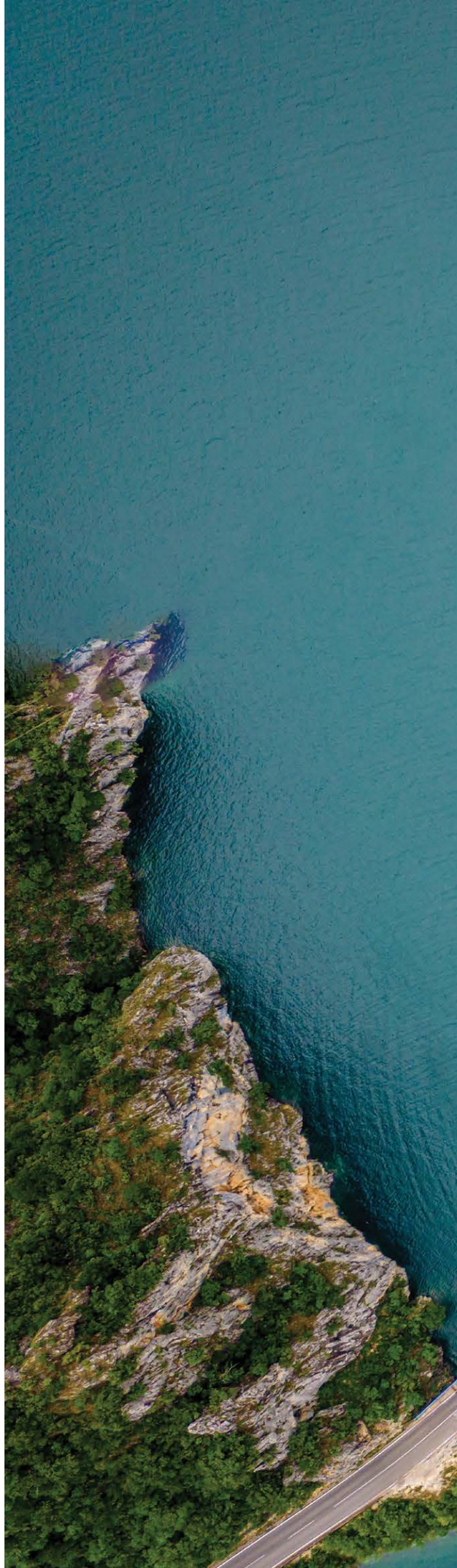
Illuminating the Future of Infrastructure

Digital transformation across India

Bentley®

“It’s a relationship, rather than a transaction, that characterizes the way we do business.”

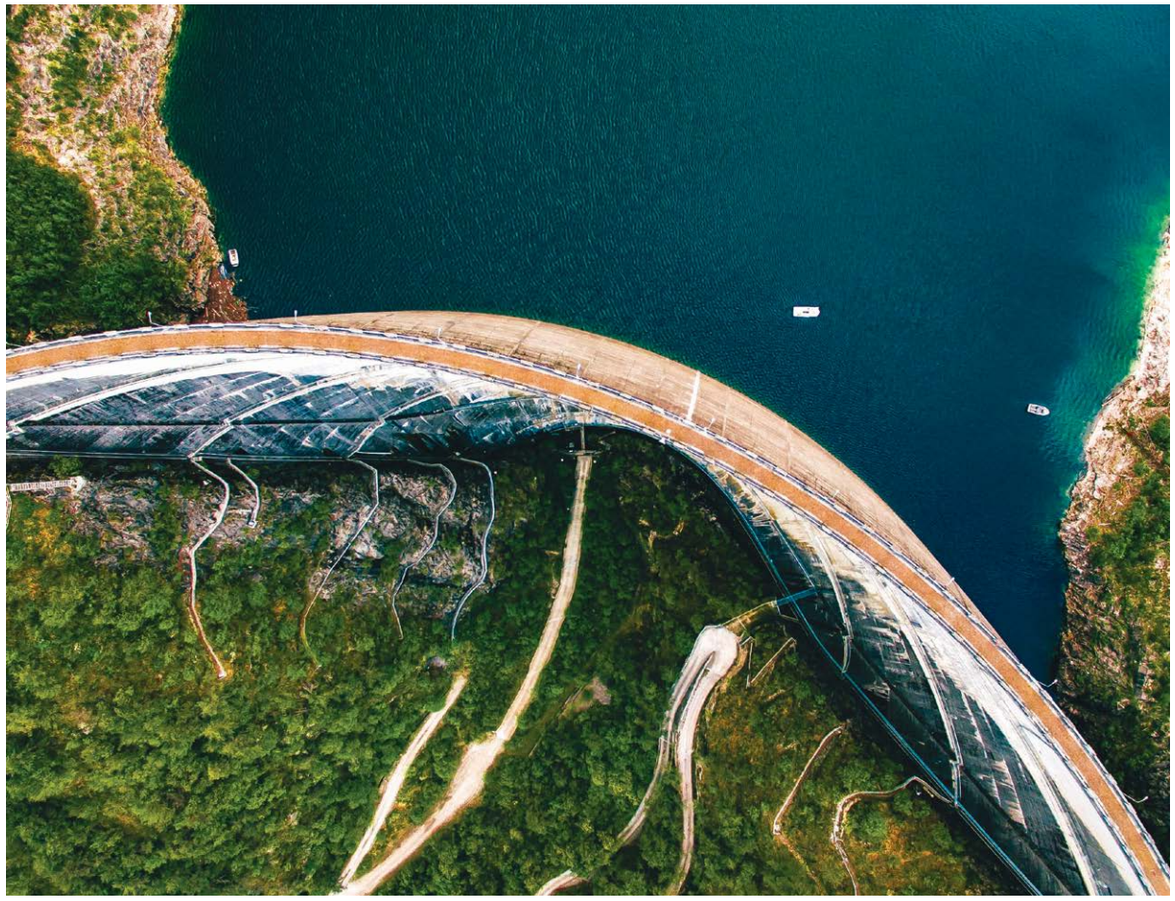
- Greg Bentley



Bentley is the leading software provider for the infrastructure sector. Our platform enables engineering firms and owners/operators to manage their assets through infrastructure delivery and ongoing infrastructure performance. We empower the unsung heroes of infrastructure working to improve quality of life around the world.

The infrastructure digital twin is the core of our offering. By integrating a wide range of inputs into a digital simulation, Bentley provides unmatched understanding into an asset's performance, allowing engineers to work in context, at scale, and in real time. This enables clear design, efficient construction, and reliable monitoring and maintenance.

Bentley is helping the infrastructure sector embrace digital workflows to become more productive and effective. We maintain a deep portfolio of specific applications that serve any conceivable need in the infrastructure sector, from transportation to water utilities to city planning to energy. Those applications and the platform they run on are interoperable because collaboration and knowledge sharing are essential to designing, building, and operating infrastructure today.



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Introduction to Bentley

Our history

Bentley has been the leading global provider of infrastructure engineering software for 40 years. Our innovative technology advances the world's infrastructure, sustaining the global economy, the environment, and overall quality of life.

Founded in 1984, Bentley was built by engineers for engineers. Our history reflects the digital evolution of our sector—from the democratization of computer-assisted drafting (CAD) to infrastructure digital twins. Along the way, Bentley has developed and acquired numerous applications and offerings to better serve the unique challenges facing engineers.

Our longstanding commitment to engineering excellence has informed our future direction for immersive infrastructure digital twins powered by AI and analytics. In our unwavering commitment to innovation, we provide an interoperable digital twin platform, a wide range of applications for all engineering disciplines, and enterprise systems that manage infrastructure delivery performance. We have grown from a small company to a global enterprise, working across industries and geographies, but our commitment to the infrastructure and engineering communities is as strong as when we started. We will continue to redefine possibilities in our field.

Bentley has been the leading global provider of infrastructure engineering software for over 40 years. Our innovative technology advances the world's infrastructure, sustaining the global economy, the environment, and overall quality of life.

Our values

At Bentley, we believe that our colleagues are our most important assets. Since our founding in 1984, Bentley has grown into a world-leading provider of software and services to design, build, and operate the world's infrastructure. Our growth and resilience have been achieved through the hard work of our colleagues and the incredible loyalty of our users. Fundamental to Bentley's success have been our core values:

Motivated: We are committed to improving the quality of life through our contributions to the world's infrastructure.

Innovative: We are a team of innovators who apply technology to deliver creative solutions.

Passionate: We are passionate about the amazing things that our users do with our software and we are committed to their success.

Connected: We are connected and able to collaborate with each other throughout our global footprint. This creates a supportive community.

Responsible: We take pride in our work and hold ourselves accountable for delivering our promises.

Our purpose

We advance infrastructure for better quality of life.

Our mission

At Bentley, we empower people to design, build, and operate better and more resilient infrastructure through the adoption of our intelligent digital twin solutions.

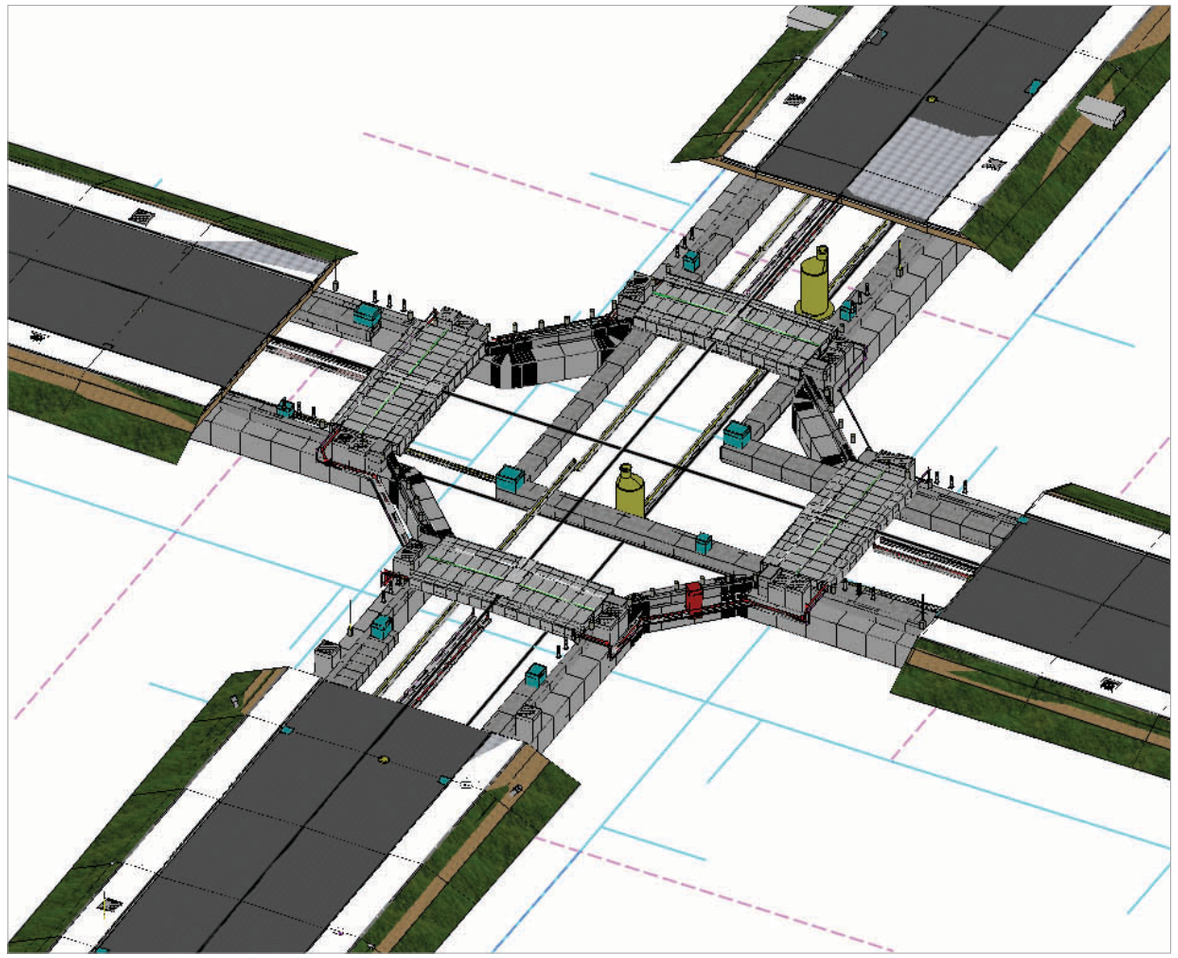
Barry, Keith, Ray, and Scott Bentley with the Bentley Systems team in 1986.

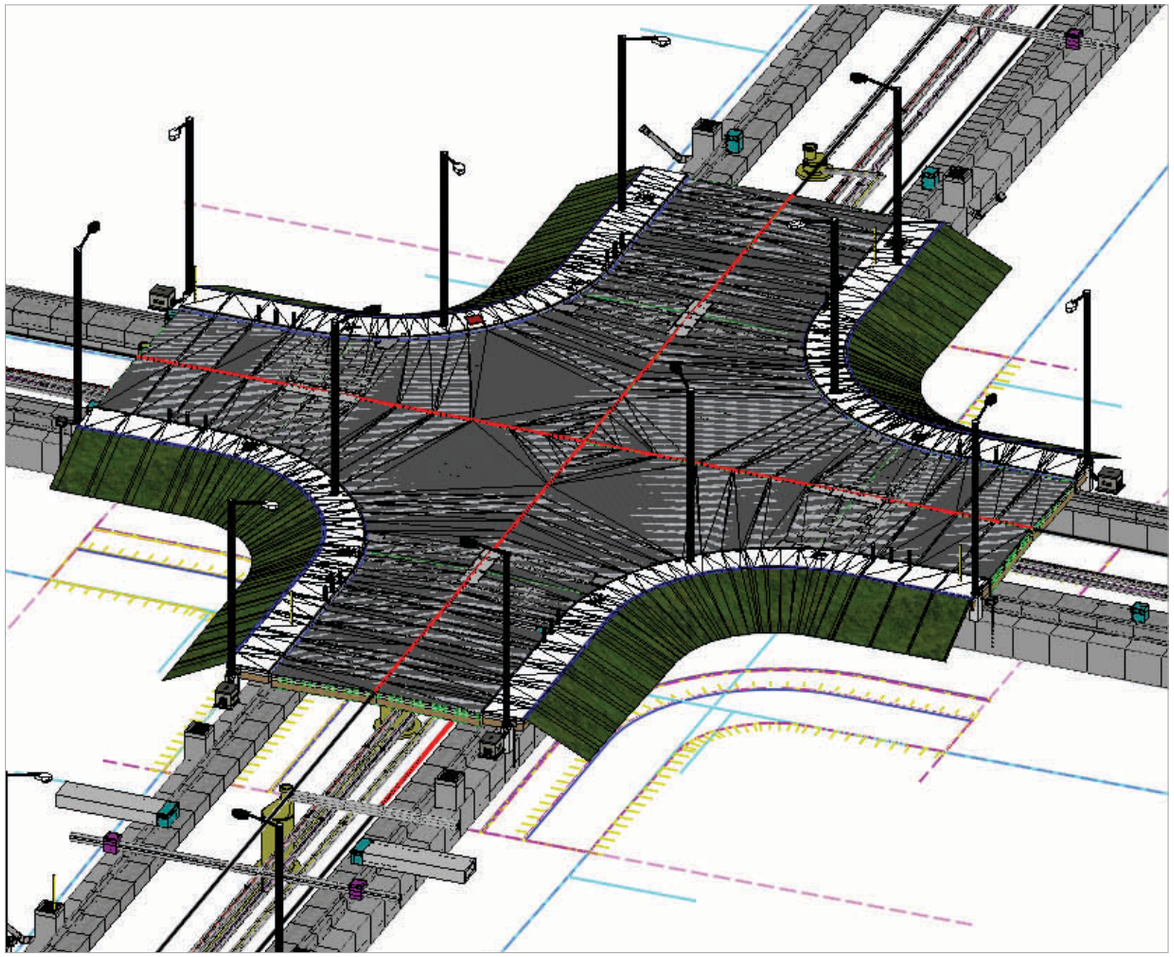
Inspiring infrastructure projects

Roads and highways

25%

increase in smart city development productivity





Larsen & Toubro

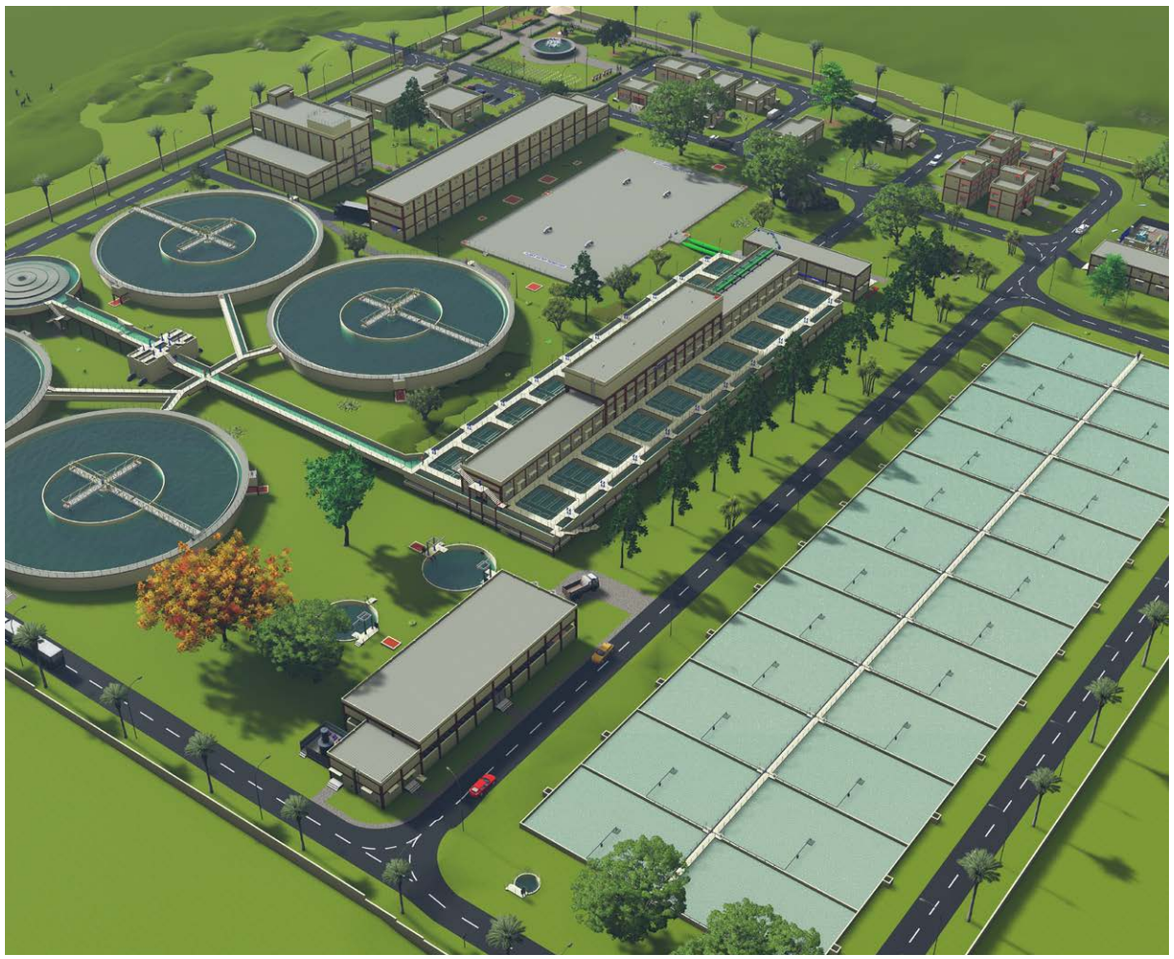
Modernizing roads and utilities infrastructure in Dholera special investment region (2023 participant)
Location: Ahmedabad, Gujarat, India

Project playbook: Bentley LumenRT™, OpenFlows™, OpenRoads™

As part of developing Dholera as a smart, energy-efficient city, creating economic development and enhancing individuals' quality of life, a 174.25-kilometer roadway is being built to provide efficient, intelligent, and sustainable transportation. The project includes power and water utilities, requiring integration with the roadway works. The team used CAD software applications during the initial project stages, but the applications failed to accommodate the voluminous data and presented data exchange issues. As a BIM-mandated project, the team needed a digital solution capable of integrating utility works and roadway alignments to optimize execution. They selected Bentley Open applications to perform collaborative 3D modeling, subsurface utility design and analysis, and clash detection.

Working in a centralized digital environment streamlined design and construction, mitigating risks, saving 1,000 work hours and INR 10 million in costs. Bentley's applications improved productivity by 25%, accelerating the project schedule by 10%. Integrating BIM with Internet of Things (IoT) and other digital systems will enable real-time data collection and insight into the city's infrastructure performance, facilitating intelligent transport systems that support smart city development.

Water and wastewater

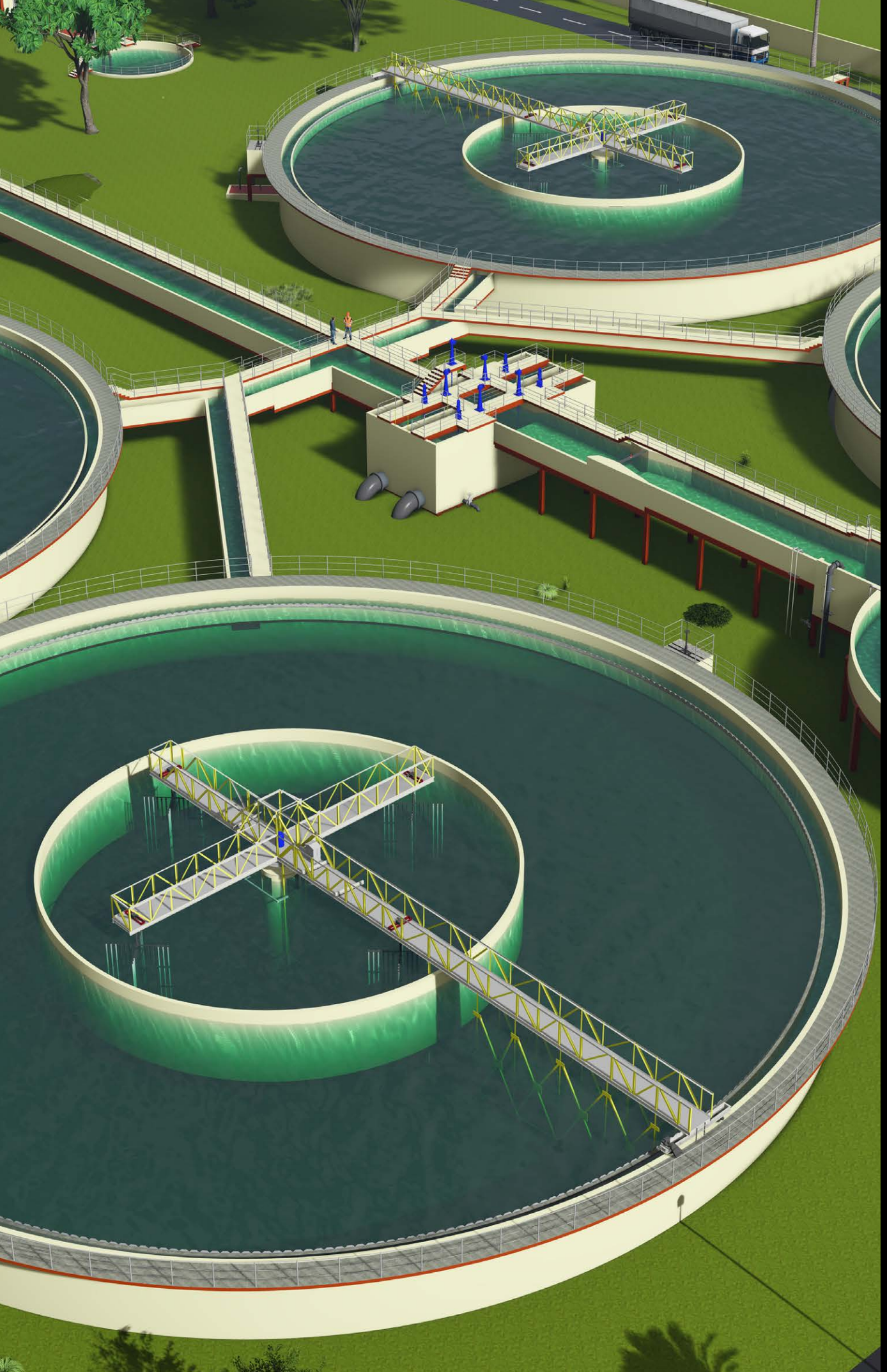


L&T Construction

Rajghat multi village rural water supply scheme (2023)
Location: Ashok Nagar and Guna, Madhya Pradesh, India

Project playbook: OpenFlows, OpenRoads, PLAXIS , STAAD

Rajghat's multivillage rural water supply scheme will provide clean and safe drinking water to rural villages across India via a 7,890-kilometer pipe system, including 698 overhead tanks and ancillary pumps and equipment. Upon completion, the water network will provide access to clean drinking water for 2.5 million people. Varying soil properties and terrain presented hydraulic and structural design and analysis challenges amid a short project timeline. Initial software applications proved time consuming and ineffective to meet the project schedule. Leveraging OpenFlows, PLAXIS, and STAAD, the project team completed engineering within four months, compared to 12 to 13 months using traditional methods. Working in an open digital environment saved 50% in modeling time, increasing productivity by a factor of 32. Bentley's applications automated and optimized hydraulic, structural, and geotechnical design and analysis, reducing the foundation size and precisely fitting the treatment plant to minimize the carbon footprint to save 10% in construction time. The 3D models and data will be linked with monitoring devices for digital operations and maintenance.

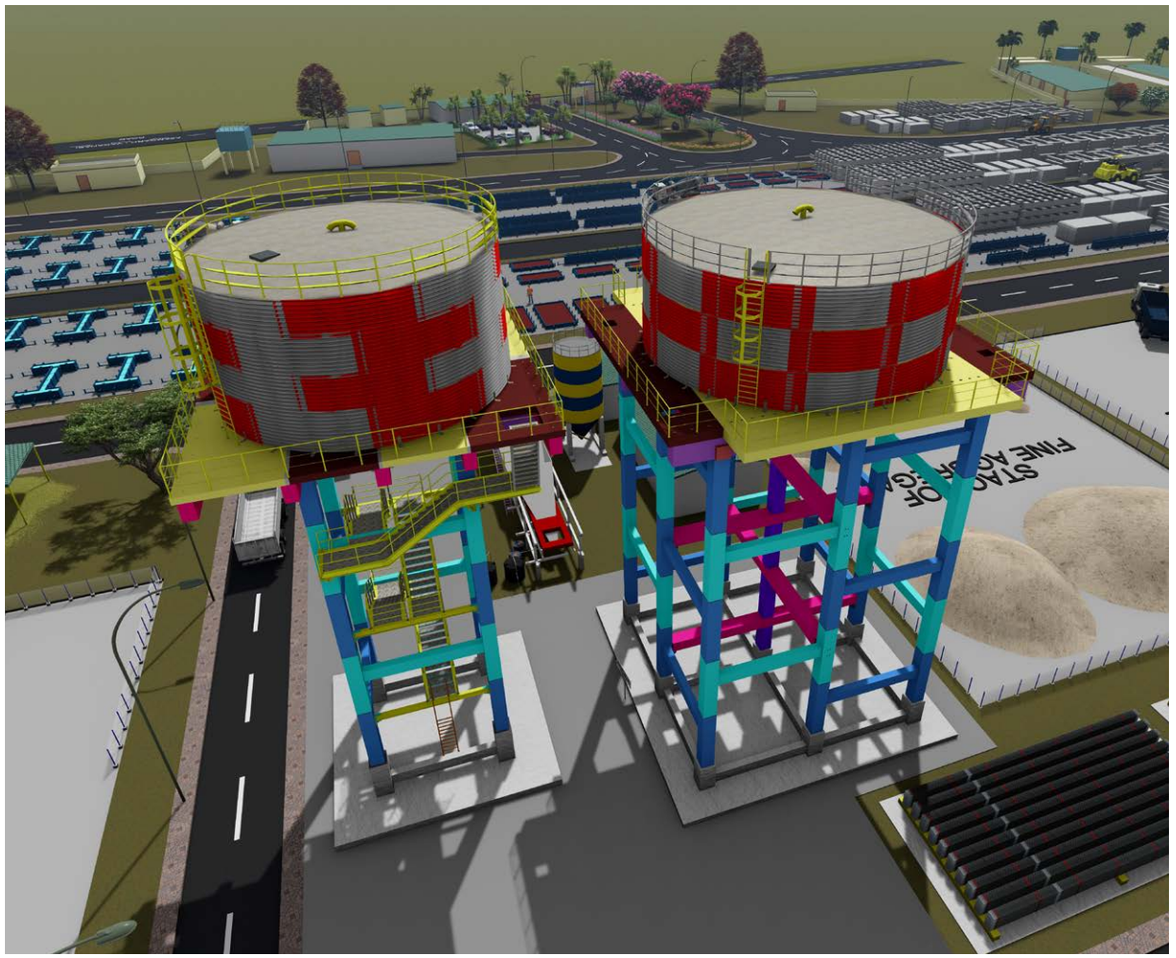


75%

design time and
10% construction
time saved

90%

construction
time saved

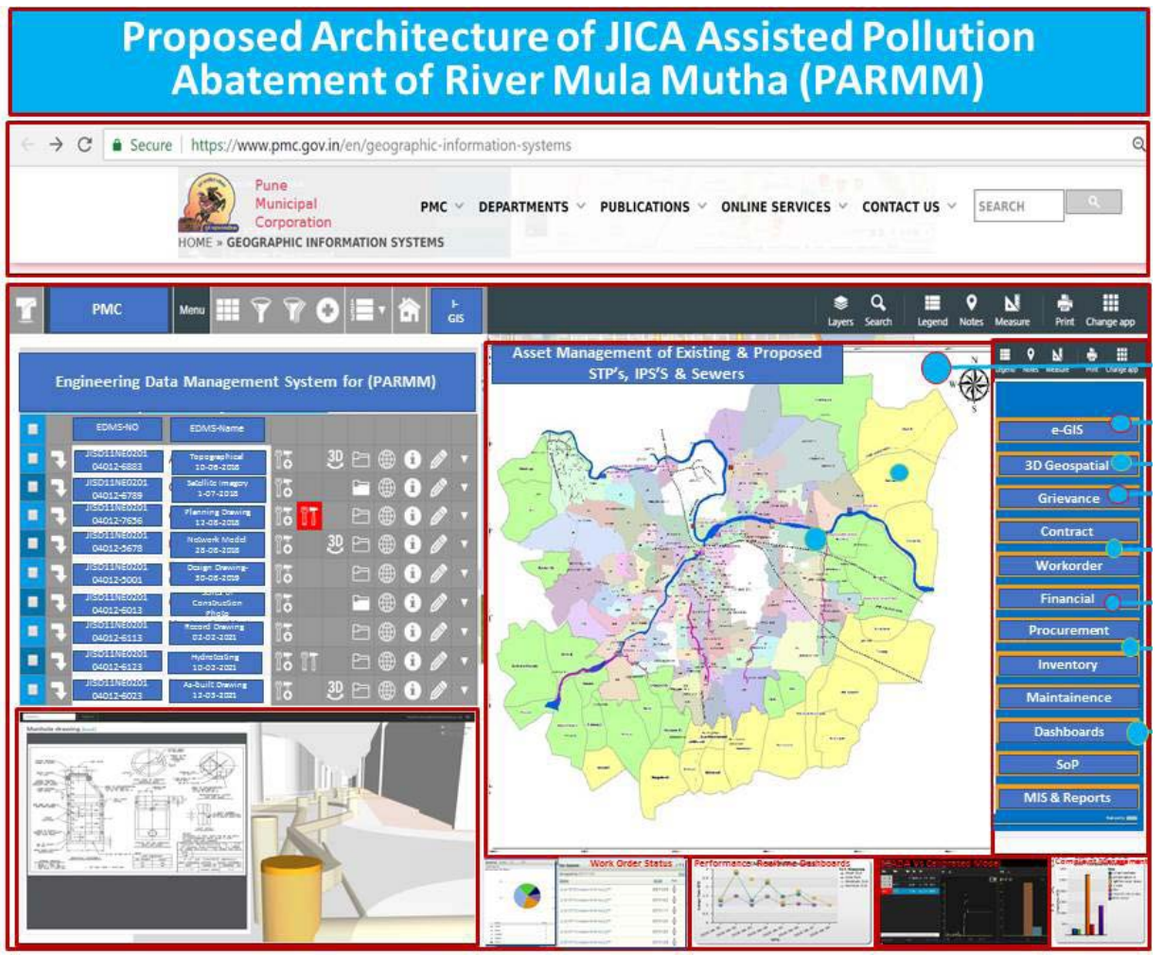


L&T Construction

Uttar Pradesh tube well project under Jal Jeevan Mission (2024)
Location: Uttar Pradesh, India

Project playbook: OpenFlows, STAAD

The Uttar Pradesh Tube Well aims to provide safe and adequate drinking water to rural households in India through 1.7 million household connections serving 6.8 million people. L&T Construction was tasked with designing and executing over 3,000 overhead tanks across scattered rural villages in a limited timeframe. To evaluate and determine an optimal construction method, L&T Construction needed an integrated BIM, structural, and hydraulic modeling solution. Utilizing 3D BIM technology with STAAD and OpenFlows, L&T Construction designed the distribution network and decided to use the precast method of construction for better quality control and risk management, compared to traditional on-site concrete pouring. Through digital modeling and analysis, the team streamlined and standardized design workflows and drawings for 600 design variants and saved 90% in construction time. L&T Construction also reduced material waste and energy consumption, minimizing the project's environmental footprint. The project sets a benchmark for digitization of future rural infrastructure projects.

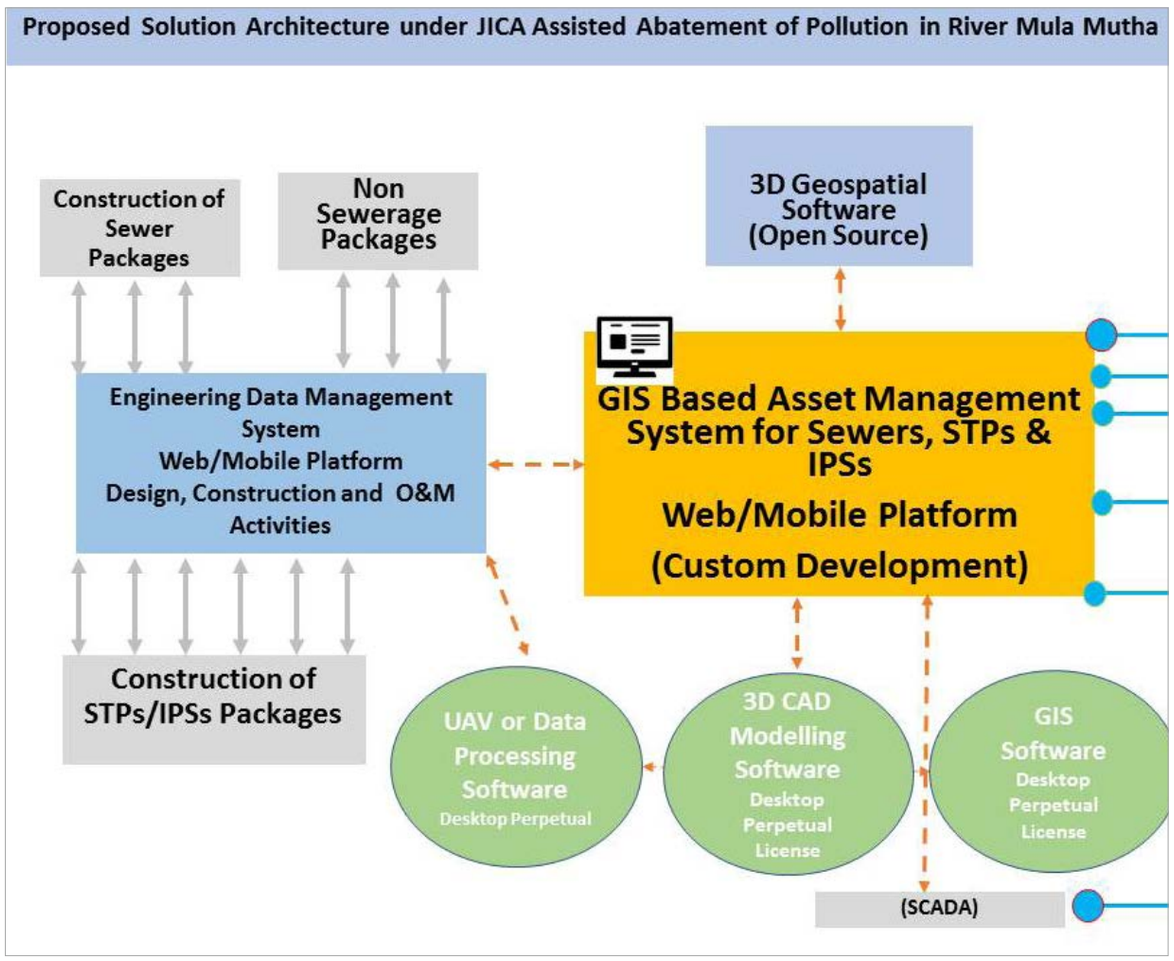


NJS Engineers India Pvt. Limited

JICA assisted abatement of pollution in river Mula Mutha in Pune (2024)
Location: Pune, Maharashtra, India

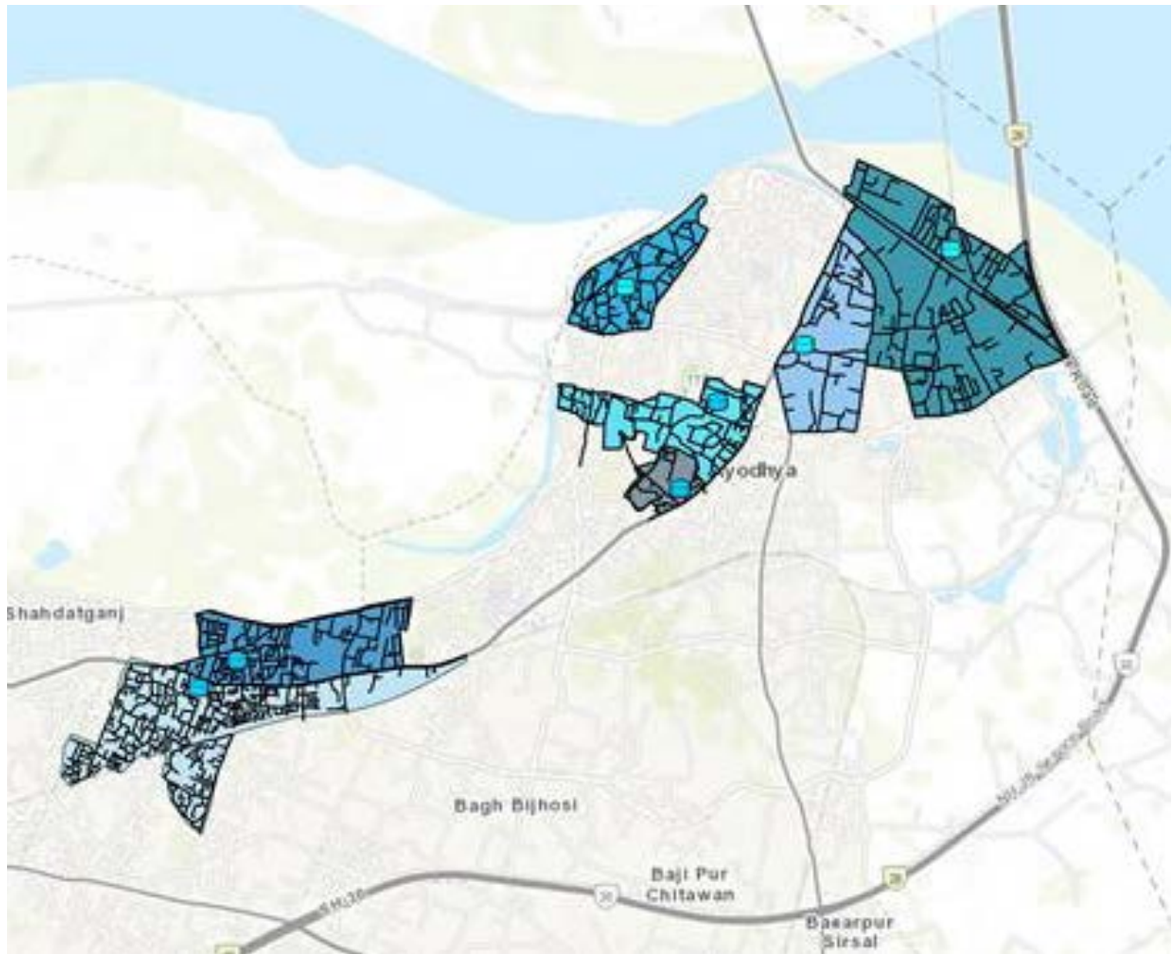
Project playbook: AutoPLANT, Bentley LumenRT, GeoStudio, iTwin, OpenCities, OpenFlows, ProjectWise, STAAD

To improve the water quality of the Mula Mutha River in Pune, NJS Engineers was tasked with designing and overseeing construction of new sewers that meet the highest standards. The goal is to reduce pollution entering the river by collecting and properly treating sewage. However, the team had to assess the current conditions and provide recommendations for improvement within a very short time frame. NJS Engineers used OpenFlows, OpenCities, and STAAD to import SCADA data into a digital model of the design. ProjectWise helped the design and construction teams review the design and provide recommendations while monitoring construction. Bentley applications helped save 30 resource months and reduced project costs by INR 240,000 as of April 2024.



30

resource months and INR 240,000 saved through early clash detection and digital modeling



347

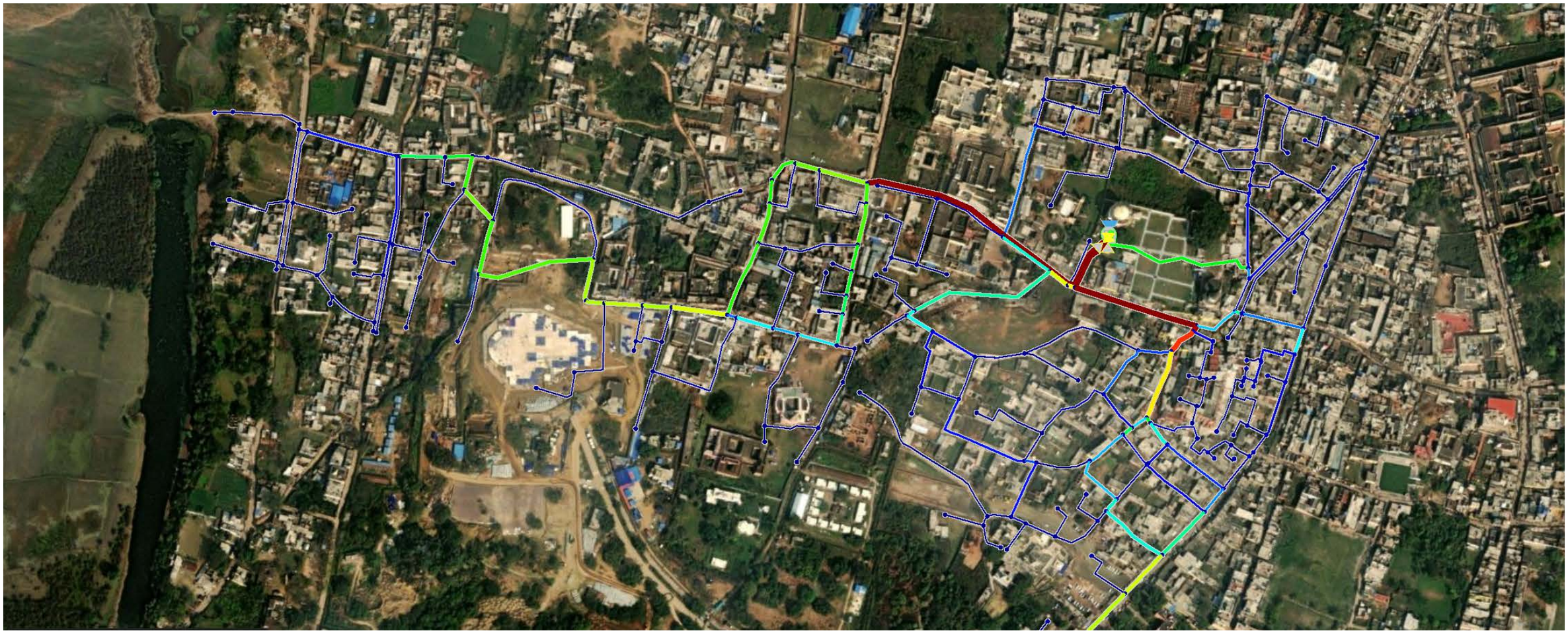
tons of carbon reduced

Geoinfo Services

Achieving 24×7 access to clean drinking water for emerging economies (2025)
Location: Ayodhya, Uttar Pradesh, India

Project playbook: OpenFlows

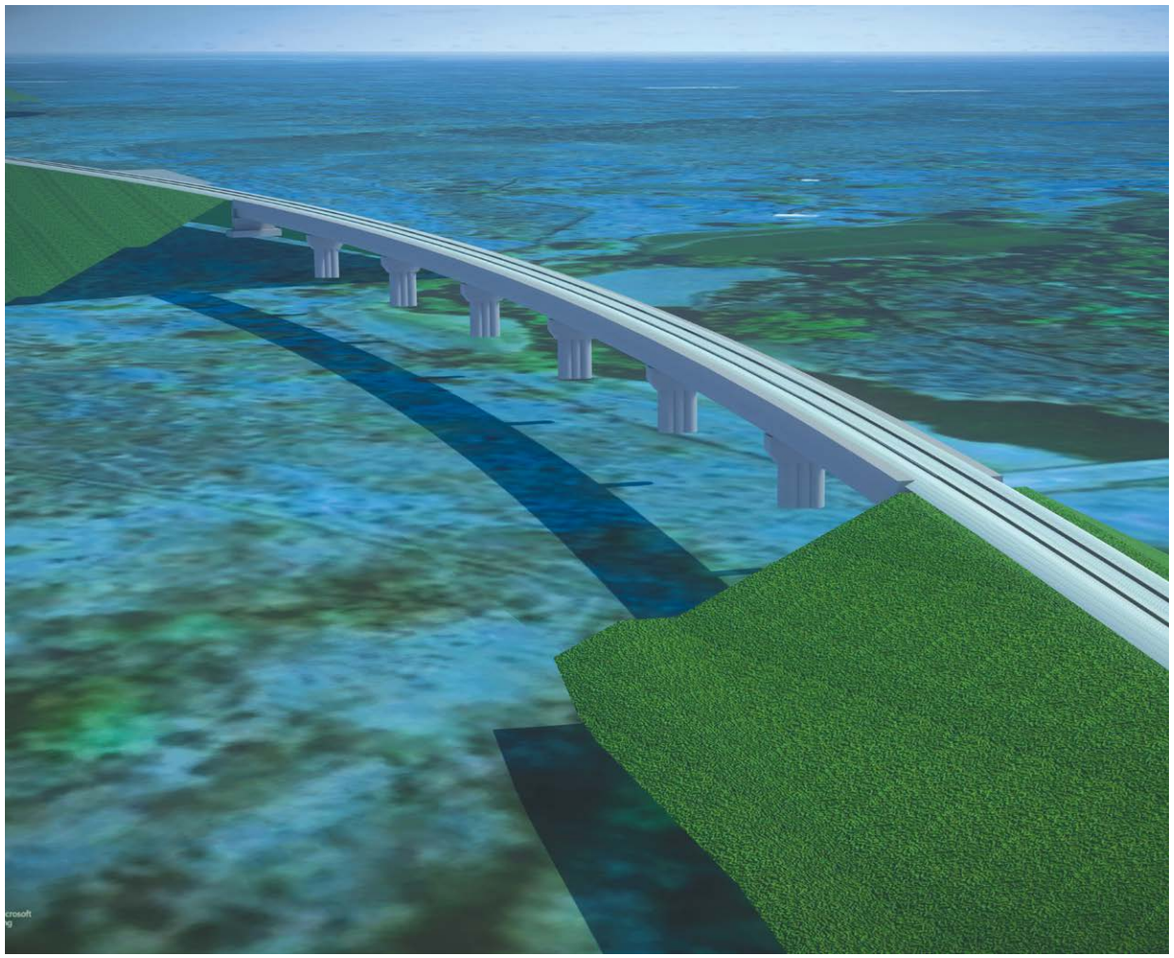
As part of the India government’s programs to provide safe, reliable drinking water and eliminate gravity-fed distribution networks, Ayodhya Authority contracted Geoinfo Services to plan and design a pressurized city water supply scheme. The new pressurized network will provide 24-hour access to clean water and reduce NRW by 35%. Geoinfo faced challenges modeling the hundreds of network pipes and nodes that previous software could not accommodate. To convert Ayodhya’s existing system to a reliable, energy-efficient network, Geoinfo needed advanced hydraulic modeling and digital twin technology.Geoinfo selected OpenFlows to generate a hydraulic model and digital twin of the city’s 24-hour supply scheme, using variable frequency drive pumps to produce the required nodal pressure. Bentley’s technology reduced design time by 75% and optimized pipe diameters, saving USD 2.5 million. The optimized network is saving USD 1.5 million in annual operating expenses and USD 46,025 in annual energy costs, while eliminating 347 tons of carbon emissions per year. The digital twin facilitates virtual monitoring with 95% confidence to improve decision-making and mitigate emergency situations.



Rail and transit

1.53

billion INR saved by integrating railway and geotechnical workflows



RITES Limited

Detailed design and engineering for the new railway link between Abu Road and Taranga Hill (2023 Participant)
Location: Rajasthan and Gujarat, India

Project playbook: MicroStation®, OpenRail™, PLAXIS®, STAAD®

This proposed new broad-gauge rail line project spans 116.6 kilometers and will provide the missing link that connects three significant and religious tourist destinations in Gujarat and Rajasthan. RITES was responsible for detailed design and engineering for a 42-kilometer section that passed through hilly, environmentally sensitive terrain. To address these site challenges amid a tight timeline, RITES needed comprehensive, integrated railway and geotechnical design and analysis technology. RITES used Bentley's OpenRail for 3D corridor modeling and design review, saving two weeks in design time. Using PLAXIS for earthworks analysis saved an additional week and minimized extraction and displacement of material, reducing the project's footprint and overall environmental impact. The integrated digital solution allowed RITES to optimize alignment while decreasing land requirements, reducing the original project cost by INR 1.53 billion while promoting sustainability and driving successful long-term project outcomes and growth.

Larsen & Toubro

Digital workflows for mass transit rail projects (2022 Participant)
Location: India

Project playbook: Bentley LumenRT, iTwin® Capture, MicroStation, OpenRail

Supporting socio-economic development in various regions in India, urban mass transit projects in the country are on the rise. Larsen & Toubro (L&T) is undertaking several of these metro, semi-high-speed, and light rail transit projects, and faces a mandate to timely deliver these projects in accordance with high standards. They previously relied on manual design and construction methods. However, to meet the tight schedules and produce quality deliverables, L&T had to develop integrated digital workflows and needed a comprehensive technology solution. They selected OpenRail to enable digital workflows and create 3D models, automating previously manual methods to produce drawings, reports, and accurate bills of quantity. The digital solution saved significant time while improving the quality of deliverables, in one case reducing the detailed cross section drawing revision time from 15 days to two days. During another project, the digital workflows and automated processes reduced resource requirements by 75% and accelerated design delivery by up to nine days.

75%

resource savings

Bridges and tunnels

480

scenarios evaluated with
3D geotechnical modeling

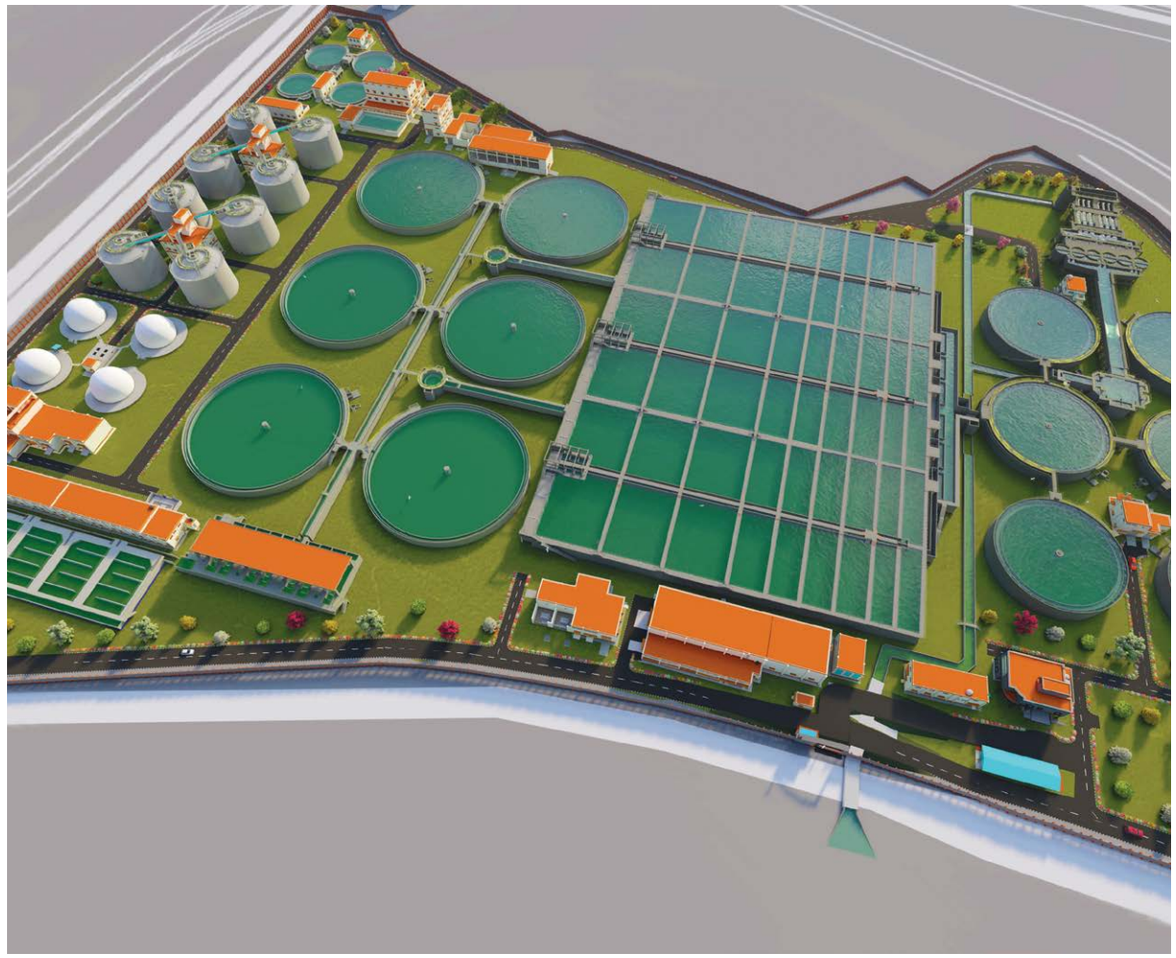
Larsen & Toubro Limited Construction

Bangalore Metro Rail project, phase 2,
package RT 02 and RT 03 (2022 Participant)
Location: Bangalore, Karnataka, India

Project playbook: PLAXIS

To help reduce traffic congestion and carbon emissions in Bangalore, public metro trains are being constructed as an alternative means to motor vehicular transport. Phase 2 of the Bangalore Metro Rail Project will extend the existing rail lines and add two new lines, totaling a length of 72 kilometers, part of which will be underground. Larsen & Toubro (L&T) Construction obtained design build contracts covering two sections of twin bored underground tunneling works. Given the mixed soil condition along the urbanized area, the company faced geotechnical challenges amid a tight construction space, requiring comprehensive 3D geotechnical modeling and analysis software. L&T Construction selected PLAXIS for soil analysis and tunnel modeling, evaluating 480 different scenarios to design the segmental lining of the bored tunnels. Using PLAXIS software, L&T Construction reduced material quantities and risk, delivering an optimal, quality design while saving costs. Working in a digital environment, they developed and shared 120 analysis files and data that can be referenced for future metro projects.

Structural engineering



17.8%

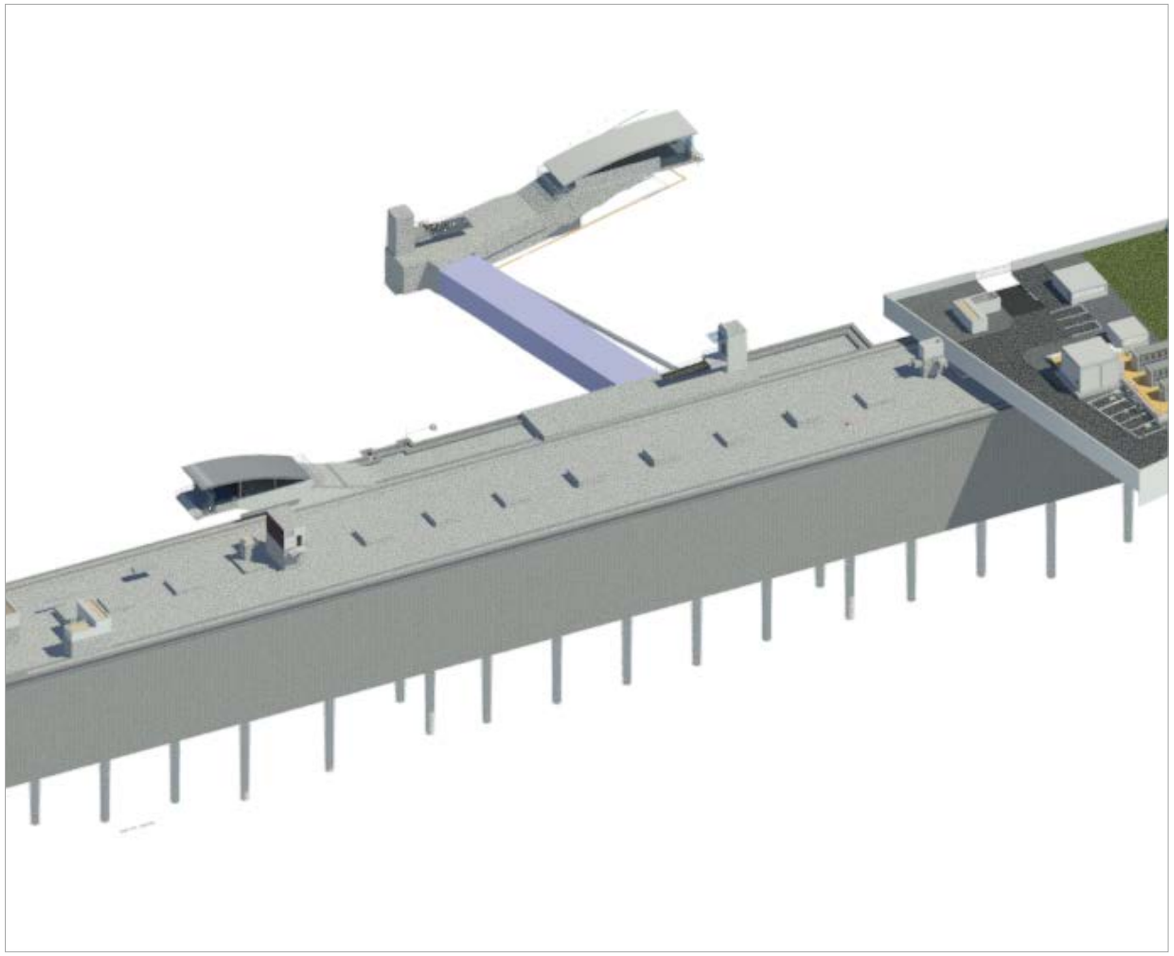
land savings

Larsen & Toubro Construction

Construction of 318 MLD (70 MGD) wastewater treatment plant
at Coronation Pillar, Delhi (2023 Participant)
Location: New Delhi, India

Project playbook: STAAD

Coronation Pillar is a new wastewater treatment plant in New Delhi, treating 318 million liters of sewage per day while reducing annual carbon emissions by approximately 14,450 tons. L&T Construction delivered the large-scale project that required multiple structures to be designed and constructed within a confined site amid liquefaction and seismic risks. Realizing that manual design and analysis methods would be ineffective to ensure optimal structural results, L&T Construction needed dynamic 3D modeling and structural analysis technology. They selected STAAD to model multiple designs with various loading configurations and applications, achieving a land savings of 17.8% and reinforced cement concrete material savings of 5%, reducing both the project's physical and carbon footprints. Using Bentley's application, L&T Construction quickly analyzed different structural designs, reducing the time to arrive at an optimal solution by 75%, compared to manual design approaches. The digital structural approach applied during this project serves as a benchmark, resulting in significant added value across other L&T Construction projects.



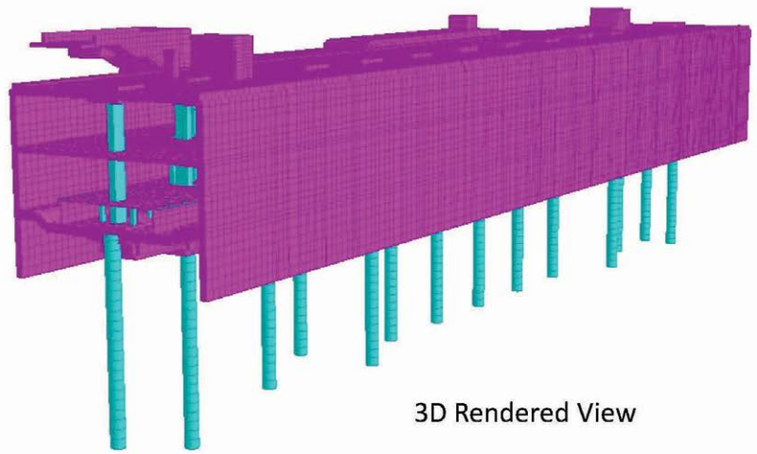
Delhi Metro Rail Corporation Limited

Design and construction of a tunnel and underground station at Krishna Park of Delhi MRTS phase-IV (2022 participant)
Location: New Delhi, India

Project playbook: PLAXIS, STAAD

The Delhi Metro Phase 4 extension will add nearly 62 kilometers to the existing 390-kilometer Delhi Metro, which has revolutionized mass transportation in India, providing reliable, eco-friendly services while minimizing roadway accidents and vehicular carbon emissions. The Krishna Park project is part of this extension and includes the structural design and construction of twin bore tunnels and an underground station. Located in a densely populated urban area with alluvial soil conditions, the project presented structural and geotechnical engineering challenges, requiring an integrated BIM solution. Leveraging PLAXIS and STAAD, the project team modeled and analyzed the soil, as well as building and tunnel structures, monitoring and simulating structural loads and excavation works. Bentley's integrated BIM applications streamlined workflows, facilitating clash detection and enabling real-time model modifications prior to work on site, saving 1,000 resource hours and associated costs. Through collaborative digital modeling and analysis, the team optimized structural design, reducing concrete material quantities by approximately 1,500 cubic meters and steel reinforcements by 250 megatons.

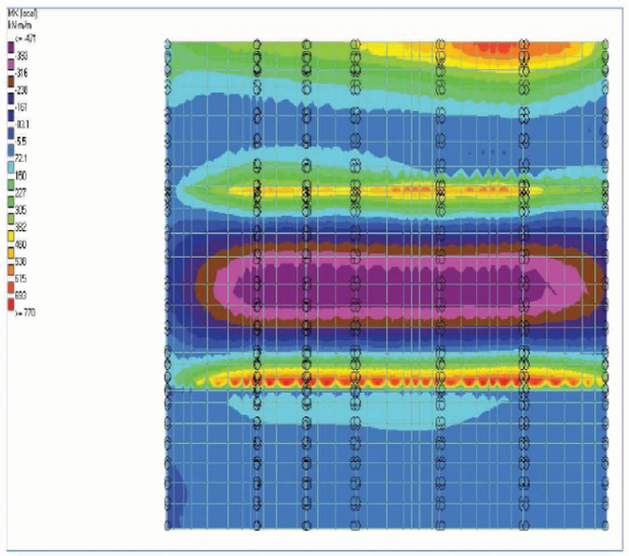
Design of Underground Station



3D Rendered View

Stress Contours

- Based on the various load combinations, stress contours are generated.
- For design of any element, load combination producing maximum stresses are adopted.
- Stress contours are then referred to extract the design forces.



1,000

resource hours saved in tunnel and underground station construction in Delhi metro phase IV

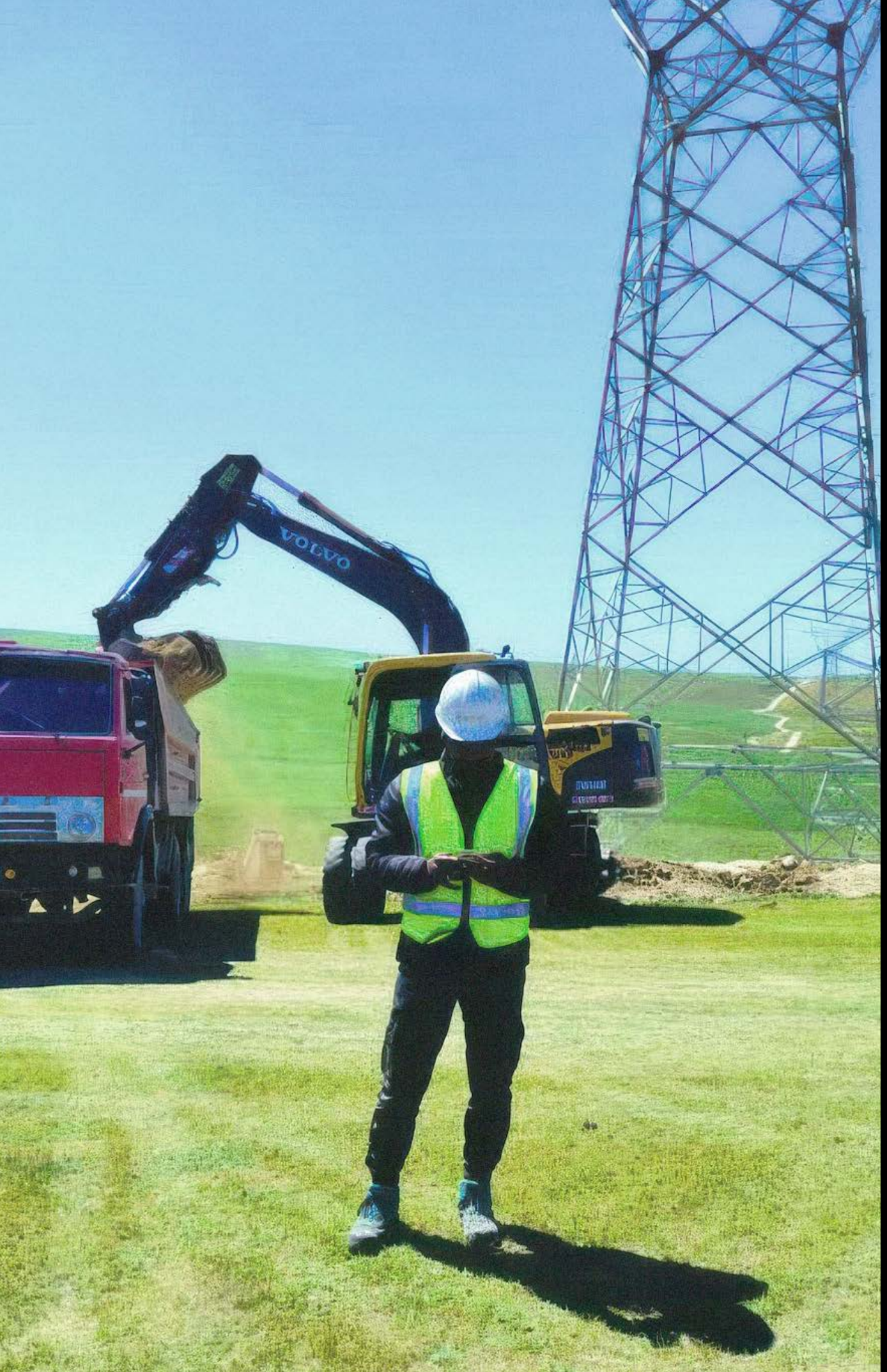
Construction

Kalpataru Power Transmission Limited

Project SPARK - digital transformation in engineering, procurement, and construction (2023 participant)
Location: Mumbai, Maharashtra, India

Project playbook: nPulse®

Kalpataru Power Transmission (KPT) initiated a project to enhance manual and disparate engineering, procurement, and construction practices. Known as Project SPARK, it covered 55 projects spanning power transmission, substation, and railway infrastructure segments. KPT realized that prior digital efforts lacked integration and automation capabilities. With no historical reference for their digital initiatives and a limited budget, they needed a cost-efficient, integrated, and interoperable software solution. KPT selected nPulse, integrating it with third-party applications and artificial analytics, to establish a centralized digital approach and single source of truth. This application facilitated digital data integration and enabled near real-time construction planning, monitoring, and risk management. By improving digital delivery, KPT shortened project completion times by 8% to 10%, reduced overall costs by up to 17%, and improved their overall carbon footprint, reducing emissions equivalent to approximately 3,600 megatons. Their digitization journey is driving a culture change, adopting data-based workflows and processes for more informed decision-making and sustainable construction.



3,600

megatons of carbon
emissions reduced

WSP - Louis Berger

Versova Bandra sea link project - VBSL (2022 participant)
Location: Mumbai, Maharashtra, India

Project playbook: AssetWise®, iTwin Capture, ProjectWise®, STAAD, SYNCHRO™

As part of Mumbai's coastal road project, the Versova Bandra sea link bridge is being constructed to reduce traffic congestion along the Western Expressway and save commuters two hours round-trip. Located deep into the sea, the bridge spans 17.17 kilometers and includes several bridge structures and toll plazas. WSP, the project management consultant, faced construction difficulties and coordination challenges working with multiple stakeholders. Their previous software lacked visual clarity and interoperability. WSP knew that they needed integrated technology and a connected project data environment. They selected iTwin Capture and SYNCHRO to create an accurate mixed-reality simulation, enabling remote construction monitoring. Integrating ProjectWise and AssetWise, they established a connected digital environment, providing better project control for more informed decision-making among the stakeholders. Using Bentley's applications, WSP established a project digital twin, streamlining coordination and mitigating potential risks on site. They plan to use AssetWise to develop an asset information model and a performance digital twin for approximately 70,000 assets.

Facilities, campuses, and cities

24%

lower carbon emissions

Central Projects Organisation, ITC Limited

ITC Green Centre phase II building 3 (2023 participant)
Location: Bangalore, Karnataka, India

Project playbook: STAAD, SYNCHRO

While developing and building Green Center Building 3, Central Projects Organisation (CPO) needed to meet LEED Platinum standards and get as close to zero environmental impact as they could. The company transitioned to BIM and digital design five years ago, and knew that STAAD and SYNCHRO could help them efficiently create 3D models that could then be used for 4D and 5D construction simulations. Their workflow on the project helps them address issues and queries faster while more easily sharing information between teams. The ease of project iteration enabled them to reduce energy use by 22.1%, carbon emissions by 24%, and water use by 43.5%.

Process and power generation

10%

acceleration in the project timeline by decreasing information latency from one month to one day

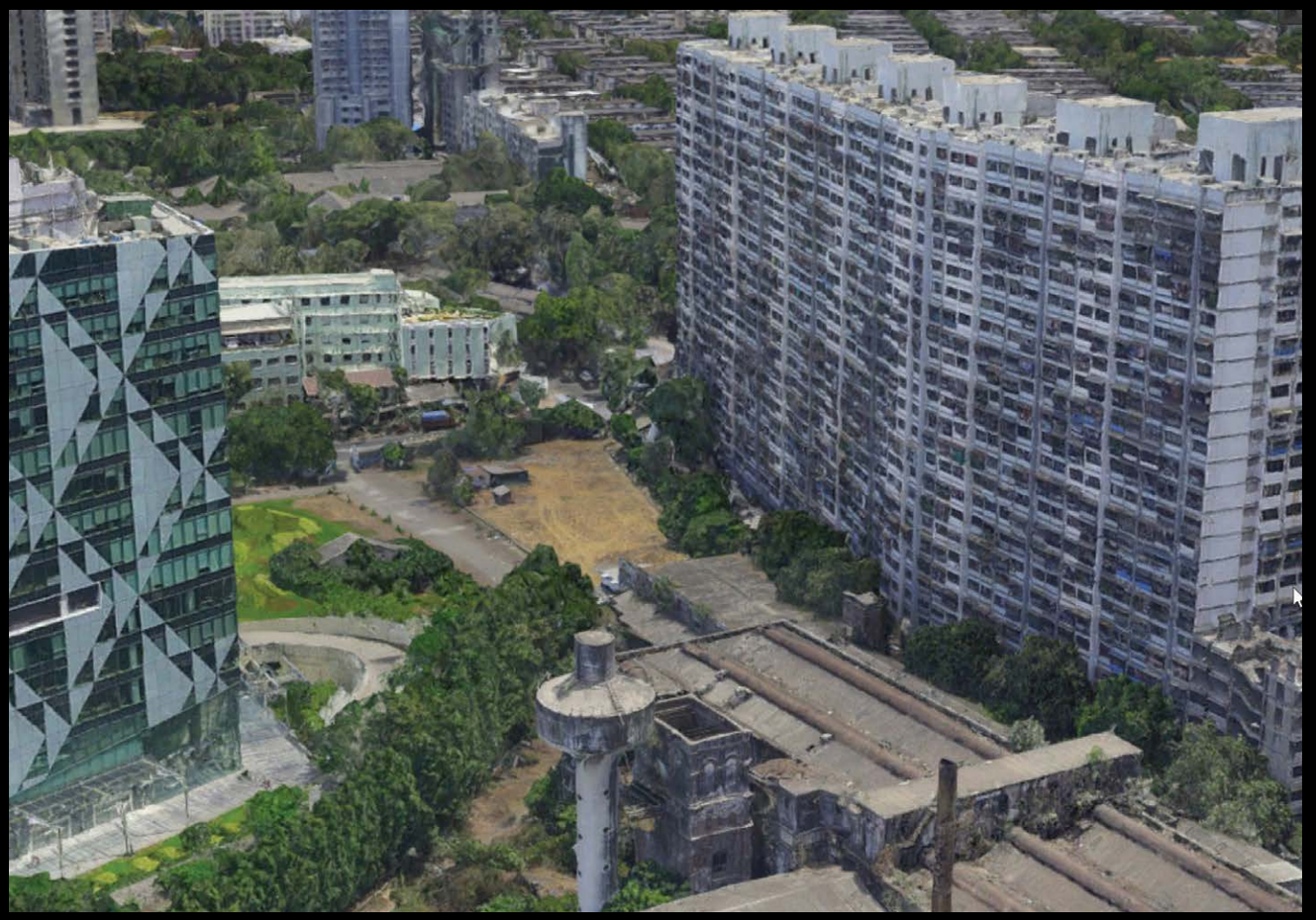
Larsen & Toubro, PT&D IC

230MW AC solar power generation project (2023 participant)
Location: Tuticorin, Tamil Nadu, India

Project playbook: iTwin, nPulse, SYNCHRO

A 230-megawatt solar power generation project in Tamil Nadu, India, aims to reduce the region's dependency on thermal power. The power generation station is expected to contribute 549 million units of electricity and offset 473 tons of carbon emissions. Larsen & Toubro was tasked with delivering a solar photovoltaic plant, pooling substation, and transmission lines. The project team needed to coordinate multiple disciplines during the pandemic lockdown, requiring a connected data environment for collaborative 3D modeling and 4D construction simulation. They selected iTwin and nPulse to create a common 3D digital platform where all information and models were stored, accessible, and shared remotely across all stakeholders. Integrating SYNCHRO to visualize the construction process helped Larsen & Toubro optimize the work sequence to keep the project on schedule. Using Bentley's applications reduced information latency from one month to one day, as well as shortened the project duration by 10%. The digital twin solution not only resulted in ROI benefits, but also provided end-to-end project visibility and competitive advantages, changing the DNA of workflows to set a benchmark for future projects.

Surveying and monitoring



Genesys International Corporation Limited

3D digital twin – urban India (2022 participant)
Location: Mumbai, Maharashtra, India

Project playbook: iTwin Capture, MicroStation, OpenCities®, OpenTower®

This digital twin project in India is a 3D content program that will capture data for simulation, planning, and analysis for different use applications, including disaster prevention and 5G tower placement, supporting smart city development and urban initiatives. Under the program, Genesys is mapping the top 100 Indian cities, covering 30,000 square kilometers. They faced challenges collecting quality data without disturbing the public and residents, compounded by technology compatibility issues and voluminous data sets. They explored numerous reality modeling and digital twin applications, but they lacked quality and interoperability. Genesys selected iTwin Capture given its ability to generate unmatched quality reality mesh outputs accessible via various content sharing platforms. Using Bentley's application supported environmentally friendly cloud-based data processing workflows, saving users the cost of purchasing specialized IT software while reducing the carbon footprint. The digital twin solution provides realistic visualizations, connecting people, processes, and technology in a collaborative, web-based environment to support smarter, greener, more efficient planning, design, and industry operations.

Enterprise engineering and asset performance modeling

40%

energy savings

Aarti Industries Limited

AIL 3.0 – digital journey with ProjectWise I (2023 participant)
Location: Gujarat, India

Project playbook: ProjectWise

Leading Indian chemical and pharmaceutical manufacturer AIL initiated a project to develop an engineering document management system (EDMS). Previous manual engineering documentation workflows were time consuming and lacked controlled access, security, and lifecycle management capabilities, causing a risk of errors and inaccuracies. Initial digitization efforts did not provide the full functionalities that AIL sought. Therefore, they needed robust digital technology capable of managing engineering data across the project lifecycle at an enterprise scale. AIL selected ProjectWise as the foundation for their EDMS, which allowed them to design and customize their document management workflows to meet their specific needs. The platform provided a single source of truth, streamlining their documentation, transaction, and engineering processes. The Bentley-based solution delivered an ROI of 116.67% in saved resource hours. It also provided a collaborative digital environment, internally and with stakeholders, reducing transaction times by 30% and the communication gaps by 95%. The digital management system saved 40% in energy consumption and 50% in paper, supporting more environmentally sustainable practices.

“What our users do with our product makes a difference in the world.”

- Keith Bentley

In closing

Invitation to collaborate

The future of infrastructure is digital. Bentley invites industry leaders, engineers, architects, and government bodies to partner with us in that shared vision. Our comprehensive suite of digital engineering solutions is designed to enable smarter decision-making, streamline workflows, and enhance collaboration.

Together, we can tackle the complex challenges of modern infrastructure, from urbanisation to sustainability. Let's continue to innovate, improve efficiency, and build a more sustainable future for India.

Join us in shaping tomorrow's infrastructure today.

Acknowledgments

Thank you to the users, partners, and collaborators involved in the featured projects.

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Advancing Infrastructure