PROVEN SHORTCUTS TO BETTER
CIVIL DESIGN WORKFLOWS
AND PROJECTS THAT DID IT RIGHT WITH

MICROSTATION

virtuosity

CHALLENGE #1

## VARIOUS FILE FORMATS, MULTIPLE DISCIPLINES, AND PROJECT WORKFLOW EFFICIENCY

The inability to coordinate data in multiple formats results in errors, project delays, and a waste of time and money. With all the different applications used by the many different consultants that collaborate on today's design projects, a lack of interoperability between software products represents a huge risk. But there is a solution.

ACCESS & SHARE DATA

REGARDLESS OF FILE FORMAT

With MicroStation®, data conversions are no longer necessary. 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.
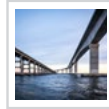
HDR
Marc Basnight Bridge

INCORPORATE
MULTIPLE DISCIPLINES

Connect project team members to the standards and projects they work on in a connected modeling environment. MicroStation's ability to easily integrate models, drawings, documents, and data from other sources can significantly improve the design process by eliminating errors prior to construction.

WS Atkins & Partners Overseas
Transit Oriented Development, Dubai

SCALE
TO MEET THE NEEDS OF ALL YOUR PROJECTS — LARGE OR SMALL

Whether it's a pond, parking lot, or 20-mile stretch of highway, MicroStation supports projects both large and small. Its robust modeling capabilities allow users to rapidly model projects of any scale and complexity while confidently maintaining design intent. Equally important, MicroStation's federated approach to managing files allows large design teams to easily and reliably share common files across multiple team members and disciplines whether they're working at the office or home. As a result, better quality designs are developed faster, saving time and money.

JMC² Civil Engineering
Downtown Pedestrian Improvement Project
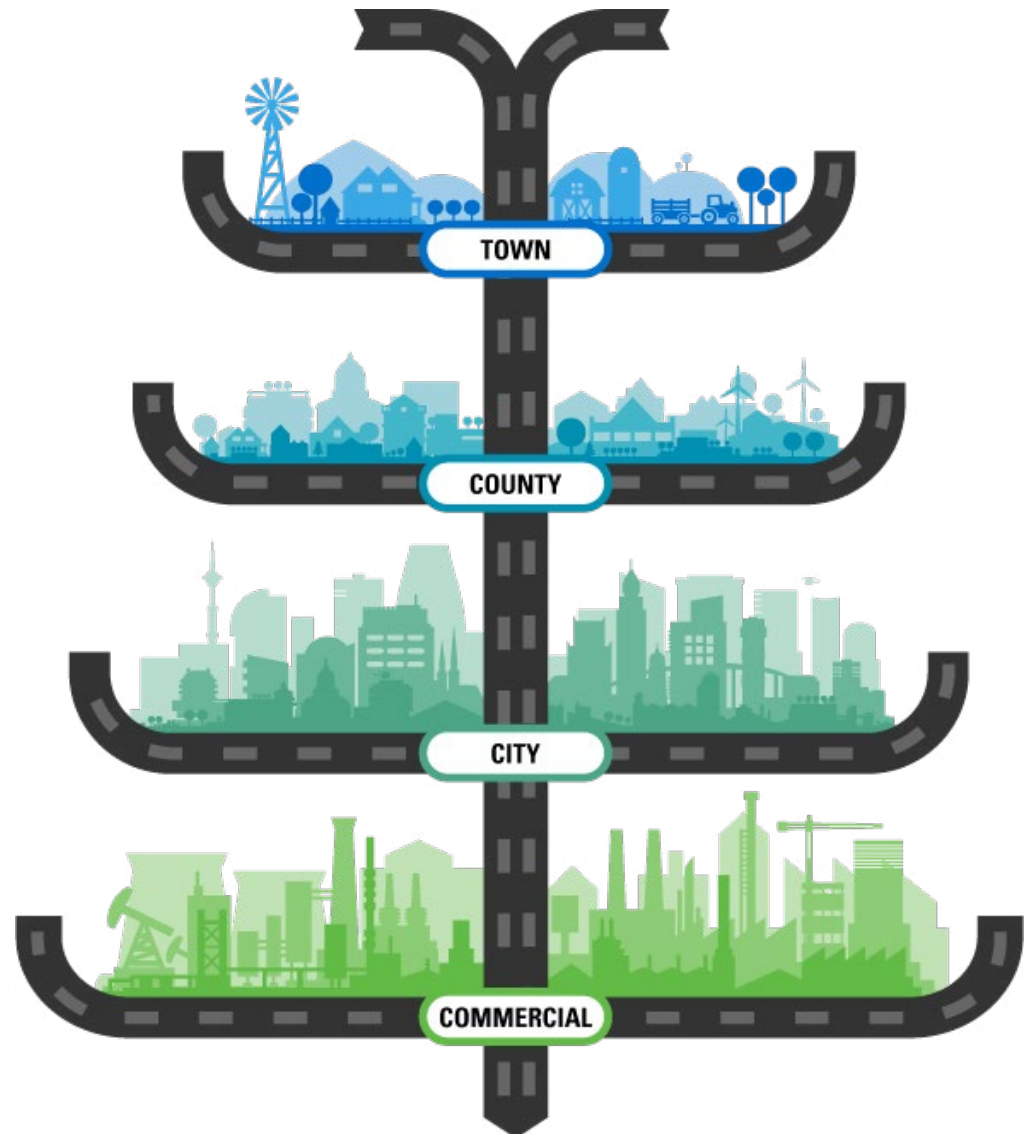
CHALLENGE #2
DELIVER QUALITY CONTRACT REQUIREMENTS ON TIME, EVERY TIME

Delivering and using drawings and models that don't conform to standards introduces safety risks to field staff, causes errors and leads to rework during construction. Unstandardized drawings and models can result in losing future work and can damage the reputation of your organization. But there is a solution.

DESIGN WITHIN
REAL-WORLD CONTEXT

Integrate representations of existing conditions into designs to generate accurate 3D models. Leverage raster images, point clouds, reality meshes, GIS, and more. With MicroStation, users can make better decisions throughout the project lifecycle and create highly impactful visuals for stakeholders.

**MA Engineering Consultants**
NCDOT U-0071 Durham East End Connector

DEVELOP COMPLEX MODELS
MORE EASILY

MicroStation supports a comprehensive set of mesh, solid, surface, and feature modeling tools so users can more easily develop demanding civil engineering designs. Robust constraint capabilities ensure design intent is maintained. Plus, MicroStation helps users simplify the management and use of similar engineering components by using a smaller number of parametric components with pre-defined variants that can be easily shared. This means users can complete jobs faster, explore more design alternatives, and develop better quality designs.
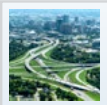
Alabama DOT
Birmingham, AL I-59/I-20 Corridor Project

Image courtesy of Alabama DOT,
The Mobile River Bridge Project

OUTPUT DESIGNS

AS PLAN SETS OR 3D VIDEOS — AND EVERYTHING IN BETWEEN

Produce all deliverables needed to support project demands in one application. Save time automating the creation and sharing of drawing sheets, models, visualizations, multidiscipline documentation sets, and more. With MicroStation, users reduce the risk of project delays and errors because they can easily adapt to project changes while assuring standards are met across design teams.

Washington State DOT
I-90 – Snoqualmie Pass East (Phase 1A through Phase 2A)

Alabama Department of Transportation

Birmingham, AL I-59/I-20 Corridor Project
Birmingham, Alabama, United States

The Alabama Department of Transportation (ALDOT) initiated the reconstruction of the six-lane, elevated I-59/I-20 interchange in the Birmingham Central Business District (CBD). The project will replace structurally deficient and functionally obsolete bridges constructed in the 1970s with improved structures that meet the demands of the state's busiest road corridor and provide improved aesthetics, noise abatement, and access management. At USD 750 million, the I-59/I-20 corridor reconstruction is the largest infrastructure project in Alabama.

ALDOT's visualization group was tasked with providing a complete 3D BIM model for visualizations, design checks, construction analysis, clash detection, right-of-way negotiations, lawsuits, and aesthetics. Using 3D modeling was key to providing construction bidders a more accurate cost estimate and encouraging lower bids. They created the digital terrain models in OpenRoads and refined them into a detailed 3D model in MicroStation. They converted the complete 3D model to a LumenRT LiveCube allowing the public, stakeholders, and various agencies to see the project progress.

Using MicroStation's clash detection capability, ALDOT provided more than a thousand clash reports. Clashes were evaluated and addressed during the design phase, which saved over USD 10 million.

> ”
> MicroStation's clash detection tool was the most effective technology used in this project. The reports allowed designers to fix costly construction/design issues before the project was ever let.
> *– Matt Taylor, State Visualization Engineer with ALDOT*
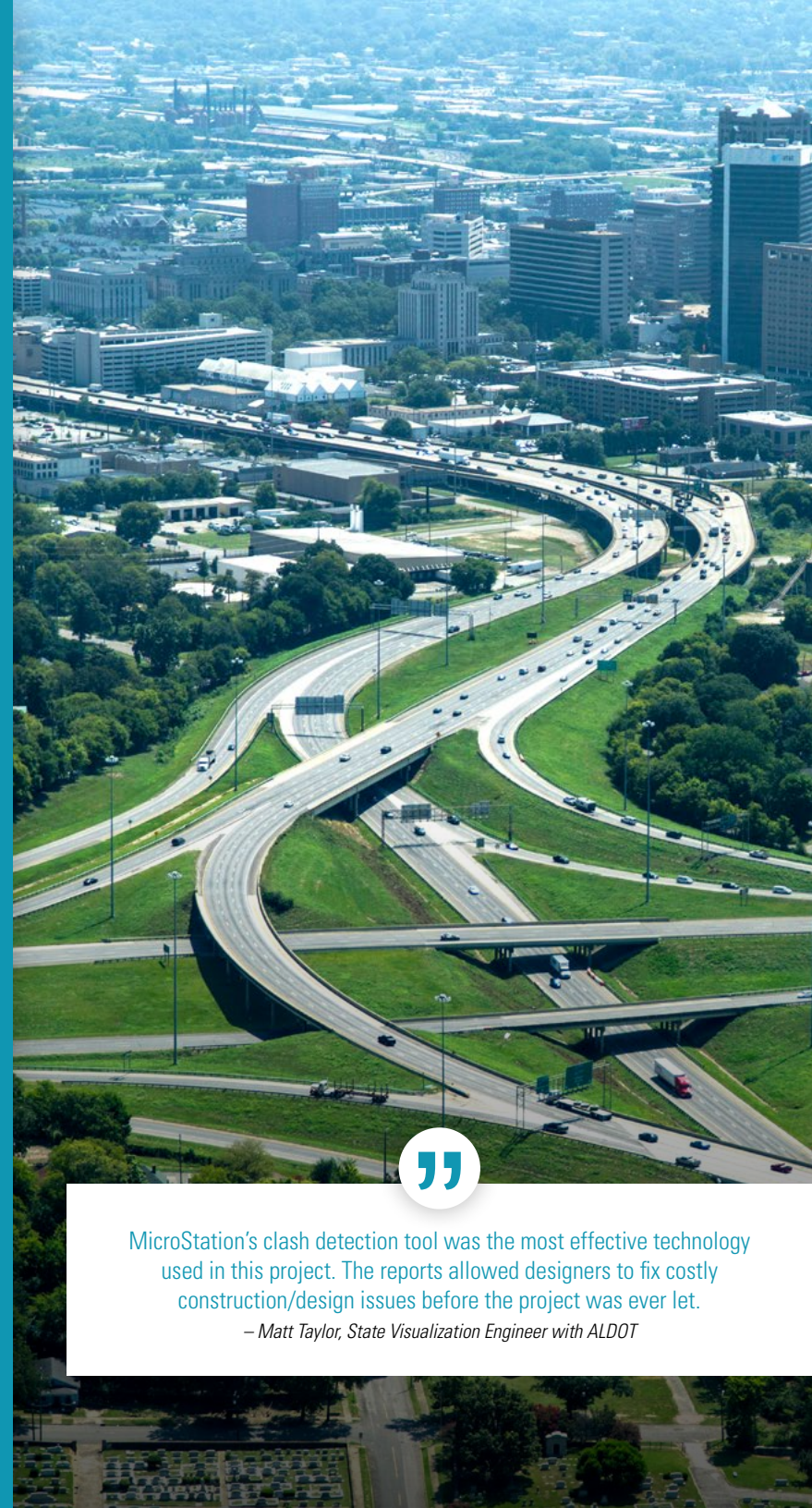
JMC² Civil Engineering

Downtown Pedestrian Improvement Project
Torrance, California, United States

When JMC² Civil Engineering worked on a pedestrian improvement project for the city of Torrance, California, they had to provide a safer, more attractive pedestrian environment along Cravens Avenue, adding streetlights, Americans with Disabilities Act-compliant sidewalks, roadway pavement, and new curbs and gutters. They also had to move the water system from underneath the sidewalks to beneath the roadway, cutting cross sections of the design and preparing roadway and water piping profiles. Additionally, the city of Torrance wanted them to create a digital twin so the city could review the design and construction.

Having used Bentley products on other projects, JMC² Civil Engineering was familiar with the software and knew the interoperable solutions with an open format would work with other software when the municipality required design files in a third-party CAD format. A full site survey and model of existing conditions gave them full control of roadway design and analysis.

MicroStation was used for the core drafting tasks, including civil CAD basemap development, file referencing, and plan sheet creation. MicroStation was essential to delivering plans that met the city of Torrance's stringent CAD standards. JMC² Civil Engineering decreased design time by at least 20% and saved approximately USD 50,000 compared to using previous design methods.

> Intuitive CAD capabilities allowed JMC² to make last-minute changes quickly, allowing us to keep the project on schedule.
> *— John Cruikshank, President & CEO, JMC² Civil Engineering*

HDR

Marc Basnight Bridge
Dare County, North Carolina, United States

The deteriorating Bonner Bridge in North Carolina required near-continuous repairs for more than 50 years. Its replacement, the USD 252 million, 2.8-mile long concrete box girder Marc Basnight Bridge, is designed to remain in use for 100 years. HDR had to ensure the bridge could resist hurricanes and ship strikes. They realized that a 3D modeling workflow would help them deliver bridge infrastructure with long-term performance, though they had to coordinate contributions from 250 people working across many different organizations.

Already familiar with Bentley applications, HDR relied on ProjectWise to store, manage, and share thousands of files among 250 people in different locations, as well as OpenBridge Designer, MicroStation, and OpenRoads for innovative and consistent modeling. Using digital workflows, they reduced costs, design time, and coordination errors to stay on budget and ahead of schedule. They also established continued data access for use during inspection, operations, and maintenance.

MicroStation, integrated with ProjectWise, greatly enhanced the ability of the CAD staff to develop nearly 700 sheets of drawings. Using MicroStation's VBA functionality, they wrote custom programs to enhance productivity and enforce consistency with the client's standards.

> ”
> ProjectWise, OpenRoads, and MicroStation provided measurable, tangible results in terms of less re-design, fewer coordination errors, more efficient, accurate access to project data, and more efficient use of resources.
> *– Bill Peterson, Structural CADD Technician 4, HDR*

Washington State Department of Transportation (WSDOT)

I-90 — Snoqualmie Pass East (Phase 1A through Phase 2A)
Washington, United States

Washington State Department of Transportation (WSDOT) initiated a USD 551 million project to improve the 15-mile section of I-90 just east of Snoqualmie Pass in Washington State, where increasing traffic and avalanche control closures have caused congestion. They are adding one lane in each direction, realigning the roadway, stabilizing major rock cuts, constructing avalanche bridges, and making other improvements to meet safety and capacity requirements. In addition to designing the road improvements, WSDOT needed to visually communicate the environmental impact of the project to decision makers and the public.

The design team used OpenRoads to produce 3D models and complete the civil engineering road design. The visualization team then used MicroStation's civil visualization capabilities to produce a realistic fly-through/drive-through animation covering 7 miles of I-90 and about 75 square miles of surrounding forested terrain. Using MicroStation's traffic animation tools, WSDOT easily added realistic. And, with the software's populate tool, they were able to add over 23,000 three-dimensional trees alongside the roadway to simulate the forested terrain.

MicroStation's ability to render animations using multiple computers greatly reduced the total rendering time. On one workstation, each frame would have taken about seven minutes, for a total of 42 days per rendering pass. Using a 14-unit server render farm, the job took three days per pass. As a result, MicroStation's process controller for distributed rendering saved 35 days in rendering time.

> Bentley's innovations in visualization, such as MicroStation's civil visualization tools, allow us to create amazingly realistic visualizations, which help to clearly and effectively communicate our project to decision makers and the public.
>
> *— Ron Jones, Visualization Specialist,*
> *WSDOT-Visual Engineering Resource Group (VERG)*

WS Atkins & Partners Overseas

Transit Oriented Development, Dubai
Dubai, UAE

WS Atkins & Partners Overseas had to be innovative when designing an underground rail station for Dubai's Green and Red metro lines near an existing shopping mall. The USD 2.9 billion development will reduce roadway traffic, boost sales, and separate the flow of shoppers from daily commuters. However, right-of-way limitations, a shallow foundation, inadequate vehicle drop-off space, and a small utility tunnel presented design challenges. WS Atkins also had to achieve LEED GOLD certification and deliver a high-quality, under-budget design on time.

They initially used Autodesk software, but when they found it insufficient for integrating the project with surrounding buildings and effectively delivering their BIM vision, they deployed Bentley software. WS Atkins overcame site constraints with MicroStation's parametric modeling capabilities. MicroStation's powerful constraints capabilities, usable in both drawing and modeling workflows, enabled them to maintain design intent while rapidly moving through design iterations and progressing development. They solved the station's complex interface geometry within the application, eliminating on-site measuring. Accurate quantity estimations reduced construction waste by 45% and material waste by 65%. They shared over 100 files of varying formats among the multidiscipline team to enhance collaboration and deliver the design one month early.

> The project required working with very large files. MicroStation is high-performance software. Its system architecture allowed us to open and work with very large raster, vector, and point cloud data much faster than you can with AutoCAD.
>
> *– Godson Jasper Sundaramony - Senior Architect, WS Atkins & Partners Overseas*

MA Engineering Consultants

NCDOT U-0071 Durham East End Connector
Durham, North Carolina, United States

To create a freeway link between major interstates and improve access to inner-city Durham, the North Carolina Department of Transportation initiated the Durham East End Connector project. The USD 141.95 million project features four interchanges along just over 2 miles of roadway, and 12 bridges that are tightly constrained by environmental, economic, and community concerns. MA Engineering Consultants was contracted to provide the design and to effectively demonstrate the project's impact on the local community.

The company designed the entire roadway project in MicroStation and used the 3D model to evaluate various impacts to the environment, local businesses, and residences. The model helped optimize design, minimizing impact in the area while providing a safe and efficient highway. They were able to take a 2D file representing the roads, highways, and bridges of the project built in MicroStation and extrude these while adding meshes and textures to create 3D objects that were "engineering-correct."

The design team then exported the 3D model into LumenRT to fill out the design with buildings, traffic, highway signage, and other environmental objects to create a lifelike, accurate visualization that the public could view. By integrating 3D models created in MicroStation into LumenRT, MA Engineering Consultants established an accurate digital representation of the project, enhancing community understanding of its impact and finally moving from a conceptualization that began over 50 years ago to construction.

> "
>
> The seamless integration of MicroStation and LumenRT provided a perfect combination to create 3D models and animations encompassing a real-world, large-scale engineering project connecting two interstates across a vast expanse.
>
> *– Edward Williams, Visualization, North Carolina Department of Transportation*

# Leighton Asia

Hong Kong Boundary Crossing Facilities, Hong Kong-Zhuhai-Macao Bridge
Hong Kong

The new Hong Kong-Zhuhai-Macao Bridge is a 50-kilometer link that comprises a series of bridges and tunnels that will connect the three cities. Vehicles traveling to and from Hong Kong will leave and enter via a 130-hectare island that is being reclaimed to the east of Chek Lap Kok. A 40,000-square-meter, 30-meter-high passenger clearance building will accommodate vehicles passing through customs and immigration and become a distinctive entry point to Hong Kong. The Leighton-Chun Wo Joint Venture is responsible for constructing the passenger clearance building, the drop off deck/area footbridges, and a district cooling system for the Hong Kong Boundary Crossing Facilities.

The project scope includes bored pile foundations, reinforced concrete structures, a profiled steel roof, curtain walling and glazing, architectural finishes, and mechanical and electrical work. Leighton-Chun Wo used MicroStation and OpenRoads to create a common platform to collaborate on all structures and manage all project information. They used a BIM methodology and co-constructed a BIM model with the survey department for contractor works. Leveraging the accuracy of MicroStation, the survey department created a georeferenced BIM model that was used for survey checking. Later, the BIM model was exported to an iModel format for senior management to view and compare during site visits. Leighton-Chun Wo identified clashes before the construction stage using MicroStation, saving about 12 percent of the budget.
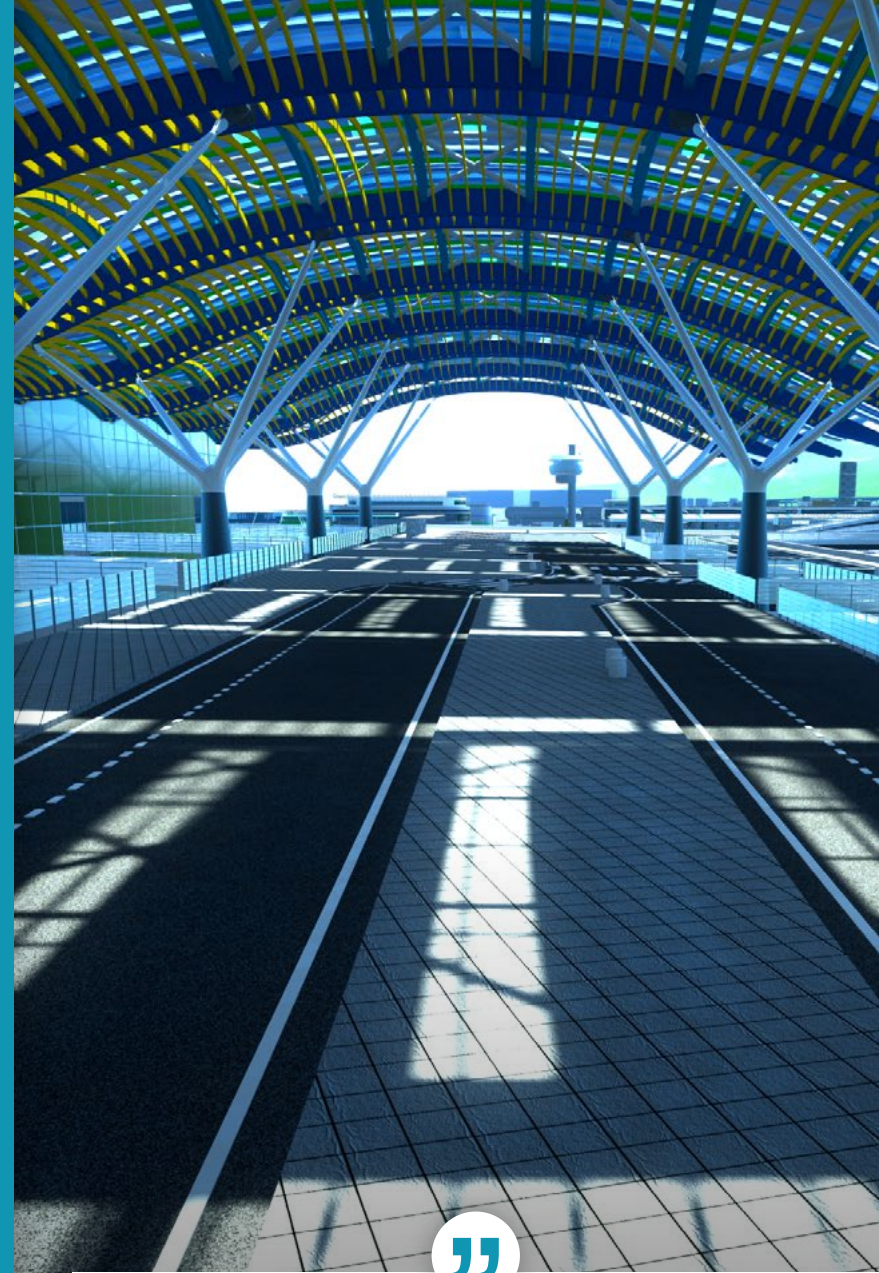
> MicroStation is a common platform for all our files.
> No matter whether it is an engineer, surveyor, contractor,
> or owner-operator, we all use and view the model with the same
> DGN format in MicroStation.
>
> *— Michael Wong, Survey Manager*

MICROSTATION

THE FOUNDATION OF EFFICIENT CIVIL ENGINEERING DESIGN WORKFLOWS

MicroStation — and all Bentley BIM applications — are built on the same comprehensive modeling platform so that users can easily progress MicroStation work into discipline-specific BIM workflows. It enables every civil engineer and designer to:

- **Create better designs, faster:** With MicroStation, users can model, document, and visualize infrastructure projects of any type, scale, and complexity using a comprehensive set of design and documentation capabilities. Reliably integrate any existing design content and work with any-size team using virtually any mix of design applications. MicroStation enables users to develop and document better designs in less time by better connecting tools, data, and the team.

- **Better integrated project teams:** MicroStation provides a common environment for comprehensive project delivery and connects users, projects, and the enterprise. With MicroStation, users have a personal portal to access learning, communities, and project information.

Plus, MicroStation offers the flexibility you need to work the way you want - with several customizable user interfaces, including a dark mode. There's also native support for RealDWG to ensure 100% compatibility and confidence in your data.

To learn more, visit en.virtuosity.com/MicroStation