

Jacobs Uses Digital Delivery to Ensure Singapore's Water Sustainability and Resilience

The Bentley iTwin[®] Platform Helps Democratize Information on the Tuas Water Reclamation Plant

CLOSING THE WATER LOOP FOR SINGAPORE

Singapore's National Water Agency, PUB, is building the state-of-the-art Tuas Water Reclamation Plant (WRP), a key component of the Deep Tunnel Sewerage System Phase 2 (DTSS2) project. The system will provide a cost-effective solution to Singapore's long-term needs for recycling water. Completed in 2008, phase one of the DTSS serves the eastern part of Singapore. The second phase, expected to be finished in 2026, will extend to the western and southern parts of the nation. Tuas WRP provides a treatment facility for domestic and industrial used water that will boost PUB's capability to reclaim and recycle water in an endless cycle. Upon completion, the entire DTSS will play an integral role in diversifying Singapore's water portfolio, creating sustainable used water management for the country's future.

Designed to maximize water recovery and reduce energy consumption, when completed, the Tuas WRP will be the world's largest membrane bioreactor facility, treating 800,000 cubic meters of used water per day. PUB appointed Jacobs as the detailed design and construction supervision consultant, responsible for integrating digital information across multiple packages throughout both design and construction. "We did the preliminary and detailed design, and we are doing the tender management and commercial management, authority approval, project control, public relations, and construction management, as well as the information management; and the ultimate goal is to deliver 6D data for operation and maintenance," said Matt Warburton, Jacobs's project director for Tuas WRP. Featuring advanced technologies and integrating with a waste management facility for process synergies, Tuas WRP is a one-of-a-kind, complex megaproject that serves as a giant step toward closing the water loop for Singapore.

ADDRESSING COMPLEX DATA AND INTEGRATION CHALLENGES

The scope of Jacobs' project responsibilities included managing and integrating 16 different contract packages from design to construction, and delivering them to the highest standards of safety, quality, and digital productivity. "This involved defining the processes and systems needed to meet the project goals and requirements," said Go Tiong Sen, PUB's senior engineer at Tuas WRP. Given the scale and complexity of the Tuas WRP project and the involvement of so many contractors, Jacobs faced major issues with information management. They knew that they would have to coordinate massive amounts of data and facilitate collaboration with and across all the contractors and PUB. Recognizing the importance of establishing a connected data environment and standardizing data and workflows, Jacobs set themselves an ambitious goal of achieving world-class digital delivery for this megaproject.

Although they established a connected data environment, Jacobs still found it difficult to create and determine the right models and federate them in a timely manner. They had to integrate and interface six major treatment process facilities with over 2,400 native BIM models during design, and 16 contractors during construction, with over 3,500 native BIM models and 150 federated models. Therefore, the process became not only a logistical challenge, but also one involving software and hardware. The data-rich models were often too heavy to federate and simulate using ordinary laptop or desktop hardware, and the complex data management and multidiscipline inputs posed compatibility challenges among software applications.

"We initially tried to federate the multiple models of this megaproject, but it proved very difficult due to the huge amount of data, complexity of multiple packages, and interface coordination,"

PROJECT SUMMARY

ORGANIZATION

PUB, Singapore's National Water Agency, and Jacobs

SOLUTION

Water and Wastewater

LOCATION

Singapore

PROJECT OBJECTIVES

- ◆ To generate a digital twin to integrate complex data and multiple work packages.
- ◆ To achieve world-class digital delivery on a water recycling megaproject.

PROJECT PLAYBOOK

iTwin, LumenRT, MicroStation[®], OpenBuildings[®], OpenPlant[®], OpenRoads[™], Orbit 3DM[®], ProjectWise[®], SYNCHRO[™]

FAST FACTS

- ◆ Tuas WRP is a state-of-the-art water reclamation megaproject designed to maximize water recovery and reduce energy consumption in Singapore.
- ◆ Jacobs is responsible for managing and integrating massive amounts of information across 16 contract packages.
- ◆ Leveraging the Bentley iTwin platform provided a cloud-based digital environment for real-time access to a digital twin to proactively manage project delivery.

ROI

- ◆ The federated iTwin model optimized collaboration and enabled a structured data environment that helped reduce forecasted capital expenditures by 5%.
- ◆ Bentley's user-friendly platform upskilled over 200 staff, democratizing data to improve workflows and save time and resources.



“With collaborative platforms such as Bentley iTwin, we have been able to truly democratize BIM and digital transformation across multiple stakeholders: Jacobs project delivery team, and client.”

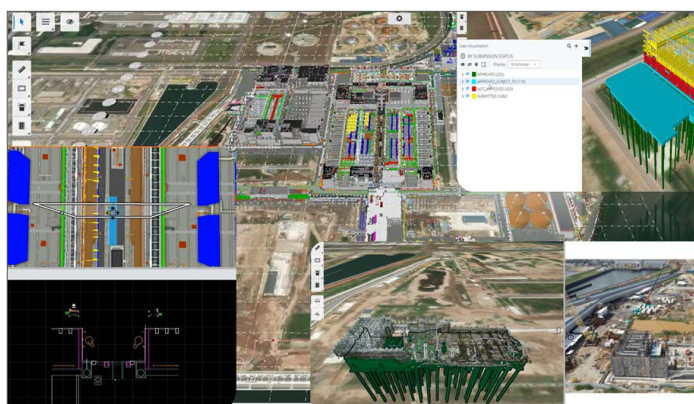
– OhSung Kwan, Tuas WRP’s BIM Manager, Jacobs

said OhSung Kwan, Tuas WRP’s BIM manager at Jacobs. “We tried various ways to facilitate coordinated models, but all failed due to the project complexity and size.” Site progress and engineering and construction reviews also had already started being carried out using uncoordinated information. To achieve their goal of true digital transformation, advancing digital project delivery through proactive design and construction management, Jacobs needed a user-friendly, cloud-based digital platform capable of collaborative, federated modeling.

LEVERAGING ITWIN TO DEMOCRATIZE INFORMATION

Jacobs selected ProjectWise and Bentley’s open modeling applications to create the preliminary and detailed design model, and integrating LumenRT, presented model-based briefs and provided models to tenderers rather than traditional 2D drawings. Leveraging the Bentley iTwin Platform, they pushed the boundaries of their digital journey, developing an integrated digital delivery process where they along with PUB could review the various contractor information submissions and visualize exact progress across multiple packages. “The key in this journey is democratizing information so it’s accessible to everyone in Tuas WRP,” said Kwan. The Bentley iTwin Platform provided the unique capability of cloud-based federation with an ability to seamlessly collaborate via a web browser among project team and stakeholders, taking out the complexities and bringing simplicity for nontechnical end users.

The digital solution enabled model-based tendering and a truly federated information model, integrating multisourced 3D information, including photogrammetry to add context to the information model by essentially creating a digital twin to meet the dynamic needs of the project. The iTwin Platform facilitates seamless, real-time access to a federated information



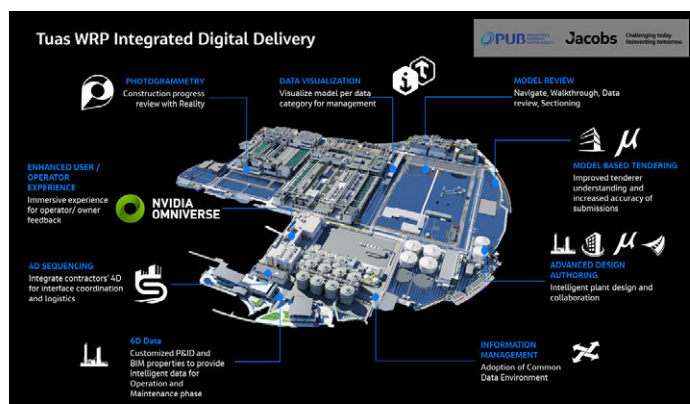
The federated iTwin model optimized collaboration and enabled a structured data environment that helped reduce forecasted capital expenditures by 5%.

model, allowing all stakeholders and engineers to visualize, search, and extract model data within one application. “That truly democratized [all the] information for the whole project team,” said Kwan.

SETTING A BENCHMARK FOR INTEGRATED DIGITAL PROJECT DELIVERY

Creating a web-based digital environment and single source of truth using the Bentley iTwin Platform provided contractors, stakeholders, and the client with real-time access to a digital twin, optimizing design and construction, and establishing a seamless transition into digital asset management for operations and maintenance of Tuas WRP. Bentley’s user-friendly applications eliminated the need for assistance from BIM specialists to open and browse federated model files by upskilling over 200 personnel across all organizations involved with the project. Sharing these federated models facilitated model-based tendering, improving the quality of tenders and reducing traditional timelines for multidiscipline design tendering of major contracts by 50%. The Bentley-based collaborative digital solution saved 75% in model federation time. Overall, the digital twin platform coupled with value engineering reduced over 5% of the forecasted capital expenditure for this megaproject.

All these digital achievements are key contributors not only to Tuas WRP’s successes, but also to Jacobs’ digital transformation journey, invoking a culture change. “The impact and outcome of this digital adoption for projects of this scale are much wider and priceless than just figures and numbers,” said Kwan. By pushing the boundaries of technology and embracing new ways of working, Jacobs demonstrated that integrated digital delivery brings better solutions to clients and market. “This has made a huge impact in the Singapore industry and sets a benchmark for other projects to follow,” said Kwan.



By adopting Bentley technology, automating information extraction, and establishing a single source of truth, Jacobs is achieving their ambitious digital transformation goals.

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