

Upgrade puts more 'free' in busy CBD freeway

West Gate Freeway



Structural steel was the main material of choice in widening the West Gate Freeway over some of Melbourne's busiest commercial areas well within project budget and way ahead of time.

The upgrade works covered approximately six kilometres of freeway in total, 3.6 kilometres of it elevated with over half of the widening using steel beams.

The upgrade project was completed three months early in March 2009 and is expected to reduce crashes by 20 percent, increase traffic flow significantly and improve travel time and reliability along the freeway.

VicRoads Project Director – West Gate Freeway Upgrade, **Andrew Williams** said that tight program controls, multiple work zones and the collaborative alliance approach were the main factors that contributed to project delivery well within budget and three months early.

The West Gate Freeway Alliance was formed to design and construct planned road improvements along the Freeway, the most complex of four sections of the AUD\$1.39 billion Monash-CityLink-West Gate (M1) upgrade project.

The route is Melbourne's most heavily trafficked and economically important connection for freight, business and private travel, carrying up to 160,000 vehicles per day.

Mr Williams added that minimising impact along the busy city corridor was also crucial for the project which called for a minimum number of columns.

"Both client and adjacent projects were happy with the reduction in impact afforded by steel spans reducing pier numbers and thus minimising impacts on traffic and stakeholders," he said.

Structural and highway engineers, Hyder Consulting investigated design characteristics from March to September 2007 with 3D modelling and load and fit testing. Design work occurred in late 2007 with steel detailing undertaken up to early 2009.

Technical Director - Civil Structures of Hyder Consulting, **Rajiv Kalra** said the extensive use of structural steel throughout the project was driven by two key constraints.

"Firstly, stitching to the existing structure required the new widening to match bridge articulation and span lengths where possible," he said.

"Standard precast concrete beams could not be used as a cost effective alternative for the upgrade work due to the long spans of the superstructure of the existing Freeway's elevated viaducts being post-tensioned concrete box girders."

He added that the lack of space available on and around the freeway made design and construction extremely challenging.

"With the viaducts running along the edge of the main CBD, the carriageways cross numerous major roads, railways and public car parks, and also pass many adjacent commercial and residential areas/buildings," Mr Kalra said.

"The very close proximity of commercial and residential areas, major roads and public car parks along the Freeway significantly limited the space and locations available for support foundations.

"As such, the use of steel allowed greater flexibility in the locations where piers could be located to match existing piers and bypass ground obstructions, and increased the ability to vary spans as required.

"For example, steel was used in lieu of precast concrete beams for longer spans over major roads, which also achieved a single span aesthetic effect"

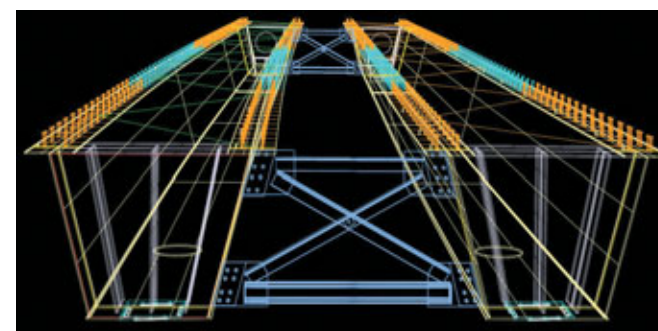
He said that the use of a fully integrated 3D modelling system using *MicroStation*, *InRoads* and in-house software was an important innovation used on the project.

"We considered it essential to have all modelling programs running on one platform due to previous experiences with non-integrated software and compatibility issues," he said.

"The fully integrated system allowed for more accuracy and detailing in 3D modelling and in turn significantly reduced the time and costs spent on construction works and prolonged traffic management.

"One benefit in the enhanced 3D modelling was the ability to include all shear studs along the steel trough girders and their interface with Transfloor® panels. Detailed 3D models of the steel trough girders, including shear stud layouts, were sent to the fabricator and site surveyor to use as a basis to create their own models.

"The fabricator and site surveyor then sent their detailed 3D model back to the design team for verification and procurement of components and construction only took place once agreement had been reached on any discrepancies between models.



"As a result of this modelling and verification process, onsite time was considerably reduced, with the panels fitting seamlessly along the steel trough girders between shear studs."

He said that the ability to prefabricate was critical for the whole project.

"Prefabrication helped to minimise onsite construction and traffic lane closures with the transportation and lifting of procured components able to be predominantly undertaken at night to avoid peak periods," he said

"Throughout this project, a new single dowel connection to existing viaduct was designed and utilised for all structural widenings in lieu of the more conventional dual dowel connection method, allowing



the use of an E-Z Drill unit and increasing hole drilling productivity onsite by 300 percent compared to original forecasts.

"The dry drilling process with dust collected via a Macro Dust Collection System negated any mess or slurry that would have been created from a conventional diamond core drill with water.

"This was especially important for work areas above dense commercial and residential areas with heavy traffic volumes, as substantial traffic management and closures below the area of work and access via scaffolding was avoided."

He said that those sorts of benefits have led to steel fast becoming industry accepted practice for longer span bridges.

"Undoubtedly, there can be significant growth opportunities for more steel to be used on other major roadworks in the future," he said.

"The knowledge obtained from this Freeway upgrade has provided a confident platform with which to continue refinement and improvement of steel design systems and detailing"

PROJECT TEAM

Project Management: Westgate Freeway alliance (Baulderstone/Thiess, VicRoads, Parsons Brinckerhoff, and Hyder Consulting)

Construction: Baulderstone/Thiess

Structural and Highway Engineering: Hyder Consulting/Parsons Brinckerhoff

Design and 3D modelling: Hyder Consulting/Parsons Brinckerhoff

Steel Fabrication: Haywards Steel Fabrication & Construction, Geelong Fabrications, Adua Engineering Australia

Shop Drawings: Cocciardi