



Delivering in partnership for Sydney Metro

In the ongoing work to expand Sydney's metro rail system, Mott MacDonald has seen its role evolve from a designer and technical advisor to a trusted delivery partner.

Project
Sydney Metro

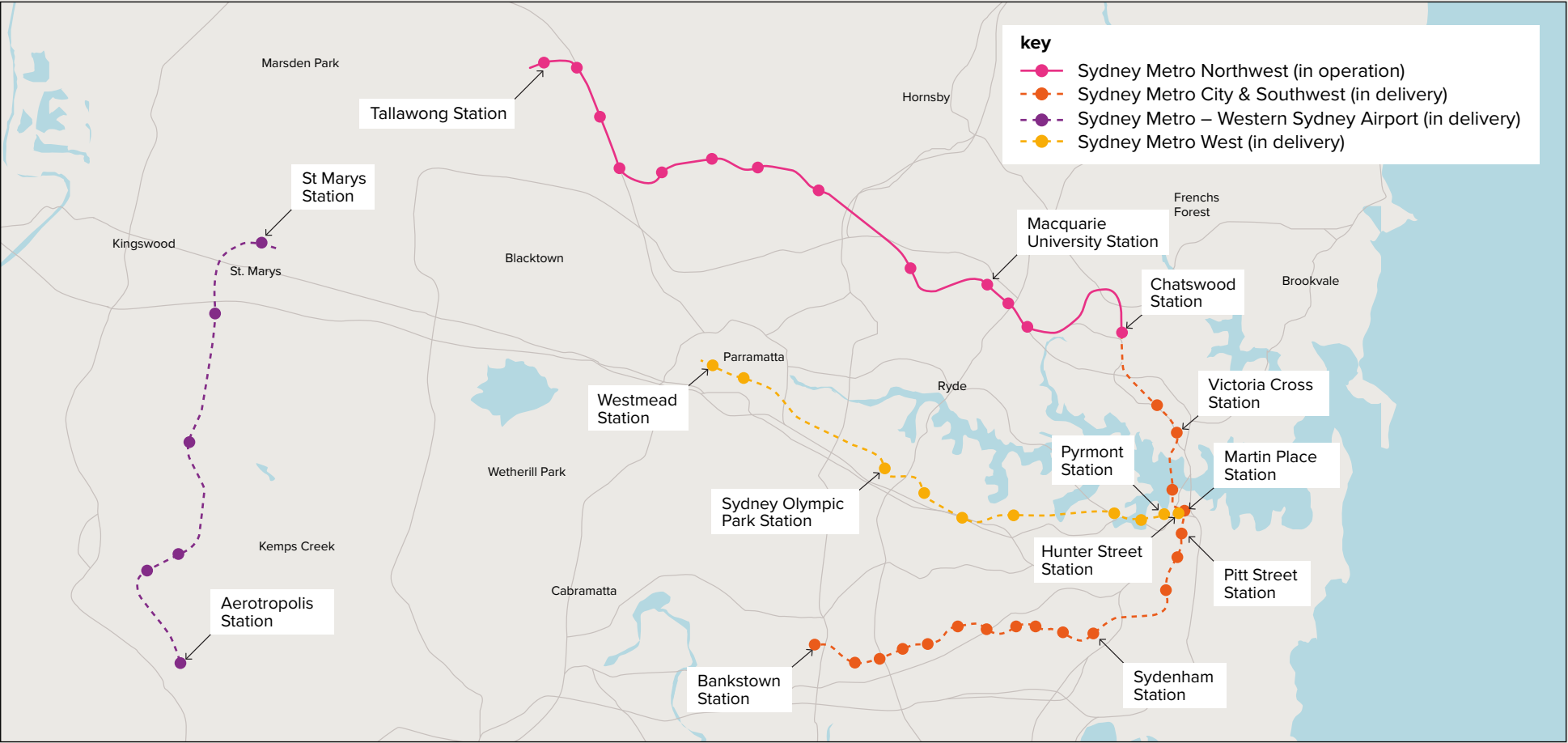
Location
Sydney, New South Wales, Australia

Client
Sydney Metro

Expertise
Integrated design and engineering



Sydney Metro is Australia’s biggest public transport project and is revolutionising travel for people in the country’s most populated city.



Over the next decade, the metro system will grow to encompass 46 stations and 113km of track, helping the city’s residents go about their daily lives quickly and conveniently and enabling further growth of the conurbation.

The programme includes three distinct projects: Sydney Metro City & Southwest, which extends the Metro North West Line into Sydney CBD to Bankstown via Sydenham and will open in 2024; the Western Sydney Airport project, which will have six stations on a new line and is due to open when airline passenger services start; and Sydney

Metro West, which will run from the central business district (CBD) to Greater Parramatta and is scheduled for opening by 2030.

Sydney Metro is Australia’s first fully-automated driverless railway and its only fully-accessible railway; it boasts access to real-time digital information and trains that are regular enough

for a ‘turn up and go’ service. We are a trusted partner to Sydney Metro in delivering this multi-billion-dollar rail programme, acting as its integrated client-partner providing engineering solutions. We have achieved this position after fulfilling design and technical roles on the City & Southwest project.

An evolving role

Our involvement with Sydney Metro dates from 2012 when we started work as a designer under a design and construct (D&C) contract in a joint venture for the operation, trains and systems for Sydney Metro Northwest.

\$1.8bn

the value of the Sydney Metro Northwest operations, trains and systems PPP contract

This AUS\$1.8bn capital value PPP scheme saw 36km of new line open in May 2019 on time and within budget. The joint venture (which also included consultants KBR and SMEC), focused on infrastructure and station design, including a depot and control centre, as well as tracks and overhead lines. The award-winning design for the 13 stations along the route made innovative use of multiple precast elements and unlocked sustainability and cost savings by minimising the use of steel.

The project proved to be a springboard for further work in the next AUS\$1.8bn phase of the metro's expansion. Appointed technical advisor as part of METRON (a JV with Arcadis) in 2017, we have since designed six new city-centre underground stations to 30% on the Metro City & Southwest (CSW) project. When completed in 2024, this will take the line down through the centre of Sydney before curving away to the south west.



“The initial contract engagement was programmed for nine months,” says Mike Barron, technical director for transport at Mott MacDonald. “But the client was very satisfied with the work and enacted contract provisions to allow services to be continued, including the detail design and construction support of one station and the provision of advisory services on the remaining ones.”

The new work included contractor programme scheduling around tunnel and station work to minimise downtime, as well as geotechnical and risk advice that repositioned us as a trusted technical advisor.

In 2018 we bid for and won more JV design work to convert what is known as the Southwest corridor into a metro system. This line features ten 100 year-old stations that will be upgraded so that they and the line can connect to, and further extend, the CSW.

In 2030 Sydney
Metro will have...

46

stations

113km

of track

4

Metro projects delivered

“

The global skills, expertise and culture that METRON (the design JV) have brought to the City & Southwest project have exceeded expectations by delivering world-class design solutions within a challenging programme and ultimately providing value for money.

Steve Myers

Senior technical manager, Sydney Metro
City & Southwest



Taking responsibility

In June 2020 we were then awarded Sydney Metro's engineering design and assurance partnership (ED&A), a AUS\$407M five-year contract with a five-year extension option, operating across all metro projects in Sydney.



This has fundamentally changed our role in terms of breadth, depth and overall responsibility. Our position now is 'Sydney Metro EDS' (engineering design solutions) as part of Sydney Metro, which means we are now the 'partner' in the delivery of two additional Metro lines.

The first of these is Metro West, a 25km line. "We will be working with the Sydney Metro team to undertake the concept and stage one designs for Metro West, which would be the equivalent of GRIP Stage 4 at Network Rail in the UK," says Mike Barron.

At the same time, the Sydney Metro – Western Sydney Airport project will also be in delivery, a north-south link connecting the new under-construction international airport in Greater Western Sydney with an existing rail line. At an estimated total cost of AUS\$11bn, this line will serve what is termed the 'Aerotropolis', a new city to the south of the airport in an area that is currently mainly farmland. Again, we will have oversight of all the infrastructure elements that feature within this budget.

By 2056 this conurbation is anticipated to have a population of 3.7M. "We'll be continuing the design for the West line in 2022 and potentially into 2023," says Mike. Combined, these two new lines will include 50km of entirely new track.



Integrated leadership

Client and partner are now working alongside each other in an integrated delivery team.

“Through our EDS integrated partnership we’re also supporting Sydney Metro in general technical advice and assistance on everything else, from supporting the efficient operation of the existing railway to planning expertise and business case technical support for future Metro line extensions,” says Mike Barron.

“We’re working alongside them and I split the engineering role in two, with my opposite number in Sydney Metro being the assistant executive director of engineering. I look after the delivery of the projects and he looks after the standards and requirements for the Metro, so we mesh very closely together.” But this hand-in-glove approach doesn’t end there.

“Similarly, I work alongside the associate executive director for design on the architecture and urban planning side, so we’re very much an integrated team,” he says. The various projects have a mix of Mott MacDonald and Sydney Metro staff leading the design teams, with this relationship continuing to build on the work and successful outcomes achieved on the City & Southwest project. It’s an illustration of how Sydney Metro’s confidence in us grew.

“As part of that CSW joint venture, we were given lots of little problems to provide technical expertise for and help solve and we moved from being a technical advisor to a trusted delivery partner,” says Mike.

Joint delivery teams



Appointing an integrated design and engineering partner enabled the client itself to take on a new role. “We have equal responsibility and we can form joint delivery teams,” says Mike Barron.

“It’s allowing the Sydney Metro team to do something they couldn’t do before, which is participating in actual design work, rather than reviewing what is presented to them by contractors or other technical advisors.”

As part of an integrated design team, the client also has the opportunity to have its graduates participate in a mentoring rotation. Here, they sit alongside Mott MacDonald staff, receive training and gain experience. Another example of this tight dovetailed approach has us jointly

setting up a portfolio system of lessons learned, as well as digital systems that were new to the Sydney Metro team. “That’s not part of a normal delivery process,” says Mike, “these are all things that sit outside of ‘just doing design.’”

As Sydney Metro EDS, we will also procure any suppliers that are needed to do design work alongside us. For example, we are employing eight architects, as well as three of the major consultants in Australia to support our work. This translates to over 750 staff from the supply chain in total.

Digital innovation

We have provided several key digital enhancements for Sydney Metro.

The first was setting up full digital modelling. “We did not produce drawings for our concept design,” says Mike Barron. “We had a digital model for review and comments, and only produced 2D drawings when we got to Stage One, which is 30% design – and then only because procurement currently requires that in Australia. It was the first time it had been done that way here.”

The second piece of digital enablement was for customer-centred design. “We created three-dimensional virtual reality models of the six new CSW underground stations and

recruited members of the public to walk through and interact with them,” says Mike. “We asked them simple questions like ‘you’re at the station entrance, can you make your way to the platform and tell us what you are feeling when you’re doing it? Is it easy; does it feel claustrophobic? Do you know where to go? Tell us whatever you feel about the journey.’”

We invited a cross-section of people to gather a range of experiences that would help us alter designs accordingly. The process was repeated after each design iteration to ensure that any issues of concern had been addressed.



“We were able to show Sydney Metro how we’d modified and made improvements to arrive at a more customer-centred design,” he says. Another example of project digitalisation was an acoustic assurance tool we developed during our work on CSW. This is a GIS-based system that allows for a better understanding of how to meet planning requirements around noise and vibration.

Each of the contractors had their own budgets for assessing noise and vibration, but it was unclear whether planning noise limits would be exceeded once these were totalled.

“The tool has been pretty successful and we hope to roll it out worldwide,” says Mike. “It gave the client the confidence to know noise and vibration requirements will be met, and it also allowed them to review things like noise barrier placement.” In some cases the team was able to either reduce barrier heights from 5.5m to 3m, thereby making them less intrusive, or in other instances to do away with them altogether.

Opening opportunities
with connected thinking.