

Bentley[®]
Advancing Infrastructure



Project Summary

Organization:

Voyants Solutions Private Limited

Solution:

Buildings and Campuses

Location:

Bangladesh

Project Objectives:

- To create an iconic design for 12 smart IT campuses across Bangladesh, promoting social, technological, and economic development.
- To deliver a 3D model of a sustainable conceptual design prototype amid limited parameters and a tight timeline.

Project Playbook:

LumenRT, OpenBuildings™ Designer, OpenRoads™, STAAD®

Fast Facts

- Voyants implemented a coordinated 3D digital approach to deliver an iconic, one-size-fits-all design.
- The team generated a master infrastructure plan to meet all design and construction requirements.
- STAAD and OpenBuildings Designer helped optimize conceptual design and overcome site constraints on a short timeline.

ROI

- Working in Bentley's open digital platform saved 50% in design time and reduced resources by 60% to achieve a return on investment five times the initial investment.
- Bentley's interoperable applications industrialized BIM workflows to timely deliver a high-quality, cohesive, and sustainable design.
- Voyants' zero-carbon design solution reduced the negative impact of existing environmental hazards and optimized energy efficiency to achieve 100% sustainability.

Voyants Implements Integrated Digital Workflows to Design Sustainable IT Campuses across 12 Districts

Bentley's Open Modeling Applications Helped Overcome Project Constraints to Achieve ROI Five Times Initial Investment

Developing Bangladesh As An IT Destination

As part of the Digital Bangladesh 2020 government initiative to establish world-class communication and information technology (IT) in the country, high-tech IT parks are being set up across 12 different districts. The project is a strategic investment to develop smart and green campuses, expanding cutting-edge research and development in the information, technology, and communications sectors. Open to local and foreign investors, the campuses are to be fully sustainable, Wi-Fi enabled, and all-inclusive operations. Voyants Solutions was responsible for conceptual design of the project prototype, through to commissioning and client handover.

The USD 193 million project required that the parks feature segregated pedestrian and vehicular traffic areas and be designed to reduce the carbon footprint, utilizing existing waterways for microclimate development, relying on natural energy, and facilitating recycling. In addition, the design had to reflect traditional Bangladesh values while emanating the modernity and innovation of a state-of-the-art structure, branding all 12 parks as unique facilities identified by design as part of the Digital Bangladesh campaign. Faced with topography, space, and climate variations across the multiple locations, Voyants required an integrated digital modeling solution to create an iconic design that was suitable to the different environments within limited design parameters and a tight timeline.

Optimizing Conceptual Design

Based on the minimal project brief, Voyants used Bentley's flexible modeling and analysis applications to design a conceptual prototype. With fixed parameters presenting little flexibility in the built area, as well as a constricted schedule, the team relied on OpenBuildings Designer and STAAD for their interoperability and open modeling while automated features also helped develop an iconic design concept. Voyants proposed a design concept based on the water lily, the national flower of Bangladesh, with a curvilinear building structure and specific zones for well-defined uses connected through covered walkways, skywalks, and plazas. The flower and its leaves were conceived as the building, and the surrounding water

was converted into the connecting infrastructure. This structure helped create a collaborative environment featuring flexible interior workspaces, health facilities, conference rooms, atriums and dedicated parking, and pedestrian zones. The overall concept facilitated an amalgamation of spaces, including indoor and outdoor areas with a programmatic interplay of light and building connections.

All 12 sites had to be conceptualized simultaneously within a 30-day time period from 2D sketches of each project site, reflecting no indication of site boundaries or demarcations. Voyants surveyed the 12 locations to establish approximate boundaries and created digital survey maps that were then overlapped with GIS maps for geo-referencing with 3D models developed using third-party software. Importing the models into OpenBuildings Designer and STAAD helped optimize conceptual design, facilitating modeling and visualization of the proposed complex curvilinear geometry for the atypical sites. Bentley's integrated applications helped standardize design features so that the team could reuse the main building components, modifying them to accommodate the different footprints, and then develop the skywalks around the buildings during detailed design. The interoperability of Bentley's applications with third-party technology helped automate conception and facilitated digital delivery of a cohesive design concept within the 30-day deadline. "[Using Bentley technology], we could derive an iconic campus with an artistic vision of nature and technology, and the client was happy about it," stated Swati Agarwal, vice president and head of architecture and project management at Voyants.

Overcoming Site Constraints

The approved conceptual design had to be further developed for schematic and detailed design to find solutions for each location among all design disciplines. Not only did the 12 sites vary in footprint—ranging between 3.5 and 10 acres—but they also were subject to varying climate and environmental conditions. Located on waterlogged and wasteland grounds across three different earthquake zones, the sites each presented geotechnical challenges and issues affecting structural integrity. Having established a digital workflow

“Iconic designs are expressions generated from innovative mind and innovative tools. Bentley software and applications helped the ideas to take shape and create the structures, helping architectural visualization come to fruition. Bentley is truly advancing infrastructure.”

– Upendar Rao Kollu, Managing Director, Voyants Solutions Private Limited

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during conceptual design, the team integrated OpenRoads for digital terrain modeling, which, in combination with parametric modeling software, helped optimally place the building base at each location.

STAAD was crucial for structural design and analysis of the complex framing and façade. The software allowed model replication and evaluation under varying loads and wind zones, ensuring that the facilities could withstand the earthquake conditions. Given the curved shape of the structures, the team determined that a combination of steel and reinforced concrete should be used for framing to optimize structural stability. For the building façade to sustainably and structurally accommodate the variable environments, Voyants designed a double-skin prototype with internal insulated glass and external vertical louvers that are adjustable depending on structural alignment and climate. Using OpenBuildings Designer facilitated 3D visualization and integration of all structural and architectural elements with mechanical, electrical, and plumbing to create an innovative and efficient design across all 12 locations.

Open Applications Deliver Benefits

Using Bentley's integrated 3D BIM applications optimized conceptual design, standardizing modeling processes and reducing time for model refinement to accommodate the different locations. “Only the skywalk component had to be developed and designed in detail. Otherwise, all the other building blocks were the same,” explained Agarwal. Bentley's open modeling platform helped simplify data transfer, changes, and modifications of the complex building form and allowed multidiscipline teams to work simultaneously across the 12 sites throughout the entire design process. During schematic design, Voyants needed to reduce the atriums and, during detailed design, they had to remove one floor. Using the 3D models and Bentley's open applications accelerated these changes to keep the project on schedule.

The timeline from inception to detailed design and tendering was a total of 120 days, with only 30 days allotted for conceptual design, 30 days for schematic design, and the remaining 60 days for detailed design to tendering. Using STAAD and OpenBuildings Designer accelerated design, simplifying development of the steel connection details and automating generation of accurate drawings. Working in the digital environment streamlined workflows, enabling a small team of eight to complete the schematic design within 15 days. In five days, the complex structural geometry was analyzed and design finalized by one person. With accurate 3D models and LumenRT, the team created animated 3D renderings in three to four days that provided designers, construction teams, and the client with visual insight for better understanding of design intent and more informed decision-making. Bentley's open digital applications saved 50% of design time using 60% less resources to achieve a return on investment five times the initial investment. The technology solution industrialized project

delivery to meet the 120-day deadline, compared to 210 days using traditional design methodology.

Digital Solutions Advance Sustainability

Sustainability was a key element of the design, as the campuses are required to function as 100% green facilities that are universally accessible. The team used Bentley's digital applications and building energy modeling throughout the design process to respect and incorporate the natural surrounding features into the design and ensure energy efficiency. The existing water bodies at each site have been retained to minimize disturbance to the ecosystem, and the developments will reduce the negative impact of the existing spaces that posed threats to neighboring areas. All the sites are easily accessible via public transportation. To improve thermal performance, the glass façade will use high-performance structural glazing with adjustable fins and projected slabs to allow for maximum natural lighting while reducing heat gain.

Bentley's interoperable design and analysis applications facilitated modeling and simulation of light and heat generation, as well as air circulation. This practice resulted in open offices and atriums that are daylit, and corridors and common areas that are naturally ventilated, requiring minimal mechanical ventilation. By integrating digital monitoring devices for light, occupancy, and indoor air quality helped to determine how much artificial light or ventilation is required based on occupancy. Digital water-flow sensors facilitate water conservation, while sewage treatment plants are in place to harvest rainwater and recycle water for horticulture operations and flushing.

3D BIM Drives Construction

Bentley's integrated design applications facilitated a high-quality, 3D deliverable with a cohesive scheme within the tight time frame. With these parks being simultaneously developed as a one-size-fits-all iconic design across 12 locations, the construction teams needed to fully understand the vision of the architect and designer to ensure seamless workflows. From the BIM model, Voyants rendered 3D animations and generated walkthroughs using LumenRT and virtual reality technology that helped construction teams visualize and digitally move through the campus for better understanding of design intent.

Moving forward, Voyants will use SYNCHRO to link the 3D BIM models with the construction schedule for monitoring and management. Leveraging SYNCHRO to advance BIM, the project team can optimize resource planning and decision-making to help keep construction on schedule and enhance profitability. With only 24 months to complete construction, Voyants has developed construction supervision dates and will use the 3D models to help drive construction. The models will facilitate seamless construction coordination, execution, and cost analysis, optimizing construction sequencing and management to meet the tight construction timeline.