ISSUE 20

SCOPE

NZ METAL ROOFING MANUFACTURERS INC.

Below is a brief introduction to the 2008 executive of The NZ 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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Visit our website at:

www.metalroofing.org.nz

SCOPE

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NZ METAL ROOFING MANUFACTURERS INC.

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

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A TRIBUTE TO AUSTRALIAN DESIGN EXCELLENCE

Steve Cooper, Gerard Roof distributor in Queensland, was ecstatic to learn that Mali Mali Private Villa, designed by internationally acclaimed and multi award winning architectural designer Chris Vandyke, was awarded" Australia's Best House," by the Australian Master Builders Association and also won "Queensland's Best House in 2008."Mali Mali is an example of the exceptional design flair where Vandyke brings the best of Tropical Asian and Mediterranean design influences together to create a truly distinctive Australian style.

Nestled atop Mount Somerset, its magnificent vantage point allows for a 360 degree panoramic vista. When arriving or leaving by Helicopter from the landing pad to the rear of the nest, one can experience the majesty of soaring like an Eagle into a vast landscape of unparalleled beauty.

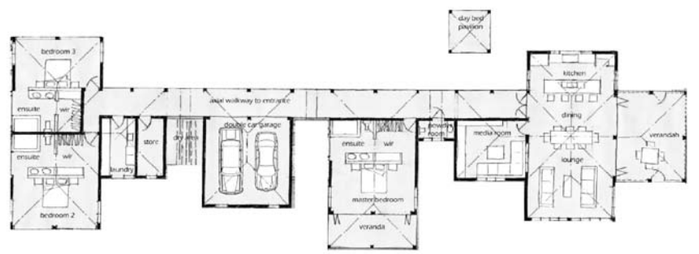
The name Mali Mali is an Aboriginal word meaning “Butterfly”. Mali Mali is the right name for this home. It’s a home that is sensitive, intimate, delicate and stunningly beautiful in an incredible natural environment.

Mali Mali is strategically placed to take full advantage of views. Views that extend from the Daintree National Park to the West, Cape Tribulation and Snapper Island to the North, East is the Coral Sea and great Pacific Ocean and to the South, can be seen Port Douglas. Prevailing wind direction, orientation to the suns position and working with the environment provide a practical and comfortable living space for its owners and guests. Amenities such as tennis court, helicopter pad and garaging have been located with care and attention to orientation and live-ability.

The home, a pavilion type arrangement, consists of an entrance pavilion, living pavilion, master bedroom pavilion and a guest pavilion all connected with a timber rafted spine alongside a watercourse. Mali Mali combines the best of Tropical design with the traditional Queensland vernacular of the veranda, defining a distinct, emerging North Queensland style. Rich natural timber posts and walls, and dark grey nonreflective metal tile roof complement the natural earthy tones of the rendered block walls.

The entrance, a day-bed pavilion, crosses the plant filled watercourse. Green tree frogs inhabit the foliage and bounce about during the night catching their evening meal.

The living pavilion, the jewel in the crown, marks the entertainment wing of the house. It consists of an open plan kitchen, dining and living area with an adjoining media room. It’s a masterpiece of handcrafted workmanship. The timber raftered and clad ceiling exemplifies the traditions of South East Asia and has become its own tradition here in tropical North Queensland.



Immediate access is gained onto the terrace where dining can be enjoyed in the balmy tropical days and nights. The pool, with wet edge, feels as if it cascades into the Coral Sea and Pacific Ocean beyond. A pool with a view during the day, but at night, the atmosphere changes and it’s as if one is floating in mid air.

Privacy with views is always hard to achieve, but here at Mali Mali, because of the topography, it is possible. Each of the bedrooms extends out into their own private courtyards, each with a spectacular view. Low height rough dry-stone walls and sensitive native planting bring the surrounding greater landscape within reaching distance. The bathrooms too extend out into the environment and allow its visitors to enjoy the sensuality of outdoor bathing in the warmth of the tropical climate.

Each of the pavilions exudes style and warmth with the use of natural stone floors, timber exposed rafters and ceiling linings. Each uses the raked ceilings to create a valuable lofty volume.

The local climate in Miallo, North Queensland is warm typically experiencing high humidity, with a stable average temperature range of around 32 degrees Celsius. It has a high rainfall for three to four months during the wet season and long periods of dry sunny weather throughout the remainder of the year. Cyclone conditions are possible. The designer consulted local climatic data and surveyed the site extensively to be aware of and utilise those factors favourable to passive environmental design.

The building site area was selected to have minimum impact on the local site environment and to maximise views. The chosen building pad was on a flat area of the site, cleared by previous owners. This reduced the impact on the precious ecology.

The designers choice of a Gerard Roof indicates, to Steve Cooper, an acceptance of the Gerard brand in a very competitive market that traditionally has been dominated by concrete roofs. " The focus of design being large open areas suits our lightweight products and offers an aesthetic point of difference," says Steve." Mali Mali is an exceptional example of architecture and to have been associated with this project and a designer of the calibre of Chris Vandyke has been a rewarding experience."

The client ,Peter Denman, enjoyed the process of briefing Chris Vandyke Designs, being involved in the entire decision making process and watching the construction stages on site. Since

completion they have enjoyed the spectacular living arena with family and friends. Whilst Mali Mali Is designed as a family retreat it is also available as a premium luxurious holiday retreat for up to eight guests. This seclude location is ranked as one of the best in Australia offering absolute privacy, seclusion, luxury and confidentiality.

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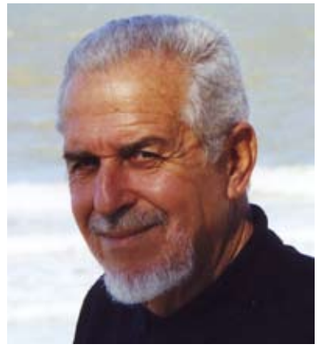
Profile: Gerard CoronaShake
Colour: Charcoal



Chris Vandyke Designs

Winner of 5 National and 14 State designs, Chris Vandyke Designs specialises in open plan buildings that draw inspiration from Tropical, Asian and Mediterranean influences creating a distinctively Australian style.

Chris Vandyke is passionate about creating low impact buildings with a small environmental footprint, utilising passive solar design, shading and environmentally sustainable materials.

The focus is on indoor/outdoor living with an emphasis on water features. Working in close consultation with clients the outcome is a functional and livable internal environment that eliminates the need for mechanical heating and cooling.

His wide ranging experience encompasses the design of resorts, luxury homes, beach houses, residences, hotels, schools and cultural centres.

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TURN POINT LODGE

The brief to Hugh Tennent, architect and senior designer at Tennent and Brown Architects, posed some rather interesting and unusual parameters. The first was to provide accommodation for two brothers allowing private spaces for each and the second was the remote location with the most direct access being a 40 minute boat ride through Marlbourgh Sound.

The design brief required that each of the occupants would have a separate bedroom, a study and a bathroom. These areas would provide privacy but be connected to the central pavilion with shared kitchen, living room and dinning areas. The communal building sits parallel to the water front below with panoramic views of the Sounds and mountainous terrain. The variable, and sometimes blustery, sea breezes required the extension of generous decking spaces to allow sheltered outdoor options depending on the wind direction and to capture both the morning and evening sun. A great deal of attention was given to landscaping the spaces between the buildings with terraces, decking and the retention of existing trees.

The hillside site for the project overlooks a remote area of the Marlbourgh Sound which has no access to any facilities. In this idyllic location preservation of the natural environment was paramount and the potential use of any heavy machinery was very limited.

These criteria inspired the solution, to create three towers which would reflect the individual quality of the private spaces. Each module was to be built off site and air lifted to the location.

Upper level of the accommodation towers

Turn Point Lodge, named after its location, is used by the owners as a retreat during the year but predominantly during summer months. The intermittent use of the retreat and the separation of the accommodation and communal facilities made the use of solar energy impractical. Electricity is made on demand by a diesel generator and to minimise the use of electricity photo voltaics and gas are used for water heating and cooking. Rainwater is collected from the roofs of each module and a biolytix septic tank system is installed which suits the dormant and long periods when the lodge is not occupied

The three building units and sub-floors were built off-site at Mahikapawa by David Kepes of Timbercraft Construction. Building the units off site meant careful consideration had to be given to every detail particularly as the helicopter had a five tonne load capacity. The marine environment and wind load considerations meant each of the units had to be

kept to a weight not exceeding 4.5 tonnes and had to be able to stay structurally rigid during the lift. The two accommodation units where constructed in there completed form but the communal building (because of size and weight) was created in two halves and winched together once landed on the sub frames.

The completed complex is 114 sq.metres and clad and roofed in ColorCote® ARX™ pre-painted

aluminium which is a strong, lightweight, corrosion resistant and low maintenance system well suited to this salt spray environment.

Tennent and Brown Architects

The Wellington based practice of Tennent and Brown Architects was formed by Hugh Tennent (Formerly Hugh Tennent Architecture) A graduate of Auckland University School of Architecture in 1985 Tennent was made Fellow of the NZIA 2001.

The practice has a history of award winning projects across many sectors, with a focus on residential, public and community projects such as education, religious and sporting facilities. Tennent is a lecturer in sustainability at Victoria University and Tennent and Brown are currently architects for the $40 million Wellington City Council Indoor Community Sports Centre.

Sharon Jansen

Jansen joined Tennent and Brown Architects in 2004 as project Architect and senior designer principally involved with the practice's residential work. Jansen graduated from Auckland University in 1985 and has spent 9 years working overseas in Australia, Singapore and France as both architect and Interior designer. Jansen has been a teacher and critic at both Massey and Victoria University and has served as national and regional juror for NZIA Architecture Awards.

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Helicopter Lift:
Grant Biel.
Heli Harvest Ltd.

Builder: David Kepes.
Timbercraft Construction.

Roofing & Cladding Manufacturer:
Dimond Industries.
Telephone: 0800 346 663.

Roofing & Cladding:
ColorCote® ARX™
pre-painted aluminium.
Colour: Ironsand.

CRADLE TO CRADLE: THE LIFE CYCLE OF STEEL

By Graham Hepburn

Building sustainably is a hot topic both locally and internationally but when it comes to choosing materials, it's tough to work out what is truly the "greenest" option.

It's like trying to compare apples with oranges. Take roofing for example: steel roofing is considered a good environmental choice although some people are put off by its high embodied energy – that is, the energy required to make it. But when you do a life-cycle analysis – a cradle to cradle study of a product – steel's average embodied energy is greatly reduced because of its ability to be recycled endlessly, but this is only part of the picture. Not only is a steel roof durable – a well maintained steel roof should last 50+ years - but when a roof needs replacing, the old one can be melted down and re-used in other steel products.

And that is one of the huge environmental advantages of using steel. It can be recycled forever without any worries about product degradation, what is known as "downcycling", when a material is recycled into an inferior product. Products that lose their original properties when recycled include some types of wood, which can be chipped, and glass, which can be turned into insulation. Plastics for example can be recycled but when they are, they produce an inferior and less valuable product. The fact that steel can be recycled endlessly and flawlessly makes it a valuable commodity backed by a well-established infrastructure for the recovery and reprocessing of scrap metal - and markets for it worldwide. And that means it is not ending up in landfill like other waste or demolition building materials, where products such as wood emit CO2 as they degrade. The recovery rate of steel from buildings is estimated at 85% and a recent report on commercial construction waste found that more than 90% of steel was recycled.

Steel is the most recycled product in the world and was one of the first to be recycled because it is easy to recycle – all you need is a magnet to help separate it from other waste. Worldwide more than 370 million tonnes of steel scrap are recycled each year, more than paper, aluminium, glass and plastic combined.

Steel might be the most recycled but all metals used in roofing such as aluminium, copper, zinc and lead can be fully recycled and are valuable.

Scrap metal is a vital part of the process for New Zealand's two steel-makers. Pacific Steel, a division of Fletcher Building, makes all its steel from scrap. New Zealand produces about 500,000 tonnes of scrap metal a year. Pacific Steel uses about 300,000 tonnes of that to make products such as reinforcing steel and wire, with the rest of the scrap metal being exported.
New Zealand Steel, which makes around 600,000 tonnes of steel a year, has an average recycled content of about 12% in its products. New Zealand Steel manufactures coil and sheet for use in building cladding and other industries. The coil may be metal coated with zinc – commonly known as galvanized steel – or a combination of aluminium and zinc (Zincalume®) and may be painted on its own coil coating line to produce Colorsteel® or trucked a small distance to an independent coil coating line (Pacific Coil Coaters) to produce ColorCote®.

As well as providing a source of feed in this process, scrap metal is used to control the temperature generated by the chemical reactions in the furnace.

Recycled steel can be made by using as little as 25 per cent of the energy it takes to make virgin steel and that doesn't take into account the savings in terms of mining, transportation, landfill and greenhouse gas emissions.

The American Institute of Architects' Environmental Resource Guide says that each tonne of recycled steel saves 1100 kg of iron ore, 600 kg of coal, and 50 kg of limestone. The AIA also states that every kilogram of steel produced from recycled sources rather than raw materials saves 12.5 MJ of energy, 86% less emissions to air are produced; 40% less water is used; and 97% less mining waste is created.

And it's not just the steel that's recycled. At New Zealand Steel's Glenbrook plant the large quantities of slag generated by the steel-making process are sold for use in products such as road surfacing or for drainage and filtering. Huge amounts of water – around 1 million tonnes a day are needed to make steel but that is also recycled – cleaned, cooled and recirculated so that so that only 1% of it is discharged and what is discharged is clean enough to drink.

Even the waste gases from the kilns used in the steel making process at Glenbrook are recycled in a cogeneration plant that produces up to 70 per cent of the electricity used on site.

Unlike other steel makers, who use iron ore, New Zealand Steel uses iron sand from Waikato North Head not far from Glenbrook. And even these sands are recycled. When the iron sand is removed, which makes up about 25 per cent of the excavated sand, the rest of the sand – or tailings - is returned to where it was extracted. Marram grass is planted to stabilise it and when that takes root, pine trees go in.

Whether steel products are manufactured from virgin or recycled steel, it's important for environmentally conscious specification to remember that the two processes are mutually dependent. Given that all recycled steel products once came through the primary manufacturing route, it's not simply a case of specifying recycled steel products to benefit the environment. Green building tools need developing to enable specifiers to easily select steel products – whether they are manufactured from virgin or recycled steel – from best practice manufacturers.

The properties of steel combined with market driven demand for scrap steel give rise to an enviable end of life product stewardship programme,

When you look at the big picture, steel is one of the most sustainable building products on the planet.

SUN SAND AND SEA

Few beach front properties, like this home on Auckland's North Shore, offer these spectacular panoramic views of the Hauraki Gulf and Rangitoto Island. This unique location has unimpeded access to the sea wall and beach that is about 5 meters from the front of the house.

When the Schofield's purchased the property their vision was to modernise the building that begun it's life as two units that were later converted into one home. The brief to Bill Dodds, architect, was to create a home which would take full advantage of the location, provide spacious entertaining facilities and guest accommodation and provide a secluded living space for their teenage son. Like many seaside locations the site is exposed to the south easterly sea breezes and protection from the elements was crucial. The close proximity to neighbouring properties, that over looked the home, was also to be considered to allow private access to garage and utility areas.

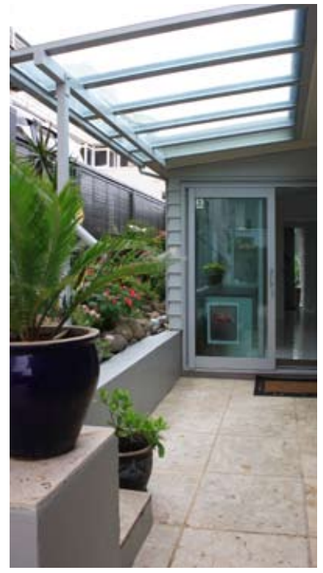
" The exterior of the home was in poor condition," says Bill Dodds. " Much of the wall cladding had to be replaced and the building was in desperate need of a roof replacement. The existing roof had endured years of salt air and repairs and was no longer weather proof."

The redesign of the internal layout and decore of the home was only part of the project. Many aspects of the exterior required urgent attention. In particular the roof had taken a "hammering" and the years of patch-ups and repairs had taken their toll.

The Schofield's sought advice from Metalcraft Roofing, Auckland.

The roof design is relatively basic however this belies a number of complexities that are inherent when choosing a suitable roofing product. The roof pitch is 10 degrees and whilst Metalcraft Corrugate or MC760 would have been suitable it was decided that MC760 would be more appropriate from the perspective of profile performance.

A wide range of material finishes were discussed but ultimately, in consultation with Metalcraft Roofing, Ray and Cherie settled on 0.55mm COLORSTEEL® Maxx™ Ivorie. Typically residential homes use 0.40mm however on this occasion 0.55mm was recommended. The primary reason was that the roof has easy access from the drive, the home is surrounded by Pohutukawa trees, which drop many leaves, and it is very visible from neighbouring properties and the drive way. This combination meant cleaning the roof was not only made easier but was also necessary, increasing the foot traffic and potential for damage. The heavier gauge made practical sense.



Upgrading the main entrance, which is at the rear of the house in relation to the beach, created a clearly defined and welcoming entrance way for the home. Internally, many changes were made to enhance the living spaces and take advantage of the views. The "state of the art" kitchen provides a central hub for entertaining and flows naturally to the open areas of the dinning room and lounge.

The open plan area creates a feeling of light and space with direct access to the beach and views of the Hauraki Gulf. The blurring of indoor /outdoor space provides an enchanting private area for either relaxation or entertaining guests. The main lounge and dining areas highlight the design flexibility achieved by using longrun metal roofing that is lightweight, providing the strength and span required. The importance of this attribute contributes to the overall success of the final open plan layout and design. On the upper level some structural changes have been made to accommodate the new entrance and to include an ensuite to the master bedroom. A centralised gas fire place was also installed to efficiently heat the upper level.

Alterations were also made to the downstairs living area, which also included the upgrade of the existing stairwell. A glass balastrade creates a unique feature connecting the upstairs and downstairs living areas. The living space downstairs has been renovated with a self-contained kitchenette, lounge, theatre and IT facilities.

With careful consideration, colour, materials and decore Ray and Cherie Schofield have illustrated the potential to breathe new life into a seaside property.

Architect: Bill Dodds
Auckland.
Telephone : 021 864 680

Roofing Maunufacturer and Installer:
Metalcraft Roofings
Auckland.
Telephone: 0800 ROOFNZ
Profile: MC760 0.55
COLORSTEEL® Maxx™
Colour: Ivorie

Metalcraft's new website makes it easy

There is always a decision to be made on the correct product to be used on any given project There are several important aspects to be considered to ensure the correct product is specified, even for roof plans that appear relatively simple.

The Metalcraft Roofing website has all the information that is required in order to select the most appropriate profile and material finish.
Roofing span is dependent on multiple factors which are: Profile type, profile gauge, fixing pattern, profile washer usage, wind zone. The Code of Practice Version 2 deals with determining the environmental factors as well as answering the above questions in section three. Within the section Corrugate, Five and Six Rib Trapezoidals, commonly roll formed by all manufacturers, are covered. The Metalcraft Roofing website presents it's profile specific Uniformly Distributed Load (UDL) spans in this manner. This has been done so for each profile with "Data Sheets" covering all profile specific performance such as minimum pitch and cover width.

COLORSTEEL® Maxx™ (used on the Schofield project) is produced by New Zealand Steel and specifically designed to handle New Zealand's tough coastal environmental. COLORSTEEL® Maxx™ is suitable for ISO environmental categories 4 and 5. Technical information on all products is available from Metalcraft Roofing by contacting your local branch on 0800 ROOFNZ or can be downloaded from the warranties section of the Metalcraft Roofing website at www.metalcraftroofing.co.nz or the New Zealand Steel website at www.nzsteel.co.nz.

Professional training starts out with theory and ends up with practice, after all we would rather our doctor or architect did not practice on us first. It seems that trade training is now the other way around.

The mixture of theory and practice is what we term experience. That's why we called the COP ' a living document'.

One that will be updated and changed in the light of experience.

The NZMRM Code of Practice has become the basis for theoretical and practical roofer training, now made even more accessible by the publication of the V2 CD.

Revitalized trade training includes a new ITO curriculum for training to National Certificate level based on the COP and placing greater awareness on knowledge.

One of the reasons for discussing this refers to section 7.11. in the COP. FIXING ALUMINIUM SHEETING. Currently under review.

AVOIDING THE PROBLEM IS EASIER THAN FINDING IT

Stuart Thomson, recognised for his vast knowledge on the use of metal and principle author of the COP illustrates the benefits of using the COP. How it can save endless hours in tracking and solving problems that should just never happen with "best practice". As illustrated the time and cost involved in finding and rectifying problems is huge....but aviodable.

Aluminium does not rust and so the issue is tracing the cause of corrosion on some aluminium sheeting. I was asked to do a Crime scene Investigation into why a roof was leaking because no one could find the culprit..

Murder mystery stories are popular. The reason is the intellectual capacity needed to analyse the evidence, weight it for importance, look for the unusual, in other words 'get clued up'. The situation of leaky buildings, leaky roofs, or noisy roofs is very similar.

There is the victim (the building), the crime (the defect), and a long list of suspects - the design, the materials, the installation, the construction details, and the environment.

The solution is arrived at by gathering information. This is the theory part. Then there is the process of elimination and deduction. This is the experience part.

In the course of this process a number of things have to be kept in mind:

- Forget what other people say and even your own first impressions. A problem must not be approached with preconceived ideas.
- All the defects may not come from the same cause.
- Information that is given must be treated with caution and must always be checked
- Don't jump to conclusions- a crack is often a symptom not the cause.
- Construction drawings should not be accepted as a true representation of the actual 'as-built' construction.
- It is just about impossible to ascertain the facts without invasive investigation. You have to take the roof or wall off

There have been many instances in the 'leaky homes' syndrome where faulty or inadequate diagnosis has resulted not only in the problem not being effectively resolved but where inappropriate action has aggravated the situation.

Recently a WHRS inspector hired a high pressure water-blaster because he could not find the leak! (It was condensation)

The CSI example:

The Brief : *A corrugate painted aluminium roof leaking after 15 years.*

The facts: *Building: Two-storey residence with multiple roofs, the majority being skillion with a roof pitch of 26^{0}.*

The Site: *A very exposed sea-coast site in Wellington across the road from breaking surf*

The Design: *Laid in accordance with the architects plans and specifications*

The Roof: *0.7mm corrugated PVF coated aluminium roof, fixed with stainless steel annular groove nails, laid at the end of 1991.*

The Underlay: *'Non-breather type' on galvanised wire netting support.*

The crime: *Small perforations in the valleys of the corrugate profile approximately 200mm and also 700mm from the bottom end of the sheeting.*

The Installation: *Supplied and laid by a company no longer trading.*

The Evidence: *Areas worst affected were at the gutter line and adjacent to a flat roof.*

The Investigation: *Photographic record of roof sheets, underlay and, wire netting removed, samples of all of these were taken for analysis.*

The Detailed analysis:

Sheets - underside of sheets showed pitting which when viewed under magnification provided evidence of a pattern pitting that originated from the underside. The laps were also pitted.

Netting - the wire netting was severely rusted and had totally disintegrated in the roof end/gutter area. The aluminium was more seriously attacked where it was in close contact with the galvanised wire netting which had corroded to red rust.

Underlay – totally disintegrated and delaminated in the affected area. Damp to touch in the upper areas.

Ventilation – No air gap under underlay, purlins were cut-in between the rafters and insulation placed between them hard up to the underlay; ventilation was inhibited.

Eave - open ends of profile at the eave, which allowed air access to the underside of the profile. Some sand had been driven up underneath and accumulated at the profile valley which could also retains salt and can cause abrasion.

So now we have the facts of the matter – the clues, we have to put the theory and practice together and use the deduction process to find out what went wrong. It is easiest to work backwards.

The small holes on the valleys of the profile were all pits but only at specific points. The points coincided with the cross-over of the wire netting – the point of contact where the wire netting had lost its galvanised protection and rusted away. The reason for the rusting of the wire was the salt laden air which had access to the underside of the sheeting because there were no baffle flashing to prevent it entering the ends of the corrugations. Aerosol salt is one of the most corrosive contaminants that the building industry has to contend with. This specific environment corresponded to ISO 9223 and AS/NZS 2728: 2007 Category E Very High, Marine – beach front and surf beaches but can extend inland several hundred metres - formerly AS/NZS 2728: 1997 C5 was Very Severe Marine 0-400m from surf and offshore.
No 1 suspect – salt.

If you are not technically inclined then you can cheat and turn to last page and see who really committed the murder, or else you could bring up the COP. Excerpts from the COP are in italics.

2.4.3.
For corrosion to occur at all there has to be moisture or an electrolyte present ....

Electrolyte: A solution such as water that contains ions, thereby becoming electrically conductive.

2.4.7. Galvanic corrosion acts in a similar way to the process of electroplating....

2.4.8.
Moist air, absorption or thin water films or condensation all can...

A continually moist surface on the underlay and the underside of the aluminium roof sheet.

Why did the underlay remain wet?
No 2 suspect – 'time of wetness'

4.6.
The amount of ventilation required for domestic, commercial and industrial buildings should be.....

Truss construction with flat ceilings and an attic have a relatively large volume of air compared with skillion roofs which are well known to inhibit ventilation.
No 3 suspect - no ventilation

All underlay underneath metal roof and wall cladding requires three properties – absorbency, permeability and water resistance. The underlay used on this job was not permeable.

4.3.
The purposes of an underlay as referenced in this code of practice is ...

NZS 3604: 1990 (current at the time of installation) required the use of permeable underlay and it was well known that a permeable underlay was required under all metal roof cladding

It can be deduced that the underlay did not comply with the NZ Standard and also that the technical literature was incorrect as it was not 'clearly presented' or adequate as required by NZS 3604.
No 4 suspect – wrong underlay

The amount of salt within the roof cavity was visibly obvious and the sheeting was 'crunchy' to the touch. A large amount of contaminated air entered via the open area of the corrugations, being 50% of the area of the profile. Plastic spouting was lower than the bottom of the corrugations whereas a high fronted spouting would have inhibited air entry.
No 5 suspect – open ends of profile

Some pitting was also observed at the spouting line where a 'chimney' gap was seen behind the plastic spouting. This has proved to be the entry point for salt contaminants to the underside of the roof on other sites.
Plastic spouting brackets allow a clearance which can cause corrosion irrespective of any underlay than might be used. This problem is a design issue that can be overcome by using an apron flashing which can become a sacrificial flashing to protect the roof cladding.

This is detailed in COP 5.3.5.4 Where the ends of roof cladding are exposed to contaminants such as sea salt or industrial pollutants it is better practice ...
No 6 suspect – no apron flashing

ARX Aluminium cladding is now promoted as being suitable for very severe marine so why corrosion pitting? The coating used at the time was Colorcote® 8000.

Both Zinc and Aluminium provide cathodic protection to steel and where the underlying steel base becomes exposed at cut edges, holes or mechanically damaged areas, the zinc coating will corrode in preference to the steel. The ability of a hot-dipped zinc coating on steel to protect it against corrosion is known as sacrificial or cathodic protection because the cathode metal (steel) is the one protected.
The three components required for corrosion to occur, (known as the corrosion triangle), are the anode, cathode and the electrolyte. In this case the underlay was acting as the electrolyte as it was almost continually wet either by salt contamination or by condensation from within the cavity.
The wire netting was galvanised but once the zinc had eroded or corroded away the aluminium would become the anode and attempt to provide 'barrier and cathodic protection' to the steel.

Aluminium does not 'rust' but will pit due to electrolytic action.

COP 2.6.2. Pitting Corrosion Pitting corrosion is a form of highly localised corrosive attack that occurs in.....

Because we have a number of suspects, all with evidence against them, it is reasonable to deduce that there is a gang at work and together they committed the crime. Individually guilty – maybe not, but collectively, yes.

Verdict.

The following conclusions can be reasonably drawn from the evidence presented.
The corrosion of the aluminium roof cladding has been gradual since its installation 15 years ago but has accelerated recently. The deterioration of the aluminium roof cladding was caused by a number of separate but inter-related factors.
The corrosion mechanism at this site was divided into several steps. First the saturated underlay provided the electrolyte by being continually wetted by condensation and salt, and the passive oxide film was dissolved due to the interaction with the rusting steel wire netting.

Secondly the aluminium sheeting reacted strongly and created a pit, the bottom of the pit being the anode and the top of the pit being the cathode. The corrosive cycle would have then proceeded according to the electrochemical reaction described.

The corrosion of the galvanised wire netting was not the only reason for perforation as the side laps were also badly pitted but it did provide areas that were more seriously attacked where the red rust at the wire cross-over and the aluminium were in close contact. The underlay contributed to the corrosion by retaining the condensation and salt water vapour to remain wet and due to the 'time of wetness' provided the moist contact required for corrosion. The underlay was unsuitable and it should not have been used as a roofing underlay as it was not permeable.

The design combination of skillion roof and 'cut-in' purlins inhibited any ventilation which would have occurred had there been an air gap between the underlay and the fibreglass batts.
It is significant that the stainless steel fixings have shown no signs of deterioration or halo around the hole. They were driven without any clearance hole. There was no sign of leakage around any of the fasteners.

The design faults have been identified and the obvious choice would be not to use wire netting or use open profiles.

Not long after this CSI, two members of the NZMRM technical committee, Rod Newbold (Steel & Tube) and David Bullock (Dimond) and Tim Rutt of Pacific Coil Coaters, visited several other properties with similar complaints.

What they found were common factors between their sites and the one quoted.
- Very Severe Marine environment
- Wire netting support.
- Corrugate profile
- Corrosion near to the gutter line (in one instance there was no lining on the verandah eave which had netting and underlay!

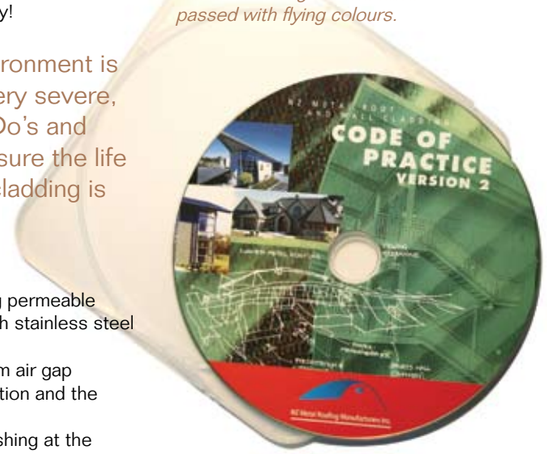
When the environment is regarded as very severe, the following Do's and Don't's will ensure the life of metal roof cladding is prolonged.

DO USE:
- A self-supporting permeable underlay and fix with stainless steel staples.
- A minimum 20mm air gap between any insulation and the underlay.
- An eave over-flashing at the gutter.
- A high fronted spouting or baffle flashing at the eave to prevent the entry of salt laden air.
- An extruded polystyrene batten to provide an air gap, with the underlay under the batten.
- A secret-fix profile instead of corrugate
- Aluminium window tape as an isolator over wire netting if the pitch is under eight degrees.
(see also COP 4.3.11.)

DO NOT USE:
- Galvanized wire netting (or safety mesh) as an underlay support.
- Skillion construction without additional provision for ventilation.
- 'Cut-in' battens without an extruded polystyrene counter batten to provide an air gap, with the underlay under the batten.
- Copper treated timber in direct contact with the roof cladding, in very severe environments, even with an underlay separation.

NZMRM are conducting an extensive test programme with Aluminium profiled sheeting using different fasteners and different fastening patterns. The results will update the COP and be posted on the NZMRM website.

What we can say at this time is that oversize holes are recommended (which means using load spreading washers) and that the new aluminium fixing screws have passed with flying colours.



The Code of Practice is specifically designed to assist in avoiding these and many other issues. For further information about the COP V2 please contact Julie Brough.
julie.brough@ema.co.nz
Telephone 09 367 0913
Fax 09 367 0914
or visit our website to download a copy www.metalroofing.org.nz

PCC have published a technical bulletin which addresses the correct procedure for ColorCote® ARX™ and AR8™ Roofing – Protection of Underside of Sheet Edge at and below First Purlin. Bulletin 1.
For a copy please contact: Tim Rutt or Rob Armstrong
0800-ARXZRX or 09-5799199

Gary Pidd Architecture Ltd.

Gary Pidd established the firm, Gary Pidd Architecture Ltd, in 1989. With a staff of 5 the practice prides itself on the personal aspects of client relationships which help establish clear design parameters. Gary's design philosophy is based on satisfying the client but also pushing boundaries a little so that the spaces are interesting as well as comfortable. He values good planning, cost management, form that follows function for liveability, workability and comfort. And he's a fan of using cutting edge technology to achieve these results.

Like any medium practice in New Zealand their portfolio ranges from commercial to residential projects from schools and churches to hospitality venues and homes. What is important to Gary Pidd, and the most rewarding, is to create architecture which is fun, bright, colourful and friendly with careful attention to the environmental aspects of the design.

Following are two examples of Gary Pidd's work showing a diversity of design flair tailored to meet the individual briefs of clients with different ideas but similar objectives.

THE CIRCLE OF LIFE

Te Kura Kaupapa Maori O Te Ara Hou. Napier

By Graham Hepburn

Napier architect Gary Pidd had done a lot of work for schools over the years but had never designed one from scratch. So when he was asked to design a new home for a Maori language immersion school, Te Kura Kaupapa Maori O Te Ara Hou, he leapt at the chance. As Gary explains, "The school had set up about 10 years prior to us getting involved but it had no real home; it was using vacant schools as a base."
When the former Wycliffe Intermediate School became available in a suburban part of Napier, the plan was initially to use the existing buildings but the discovery of asbestos meant the site had to be cleared and the school built from the ground up.
This gave the school and the parents a chance to express cultural aspects that were important to them in their new school.

Some of the key features were having the waharoa (gate house) facing east for the rising sun. And the entry to the whare (central meeting house) also needed to face the waharoa for powhiri (greeting).
The school also wanted to emphasise the concept of children entering the kohanga reo as babies and journeying around the school to leave at year 13 as young adults.
While creating a sense of community was important, the school still wanted the various age groups to have their own distinct spaces.
The school also wanted the central whare, rather than being a formal meeting house, to be a whare matauranga (house of learning).
"They didn't want a formal meeting house because of all the Maori protocols that came with that," says Gary.

The concept of a circular building came to Gary in the 10 minutes it took him to drive home from a brainstorming meeting with all those involved with the school. He roughed out a sketch once he got home and that formed the basis of the final design.
At the centre of the circular design is the whare matauranga, reflecting its importance to the school.
Because the building could not turn its back on any part of the school, it had to have four fronts.

One of these faces the waharoa for formal welcoming, and there is one entrance for the junior, middle and senior schools. This design reinforces the circle of life at the school and allows the building to be opened up on all sides when it's used as a community venue.
To the north of the waharoa is the kohanga reo so that children enter the school as babies and then move around the circle of learning until they come out at the south end as young adults.

The smallest children are also in the safest place as they are nearest the Whanau room and furthest from the road.
Walkways between the classroom blocks provide a sense of separation and allow access to the play areas at the rear.
"The school wanted to encompass all these age groups but not mix them all up," says Gary. "At the same time, the next class you go to is next door and you can see across the circle to where you will end up."
Gary says the sense of enclosure provided by the circular design gives the students a feeling of togetherness and safety. It also helps that the whanau room is in a prime spot to oversee day-to-day events in the inner circle and this helps to keep the students on their best behaviour.
"It is noticeable how quiet the children are inside the circle versus outside in the playgrounds," says Gary. "You want the building to do a lot of the work for you."
The whare matauranga has been designed as a bold, vibrant building with good acoustics where the children can express themselves in song and dance. It's also used for meetings but the school didn't want any technology in there.

When it came to discussing construction materials, Gary says the school weren't interested in going overboard on native timbers; they wanted to use materials normally seen in schools but treat them in an innovative way.

Longrun COLORSTEEL® was a logical choice for the roofing and with the help of computer technology, Gary was able to work out how to fashion the curved roof of the buildings and the covered walkway that connects them to form the circle. Tapered cap flashings – 10.6 tonnes in total - allow the runs of COLORSTEEL® to form the curve. More than 10,000 linear metres of COLORSTEEL® was used to roof the school's various buildings.

The circle might be the dominant feature of the design but there are also other motifs included of significance to the school. They wanted to reflect their history of being people of the river plains so the buildings give the illusion of growing out of the ground due to the river stones plastered into their walls. The inclusion of the school crest of crossed paddles was also important and is signified by the paddles at the cornerstone to each building.
Gary says the school asked him to design the layout so that eight more classrooms could be added to the original 12 as the roll expanded. These additional classrooms would form part of an outer circle and so far four more have been built.

"We tried to future proof it so all the services run outside the circle," says Gary. "If you want to add another class on then you just plug them into the services in the trench."
The school's unique design is not only functional but is also a source of pride among students of all ages.
"The kids are pretty pleased," laughs Gary. "They say they've got the biggest indoor track in the whole country."

The challenge was in installing a square flat roofing profile on a curved roof with an inner radius of 36m and an outer radius of 49.5m. The guttering was cut into 1m segments, then fixed to a curved fascia using external brackets.

Architect: Gary Pidd Architect,
Telephone: 06 844 0223

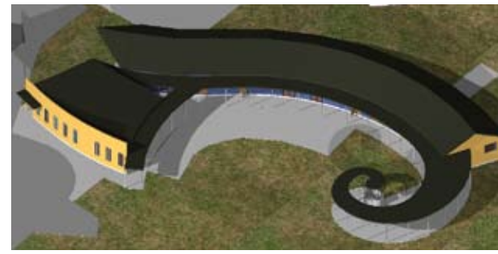
Building contractor:
Atkin Construction,
Telephone: 06 843-4925

Roofing contractor:
HB Longrun,
Telephone: 06) 843 6159.

Roofing profile: Steel&Tube
Kliplok trough section
Flashings & Guttering: 125 x 140
Box guttering, fixed in segments to curved fascia.

Product: COLORSTEEL® Endura
Colour: Storm Blue

BUILDING A LEGEND



The concept was presented to the Board of Trustees as a 3D model allowing them to view every aspect of the building. Since completion they have been impressed by how accurately the model had portrayed the final building.

Gary Pidd is the first to acknowledge that transferring the idea from concept to reality was no simple task. “Without the use of CAD we could not have worked out the complexities of the roof with the trusses, that looked like spokes in a wheel, and the curves of the purlins that formed the roof structure. The interior ceiling was to reflect the exterior contour of the roof and to achieve this scissor trusses were used with the plasterboard curving in both directions. The resulting contour creates a soft, sculptured appearance with excellent acoustics. The importance of good detailing and well set out plans and dimensions was crucial to the success of this project.”

To give the school, Te Kura O Waikaremoana, an individuality locals could identify with Gary Pidd, Architect, looked to the lake and the Maori legend of Maahu and his daughter Haumapuhia. Maahu was outraged when he thought his daughter, Haumapuhia, had used the sacred water from the Waikotikoti spring which was Tapu. In his rage he drowned his daughter in the spring turning her spirit into a Taniwha. The struggling spirit attempted to reach the sea and in the turmoil created the great lake of Waikaremoana. Taniwha take many forms but generally are represented as dragon like reptiles with scales covering their bodies. From this came the inspiration of the flowing curves and roof texture that would represent the Taniwha and its scales. Establishing this unique identity and focus was important to locals and to Gary Pidd. “It was considered important by all concerned that we did not produce a standard Ministry of Education design,” says Gary Pidd.

In essence the building reflects the Taniwha with the administration block being the head, the immersion classroom room is the heart and the two classrooms and library are the body. The verandah, which provides shelter for the children, is the tail which collects the water from the roofs and channels it to a rock filled sump symbolising the creation of the lake. The location of the school, nestled in the valley, was taken into account as it enables those approaching by road to look down on the school revealing the curved layout of the Taniwha.

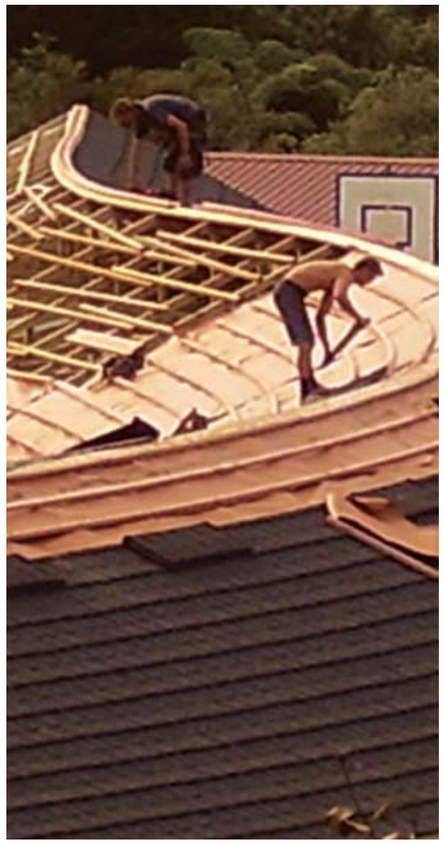
During the design process Gary Pidd looked for assistance with the roof design but all he got was," It has not been done before," and so realised that they had to find their own solution.

Confident that the plan was feasible Gary contacted Tony File Roofing in Gisborne to discuss the project. "Tony was great," say Gary, "he sent us half a dozen tiles to play with and was very supportive."

Tony File admits that he had some reservations about the feasibility of the project and consulted Peter Richards, Gerard Roofs technical adviser, to discuss the project. From working drawings supplied Richards laid out the roof structure on the factory floor and was able to confirm that the Gerard Senator Shingles would fit the curve and provide the scale like texture that Gary Pidd required.

As the project was a 4 hour drive from Gisborne, with no access to accommodation on site, Tony File decide to build a full size mock up of the roof in their yard. "After all", says Tony, 'we were being asked to do something we had never done before. This was a worth while exercise as we were able to eliminate any problems and work out the batten spacing which was critical to the success of the project."

Tony and Gary acknowledge the skills of Arkin Construction of Napier who had to ensure the trusses were spot on and square to the fascia. They did a exception job on the entire project.



Above: The accuracy of the batten layout was critical to the success of the final roof.
Below: The contoured profile of the Gerard Senator Shingle changes with the light conditions providing a "scaled" texture to the Taniwha.

As a rural school the complex provides the community with a facility that doubles as a meeting place and Marae to welcome guests. The area is steeped in traditional values which stem from the Maori heritage of the area. Gary is proud of his associate with this and similar projects where delivering something unique is very satisfying.... above all says Gary, 'the kids love it. Our school is a Taniwha they say and that is a reward in itself."

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Client: Te Kura O Waikaremoana Board of Trustees

Architect: Gary Pidd
Gary Pidd Architecture Ltd.
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Telephone: 06 844 0223
Email: garypidd@airnet.net.nz

Builder: Atkin Construction
Napier.

Roofing Manufacturer:
Gerard Roofs.
Profile : Gerard Senator Shingles
Colour: Ravine
Telephone: 0800 100 244
Email: info@gerardroofs.co.nz

Roofing installer: Tony File
Tony File Roofing Ltd..
Gisborne
Telephone: 07 867 0794
Email: tony.file@xtra.co.nz

MAKING A DIFFERENCE

When Cliff & Nora Schreiber planned a working holiday overseas they decided to rent their home. Sadly, on their return, what was a simple, but very tidy, home was suffering from neglect. There had been no maintenance done during their absence and they now had a rusting roof, broken and missing fibrolite weatherboards and a retaining wall at the rear of the house that had begun to leak causing dampness on the lower level. It was time for a major renovation!

The Schreibers had, over the years, been actively collating ideas on how they would tackle the task, the style they would like and the materials of preference.

"We looked at many properties and began a photographic file of interiors and exteriors as we encounted them, "says Nora Schreiber. " While there have been several modifications en route we always came back to the same key features – corrugated steel cladding, reflecting the iconic NZ shed, and Titan board. We liked the clean lines of both but we had only seen Titan Board used on commercial buildings."

The initial intension was simply to reclad the exterior and roof however investigation revealed that the dampness on the rear retaining wall, caused by the previous owners backfilling the wall without adequate drainage, was a problem. This required major excavations as the decision was made to clear the area against the wall. to keep it dry, and to create a deck above. As with many renovation projects the project continued to grow.

At this stage the Schreibers retained the service of Clem Kinnaird to assist in bringing the ideas together as a workable project.

"The Schreibers had done a huge about of research and Cliff had done many sketches of various designs and layouts," says Clem." My role was simply to fine tune these ideas and to produce a plan that was functional."

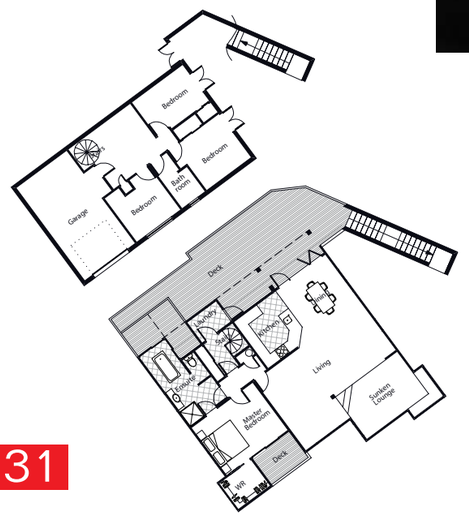
From what started as a simple reclad the project became a complete renovation inside and out including the landscaping and access. "At the end of the project only one internal wall remained without modification," says Nora.

The original verandah area was incorporated into the house as an enlarged bathroom and laundry. The roof was replaced with ColorCote® ZRX ™ to modernise the profile. New French door entrances were added to the downstairs bedrooms, existing windows were replaced with new aluminium joinery (some were repositioned) and a four panelled folding door fitted to

open the dining area to the outside maximising indoor /outdoor flow. The 1970's décor of exposed beams and textured ceilings had to go... both upstairs and downstairs were gibbed, painted and carpeted throughout.

The Schreibers speak very highly of the input of both Clem Kinnaird and builder John Fretwell. "Both worked together with us to achieve the result we wanted offering expert advice on modifications and improvements. We were very pleased with the results."

Clem Kinnaird, Architectural Draftsman with 35 years experience in the building industry. Kinnaird established his Whakatane based practice in 1985 drawing on his vast experience in mass produced group housing and Quantity Surveying. The work undertaken is primarily in the residential sector with a diverse portfolio ranging from conventional timber frame, concrete block, steel frame, to adobe earth brick. Every client has different needs and every site presents new challenges.



Client: Cliff & Nora Schreiber

Architectural Designer:
Clem Kinnaird. Whakatane
Telephone: 07 3070967.
Email: clemko@xtra.co.nz

Builder: John Fretwell Builders Ltd.
Whakatane.
Mobile: 0274929082

Roofing & Cladding Installer:
Hollowood Roofing.
Whakatane.
Telephone: 07 3088710

Roofing & Cladding Manufacturer:
Dimond Industries.
Telephone: 0800 346 663.
Cladding: ColorCote® ZRX ™ metallic silver Corrugate
Roofing : ColorCote® ZRX ™ Grey Friars Corrugate

Photography: Nikki Soos.

SCOPE NEWS AND VIEWS

Pacific Coil Coaters publish two new Bulletins.

PCC release technical bulletins 5 and 6. Bulletin 6 deals with the correct procedure related to the fixing of ColorCote® AXR TM and AR8 TM in server and very server marine environments, (also note the article on page 17). The second bulletin (No. 6) deals specifically with the problems involved in the use of touch up paints and spray cans.

For copies of all bulletins or further information please contact Pacific Coilcoaters on 0800 ARXZRX, or 09-5799199, or by email on PCCWebSales@fcsp.co.nz, or visit www.colorcote.co.nz.

Gerard Roofs "Looking Up"

Gerard Roofs have published version two of Looking Up. An in depth guide to choosing the right roof to suit the architectural style and location of New Zealand's new homes.

Looking Up is designed as a useful tool to provide design inspiration to assist architects, designers, builders, specifiers and home owners choose the best roofing profile to provide both aesthetic appeal and protection in the extremes of New Zealand's climate.

The 86 page book is a collection of New Zealand architecture in many locations and styles which show the versatility of design that can be achieved and clearly sets out the rationale and profile used for each. From new homes to re-roofing, residential to commercial, climate to colour the Looking Up guide explains in detail the key roofing decisions.

Gerard Roofs recognise the importance of their role, in the roofing industry, to provide those who specify and use their products with the means to inform and educate clients on every aspect of the roofing decision. The Looking Up guide to choosing your roof does this very well and is freely available to you and your clients.

For your free copy of "Looking Up" contact:
Gerard Roofs
0800 100 244
email: info@gerardroofs.co.nz

Town supply water tanks get new roofs.

Both projects were completed under the supervision of Watercare with meticulous quality control to insure that there was no contamination of the inner tanks and surroundings.

These project represent new innovations in roofing public water supply tanks and is certainly a coup for the industry.

The Glenfield water tank project (above) was clad by Metro Roofing using Maxispan ZRX (painted aluminium).
The St Johns water tank (below) was clad by C & A Hopkins Ltd using Ribline Profile in ZR8.

EXPERIENCE MAKES A DIFFERENCE

Having owned and operated a motel in Tauranga CBD for several years in the past Trevor Jones is the first to admit, "Nothing teaches you the needs of designing a motel better than operating your own." This experience has paid dividends for Trevor Jones who has now designed over 30 motel complexes from Whangarei to Napier.

The Beach House Motel in Mount Maunganui fully utilizes the site and deliberately presents a relaxed and "beachy" holiday environment. The Motel won the ADNZ Regional design award for Commercial/ Industrial and the ADNZ National award for "Most Innovative Design Using James Hardie Products – Highly Commended."

The location is well suited to guests wanting to be away from the crowd of downtown Mount Maunganui, but be only a couple of hundred metres from ocean beach... close enough to enjoy the many wonderful features the area has to offer. Being out of the commercial environment meant the motel was designed to be operated by a family (rather than a couple) so a spacious family home with private outdoor living was a specific design requirement. The owners have pursed their creative ambition of art and collecting items of interest that have washed up on the beach. These have been used extensively in the landscaping of the motel enhancing the relaxed beach feel.

To minimize maintenance, a combination of fibre cement sheets, COLORSTEEL® and ZINCALUME® claddings were selected with careful consideration given to natural wash down of the steel claddings and minimal retention of stormwater. There are no gutters on the verandahs allowing rain water to flow freely to the drained water catchment system below.

"The design of the building utilizes steel beams to support the verandahs and stairs giving a simpler less bulky appearance than timber.
Protective coatings on the steel were provided by a local paint manufacturer, Altex Coatings Ltd., who we engage on most projects involving exposed or vulnerable steelwork," says Trevor Jones.

Trevor Jones Design has been active in Tauranga since the early 70's. In recent years they have won 15 National and/or Regional design awards for a wide variety of projects including a National award for the Best Commercial Interior for Boffa Miskell offices in Tauranga.

The practice has developed skills in most types of commercial and residential buildings. The portfolio includes Mills Reef Winery, upgrade of Tauranga Airport Terminal, new churches, significant office buildings in Tauranga CBD and buildings covering a wide range of industrial uses including an aluminium joinery manufacturer and food processing facilities. The practice strives toward practical and functional design which is mindful of location, material usage and environmental impact and is currently working on a green star rated complex for a health products manufacturer.

Architect:
Trevor Jones Design 2000 Ltd.
Trevor Jones
Tauranga
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Roofing and cladding manufacturer:

Roof profile:

Cladding Profile

Roof and cladding installer:

For further information on Metal Roofing or Cladding or details of any of the articles which appear in this publication please contact any of the members listed below.

Members of the NZ Metal Roofing Manufacturers Inc.

A Ellery & Sons Ltd
PO Box 178
Greymouth
Telephone: 03 768 5029
Contact: Clark Ellery

AZKO Roofing Limited
41 Shakespeare Road
Christchurch
Telephone: 03 365 9808
Contact: Maurice O'Flaherty

Brockelsby Roofing Products Ltd
49 Rutherford Street
LOWER HUTT
Telephone: 04 566 1971
Contact: Malcolm Smith

B J Moss Ltd
PO Box 1007
Gisborne
Telephone: 06 867 1219
Contact: Roger Moss

B R Roofing & Walling Co Ltd
Ford Road
Onekawa
Napier
Telephone: 06 843 6968
Contact: Phillip Fendall

Besalon Industries Ltd
PO Box 58325
Greenmount
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Telephone: 09 278 3610
Contact: George Ling

Calder Stewart Industries Limited
PO Box 1400
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Telephone: 03 214 5544
Contact: Andrew Protheroe

Continuous Spouting New Zealand Ltd
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Telephone 09 268 1555
Contact: Richard Mabin

Contour Roofing Nelson Ltd
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Annesbrook
Nelson
Telephone: 03 546 4260
Contact: Dave Freeman

Dan Cosgrove Ltd
PO Box 211
Timaru
Telephone: 03 688 4169
Contact: Brian Cosgrove

Dimond
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Telephone: 09 526 8885
Contact: Gregg Somerville

Franklin Long Roofing Ltd
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Contact: Warren Oliver

Freeman Roofing
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Stoke, Nelson
Telephone: 03 5443108
Contact: Dave Hall

Glenwood Roofing Industries
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Ashburton
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Contact: Phil Hogg

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HB Longrun Ltd
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Contact: Chris Patheyjohns

Marshall Industries Ltd
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Invercargill
Telephone: 03 218 2579
Contact: Peter Marshall

Megami Metal Roofing Systems
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Takanini Auckland
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Contact: David Moselen

Metalcraft Industries Limited
PO Box 51286
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Contact: Tony Barbarich

N S Irwin Ltd
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Contact: Gary Irwin

Roof Manufacturers Limited
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Contact: Philip Meyers

Roofline Marlborough
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Contact: Phil Hogg

Silbery Long Run Ltd
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Steel and Tube Roofing Products
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Stratco (NZ) Ltd
PO Box 8494
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Contact: Mark Moore

Taranaki Steelformers Ltd
Wanganui Steelformers
King Country Longrun
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http://www.metalroofing.org.nz