



**Georgiou**

ACAA  
TECHNICAL PAPER

## AUBIN GROVE TRAIN STATION AND RUSSELL ROAD UPGRADE

*Contractor: Georgiou Group*

Client: Public Transport Authority (PTA) and Main Roads WA (MRWA)

Value: \$71.4 million

Duration: February 2015 - early 2017 (Both stages: ECI and D&C)





## BACKGROUND

The Aubin Grove Station (AGS) was constructed in a brownfields environment in the expanding southern suburbs transport corridor of Perth, and was the first island rail platform and station to be built within a “live rail” environment in Western Australia. The final scope for the project involved construction of a new train station, 2,000-bay car parking, duplication of the Russell Road Bridge and associated road works.

The multi-modal interchange station involved:

- two 150-metre long island platforms
- island platforms 10m wide.
- station entry buildings on both sides of the Kwinana Freeway.
- footbridges from either side of the freeway linked to the station concourse located above the island platform between the tracks in the freeway median.

The Project was split into three stages and Georgiou won the Expression of Interest (EOI) stage, including a detailed presentation and interactive scenario workshop, to progress into the final two stages, consisting of:

- Reimbursable Early Contractor Involvement (ECI) Phase
- Lump Sum Design and Construct Contract Phase

In February 2015, Georgiou commenced the six-month Early Contractor Involvement (ECI) process for the WA State Government’s Aubin Grove Station (AGS) Project.

Through the ECI process Georgiou worked with the client, Public Transport Authority (PTA), to provide advice on design, constructability and detailed program and costing advice. Part of this process included supporting the traffic management component of the Development Application (DA) to the Department of Planning.

Georgiou led a separate design team in collaboration with Main Roads Western Australia (MRWA) to firstly establish traffic modelling parameters for the existing network including the new Aubin Grove Station. Once these were established, Georgiou led the team through a series of optioneering workshops and presented four realistic options for consideration by MRWA. MRWA selected the preferred option and Georgiou then, as part of the original ECI, undertook a traditional Request for Proposal for the Upgrade to the Russell Road Bridge.

At the completion of the ECI stage, Georgiou was awarded two separate Design and Construct contracts:

- The Aubin Grove Station (AGS) for PTA, and
- The Russell Road Upgrade (RRU) for MRWA.

Georgiou’s involvement in the ECI process resulted in:

- A complete engineered solution for the Aubin Grove Station including accurate traffic modelling to ensure the Russell Road Bridge and surrounding infrastructure could cater for the new Aubin Grove Station at opening, and into the future.
- Significant cost savings to the WA Government and WA taxpayers, through innovation and smart construction strategies and achievement of an ambitious timeframe which carved 12 months off PTA’s standard four-year “go to whoa” program for the development of a new station.





A large bridge under construction with a green directional sign in the foreground. The bridge has a concrete structure with a wooden panel facade. The sign indicates Russell Rd to the right and Gibbs Rd to the left. In the background, there are construction workers, a blue car, and a white truck. The sky is blue with some clouds.

# PRECISE


PLANNING AND  
CONSTRUCTION





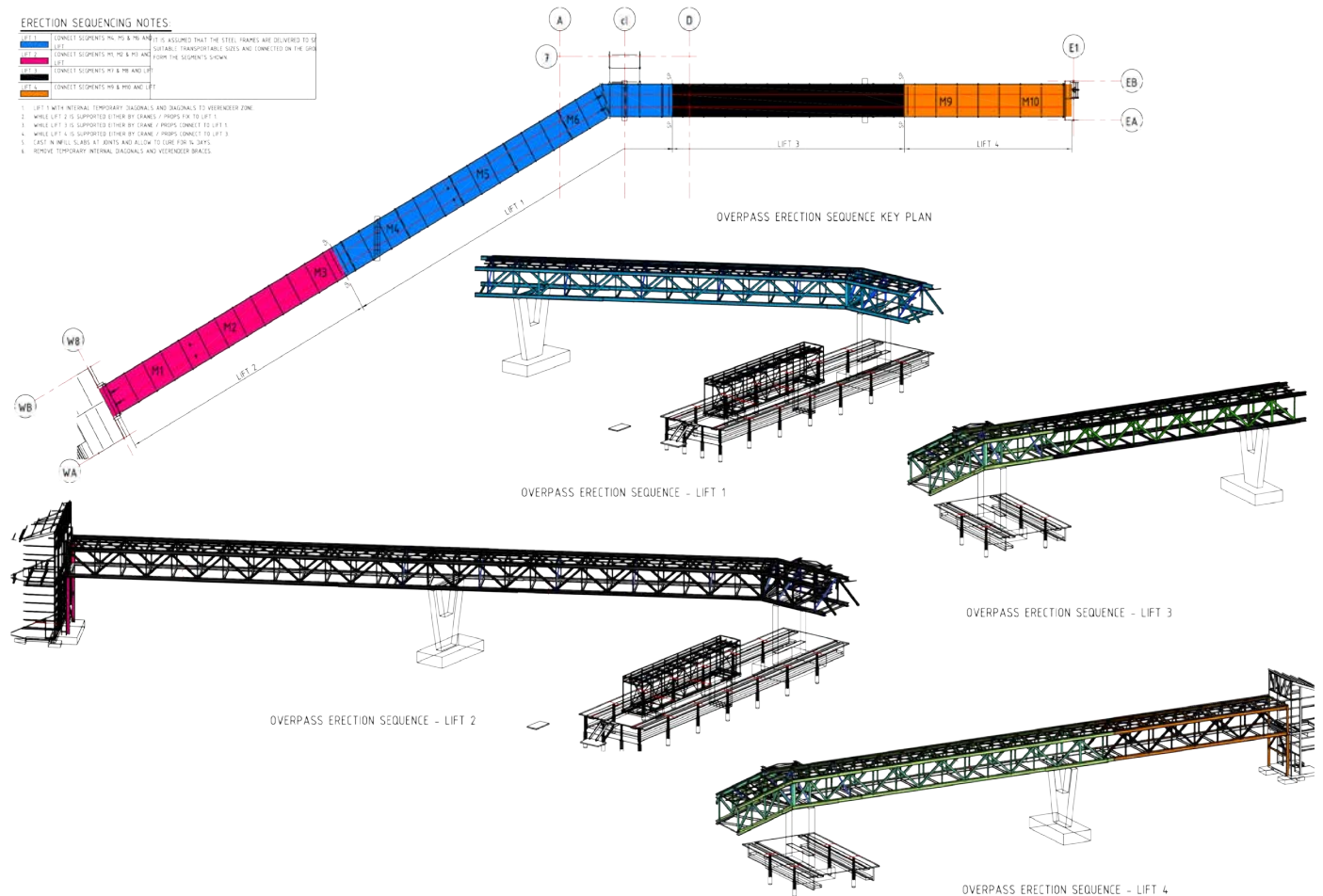
# KEY PROJECT CHALLENGES

The project presented a combination of key challenges including:

- Working between two live and fully operational 22kV train tracks, and located within the main north-south multi-lane Kwinana freeway.
  - A client requirement to maintain existing Level of Service to the existing rail and freeway networks, outside planned and scheduled shutdowns.
  - A fast and relentless program (especially in the first six months of the Project), with many concurrent and critical activities integrated between the two Projects through the road and rail shutdown processes. Significantly, over 70% of the AGS scheduled activities were either critical or within two weeks of being critical.
  - Crucial early design and procurement activities to ensure hitting critical shutdown dates.
  - Heavy lifts for station elements, footbridge and bridge beams over electrified rail and freeway.
  - Severe space constraints of working within the train station area, which was only 7.8m wide and 150m long inside the General Exemption Fence either side of the rail tracks.
  - Risks associated in working adjacent to the rail lines, with silent trains moving more than 100km an hour through the area. Georgiou negotiated with PTA for eight months throughout the ECI phase to get a 40km/hr speed restriction approved.
  - Carpark construction activities adjacent to and under 330kV and 130kV high voltage electricity pylons, and other services such as optic fibre and high pressure gas.
  - Limiting the number of major freeway closures to three, but extending the length of the shutdowns to avoid impacts on traffic. The process to convince MRWA to close the Freeway for 30 hours on each occasion was the single most onerous task and took over 10 months to negotiate.
  - Immovable dates, set up to 18 months earlier, for June 2016 rail shuts due to limited available shutdowns and PTA resources to undertake these shutdowns.
  - The Russell Road bridge central pier required innovative thinking to construct. Access between the live rail prevented normal crane access so the pier formwork was built by hand within the live rail area. A plywood clad scaffold was used to provide worker protection from the overhead electrified rail. To reduce the weight in constructing the trouser legs of the pier, polystyrene was cut to shape to allow for the leg formwork to be constructed by hand. Concrete was pumped through a directionally drilled duct under the live rail.
- Complex stakeholder interfaces included:
- joint clients (PTA and MRWA)
  - the active and political influence of the local government authority, the City of Cockburn
  - Western Power - high voltage overhead
  - underground services authorities including Optus, Water Corporation
  - vehicle, pedestrian and cyclist traffic
  - adjacent and nearby residents
  - adjacent Harvest Lakes shopping centre
  - separate contractor undertaking adjoining and overlapping upgrade works on Kwinana Freeway
  - Other rail network restrictions including Burswood Station works for the new Perth Stadium and the Mitchell Freeway extension works limiting availability for shutdowns on the rail network.
- Late inclusion of the Russell Road Upgrade
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Project introduced a higher level of risk to the program. While designs for the station advanced during the ECI process, the contract for the RRU design and construct was signed only in December 2015. This gave an unrelenting six-month window to achieve 100% design, pour bridge beams and construct the bridge pier by hand (as it was within the live rail environment) to ensure the RRU beam installation works would coincide with the AGS works with the first scheduled shutdown date in early June.

Other projects had locked in rail network shutdown times after our proposed June shutdowns for July and early August and the impact of AGS and the RRU Projects missing the planned shutdowns would have added a minimum of two months to the program. Therefore achieving the Russell Road Bridge lifts to coincide with the AGS shutdowns were crucial, as whole of Project deadlines would have been impossible to achieve if bridge beams could not be lifted at the scheduled times.



**DRAWING: Structural drawing highlighting the sequencing of the modularised installation of the pedestrian overpass.**



# KEY FACTORS IN THE PROJECT'S SUCCESS

*Key aspects of project success included:*

## Modularisation innovation

Through the ECI process PTA, the Lead Design Consultant (LDC) and Georgiou conducted a number of collaborative Value Engineering workshops. A specific station construction workshop proposed a modular train station design which would be pre-fabricated in the western carpark and then lifted into place during a concentrated installation campaign. The underlying idea was to shut down the rail and freeway for a longer period of time for a lower number of shutdowns to minimise disruption to rail services and freeway traffic. This enabled the team to “isolate” the rail and freeway simultaneously for the bridge and station works to be undertaken in parallel with two separate teams, thereby reducing the risk of working within a “live” environment.

The early decision to adopt a modularised station concept enabled the LDC and their subconsultants to design the whole station incorporating modularisation from the start. This enabled the permanent works design to allow for the temporary works design to be integrated in the one process. As an example, the lifting points for the modules mirrored the columns and therefore minimised any temporary loading effects during installation. Another benefit of modularisation is the amount of work that can be undertaken on the shop floor prior to coming to site. The project team made use of 2D design and 3D modelling to guarantee precision fabrication which enabled rapid and accurate onsite assembly to keep shutdown periods to a minimum.

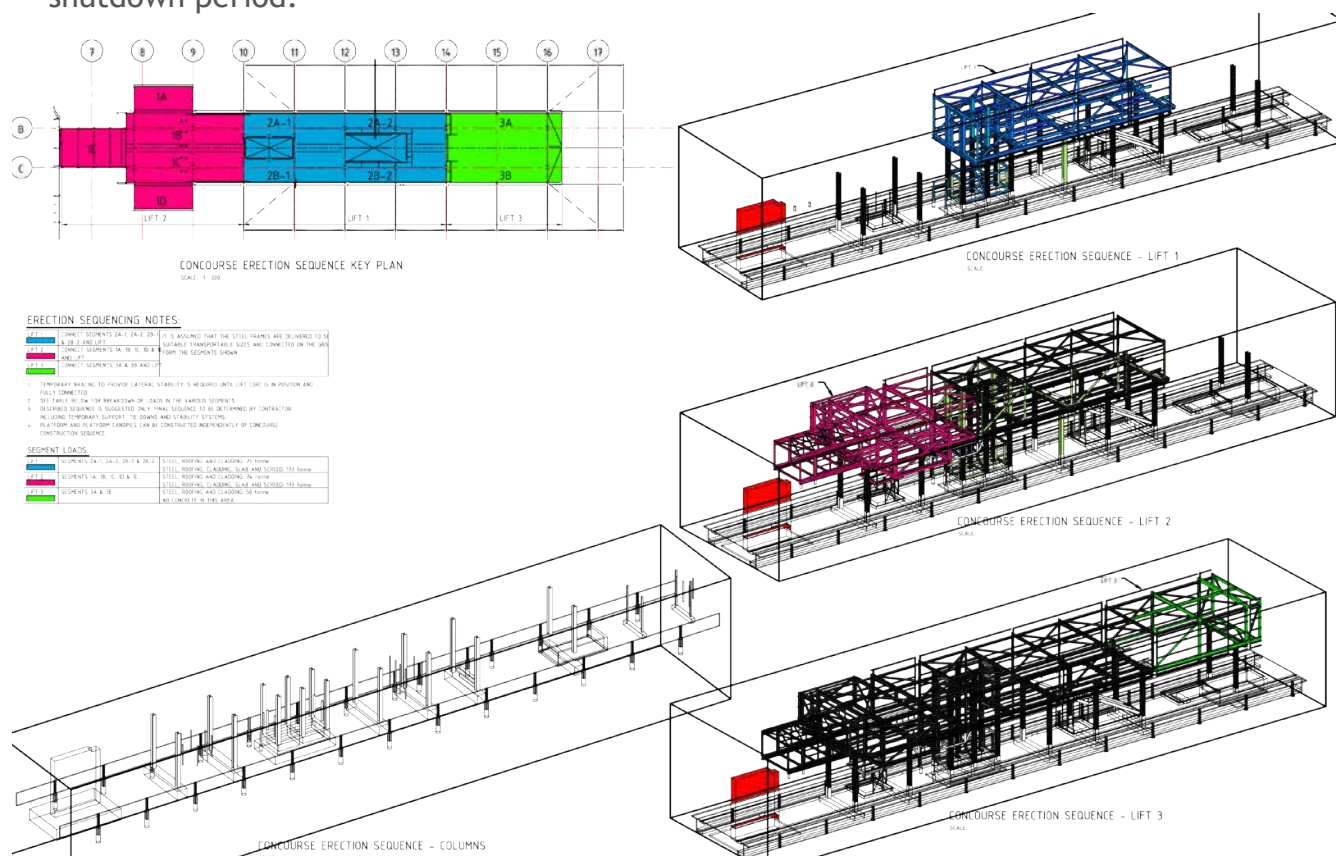
## Exceptional level of planning and control

- A major risk was the heavy lifting of station elements. As time was tight, and the level of safety risk high, trial lifts were conducted to ensure

everyone involved was familiar with the system and any concerns were addressed prior to the critical lifting program.

- Meticulous planning and execution was required for completion of works within tight rail and freeway shutdown timetables. For each major shutdown the Kwinana Freeway was closed for a window of 30 hours. The program for the lifting of the RRB beams was:
  - 10 hours for crane preparation, involving laying of road surface protection (600cms of cracker dust and 700 tonnes of sleepers) and build-up of the crane.
  - 10 hours for lifts - 2 hours per 195 tonne lift with 2 hours contingency.
  - 10 hours for crane demobilisation and freeway cleaning.
  - 1 hour only for contingency.
  - The first lift was completed with 40 minutes to spare.
- Stringent controls were put in place for any construction activities within the rail reserve. Silent trains travelled through the site at 100km/h. The team was well drilled, and throughout the duration of the Project achieved no complaints from train drivers about obstruction of driver views or signals.
- An exceptional level of planning to achieve critical project shutdowns. The three June 2016 shutdowns were booked 18 months in advance, with no flexibility for change. To complete the lifting program each element had to be lifted, placed and de-rigged within a tight two-hour window. The project team therefore took steps to guarantee this could be achieved by:

- Developing a customised lifting frame to lift the modules into position to maximise the speed and safety of the lifting operation. The frame was constructed of high tensile meccalloy bars with multiple lifting points to enable its rapid deployment for different module configurations.
- The steel lifting frame's multiple lifting points accommodated the different shapes and weights of each module. High tensile maccalloy bars were pre-installed on each module to accelerate the lifting sequence.
- Trial lifts in the week before the first shutdown were undertaken to prove up the system and verify centre of gravity calculations. The trial lifts, in the adjacent western carpark, familiarised the team with the system and honed actions required for an efficient lifting operation.
- Detailed contingency planning including pre-programmed dropdead dates for uncontrollable events such as inclement weather proved crucial when lifting had to be suspended for six hours due to wind exceeding specified limits.
- During the planning for all shutdowns, the shutdown program was broken down into discrete half hour segments with critical "dropdead" milestones which effectively created go/no-go conditions during the course of the shutdown. Progress was tracked half hourly and issued to all relevant stakeholders every two hours to ensure an open and transparent snapshot of progress as the shutdown was being undertaken.
- Detailed sequencing and planning for the Russell Road beam installation, for which the freeway shutdown period allowed for only one hour of contingency time in the 30 hour shutdown period.



**DRAWING:** Structural drawing highlighting the sequencing of the modularised installation of the concourse.



# OUTCOMES ACHIEVED

Georgiou delivered WA's first island rail platform and station within a tight budget and an ambitious timeframe.

## ECI

Throughout the ECI process, Georgiou provided constructability input and ideas which enabled the innovative modularisation approach to be integrated into the permanent works design from the start.

PTA's initial 16-week ECI program for the Aubin Grove Train Station was extended to 36 weeks to include the Russell Road Upgrade Project. Georgiou's investigations - including traffic modelling and optioneering - determined that the integrated upgrade to Russell Road, including the duplicate bridge, was required to manage traffic implications from the new station. Main Roads WA were brought into discussions and the Russell Road Upgrade Project fast-tracked.

## Shutdowns

Completing the exacting June lifting program within the allowed rail and freeway shutdown times was a major achievement which ensured the successful delivery of the project within time and budget.


The three consecutive weekend shutdowns required considerable negotiation with MRWA to enable the critical concurrent Kwinana Freeway closures. The 30-hour freeway closures were the longest ever in Western Australia. While the rail closure dates were locked in, there was some reluctance within MRWA to approve such long closures and their likely impacts on vehicle traffic. Negotiations continued for eight months until final approval was secured the week prior to the first shutdown.

## Performance against critical KRAs

Outcomes against critical KRAs included:

- Cost was a critical factor for the Client

and Georgiou's application of the ECI process resulted in no additional outlays being generated beyond the contract price.

- Through the ECI process, Georgiou was able to shave 12 months off the Client's standard four-year project delivery cycle. Prefabrication of modularised station building elements, and close attention to project management, enabled Georgiou to meet its ambitious 14-month construction timeframe.
  - Management strategies for working in high-risk environments resulted in the project recording no lost-time injuries or major incidents.
  - Successful integration with other infrastructure projects occurring adjacent to the project site and on the rail network.
  - Protection of all services
    - This included vital telecommunications infrastructure invoking national security protocols. Damage to this telecommunications service (Perth to Adelaide fibre optic) would have instigated a counter-terrorism investigation.
  - Sustainability:
    - Blending of different grades of soils enabled use of existing materials on site and negated the need for any importing of sand and fill.
    - The long-term environmental sustainability of the project was jeopardised when a contractor delivered mulch containing small amounts of asbestos. Georgiou's management plan for its removal was endorsed by the PTA, MRWA, WA Department of Health, WorkSafe and City of Cockburn. Georgiou's prompt identification of the asbestos enabled government agencies to liaise with
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the supplier and other recipients of the mulch to ensure the potential long-term issue was counteracted. As the issue was identified early, any health risks for adjacent residents were averted.

- Rail services were not affected outside shutdown times and the project successfully minimised impacts on freeway traffic.
- Meeting the fixed program for three consecutive weekend shutdowns in June 2016, set 14 months in advance.
- Workplace Health and Safety - the project achieved no lost time injuries or major incidents due to the high level of planning and risk elimination and mitigation. The project's high risk profile required comprehensive management strategies to be implemented. The combined projects involved more than 270,000 manhours.



# 270,000

TOTAL MANHOURS

## INNOVATIVE MODULARISATION APPROACH





# CONCLUSION

The AGS and RRU Projects were collectively medium-sized projects that were delivered in a complex high-risk environment integrated with tight time constraints. The project was delivered using alliance-type principles where ‘best for project’ was the attitude from commencement. This project was a community project that has been well received by the local community and the City of Cockburn, and delivered in difficult logistical circumstances.

Achieving the onerous schedule was a significant achievement with a strong safety record and minimising the impact on both road and rail.

Through innovation, attention to project management and smart construction planning, the project delivered significant value to the WA Government.

