NorthLink WA

Stage 2: Central Section - Reid Highway to Ellenbrook

The precast process behind Perth's newest infrastructure

The NorthLink WA project comprises the construction of a new vital transport link for the North West of Western Australia. When complete, the $1.2 billion project will reduce travel times and congestion, as well as provide productivity benefits to the economy, industry, motorists and local community.

As the second stage in the NorthLink WA project, the Central Section involves the construction of a free-flowing road link from Reid Highway to Ellenbrook and is extending the Tonkin Highway between Morley and Muchea.

Set to improve access to Ellenbrook and the surrounding precincts, this $417 million section comprises approximately 20 kilometres of highway with four interchanges, including 14 road bridges and three footbridges.

As a vital phase in the larger project, the Central Section is being delivered by the Great Northern Connect team—a BGC Contracting and Laing O'Rourke joint venture.

Precaster
Delta Corporation

Client
Main Roads Western Australia

Builder
Great Northern Connect (BGC Contractors & Laing O'Rourke joint venture)

Engineer
AAJV (AECOM & ARCADIS), GHD

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BRIDGING THE ELEMENTS

National Precast member, Delta Corporation, was awarded the contract to supply precast concrete elements integral to the Central Section. These included 151 TeeRoff Beams for 16 individual bridges and 200 precast column shell formers for the bridge abutments.

Each bridge is unique in design and layout, requiring varying sizes and configurations of beams. Lengths ranged from 17 metres up to 43 metres, depths from 1.0 metre to 2.1 metres and widths from 3.2 metres to 4.8 metres. Beam weights ranged from 63 tonnes to 181 tonnes.

All precast elements have a Class 2 finish, as per AS 3610 Formwork for concrete, have been designed for a 100-year service life, and were required to meet the stringent durability and quality standards.

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The project's engineers designed an innovative continuity joint detail between the bridge beams—the first of its kind ever to be used with TeeRoff beams on any bridge project in Western Australia. All projects have previously been designed with simply supported beams. As a result of the continuity joint design, there were a number of savings made, including:

- reduced prestress requirements,
- elimination of top prestress strands,
- reduced beam depth,
- reduced structural depth (-150mm to -200mm),
- reduced number of bearings required at piers by half,
- reduced pier column width,
- eliminated formwork required to construct the continuity between beams, and
- eliminated the requirement for transverse diaphragms at the piers.

COMPLEX DESIGN RAISES THE MANUFACTURING BAR

The continuity detail at the beam pier ends involved a complicated formwork design to create a void with a variety of cast-in fittings to enable the beams to be spliced on site. Additionally, the bridge geometry meant that a number of the beams needed to have acute end skews on the abutment ends and the top flange edges curved to a specific radius to suit the alignment of the bridge.

Delta's Executive Director, Matt Perrella, says although the continuity joint detail resulted in significant construction savings, it made for a complicated manufacturing process.

"The extent of strand de-bonding in this project varied from beam to beam and was far more complex, compared to others in the past. In addition to this added complexity, the strands at the continuity joint were required to extend through the shutters to the end of the beam where they were fitted with spacer plates then onion jacked after demoulding to provide anchorage for the insitu concrete stitch," Mr Perrella details.

STRINGENT DURABILITY SPECS

With the project's long-term ambition to cater for Perth's growing traffic volumes, longevity of the precast elements was critical. "Specifications for durability control on this project have been one of the most stringent encountered to date. During the pour, the concrete temperature was to be maintained at below 32°C and, during the steam curing cycle, below 80°C," Mr Perrella explains.

Curing plays an important role in the strength and durability of concrete, and the project's specification required the beams to remain in the moulds for a minimum of 48 hours after casting. To meet both this requirement and project deadlines, the precaster developed a unique control methodology, which included producing their own high strength and high flow concrete with state-of-the-art computerised batching plants. "With this methodology, we were able to meet the construction schedule and assure the client that de-moulding could be achieved within our normal overnight curing cycle," Mr Perrella says.

Delivery of all the precast prestressed concrete elements was completed three weeks ahead of program.