



Project summary

Organization:
JKR Sarawak

Solution:
Roads and highways

Location:
Limbang and Lawas, Sarawak, Malaysia

Project playbook:
Cesium®, iTwin® Capture, OpenCities® Map,
OpenRoads™, ProjectWise®, SYNCHRO™

JKR Sarawak provides first continuous land connection between East Malaysian states

Bentley's digital twin platform cuts project costs by 30% while minimizing environmental impact on protected areas by 80%

Project overview

SSLR2 is a 335-kilometer roadway that provides the first continuous land connection for communities in northern Sarawak to the rest of Malaysia.

JKR Sarawak leveraged Bentley's integrated digital ecosystem to streamline workflows and optimize design and construction.

Working in a digital twin platform provided a full lifecycle asset management approach towards a more efficient, sustainable, resilient, and more valuable roadway asset.

ROI

Establishing a connected digital twin environment accelerated design by 50% and reduced overall project costs by 30%.

Going digital facilitated smart construction methods to minimize impact on protected areas and wildlife by 80% and reduced the project's carbon footprint by 30%.

Bridging the accessibility gap for remote local communities

Initiated by the Malaysian government, funded through Ministry of Works Malaysia and led by its public works agency, Jabatan Kerja Raya (JKR) Sarawak, the Sarawak Sabah Link Road Phase 2 (SSLR2) project is designed to provide the first continuous land link between the remote east Malaysian states of Sarawak and Sabah. Historically, travel between certain parts of Sarawak and Sabah required crossing international borders, causing logistical complications for locals and businesses alike. "Sharing borders with Brunei Darussalam, the need for direct access for these communities to other parts of Sarawak and Sabah was highlighted during the wake of the unexpected pandemic, which resulted in the closure of international borders," explained Dr. Cassidy Anak Morris, director of the Public Works Department, who recently conferred the title "Datu" by the Governor of Sarawak. When the closures occurred, these communities found themselves cut off overnight, making this initiative crucial for bridging the mobility gap that has hindered accessibility and development of many rural communities.

Spanning 335 kilometers, the SSLR2 represents a strategic government effort to bring equitable development to the rural interiors of East Malaysia, redefining accessibility, safety, and economic integration in the heart of Borneo. "Current access to the nearest town through timber logging tracks and by river will be replaced by a paved-all weather road," said Dr. Cassidy. The new route will not only enhance national mobility and socioeconomic growth,

but also will significantly improve access to education, medical care, and jobs for more than 70,000 residents in underserved communities—sparking economic activity in a region rich in agriculture and tourism potential. Upon completion, the roadway will serve as a lifeline for personal travel, the flow of goods, emergency services, and economic exchange between the two states, promising to transform isolated communities into thriving hubs and bolster national integration.

Remote geography, complex terrain, multiple teams

Making this year-round connector road a reality, however, did not come without its challenges. The remote location, mountainous terrain, varying soil conditions, dense forest areas, and some of the heaviest rainfall in the country presented site and logistical difficulties. "On the ground, complex geotechnical conditions—deep soft clay deposits, high rainfall intensity, riverine flooding, and frequent landslides are present," emphasized Dr. Cassidy. On top of that, JKR Sarawak had to manage multiple teams across hard-to-reach locations, navigate environmental sensitivities, address community and stakeholder concerns, and work through frequent design changes. The project's proximity to national parks and protected forests required balancing development with environmental protection. "Such is the fragile setting for the development of the 335-kilometer SSLR2," explained Dr. Cassidy.



SSLR2 is a 335-kilometer roadway that provides the first continuous land connection for communities in northern Sarawak to the rest of Malaysia. *Image courtesy of JKR Sarawak.*



Apart from maximizing the return on investment, we ensure sustainable infrastructure for generations to come by transforming roadway construction through digital twin excellence.

— *Dr. Cassidy Anak Morris, Director of Public Works Department, Sarawak.*

With only 60 months to deliver the new two-lane single carriageway across greenfield areas—including realigning existing timber logging tracks, over 35 bridges, slope protection systems, and over 45 million cubic meters of earthworks—JKR Sarawak quickly realized that they could no longer rely on their conventional 2D CAD platforms and basic file-sharing methods. “These conventional methods presented numerous limitations managing a complex, large-scale infrastructure project like SSLR2, especially across challenging terrain and remote locations,” said Dr. Cassidy. They lacked version control and design integration, and offered limited capabilities for handling design revisions, spatial constraints, and construction risks.

Streamlining project delivery with data-centric, digital workflows

“To overcome these challenges and improve project delivery efficiency, we transitioned to a fully integrated digital design and coordination approach using Bentley’s suite of infrastructure solutions implemented by an experienced Bentley partner, Digile,” stated Dr. Cassidy. The JKR Sarawak team chose Bentley’s integrated 3D and 4D digital solutions and workflows to support multidiscipline collaboration, coordinated modeling, and construction management, streamlining project delivery. At the outset, they established a common data environment using ProjectWise to help connect all stakeholders, from design consultants to government agencies, in a live, traceable, secure environment. Working in a unified platform simplified document control, accelerated design reviews, and improved coordination across multiple dispersed teams.

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Leveraging OpenRoads throughout conceptual and detailed design enabled JKR Sarawak to integrate legacy data and perform geometric alignment, corridor modeling, terrain analysis, drainage design, and slope stability planning. Bentley’s OpenRoads helped them optimize the roadway layout in real-time while accounting for the geotechnical terrain complexities and soft ground conditions. At the same time throughout the design process, JKR Sarawak had to consider the protected zones and existing infrastructure. To support spatial planning and integration of land acquisition data, timber concession boundaries, utilities, and environmental buffers, they relied on OpenCities Map to help avoid clashes with protected zones and existing infrastructure. Using this technology played a key role in layering engineering data with cadastral and environmental datasets, and made it easier to coordinate with land offices, forestry departments, and utility providers.

Finally, the transition to 4D BIM with SYNCRHO empowered the team to simulate construction sequences and logistics, aligning plans with real-world site constraints. “The adoption of OpenRoads and SYNCHRO 4D helped us shift from a linear 2D design process to a model-based, 4D design and planning environment. This allowed for better visualization of road alignments, integration with bridge drainage elements, and efficient adaptation to ongoing design changes driven by stakeholder feedback and field conditions,” explained Dr. Cassidy. To monitor construction progress and improve transparency, they used Bentley’s iTwin Capture to perform drone-based 3D reality modeling, turning monthly site captures into photorealistic 3D models. Combined with Cesium’s web-based 3D visualization platform, these models gave stakeholders an easier way to view and manage progress.

Digital twins set benchmark for a smarter, sustainable future

JKR Sarawak’s shift to a data-centric, digital-first approach using Bentley applications proved vital in executing a project of national significance in one of Malaysia’s most geographically and logistically challenging regions. “Bentley’s integrated digital solution suite has enabled us to manage SSLR2 more effectively, reduce design cycle times,

enhance construction planning accuracy, and improve stakeholder engagement,” said Dr. Cassidy. By utilizing 3D design and enabling close coordination among teams, JKR Sarawak streamlined workflows and accelerated decision making to reduce design time by 50%, while improving quality of deliverables and saving 30% in overall project costs. Working in a connected data environment ensured data accuracy and resulted in a 20% improvement in data exchange efficiency. The ability to perform clash detection and monthly 4D simulations during construction optimized planning and sequencing and helped identify approximately 300 potential collisions, avoiding rework and mitigating risks.

In addition to cost, time, and productivity benefits, by leveraging AI and Bentley’s digital twin applications, JKR Sarawak minimized impact on protected areas and wildlife by 80%. Their solution facilitated smart construction processes that improved logistics and reduced material waste, contributing to a 30% reduction in the project’s carbon footprint. Throughout operations and management, the digital twin approach drives optimum asset performance, ensuring year-round connectivity to area communities. “Going digital is a paradigm shift that underpins the successful implementation of the SSLR2 project through a data-centric total asset lifecycle management approach towards a more efficient, sustainable, resilient, and, ultimately, more valuable asset throughout its entire lifecycle,” emphasized Dr. Cassidy.

As Malaysia builds toward a greener, more connected future, SSLR2 stands as a model not just for where it leads, but for how it was built—responsibly, efficiently, and sustainably. The project’s digital success ensures sustainable infrastructure for future generations and serves as a benchmark for Malaysia’s road construction sector. “With data-driven infrastructure solutions, we are able to design better, plan construction activities, manage risks, and deliver better road connectivity to enhance the quality of living of communities while taking care to preserve the natural ecosystem in this fragile environment of northern Sarawak for future generations,” concluded Dr. Cassidy.

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