

SUSTAINABLE **METAL** **ROOFING & CLADDING** THE MOST RECYCLED BUILDING MATERIAL IN THE WORLD



NZ CASE STUDIES ON
SUSTAINABLE RESIDENTIAL HOUSES
AND COMMERCIAL BUILDINGS

TECHNICAL INFORMATION

FACTS TO ALLOW YOU TO
MAKE AN INFORMED DECISION

A SPECIAL SUSTAINABILITY EDITION OF SCOPE THE
OFFICIAL PUBLICATION OF THE NZ METAL ROOFING
MANUFACTURERS ASSOCIATION



SCOPE

SUSTAINABLE METAL ROOFING AND CLADDING

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| | | | | | |
|--|---------------|-----------------|-----------------|-------------|-----------------|
| Total | -\$1,041 | | | | |
| SINGLE STOREY (ASHMORE) | | | | | |
| Materials | -\$716 | -\$656 | -\$1,135 | \$27 | -\$1,422 |
| Labour | | -\$1,373 | -\$113 | \$63 | -\$3,903 |
| Total | -\$716 | -\$2,029 | -\$1,248 | \$90 | -\$3,903 |
| M: SINGLE STOREY (ASHMORE CREB) (HIPS) | | | | | |
| Materials | -\$925 | -\$334 | -\$992 | \$27 | -\$2,225 |
| Labour | | -\$630 | -\$255 | \$63 | -\$822 |
| Total | -\$925 | -\$964 | -\$1,247 | \$90 | -\$3,047 |

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We're pleased to introduce this publication. In fact Warren & Mahoney is only too happy to support any initiative that encourages wise and appropriate use of energy and materials in a world of dwindling resources.

Steel has big advantages in the context of environmental sustainability. Its versatility, strength, relatively light weight and, above all, its recyclability make it an obvious choice as a building material.

Steel is unique in that it features strongly at both ends of the recycling chain. Its manufacture is relatively efficient, and at the end of its life cycle it can be recycled infinitely with little or no quality deterioration. Furthermore, the use of steel as part of a structure's design complements other building materials, adding strength, contrast and style to stone, concrete and wood.

The majority of New Zealand's metal roofing and cladding products originate from New Zealand Steel's Glenbrook Mill. There, in a process unique in the world, ironsands have been used as the primary input for almost 50 years.

During that time the company has implemented a number of sustainable business practices, became ISO 14001 accredited in 2003 and is now recycling or re-using more than 80% of manufacturing waste. The longer-term goal is 100%.

Warren and Mahoney has a similarly strong sustainability focus. We're proud of our early CarboNZero accreditation, adoption of Green Star NZ principles, development of protocols to cover materials, waste management and energy efficiency and culture of constantly looking to reduce our carbon footprint.

Established in Christchurch more than 50 years ago and now operating New Zealand-wide and internationally, our 10-year journey in developing to develop a specialism in sustainable building design makes it a very natural thing to do to endorse this publication.

We share the NZMRM's commitment to sustainability and take pleasure in supporting this special sustainability edition of Scope. But further changes are required and we therefore hope you will take actions based on read this to assist you make a more environmental friendly design or material selection.

Graeme Finlay,
Director,
Warren and Mahoney



RECYCLABILITY & RECYCLING OF METAL CLADDING

New Zealand Metal Roofing Manufacturers (NZMRM), as does every industry that wants to survive, is looking at the sustainability of their products and member companies. While some aspects of the sustainability of metal cladding products are still under consideration by the industry and the NZMRM, you will soon become aware of the sustainable manufacturing process used by New Zealand Steel at the front end of the life of steel cladding, and this is a story worth telling and one to be proud of.

What is not in dispute but also not well known is the other end of the life of steel and indeed all metal cladding – its ability to be recycled and its actual level of recycling. In fact the metal used in cladding (and elsewhere of course) is both able to be recycled with no loss of quality, and actually is recycled to a very high degree.

In this article, we have collated information from world sources and specifically New Zealand sources to discuss the generic recyclability and recycling of metal, in particular steel, and about the unique system and cycle operating in New Zealand, which works well for all parties. What follows has been taken from a number of sources and all data, volumes, numbers etc. are derived from published information so are only as accurate as the sources. The comment and conclusions are the author's. We deal primarily with steel, which is by far the main material used for metal building cladding, but many of the comments also apply to aluminium, certainly at world level.

Recyclability vs recycling

It is important to separate these two similar sounding operations. Steel is the ultimately recyclable material. It is unaffected by recycling and recycled steel is as good as new, but has much less embodied energy. All steel products have the ability to be recycled, but the degree to which they are recycled does depend on how much they are mixed with other materials and the difficulty of recovery. Reuse of material similarly depends on its quality at the end of the life of whatever contains it. Structural steel is very reusable and quite easily recycled. Steel cladding can be reused depending on its condition (and may end up on a lower quality building) but is very easily recycled (and is easier to melt than structural steel). Steel used as reinforcing in concrete is easy to recycle but difficult to recover. Steel used in motor car bodies is highly contaminated with other materials. In spite of this variability steel for recycling is a valuable resource and 85-90% of steel used in construction is recycled globally. Over 60% of all steel used globally is subsequently recycled.

The ability to be recycled

A number of common materials can be recycled in the sense of being removed from a form which is no longer needed and then converted into something else. A number of products themselves are able to be reused once the item into which they are incorporated is no longer required.

Metals in various forms, glass, plastics, paper, timber, fabrics and others are able to be reused in some way, and we are all familiar with the recycling programmes of local councils – unheard of 10 years ago but now common – in which various materials are left outside to be “recycled”. We have the idea that they are reused in some way without being very aware of what this might be. In fact, to varying degrees nearly all these – apart from metals – are either not actually reused in a recognisable way or are degraded during reprocessing from the original form or quality (often referred to as “down cycling”). Nearly all non-metals even if reused as part of a new or similar product are in a product of lower quality or value with reduced physical or aesthetic properties.

Metal and specifically steel cladding (which after all is what we make and sell) can both be reused in its same form and more importantly it can be recycled into product indistinguishable from the original, totally undegraded and capable of being recycled indefinitely. Steel cladding which is generally unmixed with anything other than metal coating and paint and has thin sections is easy to recycle, compared with e.g. reinforcing steel buried in concrete.

Throughout its history steel has always been recycled and all steel contains a proportion of recycled material from 10 – 100%, so that any steel currently in use actually has some content that may have been used many times and be 100's of years old.



Recycling levels

Because of the factors discussed above and below – (no loss of quality, scrap required for efficient function of steel mills, much lower energy content), steel has a very high level of recycling – typically up to 90% of all steel embodied in buildings and in artefacts which have ended their useful life ends up being recycled into fresh steel ready to start as good as new, into a long new useful life. In the case of building cladding, quite a lot does actually get reused (rather than recycled as material) although generally in a lower value role – e.g. steel roofing from an office might end up as a fence or a farm shed. The actual percentage of steel which is recycled obviously depends on the application, so that steel which can be reused when a building is taken down is different to steel in a crushed motorcar body or an old fridge, but overall it is very high. Some global figures are appended.

Steel manufacture and recycling Today, steel is nearly all made by one of two processes world-wide. The Basic Oxygen Furnace (BOF) is the main method for converting iron metal made from iron ore into steel. It needs to use some recycled steel for efficient running and will use from 10-25% of recycled material. This may be in-plant scrap (“pre-

consumer recycle”) or bought-in scrap metal that is derived from steel items past their usefulness (“post-consumer recycle”). Typically a BOF unit will use all its own in-house scrap and some bought-in material. The Electric Arc Furnace (EAF) can also convert iron into steel but is the main way of consuming scrap steel materials (post-consumer), and the process requires a minimum level of at least 30% scrap to function. EAF units run from 30 to 100% scrap. A number of mills with EAF only use scrap steel as a raw material.

Because steel is a durable material and is used mainly in quite long-life products (unlike packaging materials) and is also in increasing demand, the amount of scrap available (even at very high recycling rates) is not sufficient to feed the demand and so virgin steel continues to be made from iron ore. Many global steel companies have both types of furnace and are able to take in and reuse large amounts of scrap steel – typically as much as they can get, because reprocessing scrap steel requires less energy than making new steel.

It is worthy of note that the embodied energy aspect of Life Cycle Assessment of steel requires that both new manufacture and

reuse are considered, so that all steel has a multi-level energy cost reflecting the fact that any new steel made will almost certainly be recycled many times way into the future and so the energy required to make it progressively decreases as it is successively recycled.

The New Zealand scene

Globally then, steel mills making all sorts of steel products use both recycled (pre- and post-consumer scrap) and virgin iron made from iron ore. The proportion varies from mill to mill; some only use scrap and others use smaller amounts of it in their mix. Overall a very high level of recycling is achieved.

New Zealand (of course) is different. We only have two steel mills and they have effectively split functions. Pacific Steel Group (part of Fletcher Building) started operation at Otahuhu in the late 50s to process New Zealand's scrap metal, and now uses an EAF to do only this. Scrap metal including steel is collected around the country by collection agencies (coordinated by Sims Metal) and as much steel as Pacific Steel can handle is used here and the rest exported to other mills overseas for recycling. Pacific Steel converts this scrap into high quality reinforcing steel for use in reinforced concrete and into wire, and uses 100% post-consumer scrap in their EAF.

New Zealand Steel (now part of Bluescope Steel, an Australian manufacturer also operating throughout Asia) started manufacturing steel at Glenbrook in 1963. After many decades of research, a process had been developed to process the local ironsand in a unique-to-NZ process, which has a small 'ecological footprint', and the Glenbrook plant was built to use this process. After various changes in technology (and ownership) New Zealand Steel now uses a BOF and makes all new steel from iron with only about 12% in-plant waste (pre-consumer scrap) added.

New Zealand Steel manufactures coil and sheet for use in building cladding and other industries. The coil may be metal-coated with zinc (galvanised steel) or aluminium/zinc (Zincalume®), and may be painted on a coil-coating line or unpainted. The steel cladding materials NZMRM members use and supply primarily come from NZ Steel, with a small amount imported from Asian mills.

For New Zealand this is a very neat system and ensures that steel used in buildings, both for reinforcing and cladding, is made with maximum efficiency and minimum transportation. Both plants have a high level of "sustainability" which they strive to improve as an ongoing process.

Thus in purchasing steel made in New Zealand you can be sure it has been made with maximum recycled content for reinforcing steel and maximum recyclability for cladding. New Zealand has a high level of recovery of steel products either for reuse or recycling at Pacific Steel.

All good, you might think, but there is one problem with this very neat system.

Energy rating systems

For a number of years there has been an increasing global demand for energy efficient buildings. Typically this starts with office buildings and then extends to institutions like schools, and finally to domestic dwellings. The methods of rating buildings is (of course) different in different countries but generally the system looks at the derivations of the raw materials used, the transportation of materials and of people to the building, the energy used during construction and during life, the water used and processed, and finally the ability to be reused or recycled at the end of the building's life. This is only a summary, and you can find more details easily on the internet. There are some well-known rating systems including BREEAM (early 1990's) in the UK, Casbee in Japan, and LEED (2000) in the United States. These are of varying ages and levels of development and New Zealand is a rather late starter in this area.

Australia developed a system called the Green Star Rating (so far for new office buildings only, but rating systems for other buildings exist, and the intention is that all new buildings will eventually be covered by this system - sooner rather than later). New Zealand has chosen to follow suit with a very similar Green Star NZ rating system. Unfortunately both of these are somewhat different to either BREEAM or LEED in their regard for the recycled content of steel.



Without going into the somewhat complicated details – BREEAM gives points for "responsibly sourced" products (which you have to prove); LEED gives points for two levels of recycled content (not recyclability), one low and one modest, and also gives points for fairly short distances from manufacture to use (500 miles/800 kms – which is not that short!) To achieve points with either Green Star system requires the steel used in a building to have a high recycled content - "Up to two points are awarded where it can be demonstrated that the percentage of all steel used in the design has a post-consumer recycled content greater than x % as follows - 1 point = 60% by mass and 2 points = 90% by mass". Exactly what this means (read it again) is not clear to me, but it is clear that steel manufactured by New Zealand Steel will contribute no points to the total. Neither is there any recognition of distance travelled, either way (i.e. no penalty for long distance and no benefit for short distance). What this means for NZ is that reinforcing steel and wire receive 2 points while cladding made in NZ receives none. Imported cladding from 10,000 kms away, painted with paint of unknown quality, and

sourced from a plant or country with no known sustainability credentials, can get two points if it is made in an EAF.

It is recognised elsewhere that both systems complement each other and should not be regarded differently. If there was no BOF process there would be no new steel to be recycled.

The NZ Green Building Council which operates the NZ Green Star rating system invited submissions to be incorporated into the new version and the NZMRM (and New Zealand Steel) did make a submission pointing out this issue, but the latest version (June 2008) is unchanged.

Conclusion

Regardless of the Green Star rating system issue, steel is the most highly recycled building material in the world. You can use it or design for its use in buildings knowing that this in some way contributes to the sustainability of New Zealand as a whole.

Appendix – useful snippets of data

In 2005 globally approximate ratio of BOF to EAF was 2:1.

280,000 tonnes recycled pa in NZ. Produced 620,000 tonnes. Recycled content thus 45% of new. In Australia 65%.

Recycle rate of steel from buildings 85%

In the USA 29% of steel made by BOF is recycled content. For EAF it is 83%.

Recycle rates of structural steel 98%. Reinforcing steel 65% (more difficult to recover from concrete).

Steel made from recycle may use only 25% of the energy used to make new steel.

Sources (and for further reading) NZ Steel; Pacific Steel Group; Bluescope Australia; SCNZ seminar; Metal Construction Association US; Steel Recycling Institute US; Australian Steel Institute; City of Sydney; BREEAM; LEED USA; LEED Canada; NZ Green Building Council

TOWARD GREEN BUILDINGS

Today there is global awareness of the effect our buildings, culture and product usage has on the environment.

Professor Ray Cole, an internationally-eminant building scientist, argues that the rate and scale of global environmental degradation, and access to information about it are unprecedented, and that "we won't be able to plead ignorance in the history books." So what are we doing to find solutions?

Tom Evison, of Technical Press Service, reported on a new rating scheme which aims to transform the New Zealand build environment.

The NZ Green Building Council, supported by the Ministry of the environment, have access to the wealth of experience offered by Dr Cole. Dr Cole co-founded the Green Building Challenge - an international collaborative effort to benchmark progress in green building performance and environmental assessment. He was also instrumental in developing the Canadian rating scheme and is currently helping New Zealand set up its own schemes for residential and commercial office buildings.

Being familiar with the various rating schemes now operating in many countries, Dr Cole is in a strong position to advise us which components will work best. "In New Zealand, the same emphasis should be given to designing the system of output and delivery as to the technical framework of the schemes themselves," Dr Cole advises. "We could easily draw on the structural and technical component systems in other countries with the unique implementation context of New Zealand", he says. "We need to create a clear vision, inspired leadership, broad partnership, full co-operation and common language which will bring this about."

He strongly advocates the NZ Green Building Council in the leading role, providing a trusted source of rational, unbiased information. NZGBC membership must be made up of the widest



possible group of stakeholders including scientists, academics, industry, manufacturers, government and the media.

Two pathways to the mainstream adoption of green building practice were described by Dr Cole. The regulatory approach assumes that increased international environmental attention and public concern will create political intent. This will then manifest as more demanding environmental policy and subsequently as increasingly stringent regulations related to building performance requirements.

By contrast, Dr Cole identifies that voluntary assessment methods are a primary mechanism for creating interest and providing focus in building environmental issues. No other approach, he suggests, has had the same effect in giving definition to the field.

Now the issue is providing a comprehensive, objective building assessment and the time, effort and cost involved in doing so.

To make our rating schemes successful, Dr Cole favours developing a suite of related tools designed to create positive change in the way that buildings are produced - not just a system that simply scores the environmental performance of a building. "The tools," he says, "must enhance the dialogue between the various members of design teams, establish common ground and help navigate through often fundamentally different positions and priorities."

In the following pages are three projects designed by three independent architects in New Zealand with a common objective.

Helen Richards home, "Concept One" illustrates the contemporary flair possible with creative Solar design.

CONCEPT ONE

Architect Helen Richards has always had a passion for sustainable building design and capturing solar energy.

Conventional homes, globally, use huge amounts of energy that consume natural resources and are responsible for approximately 50% of the Co2 emissions which have a profound effect on our environment and Global warming. The proto-type, 'Concept One' has captured the attention of many and raised the awareness of the environmental issues and the benefits of solar design. In 2005 Helen's home was recognised by BRANZ as the first New Zealand house design, assessed by their revised Green Home Scheme for environmental Performance, to achieve a rating of excellence. It was also the first house to ever meet all the space heating requirements through passive means only.

'Concept One', Helen Richards own home, is the culmination of considerable research and collaboration. Whilst Helen is not the first to recognise style in architecture, her home is testament to this, she is adamant that it is the fusion of style and performance that is most important. In the order of priorities the choice is clear - solar design comes first.



The concept of 'Concept One' has been in progress for some years with a variety of expertise contributing. In particular Helen found a shared enthusiasm and philosophy with Wellington architect, Roger Walker, who has contributed his experience to the project.

Helen's vision was to create a template for a passive solar home using thermal mass to collect, store and release the sun's energy making it cost effective to build and run. The objective was not to create a 'one style fits all' but rather a concept which could easily be adapted to suit the tastes and styles of prospective clients at realistic cost. The proto type deliberately uses many traditional building materials and techniques which sit comfortably with the building fraternity and clearly puts 'Concept One' apart from the

perception that 'green' houses, with eco-energy efficiency, do not have to be made from materials less suited to the New Zealand climate, such as earth buildings.

The position of the 'Concept One' house was critical, with the glazed areas being oriented within 30 degrees of true north, as was the relationship of the glazing to the concrete floor and walls. To prevent heat loss the insulation under the floor slab is 1.5 times higher than stipulated by NZ building regulations. The concrete has been highly polished and honey coloured resulting in a flagstone appearance. "A challenging and complex task to get right," says Helen. The concrete floor, being the primary heat store, is kept uncovered with the exception of porcelain tiles in the bathroom area. Carpet is avoided as it prevents heat absorption.



In the centre of the house is a tilt concrete wall that provides additional thermal mass with the balance of the walls and roof being conventional timber framing insulated with 'latitude', a 100% natural wool product, which performs well keeping the house warm in winter and cool in summer.

Double glazing has been fitted through the home with the northerly profile being 80% glass to trap the maximum sunlight. Unshaded glazed areas to the west are kept to a minimum to prevent over heating and the south has only 20% glazing to prevent heat loss.

The roof is clad in 5 Rib Colorcote®. North/west exterior walls are clad in timber and the south walls are of vertical Zinalume® Corrugate.

'Concept One' favours a contemporary style to have mainstream appeal. This was a deliberate choice to illustrate clearly that energy efficient homes do not have to look 'hippy' and do not have any limitations in concept. Helen points out that Powered Living houses use the same materials and methods as non-solar houses. The difference is in the layout as it relates to the sun.

"The challenge with passive solar design is to store the heat and distribute it evenly to all parts of the house - even those that never get the sun." To aid in this process the house is open plan with levels and partitions creating separate spaces.

The efficiency of the house has now been well tested and documented and has lived up to



expectations. Dataloggers have recorded the temperatures inside and out every 30 minutes for the past 3 years and show the temperature variation within the target area. 'In reality' the temperatures were very close to the goal of 17-21 degrees without any other form of heating. Passive ventilation is also an important part of the design with clerestory roof windows that ventilate the entire house keeping it cool in summer.

In addition to the solar heating benefits the house includes many eco-friendly features. Solar panels assist with water heating, rain water collection and organic waste is composted in worm bins

Helen is the first to acknowledge that it is difficult to be 'pure' in every respect when approaching sustainable design.

She describes the process as, "Making the right choices in the right order which is where solar design takes priority. Self-sufficiency is a good feeling and we are trying to demonstrate a better way."

'Concept One', without a doubt, is an excellent example of energy efficiency combined with excellence in design flair.

Architect: Helen Richards.

Helen has been passionate about sustainable design and solar energy since she was a student at the London School of Architecture.

After graduating Helen worked on numerous projects in UK earning membership to the RIBA (Royal Institute of British Architects). She also worked in Kuala Lumpur prior to visiting and settling in Nelson, NZ. The projects she has been involved with range from sports stadiums to office developments, government housing to London mansions.

The climate in Nelson afforded her the opportunity to seriously pursue her long term interest and goal to create energy efficient housing which would benefit the clients who live in them and the environment.

Architect: Helen Richards.
Powered Living, Nelson.
Telephone: (03) 548 1680
www.poweredliving.co.nz

Main contractor: Phil Hay Builder

Roofing and Cladding:
Contour, Nelson.
Telephone: (03) 546 4260
Profile: 5 Rib Colorcote®
and Zinalume® Corrugate.

Photography by: Stirling Images.

NOW HOME CHOOSES STEEL CLADDING

The Rotorua NOW Home is the result of a collaboration between Beacon Pathway and Housing New Zealand Corporation. The home is now a part of the Corporation's housing portfolio reflecting their commitment to research into more sustainable and energy efficient homes. In 2006 Housing New Zealand invested about \$80 million on improvements to its homes through it's healthy housing, community renewal, energy efficiency, modernisation and re-configuration programmes.

This conventional looking, family home is far from ordinary. It's the result of extensive research and planning to achieve an attractive, comfortable and safe home.

The house design by architectural firm, APR Consultants, was in response to a clear budget and brief outlining research criteria that:

- is cost-effective to build
- is cheaper to run
- is healthier to live in
- uses fewer resources
- uses less energy and water
- effectively disposes storm water
- generates as little waste as possible.

The design features, products and materials chosen for the Rotorua NOW Home reflect a balance of criteria that considered environmental, social and

economic aims. They were selected to make the best possible use of the site and to meet a careful budget.

Products were preferred if they had lower life cycle costs, could be recycled or were made from renewable materials. The Rotorua NOW Home has used Shadowclad primed wall cladding combined with Dimond Corrugate in COLORSTEEL® Endura™ prepainted steel for the roof and wall cladding.

COLORSTEEL® prepainted steel cladding was selected after assessing each product for its potential cost over its life time. Prepainted steel products over a Zinalume® substrate are durable and lightweight.

These products score well on the BRANZ Ltd Life Cycle Tool rating:

- very well for Lifetime Financial Costs
- medium well on life cycle embodied energy
- medium on recyclability.

The single-storey, three bedroom home of 141.2 m2 (including garage) was built to a budget. It features a butterfly roof line and the U-shaped footprint creates a large sheltered patio area. Attention has been given to room size, layout and indoor-outdoor flow to ensure a comfortable, flexible home catering for extended family.

With an insulated concrete slab floor, northern orientation and large north facing windows, the Rotorua NOW Home absorbs, retains and releases solar warmth. High levels of insulation and double glazing have been installed, meaning the NOW Homes will be warmer in winter and cooler in summer, with significantly less energy cost. A solar water heater, supplemented by electricity, provides hot water needs. Appropriate ventilation (passive, where possible) and high levels of insulation minimise moisture and dampness in the homes. The passive solar heating is



supplemented by a low emission pellet fire. Care was taken to select and use products with low toxicity.

Rainwater is harvested to an underground tank for all non-drinking purposes. Limiting water flow and dual flush toilets further reduce water consumption. Composting bins and dedicated under-sink containers encourage residents to recycle and re-use waste.

The home used low maintenance, durable materials and where possible, construction waste was re-used or recycled.

The COLORSTEEL® Endura™ prepainted roofing system is designed to provide protection against corrosion in areas where moderate to severe environmental conditions are experienced and will exceed the service life of most traditional post painted systems. It carries a 15 year surface warranty and a durability warranty of 30 years.

The Rotorua NOW Home is a live research project and its energy consumption, water consumption, moisture and temperature levels will be remotely monitored for two years.



The monitoring process is already underway in the first NOW Home in Waitakere, completed in September 2005. While it's been life as usual for the young family living in the home, Beacon has been busy behind the scenes, monitoring the performance of the home to evaluate the effectiveness of the design.

On the basis of data collected so far in the project, compared to similar sized homes in Waitakere, the NOW Home uses:

- about 30% less energy
- about 25% less water

Beacon Pathway Ltd (established in 2004) is a collaborative research consortium working to find affordable ways to make New Zealand homes more resource efficient, cheaper to run, healthier to live in and environmentally friendly.

Beacon's object is to create economical homes that work well into the future. To achieve this Beacon are researching building technologies, construction industry practices, urban planning, policy and regulation and consumer attitudes.

This information will be available to home-owners, the building industry, and those working toward improving the quality and sustainability of New Zealand's housing.

Beacon's shareholding partners are organisations with a considerable stake in the quality of the residential sector: New Zealand Steel, Fletcher Building, Building Research, Scion and Waitakere City Council. Shareholder contributions are matched, dollar for dollar, by funding from the Foundation for Research, Science & Technology (FRST).

For more information about Beacon's NOW Homes visit www.nowhome.co.nz.

Client: Beacon Pathway Ltd, Housing NZ Corporation.

Architect: APR Consultants, Rotorua.
Telephone: (07) 349 8333

Main Contractor: Warren Monk Builders, Rotorua.

Roofing and Cladding Manufacturer: Dimond.

Telephone: 0800 Dimond 0800 346 663

Profile: Dimond Corrugate in COLORSTEEL® Endura™ prepainted steel.

Colour: Grey Friars.

Craig Robertson Photography for Beacon Pathway Ltd.

KEEPING OUR KIDS SAFE

The recent New Zealand documentary, "Are you ready", brought some sobering reality to the potential effects a Natural disaster could have on our nation. The question was not "if" we have a disaster but more realistically "when" we have one.

In 1998 the New Zealand Ministry of Education undertook a Nationwide structural survey of all school buildings. The directive from the Ministry was for education boards to plan to rectify any building defects, which failed to meet their requirements, in each schools 10 year property plan.

Two schools featured here have taken the steps required. In both cases the cost effective way to meet the Ministry criteria was to replace the existing heavy tiled roofs with lightweight roofing.

Looking beyond our schools at the effect of natural phenomenon on our homes, should we ask if there is a lesson to be learned?

Extracts from the Ministry of education directive.

3.2 Heavy Roofs

Issue

As long as they are adequately connected to their foundations and do not contain a heavy roof or ceiling, school buildings are expected to perform adequately during a severe earthquake almost irrespective of configuration. The major reason for this is the lack of seismic mass at roof level generating significant lateral forces. This is not the case if the building has a heavy tile roof. All buildings with heavy tile roofs have been identified.

Recommended Action

All heavy tiled roofs are required to be removed and replaced with a lightweight roof. The only exception to this is if the school wants to retain the tile roof and this would need to be agreed to by the District Property Manager. In the latter circumstances, a detailed analysis of the building would be required and strengthening provided, as necessary, to meet the full requirements of NZS 1170.5 including the 1.3 return period factor.

The costs that were allowed in the 1998 National Survey were for replacement of the heavy tiles with corrugated iron. This also included some allowance for replacement of damaged roof framing members and bracing should this have occurred. At the time that the heavy tile roof is removed, the connectivity between the top of the walls and the roof and ceiling members should be checked by a structural engineer to ensure that the load transfer between the ceiling or roof diaphragm and the walls can take place. While on site, the engineer should also visually

check the roof bracing and the condition of the roof framing.

National Structural Survey

Because many school buildings were built before modern structural design standards, the Ministry commissioned a nation wide structural survey of all school buildings in 1998. The purpose of the survey was to identify specific structural defects that could potentially cause death or serious injury during wind or earthquake or every day loadings. As well as buildings, site structures such as retaining walls were also checked.

For the full report visit the Ministry website: ¹



Architect John McCulloch says, "Southland Girls High School in Invercargill needed to be structurally upgraded. The refurbishment included the installation of a new roof. The existing concrete tile roof was deemed to be too heavy, under the Ministry of Education building requirements, and a lightweight roofing was specified. Installing a new roof also provided an opportunity for the school to promote a new identity, particularly as it was extending and taking over the neighbouring intermediate school premises. Gerard Tuffcoat satin tiles were chosen for their light weight, their cost effectiveness and character, which is in keeping with the look of the former concrete tile roof. We opted to change the colour of the roof by choosing Wedgwood Blue tiles. The colour is sufficiently different to create an awareness of the new identity. It also enhances the sense of a large campus."

Southland Girls High

"The Tweedsmuir Junior High next door was closed at the end of last year and Southland Girls was expanded to take in years seven and eight," says Yvonne Brownie, Principal of Southland Girls.

The decision was made to have Southland Girls combine the now empty buildings and the school.

Horowhenua College was re-roofed with Gerard tile in Christmas 2001 by Wellington Lightweight Roofing.

The Southland Girls High School with its new Gerard roof now has a staggering 315 tonnes less weight over students heads.

Trevor Keeste from Permacoat Roofing Invercargill, won the roofing tender for the project which started in early January, for safety reasons, to ensure the bulk of the work would be completed before the beginning of the school term.

"The most challenging part of the work was removing 350 tonnes of old concrete tiles which were breaking as they were removed. The new roof weighs in at just 35 tonnes which is a huge weight saving of 315 over the 7000 square metre roof," says Trevor.

"The primary reason for making a change to this roof is safety," says Grant Williams, business development manager for AHL Roofing Ltd. "The Ministry of Education require that some schools with heavyweight roofs be either structurally strengthened or the heavy weight tiles be replaced with a lightweight alternative to meet earthquake regulations."

Before re-roofing



¹ <http://www.minedu.govt.nz/index.cfm?layout=document&documentid=8544&indexid=9383&indexparentid=9382>

Earthquake damage North Ridge, California, 1994 registered 6.7. The heavy tile roof (top) collapsed while the lightweight Gerard roof (below) in the same street survived.



Earthquakes

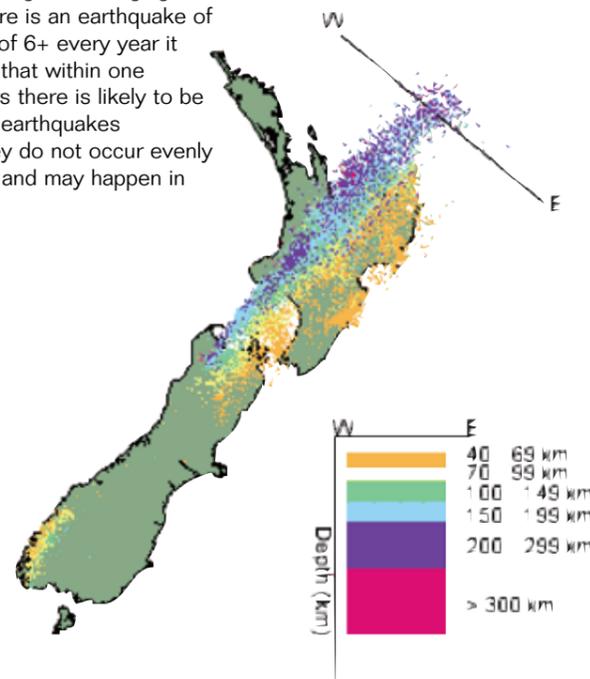
New Zealand lies on the boundary between the Pacific and Australian tectonic plates which basically follow the country's mountainous areas, diagonally from east to west. The eastern areas of this divide generally experience shallower earthquakes than the western areas as indicated in figure 1. The Institute of Geological & Nuclear Sciences locates about 14000 earthquakes in New Zealand each year however most are too small to be felt. It is estimated that between 100 and 200 earthquakes are significant enough to be felt.

Most earthquakes which cause damage are of a magnitude of 6+ and we generally experience one of these per year. A magnitude of 7 occurs about every 10 years and a magnitude of 8 about once a century. The largest known earthquake in New Zealand was the Wairarapa earthquake in 1855 which was an estimated magnitude of 8.2. The biggest New Zealand earthquake since instrumental recording began was the 1931 magnitude 7.8 Hawke's Bay earthquake with a death toll of 256.

When seismologists averaging suggests there is an earthquake of a magnitude of 6+ every year it really means that within one hundred years there is likely to be one hundred earthquakes recorded. They do not occur evenly through time and may happen in clusters.



Some historical

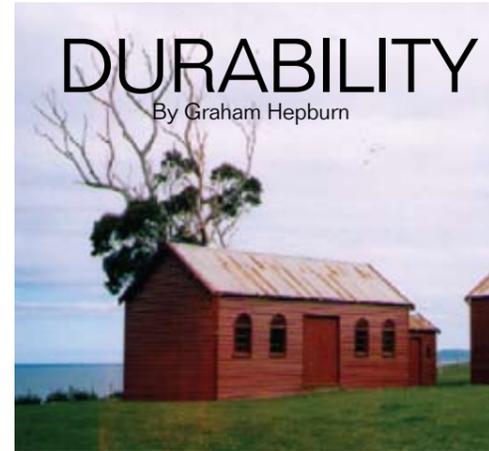


New Zealand earthquakes

| Earthquake | Year | Mag. |
|---------------|------|-------|
| Wairarapa | 1855 | 8-8.2 |
| Hope Fault | 1888 | 7-7.3 |
| Buller | 1929 | 7.8 |
| Napier | 1931 | 7.8 |
| Inangahua | 1968 | 7.1 |
| Edgecumbe | 1987 | 6.1 |
| Weber | 1990 | 6.1 |
| Arthur's Pass | 1994 | 6.7 |

New Zealand is fortunate that whilst experiencing earthquakes in a similar Richter scale range to other countries we have not suffered similar loss of life. Much of this comes down to three factors. The standards of our buildings and building code, the density of our population and for want of a better expression, "luck". Most agree it is not an area for complacency as we continue to hear it is not "if" it happens but "when".

Farm buildings in Matanaka, Otago built in 1843 is one of the oldest examples of galvanised corrugated iron roofing.



DURABILITY

By Graham Hepburn

You only need to look about you for evidence of New Zealand's long and unbroken love affair with metal roofing.

Alongside weather board villas from the early 1900s with their corrugated iron roofs you'll often see modern townhouses with standing seam roofs or brick homes topped with metal tiles. Corrugated iron has also become popular as a cladding with people who are after a certain look.

The reason for this is not only metal roofing's versatility but also its durability.

That's evident in some of this country's oldest buildings such as some farm buildings in Matanaka in Otago which still have their "patent galvanized tinned iron" roofs that went on in 1843.

The Camphouse on the slopes of Mt Taranaki is another example. It was built in the 1850s and shifted to its present site at the end of the North Egmont Road in the 1890s. While the roof has blown off a couple of times, the original galvanized iron walls remain and are in excellent condition.

And since these buildings were erected, technological advances have improved the durability of metal roofing, especially in the last 30 years. This significant improvement in durability is what makes metal roofing a sustainable option – as it will not have to be replaced for generations.

One of the major breakthroughs was the advent of longrun roofing in the 1960s, meaning roofs could be made from cut-to-length sheets rather than having shorter length sheets lapped together, which invited corrosion problems and made them harder to maintain. Advances in durability also came on several other fronts: most notably the move from zinc-coated (galvanized) steel to a combination of zinc and aluminium (Zincalume®) that gives the steel a lifespan up to 16 times greater than before. Manufacturers also began making long-run roofing from high strength

work best as cladding – they are often two different things. Because metal roofing and cladding benefits from regular washing by rain, it's always best to resist using metal wall cladding – unless it's aluminium - where it won't get rinsed down from time to time. While it's fashionable to run the lines of corrugated iron horizontally when used as cladding, orienting them vertically – although maybe not so aesthetically pleasing - will help the material last longer. There's also a need to make sure

Architect: Jonathan Hawksworth.
Photographer: Brent Parsons



steel coil, which is about twice as tough as the softer steels that were previously used in roofing and cladding.

At about the same time as these developments, manufacturers were also investigating colour-coating steel coil which could then be turned into ready-painted steel roll-formed into a range of shapes. Improvements in paint technology mean products such as Color-Cote®, made by Pacific Coilcoaters, ColorSteel®, made by New Zealand Steel, and Gerard Roofs made by AHI Roofing, provide robust cladding and roofing that will cope with the harshest environments.

The improved lifespan of metal roofing and cladding has also been helped by a better understanding of design and knowledge of the materials themselves. It's important to distinguish between the right style of product for a roof and what will

you're using the right product for the environment – especially in tough conditions such as coastal situations or ones where there's geothermal activity. Being aware of any extreme conditions and choosing the correct product to withstand them is essential to the longevity of the roof. Getting the best out of your metal roof also depends on using it in combination with the right materials and fixings according to the correct specifications and industry practice.

Durability is also enhanced by regular maintenance such as washing and keeping paintwork in good condition – the same sort of thing people wouldn't give a second thought to when looking after their cars.

With technology, design and good maintenance there's no reason the metal roofs and claddings of today couldn't be around for 160 years just like their earliest counterparts.

KNAPDALE ECO LODGE

The owners, Mr and Mrs Weytmans, briefed architect, Graeme Nicoll of Nicoll Blackburne Architects, Gisborne, to design and plan a proposed 3 stage hospitality Eco Lodge. The owners vision is to create an upmarket conference/reception facility to cater for approximately 100 guests and to provide chalet accommodation. Stage one of the project, the family home, is now complete and won Gisborne 2006 House of the Year and PlaceMakers Supreme Award for building contractor D Stevens Ltd.

The Weytmans had some plans drawn prior to approaching Graeme Nicoll and although they felt there were some good ideas in these plans they also felt it did not entirely fulfil their expectations to take full advantage of the site and their desire to incorporate sustainable 'green' features.

The well-developed eco-property at Knapdale near Gisborne, has a gentle north-facing slope of approximately 12 degrees. The approach to the building site was along a 400 metre driveway that passed through a large wooded area and overlooks a man made lake. The home was to take advantage of this vista and the surrounding tranquil forest and farmland.

The owner, Kees Weytmans, of European descent, has had a long association with forestry and was keen to include exotic untreated timber in the building. These



timbers, which the owner supplied, include, Lawson Cypress, Douglas Fir and Oak that was used in the large pivot doors and lintels. Only a limited amount of Pine was used in the roof trusses.

The brief encompassed Eco management in energy efficiency aspects such as solar energy water heating, solar energy floor slab heating, extra insulation to walls and ceiling, northerly aspect, roof windows, wetback system, thermal mass considerations and the collection of rain water and redistribution of grey water.

In general the requirement was for a 3 bedroom home which included some features such as coat and boot storage, freezer room and exterior access to wash and shower facilities. The European influence is reflected in the alfresco dining area that takes full advantage of the countryside and lake panorama. The accent is on bringing the outdoors in where possible.

The vaulted ceilings instone/precast that were detailed in the Jorn Utzon's 'Can Feliz' house influenced the architect. This feature was

redesigned in keeping with the owners' empathy with timber and forest.

The entire concrete footprint of the building slab is heated by passive solar energy. Large expanses of glazed areas in the north facing profile capture the maximum sunlight. In addition to this skylights with double-glazing are strategically positioned to assist in heating the tiled concrete thermal mass and provide extra light. The rib-raft waffle slab floor is well insulated with polystyrene sheeting and contains built-in Alcatene piping. A separate circuit of polythene piping is also set into the floor slab.

A hundred metres of similar black plastic piping is fixed between the battens supporting the Gerard Colortile textured roof. These tiles were selected because of the lightweight benefits, to give the building a traditional European tiled appearance and to absorb heat the dark pepperstone texture was chosen. Water heated by solar energy is pumped into the floor slab and foundation piping at two levels - the lower one running under the foundations during summer to reduce heating and the floor slab circuit runs in winter to increase



heating. A significant benefit of this system has been noted during the months of autumn and spring.

Linked to the solar heating system is a wetback fire burning timber from the property, and an electric hot water system.

Walls of the lower storey are concrete block to provide thermal heat storage and reduce temperature variations. They are adobe plastered inside and out.

The Eco Lodge satisfies the owner's keen interest in environmental friendliness, looks completely 'normal' and fits beautifully into the established landscape.

Graded 4 Star PLUS Qualmark Member, Guest & Hosted.
2006 Husqvarna Farm Forester of the Year, North Island.
2006 House of the Year, Gold & Supreme Award, Gisborne.
2003 Rural Environmental Award, Gisborne.

Architect Graeme Nicoll expresses some enthusiasm for the project which set it apart from "suburban" influences and incorporates many sustainable "green" features. As with all projects there are always budget limitations and the objective is to work within the budget and achieve the result that matches or exceeds the client's expectations.



Client: Mr & Mrs Weytmans, Knapdale Eco Lodge, Gisborne.
Telephone: (06) 862 5444
www.knapdale.co.nz
kees@knapdale.co.nz

Architect: Graeme Nicoll, Nicoll Blackburne Architects, Gisborne.
Telephone: (06) 867 9622

Builder: D Stevens Ltd, Gisborne.
Telephone: (06) 867 5700

Roofing Manufacturer: Gerard Roofs.
Telephone: 0800 104 868
Profile: Gerard Colortile Textured.
Colour: Pepperstone.

Roofing Installation:
Tony File Roofing, Gisborne.
Telephone: (06) 867 0794

Photography: D & K Photography, Gisborne.

NZ POST AUCKLAND MAIL CENTRE

By Graham Hepburn



Prominent acrylic panels at the entrances outline the building's

Changes to the way people are using the postal service were part of the reason NZ Post undertook a review of its operations. The advent of email, the rise in internet shopping and the growth of courier services have radically altered the landscape. Coupled with the company's desire for greater use of automated mail processing, it soon became apparent that NZ Post needed to upgrade and expand their mail sorting centres.

The company decided to upgrade three premises and build three new mail processing centres at Hamilton, Christchurch and Auckland.

The new mail centres would provide the company with purpose-designed premises, capable of housing new and more efficient mail sorting machines that could process up to 70 per cent of mail – as opposed to the 30 per cent automation the



old machines were achieving. The decision was made to bring in six new sorting machines from Japan, with three going to the Auckland site.

The Auckland Mail Centre at Highbrook Estate in East Tamaki was the biggest project at 15,700sq m and with a processing hall of 8000sq m, about the size of two football fields.

Created with sustainability in mind by architects Warren and Mahoney, the Auckland Mail Centre was finished in June and shares a similar plan to its sister buildings, which

vary only in size. Warren and Mahoney director Peter Marshall says using the same model for all three centres created efficiencies for everyone involved. "In essence, we saw that the form of the building was dictated by the need to find a cost-effective solution to New Zealand Post's needs within a tight timeframe. The function of the three buildings was the same, so in planning terms the same model was appropriate."

Time was of the essence due to the impending arrival from Japan of the new mail sorting equipment and



installation teams. Principal project manager David McLernon, from Octa Associates, says working with the same plan for three different buildings is "not the norm", but worked effectively for NZ Post.

"They wanted the same national design with a single architect and, where possible, national subcontractors as well." In accordance with Warren and Mahoney's principles, the buildings were designed along sustainable lines, aiming for a four-star green rating. Warren and Mahoney used an in-house matrix to analyse sustainable features according to cost, practicality, appropriateness, benefits and philosophical fit. Marshall says while many sustainable elements can be introduced with little cost, achieving a high green rating can add up to five percent to the cost of a building. Although that cost can be regarded as an investment in the future. "In another generation, a building will depreciate more quickly if a good green rating is not in place."



Prominent acrylic panels at the entrances outline the building's sustainable features, which include unpainted Zinalume® cladding for the roof and Colorcote® ZR8™ wall cladding.

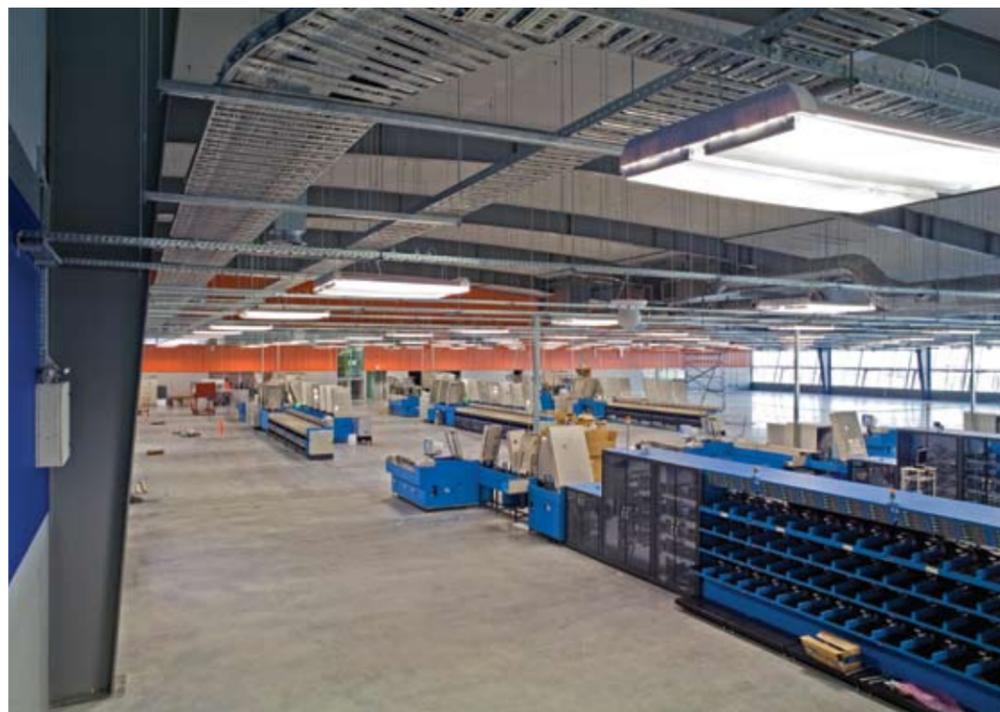
The centre has an area where mail trucks drop off mail, which is then transferred to a staging area and taken by trolley into the large sorting hall. Offices occupy a mezzanine level. A draped curved Zinalume® roof gives a clean, modern profile. A break-out area was created on the opposite side of the building from the cafeteria, to enable workers on that side to relax without having to trek across the vast floor.

To allow for more natural light in the processing hall – and a view outside during the day – one entire wall of each building is glass. Inside, lights are zoned, with sensors, timers and switches to ensure lights only come on when needed.

Cheerful blocks of bright blue, green and orange help break up the large space. "Getting the right colours was very important to the client," Marshall says. "Blue is associated with the process leaders area, and picks up the colour off the sorting machine, green is associated with relaxation in the cafeteria and breakout area, and orange signifies administration." Post-tensioned concrete ensures a crack-free floor, critical in a facility where trolleys must be able to move smoothly. A perforated metal acoustic ceiling absorbs sound.



Other elements that contribute to sustainability and low maintenance include the use of solar water heating, low energy equipment such as dishwashers, fridges and light fittings, Environmental Choice paint systems, linoleum instead of vinyl wherever possible, and recyclable carpet tiles. The buildings are not only sustainable but are also 'maintenance friendly' to allow NZ Post to concentrate time and money on their core business.



Warren and Mahoney

Established in 1958 as a partnership, Warren and Mahoney has grown over the years to become one of New Zealand's leading architectural practices. In that time the company has won many awards for its new buildings as well as refurbishments for large commercial and government organisations. Warren and Mahoney has become New Zealand's first accredited CarboNZero architects and has developed a plan that involves monitoring carbon emissions, lowering them where possible and encouraging staff to think about ways to reduce the company's carbon footprint. The firm is a founding member of the New Zealand Green Building Council (NZGBC) and has, over the last 10 years, become increasingly focused on environmentally sustainable design, developing protocols that cover materials, waste management and energy efficiency. Two recent projects involving Warren and Mahoney – the Meridian Energy building in Wellington, and the BNZ building in Auckland - became the first buildings in New Zealand to be awarded a 5 Star Green Star rating by the NZGBC.

*Designers: Warren and Mahoney, Christchurch
Telephone: 03 961 5926
www.wam.co.nz*

Construction: Haydn & Rollett, Telephone: 09 444 7379

*Roofing Manufacturer: Roofing Industries Auckland
Telephone: 09 414 4585
Profile: Zinalume® Maxispan*

*Wall Cladding Manufacturer: Roofing Industries Auckland
Telephone: 09 414 4585
Horizontal Profile: Colorcote® ZR8™ Multirib
Pre-painted in Gull grey and Grey Flannel
Vertical Profile: Ribline®*

*Roofing and Cladding installers: Steel Roofing Ltd.
Telephone: 09 415 8060*

When New Zealand Post signed the Warren and Mahoney protocol, they committed to taking on, as a minimum, 12 significant items associated with environmental sustainability: As a result the three new buildings included many, if not all, of the following features:

- 1) Modelling of building to determine benefits/paybacks of insulation levels.
- 2) Horizontal shading of windows to office areas.
- 3) Maximising natural light to the processing hall with glazed wall, while taking into account low afternoon sun.
- 4) Roof lights to the staging and interchange area
- 5) Fast acting doors to the staging area.
- 6) Low energy light fittings
- 7) Zoning of lights, with sensors, timers, and separate switching as appropriate.
- 8) Natural ventilation wherever possible
- 9) Low energy equipment such as dishwashers, fridges
- 10) Solar water heating
- 11) AAA rated plumbing fittings
- 12) Rainwater harvesting for "grey water"
- 13) Permeable paving to selected carpark areas.
- 14) Recyclable carpet
- 15) Linoleum in lieu of vinyl wherever possible.
- 16) Sustainably sourced timber
- 17) Environmental Choice paint systems
- 18) Zinalume® unpainted roof
- 19) Ceiling tiles with high recycled content.
- 20) NZ manufactured hardware
- 21) Waste separation to kitchens; recycling
- 22) Rain gardens and drainage swales wherever possible
- 23) Bike stands for staff

ZINC IS GOOD

Zinc and roofing go hand in hand and have done so since the 1800's. Roofing products incorporating zinc have been used to roof the historic buildings of Paris to the garden shed in your back yard and for very good reason. Zinc is truly an amazing material. Zinc has the ability to protect less noble materials from rusting, such as the steel base on "galvanised steel" or where it's used in a pure zinc sheet application it protects itself.



Zinc sheet used in roofing in its purest form, allows a patina (zinc hydroxycarbonate) to form which is insoluble in rainwater, and thus significantly reduces the corrosion rate. The durability of Zinc can be affected by some acid pollutants, the main one being sulphur dioxide (SO₂). During the 1970's Europe acknowledged SO₂ pollution of the atmosphere as a major environmental problem and have taken the required steps to significantly reduce it. The reduction in the corrosion rate of Zinc roofing has been staggering...up to one third. Fortunately in New Zealand, with the exception of geothermal areas, SO₂ is not a significant pollutant.

Pure zinc roofs in Europe currently have a life expectancy of up to hundred years with little or no maintenance.

Not only does zinc make sense to use in roofing it is also an essential element for all living organisms. Humans are unable to synthesise their requirement of zinc and need to consume zinc - up to 15mg per day for men to meet the World Health Organisation recommendations. Unfortunately in many developing countries there is a deficiency of zinc in the diet. As a result the World Health Organisation ranks this as the 5th health risk factor for developing countries and attributes 800,000 deaths worldwide to zinc deficiency.

There had been information issued by the ARC over concerns of zinc build up in Auckland harbours. The ARC concern was that the level of zinc, at selected sites within the Manukau and Waitemata, is higher than natural background conditions and is increasing. For every organism there is a range of optimum zinc concentrations. The ARC stated in the July 05 Storm publication "we don't yet know the concentration of zinc at which cockles, for example, will start to disappear....." The ARC also acknowledge that the two common methods for measuring these effects suffer from large uncertainties and are working with NIWA to develop an Ecosystem Health Model to better understand the link between sediment contamination and the effects on animals.

In 2003 the ARC commissioned Kingett Mitchell to look at zinc run-off from roofing. Kingett Mitchell determined that the main source of



zinc run-off, from roofing, was coming from unpainted galvanised roofs. In 2004, the MRM commissioned Tonkin and Taylor to conduct a similar study to understand the amount of zinc run-off from various types of metal based roofing. Both studies concluded, not surprisingly, that the highest level of zinc run-off comes from unpainted galvanised roofs (100% zinc over a steel base often referred to as galvanised iron). At the other end of the scale, also no surprise, was painted zinc/aluminium coated steel. The big difference in the results was with unpainted zinc/aluminium coated steel (43.5% zinc and 55% aluminium) where the Tonkin & Taylor result was significantly lower (ZINCALUME® is the most common brand of this material in New Zealand). The MRM study used controlled test rigs with over 500 samples taken over a period of 8 months. All the run-off samples were tested in an internationally accredited New Zealand laboratory.

Test Rigs used by MRM to collect over 500 samples over 8 months.

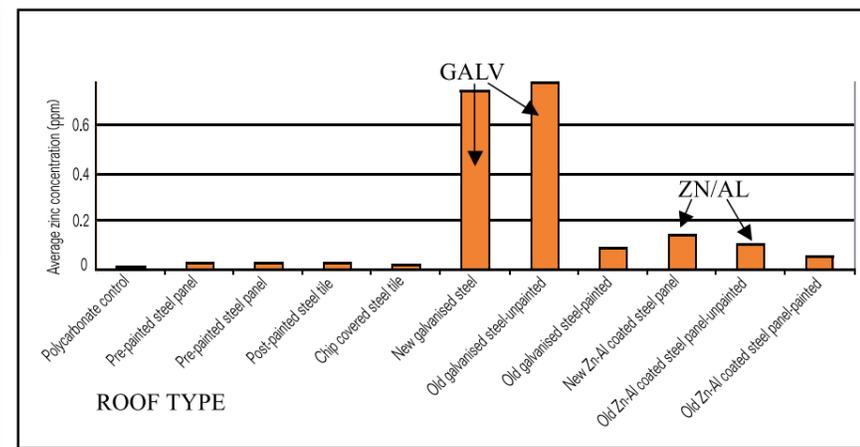


In contrast, the ARC report involved only 5 samples. Even so the difference was surprising and on investigation it was discovered that one of the ARC samples was taken from a contaminated roof. The roof had cement spilt on it, which due to its high alkaline content reacts with the aluminium and accelerates zinc run-off. However, on the basis of these results the ARC issued a draft policy on roof run-off, without

any public consultation and without following any of the formal processes required by the Resource Management Act. They concluded that painted roofs, due to their low zinc run-off, didn't require any water treatment, but that galvanised iron (their term) and unpainted ZINCALUME® did. The reason given for including ZINCALUME® with galvanised iron was due to the wide range of results - influenced by a contaminated roof! The below results from the MRM test data clearly show that unpainted zinc/aluminium is more in line with results from painted roofs rather than unpainted galvanised roofing.

ZINCALUME® has been on the market in New Zealand since 1994. The aluminium content of 55% gives it up to twice the life of galvanised products in severe environments. As a result of its improved performance it is now used in nearly all new pre-painted roof systems and over 70% of unpainted applications. Not only does this mean good news for all

Fig 1: Zinc run-off concentrations for various roofing materials"



building owners, it has and will increasingly have a dramatic impact on the amount of zinc run-off from roofs. Remember it is not known at what level zinc in waterways goes from being a positive to a negative and in ARC's TP217 it indicates the biggest issue for Auckland harbours is actually sedimentation build up - "Sediment run-off from land to sea is an increasing threat to the Auckland Region, not only to inter-

tidal flats, but to the sub-tidal coastal realm as well." There is also the question of whether the zinc is bio available or not. All run-off from roofing is bio available, but this allows it to quickly form non-bio available zn-complexes with soils/sediments and is also diluted by large volumes of harbour water. Zinc from other sources is significant, such as car tyres that generate zinc oxide, which may directly accumulate as sediment in harbours/estuaries.

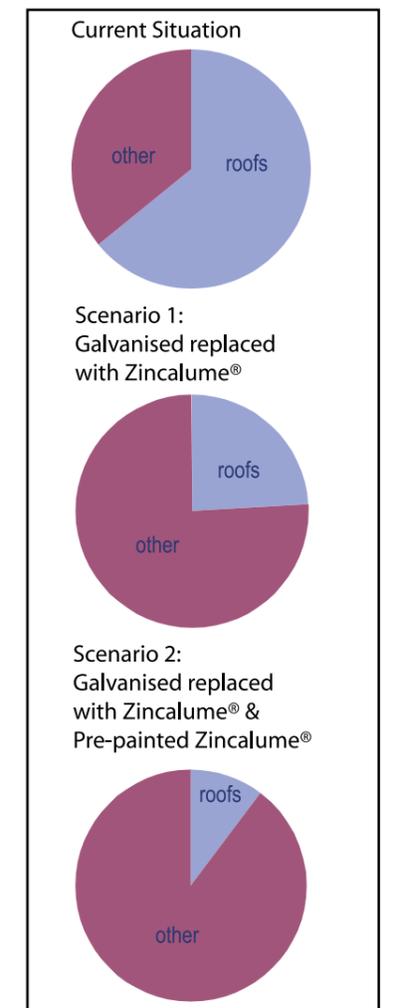
Zinc run-off from roofing is just one component in a broader urbanisation problem and with the positive environmental changes made over the last decade in metal roofing, Based on ARC data, Auckland City stormwater catchment carries about 12800kg/year of zinc of which galvanised based roofs contribute 8200kg/year. In Figure 2, Scenario 1 shows the reduction in zinc from roofs if they were all replaced with ZINCALUME®. Scenario 2 shows a more realistic result where the

The MRM is actively working with other parties and have offered to form a working party with the ARC so we can all work towards protecting the environment. We believe this must be done on the basis of correct analysis, well understood and researched scientific information.

The MRM has actually worked with the ARC since 2004 and in 2009 the ARC withdrew their draft policy and now ZINCALUME® roofs can once again be used without any restrictions.

ZINCALUME® is a registered trademark of BlueScope Steel Ltd.

"Fig 2 Reduction in zinc run-off from all roofing by replacing galvanised roofs



THE DART SUSTAINABILITY BUILDING DESIGN MEETS SUSTAINABLE WINE GROWING”

By Graham Hepburn



When Winegrowers of Ara commissioned an operations centre for its vineyard, they wanted to make a statement. As well as making a visual statement with the building, they wanted to make a statement of intent about their commitment to making high quality, boutique wines on a large scale on their 1600ha vineyard in Marlborough's Waihopai Valley.

The Dart, so-called because it resembles a paper plane from the air, is the first of a family of four planned buildings for the site, a river terrace at the confluence of the Wairau and Waihopai rivers that used to be the Bankhouse sheep station.

From its very first days, Winegrowers of Ara has taken care to invest in a master-planning process for the vineyard as a whole: a long-term, collaborative process involving representatives of Winegrowers of Ara in conjunction with lead architects Warren and Mahoney, Hillery Priest Architecture, landscape architects Boffa Miskell and brand identity and design consultants Designworks Enterprise IG.



The Dart, which was opened in March, is the first built expression of this massive undertaking, as well as the company's philosophy to create a sustainable yet functional vineyard. The building is designed to be one of the finest vineyard staff environments in the world, fit for a community of wine people whose shared goal is to produce wines that express the site's unique characteristics and set a New World standard in wine.

Winegrowers of Ara general manager Damian Martin says the building may look dramatic but it is also extremely practical as you would expect of an operations centre that houses vehicles and machinery, workshops, offices, meeting rooms, a lunchroom, and workers' showers and changing rooms.

"It's a mixture of form and function - even the architectural features do have a function," Damian

says. "At the western end of the building the roof folds down over a stone embankment and one of the reasons it does that is the roof deflects the wind up and over the forecourt."

The way the ZINCALUME® roof folds down creates an arrowhead pointing west that nestles into stones mounded high around it. Apart from protecting the building and workers from the elements, this form was part of a design concept to make the building look part of the land.

The Dart's distinctive shape also serves another purpose, as Damian points out. "One thing we were keen to do is make it look like a graphic from the air because this site is so massive we think that a lot of people will only see the building aerially."

John Coop, of architects Warren and Mahoney, came up with the design when he began folding bits of paper while he was sitting on a flight from Los Angeles to Auckland. From there, the building began to take shape and it has gone on to win a local award for commercial architecture this year from the Zealand Institute of Architects - and it is among the finalists for a national award.

The structure is 9m high, 80m long and 45m wide, with 100m of garaging frontage within. A large, fully enclosed forecourt allows space for vineyard machinery to be stored, maintained and repaired. The full-height entry and exit gates on either side of the building are also a striking design feature. These steel gates, which weigh 2 tonnes each, sit opposite each other on the north and south sides of The Dart so when they are rolled back they create a 10m-wide gap so you can see through the building to the vines on the other side. When closed, the gates provide the security needed when you are garaging expensive equipment in an isolated rural setting.

Just like the ZINCALUME® roofing, the other building materials are ones with low maintenance finishes and sustainability in mind. The exterior



cladding is exposed aggregate concrete panels that have been made on site, while the decking and flooring is red beech sourced from a sustainably grown forest in South Westland. There is also extensive use of plywood linings internally. At the eastern end of the building is the lunchroom, which is 30m x 8m and boasts an open fire. The large wooden tables and benches can seat about 100 people. The lunchroom opens to a deck with more seating that overlooks a landscaped garden and pond designed to create a restful setting.

"The lunchroom and garden is an oasis from what can be very hot or cold conditions out in the vineyard,"

says Damian. "One of the reasons we built it was our approach in the vineyard is quite labour intensive so we have a lot of staff. We want to make sure we can get workers and keep them and that they're happy in their work. Both our permanent staff and our casuals are very happy to be in the building."

Creating a gathering point for all staff was also part of the thinking so that knowledge and ideas could be shared among the wider group, encouraging a communal approach to managing the vineyard.

Upstairs there is office space and presentation rooms with views out over the vines.



Damian says The Dart is the first of a planned three operation buildings on the site, which measures 9km long by 2-3km wide. It is servicing the 400ha of vines they already have planted and as the remaining 1200ha is planted, predominantly with pinot noir and sauvignon blanc, the other buildings will go up so there are three buildings serving as operations hubs. A winery with tasting rooms is also in the pipeline. He says the scale of the vineyard demands having these hubs spread throughout to maintain efficiency. The other two operations centres will be similar to the Dart with some adjustments for their sites. While they've taken a modern approach to their architecture, Winegrowers of Ara are using some old-fashioned values to craft their wines. They have narrower rows much like the older European vineyards and a labour-intensive approach to grape growing. Because they aim for lower crop yields in the pursuit of higher quality grapes, their vines are lighter and can be supported by steel stakes rather than wooden posts. The stakes have several advantages: they last longer than wood and are

easier to recycle, and they allow the wires to be closer together on the rows. Overhead sprinklers, which mimic the effect of light rain, are used to fight frost and they are also encourage deeper root growth than drip irrigation.

Winegrowers of Ara have so far produced two brands of sauvignon blanc and pinot noir wines: the premium level Composite, which is made with grapes from blocks throughout the vineyard, and the super-premium Resolute, which comes from a single block at the heart of the site. The former is designed to be consistent in style and flavour year on year, while the latter, which is an elegant wine of great complexity and finesse will be more subject to vintage variation. For more information on Winegrowers of Ara and its wines, please visit: www.winegrowersofara.co.nz.

While it might seem a daunting project that Winegrowers of Ara have taken on, they can take some comfort from the fact that, like The Dart, the wines are gaining early praise.

Warren and Mahoney

Established in 1958 as a partnership, Warren and Mahoney has grown over the years to become one of New Zealand's leading architectural practices. In that time the company has won many awards for its new buildings as well as refurbishments for large commercial and government organisations. Last year, Warren and Mahoney became New Zealand's first accredited CarbonZero architects and has developed a plan that involves monitoring carbon emissions, lowering them where possible and encouraging staff to think about ways to reduce the company's carbon footprint. The firm is a founding member of the New Zealand Green Building Council (NZGBC) and has, over the last 10 years, become increasingly focused on environmentally sustainable design, developing protocols that cover materials, waste management and energy efficiency. Two recent projects involving Warren and Mahoney – the Meridian Energy building in Wellington, and the Deloitte building in Auckland - became the first buildings in New Zealand to be awarded a 5 Star Green Star rating by the NZGBC.

Architectural Design:
Warren and Mahoney in conjunction with Hillery Priest Architecture and landscape architects Boffa Miskell.
Warren and Mahoney
(9) 916 5057
www.warrenandmahoney.com

Contractor: TH Barnes,
Telephone: 03 578 9329

Roofing Manufacturer:
Dimond

Roofing profile: ZINCALUME®
Dimondek 630
Cladding: ZINCALUME® LT7

Roofing installer:
Nelson Marlborough Roofing Ltd.
Telephone: 0800 101 155

Photography:
Jean-Marc La-Roque
Patrick Reynolds

LIGHTWEIGHT METAL ROOFS REQUIRE LESS FRAMING, BE IT TIMBER OR STEEL

It is generally accepted that structural framing requirements for a lightweight roof are less than for a heavyweight roof and can result in cost savings.

The degree of these cost savings is often debated, so the NZMRM engaged an independent consultant to look at the savings that could be achieved using a lightweight roof.

This work was carried out by an independent consultant, Mike Flocks of MF Design Ltd. Mike Flocks is well respected in the industry and has just been appointed Chairman of the board of the Architectural Designers NZ Inc.

The review has now been completed and the findings show that significant structural costs savings are achievable when using lightweight roofing materials compared to using heavyweight roofing materials.

An NZMRM Information Bulletin has been prepared titled – "Lightweight vs Heavyweight Roofing Structural Cost Comparison".

This bulletin summarizes the findings and provides advice on how builders, designers and merchants can maximise the cost savings for their clients through using a lightweight roof.

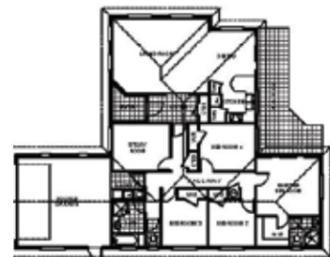
Extracts of the information bulletin follow. The full information bulletin can be downloaded from the NZMRM website – www.metalroofing.org.nz

Extracts from NZMRM Information Bulletin – Lightweight vs Heavyweight Roofing Structural Cost Comparison,

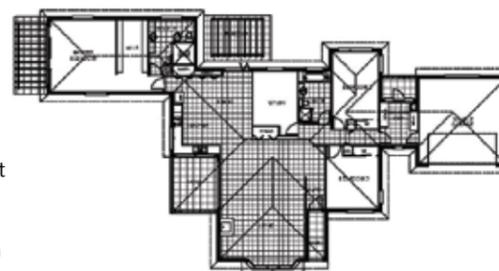
EXECUTIVE SUMMARY

The average approximate structural cost savings using a lightweight roof compared with a heavyweight roof were as follows:

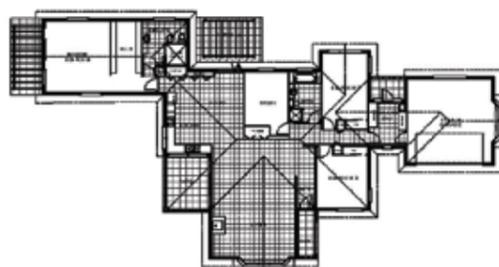
| Area of savings | Approx. average savings | |
|--|-------------------------|---------------------|
| Truss supply (materials) | -\$900 | -\$3.00 / m2 |
| Roof bracing (materials) | -\$450 | -\$1.50 / m2 |
| Lintels & framing (materials) | -\$700 | -\$2.30 / m2 |
| Lintel & Top Plate Fixing down (materials) | +\$50 | +\$0.15 / m2 |
| Total materials | -\$2,000 | -\$6.65 / m2 |
| Labour (mainly Roof bracing savings) | -\$1000 | -\$3.30 / m2 |
| Total materials plus labour | -\$3,000 | -\$9.95 / m2 |



Single Storey (2) (Gables & Hips)



Single Storey (Ashmore Cres) (Hips)



Single Storey (Ashmore Cres)(Gables)

METHOD

Three typical single storey roof designs were chosen. The structural requirements for a heavyweight roof and lightweight roof were then optimised to the minimum allowable under current standards, primarily using NZS3604. The costs for these structural requirements were then compared.

The following design parameters were used:

Design Wind Speed: High
Design Earthquake Zone: C

RESULTS

Table 1 - Shows structural savings for a lightweight roof vs a heavyweight roof.

Designer managing project: Mike Flocks - MF Design Ltd.
Quantity Surveyor: Quantech Consultancy Ltd.
Structural Engineer: Airey Consultants Ltd.
Note: The full structural comparison table, methodology and summary notes is available from www.metalroofing.org.nz

Table 1 - Shows structural savings for a lightweight roof vs a heavyweight roof.

| Plan | Truss Supply | Roof Bracing | Lintels & Framing | Lintels & Top Plate Fixing Down | Totals | | |
|--|-----------------|-----------------|-------------------|---------------------------------|-----------------|-------------------------------|---------------------------------|
| | | | | | Total Variation | Plan Roof area M ² | Variation \$ per M ² |
| PLAN: SINGLE STOREY (2 GABLE HIPS) | | | | | | | |
| Materials | -\$1,041 | -\$381 | -\$85 | \$74 | -\$1,433 | | -\$6.12 |
| Labour | | -\$843 | -\$84 | \$246 | -\$682 | | -\$2.91 |
| Total | -\$1,041 | -\$1,224 | -\$169 | \$319 | -\$2,114 | 234 sq. m | -\$9.04 |
| PLAN: SINGLE STOREY (ASHMORE CRES) (GABLES) | | | | | | | |
| Materials | -\$716 | -\$656 | -\$1,135 | \$27 | -\$2,481 | | -\$7.43 |
| Labour | | -\$1,373 | -\$113 | \$63 | -\$1,422 | | -\$4.26 |
| Total | -\$716 | -\$2,028 | -\$1,248 | \$90 | -\$3,903 | 334 sq.m | -\$11.68 |
| PLAN: SINGLE STOREY (ASHMORE CRES) (HIPS) | | | | | | | |
| Materials | -\$925 | -\$334 | -\$992 | \$27 | -\$2,225 | | -\$6.56 |
| Labour | | -\$630 | -\$255 | \$63 | -\$822 | | -\$2.42 |
| Total | -\$925 | -\$964 | -\$1,247 | \$90 | -\$3,046 | 339 sq.m | -\$8.99 |
| AVERAGE COST SAVING | | | | | | | |
| Materials | -\$894 | -\$457 | -\$737 | \$42 | -\$2,046 | | -\$6.77 |
| Labour | | -\$948 | -\$151 | \$124 | -\$975 | | -\$3.33 |
| Total | -\$894 | -\$1,405 | -\$888 | \$166 | -\$3,021 | 302 sq.m | -\$9.99 |

DISCUSSION

The analysis of these plans shows that significant structural cost savings are achievable when using lightweight roofing materials compared to using heavyweight roofing materials.

Savings achieved could be higher or lower depending on house design and location. For example the design parameters chosen for these plans are generally considered less favourable to lightweight roofing. Additional structural savings are likely to be achieved in lower wind zones, higher earthquake zones and if moving to two storey construction.

It should be noted that lightweight structural cost savings will increase as more gables are present in the roof design.

HOW YOU CAN ACHIEVE LIGHTWEIGHT STRUCTURAL SAVINGS

Truss supply

Truss design and pricing is determined by the frame & truss merchant. Check that your frame & truss merchant is optimising the truss design for a lightweight roof, that they are providing separate truss prices for lightweight roofing and that they are passing on the full cost savings to you.

Roof bracing

Roof bracing design is determined by the designer. It has been found that it is common to "over brace" roofs which incurs additional cost. By referring to the appropriate tables and specifying roof bracing to the minimum, good material savings can be achieved in this area. Additional labour savings for roof bracing could also be achieved if builder's payment methods accommodate this.

Lintels

Lintel design is determined by the designer. By referring to the appropriate tables and specifying lintels to the minimum good material savings can be achieved in this area.

Lintel & top plate fixing hold downs

There is an additional cost in this area for a lightweight roof that is small compared to the savings in other areas.



NZMRM engaged an independent consultant, Mike Flocks - MF Design Ltd. to calculate these potential cost saving when using lightweight roofing materials and to provide tips and considerations in roof design.



URBAN ECO

By Graham Hepburn

Raymond Q's Takapuna home is testament to how sustainable building is becoming more mainstream in New Zealand.

And that change in mind-set has been helped in no small part by the home's designer, Johann Bernhardt, who has recently released a comprehensive book on sustainable building, *A Deeper Shade of Green*, after years of designing energy efficient and environmentally friendly homes.

Not only has Johann, a Berlin-trained architect, been designing eco-friendly homes, he has also been running the Auckland office of the Building Biology and Ecology Institute, which researches, compiles and disseminates information on healthy and environmentally friendly building and living. The institute has a comprehensive directory of building solutions and services.

While Johann is a friend of Raymond's, that didn't mean he was an automatic choice to design a home for Raymond and his partner, who had become tired of their traditional bungalow.

Raymond found their existing home cold and damp, causing him problems with allergies. His partner, originally from Germany, wasn't used to homes without central heating. "He literally sat on the heater during winter," says Raymond.

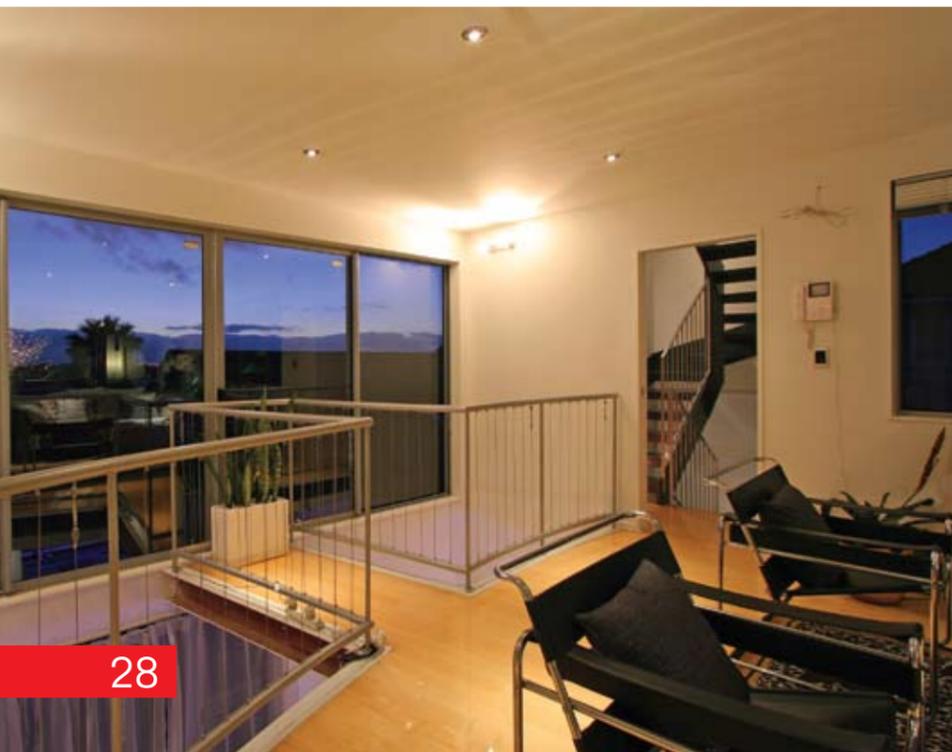
Raymond admits he was "a bit sceptical" about the idea of building an eco home, which conjured up images of "a mud brick house or growing grass on the roof".

"I wanted something smart and contemporary that would suit my interest in art and design." When Johann reassured him he could have that and a home that would be healthy and energy efficient, the partnership began on the house that was finished about two years ago.

Because Raymond, a flight attendant, and his partner travel a lot, he also wanted a home that was low maintenance. Budget was an issue, too, and so was maximising the harbour views.

To create that contemporary look and to resist sea spray, COLORSTEEL cladding was a natural choice. As well as being cost-effective and low-maintenance, it gives the home a modern look in combination with Titan board.

"That was my choice right from the beginning in my first hand-drawn sketch," says Johann. "I like the contrast in textures between the 3-D of the COLORSTEEL and the flat surface of the Titan board."





A major constraint on Johann's design was the tight site – Raymond subdivided land around his existing bungalow to build on. And the tight budget meant that desirable eco features such as a solar panel and dealing with storm water on site were postponed, with the initial focus on less costly factors such as good passive solar design.

With the help of computer modeling, Johann showed Raymond how the sun would come into the various rooms in the house through the day and the seasons. "I think the way Johann designed the windows works really well with the way the sun moves around the house," says Raymond.

Hand-painted concrete floors soak up heat from the sun pouring through the windows and release it at night. To ensure that heat is not lost, polyester insulation above building code requirements was fitted as well as double glazing on the south, west and east faces of the house. The double glazing allows Raymond to have large windows on the western side of the house so that he can enjoy the harbour views, city skyline and sunsets over the Waitakeres from his first floor lounge. A unique feature is the bridge from this lounge to a set of full-height sliding windows, which creates a void in this part of the house that allows warmth from the underfloor heating at ground level to circulate throughout the house.

Bamboo flooring on the first floor is another sustainable feature as is the NZ plantation grown hardwood used in the deck on the northern side of the house that connects the home to the self-contained studio. Because of Raymond's allergies, low or non-toxic building materials and paints have been used where possible.

Neither Johann nor Raymond is a fan of hallways so the home has been designed to incorporate passageways through the living spaces. This optimises space and makes the home easier to heat and light.



"I can create a really nice atmosphere in the whole house by using just four energy saving lightbulbs," says Raymond. And the power bill in his new home during winter is about \$150 a month compared to the \$500 a month he used to spend on electricity and gas in his old home.

One indulgence Raymond did allow himself was a rooftop terrace for outdoor dining and admiring the view - although it again allows him to create more living space on a limited site. And with Johann elevating the southern wing, windows have been added up here to allow sun into rooms on the south side of the house. The stairwell on the opposite side of the house is also elevated to allow light into it and it is partially clad in Titan board to create a striking vertical element. A pair of porthole windows heightens the effect.

While Raymond might have been doubtful about the benefits of an eco home, he's now a convert and something of an advocate for sustainable design.

In fact, one of the reasons he wanted a modern and dramatic-looking home – apart from his personal taste – was so that it would stir up interest in the community.

"I wanted a striking home to spread the message," Raymond says. "My concept for this house is to create an apartment in the suburbs with a lot of eco features. It's a good example to the younger generation that you can have an eco home but don't have to compromise your lifestyle."

And that's exactly the message that Johann would like to get out.



"The general idea about sustainable housing four or five years ago was that it had to be an earth house in the country but that's starting to change now because a lot of attractive houses have been developed."

He's also had a lot of positive feedback about his book, which he hopes will point law-makers, councils, manufacturers, architects and builders down the right path at a time when global warming and soaring energy prices are becoming huge concerns.

"A lot of people have said to me that it is the right book at the right time."

While the advantages of building a sustainable home are obvious, Johann says the concept has taken a long time to get traction with the public, who often take a short-term view about their homes.

"A sustainable home beats a conventional home hands-down in terms of costs during the life cycle of the home," he says. "Unfortunately, the problem for New Zealand is that people here sell very often and move very often so they tend not to plan for the long term."

Maybe that attitude will change with people like Raymond showing that a sustainable home can be practical, stylish, healthy - and good for the planet.

Johann Bernhardt

The director of Bernhardt Architecture, Johann Bernhardt is passionate about creating healthy, warm homes that are energy efficient and environmentally friendly. He took a year off his design practice to edit his book, *A Deeper Shade of Green*, which was published this year and



Photographer: Daniela Incoronato

looks at every facet of sustainable building. He says, "Hopefully, with this book people will have more information and be able to make better decisions."

His firm has been designing eco homes for many years, and he has also been running the Auckland office of the Building Biology and Ecology Institute, which researches, compiles and disseminates information on healthy and environmentally friendly building and living. Johann has an architect's degree from Technical University Berlin, a PhD in urban development from Paris University VIII, and a lifelong interest in sustainability.

Architectural Design:
Johann Bernhardt,
Bernhardt Architecture,
Telephone: 09 376 6767

Drawings: Eddie van Uden,
Equinox Design,
Telephone: 09 815 3838

Builder: Inger Builders,
Telephone: 09 424 8833.

Roofing: COLORSTEEL Endura
Cladding: COLORSTEEL Endura
New Denim Blue

Roofing and cladding installer:
Slater Roofing & Spouting,
Telephone: 09 424 1591.

Photographer:
Peter Lawrence

SUSTAINABLE NEW ZEALAND STEEL PRODUCTION

Article by Jenny Bain, Rooflink Magazine.

Climate change and rising energy costs have seen sustainability and environmental management gain momentum all around the world. In New Zealand the Government has outlined some initiatives as part of a broader programme to improve energy efficiency and sustainability and the building environment will be a focus for much of this activity, with sustainable building materials being a significant part of that process.

In changes outlined in the review of the New Zealand Building Code, building designers will be required to demonstrate the "intended life" for a building and demonstrate that "sustainable" factors have been given full consideration in material selection.

The plant is now extremely efficient at getting the white-hot iron from a to b minimising the heat loss and reducing the need to reheat it. Everywhere you turn ways are being found to cut energy costs.



As one of the country's major companies, New Zealand Steel began its journey with sustainable business practices 40 years ago, though much of what it has embraced is little known or recognised. New Zealand Steel has long been striving to minimise waste and reduce the environmental impact of its mining and manufacturing operation while still delivering innovative sustainable steel products and co-products. It is actively involved in the sustainable building movement and is a shareholder in BEACON, which is running the NOW homes project, a research programme creating affordable homes that are warmer, healthier, cheaper to run and reducing the impact on the environment.

New Zealand Steel advocates the use of Life Cycle Assessment (LCA) as a measurement tool for quantifying the impact on the environment of a product or service throughout its lifespan. This is seen as the fairest way of assessing potential environmental impact and extends from the extraction

and processing of raw materials through to the manufacturing process, distribution, end-use and then waste management and/or recycling including all the intervening transportation steps. Of significance is the fact that embodied energy in building materials is significantly less than the energy consumed by the occupants of the building. In the UK a study by the Steel Construction Institute showed that the energy embodied in the structural system is about 2% of the total energy consumption of the building over an expected life of 60 years. Research by the Steel Construction Institute found that for an air-conditioned office building over a 60 year design life, the ratio of embodied to operational energy is around 1:10.

Unique local resource

New Zealand Steel is unique in the world of steel making. This is because it uses its own iron sands resource as a key ingredient in the production of high quality steel and is the only company in the world making steel in this way.

In recent times technology and product development have been at the heart of changes in the steel industry, with increasing importance placed on product lifecycle and a manufacturing process that delivers sustainable products.

New Zealand Steel is the single largest employment site in the country and is the country's largest steel producer (620,000 tonnes of steel per year). New Zealand Steel contributes 1% of New Zealand's GDP and over \$2 billion into the economy. One half of all steel produced is exported.

New Zealand Steel was one of the first companies in New Zealand to set up a laboratory to measure the environmental impact of its manufacturing site with air and water quality being constantly monitored and information presented to the Auckland Regional Council and a local environment committee.

The company's objectives of managing its environment and minimising harmful affects from its Glenbrook site was recognised by achievement of ISO 140001, one of only a few major New Zealand companies to achieve this internationally recognised standard. The company had already developed its Environmental Management Systems prior to the establishment of the ISO standard in 1997 and by far the biggest percentage of capital investment in environmental control has been in the improvement of the quality of emissions into the atmosphere.

It is the increasing importance of product lifecycle and a manufacturing process supporting sustainable products that is shaping the future for New Zealand Steel and its primary manufacturers. It is no longer merely a steel business but one that is producing a number of innovative co-products from what previously were 'waste streams'. For example a co-product from the smelting process is used for road surfacing, soil conditioning, sports field drainage and filtering in waste water treatment by both Auckland City and Franklin District Councils.

The use of electric conveyors, directly from the mine face, and the pipeline to the Glenbrook Plant reduces energy costs and the impact on the environment.

Extraction of iron sand

The iron sand extraction process at New Zealand Steel's Waikato North Head mine site and concentration plant is itself an exercise in improved environmental efficiency. When the iron sand is concentrated using double drum magnetic separators and further cleaned before stock piling, the iron sand is transported in the form of slurry through an underground pipeline over a distance of 18k to the Glenbrook mill. No trucks required. Strenuous efforts have been made to reduce the levels of clay in the slurry and as part of a study into utilising this "waste" material the company is awaiting resource consent to develop a worm farm from the clay material carried in the slurry pipe. The sand that is left over from the extraction process - called "tailings" - is returned to the site where the iron sand was removed and these areas are being progressively planted with Marram grass and pine trees. It is almost impossible in parts of the sand dunes to tell that the area was once mined.

Recycling

The steel industry in New Zealand has a good record of recycling. Scrap steel comes from a variety of sources including the scrap generated in steel plants and the off-cuts generated by manufacturers. There is also steel that has been used to manufacture items that have become obsolete. Steel can be endlessly recycled and does not suffer any product degradation, which makes its life cycle potentially continuous. Steel scrap is a necessary and integral part of the steel manufacturing process and the average recycled content of steel produced by New Zealand Steel is approximately 12%. The recovery rate of steel from buildings is 85% and a recent report on commercial construction waste found that more than 90% of steel was recycled.



The Attritioner unit's successful operation has meant a significant reduction in waste clay at the steel mill.

Slag recycled to roading aggregate

Other waste reduction initiatives include.-

- Nearly 82% of the total waste from New Zealand Steel's sand to steel process is recycled, reused or resold and the company continues to actively pursue new ways to reduce waste.
- Hot gases are recycled to generate 70% of its electricity needs; the waste stream going into the onsite landfill has been reduced 60% in the past three years owing to targeted recycling and reduction programmes.
- 15 tonnes of plastic and 25 cubic metres of polystyrene have been diverted from landfill in the last year; all old machinery and scrap metal on the site has been recycled through the steel making process and the use of chemicals has been reduced.
- One million tonnes of water is circulated through the steel making and finishing operations daily with 2% of the total added each day to replenish discharge water. Maximum conservation is achieved by water being cleaned, cooled and re-circulated many times. A large volume of storm water is collected on site but New Zealand Steel also takes water from the Waikato River, with an innovative system in place to ensure that fish stocks and recreational users of the river are not affected.



Extensive planting of Marram grass and Pine forests returns the environment to its pre-mining state. The green purist could argue that the best thing for the environment is to leave it alone, however if you are going to disturb it then leaving it in arguably a better state is not a bad compromise.

Capital investment

The greatest amount of capital investment at the 190 acre Glenbrook site has been directed into issues concerning the environment, specifically improving the quality of emissions into the atmosphere. New Zealand Steel is a member of the World Steel Association (formerly the International Iron and Steel Institute IISI) which in its first sustainability report for the world steel industry commits to seven key actions including.-

- Expanding the use of efficient technology
- Research into new low carbon steelmaking methods
- Maximising the recycling of steel and by-products
- Developing new generation steels that improve energy efficiency of the products in which they are used.

Steel cannot be produced without the production and emission of carbon dioxide. However NZS has committed to reduce CO2 emissions to the minimum and has consistently met government targets for reducing these emissions. It is currently involved in a joint venture with a Japanese steel company researching new technology for reducing coal use in the steel making process.

A big factor in consideration of steel for sustainable building is the distance required to transport it through the supply chain and the level of recycling that is possible

at the end of its life. As our environmental consciousness is being constantly aroused, the 80% of RANZ primary members involved in metal roofing plus associates in the manufacturing and supply sector should note the following advantages of steel for today's building applications.-

- Steel can be engineered to precise specifications which means minimum waste on site
- It is non-toxic and is available coated to give greater corrosion resistance and durability
- Steel products can be used to reduce the cooling and heating of buildings, leading to reduced energy use
- Steel products are light and easily transported
- Steel products have been in use in New Zealand for over 100 years for the catchment and storage of drinking water

- Steel is the most recycled material in the world and does not suffer any degradation through repeated recycling.
- Steel requires minimum maintenance and has a long life.
- Steel is non-combustible
- Steel has a high strength-weight ratio which means buildings can be extended without the need to alter foundations.



New Zealand Steel's journey for sustainability is a challenging one but has led to exciting product improvements, new products and the development of many co-products from waste such as materials for pigments, material for magnets and even waste material that can be used to manufacture house bricks. Going forward the company is supporting the development of a standard New Zealand methodology for LCA and is actively participating in this work with a group of organisations with a vested interest in resolving the issues. Sustainability has become a hot topic of debate and many companies and organisations may just be starting to consider it. New Zealand Steel had the foresight to predict the impact of its steel making operation on the environment and has been actively managing sustainability since the 1970s. It's almost as if the rest of New Zealand has just caught up.

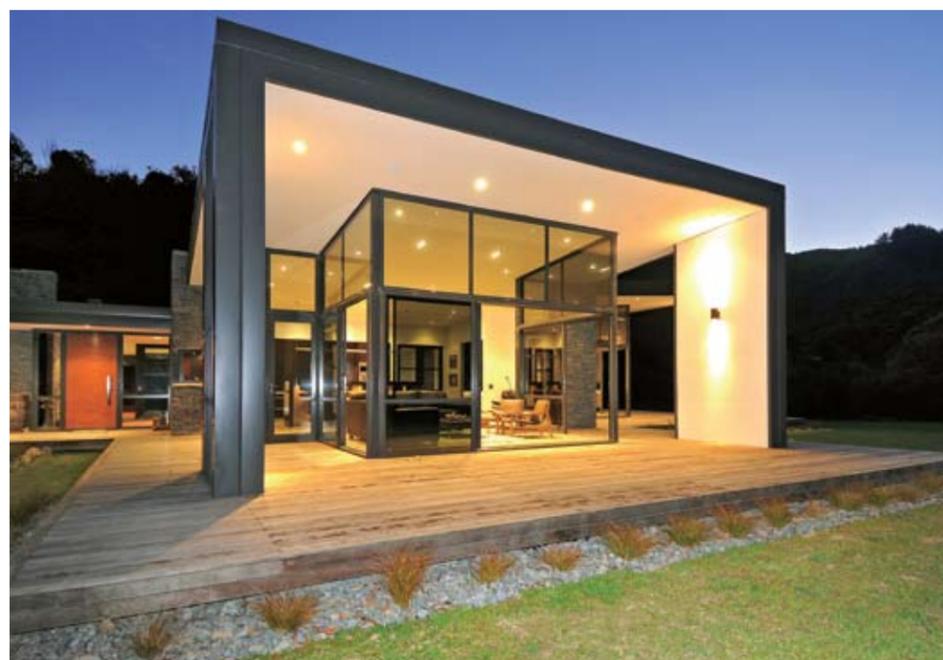


IN PURSUIT OF DESIGN EXCELLENCE

Today the global concern for our dwindling resources has made industry, and particularly the building industry, acutely aware of sustainable building and what this means now and in the future. Designers can no longer be content to provide an aesthetically pleasing building without considering the many aspects that contribute towards greener building and healthier environments.

In many instances choices are made related to local

resources, consideration to transport cost, shipping, recycling, rain water collection and storage, heat retention, solar energy...and so the list goes on. Each aspect can and does play an important role in the evolution of a building and contributes in some way towards improving our future living and working spaces. It is within these constraints and opportunities that Studio MWA excel. The Dulieu home is an excellent example of what can be achieved blending design and sustainable building practice.



The clients, Dianne and Barry Dulieu having just purchased their site, were advised by the previous owner to discuss the potential of the site with Davor Mikulcic, Studio MWA Ltd. Wellington, as he had been commissioned to do some site analysis and preliminary sketches which may prove beneficial.

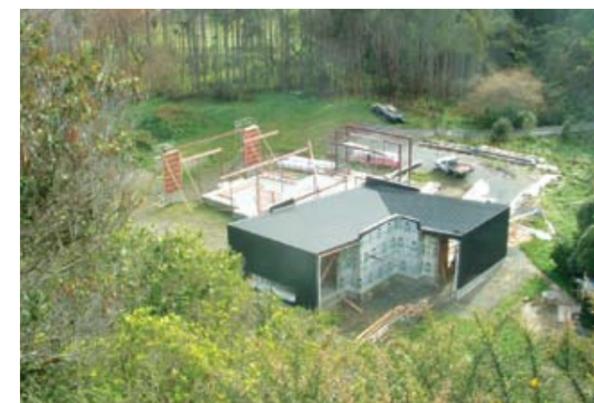
Davor was quick to point out that although he was familiar with the site it was crucial they visit the site together as it was important the Dulieu's expressed their impressions of the site and which aspects of the property they enjoyed. Building this rapport and understanding is the key to any successful project.

For Davor and his team design is more than a business, it is a passion. "The budget (large or small) does not reflect the success of the project. You can recognize a project that is driven only by money," says Davor. "The defining factor is the degree of personal involvement and understanding between the design team and the client. This is the separator between good design and excellent design.

The site is magnificent and the client brief was relatively simple with nothing particularly unusual. A contemporary residence, on a single level with a simple indoor / outdoor flow. The home should take advantage of every aspect of the very unique site. Easy maintenance inside and out with the maximum usage of passive solar energy and good building orientation, under floor heating – heat pumps were installed to heat the under floor water system, double glazing and maximum thermal insulation for floors, walls and ceilings.

Discussion between different clients and site visits is always beneficial and often leads to a refined brief and detail," says Davor.

An example on the Dulieu residence was related to the exterior cladding. In the first instance there was a desire to



use natural schist, which proved very expensive. Having visited other projects and seeing first hand the visual effect achieved with a combination of schist and the vertical metal cladding a decision to use metal could be made with confidence. This is now a feature of the residence.

"At the outset I asked Dianne and Barry for their permission to explore many different options from the bizarre to the conservative. They were open to this approach and this latitude and freedom to explore is vital to the creative process of design."

Barry built and project managed the house "part time" with help from his son, Rhys Dulieu. (Rhys is owner and director of Rhys Construction from upper Hutt – www.rhysconstruction.co.nz)

Often when clients decide to manage a project it is a recipe for disaster but in this case there was no doubt they had the skills and experience to complete a high end residential project.

There are always many practical aspects of any design that have to be considered and these included factors which are influenced by; the clients' brief, site, surroundings, context and a variety of compliance criteria. This site is within the 100-year flood zone and required design solutions to ensure it would not be an issue in the future. Two large water tanks, a septic tank with influent field and the inclusion of gas for hot water where mandatory. Some of these elements represent a design challenge and must be incorporated as an integral part of the design, not added on. Something that is often over looked.

The building that others describe as a "Butterfly" is first seen from above (fifth elevation) making the roof a prominent aspect of the design that forms two connecting "L" shapes. These forms allow shelter in all weather and take full advantage of the sun and assist with natural ventilation throughout the building via strategically placed opening windows.



Part of the sustainable strategy and one of the goals of the design was the use of passive solar energy, natural ventilation, rain water collection and the use of natural materials. In essence to be sensitive to the site and enhance the natural aspects of the surroundings.

The building platform is on one level to allow residence, now and in the future, to enjoy easy access to the home with no compromise.

Polished concrete floors with under floor heating was one of the imperatives from the start. With good building orientation, this project maximized the use of passive solar energy with highly compressed polystyrene thermal insulation under the concrete slab.

To achieve large open plan areas, with more than 70 % of the buildings elevations in glass, an elegant steel cantilever structure was chosen as the main form. The structural steel was incorporated into the thickness

of roofing structure or walls giving the entire composition a light appearance

To achieve these big open spaces without any additional support between, a simple yet elegant support was designed at the end of the cantilevered eaves that turns down the roof to touch the ground. This creates a very simple, clean line that frames the view from the interior. This cantilevered section provides bracing to the "virtually glass structure", with eaves that extend 3-4 meters providing shade during the summer.

The "trough section" metal profile of the Dimondek 400, was an excellent cladding choice as it helps to maintain simple clean lines in both sloping and vertical planes, Sharp lines emphasize the simplicity of straight lines. Roof and wall claddings are without any penetrations avoiding potential problems and give an aesthetically pleasing appearance. Schist was



strategically used on corners in L shaped forms and with the intention of creating a dramatic appearance to the exceptionally well-executed masonry. From the outset the intention was to use some of exterior materials (like schist) and incorporate them as interior details providing continuity and a connection between the inside and out. Mr. Glen Bosworth, from Bosworth Stone Ltd., and his team worked nearly 6 months to achieve an incredible, unique finish – definitely one of "key" features in new Dulieu Residence.

Throughout the house halogen lighting is used in blocks of usually 2,3 or 4 lamps. This gives a bright, dramatic appearance and in the evening transform the house. Exterior halogen lamps, strategically located, provide lighting to the covered exterior decking making a soft transition between the very bright interior light and pitch-black exterior.

In the final analysis of any home design the ultimate judgement will be from the client. In this case Dianne and Barry Dulieu have aptly called their new home "Paratiho" which is the Maori for paradise. "We are living in Paradise", says Barry, "everything is in harmony with the preservation of natural beauty."

This is what Studio MWA strive to achieve ...the moment when the synergy between client and designer produces a result they are both proud of.

Studio MWA

Studio MWA now works in collaboration with the new, Brisbane based office of Davor Mikulcic Architect. The range of projects is a spread between commercial and residential. Our primary focus is on high end residential and new clients predominantly are the result of recommendations, or they are people who have seen our work through publications, Industry Awards or from visiting completed projects.

The core team at Studio MWA consists Davor Mikulcic (Architect) and Micheal Maddren (interior design and ArchiCAD specialist).

Micheal teachers at Wellington Weltec in interior design and ArchiCAD systems and Davor Mikulcic teachers in the Queensland University of Technology (QUT) - faculty of Build Environment- School of Design

Davor was on the jury for the 2009 Royal Australian Institute of Architects (now AIA) for Queensland and Brisbane and this year AIA- Queensland, have chosen Davor to chair the 2010 Judging for Award in Architecture in the Brisbane region in most prestigious category – Public architecture.

In 2010, for the second year in sucession, Davor was invited onto the jury for the international architectural student's competition in Denver, Colorado, USA for the Socio Design Foundation.

Client: Dianne and Barry Dulieu

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SUSTAINABILITY: WASTE REDUCTION

By Graham Hepburn

Metal roofs have long been recognised as one of the best ways to keep buildings weather-tight but most people probably don't realise they are a shining example of waste reduction.

From manufacture to installation, metal roofing has come a long way – not only is it made more efficiently but the process is cleaner with waste minimised at every turn.

The fact that steel and other roofing metals such as aluminium, copper and zinc can be recycled repeatedly with no loss of performance gives them an endless life cycle and means less energy is wasted converting raw materials into new metal products.

This constant recycling means that steel especially is not ending up in landfill like other waste or demolition building materials. 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.



Scrap metal is a valuable commodity to New Zealand's two steel-makers, particularly Pacific Steel, a division of Fletcher Building, which makes all its steel from scrap. New Zealand Steel, which makes 620,000 tonnes of steel a year at Glenbrook, has an average pre-consumer 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/zinc alloy to produce ZINCALUME® steel. Since the introduction of ZINCALUME® steel nearly two decades ago nearly all new steel roofs use it as their substrate. ZINCALUME® steel uses less raw materials (Aluminium/Zinc Alloy – 150 gms/m²) than Galvanised (Zinc – 450 gms/ m²) whilst providing better durability.



Scrap metal is not only used to feed the kilns but also to control the temperature generated by the chemical reactions in the furnace.

While recycling steel reduces the amount of materials being dumped in landfills, the process also saves an enormous amount of energy: 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 knock-on effects of reductions in mining, transportation, and greenhouse gas emissions.

The American Institute of Architects estimates 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. Thus the relatively high embodied energy in steel made from virgin materials is significantly reduced globally by the universal high percentage use of scrap.

One of the problems with steel production used to be the piles of slag generated by the process but rather than slag being a nuisance "byproduct" it's now looked on as a "coproduct" that is treated and then widely used for drainage, filtering and roading. Water usage also used to be an issue in the steel making process



but these days Glenbrook recycles the 1 million tonnes a day it uses so that only 1 % of cleaned wastewater is discharged. Technological advances have meant 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.

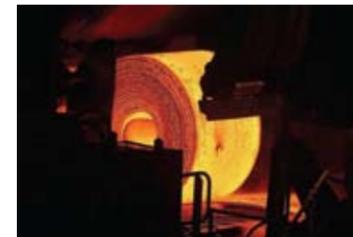
It's not just the steel-making process and the base coating (ZINCALUME® steel) that has become more efficient, but also the paint systems used to produce COLORSTEEL® and ColorCote® have too. They have far less by-products such as solvents as



Extensive coatings test facilities in many locations provide a data base to improve paint systems

improved paint technologies have allowed the wide use of water borne paint systems that not only have less waste and are better for the environment but also last longer.

Metal roofing technology has become much more advanced over the decades, meaning that less steel is needed to make metal tiles or longrun roof material used in both residential and commercial applications.



High tensile steel uses less resources and provides a stronger product.

One of those advances came about when manufacturers began making long-run roofing from high strength steel coil, which has higher strength than the softer steels previously used. Because it is high strength this steel can be produced in thinner

gauges, this means less steel is required and consequently less waste generated. The typical gauge now used on residential buildings is 0.40mm and commercial buildings, 0.55mm. This lighter product enables designers to optimise building design and reducing cost.

Another factor in waste reduction is the durability gained when zinc-coated (galvanized) steel was superseded by a combination of zinc and aluminium (ZINCALUME® steel) that gives the steel a lifespan up to 4 times greater than before. Durability has also been enhanced by colour-coating steel coil which could then be turned into ready-painted steel rollformed into a range of shapes. These advances in durability mean roofs need replacing less often and that saves resources, energy, time and money.



These sheets were made to size using the Dimond on-site manufacturing unit for the new 8000m² Turners and Growers facility in Christchurch.

The advent of long-run roofing (made to measure in one length from ridge to gutter) also reduced waste as the roof can be made to the exact size required and achieves a much longer lasting result particularly with large commercial buildings which would have had a series of overlaps with standard sheets, leading to corrosion and the need to replace the roof much sooner. Unlike virtually all other building materials there is minimal on-site waste with long-run roof and wall cladding because it is made to length in the factory, and even in the factory waste is minimal at typically less than 1.5%, and 100% of this waste can be recycled!



These Colorcote® ZRX Corrugate sheets were manufactured to size by Roofing Industries, Auckland, reducing waste. The 50 year old metal roof was removed and recycled.

With manufacturing sites all around the country producing longrun roofing, there is less energy used to transport the product long distances to building sites. Because of these shorter distances, the amount of packaging used when the roof is transported can be reduced to save waste. There is also minimal damage incurred transporting steel compared with other roofing products such as concrete that can suffer significant breakages and waste during transportation. Even small improvements can have a big impact in the fight to reduce waste - more efficient roof profiles have been developed, which means there is less steel used per square metre than in old profiles. This combined with thinner gauges could mean up to 35% less steel is used in a modern roof, which also lasts longer and requires less supporting structure.

All these progressive developments over the last few decades have resulted in metal roofing that is far more efficient, more environmentally friendly, and more durable whilst providing just about endless design options.

LOW ENVIRONMENTAL IMPACT PIHA CAFE

By Graham Hepburn

Piha Cafe

A combination of traditional looks and new technology means the Piha Café sits comfortably within its seaside environment and, more importantly, will be kind to it. The wooden homestead-like structure of the café has been designed so that the timber will silver off over time. It's tucked back against the hill on its northern side to give it a sense of nestling on the site. Being set back from the road not only allows visitors a feeling of arrival as they approach but also serves the more pragmatic purpose of creating room for a car park.

smallest details to minimise the building's impact: the toilets are low-flush, the taps are triggered by sensors and there are even sensors on the hallway lights to the toilets. The building has been insulated to the latest standards and the windows are double glazed. On cold winter days, extra warmth is

The café uses photovoltaic cells in flexible panels laid directly on to the north face of the COLORSTEEL® roof to harness energy that helps to drive the heat pumps that warm the concrete floor of the cafe and provide its hot water. "We basically get free heat and free hot water," says Andy Higgs, one of four owners along with Richard Hatton, Christian Fougere and David Bensley, who drove the build as project manager. "If Dave hadn't come on board it would have been a disaster without him," says Andy.

The café also has an inverter so it can export any excess power back to the grid. "It's behind the walls where people usually cut costs, but that's where we've put in the investment," says Andy. "The payoff is lower impact on the environment and lower running costs."

And it's not just behind the walls where they've spent money; a fair bit has gone underground with an 87m deep bore supplying fresh drinking water, or "Piha pure" as Andy calls it.

There is also a sophisticated on-site wastewater treatment set-up, which actually sits under the carpark. The carpark itself is grassed to provide a permeable surface that won't create stormwater runoff. The grass is laid over Permathene Turfpave grass pavers, made from 100% recycled polypropylene, which help the grass to withstand traffic. Beneath the



carpark Andy says there is a 80m long network of 2m deep scoria trenches that can cope with up to 3000 litres of wastewater a day. "By the time the wastewater gets to the end of that it's pretty much drinkable," he says.

There has also been a conscious effort to avoid using paints, sealers or stains as much as possible. Andy says the macrocarpa and Japanese cedar in the building don't require finishing to withstand the elements and will age beautifully. Attention has been paid to the

provided by a retro-looking but highly efficient low emission burner, called an Oh-Ah. Skylights are used on the southern side of the roof to flood the café with light but not on the northern side as the direct sunlight would have been too harsh.





"The really innovative thing about this is where we've used technology we've used the latest greatest things but where we haven't had to we've gone secondhand," says Andy.

Some appliances have been sourced from other cafes as have the tables and chairs. And there's a fair assortment of rescued items from demolition yards and secondhand stores such as the light fittings, toilet doors, and packing crates under the counter. The interiors were done by Tony Brandso and Liv Harper, of Material Creative, who had to be resourceful and imaginative on a limited budget. Andy says the takeaway bar on the eastern side of the building could have had nice modern lines but instead they chose to use a 5m wide slab of macrocarpa for the bench to give the area warmth and character.

Architectural graduate Nick Dalton says the building had to be modest because planning rules dictated the site coverage of the café and the number of seats it was allowed. But carrying off that look wasn't as easy as it might seem.



"It just looks like a really simple box but it's deceptively complex to do it well," says Nick. "It's got all the bells and whistles but we didn't want it to look like it's got all the bells and whistles."

He says the building's simple lines and easy flow can be attributed to hammering out every detail beforehand and then leaving it to the craftsmanship of people like head builder Duncan Clarke, of Coastal Construction, and Derek Mullooly, of New Zealand Log Homes. Features such as a seamless threshold are difficult to achieve but look elegant and make it easier for customers coming and going as well as providing a sense of openness, especially when the glass doors slide backwards from the southwest corner to embrace the view of Lion Rock. The deck on this corner also has a hidden fixing system, meaning no nails and this gives the wide eucalypt boards a look that is

flawless and flowing. Andy laughs when he recalls how he was tempted by the offer of some free roofing in a sandy colour but Nick wouldn't have anything to do with it. Nick was adamant they had to go with a silvery grey colour to blend with the environment. The colour and the clean, simple lines of the Euroline SeamLok complement the building's form. As Nick says, "It was really important that the roof looked right as the whole building is supposed to silver off over time so it will look like it's always been there." While the café is now up and running, Andy says it's been a tough and costly battle for him and his fellow owners to get it off the ground after fighting local opposition through hearings at the Waitakere City Council and then in the Environment Court.



Above: Innovation in water dispensing, historic post office memorabilia, and even the worms recycle the restaurant waste in the on site worm farm.

Right: The water heating system and the electrical system, powered by the solar panels, work in tandem.



That process took almost three years and cost hundreds of thousands of dollars but there has been an upside.

"All the local tradesmen have pitched in and cut their rates or done us a good deal because of the battle we've had and because they've believed in the project," Andy says.

"Mind you, if we hadn't spent two-and-a-half years in the courts we wouldn't have got that sort of support."

Nick says the irony is that people who opposed the café on heritage grounds were conveniently overlooking the fact that in recent times Piha had been a vibrant seaside community with a movie theatre and milk bars.

"So when people who oppose the café say they want to preserve the heritage of the area that is what we wanted to achieve as well," says Nick.

But with that battle fought and won, one of the nicest touches in the café is that it still has some of the old post boxes from the post office that used to be on the site.

Andy says the idea is that regulars can keep their coffee cups in them or people can leave keys there or messages for friends.

As Nick says, "That was a really important thing for us because it had been the site of the old post office and we wanted to keep that sense of community."

HarleyDalton Ltd

HarleyDalton Ltd was established in 2006 by husband and wife team Anna Harley and Nicholas Dalton. Both graduates from Auckland University Architecture School, Anna and Nicholas have received

national and international design awards for innovation in architecture and urban design. Their experience is diverse, taking in hospitality related, residential and urban design projects including converting a 100-year-old derelict church into an apartment in the South island, a stunning house in Blenheim overlooking the Dryhills vineyards, and a state of the art dental surgery in Tokyo. HarleyDalton is an energetic inner city practice which is committed to the continuing evolution of urban culture in Auckland. Nicholas and Anna pride themselves on working closely with their clients to produce enduring designs.

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