The 4th Modular Building and Offsite Construction Conference.

25th & 26th March, 2013. Perth, Western Australia.

Presentation by Peter Smith, Director, Unibuild Technology

SLIDE 1
Thank you for the invitation to present my paper.
Unibuild is a privately owned, applied building research company specialising entirely in modular design and construction.
The research data base comprises the design and project management details of several hundred different modular projects designed for clients in Australia and overseas.
Projects have been built in most climatic regions and on most soil types.

SLIDE 2
This presentation will support the growing need for hazard reduction technology in modular construction.
These hazards are floods, bushfires, earthquakes, tsunamis and aircraft noise.
For the remote areas you can add cyclones, condensation, termites and long term building maintenance.

SLIDE 3
Over the last decade, bushfires have burned down 500 houses in Canberra, 2000 in Victoria, many in WA, and recently, 100 plus houses in Tasmania.
Thousands of houses were damaged by floods in Queensland, NSW and Victoria. This year Queensland was flooded again with more than 1000 houses badly damaged in Rockhampton alone.
Hundreds of Queensland houses were knocked out of shape by cyclones, and the earthquake toll in Christchurch NZ is still being assessed.
According to a recent Boral advertisement, $9.9 billion worth of damage was caused by natural disasters in the last 5 years alone.

SLIDE 4
All damaged and destroyed buildings were, in the main, designed and built traditionally.
Had the above structures been designed and constructed with the modular Unibuild Technology, it is highly likely all would have remained habitable.
My talk will support this claim by way of proven, applied modular solutions.

SLIDE 5
This is Unibuild project No 5710, now 14 years old.
It has been our benchmark display building and represents our modular design and construct system resistant to all the above hazards.
I will be referring to various hazard proof technical aspects of this project throughout my talk.

SLIDE 6
The forensics of fire is fairly simple.

When the temperature reaches 47.7 deg. C., liquid in tree leaves, vegetation, building structures, adhesives, and other matter turns to flammable gas requiring only a spark of fire to engulf the whole.
In this Victorian fire aftermath photo the only intact building structure left standing was a concrete fire bunker.
Concrete does not burn in a bushfire.

SLIDE 7
The only structures left intact here are the concrete water tank and swimming pool.
On black Saturday, February 7th, 2009, in Victoria, the daytime temperature was recorded at 47.2 deg. C.
The fire temperature reached 1200 deg. C.
It's estimated the destructive force of the fire storms that day equaled the force of 1500 Hiroshima bombs.
This bushfire claimed 173 lives and caused $3.5 billion in damage to buildings, crops and plantations.

SLIDE 8
Since the Victorian fires, modular prefabricated concrete pods have been built to be used as fire shelters.
However, the rebuilding of traditional houses near or around these cores does not prevent the traditional structures from burning down in the future.
With The Unibuild Technology, the whole modular precast house structure becomes a fireproof home in its entirety.

SLIDE 9
Usually tree leaves and other rubbish lodged in roof gutters and around buildings ignite and begin the house burning process. This is true, however,
When you study ABC Television footage of the Canberra fires, as I have, blue flames are briefly seen flashing from house roofs randomly.
Then all seems normal. Later these houses explode and burn. Why?

SLIDE 10
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SLIDE 11
Recently, research into the Canberra bushfire proved that a tornado similar to this photo formed and ripped a path through suburbia 500 meters wide at about 30 km/hr.
The fire boffins call this phenomenon ……."pyro tornado genesis"
It lifted roofs of houses and blew cars off the street.
Conclusion: Houses need to be not only fire proof but tornado proof, both extreme building hazards.
Unibuild project 5710 satisfies both criteria.

SLIDE 12
Burning embers of the Canberra fire fell on project 5710 located 20 kilometers from the fire front.
Had this house been built within the fire front it would not have been destroyed because there are no flammable structural or non-structural materials to burn?
Although 90% of the external wall, floor and roof modules comprise flammable thermal insulation, the insulation is surrounded by a thin layer of fiber reinforced concrete which has a fire rating of 1 hour.
The panel insitu columns and beams have a fire rating of 6 hours when assembled.

Bushfires sweep over terrain in minutes. They linger and burn in one place because they have found fuel in the form of traditional house construction, trees and bushes.

SLIDE 13
A few years ago, when licensing The Unibuild Technology in San Diego, California, I witnessed a small fire burning in a paddock adjoining the local shopping center. I had driven to Kinko's to do some photocopying.
The fire got out of hand, and that night burnt over 500 houses. I later investigated the cause.
Due to developers design covenant, all house roofs had to be of Californian redwood shingles.
In northern California, the moisture content of a shingle is over 95% making them virtually fireproof.
In hot, dry southern California, the moisture content drops to less than 5%. Perfect fire kindling.

SLIDE 14
The shingles were laid on a plywood base which was covered with a bituminous damp proofing coat.
When the temperature reached 47.7.degrees C it was all over. Just like the in Canberra and Victorian fires.
The only structural materials left intact were the solid masonry fire chimneys.
Incidentally, I have never seen a fire lit in a Californian masonry fireplace. They are mostly built for "traditional" show.

SLIDE 15
The American flag survived, almost.

SLIDE 16
This is a photo of wind damage caused by cyclone Tracy, Darwin, Christmas Eve, 1974.
Almost every day, somewhere in the world, residential areas are being flattened by cyclones, hurricanes, tornados or high winds.
Today, tornado winds are ever more frequent, the latest hitting Port Kembla a few months ago causing similar localized damage to a few exposed houses.

SLIDE 17
This is a close up of the cyclone Tracy damage.
What a sight to wake up to on Xmas Day.

SLIDE 18
Like in the fire photos, the indestructible structural material was concrete.
Mostly, the destroyed portions of the buildings were of “traditional” construction.

A design “rule of thumb” for cyclone and earthquake construction is that when the building is completed you should be able to lift it up, turn it upside down and it will remain intact.

SLIDE 19
Never underestimate the power of a cyclone.
This 6 x 2 timber would not have penetrated a Unibuild hazard proof wall.

SLIDE 20
Last Tuesday evening, two tornados ripped through Victoria’s NE near Rutherglen.

SLIDE 21
This is all that remains of the Denison County Caravan Park.

SLIDE 22
The local car dealer also took a hit.
Wind strengths were recorded of between 117 and 253 K/HR.
The tornados cut a path 150 to 250 meters wide.

SLIDE 23
Unibuild modular components include built in columns and beams, and all component connections satisfy this upturn theory.
Maximum cyclonic wind speeds are contained horizontally and vertically by the interlocking modular assembly of the precast modular components.
The structure complies with, and exceeds, the cyclonic wind code requirements.

SLIDE 24
This is a photo of an earthquake damaged house in Christchurch.
In the aftermath of the earthquakes that hit Christchurch on September 4th, 2010, and February 22nd 2011, an estimated 10,000 homes needed to be demolished, along with 1000 of the 4000 buildings in the Christchurch CBD, an area that was closed off to the public.
There were 185 people killed.
When the earth moves, load bearing structures built into the earth move equally.
Traditional brick and block structures are most affected. They crack on tremor movement and being inflexible will not revert to their original position.
Timber structures fair better as they can flex and bend, and will return to their original shape with only minor cladding

SLIDE 25
This photo shows minor earthquake damage to a masonry wall.
The damage is permanent as the wall will not recover to its original shape.
It’s then a question as to the structural integrity of the wall.
In Christchurch, city and suburbs, every building has to be inspected by engineers for permission to re-occupy.

They fix an official sticker fixed to the front door. OK or Not OK.

SLIDE 26
Buildings in earthquake zones need to be able to “wobble” to ride out an earthquake tremor.
All Unibuild modular buildings have built-in earthquake “wobble” tolerances.
Between all components is a 10mm gap which acts as a “wobble” joint.
Connection bracket bolt holes are wider than bolt diameter, and bolts are not tightened too hard.
A few millimeters of earthquake wobble in a Unibuild joint is not even detected as the wall has many vertical joints to absorb the shocks.
Unibuild insulated components also flex, and will not crack or fail due to the strong fiber concrete construction method.

SLIDE 27
Another earthquake resistance feature is to sit the wall components on concrete pier footings.
These footing piers extend about one meter or more deep into hard dry clay.
There are no wall-to-footing connections.
When the earth moves, the walls “wobble” on the footing tops, then restore.

SLIDE 28
Tsunamis are one of the most destructive hazards. Traditional timber and light weight constructions mostly disappear.
Most concrete structures are damaged, as seen in this photo, and are repairable.
Tsunamis hit fast and hard. The 40 meter high tsunami which hit Japan following a 9.03 magnitude earthquake travelled 10 kilometers inland in some places.
There were an estimated 16000 deaths. 3000 people still listed as missing. The cost to clean up just one building, the imploded Fukushima nuclear power plant is estimated at $235 billion. This is about 2/3 ds of Australia’s federal budget.
Only 2 months ago a 1 meter high tsunami destroyed some 1000 houses in the Solomon Islands. 10 deaths and 3500 people homeless.
I have witnessed this destructive force both in Thailand and the Maldives where Unibuild has been engaged in reconstruction projects.

SLIDE 29
This is a tsunami community safe house built in Thailand. (It is not a Unibuild project).
Buildings which survived the Thailand tsunami were mostly precast or insitu concrete structures.
The Unibuild solution for tsunami construction is similar to earthquake construction. In order to resist better resist the overturning moment of the initial rush of sea water, the wall bases are fixed to the footing piers.
Window and door openings are allowed to fail under pressure so as not to resist the water flow above ground level.

SLIDE 30
In this Thailand and Bangladesh solution, modular shell walls are fixed to the footing piers.

An insitu concrete floor slab interlocks with the precast walls to prevent overturning moment.
Owners build traditional structures on the modular roof panels as is their custom.

SLIDE 31
Flooding of low level land in Australia has become a common hazard in recent years.
This photo shows the record Rockhampton flooding only a few months ago.
For Brisbane, the term “it’s only a 100 year flood” has become “it’s only a 2 year flood” .
For several towns in NE NSW and SE Queensland the saying is “four floods in one year”.

SLIDE 32
If Unibuild project 5710 had been built in the lowest level Brisbane residential area during the recent Queensland big flood, and had been completely submerged, only a high pressure water hose would have been needed to restore the building to its original state when the flood subsided.
Give the electrics several hot days to dry out and its business as usual.
Unibuild Job 5710 hazard proof modular technology has eliminated almost all traditional materials and practices.
When traditional housing is flooded, an expensive refit is required as most of the flooded materials have failed and need to be trucked off to the nearest tip.

SLIDE 33
This photo shows the assembly of a 2 level modular structural shell developed for flood proof housing in Thailand.
They are finished by local builders using traditional materials.
Floods pass through the lower level every wet season.
Thai’s are used to seasonal flooding as most of the country is built on a massive flood plain.

SLIDE 34
The modular components are freighted horizontally to the building location, usually rural.
A crane truck is all that is required for pick up at the factory, and to erect on site.

SLIDE 35
This photo shows the marketing of the Unibuild Modular Building Technology at a Bangkok trade show.

SLIDE 37
We provided the buyers of these modular shells with a plan of how they can be finished in the traditional way.

SLIDE 37
This photo shows the modular component assembly for a restaurant on the Gulf of Thailand.
Flash flood water runs under the podium modular slabs every wet season.

SLIDE 38
The building is finished in the traditional way, safe from flood and earthquake damage.

SLIDE 39
Closer to home, this Unibuild job has been planned for construction on a flood plain block at Forbes, NSW.
You design a 2 story structure with the lower story built with indestructible materials.

SLIDE 40
Since the Brisbane flood a couple of years ago, insurance premiums for building structures in flood plain regions has doubled and in some cases, tripled, if available.
Building insurance is now no longer possible for low income householders.
The Queensland government's estimate for damage from ex-tropical cyclone Oswald is $2.5 billion.
The Insurance Council of Australia recorded 91,128 loss claims over the past summer totaling $942 million.
Who, in the long run, reimburses the Insurance companies? You, me and all policy holders.

SLIDE 50
Let's do some sums. A new traditional house building structure is valued at say, $100,000.00.
Say you are required to pay $10,000.00 per year for structure insurance. That's $100,000.00 over 10 years.
With a Unibuild modular hazard proof structure you already get a 7 year structural guarantee under the building code.
There is no need to buy structural insurance therefore you would save $100,000.00 over 10 years.

SLIDE 42
A common problem faced by the modular industry is the entrenched traditional finance approval system.
This photo shows the component assembly for a duel occupancy residence extension proposed for a Canberra suburb partly burned by the big bushfire in 2003.
My client, an owner-builder wanted a modular fireproof structure he could complete himself.

SLIDE 42
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SLIDE 44
My client was refused full building loan funds because the project was different. The bulk would be built off site.
The local bank would not revise its traditional progress payment schedule to pay for the cost of the off-site modular prefabrication work.
I took this bank on. (They were also the insurer). I accused them of not wanting to finance hazard roof building technology which would not require building hazard insurance. They

carried out due diligence and paid me a substantial settlement to go away and not take the matter further.
I usually get my projects advanced because of Unibuild's track record in modular technology since 1968.
To deny Unibuild's development because it is not "traditional" is an illegal restraint of trade under the Trade Practices Act.
My client has since obtained finance through a local credit society and work is underway.

SLIDE 45
What is modular building? I believe every person in this room would have a different explanation.
Is it a converted shipping container? Factory built dongas trucked to remote regions? Accommodation modules shipped in from China? Factory built houses? I guess it's a combination of all these methods.
I shall overview Unibuild's definition of "modular", and our method of designing hazard proof, and other modular buildings.
It all begins with a simple planning technique called "Modular Co-ordination".

SLIDE 46
This is a design module space.
It is a simple cube.
You can give this module any dimension you like.

SLIDE 47
This is an array of design modules which will enclose a small modular site office.

SLIDE 48
The wall, floor, roof and other components, each made up of single design modules, fit within the overall module array.

SLIDE 49
This shows the modular component assembly.
The design is now ready for production.
As the components fit together in 3D CAD, the components will fit together on site.
This modular coordinated design method eliminates most dimensioning.
You are simply assembling components with known modular dimensions.

SLIDE 50
For 2D design the modular components line up on the modular grid lines as shown in this slide.
This is the preliminary modular design for a micro unit apartment recently designed for a client in New York where there is a growing market for low cost singles accommodation.
When you view the following photos, keep in mind the "modular co-ordination" of all designs.

SLIDE 51
This is possibly one of Australia's first environmentally sustainable, modular passive solar energy houses.

Now 45 years old, it is double insulated and has remained structurally maintenance free to this day.
In 1968 the terms, star rating, passive and active solar, environmental, sustainability, global warming and carbon tax had not been coined.
It was simply practical building design for the site and climate.

SLIDE 52
The modular design determines the onsite positioning of walls, windows, roof beams and fascias.
The design grid was 4 inches, before metrication.

SLIDE 53
In winter, free solar heating is gained from the northern sun.
A double curtain system maintains the internal heat overnight and longer.
The width of the overhanging eaves keeps the sun off the windows in summer.

SLIDE 54
This modular house was built on the side of a cliff at Kuring-Gai Chase National Park, Sydney.
Offsite modular prefabrication is ideal for difficult sites.
Most of Unibuild's best projects have been built on difficult sites.

SLIDE 55
This site in Perth was too steep even for a conventional driveway.
The offsite modular components were craned in from the neighbor's rear property.

SLIDE 56
In this early masonry project you can see the design modules clearly.
A concrete block occupies 8 3D modules.

SLIDE 57
This house in Perth was originally a traditional design drawn by a professor of Architecture for his client.
I was approached to convert the design to Unibuild modular and the project was built for the original budget.

SLIDE 58
This internal photo shows the modular design and construction expressed as a decorative feature.
If a modular material doesn't function, it doesn't fit.
There is no need for expensive fake decoration.

SLIDE 59
This was the last of the Unibuild modular masonry houses.
The cavity walls were modular sand/lime bricks.
This house was commenced on the same day we started our first modular precast house on an adjoining block.

SLIDE 60
This is the first Unibuild modular precast off-site house.
It was built in 7 days and received the first of Unibuild's many "innovation" awards from the Housing Industry Association.

SLIDE 61
This photo of the masonry house progress was taken after 7 days.
Unibuild had finally eliminated the "on site" modular masonry trade from its design and construct process.
Over following years we eliminated most other traditional materials and trades by dropping them off, one by one.
Last year, 2012, we eliminated steel reinforcing bars from our modular precast operation.
It's an ongoing process.
If you are the developer of a super new building product in need of a building system, I will give it a tryout with a Unibuild modular design.

SLIDE 62
Another modular innovation bonus was achieved here.
Traditional masonry cavity walls are 250 mm thick. Unibuild insulated modular precast walls are only 100 mm thick.
5 SQM of additional internal living space was gained over the masonry plan.
Many clients converted to Unibuild for the additional internal floor space offered for the same "traditional" price.

SLIDE 63
The move to modular precast opened Unibuild up to rural locations where it was more expensive to build traditionally.

SLIDE 64
This photo shows the design modular coordination internally.

SLIDE 65
This is another modular rural house south of Perth.

SLIDE 66
This is a remote area house, built for a fisherman at Dongara, Western Australia.
It looks traditional, but it is offsite modular.

SLIDE 67
This offsite precast modular house was built for the then State Minister for Housing in Western Australia.

SLIDE 68
Australia's first active solar energy house was a modular house, built in 21 days.
It won the HIA Home of the Year "innovation" award.
It won a National solar energy award at the time.
It was Australia's entry in the Misawa Japan international prefabricated housing competition of that year and ran second to a Swiss entry.

SLIDE 69
An insulated underground water tank stores hot water pumped through the array of solar hot water panels on the roof.
The sun's rays reflect off the lower aluminum roof which doubles the sun's heating intensity.
In winter, the hot water is pumped through a system of heating radiators throughout the house.
In summer, all surplus hot water, is circulated through the swimming pool by a separate heat exchanger.
This installation cost $1.00 / day to run.

SLIDE 70
This photo shows the positioning of the first modular precast panel for this solar house.

SLIDE 71
This internal photo shows one of the solar heated radiators fixed to the wall on the right.
The external windows and doors were all double glassed the first in Western Australia.

SLIDE 72
We had fixed a small solar panel on the north facing external wall.
It solar powered this DC black and white TV which was loaned to Unibuild to demonstrate the future of solar electricity.
For many who visited this display home it was their first experience of solar electricity.
At the time, the small solar panel cost $1000.00 to buy, about 50 times today's price.

SLIDE 73
This is a Unibuild low cost modular active solar house.

SLIDE 74
North facing precast walls are doubled back to back to give a 200 mm thick solid concrete wall.
The outside face is painted black. A glass face is installed 50 mm from the black surface.
In winter, the sun heats this outer wall and the absorbed heat is transferred to the inside.
In summer, the eaves overhang keeps the wall in shade, and the walls act as insulators to keep the interior cool.

SLIDE 75
Unibuild designed and built many modular houses throughout WA for the State Housing Department.

SLIDE 76
Many Unibuild modular projects were designed and built overlooking the Indian Ocean.

SLIDE 77
My client of this passive solar energy house in east Melbourne was derided for daring to build an offsite modular house amongst a sub division of affluent double story red coloured brick and tile houses.
The soils in this area are a building hazard.
They are very plastic and move constantly.

We applied our earthquake footing technology.

SLIDE 78
These cardboard cylinders, about 1.2 meters deep, encase the poured concrete footing pads sitting on hard clay.
The plastic soil can expand and shrink but never dislodge the structure.
If you go there today you will notice many adjoining traditional houses have major foundation structural problems.
My client's house has never even wobbled.

SLIDE 79
This was the site for a small sports pavilion in Victoria.
It was a reclaimed rubbish tip some 6 meters deep.
Below each concrete pad footing is an 8 meter long used steel oil drilling pipe hammered into hard clay.

SLIDE 80
The modular building sits on the pad footings.
Over time the surrounding soil dropped in places up to 1 meter but the building remained stable in its original position.
They kept installing new entry steps.

SLIDE 81
A suspended concrete floor slab was poured insitu between the precast modular walls spanning the footing piles.
The white coloured material is autoclaved blocks, cast into the wall panels to increase the fire rating for this public building.
Autoclaved block is a modular material and fits within the precast components.
Building materials of imperial measurement are rarely considered.

SLIDE 82
This internal photo demonstrates the design modular co-ordination in practice.
The modular ceramic floor tiles fit exactly between the modular walls layout, as drawn on the plan.
It is my opinion this hazard proof precast modular building on piles would have easily survived the Christchurch earthquake.

SLIDE 83
This is a plan of a two story, six person group house designed for the athletes accommodation for the Sydney Olympics.
Later the buildings were to be relocated to Universities as campus student housing.
25 precast modular components per unit. One large semi-trailer required to freight two units. About two days erection time per unit on site to lockup.

SLIDE 84
This is a hazard proof modular holiday cabin we are developing for a NSW south coast tourist park.

They replace the existing aging caravan and annex siting arrangement.
A practical feature is a lock up rear open storeroom for fishing and surfing gear.
This design would be equally at home in a remote area mining camp, which has barramundi fishing close by.

SLIDE 85
I recently converted a local Perth caravan park owner's traditional plan to Unibuild hazard proof modular.
After receiving my proposal he phoned me to ask "where are the wheels".
I explained to him that I campaigned against the "compulsory caravan park wheels" regulations 40 years ago.
Change is slow.

SLIDE 86
I will now briefly overview the manufacturing process for making Unibuild hazard proof components.

SLIDE 87
All you need is a simple steel mould to make the wall, floor, roof, and other panels.
One modular mould shape makes all components.
This mould is being readied for a foam concrete panel.
Any plastic building material can be poured into these moulds, including standard concrete.
You can even use clay with bamboo reinforcing.

SLIDE 88
Foam concrete comprises sand, cement and a chemical foaming agent.
These panels are very low cost but not strong, between 5 and 10 MPA.
They are good thermal insulators and waterproof.
Unfortunately they do not transport well so are made close to the construction site.

SLIDE 89
Door and window frames are permanent and built in.
It's cheaper than messing about with removable formwork.

SLIDE 90
For strong, hazard resistant insulated components, insulation is placed within 2 thin layers of fiber reinforced concrete.
These panels are 3 times stronger, and 3 times lighter than an equivalent standard precast concrete panel.
They are long term maintenance free, fireproof, termite proof and have a high impact resistance. (They are bullet proof).
At the end of the building's life cycle, they can be recycled into other building shapes. (Traditional buildings usually end their life at the tip).

SLIDE 91
For cool climate house space heating, resistance wiring is placed on the insulation of this floor slab.

SLIDE 92
Solar panels are fixed on the hazard proof modular roof panels.
The direct current electricity produced by the sun runs through the resistance wiring in the floor panels.
All the heat produced radiates upwards. You are getting free space heating when the sun shines.
The system is connected to off peak power tariff to keep the internal space at a constant temperature when the sun is not shining.
In summer, a switch diverts the solar electricity into the floor of the insulated swimming pool.

SLIDE 93
When the fiber concrete has hardened by touch, after about 1 hour, you can commence another panel above.
This method is 4 – 5 times faster than traditional precast concrete construction.
Traditional precast averages one panel per mould per day, then vertical stacking, curing time off site, and vertical panel delivery by transporter.

SLIDE 94
Completed Unibuild modular panels are stack lifted horizontally to stockpile, or directly on to trucks for delivery to site.
They cure on the move.
Most site workers are unskilled.
You only need one semi-skilled person who can read a simple shop drawing to oversee the pre-casting process.
The supervision is in the steel mould assembly which is +/- 2mm accurate.
There is virtually no material wastage.
In traditional construction, about 5-10 percent of traditional building material is unused and delivered to the tip.

SLIDE 95
When the precast making is finished you pack up the moulds and equipment into a couple of containers and move to the next project, either local or remote.
No expensive precast concrete factories are required.
Any small builder can commence with one precast mould, and grow.
The system is ideal for remote area mining camp construction where there is usually a supply of sand and cement and a mobile crane for lifting.
It’s also an ideal system for Aboriginal communities to create their own housing factories to employ, train and maintain teams of unskilled local indigenous labour.

SLIDE 96
I will now briefly demonstrate the modular erection process.
It’s a Thailand job but the process is the same for Australian remote area low rise buildings.

SLIDE 97
This is the plan of a hazard proof, live in site office, located 300 Kilometers SE of Bangkok on the Gulf of Thailand.

SLIDE 98
Modular components for this job were made at the Bangkok tsunami reconstruction dockside site.

SLIDE 99
This photo shows some completed components ready for freight delivery.
They are half module solid internal walls 50 mm thick.
Fiber concrete is very strong and facilitates the horizontal freighting of the components.

SLIDE 100
Components are loaded to the maximum truck carrying capacity
No panel, or loading assembly, is wider than the legal freighting load width.
Escort vehicles are never required.

SLIDE 101
All the modular components for this building have arrived on site .
Pad footings and support piers are under construction.

SLIDE 102
Floor support beams, floor slabs and walls under construction.

SLIDE 103
Only one worker in this photo is skilled.

SLIDE 104
This photo shows all the modular components erected in only a few days.

SLIDE 105
These slotted modular cross ventilation walls also provide security for the occupants.
All other wall, floor and roof components are insulated, helping to cool the internal spaces naturally.

SLIDE 106
Unibuild two level hazard proof modular housing.
This photo shows an upper floor panel sliding down between the 2 story wall panels.
A major advantage of modular precast assembly is that relatively little scaffolding is required.
All traditional masonry buildings need to be encased by expensive scaffolding to meet OHS requirements.

SLIDE 107
This was the first of Unibuild's American modular hazard proof projects, built overlooking the Pacific Ocean.

SLIDE 108
Due to the poor, friable ground soil in this location, and earthquake strip footing system was installed to take the structural modular walls.

The factory produced modular walls have already been manufactured and are ready for delivery to site.

SLIDE 109
This project will survive tsunamis, earthquakes, severe bushfires and hurricane force winds. This is what Unibuild's hazard proof modular design and construct system is all about.

SLIDE 110
Some comments on freighting of Unibuild hazard proof components.

SLIDE 111
Because they are very strong and flexible, hazard resistant components can be freighted horizontally, for long distances, free from damage.
Being impact resistant the panels can handle remote area rough road conditions.
They need to be chained down, and a thin strip of polystyrene fixed between concrete to concrete bearings as micro shock absorbers.
These panels were made in Perth for a Karratha project which did not proceed.

SLIDE 112
After many years and multiple storage locations, the panels were freighted 3800 kilometers and redesigned into a rural house outside Canberra.

SLIDE 113
This is an internal view on completion.

SLIDE 114
This is one of two adjoining modular houses built at Derby, WA.

SLIDE 115
The two houses were freighted on two trucks loaded to the maximum.
This man is standing on a garden shed. We usually designed sheds into the projects.
The sheds contained, and secured, the smaller finishing materials.
To freight the equivalent floor area to Derby using transportable housing would have required 6 trucks minimum.
At the time, Unibuild was able to undercut any remote area "transportable home" price.

SLIDE 116
This is another truck loading photo.
Window and door modular components slide between the precast modular wall panels.
No loads exceed the legal freight widths.

SLIDE 117
This modular house is in Karratha, WA. The North West Pilbara region has a very hot and arid climate.

SLIDE 118
This is the back view.

Because the Unibuild components are highly insulated we were able to halve the installation and running cost of the air conditioning units.
Today, split AC systems are mostly used but the energy savings are similar.
The white walls and roof reflect the constant heat and only minimum wall openings are installed.

SLIDE 119
Being in a cyclonic region, the modular precast walls are bolted to the concrete raft floor slab.
The roof structure is bolted to a steel perimeter angle, which has been bolted to the lifting sockets in the modular wall panels.
You can lift and turn this house upside down and it would not collapse.

SLIDE 130
This is a duplex modular house built in Karratha.
Either city or remote locations, the Unibuild modular coordination system is common to all projects.

SLIDE 121
All hot, arid and tropical remote region houses need as much verandah space as possible.
Note the lower panels of the windows.
They all open outwards to create natural cross ventilation throughout the cooler evenings.
Unibuild modular houses have been designed and built throughout Western Australia from Broome to Esperance.

SLIDE 122
With population growth encroaching under aircraft flight paths there is developing confrontation between Government, airport owners, local councils and concerned citizens.
Back in Canberra, the neighboring city of Queanbeyan and the NSW government recently approved a new sub division which sits under the flight path of the Canberra airport, shortly to become a major international airport.
If the houses are sound insulated during construction it is not a big deal.

SLIDE 123
This slide is of a Unibuild modular roof panel under construction.
The insulation shown is for thermal reasons.
For sound proofing you substitute acoustic insulation slabs which act equally well as thermal insulation slabs.
There is no adjustment of the Unibuild components, only a substitution of material.
Modular wall panels are treated similarly.
Double glaze the window and door openings and you have a very soundproof house.

SLIDE 124
Many years ago I was invited to Port Headland by BHP to look at a problem they were having in their traditional houses.
The plasterboard ceiling and wall linings were rotting and falling apart.

They houses comprised concrete block external cladding, steel wall and ceiling framing, fiber bat insulation and of course plasterboard lining.

SLIDE 125
When the outside temperature is 40 degrees plus, and the internal air conditioning is running at 20 degrees, somewhere between the outside and inside moisture in the wall or roof space turns to water.
With the high natural humidity of Port Headland, this “due point”, occurred at the junction of the steel framing and the plasterboard.
Over time the linings became waterlogged and failed.
It proved to be an expensive renovation project for BHP’s company housing.
With Unibuild hazard proof walls there is no air or moisture in the wall and roof components to condensate.

SLIDE 126
Termites are active all over the Australian mainland and the maintenance required to keep building properties termite free costs $millions every year.

SLIDE 127
This is a termite hazard map of Australia.
Very high activity occurs in tropical Australia, and interestingly, the SW corner of Western Australia.

SLIDE 128
This is a typical suburban termite mound.
In the north of Australia I have seen mounds over 3 meters high and 2 meter in diameter.
Termites travel long distances underground to feed on any timber they smell out.
In the past, trees of the jarrah and turpentine class would be used for timber house building due to the termite resistant chemical in their sap.
Unfortunately these trees have been mostly cut down or are protected in forests.
Today most house building timber is plantation pine which termites devour quickly when discovered.

SLIDE 129
Termite infestation is fairly common in older timber houses.
Unibuild hazard proof modular components are completely termite resistant.
There is no food value in cement, sand and steel fiber reinforcing.
I lived on a property outside Darwin at one time and planted some mango trees.
After a few years, the termites had completely eaten the inside wood of 3 out of 4 trees.
The North will not become the Asian food bowel if the local termites have their say.

SLIDE 130
Unibuild modular projects begin with our Client Design Sheet.
The planning design module is 900 mm x 900 mm or 0.81 SQM. A $300,000.00 construction budget buys you 230 planning squares.
Customers usually sketch plan their own projects. We assist in adjusting for Planning Code requirements.

Thus begins the Client/Unibuild relationship on a sketch plan and cost basis.
When converting “traditional” designs for conversion to Unibuild, we overlay the Unibuild modular design grid over the “traditional” plan then massage the walls, windows, doors etc. to fit the modules.
It is surprising how close the “traditional” and “modular” layouts combine.

SLIDE 131
Once again, thanks to the organizers for the opportunity to contribute to the modular construction debate.
I conclude by saying …. The Unibuild Technology has been packaged on DVD and other media for easy transfer, under license, to anyone wanting to get into the modular business, and doesn't want to have to reinvent the modular wheel.
Those already in the “traditional” modular business may consider acquiring the technology to value add their existing product. There are many options.
For those wishing to learn more please feel free to meet with me during the remaining conference time, or beyond by Email (peter@unibuild.com), Phone (+61 2 62554091) or Skype (Smithpeterc1). Thank you.