MicroStation® for Water Infrastructure

Global Case Studies in Innovative Design and Engineering

Bentley®

CHALLENGE:

Disparate and Complex Software across Disciplines

The planning, analysis, and design of sustainable and resilient water, wastewater, and stormwater infrastructure is complex and ever changing.

No matter the type of water infrastructure you are supporting, whether it is a water/wastewater treatment plant, water distribution, sewer collection and transport, urban drainage, or transportation drainage, delivering an effective design requires a knowledge and understanding of how the asset interacts with its surroundings and the existing infrastructure within the communities it serves.

Though vital for development, safety, health, and sustainability, these projects are often completed by several separate teams using different tools and file formats. Working in a vacuum only leads to a lack of coordination across disciplines, costly mistakes from out-of-date data, and missed opportunities to address conflicts.

It is time for connected solutions that support the whole picture.

SOLUTION:

Connected, Complete, Innovative Solutions

Water and wastewater engineers, water utilities designers, project managers, and engineering firms worldwide choose Bentley's MicroStation so they can:

- **Access and share data** regardless of file format without data conversions. Users can incorporate legacy client data and a variety of natively supported file formats, like DWG, SHP, point cloud data, and more, so workflows are accelerated.
- **Incorporate multiple disciplines** and easily integrate models, drawings, documents, and data from other sources to significantly improve the design process by eliminating errors prior to construction.
- **Scale to meet the needs of all projects**—large or small. Its robust modeling capabilities allow users to rapidly model projects of any scale and complexity while confidently maintaining design intent.
- **Design within real-world context** by integrating representations of existing conditions into designs to generate accurate 3D models. Leverage raster images, point clouds, reality meshes, geospatial information systems, and more.
- **Develop complex models more easily** with a comprehensive set of mesh, solid, surface, and feature modeling tools, so users can more easily develop demanding engineering designs.
- **Output designs as plan sets or 3D videos**—and everything in between—in one application.

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Using MicroStation

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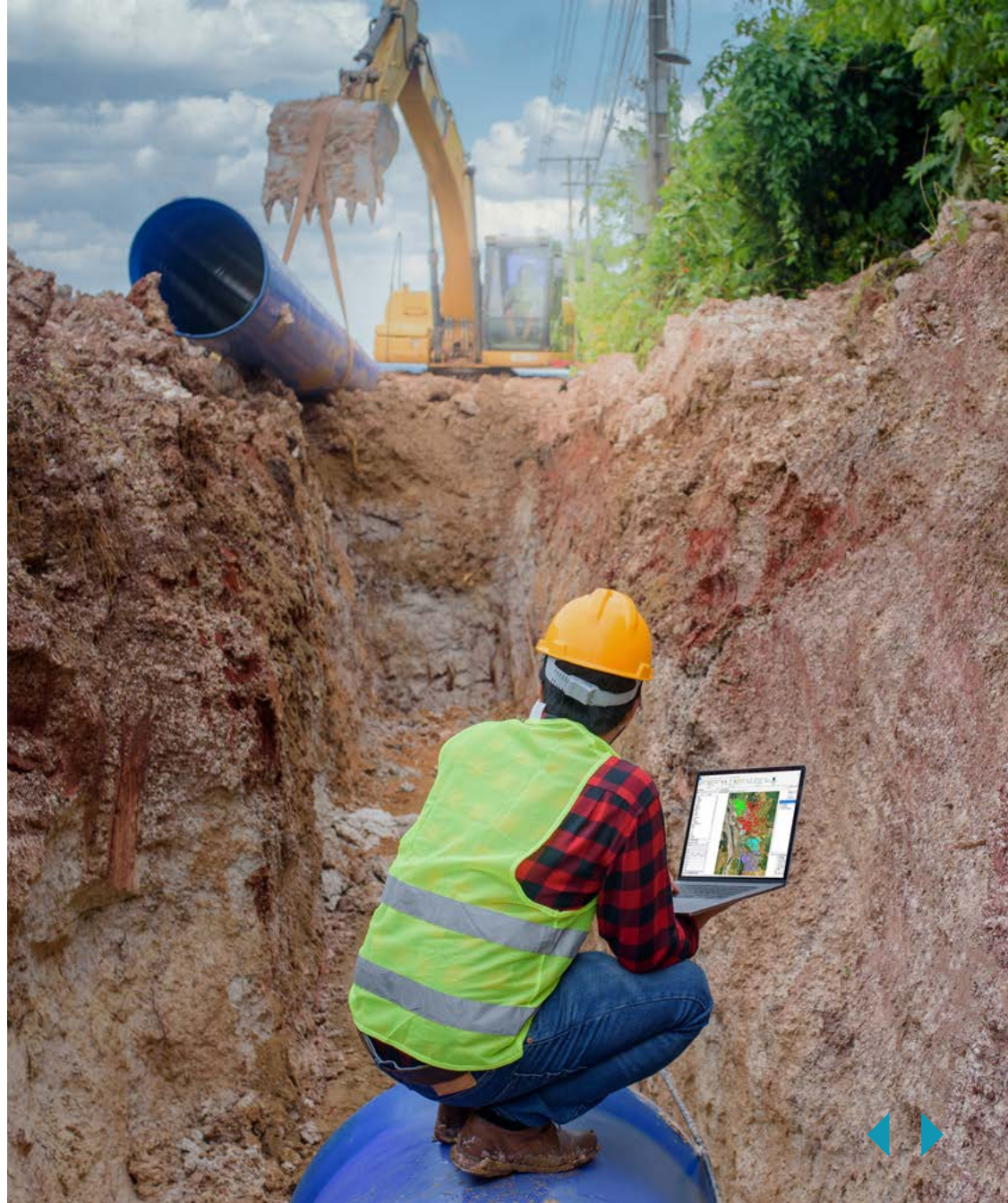

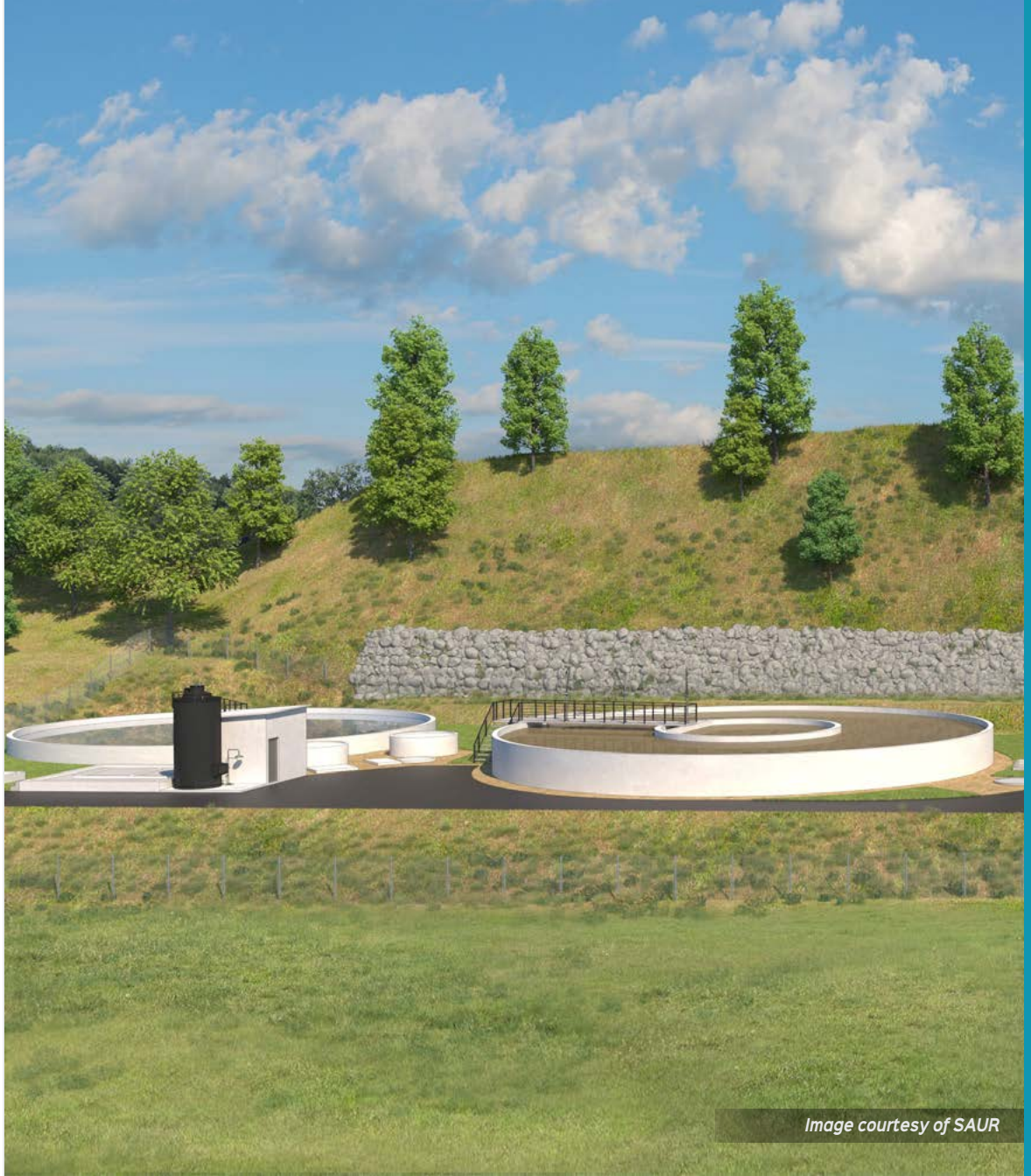

Image courtesy of SAUR

CASE STUDY

New Saint-Flour Water Treatment Plant

SAUR, FRANCE

A EUR 5 million project was initiated to replace a 60-year-old water treatment plant in Saint-Flour that no longer met the applicable wastewater regulations or accommodated the growing population. The new facility is a 13,600-population-equivalent water treatment plant with a 900-cubic-meter-per-hour capacity. Located at a foothill in a flood zone of the Rhone Alpes, the project presented a tight footprint and needed a limited visual impact on the surrounding area. To optimize design and win the contract within the allotted time, SAUR chose to implement 3D modeling and visualization technology.

The team used MicroStation to model and analyze the facility and to present its design to the client. Working in MicroStation facilitated multidiscipline design integration and saved 20% in time to deliver a cost-effective design proposal. The quality of graphic renderings and 3D visualization features of MicroStation enabled the team to present an accurate, realistic representation of the design to the client to win the contract.

"Working in MicroStation in 3D—a tool mastered by our teams—has allowed us to save time on the design (more than 20% on the building, including some components coming from previous successful constructions) and to make location decisions quickly and effectively. The graphic quality of the renderings produced by MicroStation strengthened the professional impact of our work."

— David Dischly, Works Manager, SAUR

CASE STUDY

Ashbridges Bay Treatment Plant Outfall

HATCH, CANADA

With team members in Australia, Canada, and the United Kingdom, Hatch was responsible for the design and construction of a new tunneled outfall that will send treated wastewater from the Ashbridges Bay Treatment Plant into Lake Ontario. The treatment plant is one of Canada's largest and oldest water treatment plants, built in 1910 and operational in 1917. It is the largest of Toronto's four sewage plants and serves about 1.5 million residents, with a maximum hydraulic capacity of 1.136 million liters of wastewater per day. Hatch needed applications that combined computer-aided design and engineering analysis for the estimated CAD$ 350 million wastewater outfall project. They also had to minimize costs while considering the underwater soil and environmental features.

Using Bentley's OpenRoads™, Hatch's engineers predicted the geological boundary conditions below the lake to steer significant design decisions. Using MicroStation, they modeled all elements of the shaft and tunnel, allowing them to complete the tunnel rings and determine the proper rotation of each ring to help with possible connection problems. They collaborated across several time zones in ProjectWise's® connected data environment to keep the project on time and under budget. They delivered a high-quality design by using digital models and structural analysis, conserving CAD$ 25,000 in resource hours. They also saved more than CAD$ 45,000 on paper and printing, as well as consolidating their design team to save more than CAD$ 350,000.

"The Bentley suite of software was implemented on the ABTPO project to build practical solutions that solve unique engineering challenges, to facilitate a connected and collaborative work environment, and to deliver a cost-effective and efficient project."

— Kevin Waher, Senior Project Manager Tunnels, Hatch Infrastructure

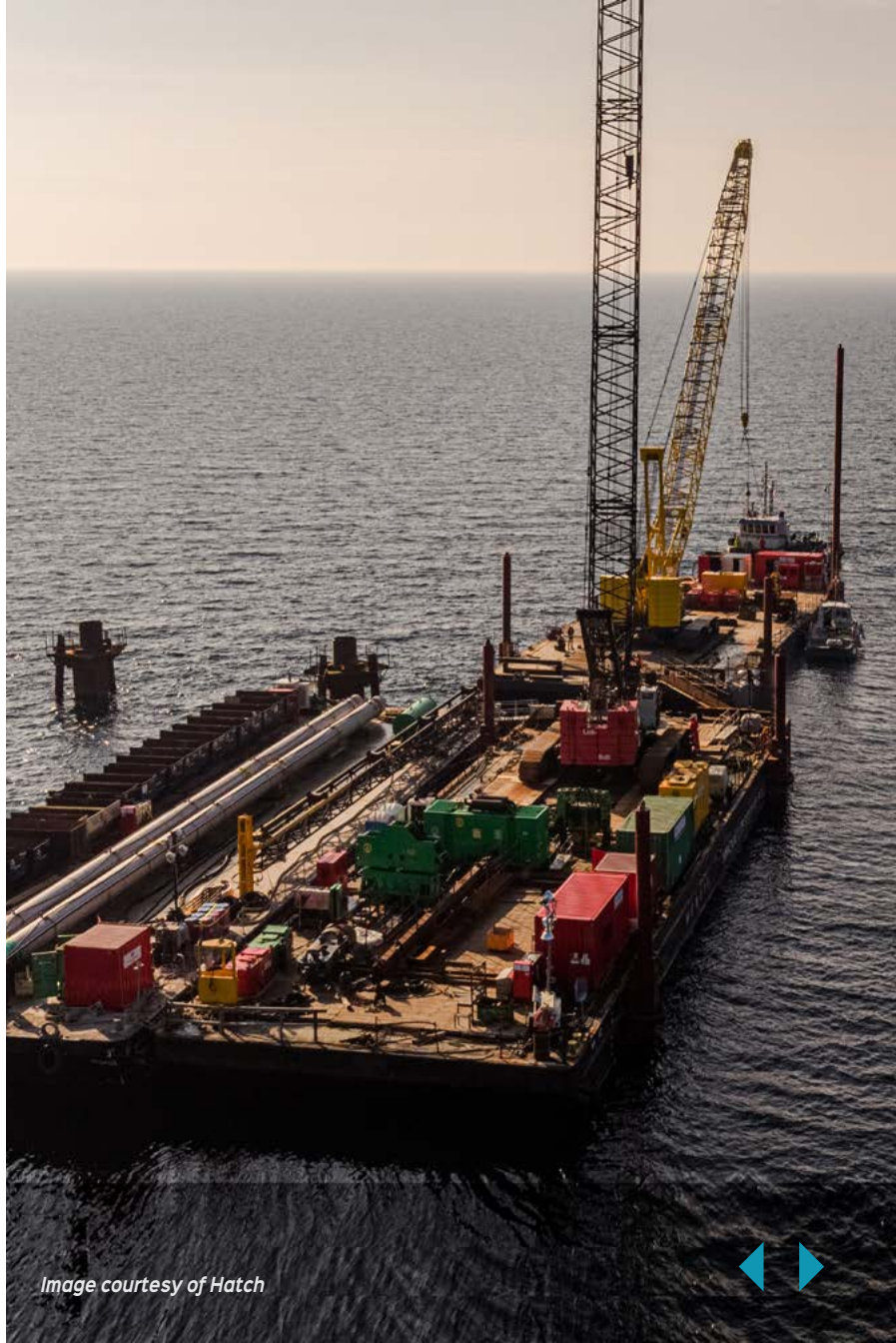

Image courtesy of Hatch

Image courtesy of COBA

CASE STUDY

Digital Design of MARPOL Waste Treatment Plant

COBA, BAHAMAS

In Freeport, Grand Bahama Island, the state-of-the-art MARPOL waste treatment plant facility will receive and treat oily residues to produce a high-quality fuel that can be sent to local markets or exported for sale. The facility will include a storage and treatment plant and a ship berthing area connected by a pipeline on a 60-foot-wide easement. COBA was responsible for preliminary and detailed design, as well as for performing a hazard and operability study. The multidiscipline design team faced a limited footprint with a complex piping layout.

OpenPlant® and AutoPIPE® helped model and analyze design alternatives for the piping and equipment, optimizing structural integrity within the confined space while saving significant engineering time. Using OpenBuildings® Designer, the team identified and resolved conflicts between the piping layout and structural elements. The interoperability of MicroStation facilitated development of a digital twin. Using a connected data environment based on ProjectWise streamlined digital workflows, increasing productivity by an estimated 10%.

"Information from external entities was incorporated into the digital twin with little effort. By means of the broad range of file formats that MicroStation reads and manipulates, the geometry of the different elements was incorporated in the digital environment. This was a crucial part of the working process allowing the team to accurately verify the feasibility of the different solutions."

– Pedro Serra, Engineer, COBA

CASE STUDY

Northeast Water Purification Plant Expansion

HOUSTON WATERWORKS TEAM, UNITED STATES

To help reduce dependency on groundwater and increase the amount of fresh drinking water, the city of Houston initiated the Northeast Water Purification Plant expansion, which will add 320 million gallons per day by 2024. The Houston Waterworks joint venture team was tasked with designing and constructing this USD 1.4 billion expansion, with detailed BIM requirements that included handover of a federated model and producing more than 5,500 construction drawings.

The team established a connected data environment using OpenPlant, OpenBuildings Designer, and MicroStation. The connected data environment helped design in context and conduct collision detection, which optimized design efficiency and reduced construction rework. Bentley applications eliminated manual duplication of the four water treatment trains, saving 1,200 hours per train. Using iModels saved a total of 3,600 hours per submittal.

"The innovative designs and treatment processes represented accurately and completely in a digital environment using Bentley solutions will provide the city of Houston an equivalent opportunity for innovative and streamlined operations and maintenance moving into the years ahead."

– Donna DeMarco, Water Global Platform Technology Lead, Jacobs Engineering

Image courtesy of Houston Waterworks Team

Image courtesy of PGESCO

CASE STUDY

Al Hammam "New Delta" Agricultural Drainage Water Treatment Plant

PGESCO, EGYPT

PGESCO was contracted to build an agricultural drainage water treatment plant, one of the world's largest of its type, south of Al Hammam. The plant has a capacity of 7.5 million cubic meters of water per day and irrigates up to 2,200 acres west of the Nile Delta area, helping to expand agriculture and develop the Western Desert region. The canal carrying agricultural wastewater from the plant will stretch over 114 kilometers, with 22 kilometers of pipes. PGESCO needed flexible digital applications that could accommodate the wide scope of the project.

A longtime user of Bentley applications, PGESCO used ProjectWise to establish an open, connected data environment, helping team members in various disciplines manage, share, and distribute project information, making all documents and engineering drawings readily accessible as needed. Additionally, they used MicroStation for design drafting. With the help of these solutions, PGESCO was able to meet their client's requirements and finish the plant on time and within budget.

"With Bentley, PGESCO was able to meet project challenges meeting the client's demands and contractual commitment and finishing all deliverables within schedule and on estimated budget."

– Mohamed Mostafa, Senior Civil Engineer, PGESCO

CASE STUDY

INTELLIGENT DESIGN OF Automated Waste Management for Singapore General Hospital

STREAM ENVIRONMENT SDN. BHD., SINGAPORE

A total solution provider of automated waste collection systems (AWCS), Stream Environment was retained to perform engineering, conceptual, and detailed design for Singapore General Hospital. Stream Environment's AWCS transports waste through underground pipes at high speeds to a sealed container located almost 2.5 kilometers away, ensuring a secure process aligned with the highest health and hygiene standards. Given the project's strict schedules and tight deadlines, Stream Environment needed a comprehensive alternative to traditional CAD software.

The electrical team implemented MicroStation and Promis.e® to model and visualize the entire system, as well as automate production of electrical drawings. The team met the three-day delivery of the electrical drawings, which reduced typical design time by seven days. Navigator facilitated model sharing and design review through iModels®. Bentley applications helped the team create standard component libraries and automate previous manual processes, involving design accuracy and ensuring compliance with international standards while saving an estimated RM 200,000.

"Bentley products were a great help to STREAM. We saved design time, produced more accurate drawings, and we enhanced the skills of the engineers. We were able to build libraries of databases and templates for the engineering design team that are of STREAM standards and provide design works that meet international standards. And, most of all Bentley products helped the company gain profit on projects up to an estimated of RM 200,000 per project."

– Magesh Suppu Kumar, Stream Environment, Sdn. Bhd.

Image courtesy of Stream Environment Sdn. Bhd.

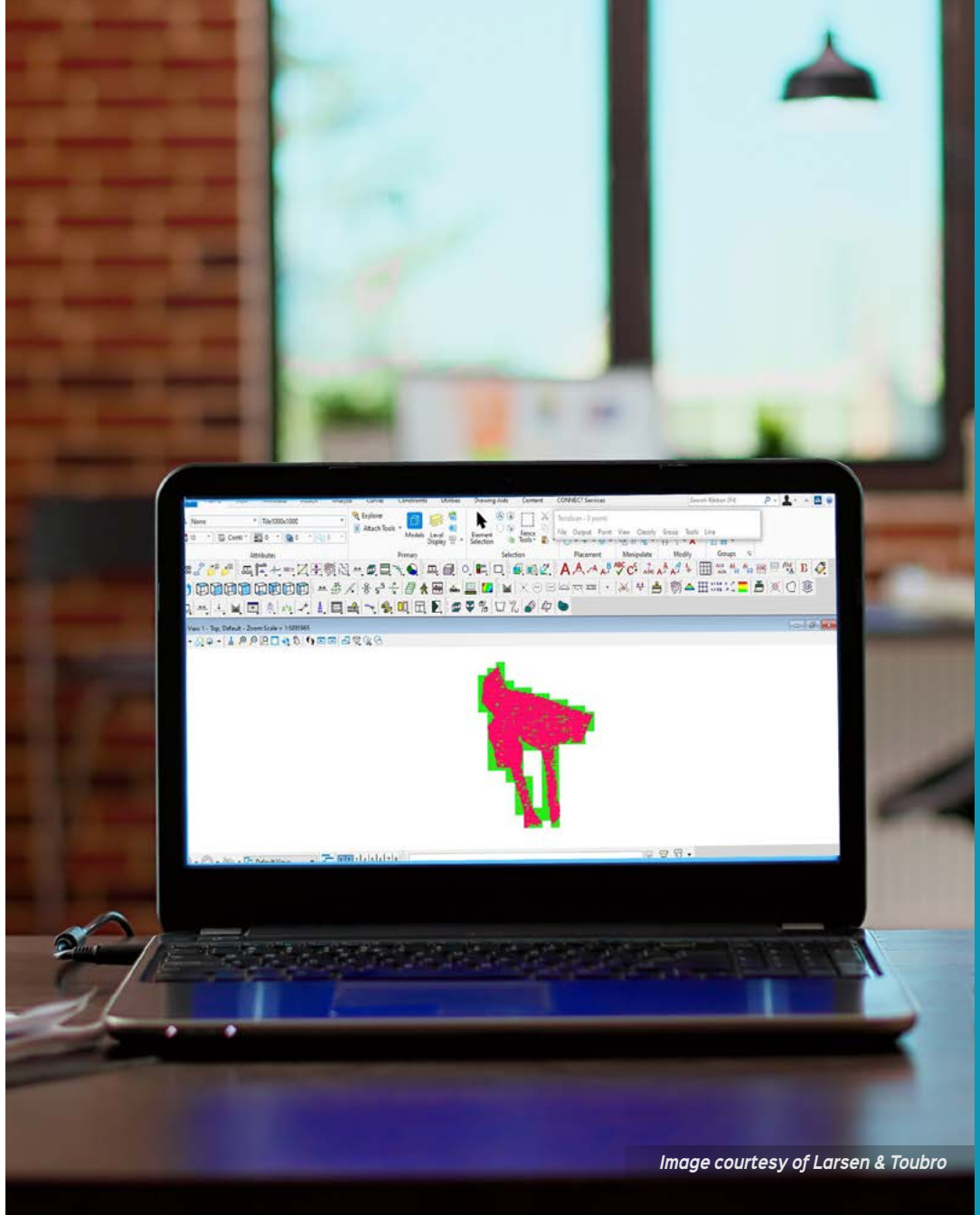

Image courtesy of Larsen & Toubro

CASE STUDY

INDIRA SAGAR PROJECT

Kalisindh & Parwati Micro Lift Irrigation Schemes

LARSEN & TOUBRO, INDIA

Narmada Valley Development Authority initiated a project to irrigate 200,000 hectares of farmland by assessing water from the Indira Sagar Reservoir. Designer Larsen & Toubro faced site challenges when surveying more than 4,500 square kilometers within a tight timeline. They recognized the limitations of traditional methods and various photogrammetry software, realizing that they required full lifecycle digitization to meet modeling and mapping demands.

They conducted aerial LiDAR surveys, using ContextCapture™ and MicroStation to process the point clouds and integrate GIS data from their in-house web portal. They generated accurate 3D reality meshes in three months and topographic maps in two months. They established a digital twin, providing a dynamic, real-time view of the project for progress monitoring. Using Bentley's applications, they determined optimal routes and delivered designs ahead of schedule, while saving costs and avoiding material waste.

"Using Bentley's MicroStation helped the data processing team to save time by 50% to prepare a topographic map and contour generation in comparison with other market software. The topographic map for the entire 4,500 square kilometers was prepared in less than two months using MicroStation. This is mainly due to user-friendly readily available modeling and design tools in the software."

— Pari Y, Head of Geospatial Technologies, Larsen & Toubro

CASE STUDY

PIPELINE NETWORK MODEL OF Anamaduwa Integrated Water Supply Project

UTE SETAPI, SRI LANKA

Located in Sri Lanka, Anamaduwa is dependent on ground water sources with high salinity and is suffering from an acute shortage of safe drinking water. To permanently address the drinking water issue, UTE Setapi Ellipse was retained to design the pipe network for the water distribution and transmission system and coordinate execution across 125 municipalities. Given the financial constraints, the client requested separate water distribution designs to accommodate an 800-kilometer pipe covering all roads and a 325-kilometer pipe length spanning selected roads.

MicroStation and OpenFlows™ helped create a geo-coordinated water supply network that considered real-time field conditions. The applications facilitated seamless integration with third-party GIS and planning features to leverage multisource data within the hydraulic network model. The dynamic modeling and analysis features evaluated numerous network scenarios for better decision-making, saving 20% to 25% in resource hours and shortening design review by 30% to 40%.

"Bentley's tools seamlessly integrated with other GIS and planning tools, helping us to bring all forms of data into project information and create network design in line with field reality."

— Mohamed Sijjeen, Water Supply Design Engineer,
UTE Setapi Ellipse Anamaduwa

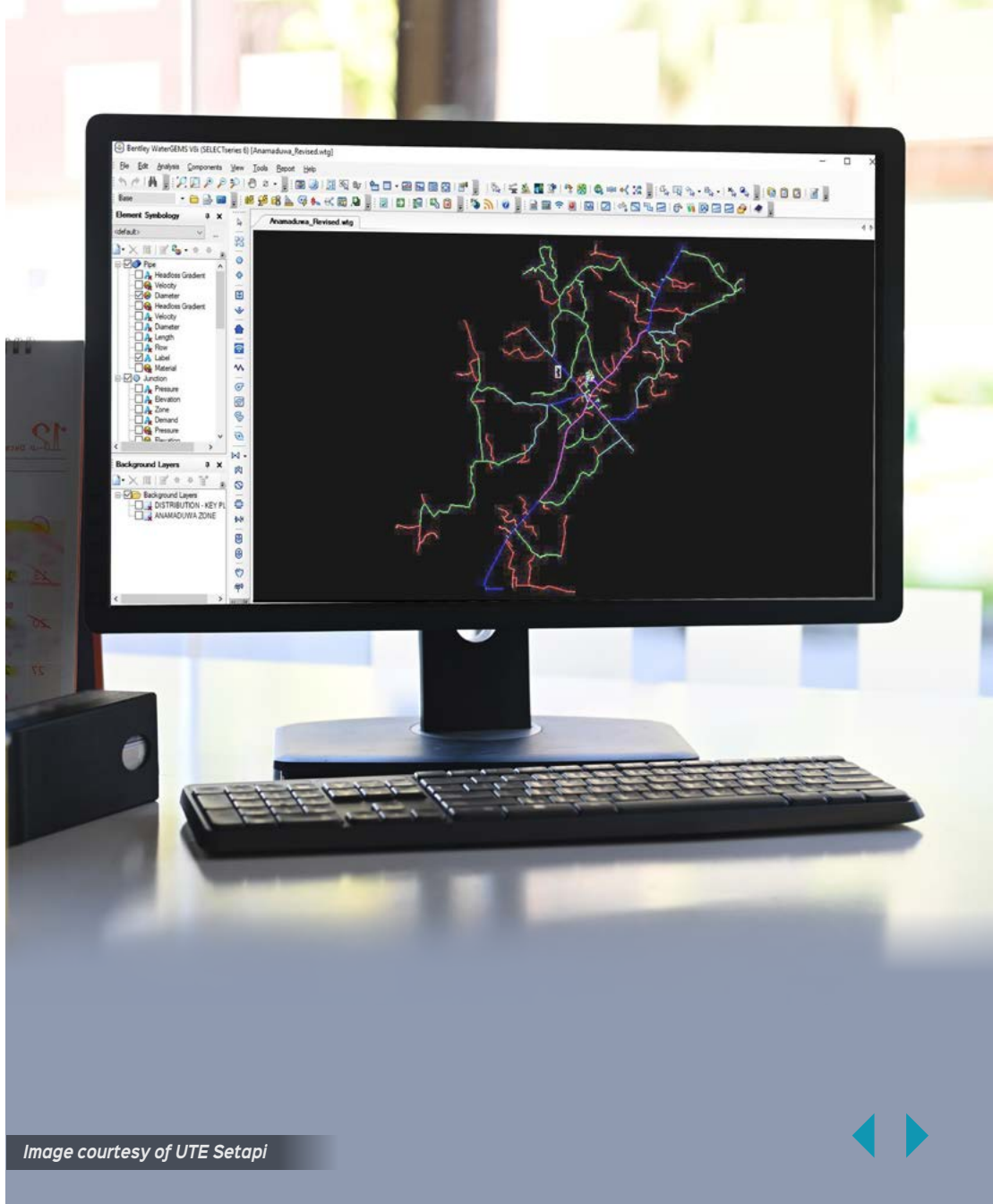

Image courtesy of UTE Setapi

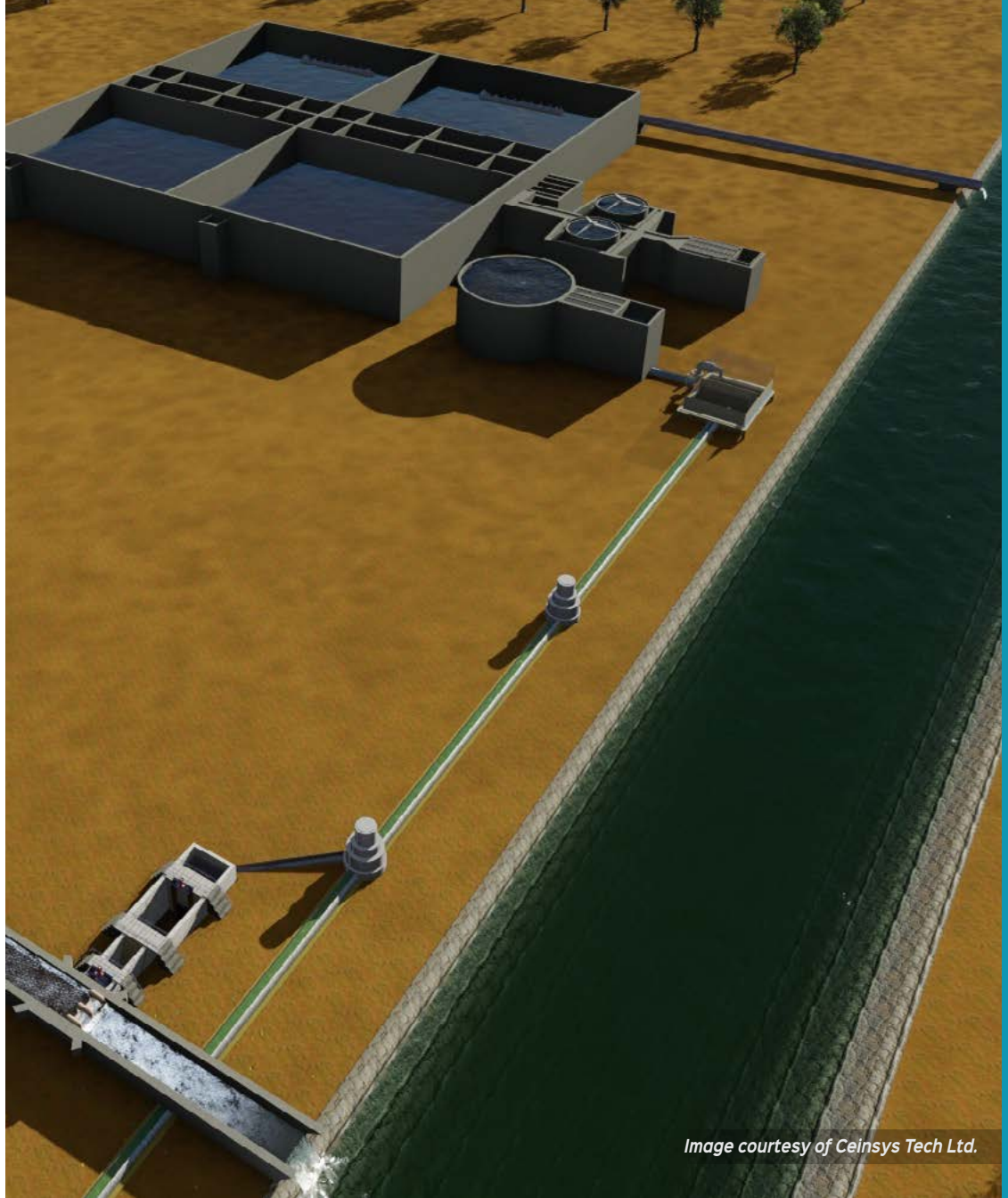

Image courtesy of Ceinsys Tech Ltd.

CASE STUDY

Sewarge Master Plan of Jagdalpur

CEINSYS TECH LTD., INDIA

The city of Jagdalpur is the administrative headquarters of the Bastar district. To improve the sewerage management system and reduce pollutants, Jagdalpur Municipal Corporation initiated a USD 10.5 million project to ensure that discharged sewerage is properly collected, transported, and treated. Ceinsys Tech was required to identify sewage ingresses where excessive sewage and effluents are polluting rivers.

The team modeled the area using MicroStation, integrating GIS and survey data into a visual modeling platform. OpenFlows applications helped model numerous scenarios for the sewer network and treatment plant. OpenFlows SewerGEMS® saved significant resources, developing an optimal design for the new sewerage system and reducing large-scale drawings. The applications streamlined workflows to facilitate clash detection and resolution. Establishing a digital context resulted in a cost-efficient wastewater treatment plant and provided the basis for operations, maintenance, and asset management.

"Digital data of survey and network design will help the utility not only in implementing the project but in future asset management. The project has been a pioneering effort in the wastewater management sector and is followed by similar projects in other parts of the state."

— Vikrant Joshi, General Manager, Ceinsys Tech Ltd.

CASE STUDY

Using 3D Reality Mesh for Water Crack Detection

SOCIÉTÉ WALLONNE DES EAUX, BELGIUM

Regional water corporation Société wallonne des eaux (SWDE) owns and operates a 50-meter-high water tower in Juprelle, Belgium, with a storage capacity of 500 cubic meters. Previous surveys revealed damage, so they took ground photos to define the renovation works but missed the most significant damage. To refine their methods and obtain a more insightful assessment of the water tower's condition SWDE needed to apply photogrammetry, machine learning, and 3D modeling technology.

They selected ContextCapture Insights to process over 3,000 images and generate a digital twin of the tower to visualize the entire structure and assess the damage. Using machine learning on the digital twin, they automated the accurate identification and quantification of the size of the cracks and determined the optimal corrective actions. The digital process reduced survey and modeling time and reduced costs. The digital twin could be completed in one day, enabling a quick assessment and remediation plan to ensure a reliable water supply.

"Thanks to our experience and the use of Bentley applications, we can state that this solution is part of a preventative maintenance strategy of our infrastructure and anticipation of risks in our operation processes."

— Christophe Taelman, Design Engineer, Société wallonne des eaux

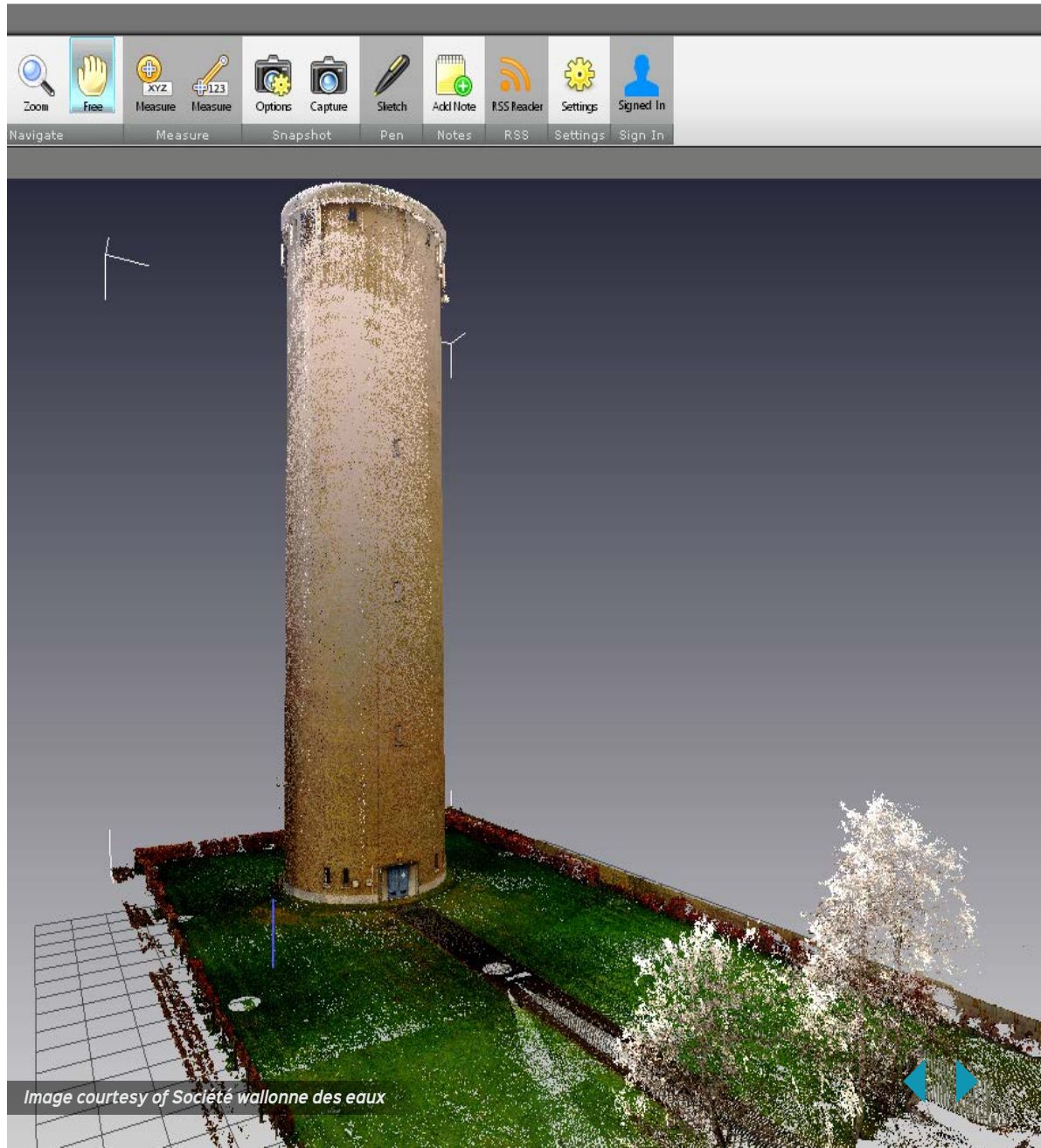

Image courtesy of Société wallonne des eaux

WE UNDERSTAND HOW CHALLENGING IT CAN BE TO ANALYZE, DESIGN, AND TRACK CHANGES IN WATER INFRASTRUCTURE PROJECTS.

According to a 2021 report from Dodge Data & Analytics and Bentley Systems, 87% of water utility respondents said they gather data digitally, and 90% said a challenge is that data is either isolated in disconnected IT systems, spreadsheets, or paper records, which prevents effective operations and maintenance at their organization on occasion.

Your design solution should solve these challenges, not contribute to them.

MicroStation

The foundation of efficient water design workflows

MicroStation is the only CAD software purpose-built for infrastructure design, helping designers and engineers like you bring their vision to life, present their designs to their clients, and deliver their projects to the community.

MicroStation – and all Bentley BIM applications – are built on the same comprehensive modeling platform, which means you can easily integrate all the tools you need .for complete infrastructure design and engineering – from water to roads, bridges, rail, tunnels, and more.

Experience the Power of MicroStation

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Bentley®