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Project Summary

Organization
PT. Waskita Karya (Persero) Tbk

Solution
Rail and Transit

Location
South Jakarta, Jakarta, Indonesia

Project Objectives
- To implement 3D modeling and visualization throughout design review and construction.
- To use digital twins to advance workflows and optimize decision-making.

Project Playbook
ContextCapture, LumenRT, OpenBridge® Designer, OpenRail™ Designer, SYNCHRO™ 4D

Fast Facts

- The Manggarai Station in Jakarta will replace the Gambir Station as the terminus for the city's long-distance trains in late 2021.
- Waskita was tasked with constructing a new bridge and track slabs, connecting new and existing lines at the station.
- Their success was based on quality, cost, and time efficiency, and required precise decision-making.

ROI

- Using OpenBridge Designer, OpenRail Designer and ContextCapture, Waskita identified and resolved potential issues prior to construction, saving 0.3% per month.
- OpenBridge Modeler's geometry control functions facilitated accurate calculations for the concrete bridge segments, reducing risks and avoiding unnecessary costs and delays.
- SYNCHRO 4D helped visualize the construction scheme and optimize available resources to shorten the construction schedule.

PT. Waskita Karya Revitalizes Manggarai Station for Jakarta's Long-distance Railway Hub

Leveraging Bentley's Digital Twin Technology Streamlined Decision-making to Transform Future Project Delivery in Indonesia

Improving Railway Reliability in Jakarta

Projected to be the world's largest city by 2030 with more than 35.5 million inhabitants, the Jakarta metropolitan area aims to increase passenger capacity and railway reliability for the over 1 million daily users of its network. As part of those efforts, Indonesia's national rail operator is investing in station upgrades and alignment improvements, one of which is at South Jakarta's Manggarai Station. The station has a single platform that currently serves over 100,000 daily commuters along the Jabodetabek and Soekarno-Hatta Airport Rail Link. When work is completed in late 2022, Manggarai Station will replace the current Gambir Station as the city's terminus for long-distance trains.

To achieve this station transformation, Indonesia's Ministry of Transportation appointed PT. Waskita Karya (Persero) Tbk, to construct a new bridge and assemble track panels, which will connect the existing first-floor mainline track to a new second-floor rail line of the main building. The project is vital to improving passenger flow and ensuring reliable transport, but presented significant construction constraints, compounded by additional challenges—including conducting a design review within the 720-day contract period.

Committed to Quality, Cost, and Time Efficiency

In addition to construction, Waskita was required to take on the design review of the existing contract drawings due to discrepancies with current standards and existing conditions. It required an accurate representation of the existing station and surroundings to precisely design and ensure seamless integration with the new infrastructure elements. In addition, Waskita also faced construction restrictions due to the large amount of rail traffic at Manggarai Station and the requirement to maintain train operations throughout construction. Lastly, the project team also needed to pay particular attention to controlling costs on prestressed concrete bridge segments, which accounts for up 30% of the total project budget. Negotiating any changes or amendments to the contract would require presenting several options to the client for approval.

To overcome these challenges and produce quality deliverables within the contract schedule, Waskita realized that its success hinged on three main objectives: quality, cost, and time efficiency. The team determined that their traditional, paper-based 2D processes were insufficient, and that collaborative, coordinated digital workflows were critical to enabling accurate decision-making and the production of contract deliverables. They also needed to provide clear visualization of different alternatives in terms of project scope and cost to the client and authorities. They sought to push the boundaries of information modeling and decided to adopt integrated BIM workflows and a digital-twins approach to develop visual, digital workflows, improve communication, and enable prompt and precise decisions.

Integrated Modeling Applications Drive Digitalization

Recognizing that reality, rail corridor (track and civils), and bridge modeling were essential elements to their workflow, Waskita selected Bentley's ContextCapture to generate a 3D reality mesh of the current infrastructure, OpenRail Designer to model 1.5 kilometers of new railway track, and OpenBridge Designer to model the concrete bridge structure. With Bentley's integrated applications, they established a digital twin that incorporated existing site conditions and a multidiscipline BIM design model of the proposed structure.

Digital twins have played a critical role in the transformation of Waskita's approach to working on the project. It has significantly improved the team's productivity, and even replaced 2D CAD drawings as a decision-making tool. Through their ability to leverage digital twins via tablets on site, Waskita ensured the accuracy of structures being built on site, enabling engineers to measure actual distances between designed structures and existing assets to detect and resolve conflicts, allowing for appropriate clearance and avoiding on-site construction errors.

Through digitalization and visualization, the team at Waskita were also better able to present their client with numerous design options, and as part of the design review process negotiate an amended project budget. "When the client

"Setting up a digital twin with Bentley technology is very convenient."

– Marsa Achadian Tyarpratama, Junior BIM Expert, PT. Waskita Karya (Persero) Tbk

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asked us to indicate options, what results they wanted to get out of the project, and how much it would cost, there was no better way to point out those options than to visualize them with a digital twin," explained Marsa Achadian Tyarpratama, junior BIM expert at Waskita.

To address all issues with designing the concrete bridge segment and the construction constraints, Waskita relied on OpenBridge Modeler® and SYNCHRO 4D. With the geometry control functions in OpenBridge Modeler, they calculated precise geometry, coordinated information for each bridge segment, and exported the data directly to the fabricator to help mitigate risks associated with ordering segments of the wrong size and/or number. To ensure that railway operations were maintained throughout construction, Waskita performed construction simulation in SYNCHRO 4D, which helped them visualize planned activities and clearly communicate them to the client and stakeholders. Working with Bentley's integrated modeling applications, Waskita transformed their conventional 2D processes into digital workflows that improved efficiencies and quality of deliverables to meet contract demands.

Digital Twins Industrialize Industry Workflows

Developing a digital twin that combines design information for tracks, civils, bridges, and structures with a 3D reality model of the existing ground helped Waskita and project stakeholders make more informed decisions. Working in the connected digital environment, they identified budget shortcomings during the design review and were able to clearly visualize alternatives relative to the project scope and cost, as well as present those options to the client. The model helped identify and resolve conflicts at an early stage, avoiding approximately 0.3% per month in additional time and costs.

Exporting the precise geometry details for the bridge segments directly to the fabricator meant that Waskita avoided additional costs of 0.8% and helped mitigate the risk of casting errors that could result in segments being discarded. If these errors had occurred, in addition to wasted time and effort, the team could have faced additional re-procurement costs. Using figures from phase 1 of the project, the additional cost of only two concrete spans was approximately IDR 2.785 billion. Finally, generating 4D construction models with SYNCHRO optimized resources, shortened the construction schedule, and enabled coordinated delivery of the project while railway operations continued.

Establishing digital twins not only provided Waskita and the project stakeholders valuable insights into the revitalization of Manggarai Station, but it also served as an example to encourage other engineers to implement this technology. By adopting Bentley solutions, Waskita modernized their own workflow processes and are promoting building information modeling and digitalization within the industry to achieve greater efficiencies when delivering infrastructure projects in Indonesia. "Bentley has helped us have cost and time efficiency from the beginning of our project. Even the slightest efficiencies are a big movement to help us encourage people in our field, especially in Indonesia, to implement BIM," said Luki Danardi, senior vice president of technology, research, engineering, and knowledge management at Waskita.

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