

# The Rozelle Interchange Project Lift of the Year Award Nomination > 20 tonne load

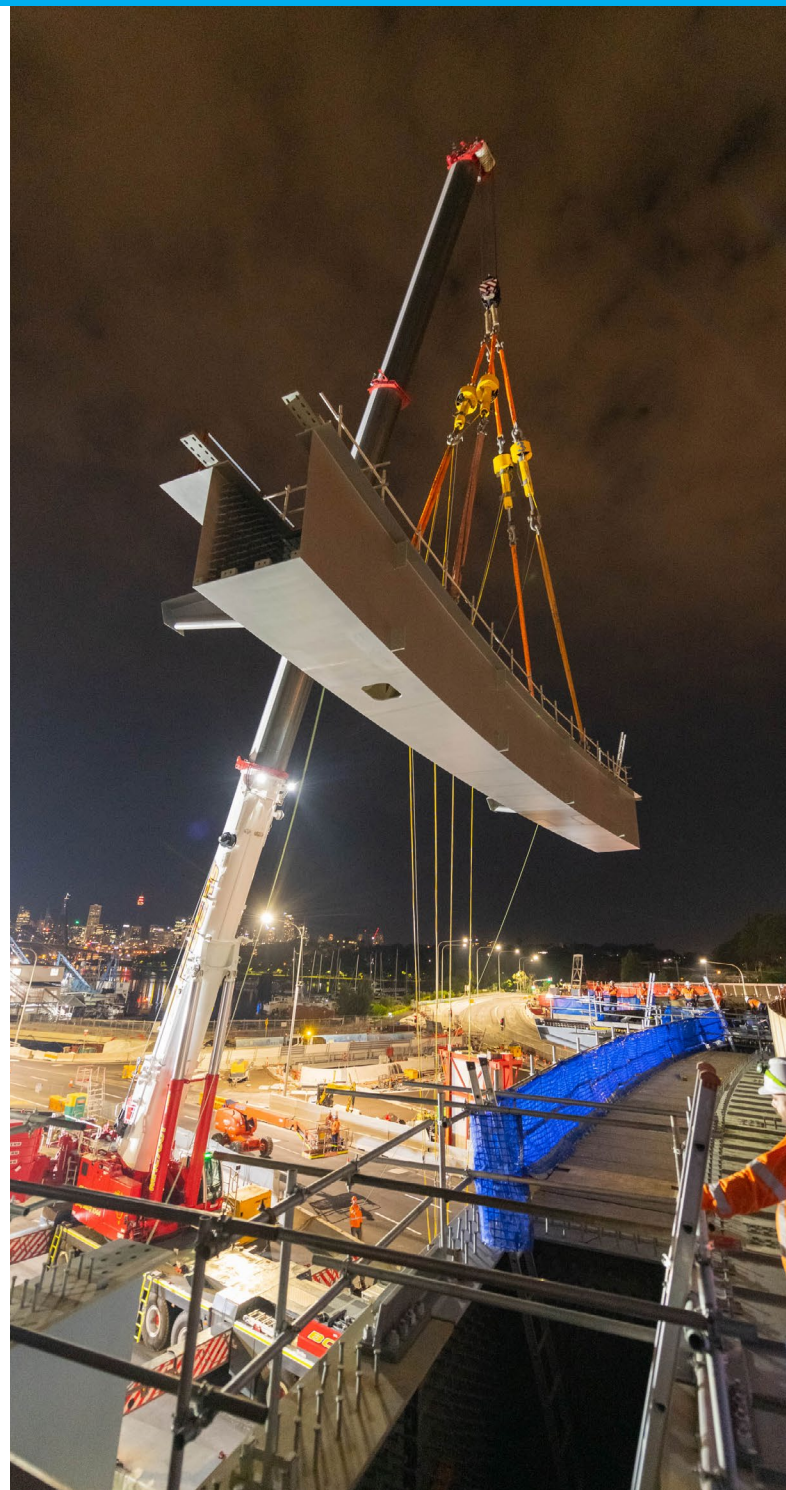
## Green Link Bridge

The Rozelle Interchange Project is being delivered by a joint venture between **John Holland and CPB Contractors (JHCPB)** on behalf of **Transport for New South Wales (TfNSW)**.

This nomination is in regard to the Green Link Bridge girder lifts 3A and 3B, completed in Annandale and Rozelle by JHCPB in April 2022, using cranes and rigging supplied by **Borger Cranes**.

### Declaration

In submitting this nomination, JHCPB declares that the lift was always within the Working Load Limits of the equipment used, and complied with all safety standards and safe working practices.





## The Project

The Rozelle Interchange is the final stage of WestConnex. It is a new underground motorway interchange which provides connectivity to the M4-M5 Link Tunnels and the City West Link, and an underground bypass of Victoria Road between Iron Cove Bridge and Anzac Bridge. The Rozelle Interchange also provides a connection to the future Western Harbour Tunnel.

The project scope includes the following:

- an underground interchange at Rozelle and associated infrastructure providing connections from the Main Tunnel Works infrastructure to the surface road network at City West Link, Victoria Road, Iron Cove and Anzac Bridge
- provision for connections to the future Western Harbour Tunnel
- new and upgraded pedestrian and cyclist infrastructure
- provision of up to 10 hectares of new public open space located at the former site of the Rozelle Rail Yards

The Project aims to:

- improve traffic conditions and reduce congestion on key arterial roads in proximity to the project
- deliver beneficial urban design outcomes, including returning up to 10 hectares of parkland to the local community
- provide new and upgraded pedestrian and cyclist infrastructure and connectivity between Annandale, Lilyfield and the Bays Precinct
- enable long-term motorway network development by providing connections to the proposed future Western Harbour Tunnel and Beaches Link project to the north.



# GREEN LINK BRIDGE

Rozelle Interchange  
WestConnex

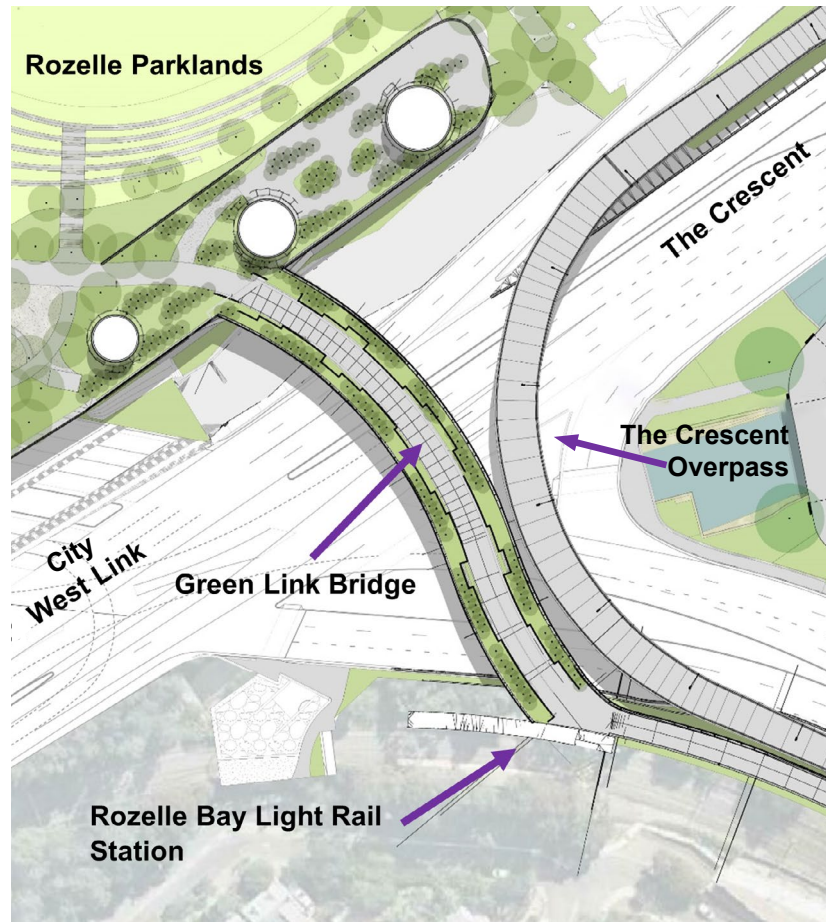
JOHN  
HOLLAND

CPB  
CONTRACTORS

The Green Link Bridge (the 'Bridge') is a new, landscaped shared user path bridge spanning City West Link and the Crescent. The Bridge creates a pedestrian and cyclist connection between the historically separated suburbs of Rozelle, Lilyfield and Annandale.

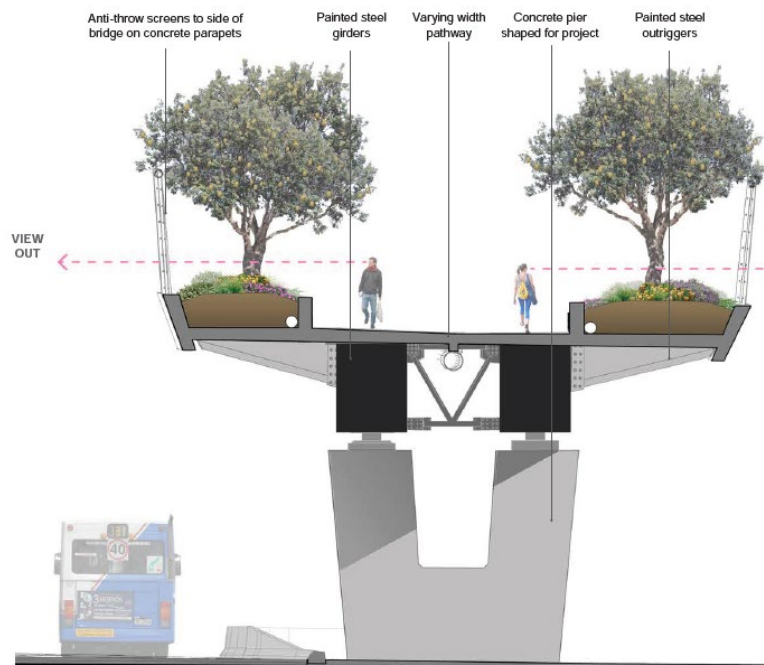
The Bridge was designed as a landscaped structure with small trees, grasses and groundcover plants lining the edges of the 15m-wide bridge structure. A varying width path of 6-7m between the landscaped zones will offer a shared-use area for pedestrians and active transport users.

The northern landing of the bridge connects into the future Rozelle Parklands, a 10 hectare open green space in the Inner West. The southern landing of the bridge adjoins the Rozelle Bay Light Rail Station platform, with a gentle ramp down to the platform offering a safe crossing point for active transport users. The Bridge will significantly enhance local amenity and accessibility by providing connectivity between these existing and future public realm areas.

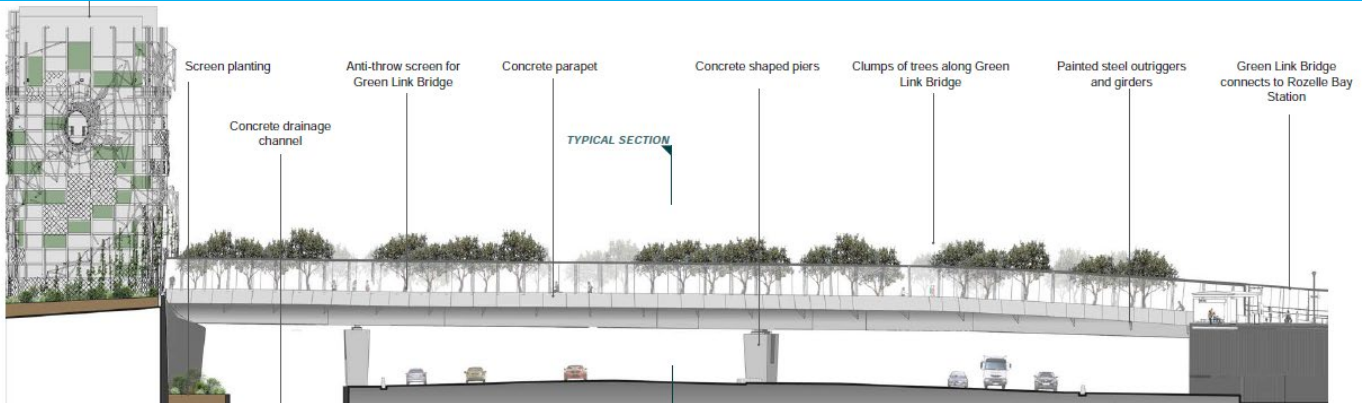


# GREEN LINK BRIDGE

Rozelle Interchange  
WestConnex



## Structure and Lift Overview



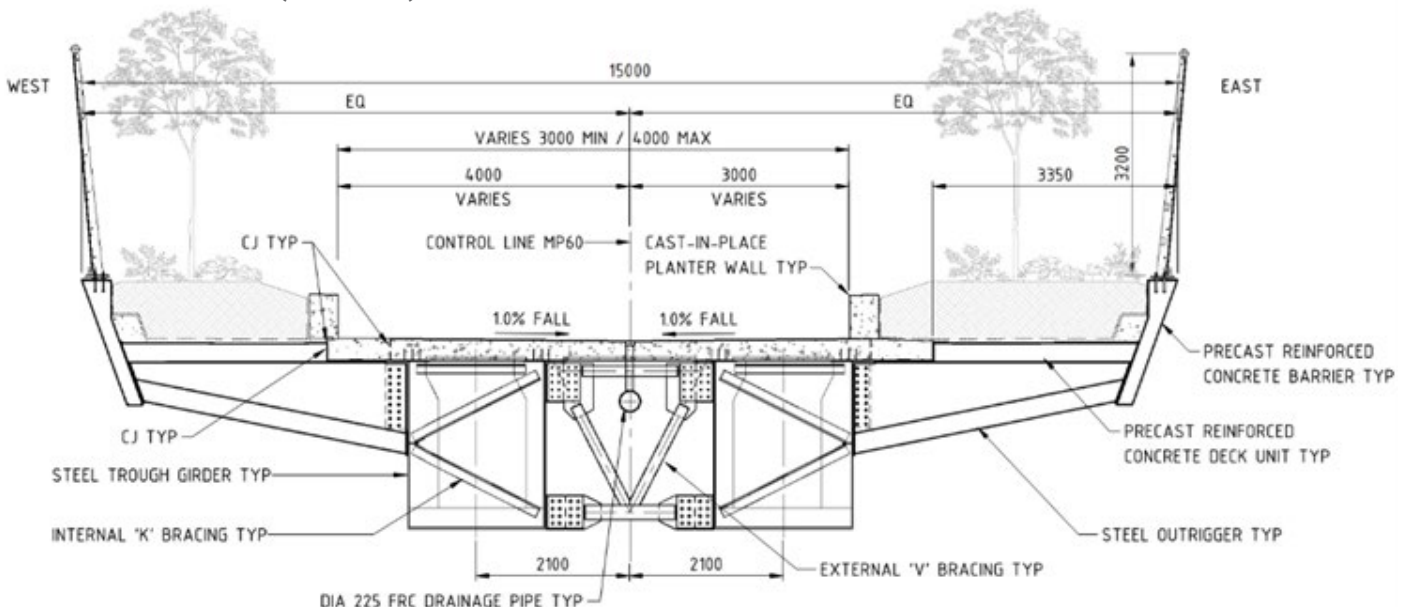
The Bridge consists of eight main segments, with twin steel-box girders spanning City West Link. The structure is 116m in length and 15m in width. The horizontal alignment of the principal spans forms an S-shaped, ‘undulating’ curve; posing a complex engineering and construction challenge.

- Girders 1A and 1B measured 40m in length and weighed 85t. Once pre-assembled and ‘dressed’ at ground level, the total lifts weighed 110t. The girders were installed in June 2021 using a 750t mobile crane (LTM1750) with superlift; the largest mobile crane (at the time) on the east coast of Australia. The lift of 110t at 18m radius took the crane to 95% of its lifting capacity.
- Girders 2A and 2B each measure 22m in length and 67t and were installed on 5 July 2021 during night shift with a 500t mobile crane (LTM1500).
- Girders 4A and 4B measured 32m long, weighed 70t each and were installed in February 2022. These were installed with a 500t mobile crane (LTM1500).

**The final ‘drop-in’ girders, Girders 3A and 3B, were installed in April 2022 using a 650 tonne mobile crane (LTM1650). The girders measured 24 metres each and weighed 46 tonnes and 47.6 tonnes respectively.**

The girders rest atop V-shaped piers which are positioned within a major 8-lane intersection (City West Link and The Crescent). With close proximity to live traffic and a significant working from heights risk, safety was a critical factor in the design and delivery of the works.

This nomination is provided in regard to the installation of Girders 3A and 3B of the Green Link Bridge. These girders were installed on consecutive night shifts in April 2022.



## Methods

Girders 3A and 3B were the final girders installed to complete the main body of the Green Link Bridge. They were installed using a LTM1650 supplied by Borger Cranes, which was situated within the median of City West Link and The Crescent; one of Sydney's largest major arterial roads.

**Located at this critical junction within Sydney's traffic network, it was essential that the lifting operations occurred smoothly and efficiently. The construction methodology required delivery, lifting and installation of the girders within the same night shift.**

The girders were highly complex structures to install, with architectural curves and a different final resting height for the corners of each girder. To accommodate this, custom rigging lengths were required for each of the lifting points, with four Enerpac synchronous hoist rams (each rated to 110t) used to precisely adjust the placement of each girder during the lift and ensure a seamless installation.

Girder 3A took the crane to 92.9% of its lifting capacity, while Girder 3B took the crane to 92.1% of the crane capacity during picking and slewing. The combined weight of the two lifts was 116T, with lift 3A totalling 57t and lift 3B totalling 59t. The total weight of the rigging measured 8.6t, which included the Enerpac rams weighting 1.35t each. The largest radius measured 18.4 metres.

Total weights and centres of gravity were calculated from the girder fabricator's TELKA model, which was used to plan lift lug placement. The accurate calculations ensured a safe erection of each girder, without incident.

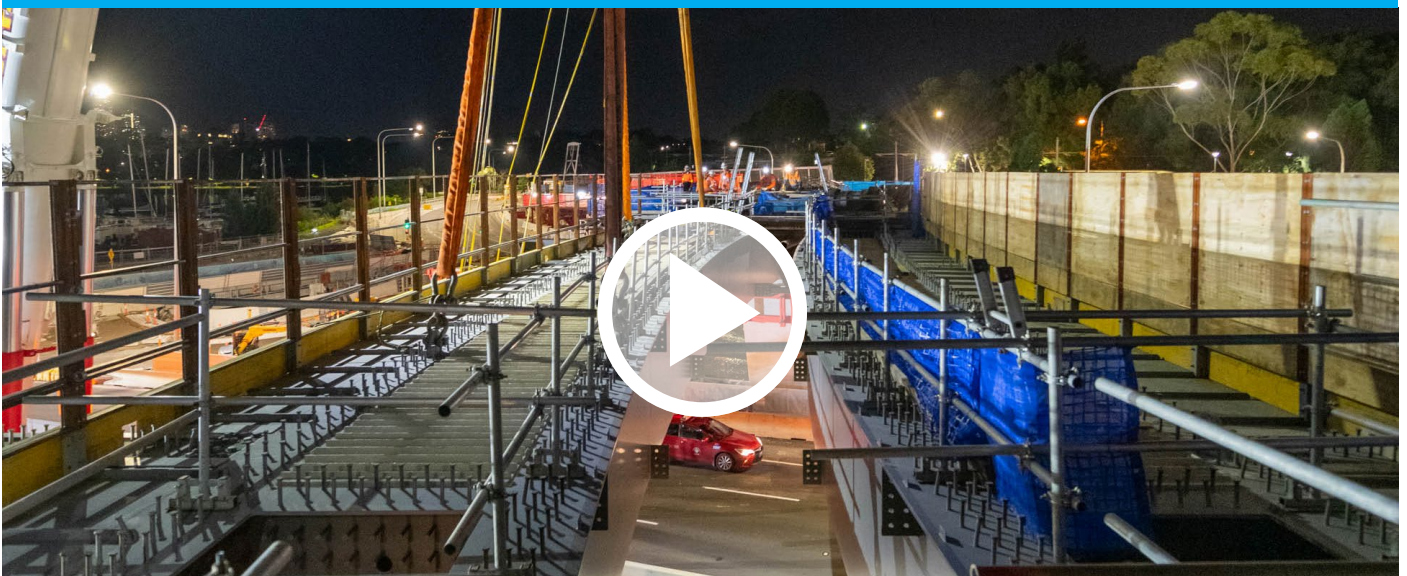
The lift plans for the 'drop-in' installation of Girders 3A and 3B are provided in Appendix A, and includes details on the:

- weight and capacity of rigging used;
- safety factors;
- lifting radius of the crane;
- capacity of other load-supporting devices
- crane load charts

The Activity Method Statement and Safe Work Method Statement are provided in Appendix B and C respectively.

Rozelle Interchange  
WestConnex

City West Link | Green Link Bridge  
Final Girder Installation



## Site and Lifting Conditions

The site and lifting conditions for the girder installations were exceedingly complex and posed a number of logistical challenges for the works.

- **Narrow site.** The Bridge was erected at the junction of City West Link and The Crescent, a major 8-lane arterial road and one of the main thoroughfares into the CBD from Western Sydney and the Inner West. The crane was situated within a narrow laydown area in the median between City West Link's east and westbound lanes. As can be seen in the video, the construction site was just large enough to accommodate the crane and girder. It is bordered on each side by major traffic thoroughfares, a large water body (White Bay), the Sydney Light Rail corridor, the Rozelle Rail Yard ventilation facility building, and residential homes.

This created a number of complexities accounted for in the planning phase of the lifts. Firstly, while being lifted within this narrow site, the girders had to be navigated over and clear nearby structures, including the hoarding and edge protection on Girders 2A and 2B. Secondly, with Girder 3A and 3B each measuring 24m, the slew path of the crane passed over both the westbound and eastbound lanes of City West Link and The Crescent, meaning a road closure would be required to ensure a safe exclusion zone over the intersection during the lifts.

- **Traffic thoroughfare.**

**The TMC granted the Project a mere 10 minutes to close the road and undertake the lifts.**

Approximately 66,000 vehicles transit through City West Link daily. The road is one of the main access routes into the Sydney CBD, with no nearby roads capable of carrying this volume of traffic while maintaining acceptable journey times. For this reason, no extended road closure of City West Link and The Crescent could be granted by TfNSW's Traffic Management Centre (TMC). There was only one solution for the girder installations; the works had to occur quickly but safely under a short duration road closure.



## Site and Lifting Conditions



- **Unbalanced, heavy load.** Girders 3A and 3B are curved structures with a horizontal S-shaped alignment. The shape of the girders means they are under a constant rotational/twisting force, and this needed to be closely considered and counteracted during the lift and installation. In addition, the load was unbalanced. The Bridge has a sloped gradient, meaning there was a 1% longitudinal fall from Girders 4A/4B to 3A/B. There was also a 0.3% cross fall from east to west.

Another consideration was that, for safety and efficiency reasons, the girders were pre-dressed with outriggers, formwork for edge protection and Permadec panels prior to installation. While this pre-dressing meant installation of the girders could occur more quickly, it also increased the weight of each lift. The weight of lift 3A totalled 57t, while lift 3B totalled 59t. The heavy weight, coupled with the torque of the structure and unbalanced load, time constraints and narrow site conditions, created a highly complex lift.

- **Narrow tolerance.** The final drop-in girders only had a 20mm tolerance between the ends of Girders 4A/4B and 2A/2B. Because of this narrow margin for error, and the longitudinal fall of the structure, there was a significant risk that the girders would 'bind up' on the adjacent girders during installation if the lift was not executed precisely. Given that the site team only had 10 minutes within which to complete the pick, lift, slew and installation, it was critical that the lift was executed with extreme precision, and on the first attempt. There was only a very small window of opportunity to adjust the rigging if the weight of the girders varied from the predicted load, or the heights of the corners failed to align with the final landing points. Any complications risked damage to one or more of the bridge structure components if the girders made unintended contact during the lifts. Complications also risked requiring a longer road closure than the allotted 10 minutes, risking flow-on traffic delays throughout Sydney.



## Risks

The site and lifting conditions created various risks which were identified through a number of safety workshops, and recorded in the Safe Work Method Statement and Activity Method Statement. A wide range of stakeholders were involved in safe work planning for the works, including JHCPB's engineering, supervisory, traffic and safety personnel (including a dedicated lift specialist), the crane supplier (Borger Cranes), fabricator, workforce personnel, and the client. Copies of these documents are provided in Appendices B and C.

Key risks included **working at heights**, **proximity to vehicles/the general public** under the crane's slew path, and the very real risk of causing **serious traffic delays** into the Sydney CBD if the girders were unable to be installed within the road closure window. If the lift was unsuccessful and the road closure had to be extended for safety reasons, substantial flow-on effects for businesses and residents were likely.



## Planning and Controls



Detailed planning and controls were therefore required to minimise the duration of road closures on City West Link and The Crescent while maintaining safety for workers and the general public as the primary priority.

Through the careful planning and controls outlined below, the picking, slewing and installation of each girder was able to occur in less than 10 minutes.

- **Traffic.** Both girders were installed under traffic control as a safety measure to protect both workers and the general public. Works occurred at night when traffic volumes were at their lowest. During preparatory works, a temporary road widening was in place, with live traffic pushed as far north and south as possible on City West Link eastbound and westbound. This shift kept City West Link open for as long as possible while giving adequate clearance for preparation of the lift.

During the lift operations, a full road closure was in place. An exclusion zone was instated in each direction, extending 100m from the lifting operations.

- **Rigging.** With a key risk identified being the 'binding up' of the girders on the adjacent structures due to incorrect alignment during the lift, the team undertook careful planning and research to identify potential engineering

**Each installation occurred seamlessly and on the first attempt; a resounding success and credit to the construction team for excellent planning and execution of the works.**

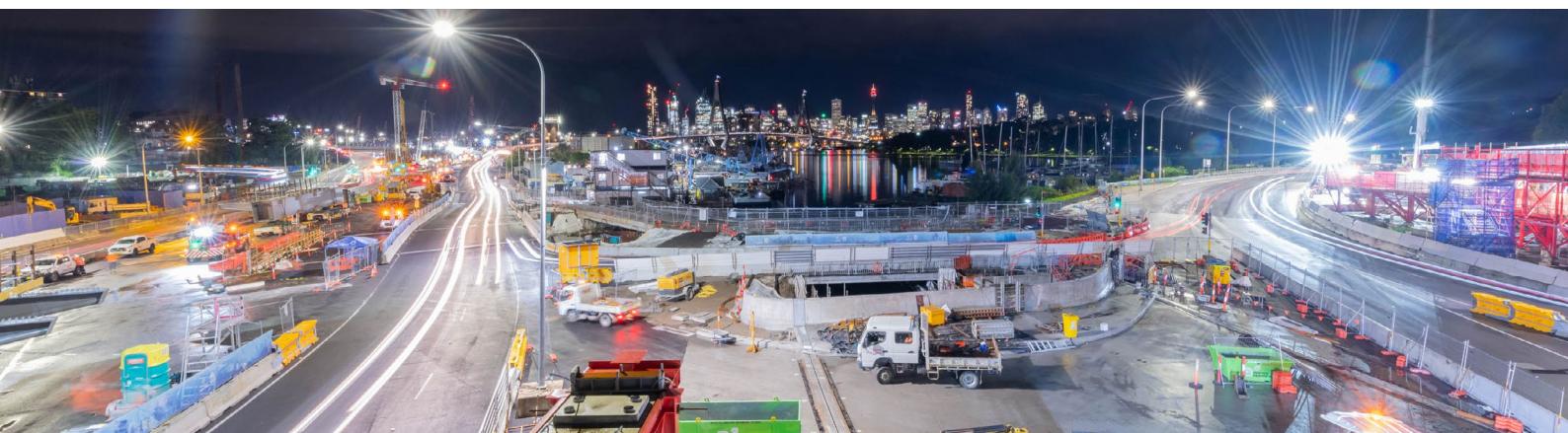
controls to mitigate this risk. The team identified the opportunity to use Enerpac Synchronous Hoist Rams instead of the more standard chain-block technology. These rams are designed for heavy and unbalanced loads, and allow the operator to precisely monitor and micro-adjust each lifting point independently using a wireless, Bluetooth connection during the lift. Each ram was powered by a hydraulic system that could minutely and remotely adjust the height of each lifting point. Prior to the lift, the survey team precisely measured the height of each landing point, and the girders were adjusted using the hoist rams. This was not only a time-saving measure, but also a safety one; it eliminated the risk of workers passing under or near the load during the lift to adjust the rigging.

In addition, total weights and centres of gravity were calculated from the girder fabricator's TELKA model, which were used to plan lift lug placement. The accurate calculations ensured a safe erection of each girder without incident.

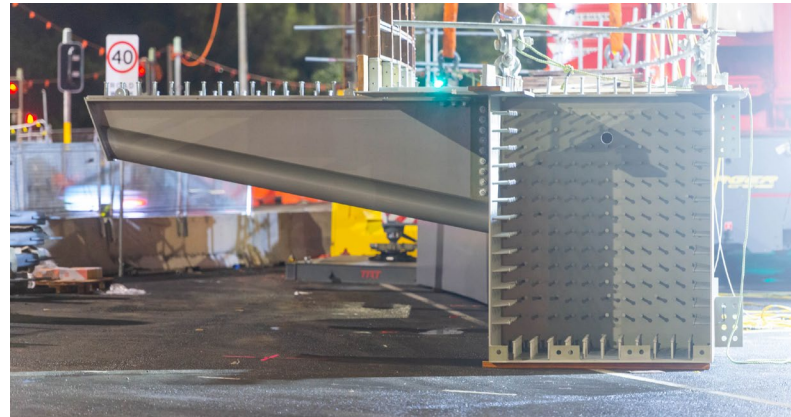
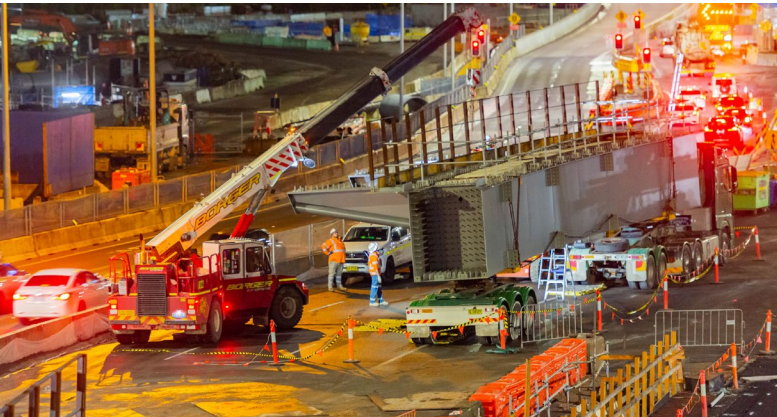


## Planning and Controls

- **Time and Safety.** The short duration of the lifts was made possible through a number of other design and construction measures that simplified the installation process while the lift operations were underway, and also enhanced safety outcomes. These included:
  - the construction program allowed for the final drop-in girder segments to be fabricated to the correct length to suit the on-site conditions. JHCPB's survey team collaborated closely with the fabricator, using survey data of the Girder 4A/4B and 2A/2B ends to make minor adjustments to the manufacture of Girders 3A/3B and ensure a good fit when installed.
  - transport of the girders was engineered such that the girders could be delivered directly on site and preassembled prior to the install. When the crane was mobilised, the preassembled girder was driven within radius of the crane and lifted directly from the road, all within the same shift.
  - preassembly and 'dressing' of the girders at ground level, including bolted outriggers, Glassfibre Reinforced Plastic (GRP) formwork and edge protection/hoarding. This meant that, once lifted in place, works could commence immediately on girder stitch joints, with edge protection and GRP formwork already in place.
  - lift lugs were designed with a 4-point lift, with lugs aligned with the reinforced parts of the girders. This simplified the rigging arrangement, with no spreader beams or specialist rigging required.
- **Digital Technology.** As noted above, the Bridge has a number of architectural curves which posed a challenge for lifting and installation operations. To facilitate safety and construction planning, the design of the Bridge was printed using a 3D printer to visualise the build and identify any potential issues with the site assembly process. The construction team 3D-printed the bridge elements in 1:20 scale to check the assembly of parts and run a trial for how the site team would assemble the various modular components. This process greatly facilitated communication within the team, created a shared understanding of the risks and mitigations, and was a critical tool in ensuring the assembly of this complex structure occurred seamlessly and efficiently.



## Summary



The apparent simplicity with which the final drop-in girders 3A and 3B were installed belies the complexity of the lift operations. It is a testament to the construction team and the countless hours of planning and review conducted that such challenging lifts occurred safely and without incident, under tight time constraints and with an exceedingly small margin for error.

The construction of the Green Link Bridge represents a momentous accomplishment for the Rozelle Interchange team. For the vast majority of Sydneysiders, this structure has been erected almost imperceptibly, with each of the structure's eight girders seemingly effortlessly appearing overnight to bridge the historically disparate suburbs of Annandale and Rozelle.

