

Bentley[®]
Advancing Infrastructure

Project Summary

Organization

Voyants Solutions

Solution

Buildings and Campuses

Location

Dhaka-Shasanghat, Narayanganj, Chandpur, and Barisal; Bangladesh

Project Objectives

- To deliver a cost-effective, eco-friendly, and modern passenger inland water terminal network.
- To determine an interoperable technology solution to integrate multisourced data for greater collaboration.

Project Playbook

OpenBuildings[™] Designer, ProjectWise[®], STAAD[®]

Fast Facts

- Bangladesh Inland Water Transport (IWT) Authority sought to improve their infrastructure, reduce traffic congestion, and meet international standards.
- Voyants Solutions was hired to develop four major IWT terminals to provide an affordable, eco-friendly, state-of-the-art transportation system.
- Establishing an open digital environment integrated data and streamlined collaboration throughout traffic assessments, feasibility studies, design, and construction management.

ROI

- ProjectWise provided an integrated platform to share and manage survey data and design models for enhanced decision-making.
- OpenBuildings Designer and STAAD optimized architectural and structural design to complete and submit final design in 18 days — three days ahead of schedule.
- Using Bentley's open digital applications, Voyants increased ROI by 50%.



Voyants Solutions Creates a World-class Experience for the People of Bangladesh

Bentley's Interoperable Applications Industrialize Project Delivery to Achieve a 50% Increase in ROI

Transforming a River Transport Network

Bangladesh has the world's largest inland waterway transport (IWT) system, ferrying 157 million passengers annually along a navigable river length of 3,800 kilometers. The country's thriving passenger river transportation industry carries more intercity travelers at a lower cost than railways or buses. With a current national population of approximately 170 million and transport demand growing at a rate of 8%, the country's IWT network was not keeping pace due to a lack of modern infrastructure, thereby resulting in a declining trend of modal transport share. Instead, travelers were choosing rail and road transport, despite their costs and longer routes. To improve key multimodal transport corridors and networks that would address traffic bottlenecks and reduce congestion on both land and water, Bangladesh Inland Water Transport Authority proposed the development of new major IWT terminals in four locations, including Dhaka, the capital city and epicenter of Bangladesh. The new infrastructure would ease terminal capacity, accommodate more riders, and improve passenger and vessel transport safety, all while boosting commercial, economic, and social development.

Voyants Solutions was tasked with developing the terminals, which required conducting 20-year traffic assessments, performing feasibility studies, and providing design and



Bentley software was used to overcome structural challenges on the land and marine sides.

construction management. The goal was to operationally and aesthetically modernize the infrastructure to reduce congestion and keep up with international standards, while designing a structure that depicted the cultural heritage of the country and its people. The project needed to consider the safety and comfort of passengers, safe vessel berthing, efficient passenger and vehicular flow in and out of terminals, intermodal connectivity, and accessibility for elderly and specially-abled riders. Overall, Voyants had to deliver a cost-effective, sustainable, and environmentally friendly infrastructure to transform the world's largest IWT industry into the world's best river transport network.

Integrating Data, Design, and People

The project presented challenges across all locations, including surveying and forecasting dynamic traffic patterns and demands, as well as geological concerns and site constraints. The situation was compounded by the client-imposed, tight 30-day design deadline. To address these issues, Voyants desired a digital approach to integrate survey and design data from multiple sources for both land and water works. They also wanted the solution to improve collaboration with stakeholders and the client. They recognized that the varying traffic volumes ranged from 60,000 passengers on weekdays, to 100,000 on weekends, and up to 500,000 during festivals. This wide range required comprehensive integrated technology to accurately capture and forecast the most realistic traffic patterns and understand the right mix of travelers at all locations. The feasibility stage involved various studies; topographical, geological, and traffic surveys; and continuous data integration and information sharing among all stakeholders. They would ensure rapid and informed decision-making to meet the client deadline.

Additionally, the geological conditions and site constraints provided technical and structural challenges on both the land and marine sides, with the team needing to accommodate small footprints, connect with existing infrastructure, and address varying water levels amid narrow channels. Architecturally and structurally, the conceptual design also presented complications when trying to depict the cultural heritage of the country and the

“Bentley solutions expand the capabilities of designers and provide them [with] the tools to experiment and digitize their thoughts and visions to create physical structures, which will exist in the real world for a long time.”

*– Upendar Rao Kollu,
Managing Director,
Voyants Solutions Pvt Ltd.*

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people, all while remaining cost-effective, structurally robust, eco-friendly, and fully accessible. The design was conceived from a famous Bangla song explaining the beauty of the rivers that are deeply connected with Bangladesh and had a complicated, wave-like roof structure. Voyants realized that to facilitate digital data and design integration, ensure structural integrity, and optimize coordination on the short schedule, they needed interoperable technology and an open, connected data environment.

Leveraging the Interoperability of Bentley Applications

Voyants decided to select ProjectWise to monitor and integrate multisourced data from traffic assessments, topographical surveys, and geotechnical analyses, as well as to manage and share information with all stakeholders and the client. This practice helped streamline collaboration, facilitate simultaneous design, and enable informed decision-making. Using OpenBuildings Designer and STAAD for architectural and structural design, they modeled the Shasanghat terminal in Dhaka, spread across five acres with sufficient green spaces. They also modeled the access and connectivity roads to the existing terminal and other transportation infrastructure, while ensuring structural integrity within the highly seismic area and flood zone. “The wave roof design was especially challenging, but we overcame that by [using STAAD] to analyze and address wind forces to ensure structural integrity,” commented Santosh Kumar, project manager at Voyants.

The interoperability of Bentley applications generated accurate and cost-effective models that helped collaborators visualize and better understand the project scope to optimize design of both land and marine works. They quickly determined solutions to accommodate the complex, open rooftop terminal design that provided space for social activities. The software enabled design of the river pontoons and linkspans to withstand water level variations of 6 meters to 7 meters, as well as connect to land-side structures. With Bentley technology, Voyants met all engineering and technical requirements, designing an earthquake and flood resistant, 22,000-square-meter terminal with basement parking and six floors, all in accordance with international standards. Leveraging the applications’ interoperability streamlined collaboration so that it was easy

to share information and quickly determine design solutions. Working in an open digital platform, Voyants simultaneously performed survey, analysis, and architectural and structural modeling, integrating client and stakeholder feedback that accelerated decision-making to timely finalize the design.

Industrializing Delivery of Sustainable Infrastructure

“Through various [Bentley and third-party] software, we have optimized the project,” stated Kumar. Voyants completed the initial conceptual design within seven to eight days, leaving only 21 days for detailed design. Using Bentley’s integrated technology, they finished and submitted the final design within just 18 days, three days ahead of schedule. Working simultaneously in an open digital environment improved productivity to deliver the BIM model with a team of eight, compared to fifteen using conventional methods. They saved 596 resource days and 1,200 resource hours, which contributed to a 50% increase in ROI. They also industrialized delivery, resolving engineering, structural, and coordination issues, while optimizing capital costs, as well as operations and maintenance costs, to achieve full project sustainability. The new IWT infrastructure provides safe and efficient berthing and passenger accessibility, effective natural energy and space utilization, and areas for social recreation and entertainment.

With innovative digital solutions, Voyants successfully delivered marine and land works, creating an eco-friendly infrastructure for the social and economic benefit of the people, the region, and the country. The new modern IWT facilities will eliminate traffic congestion, reduce the country’s carbon footprint, and change people’s perception of inland water transport, promoting ridership and establishing an affordable rapid transit mode in Bangladesh.

The models and criteria used for the Shasanghat terminal can be replicated and reused, which will save considerable resource hours when designing the IWT systems at the other three locations. The 3D BIM model will be converted into 4D models for construction and project management.

Voyants eventually plans to establish the model as a digital twin, helping the client link their building and asset management system with the model for lifecycle operations and maintenance management.



River pontoons and linkspans were designed to withstand water level variations of 6 meters to 7 meters.