MANUFACTURING CERTAINTY FOR AUSTRALIA'S FIRST EXTRADOSED BRIDGE

When replacing the ageing Fremantle Traffic Bridge, the Swan River Crossings project represented a significant milestone in Australian bridge engineering.

It also reflected a broader shift across the nation's transport infrastructure sector, where increasingly ambitious designs and tighter delivery programs are placing new expectations on precast manufacturers.

The project delivered Australia's first extradosed bridge, combining the structural efficiency of a cantilever bridge with the visual appeal of a cable-stayed bridge. Success relied on delivering highly engineered precast elements while maintaining installation precision and delivery certainty across one of Western Australia's most significant transport infrastructure projects.

For National Precast member Permacast, this meant considering how every element would be manufactured, transported and installed long before construction began.

"On projects like this, manufacturing becomes part of the engineering solution," says Everson Ribeiro, Civil Engineer – Permacast.

"Every production decision, from curing to transport preparation, was made with the final bridge construction in mind. Success depended on understanding not just how to manufacture each component, but how it would perform throughout delivery and installation."

How every element would be manufactured and installed was considered long before delivery.

MANUFACTURING BEYOND THE CONVENTIONAL

Permacast manufactured 46 transverse T-Roff beams and 193 structural and architectural parapets for the bridge's permanent works.

Some beams exceeded 110 tonnes and measured 2.6 metres deep, placing significant demands on casting, lifting, storage and transport. Rather than treating production and construction as separate activities, the team developed an integrated approach that anticipated installation requirements from the outset, ensuring factory operations supported efficient site delivery.

ENGINEERING PRODUCTION AROUND MILLIMETRES

One of the project's greatest technical challenges involved maintaining exceptionally tight post-tensioning duct tolerances.

Individual ducts were required to remain within plus or minus (±) three millimetres (mm), while the complete duct group was limited to ± six mm. Recognising that full steam curing would influence beam hogging and alter final duct positions, engineers predicted this movement in advance. Laser-cut end shutters, internal duct stiffeners and adjusted duct positions compensated for the anticipated movement before casting commenced.

By accounting for beam behaviour during production, the required installation tolerances were consistently achieved without corrective work on site.

RETHINKING PRODUCTION METHODOLOGY

The project also challenged conventional steam-curing practices as it required continuous full steam curing until each beam achieved the specified seven-day compressive strength, while complying with strict heating, holding and cooling requirements.

Rather than simply adding equipment, Permacast undertook full-scale curing trials to understand how the concrete would perform under controlled steam conditions. Remote-controlled vapour generation, continuous temperature monitoring and repeatable curing cycles were incorporated into the production system, creating a reliable process that consistently met specification and improved delivery certainty.

The result was a repeatable manufacturing approach that reduced production uncertainty and increased confidence throughout construction.

DESIGNING FOR TRANSPORT BEFORE LEAVING THE FACTORY

Production did not end once each beam reached strength.

Every element required detailed preparation for transport and installation before leaving the factory.

Because the architectural soffit could not be penetrated for transport tie-downs, Permacast developed dedicated transport beams that securely restrained each unit without compromising finished surfaces. Temporary hanging brackets, condeck fixings and transport protection were also incorporated during fabrication, allowing the beams to arrive on site ready for efficient handling and installation.

Every element required detailed preparation for transport and installation before leaving the factory.

The same disciplined approach extended to the bridge's structural and architectural parapets, where evolving design revisions, congested block-outs and irregular lifting requirements were addressed during production rather than on site, reducing construction risk and improving efficiency.

SUPPORTING COMPLEX INFRASTRUCTURE DELIVERY

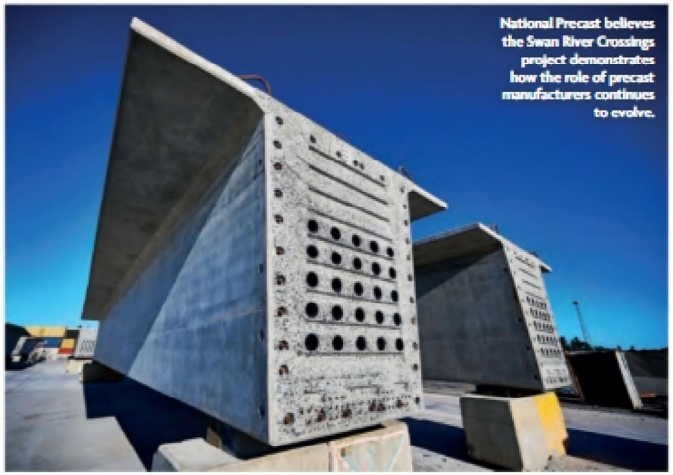
The Swan River Crossings project demonstrates how the role of precast manufacturers continues to evolve.

Major infrastructure projects increasingly rely on manufacturers to contribute engineering expertise, production planning, logistics and constructability alongside high-quality precast elements. Factory operations have become an integral part of project delivery, helping reduce risk and improve construction certainty.

As Australia's transport projects continue to grow in scale and technical complexity, many of the decisions that determine project success are made long before work begins on site. Increasingly, they begin on the factory floor.

"Projects like the Swan River Crossings demonstrate how modern precast manufacturing has evolved beyond simply producing concrete components," says Cadell Taye, CEO, National Precast Concrete Association Australia.

"Success increasingly depends on integrating engineering, manufacturing, logistics and construction planning from the earliest stages of a project." ■



National Precast believes the Swan River Crossings project demonstrates how the role of precast manufacturers continues to evolve.

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