

## Sydney Metro City & Southwest



### InfraBuild's Reinforcing solutions pivotal to Sydney Metro

The Sydney Metro City & Southwest project is set to expand the city's rail capacity by up to 100,000 commuters when it opens in 2024.

Encompassing the construction of new CBD metro railway stations at Martin Place, Pitt Street and Barangaroo, new metro platforms at Central, and 66 km of new metro rail, the Sydney Metro City & Southwest project has redefined what a mega project is for primary contractor JHCPBG joint venture (John Holland, CPB & Ghella). Working to a tight construction schedule to deliver the project's Stage 2 and Tunnel Excavation (TSE) works, JHCPBG joint

#### Project details

<b>Location</b>	New South Wales
<b>Solution</b>	5D Detailing
<b>Primary contractor</b>	JHCPBG joint venture (John Holland CPB Ghella)

venture approached InfraBuild to help them meet demands through innovative reinforcing solutions.

Collaborating closely with JHCPBG joint venture, InfraBuild supplied over 48,000 tonnes of reinforcing steel to Sydney Metro City & Southwest metro sites. But beyond delivering reinforcing steel, InfraBuild proved essential in providing strategic solutions to meet tight construction schedules and challenging logistics.

**48,000**  
tonnes of reinforcing steel supplied across 7 sites

**3D** Modelling delivering unmatched insight, assurance and accuracy

**+30** days saved on the construction schedule across 3 sites


**+1,700** tonnes of precision prefab

## Martin Place Station: Precision Prefabrication Solves Site Congestion

Located in Sydney's CBD, Martin Place Station is one of seven new underground stations to be developed as part of the Sydney Metro City & Southwest project. This section of the project had a strict completion deadline as the tunnel boring machines remained on track to break through to the station. Hampering this deadline was a significant design change that raised the excavation volume within the Martin Place cavern by 40 per cent. This revision significantly increased the complexity and volume of reinforcement required. This, coupled with the challenge of a confined site that was vulnerable to congestion and access delays, meant the project team anticipated a challenging delivery. InfraBuild was engaged early and used 3D Modelling to proactively inform the reinforcing design and identify efficiencies in the construction schedule.

This modelling facilitated the transition of the Martin Place tunnel lining to a prefabricated solution. The design comprised of 220 cages weighing approximately 2.4 tonnes each that were verified as clash-free, buildable and complementary to the complex geometry of the cross passages. The cage design also optimised the installation

process by allowing efficient fixing to walls using a custom lifting process involving only a small amount of mobile equipment. The use of InfraBuild's prefabricated cages allowed uninterrupted access to the tunnel's main traffic area for associated trades, which in turn allowed more than 50 tradespeople to have uninterrupted access and continuity of on-site works. Additionally, the cages incorporated structural support through load-bearing internal girders fabricated from reinforcing bars that enabled simple attachment to surrounding cages.

From delivery to site, to lifting and fixing in place, the elements took approximately two hours to install. Seven tonnes of prefabricated cages for Martin Place Station's tunnel lining were able to be installed a night, a desirable alternative to steel fixers working at height and navigating other trades on a congested site across multiple days for an equivalent result. In all, the use of prefabricated steel cages generated greater than a 15-day program saving for the project. Through collaboration with JHCPBG JV, InfraBuild's prefabricated solution improved safety, simplified installation and delivered a quality ensured product ahead of the construction program. 

**“InfraBuild Reinforcing's 3D Modelling offer provided essential insight into Martin Place tunnel's reo design and adopting a prefabricated approach. By transitioning Martin Place tunnel's reinforcing steel requirements to a prefabricated solution, we saved more that 15 days on our construction program.”**

*Kenny Plenderleith,  
Contracts Manager,  
Sydney Metro City & Southwest  
TSE Works*



Image Credit: JHCPBG  
Joint Venture



## Victoria Cross Station: 3D Modelling Insights Improve Onsite Outcomes

The success of Martin Place Station meant a combined detailing and prefabricated solution from InfraBuild was preferred to overcome the complexities of Victoria Cross Station's basement slab. A comprehensive 3D model of the station invert cages was produced which, in addition to precisely detailing each bar, specified the sequencing of the on-site installation and interaction between non-reinforcing elements within the slab.

Each of the 205 cages within the slab (which consisted of 16 layers of varied, oversized ligature sets connected internally by perpendicular brace bars) were installed eight at a time to suit a large concrete pour. The model provided valuable insights for the project team regarding the on-site sequencing and access limitations while fixing these cages together. Further, the model contextualised the scale of the elements within the Victoria Cross Station worksite and ultimately assured the maintenance of the construction program.

Without prefabricated cages, on-site steel fixing of the 2.3 m high elements would have required onerous crane work to position the individual ligature sets. Moreover, scaffolding would have been required within the tunnel to >>

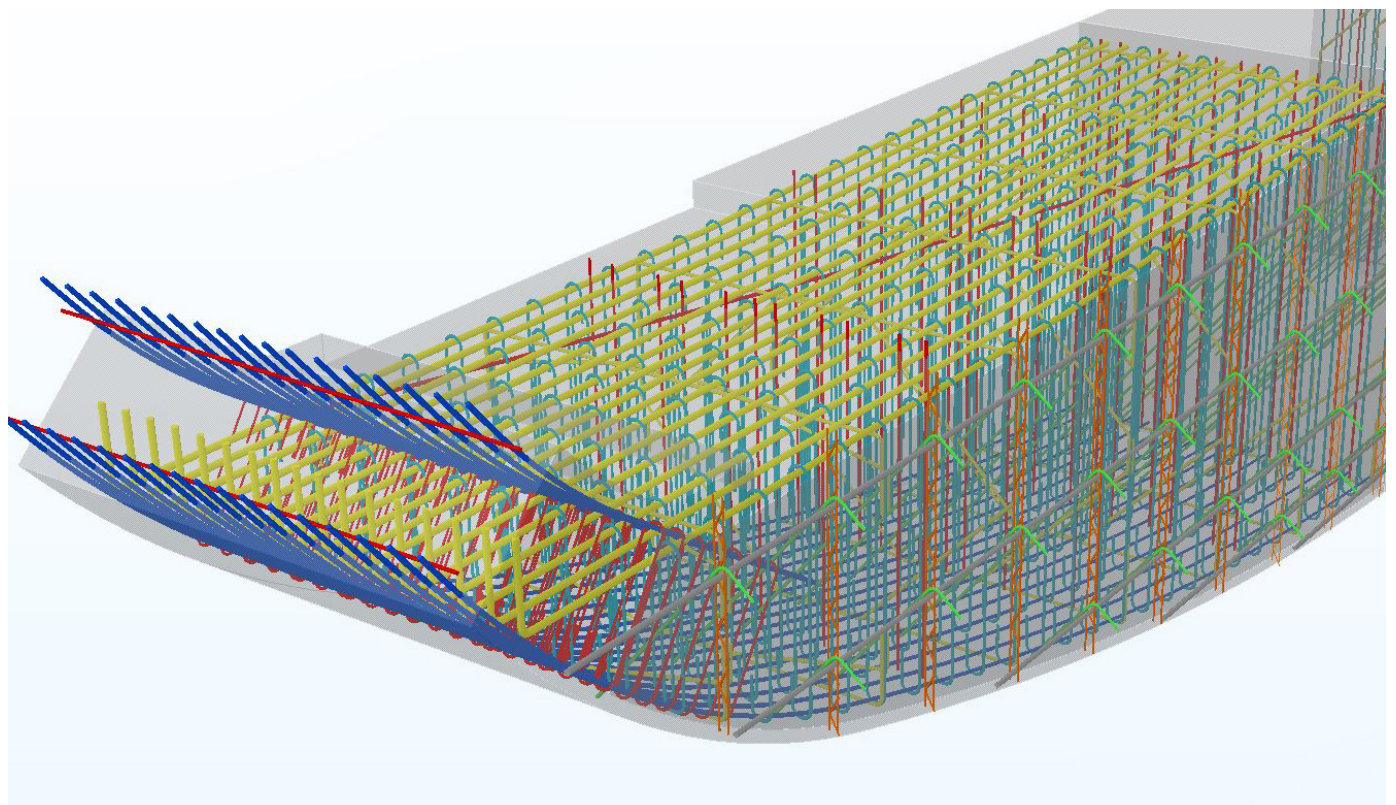







Image Location:  
InfraBuild St Marys

provide safe access, restricting a large portion of the on-site work area. With these limitations in mind, the project team made an informed decision to prefabricate the cages off-site. Fabricated at the InfraBuild's St Mary's facility by our expert team, custom jigs were used to ensure a repeatable, quality assured outcome for every cage. To preserve cage

integrity during delivery, each 4-tonne element was delivered using a specialised transport jig attached to a standard trailer base. In all, 880 tonnes of precisely detailed cages were prefabricated for Victoria Cross Station's basement slab, saving more than 15-days for the project's construction program compared to traditional steel fixing. 

### Contact InfraBuild's Reinforcing team

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 1800 ONE REO

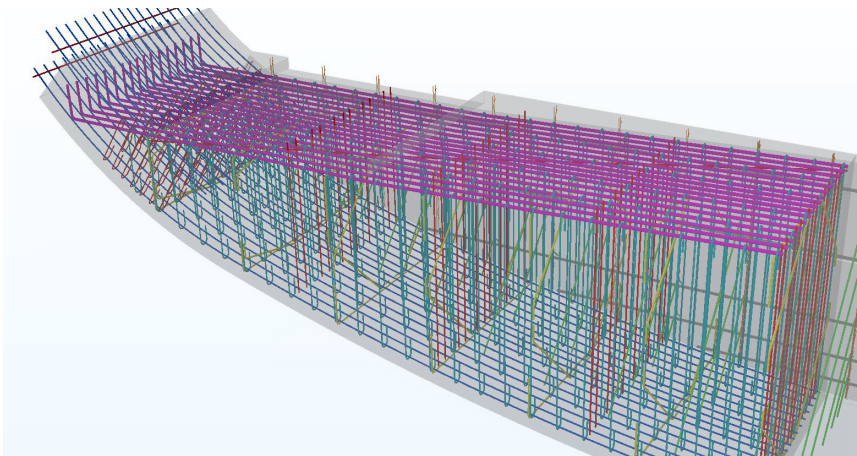
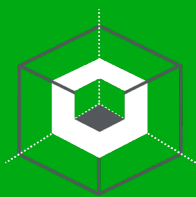


Image Credit: JHCPBG  
Joint Venture



## Our Detailing Difference

InfraBuild's 5D Detailing offers unparalleled insights to our construction industry partners. Our approach centres around informing the reo design from the early stages of the project. This facilitates a reduction in the overall number of revisions and potentially eliminates entire stages of the design process, resulting in time and cost savings for the project from design through to construction.


Our 5D Detailing offer not only verifies elements as clash-free and buildable but also:

- Accounts for onsite conditions, work methods and tolerances
- Allows visualisation of the assembly and sequence prior to onsite start-up
- Facilitates the identification of innovative, safer, simpler, and faster reo solutions
- Integrates with customer systems, ensuring a seamless workflow

## Barangaroo Station: Problem Solving Large Scale In-Situ Reo using 3D Modelling

Of all the stations supplied by InfraBuild, Barangaroo Station presented some of the most unique challenges. The interaction between the station's square slab and circular tunnel posed a significant risk to the construction schedule, not only because of the scale of the elements but the inability to transition them to a prefabricated solution. This limitation, which arose from associated risks to the tunnel's waterproofing membrane meant machinery on-site could not lift over 1-tonne without compromising the membrane. Rather, the 14,000 tonnes of N36 and N40 bar supplied to the project had to be fixed on-site.

To ensure the circular to square interaction was seamless, InfraBuild modelled both station slab and tunnel to ensure both were clash-free and buildable. These models not only exposed fundamental issues with the initial reo design, such as rebar terminating in mid-air but also assisted in overall buildability and simplification of design. This included the incorporation of couplers within the slab. These couplers, which eliminated traditional lapping, saved over 2,500 tonnes of reinforcing bar from the project and was an essential buildability gain for an element whose density was in excess of 500 kg/m<sup>3</sup>. Additionally, the model was essential in identifying potential safety risks for the on-site team. The 2.8 m high station slab would have required steelfixers to handle heavy bar at height. Considering the 15 m lengths of 36 and 40 mm bar used throughout the slab weighed up to 140 kg each, accommodations including a temporary platform within the structure for steel fixers to work on were developed. Moreover, the 3D Model was utilised during meetings with the steel fixing team to proactively work through buildability issues saving the project potential downtime. In addition to the model, full marking plans supplied in two and three dimensions also assisted the on-site team.

The success of the planning and modelling undertaken by InfraBuild was quickly proven. The first slab section, where tunnel and slab met and which weighed around 200 tonnes, was installed with no clashes, delays or missing product. 

### Eliminating Material Wastage

**Leviat**  
A CRH COMPANY

The complexity of the Sydney Metro City & Southwest's Barangaroo Station, in addition to the heavy reinforcing used throughout, meant traditional lapped joints would have resulted in excess material wastage. For example, every heavy bar throughout the project would have required over 1400 mm lapping on either end. This would have inflated the project's total tonnage by 1,800 tonnes. InfraBuild's team of expert detailers identified Couplers as the best solution to address bar congestion and eliminate potential material wastage from lapping.

Leviat's Ancon BT system is one of the smallest and the most cost-effective coupler systems when used on large scale, high coupler volume projects. Over 300,000 Ancon BT threads and 130,000 Lock Nuts were used in addition to nearly 150,000 Ancon BT Couplers across the stations supplied by InfraBuild. To meet demand, two Ancon threading machines were commissioned for InfraBuild's St Mary's facility. In partnering with Leviat to secure these machines, the InfraBuild team were not only able to streamline the process but also enhance production. At peak, 1,300 Ancon BT threads were processed a day at St Marys. Securing these machines played a key role in scaling production to meet the project's deadline and was made possible due to InfraBuild's close relationship with Leviat.

