thinker and he most likely sat on one of the beach seats on the promenade smoking his pipe with a sketchpad and a 2B pencil on his knee.

The Yacht club's new roof . The restoration of the iconic building continues.

"He followed the well-known adage 'Form follows function' and he would have been keen to make the structure as simple as possible. I am sure he took some of the design ideas from previous commercial projects he had undertaken and added the necessary design elements to make it a comfortable building."

About $15,000 was required for the building work – a huge amount of money for the club members, who went on a monumental fundraising drive. All manner of means to raise funds were employed - carnivals, sausage sizzles, garden parties and stalls. Members also built P-class boats at the Boat Show and took the completed boat around shopping centres to raffle it off.

But most of the money came from bottle drives – in the days when you got several cents a bottle from the recycling depot.

Martin recalls fleets of trucks and cars and trailers going out into the local area, with youngsters raiding any stashes of bottles that they could find.

With funding being such a big issue, there were doubts about proceeding with Brian's design – a huge project considering it also involved a reclamation, breakwater, launching ramps and stone wall.

"The crux of the design was the clubhouse had to be out on the water purely to leave space for rigging boats on land and to secure the view out to the top mark and around the corner," says Martin. "I can still recall the fights my father had with the harbour board and all the work he had to do to get it through."

To keep costs to a minimum, the club decided that members would undertake all the manual work in preparing for the build, including forming the concrete foundations – large reinforced concrete piles anchored into the sea floor – the huge precast floor members and retaining walls.

With the money saved on all this preparatory work, the club was in a position to have the clubhouse finished in 1967.

Martin says his father was able to create a large open plan, light-filled space in the main part of the clubhouse by using a steel portal frame that sits on a post-tensioned slab with concrete beams beneath that sitting atop concrete piles driven into bedrock. Big sliding doors arranged in a symmetrical fashion embrace the harbour views and open out to the east-facing deck. Tawa floors (40mm) thick also hint at the building's heritage. Upstairs is the tower or racing loft and a committee room that was used as a discreet social room in the days of tough licensing laws. "Races used to be started up in the racing loft using a sawn-off shotgun firing blanks," says Martin, who began sailing at the club as a six-year-old and later had a stint as commodore.

He says his father's original design has been changed slightly over the years with a boatshed being added out the back and the kitchen moved into the corner of the room to make the downstairs space more usable for hireage for social functions such as birthdays and weddings – a big part of the club's revenue stream.

"The kitchen was in the middle of the building facing the sea because the mothers and wives were a big part of the club," says Martin. "My father's idea was that they could see the starts and finishes from the kitchen and look around the corner and see their children out on the course."

While the clubhouse's position helps members to keep an eye on events out on the water, it also means the building is exposed to the elements and needs regular maintenance.

Present commodore Matt Hall-Smith says the club has developed a phased programme for renovating the clubhouse and that included replacing the roof recently.
"The building was leaking and we had run several working bees to patch up the roof iron but it had rust holes in it," Matt says. "We were starting to get water coming down the walls and that put us in a bit of tricky position."

Luckily, The Trusts came to the rescue with a grant to replace the roof – part of the valuable support they have provided to the club over the years, which has included supplying it with rescue boats.

Dimond recommended Paton roofing to the club as an installer they should bring on board to discuss how to tackle the removal and installation of the roof.

Grant Gilmore, manager of Paton Roofing, says the roughly 30-year-old 0.55 galvanised Dimond Styleline was removed and replaced with Dimond Styleline 0.90 ARX in lengths of up to 12.5m fixed with the help of Aluminium Alutite self drilling screws with profile washers and epdm seals.

Above: The new Dimond Styline 0.90 ARX roof.
Below: After 30 years life span the Dimond galvanised roof shows the effects of a very severe salt water environment.

"We pretty much replaced like for like, except this time aluminium was used instead of galvanized iron," says Grant. "Lots of flashings were rusted out and so were the ends of the roof iron over the eaves - the usual places."

Matt Hall-Smith says as well as a re-roof, the clubhouse is being repainted and having rotten weatherboards replaced.

He says the club is hoping to secure a long-term sponsor so it is not so reliant on hiring out the clubhouse for functions.

Brian Northcott

After enrolling for a degree in architecture, Brian Northcott withdrew without completing the course due to a lack of funds. Instead, he spent years doing draughting work in Wellington before he came to Auckland to work for Rigby Mullan. In order to take up a partnership in the practice he had to return to university and complete his degree. Most of his work with the firm was commercial – the Reckitt & Coleman factory in Rosebank Rd, for example, and jobs for Kerridge Odeon cinemas. He also did residential work, including designing the family home in Titirangi, which, his son Martin says was based on the Bauhaus aesthetic due to Brian's modernist training and inclinations. Brian, who is now deceased, worked at Rigby Mullan – which became Rigby James following Tony Mullan's death – until he retired.

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www.patonroofing.co.nz

Manufacturer: Dimond
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Roofing: Dimond Styline 0.90 ARX
Colour: Kestrel

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