Torrens to Torrens Rail Overpass

Adelaide's North-South road corridor is a vital route for the region's motorists and freight heading to key transit hubs. Rising congestion problems, low travel speeds and low productivity were triggers for the redevelopment of this route.

The Torrens Road to River Torrens Project, also known as T2T, forms a crucial part of the North-South corridor. This section marks one of the busiest sections of what is a major Adelaide north-south corridor for traffic. It will be a 4km non-stop section of road, providing significant travel time savings for commuters and freight. One of the key project drivers was the need to address the frequent traffic delays due to the Outer Harbor Rail line level crossing just north of Port Road.

The T2T rail overpass carries the existing Outer Harbor Rail line over the new lowered motorway and surface roads. Given the size and complexity of this operation, undertaken over one of Adelaide's busiest roads, the successful delivery of this project is a triumph of innovation and collaboration.

Innovation in Design

The original reference design for this bridge was a pre-stressed concrete solution. This design required heavy falsework and major disruption to the South Road traffic due to its required staging. As with any concrete bridge, the strength requirements were largely driven by the self-weight of the superstructure.

During the tender design for the project, the concept of a steel through-girder alternative was considered and eventually adopted. The large reduction in weight of the steel structure in comparison with the concrete alternative allowed a more efficient build. Not only was impact to the traffic significantly reduced, the consequent effects of weight reduction resulted in significant savings and environmental benefits.

Steel through-girders are highly efficient, allowing minimisation of overall structural depth, with consequential aesthetic benefit and reduction in lowered motorway excavation, retaining walls, and so on. The relative simplicity of the solution, incorporating maximisation of pre-fabrication, allowed significant cost savings to be achieved. The deck consists of two, three-span continuous steel girders, being 2.5m deep three plate I girders. U-frames provide lateral restraint to the girders and consist of steel cross girders at 2.2m centres, bolted to vertical stiffeners. An in-situ concrete deck spans in the longitudinal direction between the cross girders.

Significantly, this rail overpass was constructed in a disruption envelope of just 21 days. It was necessary to install the headstock elements during the 21 day occupation, adding another task to an already congested program. Steel box beams were adopted, in lieu of the conventional reinforced concrete, in order to also keep the weight to a minimum. These beams consist of 1.6m wide flanges and twin 1.5m deep web plates. They weigh up to 50 tonnes and are 17.2m long. A fully fixed connection between the headstock and columns was adopted to provide frame action for transverse loadings such as wind and earthquake.

Construction Efficiency

Speed of safe construction was paramount for this project. The structural solution for the grade separation required full consideration of the construction methodology to ensure road and rail commuter disruption was kept to a minimum. The overpass solution was developed in close collaboration between design and construction team members and incorporated many innovations to enable a major bridge build during a three week closure of the Outer Harbor Rail line.

The construction methodology drove the design solution by utilising steel elements which maximised the amount of work that could be done offline, prior to the main closure. The efficiencies gained in reduced weight steel headstocks compared to heavy conventional concrete meant that these members could be readily erected during the short rail closure. The construction methodology allowed pile-column construction within the rail corridor, but safely away from operating trains. The change from concrete headstocks to steel meant that a larger span with reduced pile construction could be accommodated and also meant the headstocks could be conventionally lifted into position during the closure.

The entire bridge deck was split into three segments which could be pre-assembled on the ground and installed from east to west. Each segment assembly consists of two main girders, several cross girders, deck formwork and reinforcement, cantilevered walkway deck and anti-throw screens. The maximum segment weight was 280 tonnes. These segments were lifted, moved from the assembly yard and placed into position with a 600 tonne crawler crane.

PROJECT TEAM

- **T2T Alliance:** Department of Planning, Transport and Infrastructure (DPTI), CPB Contractors, York Civil and Aurecon
- **Steel Fabricator:** Samaras Group
- **Urban Designer and Architect:** Grieve Gillett Anderson
- **Sub-alliance Design Partners:** Mott MacDonald and Wallbridge & Gilbert