Bentley®
Advancing Infrastructure

Waskita Karya Digitalizes Delivery of Toll Road to Speed Travel to Indonesia's New Green Capital City

Using Bentley Technology to Establish
an Integrated Digital Twin Reduced Construction
Carbon Emissions and Saved IDR 12.5 Billion

SUPPORTING DEVELOPMENT OF A WORLD-CLASS, SMART FOREST CITY

Situated on the east coast of the Island of Borneo in the East Kalimantan province, Nusantara (IKN) is replacing traffic-congested and flood-prone Jakarta as Indonesia's capital city. Covering 2,560 square kilometers and surrounded by hilly landscape, forests, and a natural bay, Nusantara is part of a strategic plan to improve governance and achieve Indonesia's 2045 vision of becoming a developed country. It is a megaproject being built with a national identity, promoting economic transformation, tourism, smart sustainable transport, and renewable energy. In accordance with IKN's smart city forest concept and green development, the project utilizes artificial intelligence (AI) and advanced technology, and supports reforestation.

One of the first phases of the capital city's development is the toll road infrastructure, featuring a 75.62-kilometer highway being constructed to improve connectivity between the gateway city of Balikpapan and Nusantara's Central Government Core Area. Upon completion, the new highway will cut the 95-kilometer trek along the shoreline, which takes two hours and 15 minutes, to 57 kilometers for a 30 to 45-minute drive. PT Waskita Karya is the main contractor delivering the 6.675-kilometer Simpang Tempadung-Jembatan Pulau Balang toll road section 5A that will also connect the capital city center to the new IKN Nusantara airport, which is still under development.

With trees lining both sides of the highway, the toll road is set to be finished by July or August 2024, when the new green, smart capital city will be inaugurated as a symbol of technological advancement and sustainable urban development. "Connecting roads, government offices, power supply, and all the infrastructure needed are [being developed] to create the world's best smart and sustainable city," said Indah Nurcahyani, BIM engineer at Waskita Karya.

CHALLENGING TOPOGRAPHY, EXISTING INFRASTRUCTURE, MULTIPLE STAKEHOLDERS

The central location and surrounding environment of the new capital city play a crucial role in developing Nusantara as a smart forest city of the future. However, despite the favorable positioning of the capital in the middle of the Indonesian archipelago and its green surroundings, the topography and geology in the lush rainforest consists of hilly terrain with soft soil and clay, presenting site challenges designing and constructing the roadway infrastructure. "One of the conditions to be considered in determining the design is the extreme terrain and the geological conditions dominated by soft soil and clay layers," said Nurcahyani.

Another challenge was that the toll road section needed to connect to the existing Pulau Balang Bridge. After performing basic design modeling to get a clear visual picture of the project, Waskita Karya saw that their initial design plan did not match the Pulau Balang Bridge, demonstrating a 1.5-meter horizontal alignment difference and an average vertical elevation difference of 4 meters. "The difference in distance and elevation must be discussed with several relevant stakeholders, [and] it must be decided quickly and precisely to keep the project [on] schedule," said Nurcahyani. There was an imminent need for a design review among the multiple stakeholders and project team to determine the necessary design changes to ensure compatibility with the existing bridge parameters. To keep the project on schedule, Waskita Karya realized that they needed a multidiscipline collaboration platform, where all participants could virtually visualize and communicate to make quick and informed design decisions for optimal change management.

PROJECT SUMMARY
ORGANIZATION
PT Waskita Karya (Persero) Tbk

SOLUTION
Roads and Highways

LOCATION
Penajam Paser Utara, East Kalimantan, Indonesia

PROJECT OBJECTIVES
◆ To deliver a section of the toll road connecting to Indonesia's new eco-friendly capital city of Nusantara.

◆ To develop a collaborative digital design and construction management platform.

PROJECT PLAYBOOK
iTwin®, iTwin Capture, OpenBridge®, OpenRoads™, ProjectWise®, SYNCHRO™

FAST FACTS
◆ Indonesia is developing their new purpose-built Nusantara capital city as a smart sustainable forest city, with a new 75.62-kilometer toll road network to support development.

◆ Waskita Karya is the main contractor for the 6.675-kilometer toll road section 5A, Simpang Tempadung-Balang Island Bridge connection.

◆ They relied on Bentley applications to create a connected digital ecosystem and generate digital twins for real-time cloud-based design reviews and construction simulation.

ROI
◆ Working in Bentley's connected digital ecosystem improved data exchange processes by 80%.

◆ The digital twin solution optimized roadway and bridge alignment, saving IDR 12.5 billion in potential rework.

◆ Through real-time design reviews and construction simulation, Waskita Karya lowered diesel fuel consumption by 32,800 liters to reduce carbon emissions and save IDR 590 million.

> "The digital twins provide valuable data and information and function as a communication platform, enabling real-time collaboration and problem-solving among the team without disrupting current processes."
>
> *– Indah Nurcahyani, BIM Engineer, PT Waskita Karya (Persero) Tbk*

ESTABLISHING A CONNECTED DIGITAL ECOSYSTEM

Waskita Karya chose Bentley's integrated applications to establish a connected digital ecosystem and digital twin. Leveraging ProjectWise, Bentley Open applications, and the iTwin Platform, they generated a digital twin and created a real-time, iTwin-based design review platform. "The first step before the construction started, we set up a common data environment with ProjectWise, ensuring that all information data is always up to date and accessible," said Nurcahyani.

Waskita Karya relied on Bentley applications to create a connected digital ecosystem and generate digital twins for real-time cloud-based design reviews and construction simulation.

Next, Waskita Karya set out to compare and review the existing bridge with their roadway design plan using digital twins. They performed drone surveys of the project site, capturing over 10,000 high-resolution images. They then processed them with iTwin Capture into a 3D reality mesh of the existing bridge, which was superimposed with the 3D toll road model created with OpenRoads and OpenBridge, virtually visualizing the project to determine an optimal design plan.

Working in the collaborative digital twin environment facilitated real-time design reviews, discussion, and decision-making, allowing Waskita Karya to predict potential clashes and make optimal decisions regarding changes to ensure compatibility and structural integrity of the infrastructure. "Working with the 3D digital twin means that the field team could inspect the basic design plan remotely, record their findings directly on it, and accurately pinpoint the areas in need of repair," said Nurcahyani. Integrating SYNCHRO as part of the cloud-based digital twin solution helped them visualize the construction sequence and perform what-if scenarios to ensure optimal bridge and roadway alignment and construction workflows, keeping the project on schedule.

DIGITAL TWIN SOLUTION DRIVES SAVINGS AND SUSTAINABILITY

With ProjectWise and Bentley's integrated 3D modeling and construction simulation applications, Waskita Karya was able to generate 3D design models and perform design reviews in days, compared to weeks using manual methods. They could also link the construction schedule to the models, mitigating risks and meeting project deadlines. "Bentley [applications] provide a connected digital ecosystem and single source of truth that improve project construction and make teams work together more effectively to manage work time and control budget costs," said Nurcahyani. The digital twin solution provides valuable data and information, functioning as a virtual collaborative communication platform for real-time coordinated design reviews that reduced design time by 40% and field inspection time by 50%. By optimizing the horizontal and vertical alignment of the road in a 3D design environment, Waskita Karya saved potential rework equivalent to IDR 12.5 billion on just the first kilometer of the design plan.

Using Bentley software to establish an environmental and digital construction management platform and digital twin resolved visibility issues, provided accurate material information to construction teams, and saved critical time and costs. The integrated solution improved communication among engineers, field personnel, and stakeholders, facilitating collaborative digital design and construction reviews, streamlining workflows, and industrializing project delivery. Utilizing digital twins to perform virtual visual design checks and construction simulation optimized decision-making to save not only time and costs, but also support more sustainable construction, eliminating 10,000 kilometers of truck movements during construction to lower diesel fuel consumption on the project by 32,800 liters, significantly reducing carbon emissions. "Bentley's integrated technology combines disparate data into a federated environment, allowing us to track and visualize changes. This facilitates more informed decision-making to reduce risks and costs associated with conservative decisions based on a lack of information," said Nurcahyani.
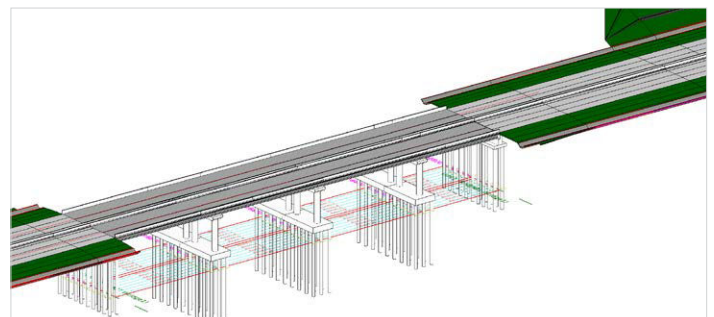
The digital twin solution optimized roadway and bridge alignment, saving IDR 12.5 billion in potential rework.

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