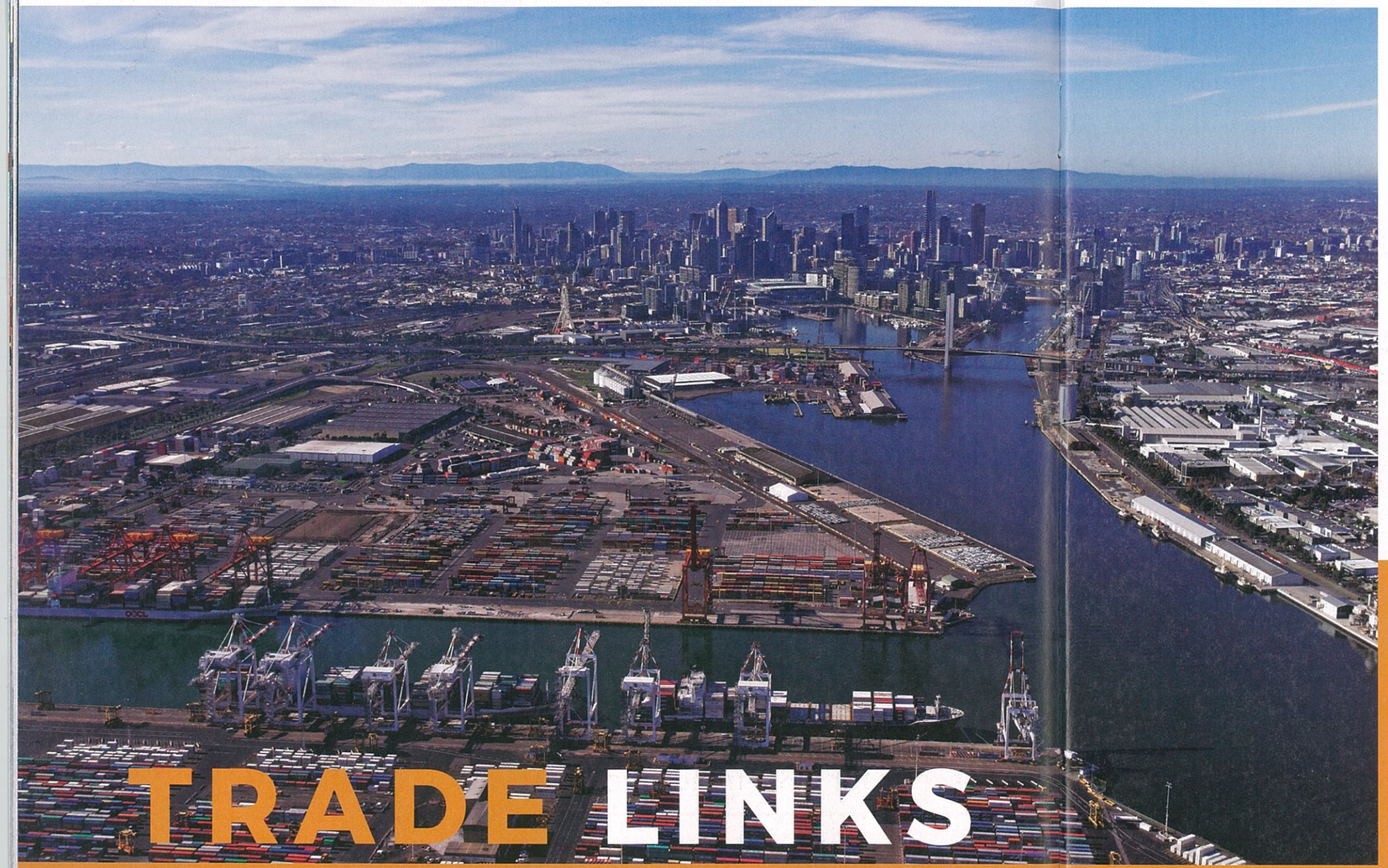


TRADE LINKS

WORDS BY **SUSAN MULDOWNEY**

AN AMBITIOUS PROJECT PROMISES TO EXPAND THE PORT OF MELBOURNE'S ABILITY TO MOVE CONTAINERS BY RAIL, BYPASSING THE NEED TO SEND TRUCKS THROUGH THE INNER CITY.

A **$125 MILLION** rail project at the Port of Melbourne presented a number of engineering challenges, but the toughest one was hidden beneath the surface.

More than a century of industrialisation had left a layer cake of waste between the Port Rail Transformation Project (PRTP) site's ground level and its Coode Island silt base.

Along with pockets of PFAS chemicals and fill material, there were old concrete slabs, asphalt pavers and random bands of scoria in the mix.

A key aim for construction is to recycle as much of the site's existing materials as possible.

Latent ground conditions have tested this goal, but engineers are confident that the land will be left in better condition than before the project broke ground in December last year.

BELOW: Matthew Brooks, Port of Melbourne Senior Project Manager, Port Rail Infrastructure.

"IT'S ABOUT TAKING MORE TRUCKS OFF INNER-CITY ROADS AND PUTTING MORE CONTAINERS ON TO TRAINS."

CHANGING TRACKS

Site investigations for the Port Rail Transformation Project began in March 2021, a month after the engagement of engineering firm WSP and Seymour Whyte Constructions.

Despite the series of COVID-19 lockdowns across Melbourne, the design phase remained on track, thanks in part to WSP's cloud-based platform, which enabled remote collaboration between the project partners and their Port of Melbourne client.

Spanning more than 500 ha of land at the mouth of the Yarra River, the Port of Melbourne handles about a third of Australia's container trade.

The PRTP is part of a broader state and Commonwealth Government strategy to improve rail freight across Victoria. Almost 95 per cent of the state's import containers are destined for metropolitan Melbourne, and the vast majority of freight is currently moved by road.

The project incorporates the development of new rail infrastructure at the port. A new rail depot will interface with the container terminal at Swanson Dock East International Container Terminal and includes two new rail sidings that can each handle 600-metre-long trains.

While a B-double truck has capacity to transport an average of up to four 20-foot containers, a train of this length can carry up to 84 of them.

A road will also be built to support the uninterrupted movement of containers. It will provide a continued east-west connection within the Swanson Dock Precinct without trucks needing to exit onto busy Footscray Road.

"A key aim of the project is to facilitate and increase rail-road share," says Matthew Brooks, Senior Project Manager, Port Rail Infrastructure at Port of Melbourne.

"It's about taking more trucks off inner-city roads and putting more containers on to trains destined for outer-suburban logistics terminals."

BENEATH THE SURFACE

Latent ground conditions presented the bulk of the project's engineering challenges. Brooks says extensive geotechnical and environmental investigations were required to determine exactly what materials they were dealing with and what could be reused.

"Being in a port environment, especially being on Coode Island where lots of different fill materials

have built up over time, we knew that we had to deal with changing ground conditions and have a design that could last the 50-year design life," he says.

"But working out what we could reuse was tough. I think we went above and beyond in our investigations to determine this."

Brooks estimates that approximately half of the construction site had layers of pavement beneath the surface.

"When you dig down, you can find five or six different pavement layers dating back 40 or 50 years, and it's all just been built up on top of each other," he says. "Throughout our investigations, we needed to understand what of the existing materials could be crushed up or removed and then stockpiled and put back in as crushed rock materials or in the sub-base pavement layers. We didn't want to take those materials offsite or remove contaminated materials and put them into other landfills."

RECYCLE AND REUSE

The PRTP is adjacent to the troubled West Gate Tunnel Project, which faces significant cost blowouts and delays due to the handling of about three million tonnes of soil contaminated with PFAS – per and polyfluoroalkyl substances – a group of potentially toxic manufactured chemicals used in everyday products from waterproof jackets to stain-resistant cookware.

BELOW: Maurice Gubiani, Seymour Whyte.

Maurice Gubiani, Environmental Manager at Seymour Whyte, notes that PFAS and Category D waste were also identified during early phase investigations of the PRTP site.

"We got a full contamination map of the site, so we knew exactly where the PFAS was, for example, and we put that into our design and marked it out on site," he says. "We anticipated that we'd be able to use reuse a certain quantity of material that we've been given permission for from the [Environment Protection Authority (EPA)]."

"We had a pretty good grasp of what was going on under the surface," adds Gubiani. "But the heterogeneity of the waste made it so tricky, because we'd work on one section and it was exactly as we'd anticipated and it fell into our reuse-of-material plan, but then we'd move five metres, and it was something totally different."

Rail terminals require heavy duty pavements to support the weight of containers.

A 40-foot container can weigh about 35 t when fully loaded and Brooks was working with the WSP team to design pavements that could withstand the weight of four containers stacked on top of each other. ➤

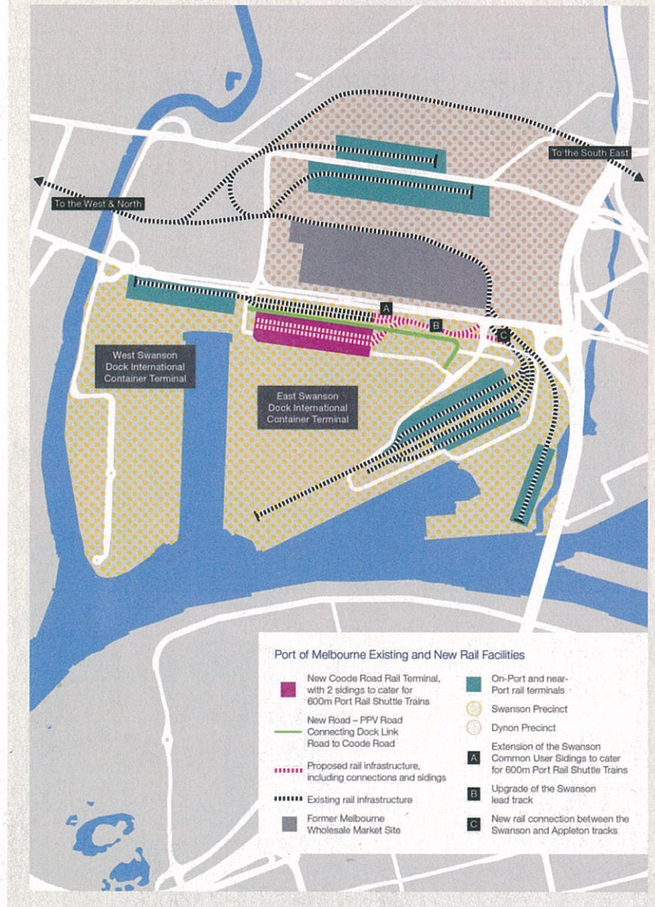


IMAGE: PORT OF MELBOURNE

LEFT: The Port Rail Transformation Project site.

"WHEN YOU DIG DOWN, YOU CAN FIND FIVE OR SIX PAVEMENT LAYERS, AND IT'S ALL JUST BEEN BUILT UP ON TOP OF EACH OTHER."

"There's also heavy container-moving equipment operating around them," says Brooks. "Some of our pavement profiles are a metre deep. Where possible, we're only digging through the top 500 to 600 mm, and then building up so that we're not even touching those existing lower layers where we can avoid it."

Gubiani says the recycling of above-ground demolition materials has proved more straightforward.

"There was a large old storage shed on the site and, after the first half of that had been demolished, we received the recyclable breakdown and we'd already received a 97 per cent recycle rate on that.

"But when we started to get to the excess concrete, bitumen and so on, we had to explore every avenue we could to see who could reuse the material."

Excess concrete of poor quality was crushed up on site and reused for assets like walkways.

The EPA also provided approval to reuse 33,000 cubes of waste material on site.

"We gave careful consideration to how we could reuse it on site," says Gubiani.

"Could we use it for drainage backfill, for example, or in pathways? This takes a lot out of landfill and when you think about the volume of material you require for the project and the carbon emissions that go into acquiring the material and transporting it to site, we're looking at some pretty big carbon offsets."

Gubiani says their approach was to excavate, assess, and then separate the material.

"So, when you get your rubble mixed with bricks and concrete, let's separate the concrete on site and that goes to recycling," he explains.

"Take the steel out and that goes to recycling. What can we do with the pavers? Is there a facility that can have a secondary beneficial use for them? Can a quarry re-mill them?

"Also, if you have a cleaner site, the discharges from runoff are of better quality, and we've been very active in ensuring that we treat all our water before it heads off site." ▶

BELOW: Port of Melbourne CEO Saul Cannon and Victoria's Minister for Ports and Freight Melissa Horne mark the official start of works with a sod turn.

"WE'D WORK ON ONE SECTION AND IT WAS EXACTLY AS WE'D ANTICIPATED, BUT THEN WE'D MOVE FIVE METRES, AND IT WAS SOMETHING TOTALLY DIFFERENT."

Building digital smarts

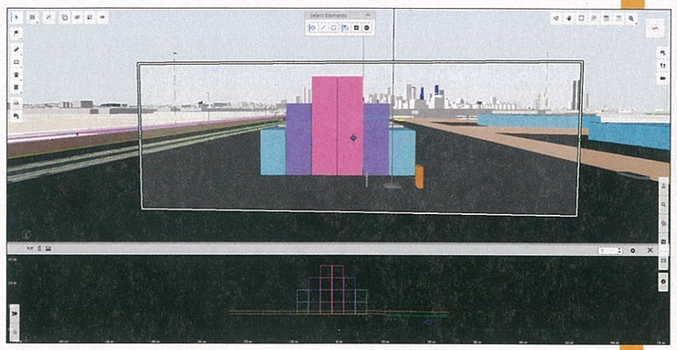
The WSP Create platform provided a single source of truth across key areas of Melbourne's Port Rail Transformation Project, including design, document control, general issue commentary, building information modelling and digital engineering.

Alexander Yammas, WSP Victoria Digital Engineering Lead for the roads, aviation and civil team, explains that the 3D model of the design used a point cloud dataset.

"It's a scan taken on site with millions of points to create a 3D mesh of the site," he says. "That gave us some context of how the site looked and then we could overlay the design. We could access all that external information while sitting at our PCs, locked down in Melbourne."

Andrey Torgunov, Senior Application Engineer, Enterprise Systems at Bentley Systems, says it was "paramount to ensure that the right people on the project had the right access to information at the right time".

He says ProjectWise provided granular access and version control, integration with design applications and enhanced real-time collaboration.



RIGHT: WSP Create helped the team collaborate on the project.

ABOVE (from top): Alexander Yammas, WSP; Andrey Torgunov, Bentley Systems.

"And there's never been better integration between ProjectWise and the iTwin platform, so all the native engineering information in the common-data environment could be federated and visualised in a single web-based digital twin for review and coordination," Torgunov says.

Yammas adds that the technology enabled more accurate estimates of the resources required for the project.

"This kind of technology has really moved ahead in the past few years. It's getting toward a point where the 3D model and the data that's in it looks very similar to the eventual asset. The model is basically intelligent, and there are BIM methodologies for this."

Yammas says that the more data they get for the model, the better.

"We can link this to construction planning schedules, as well as quantity and cost planning, so we can get an accurate estimate of what materials and resources are needed," he says. "Engineers have historically relied on their knowledge and experience to guestimate and then test. But this kind of technology can provide so much more certainty in the early stages and enhance collaboration, which achieves better results in a shorter amount of time."

The PRTP recycling challenge will be overcome through site investigation and lateral thinking, but technology helped to address challenges during the design phase, despite interruptions from COVID-19. The final design was completed within 12 weeks, including a preliminary design submission at the six-week mark.

Robert Freeman, Digital Operations Lead for WSP Transport, says the company's cloud-based digital platform, WSP Create, allowed stakeholders to access, visualise and share key information.

The platform integrates the ProjectWise 365 and iTwin Services tools from Bentley Systems.

"WE WANT TO LEAVE THE LAND IN A BETTER WAY THAN WHEN WE STARTED. WE'VE EXPLORED ALL AVENUES POSSIBLE FOR RECYCLING AND REDUCING OUR DISPOSAL RATE."

ABOVE: Robert Freeman, WSP Transport.

"There were times during COVID where we couldn't get to the site, but WSP Create allowed everyone to log into the project and, depending on the stage of the project, they could go straight into a 3D model, review the design and request any changes," he says.

IMPROVING THE LAND

Practical completion of the PRTP is slated for early 2023. Along with providing new port infrastructure and removing more trucks from Melbourne's inner-city roads, Brooks believes the project will result in better land conditions.

He says they want to leave the land in a better way than when the project started

"I think we can comfortably say that we've explored all avenues possible for recycling and reducing our disposal rate," he says.

"This is not just because it makes sense for us, but because it's the right thing for engineers to do". •