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President's Report

Australian Standards and Codes of Practice govern the construction of any building project. These need to be relevant, well understood and applicable to all forms of building construction and reflect current modern practices. With the precast industry continuing to grow its share of building construction around Australia, it is important that the National Precast Association is part of any review of these Standards and Codes.

The Australian Standard AS3850-2003 is currently undergoing an extensive review to bring it in line with the continuing widespread use of precast elements in buildings around Australia. The proposed new standard "Prefabricated Concrete Elements" with part 2 dealing with Building Construction will cover all precast concrete elements in building construction, expanding on the present standard which covers mainly single storey industrial buildings and which is now often not relevant to many of the precast buildings being constructed.

Our Association is involved in the current review of AS3850 and also in the current review of the National Code of Practice for Precast, Tilt up and Concrete Elements. These two reviews are crucial for our members as they will govern all aspects of the manufacture and safe erection of precast concrete and provide clear direction to all in the building industry.

National Precast is represented on the AS3850 review committee BD66 by Member representatives Jeff Stratford from Reid Construction Systems and Kevin Crompton from Ultrafloor. In addition, several representatives of other National Precast Members are on the committee, representing different associations.

We have an internal committee chaired by Chris Parsons from Hanson Precast, which is considering the review of both documents, and our Marketing and Education Manager Peter Webb has been providing Association input to Safe Work Australia on the upcoming release for public comment of the National Code of Practice.

We see the review of AS3850 and the National Code of Practice as an important milestone in the safe incorporation of precast concrete elements in building construction. I would like to acknowledge the hardworking contribution of our representative and committee members. They bring many years of experience to the table and I'm sure they will achieve an excellent outcome for our industry.

LEO VALENTE
PRESIDENT

In This Issue

Stellar result

Using the latest and best available in thermally efficient design and materials has delivered a design with an 8.8 Star House Energy Rating and a 'net zero' energy objective that looks every bit as good as it sounds.

The eco approach to the new Launceston home spanned design, materials, thermal efficiency, strict infiltration controls, lighting design, appliance choices, waste water re-use, rain water collection, PV power and solar hot water with heat pump boost.

"We had the privilege of working with a well-informed client who was open to various energy saving tactics," says Mark Dewsbury, project designer from environmentally aware building and landscape design company, Carawah.

Once the sketch design was agreed, the palette of possible materials was explored in the context of sustainability, cost, maintenance requirements and aesthetics.

Toward 'net zero'

"In this case, given that our aim was to achieve a net zero requirement for heating and cooling, we suggested the use of precast concrete," says Mark.

"Precast minimises construction waste when compared to in-situ or core-filled block walls, while the flexible combination of structure and mass that sandwich panels offers enabled us to optimise the passive thermal capabilities of the house. Add economics into the equation and the client's initial caution was overcome, especially after some careful aesthetic planning to ensure the house would not be too industrial and cool – the aim was for a warm family home."

To soften this 'industrial' look, the final palette of materials for the project was mixed to include exposed precast concrete panels, complemented by a 'woodform' timber cladding system at ground level and insulated precast panels with a soft metallic finish at higher levels.

Sandwich panels exceed BCA requirement

A key part of achieving the net zero result and 8.8 star energy rating was use of the insulated precast concrete sandwich panels, made offsite at Duggans Precast in Launceston.

The wall panels provided a durable external and internal surface with good R-values. With an inner precast concrete layer of 120mm, 100mm expanded polystyrene and an external concrete layer of 120mm, an R-value of R3.3 was able to be achieved, well above the minimum BCA requirement for Climate Zone 7 of R1.9.

Insulated precast sandwich panels are commonly used internationally due to their superior thermal performance. Whilst they are increasingly being specified here in Australia for BCA compliance, Mark Dewsbury is intrigued that in Australia we are still arguing about insulation in buildings – even though it can dramatically reduce energy use – as have the sandwich panels in this case.

To ensure the thermal integrity of the building, particular attention was paid to reducing thermal bridging throughout. Non-conductive connectors were used in the sandwich panels to tie the two

concrete layers together. In addition, thermal breaks were provided at all wall junctions, within walls and between walls, floors and roof spaces. This required the extensive review of all precast shop drawings to ensure that the sandwich panels provided a consistent thermal break wherever they were used.

Pooling resources

From the outset of the project, it was clear that the swimming pool would require the most energy. The design therefore relied on the use of well-insulated concrete, concrete block and precast concrete, all of which played a role in thermal storage principles of the pool and pool house to reduce energy use dramatically.

Scoring the final result

The completed project ticks all of the required boxes, delivering the desired aesthetic and, more importantly, energy performance – and precast has played a strong part in both.

In terms of appearance and finish, the main spine wall, for example, has been left in its original off-form precast concrete finish, grounding the structure over two storeys with the perpendicular walls painted white to lighten and define living and 'gallery' spaces.

In terms of thermal performance, Launceston is a cool temperate climate mainly calling for heating of homes. Although it does not have the prolonged hot spells of mainland states, there are weeks of very warm weather.

To date, inside the house has been predominantly 20-22 degrees Celsius regardless of the exterior condition, thanks to the precast concrete elements, adequate levels of insulation throughout and the use of a suspended rammed earth floor for the second level of the house. Rammed earth is quicker to absorb and re-radiate solar radiation on a day to day cycle, whereas the other concrete elements moderate heat and cold over much longer periods.

What makes for star performance?

The completed project has achieved an impressive 8.8 Star House Energy Rating via simulation with the AccuRate software, following a thorough submission detailing all fabric matrices including floor, walls, ceilings, roof and windows to demonstrate that the design exceeds BCA requirements.

Passive design features:

- Southern face of the ground floor is fully bermed
- High levels of external wall, subfloor, ceiling and pool-house insulation
- Northern orientation with calculated levels of glazing and shading
- Large amount of active and insulated thermal mass: Level 1 - insulated waffle pod floors and precast walls; Level 2 - Rammed Earth Floors and precast walls
- Thermally broken aluminium windows
- Thermally improved aluminium doors

Active design features:

- Evacuated tube solar hot water with heat pump boost (to date boost not required)
- 3.6kw grid connect roof top PV
- Geothermal refrigerant ground loop system
- Rain water harvesting
- Black and grey water treatment and reuse on site.

Location: Launceston

Design: Carawah
Structural engineer: Engineering Edge
Builder: John Faulkner
Precast manufacturer: Duggans Precast

Photography: Belinda Fettke

The True Cost of Precast Concrete

The smart and effective use of materials is becoming increasingly important in the design of all buildings, from the smallest residence to the tallest high-rise commercial building.

When the smart use of precast concrete is considered then the focus on the initial cost of precast concrete is central to many discussions. Often, with the briefest amount of design input a decision will be made to use precast based on a square metre rate, a tonnage rate or someone's recollection from a past project. Often, with this haphazard approach, this will lead to the remark that 'precast is too expensive for my project'

Precast comes in many forms from architectural precast walling made from purpose built moulds through to precast flooring manufactured in highly mechanised factories. There are many aspects that a precast manufacturer must assess in determining the selling price for any precast element. All precast concrete elements must be handled by cranes, by either a small mobile crane or the use of a tower crane on site. Therefore, the size of the element is probably the most critical consideration in determining the initial cost of precast. The danger of using rates without understanding the number of elements in any project will almost always lead to errors in a building cost plan, confusion or unnecessary angst in the tender process.

There are five good simple rules to follow to ensure the best possible initial price for precast concrete is achieved.

- Make the precast elements as big as possible with transport and site crane limitations usually the controlling influences.
- Use standard moulds/forms or processes wherever possible.
- Have sufficient lead time to manufacture the precast in the most efficient way.
- Produce good consultant's drawings that encourage a quick and once only shop drawing process.
- Use element connections that are easily assembled on site.

But this is only a third of the story to establish the true cost of precast. The initial cost is what most people think about but the true cost is actually much less.

Here is how precast can minimise the cost of construction and the cost of a building throughout its life… cost savings which reduce the initial cost of the precast.

Cost savings in Construction

Precast construction can deliver significant savings in the construction of any building. A recently constructed 4 storey total precast building of 60 apartments saved 4 months over the insitu concrete/blockwork option first considered for this building.

Faster construction: Precast elements can be delivered just in time for fast erection, reducing unnecessary handling and equipment use. With minimal propping and bracing, and with precast flooring providing an immediate working platform, precast concrete allows other trades to begin work more quickly, speeding the construction time and saving costs. Fast construction on site also means fewer disturbances for surrounding properties.

Uses less concrete, cement and steel: Being factory manufactured (with more advanced mix designs and better vibration), precast concrete requires less concrete, cement and reinforcing steel. Less concrete is also used in precast flooring systems such as hollowcore, bubbledeck and Ultrafloor than insitu alternatives. Long spanning precast flooring means reduced material use for any supporting structure.

OHS benefits: Safety can be improved on site with less trades, equipment, workers and materials… reducing site congestion. Construction sites are also cleaner and tidier. Precast floors provide a safe immediate working platform for the construction team.

Minimises waste: Exact precast elements are delivered to site, generating less air pollution, noise and debris on site than other building options. Recycled aggregate, recycled steel, grey water, stormwater runoff and waste materials which would otherwise be used in landfill (such as slag and fly ash) are very often incorporated into the precast mix design. Any waste produced in the precast manufacturing process is easily captured and most is recycled.

Locally supplied: Precast elements are usually locally manufactured and supplied to sites meaning reduced haulage and fuel costs. Materials used by precast manufacturers are also usually supplied locally. This further reduces haulage and fuel costs. Local highly skilled erection crews erect precast concrete elements safely on site.

Cost savings of the building

Every day we hear, read or see how building designers are thinking more about sustainability - the capacity to endure - as the primary design input when a building is first considered. Precast concrete's inherent properties make it a natural choice for achieving sustainability with today's modern buildings.

Energy efficient buildings: The high thermal mass of precast concrete enables it to absorb, store and later radiate heat. Using precast concrete in passive solar designs allows natural heating in winter and cooling in summer, thereby reducing the need to rely on artificial heating and cooling. Systems such as insulated sandwich panels provide an exceptional solution for energy efficient buildings.

Improved internal building amenity: Use of precast concrete can even out internal diurnal building temperatures and some precast systems (such as TermoDeck® can improve indoor air quality, providing fresh air inside the home.

Good acoustic performance: The high thermal mass of precast concrete assists with sound insulation to reduce noise and absorb noise impact.

Fire resistant buildings: Precast concrete is non-combustible, does not melt and therefore does not require additional fire-proofing applications. Precast concrete does not emit toxic fumes under fire and can limit smoke spreading in buildings.

Environmentally considerate buildings: Precast concrete is an inert substance which does not emit or give off gases or compounds. This is a huge relief to allergy sufferers. Precast does not attract mould or mildew. Precast concrete absorbs CO_2. Being termite proof means the unlikelihood of requiring chemical spray to reduce termites and vermin which is safer for the environment.

Recyclable precast buildings: Precast concrete elements from redundant buildings are easily recovered for reuse, or crushed and used as aggregate for road bases or construction fill, providing economic and environmental savings. Alternatively, whole precast building structures can remain and simply be refitted.

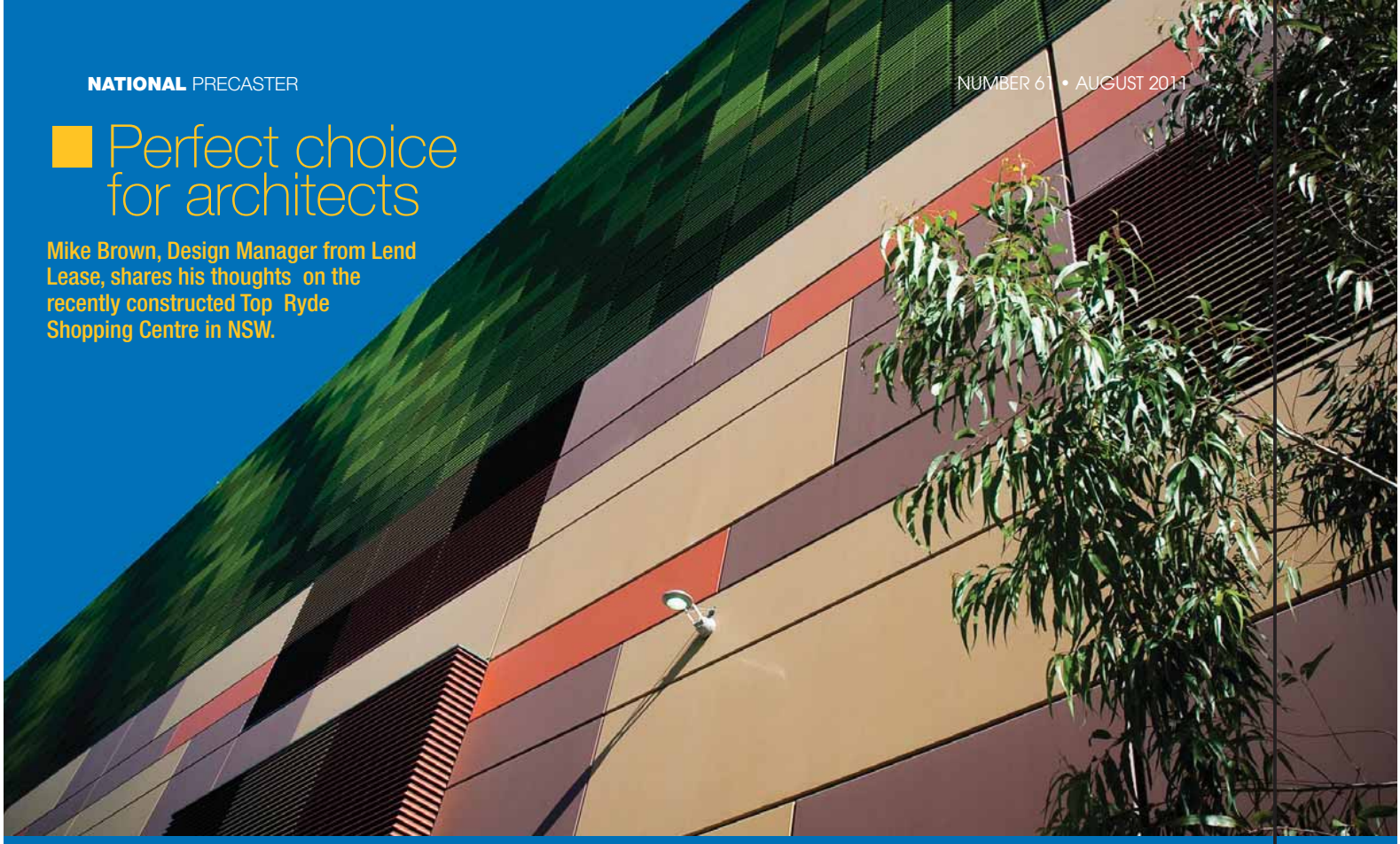
Durable, low maintenance buildings: Precast structures are durable with a long life expectancy of up to 100 years. Precast is tough and can withstand wear and tear, is easy to keep clean and requires minimal repairs or maintenance.

Precast concrete can be moulded into almost any form and finish. Precast concrete gains strength as it ages, won't shrink, distort or move and will not deteriorate with exposure to climatic change. Being flood resistant, precast concrete does not erode or rot therefore is suitable for river and coastal barriers to protect against high tides and storms. Precast concrete is impact resistant and hard to cut, offering security and protection against terrorist acts.

When considering the true cost of precast it is wise to consider not only the initial tender cost, but also to factor in the construction and building cost-savings. Ignoring this total evaluation will often lead to poor decision making, the overuse of materials and the strong possibility that an inferior building has been constructed.

Perfect choice for architects

Mike Brown, Design Manager from Lend Lease, shares his thoughts on the recently constructed Top Ryde Shopping Centre in NSW.



"Upon arrival at Top Ryde City, the two most distinguishing features greeting the visitor are the immediate proximity of the network of arterial roadways, and the amazing 25m site cross fall. By working with this radical topography, an enviable opportunity arose whereby an impressive façade palette was made available to the design team, for project theming.

Granny Smith has long been respected as a local legend, and co-incidentally across the lower Tucker Street is a playground full of Top Ryde school children facing this facade. What better way to celebrate and promote this local heritage celebrity, than to create a full façade graphic, depicting an apple orchard sitting over a patchwork quilt of earthen colours?

These beautiful, rich colours were the colours of Nawkaw, and the patchwork quilt was the amazing array of Hanson precast panels, stacked randomly in as many shapes as there were colours in the palette. It was fun, it was eye catching and it was unique to this local community.

Beyond and bordering on one of the busiest highways in the state, was the primary address façade of Top Ryde City. In this location, a soft honed precast panel was employed both to combat this aggressive environment, but at the same time to present a sense of quality and reliability – echoing the retail experience that was on offer behind the ramparts of this imposing development.

Finally, the open air, internal pedestrian Strada is lined with high-end retail fashion, cutting edge merchandising and coffee bars. Semi-polished creamy precast panels fill the parapets of this alfresco arcade, bringing a tone and mood of elegance and sophistication, to an otherwise intimate retail retreat.

Precast concrete panelling was the perfect choice of façade lining in this particular project. It offered expediency in construction, an unlimited choice of shapes and finishes, and helped create an opportunity to have some fun for all to share."

The sheer scale of Top Ryde City is impressive. Occupying a 3.5 hectare site with 80,000 square metres of retail space, it boasts around 300 retailers and over 3000 undercover car spaces, including an outdoor fashion promenade, an entertainment and dining precinct, water features and public artworks.

546 precast wall panels were supplied with the original project design noting that the precast walling has 3 different finishes – polished, honed and a class 2 off-form finish with a high dosage of integral oxides in a range of colours.

According to Chris Parsons, Manager of Hanson Precast "the challenge to produce a precast panel with four different coloured concrete mixes would have been difficult and time consuming, with any bleeding of any concrete mix into the adjoining portion of a panel being a potential reason for rejection. Also, the architect didn't want to see any tonal variations in any of the concrete colours."

The Nawkaw colouring process that penetrates into the pores of the concrete surface substrate to produce a consistent and long lasting finish, was therefore selected and applied to the surface of the off-form precast panels. The process is guaranteed for a minimum of 25 years and was carried out in the precaster's factories, after the panels had been cured for 7 days.

Erection of the precast wall panels needed to take place at night to minimise disruptions. The panels were erected using 50 and 130 tonne mobile cranes with all traffic management, task lighting, surveying, welding, grouting and caulking to the panels included in the precast contract.

The shopping centre was opened in three stages with the centre completed in late 2010.

Location: Top Ryde NSW
Developer: Gridcorp
Architect: Lend Lease Design
Builder: Bovis Lend Lease
Precast manufacturer: Hanson Precast
Precast staining: Nawkaw Australia

Permeable drainage walls combine best of both worlds

An earth retention system manufactured by Rocla has provided the "best of both worlds" for Cairns Regional Council when needing to re-line a 220 metre open drainage channel.

Jaye Street Drain runs through Edge Hill, a heavily populated northern suburb of Cairns, with the Jaye St roadway on one side and a row of properties on the other, and with not much clearance between either the road nor the rear of the properties. Existing drain walls were mostly in a state of collapse.

Parameters considered in the design solution included the footprints of the road, drain and private properties, the capacity of the drain and the velocity of stormwater, as well as cost, construction time and practicality.

Typical concepts considered for surface drain rehabilitation included in-situ cast concrete lining, gabions and reno baskets, and concrete blocks. Gabion and reno baskets were eliminated as an option because, among other things, they were too labour intensive and time consuming to construct in an environment that could be under water every time it rained. A concrete lined drain was eliminated because the construction would not have fitted easily into the existing drain footprint, in particular it would encroach too closely to the private property boundaries. For example, a concrete lined drain with a 3-metre base and a 45 degree batter would have created a width at the top of the drain of typically 8 metres.

These considerations, with the need to cope with a minimum 1 in 100 year rainfall event, made it clear that the ideal profile of the drain would have walls that were essentially vertical. The Rocla earth retention block system met this requirement. It meant that a wall on the property side could be constructed in front of the existing gabions, requiring little or no extra excavation and consequently had little or no effect on the existing vegetation and infrastructure. It also allowed the drain to be built within the existing footprint, with a bed width of 3.4 metres and a top width of approximately 3.8 metres. The permeability of the system was a bonus, allowing groundwater to flow out into the drain and prevent hydraulic pressure from building up behind the wall. And speed of erection was a further bonus.

Construction Supervisor, Darren Falkiner, and his team of Council staff found the system relatively quick and easy to install. "It offered the best of both worlds," Darren said. "It provided a solid, monumental wall that fitted within the available footprint."

Two 20-tonne excavators, one in the creek bed and one on the roadway, were used to erect the system.

After excavating to the founding layer, geo fabric and a 300-500mm ballast layer was placed and compacted, then bedding sand was levelled and compacted on top to form a base for the precast units.

When the units arrived on a semi-trailer, the excavator on the road passed the blocks down to the excavator in the drain bed for placement on the north side of the channel. The concreters followed behind the excavators, at first placing a blinding layer, principally for erosion control in case of rain. The reinforcement and 150mm slab were then laid, up to the base of the retaining wall and in between the blocks, to lock them into place. No-fines concrete was poured behind the wall for extra stabilisation of the embankments and to fill the voids behind the precast units.

"It was the ideal product for the job," Darren said. "It gave us the ability to work in poor ground quickly, to build a vertical wall with minimal disturbance to properties and the roadway, with a material that is by its nature very durable."

Location: Jaye Street Drain, Cairns
Client: Cairns Regional Council
Engineer: Cairns City Council Design Services Unit and PDR Engineers
Precast manufacturer: Rocla

Cutting to the chase

A new, clean sweep of freeway that cuts through hilly country in Melbourne's far west and includes three new bridges, two overpasses and two new Melbourne-bound access ramps will soon be speeding the journeys of both commuters and freight carriers.

The Western Highway Melton West to Bacchus Marsh Realignment Project is upgrading a steep and circuitous five-kilometre stretch of highway known as Anthony's Cutting. A notorious accident black spot and well known 'go slow' area on a vital freight route, the $200 million upgrade was fast tracked as part of the then Rudd Government's economic stimulus plan.

When complete, the new freeway will improve safety and reduce travel times by eliminating steep grades and tight curves, enabling the speed limit to be lifted from its current 80 km/h to 110 km/h.

One of the major challenges of the project, which will take one million man-hours to complete, has been the rugged terrain, including the need to span three creeks which run in steep valleys along the route. This has required cuts of more than 25 metres in depth and, by completion, will involve movement of some 1.5 million cubic metres of material and a total of 112 precast beams.

Some 92 of those are already in place. Supplied by Westkon Precast, the 60-tonne T-Roff 1500 deep prestressed beams have so far been used in the construction the Bulman's Road Overpass, a two-span bridge approximately 65 metres long with a centre pier in the middle of the existing Western Freeway which required 12 beams, along with the Djerriwah Creek Bridge which called for 50 beams and the Pyrites Creek Bridge, which used 30.

Andrew Steer is the Westkon project manager on the job. As he explains, the key challenge, in particular with the Djerriwah Creek Bridge, was dealing with the very high piers and steep surrounding terrain. The largest of its kind in Victoria, this five-span bridge is 165 metres long and 30 metres high.

"What could have been a real issue at the construction stage was overcome by the outstanding planning and foresight that went into the project," he explains. "Although the beams we produced were of uniform size, which from a design and production perspective saves time, cost and unplanned variations, they included cast-in plates to assist with propping during installation and then locking into place, overcoming the issues of access and the high piers."

As Andrew explains, the structure was built using two cranes to pass the beams, bracing the beams onto adjacent spans and backing them on to the structure from one previously installed span to the next.

"It wasn't possible to get the trucks into the valley so they backed down onto the structure, the first crane picked up the end of beam, the truck continued to back as crane held it, then, using an equalising triangle, the first crane passed the beam to the next crane, and so on," he explains.

The entire project is well on track to meet its completion date of early 2012.

Location: Melton West to Bacchus Marsh VIC
Client: VicRoads and the Australian Government
Engineer: Aecom
Builder: John Holland
Precast manufacturer: Westkon Precast

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