conecta
At home in solid wood since 1979

Fact sheets

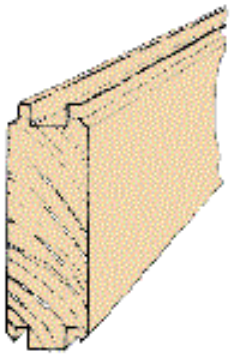
About the Conecta System - How it works

The **Conecta®** system consists of just four main components:

- boards;
- connectors;
- bracing Co-Pins®;
- tie rods.

1. BOARDS:

There is only one type of board used for both interior and exterior walls: double tongue and groove profiled 45mm x 137mm wooden planks with 18mm holes every 50mm. These same boards are even used to make beams and lintels spanning over 6 meters. The holes in these unique **Conecta®** boards fulfil many essential functions during the production process, for the builder on the building site, in the building itself and also for the home owner:



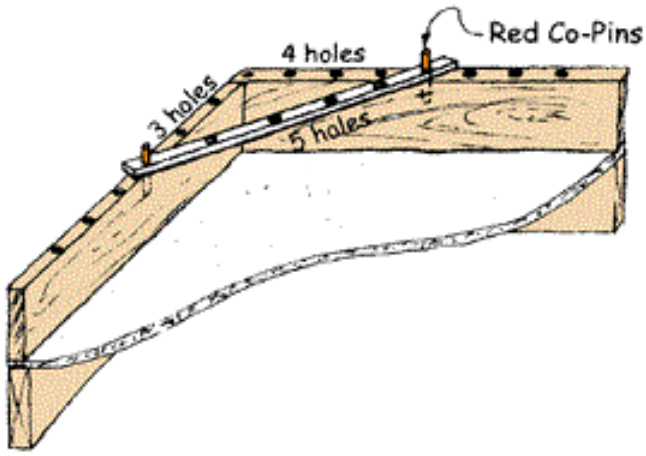
Conecta Board.

Production:
- measure for pre-cutting;
- eliminate need for costly drawings for electrical wiring, plumbing and bracing;
- determine door and window openings;
- help to get treatment into the core of the boards if required.

Builder:
- setting out of the walls with set out battens (no measuring required);
- line up walls and keep them plumb and square:
- fixing walls to foundation/floor.

Building:
- used to connect walls to each other;
- provide conduits for bracing Co-Pins®, tie rods, power cables and plumbing pipes;
- permit the formation of long spanning lintels and beams.

Owner:
- seamless extensions and enhancements to the building are possible;
- offer opportunity to install invisible cabling at a later stage.



Squaring a corner using set-out battens and the 3-4-5 method.

2. CONNECTORS:

Manufactured from high-grade aluminium conforming to BS1474. The manufacturer is Telarc registered ISO/IEC Guide 25 1990. These are standard, double and half profiles to join the walls together. The standard connector can be used to construct an entire building; double and half connectors are used for special joints.

3. BRACING CO-PINS®:

Manufactured from high impact plastic, two types exist: one to locate the walls on the floor and start the vertical bracing lines, the other is used as required to impart bracing to the system.

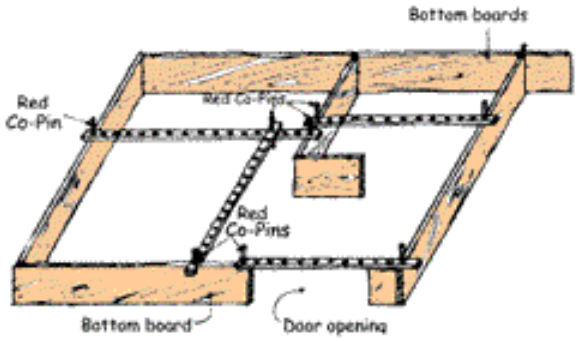
4. TIE RODS:

Manufactured from 10mm Rebar with a 100mm long M10 thread attached to one end, they are used to tie down the walls and the roof to the floor or subfloor, and are hidden within the wall. They are galvanised to prevent corrosion and come with galvanised washers and nuts.

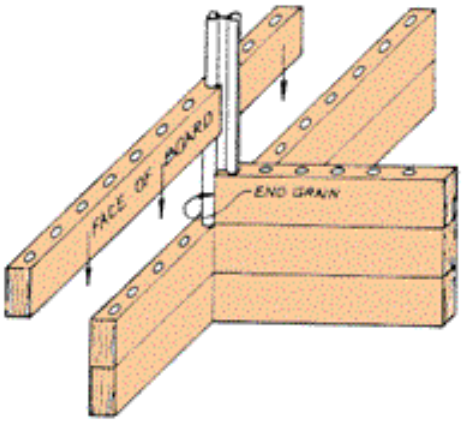
Construction is simple. The **Conecta®** boards are precisely cut to plan, numbered and delivered ready to put up. After laying out the bottom boards according to the floor plan, all corners and wall intersections have to be connected using the appropriate alluminium connectors. Set-out battens are used to square corners, parallel walls and space openings.
Adjusting the 'first board frame work' on the floor with Co-Pins® is the next step, keeping the boards straight and aligned. When the set-out battens are removed the erection of the **Conecta®** walls can start, always making sure that after each layer of boards the bracing Co-Pins® , as per bracing plan, are in place. For more information about bracing see our **Fact Sheet 7: About Bracing with the Conecta® System.**
The boards just slide over the aluminium connectors following a numbered plan. There is no need for measuring, plumbing, levelling or even using nails or brackets. As the walls go up the windows and doors simply slip into place; matching solid wood door frames and window reveals are supplied. After the walls are up, the tie rods are installed to anchor the structure to the foundation.
The installation of electrical wiring and plumbing can be done during construction or afterwards.
Standard compliance:

NZS 3604:1990

NZS 4218:1996

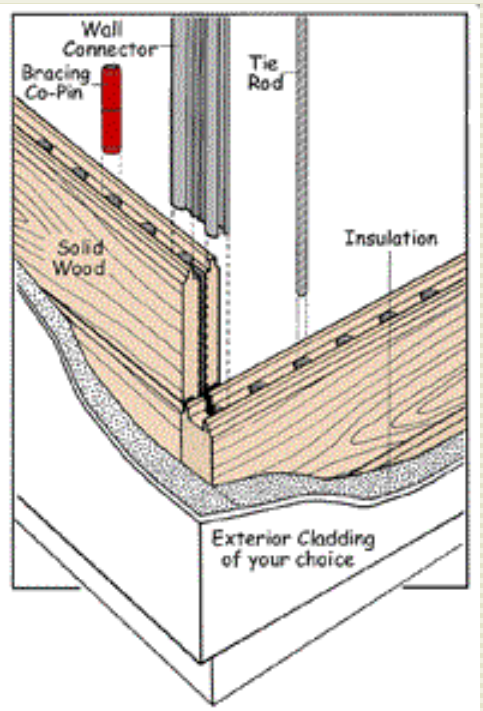


Setting out parallel walls and spacing openings using set-out battens.



Building walls is easy.

Why build in Conecta solid wood and not light timber framing, concrete or steel frame?



Construction with Conecta.

Because wood is the most amazing and versatile building product given to mankind. It out classes any other man made substitute in terms of its user friendliness, insulation qualities, resistance to chemicals and its strength to weight ratio. Whether we are living, playing or working, wood provides us with a strong natural and healthy environment.

You'll find the cost of building with **Conecta®** compares favourably with concrete or light timber frame. Because **Conecta®** walls bear heavy loads, you're unlikely to need expensive laminated beams and posts. When compared to building in other materials, it also offers hidden cost savings including speed of erection, no need for special tradespeople, no dry wall fixing and stopping and there's freedom from maintenance. There are only two basic machining operations to make the **Conecta®** wall boards which are then finished in natural oil. No painting is required, saving thousands of dollars.

The walls in a **Conecta®** building are made from prepared solid wood boards. They come in single components forming a structural wall system of great strength and durability. Architects and designers have complete freedom of choice without sacrificing shape, structural strength and integrity. The boards simply slot together using hidden connecting profiles and shear member inserts for silent, secure bracing. You can build on a wooden or concrete floor, simply threading the boards onto the connecting profiles, and have your walls up in a matter of hours.

When built to manufacturer's specifications, and where requested, **Conecta®** buildings can be designed to withstand earthquakes to
Richter 8, and wind speeds to 252 km per hour without suffering major structural damage. In hurricanes and earthquakes, a **Conecta®** building will simply bend with the forces and resume very closely its original position (shape) without suffering any structural instability. No other known building system is able to perform this feat.

Conventional building after a typhoon.

After typhoon Iniki a category five storm hit Hawaii in Sept 1992, our **Conecta®** house was the only one left standing in good condition in an area where most other buildings were destroyed.

Conecta® is also completely natural. It doesn't contain any unhealthy quantities of chemicals or toxins.

CONCRETE WALL CONSTRUCTION:

From the day it is cast, concrete continues to cure and shrink. Eventually it becomes so brittle there is no resilience left which is essential for good building performance. In an earthquake or hurricane, or when shrinkage is advanced, concrete walls will develop small cracks through which water can enter, corroding the steel bars within. The molecular forces of the expanding iron oxide (rust) will break the concrete apart and weaken the structure.

Collapsed concrete buildings appear on television news frequently. In tension, concrete is very weak and needs to be held together with lots of expensive steel rods to stop it from crumbling. Too often we see the catastrophic results of concrete building collapsing on their occupants in storms or earthquakes because the concrete was not reinforced with steel rods. Perhaps at the time of building the rods were either not available, too expensive or the builder thought them unnecessary.

While perceived to be cost effective, concrete is heavy and cumbersome for building walls. And, unlike wood, concrete walls absorb the heat or cold from outside making it expensive to maintain a comfortable temperature inside. Many people complain of headaches and nausea through natural radiation being blocked out and radon gases being locked into their concrete and steel homes.

When compared to wood, concrete and steel require approximately 30 times more energy to produce.

LIGHT TIMBER FRAME WALL CONSTRUCTION:

Light timber frame buildings are unable to withstand earthquakes or high winds without some minor or major damage occurring. Flying debris can easily puncture light timber frame walls during a major storm or hurricane endangering the occupants. Strong winds can cause exterior lining materials to fail, allowing wind pressure to increase within a building to such a level that the building could suffer catastrophic failure. That may be why they are called 'light timber frame buildings'. Light timber frame buildings also contain a high proportion of less healthy manufactured and artificial products which are energy intensive to produce and require long term maintenance.

With its unique bracing system, Conecta buildings can be designed to withstand:

- wind speeds in excess of 250 km/hr
- earthquakes exceeding Richter 8.

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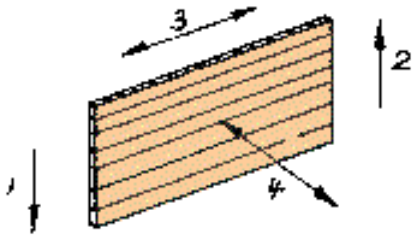
About the effect of the holes in the Conecta® boards.

Do the holes in the board weaken the walls? No, not really The degree of stiffness and strength is a function of the amount of material removed versus the directions of the applied loads.
The four directions of loads on a wall:
1. downward;
2. upward;
3. along;
4. perpendicular.



There are two types of loading:
A. Dead Loads - such as the weight of a roof structure on a wall acting generally downward.
B. Live Loads - such as wind or earthquake forces, acting in all four directions.

At worst, all forced loading a building can act together at any one time, at best they act individually at some time.

Analysis of the effects of holes versus the different loads acting on a Conecta® wall:

1. DOWNWARD:
The load bearing capacity of a Conecta wall with 18mm holes every 50mm has been tested under supervision of the New Zealand Forest Research Institute and by the Building Research Association of New Zealand to withstand 33.75kN/m (3.375 t/m) before failure occurs.
Considering that the average wall carries a dead load of 4.15kN/m, the safety factor is 8, i.e. a **Conecta®** wall has excess downward load bearing capacity, and the effect of the holes is insignificant and not relevant.

2. UPWARD:
Any downward force will reduce the downward load on the wall; the existence of holes has no effect. Tie rods installed in the **Conecta®** walls, hold the structure down.

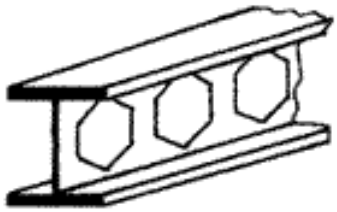
3. ALONG:
In light timber of steel frame construction this direction of load is usually resisted by sheet bracing and/or diagonal steel.
In a **Conecta®** wall, the installation of appropriate numbers of bracing pins and tie rods (adjustable to prevailing conditions) in the holes at predetermined positions in the board, satisfies the bracing requirement. For more information about bracing, see Fact Sheet 07: About Bracing with the **Conecta®** System

4. PERPENDICULAR:
This direction of loading, due mainly to wind pressure and/or suction, causes a wall to bend. When bending occurs, the fibres in the outer most layers of the wall planks are being compressed on the high-pressure side and tensioned on the low-pressured side. There is neither compression nor tension in the centre of the wall planks (neutral axis). This region therefore, contributes to little to the load bearing capacity except that sufficient material needs to be retained to counter the longitudinal sheer forces in the neutral axis.

Examples of this principle at work are:

CASTELLATED BEAM:

This has thick cords on either side of the thin centre web, where parts of the web have been removed to save weight and material without much loss to its load carrying capacity.



AIRCRAFT WING:
Stresses are in the skin, wing and webs are perforated.

PIPE:
The same amount of material in a 20mm Dia solid bar produces a pipe of 44x2mm Dia which is 3.3 times stronger and 7.4 times stiffer.

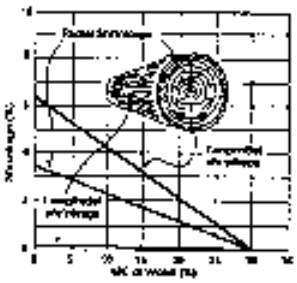
A **Conecta®** board can therefore be compared with a castellated I-beam and acts like one when under lateral loads. With the holes in place, the **Conecta®** boards loses only 6.4% of its stiffness when compared to a solid board of identical density. Because the holes are located on the centre line, they therefore do not compromise the lateral stiffness and strength of the wall. The natural variations of the wood's density would be more significant, if stiffness and strength were a consideration, which they are not. The change in stiffness is identical to a reduction of board thickness by 1mm from 45mm to 44mm.

Conecta® boards with holes have been extensively tested and permissible wall spans are recommended accordingly.

About the wood for Conecta® boards.

Wood is the most amazing and versatile building material given to mankind. It has been used successfully in housing construction for thousands of years without any adverse effect on humans. Wood outclasses man made substitutes in terms of its user friendliness, resistance to chemicals, its strength to weight ratio and its insulation qualities. For more information about insulation see our **Fact Sheet 08: About Climate control with Conecta® Boards**

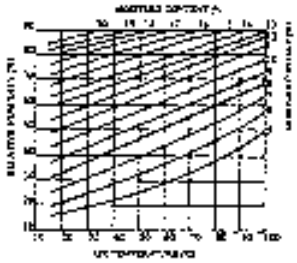
ENVIRONMENT:
Conecta® uses a light coloured, tissue cultured and plantation-grown wood - Radiata Pine. It is a renewable resource that requires a lot less energy to produce than man made building materials. Tissue culture is a way of producing thousands of trees from a single seed - one reason why we can guarantee consistent quality wood. Radiata Pine has established an international reputation for outstanding appearance and excellent performance. In New Zealand it is grown specifically for the building industry and therefore saves indigenous tree.



MOISTURE CONTENT:

Moisture occurs in wood in two ways. As free water, which fills the cell spaces, and as bound water, which is contained within the cell walls. As wood dries, the free moisture is the first to leave the wood and when this has been removed, the bound moisture follows. The point at which the cell spaces no longer contain free moisture is called the 'fibre saturation point'. and from this point onward, the cells will shrink to an extent which is roughly proportional to the loss of bound moisture. When the wood takes up the moisture, the opposite occurs and the wood swells.
On average, Radiata Pine will swell or shrink 0.17% per 1% moisture content change. As wood is a hygroscopic material, it gives off and takes up moisture until it reaches a balance with the surrounding atmosphere. This is called equilibrium moisture content (E.M.C.) High temperature kiln dried wood, dried to customer's requirement, is used by **Conecta®**, ensuring a moisture content suitable for the climate where the buildings are to be built. This keeps later movement of the walls to a minimum.

Shrinkage at various directions to the grain (Timber Drying Manual, Building Research Establishment UK, 1986)



***Equilibrium moisture content as influenced by relative humidity and temperature.
(Timber Drying Manual, Building Research Establishment UK, 1986)***

RESILIENCE:

Radiata Pine will stretch of compress elastically at low levels of load. Once the load is removed, it will return to its original length and shape without permanent distortion.

TEST RESULTS FOR THE Conecta® WALL:

Load bearing capacity wall 33.75kN/m
Average download
in a house 4.15kN/m
Safety Factor 8

BASIC WORKING STRESSES:

Bending 8.3MPa
Shear 1.3MPa
Compression Parallel 8.2MPa
Compression Perpendicular 3.2MPa
Tension parallel 6.6MPa
Modulus of Elasticity 10Gpa
Density: 450 Kg/m3 average in dry conditions.

TREATMENT:

Untreated pine has some natural ability to resist insects, fungi, rain and ultra violet light. In special cases however, we treat the pine to preserve the wood and prevent decay.

Other woods such as cedar and redwood can also be used on special request.

About wood preservation for the Conecta® boards.

Untreated pine has some natural ability to resist insects, fungi, rain and ultra violet light. In special cases however, we treat the pine to preserve the wood and prevent decay. Once treated, pine can outlast most other untreated species of wood commonly used building materials, and even concrete.

INTERIOR WALLS:

For most interior applications, pine does not require any treatment unless of course there is a risk of infestation by insects or termites. Rooms with high humidity such as bathrooms and laundries, should always be lined with suitable sheet material or the walls need to be protected with an alcyd based paint or varnish.

EXTERIOR WALLS:

When a building is covered on the outside with cladding materials, the exterior pine walls do not require any protective treatment. Where the pine walls are exposed to the elements we treat them to provide protection against damage from rain and ultraviolet light and , in special cases, against fungi and insects.

SAFETY OF THE TREATMENT:

World wide, there are six Hazard Levels of treatment (H1 - H6). When boards need to be treated, we use any one of the first three: H1, H2 and H3 depending on the level of protection required. To do this, we use a colourless environmentally friendly treatment called Light Organic Solvent Preservative (LOSP).
The H1 and H2 preservative contains a contact and digestive insecticide carried by a solvent. The insecticide is Permethrin and the solvent is white sprits, both common household products. Fly sprays contain Permethrin at 2.5 grams per litre compared to 0.006 grams per litre for H2 treated wood. Permethrin is also used as an insecticidal rinse for clothing in tropical areas. The solvent is also used for dry cleaning clothing. H3 treated wood contains Tribtyltin Naphethenate (TBTN) as a fungicide at 0.08 grams of tin per 100 grams of wood and has been found to be less than 0.2% of the safe level after one year, i.e. less than normal carbon monoxide (CO) levels.
LOSP contains some resins and waxes which act as a surface repellent and aid the stability of the wood. It does not alter the dimensions of the wood during treatment and is not corrosive to metal fixing plates and mild steel nails.

DEPTH OF TREATMENT:

Many species of wood and construction timber can only be effectively treated to a depth of 5mm or 15% or so. Even a high pressure will not be able to force treatment into the core. Pine's unique fibre structure allows easy passage of the liquid treatment agent. In addition, our **Conecta®** boards have been drilled through the holes every 50mm, allowing the treatment to penetrate the wood to 100%. That's why **Conecta®** wood is so much more durable. When treated, **Conecta®** boards will outlast even concrete.

DURABILITY OF THE TREATMENT:

The LOSP treatment provides protection for a very long time. It has been used in Europe since 1950 and in Australia and New Zealand since the late 1970s with no reported problems. Since that time, solid wood houses treated with LOSP have been exported to Korea, Japan, Taiwan, Australia, USA, Germany, the Cook Islands and Samoa. Our LOSP treatment has been particularly successful in Australia where there are 350 known species of termites. The relevant Standards of Compliance are AS1604-1993, AS36660 1-1995. We encourage homeowners in regions where insect infestation is likely, to annually undertake an inspection of their property and to landscape their garden in such a way that they do not encourage unwanted insects to enter

their dwelling.

Conecta® WATER REPELLENT TREATMENT:

When buildings need to be constructed during prolonged periods of rain, the pine boards will be protected with additional water repellent to minimise the uptake of moisture during the construction period. We use a safe combination of silicon and timber oil specifically developed for Conecta® boards by leading industrial chemists. For untreated boards we may add a low concentration of mouldicide to give temporary protection.

WOOD PRESERVATIVE	PROTECTION AGAINST	CONTENTS
Hazard class 1 (H1) *Interior uses	lyctus and anobium borers	Permethrin, white spirits, resins and waxes.
Hazard class 2 (H2) *Interior uses	*termite	** Permithrin, white spirits, resins and waxes.
Hazard class 3 (H3) *Exterior uses	*termite, fungi, mould	***Tributyltin Naphthenate, Permethrin, resin and waxes.

* Relevant to Australian standards of compliance AS1604-1993, AS36660.1-1995
** Fly spray contains permithrin at 2.5 grams per litre compared to 0.006 grams per litre for H2 treated wood.
*** TBTN level after one year is less than normal CO level in air.

WATER REPELLENT	TREATED WOOD	UNTREATED WOOD
	Silicon, teflon, resin, timber oil.	Silicon, teflon, resin, timber oil, Mouldecide.

Additional Hazard Classes available are:

H4	HIGH DECAY HAZARD Ground contact	Fence posts Agricultural Posts Cribwalls Sawn timber in ground contact
H5	SEVERE DECAY HAZARD Ground contact and high Risk end use.	Sawn timber House piles and poles Horticultural posts and poles Transmission poles
H6	MARINE HAZARD Salt water immersion	Marine piles and timber

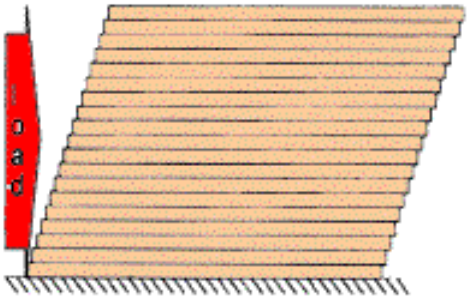
About fire resistance of Conecta® walls.

It is not quite true to say that a house built in wood burns more quickly than one built from concrete, steel or other building materials. In a fire, wooden beams and trusses will outperform those made of steel, because steel beams and trusses soften, distort and then collapse into the building.
Another misunderstanding is that one has to be careful with an open flame in a wooden house "so the wood doesn't catch fire". Wooden walls do not catch fire and start burning by themselves unless the temperature has risen to well over 600ºC. Try to start a fire with a single large piece of wood. It's almost impossible!
Cooking causes many house fires where flames spread quickly to the ceiling, setting it, but not

the walls, alight. Otherwise, the first items to ignite in a house fire are usually bedding materials, furnishings, curtains, carpets and the painted surfaces of the walls.
At this first stage thick dense smoke, toxic gases and heat develops. Unless the occupants can leave quickly, they will be overcome by the smoke and gas and will not survive this initial burning process. In the next phase, the heat increases rapidly at ceiling level. If the flames have consumed all the oxygen in the room, the fire will go out by itself at this point and there will only be smoke damage to the walls.
What happens next, in most cases, is that the ceiling burns through, because the heat at ceiling level is many times higher than at floor level. The smoke and gases then ignite, setting other materials alight, including the wooden walls. One of the most remarkable properties of wood is that it changes to charcoal (char) when exposed to an open flame. This black shiny unburned wood substance is a slow burning insulator. Its acts like a fire resistant jacket protecting the core of the timber from burning and inhibiting the spread of flame. If the wooden walls of a house are thick like the **Conecta®** walls, they burn very slowly, if at all. This is because the wood has to heat up first and lose all its moisture before it can burn. Thick walls take much longer to heat up and start burning than thin ones. Thick walls are also a much better insulator, allowing the face to start burning while the back is still cold to touch. All this was test in a laboratory and none of our buildings have ever burned. So you can feel confident.

About bracing the Conecta® system.

THE FACTS:
To achieve structural resistance against external forces (i.e. wind and earthquake), all buildings have to be braced.
Bracing elements in a building will usually behave in one of two ways.

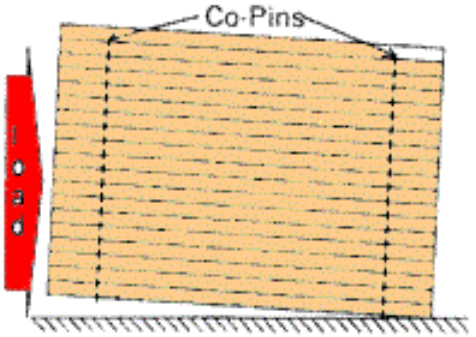


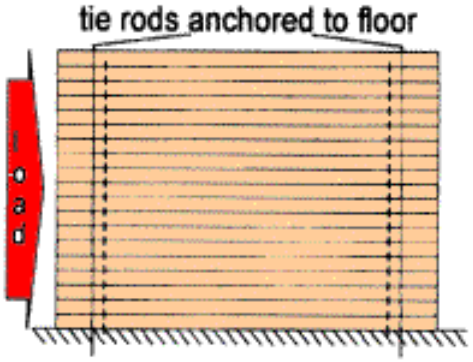
1. A brittle bracing element such as a concrete wall, will withstand a load without flexing, but will fail suddenly when the load becomes too great.
2. A flexible system such as conventional timber or steel framed walls will not fail suddenly but may not retain their original shape after being subjected to a high wind or earthquake load. This may also result in the cracking of usually brittle wall linings.

Conecta® however has an inbuilt bracing system that exhibits *elastic* behaviour. When subjected to a high wind or earthquake load, **Conecta®** walls will flex, yet will return to their original shape without suffering structural damage. The forces of wind or earthquakes can act in all directions on the entire building, and therefore all structural parts have to be braced. For the following explanations only the walls will be considered.

THE PRACTICE WITH Conecta®:

Bracing, in general, is required along the walls. Different wall building systems require different bracing types e.g. sheet bracing and/or diagonal bracing for light timber or steel framing, Co-Pin® shear members for the **Conecta®** system. A load along a **Conecta®** wall would make the boards slide on each other, as there is little friction between the tongues and grooves of the **Conecta®** boards (the reason for this lack of friction is to eliminate the creaking and banging of walls which is common to other solid timber building systems).
To prevent this sliding of the boards, vertical lines of bracing Co-Pin® , starting in the floor and using the existing holes in the **Conecta®** boards, are installed in predetermined positions. The number of these vertical lines of Co-Pin® , is adjustable to suit the prevailing conditions and design. Because the boards therefore can't slide on each other anymore, under load the entire wall behaves like one solid piece of wood. The entire bracing panel could therefore be lifted off its supporting floor in high wind conditions, so we install tie rods on either end of a bracing section to prevent this potential uplifting. Further additional tie rods are also installed to facilitate a pulling down of other non braced walls. **Conecta®** Buildings can be designed to withstand earthquakes to Ricter scale 8, wind speeds to 252 km/h and gusts up to 378 km/h without suffering structural damage. A **Conecta®** Building will simply bend with the forces and resume very closely its original shape because the Co-Pin® , boards and tie rods act together as a ductile bracing system. If the forces exceed the above values, the bracing system doesn't fail suddenly. The load will be transferred to other parts of the structure - i.e. aluminium connectors.





About climate control with Conecta® boards.

Did you know **Conecta®** homes and buildings are easier to heat and keep cool? Wooden walls do not absorb and store heat and cold like concrete does. This means a **Conecta®** building is much cheaper to heat and cool. You can increase or reduce the insulation to suit your climate and your own personal comfort levels. You can also use different exterior cladding materials to suit your climate, your surroundings or your personal preference. **Conecta®** offers a range of insulation options to provide comfortable energy efficient living and working environments for tropical, temperate or cold climates.

TROPICAL / SUB TROPICAL CLIMATE ZONES:

For tropical and subtropical climates where temperatures range from +10ºC to +40ºC or more, we recommend single thickness **Conecta®** solid wood construction. No insulation is necessary for the exterior walls but ceilings or roof spaces should be insulated against the heat. In tropical conditions heat generally flows in. Good design also helps increase your comfort level. Louver windows, ceiling fans and air conditioning units all help to keep a building cool. **Conecta®** is ideally suited to hot and humid climates. Much of our business comes for the tropical areas of Australia, Hawaii, New Caledonia, Western Samoa, and the Cook Islands.

Recommended insulation values:	
- Roof = R2.0	$m^{20}C/W$
- Walls = R0.45	$m^{20}C/W$
- Floor = R0.5	$m^{20}C/W$

TEMPERATE CLIMATE ZONES:

For temperatures ranging from 0ºC to +30ºC we recommend building in **Conecta®** with the exterior walls insulated with foil insulation. On top of the insulation you just add the exterior finish of your choice. You have the complete freedom to choose the cladding material which best suits your environment, building design, budget and

personal taste. **Conecta®** homes and buildings have been build\t in temperate areas of New Zealand, Australia and Europe.

Recommended insulation values:	
- Roof = R3.0	$m^{20}C/W$
- Walls = R0.6	$m^{20}C/W$
- Floor = R1.3	$m^{20}C/W$

COLD CLIMATE ZONES:

If you're building with **Conecta®** in an area where temperatures range from -40ºC to +30ºC we recommend added insulation for the exterior walls, rood and floor. You still have the absolute freedom to choose a brick, cement or weatherboard exterior finish.

EXTERIOR FINISHING OPTIONS:

Recommended insulation values:	
- Roof = R4.5	$m^{20}C/W$
- Walls = R2.5	$m^{20}C/W$
- Floor = R1.5	$m^{20}C/W$

- Shadow clad plywood
  Wood based weatherboard
  Cement plaster over rigid foam
  Cement sheet with textured finish
  Vinyl weather
  Brick veneer
  Or any combination of the above.

CLUES FOR CUTTING OUT THE COLD:

Warm air is lighter. It always rises to the ceiling leaving the colder and heavier air at floor level. That's why many people in cooler climates complain of cold feet in an otherwise warm room. Most heat is also lost through the ceiling unless the insulation is adequate. You can save energy and heating costs by installing a recirculating fan to push the warm air down from the ceiling, increasing the temperature at floor level and ensuring a more even air temperature throughout the room.