Reality Modeling for Transportation

# Generate ROI with Reality Modeling for Your Transportation Projects

Owner-operators and their supply chains need effective and efficient solutions to plan, design, build, and operate road networks around the world, and are adopting reality modeling to improve worker safety, start projects faster, iterate designs efficiently, and share information more effectively.

Reality modeling is the process of capturing the physical reality of an infrastructure asset, creating a virtual representation of the asset, and maintaining the representation through continuous surveys. These highly detailed reality models are generated using photographs and, when additional accuracy is needed, LiDAR point clouds are used to provide precise real-world digital context for planning, design, construction, and operations decisions for use throughout the lifecycle of an infrastructure asset.

Planning
Assess and understand existing conditions.
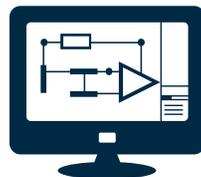
Design
Accelerate design and manage constructability risk.

Construction
Monitor sites for change and to verify design.

Operations
Document existing conditions and manage assets in real time.

Inspection
Continuously survey to create high-quality documentation and reduce safety risks.

To make informed decisions you will always need up-to-date digital context so that you can visualize the asset, check its status, perform analyses, and generate insights to predict and optimize its performance.

Leveraging two leading software products, **ContextCapture and Orbit 3DM®**, Bentley's reality modeling solutions take the creation, management, analysis, and sharing of reality data and digital context to a new level so that you can make informed decisions based on an up-to-date single data environment.

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ContextCapture

ContextCapture enables you to automatically generate high-fidelity 3D reality models from simple photographs and/or point clouds. These reality data can be captured from a variety of devices and techniques, including aerial LiDAR, drone photography, hand-held cameras, terrestrial laser scanners, mobile mapping systems, and even smartphones. The process brings new opportunities to optimize workflows to win projects.

Point Clouds

Reality Mesh

360 Images

Obliques Images
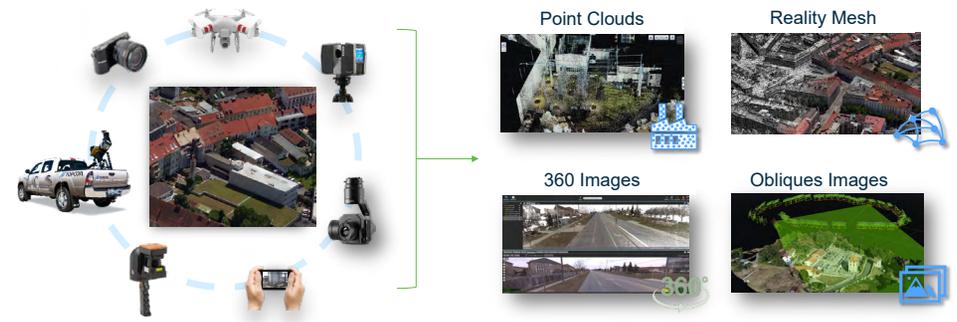
Orbit 3DM

With Orbit 3DM you can manage, analyze, and share terabytes of reality data of any size, from any system, into one single source of truth that provides 4D digital context to solve infrastructure challenges.

- ◆ **MANAGE** your high volumes of captured 3D that come from a variety of systems over time.

- ◆ **ANALYZE** and update the assets and extract features at the speed of data capture based on semi- and fully automated point cloud detection techniques.

- ◆ **SHARE** the data internally, online to customers and stakeholders, or embedded in any third-party software to support everyone's workflow.

This e-book explains how ContextCapture and Orbit 3DM help transportation agencies across the world make informed decisions and solve infrastructure challenges in a digital context.

ANALYZE

CAPTURE

SHARE

MANAGE
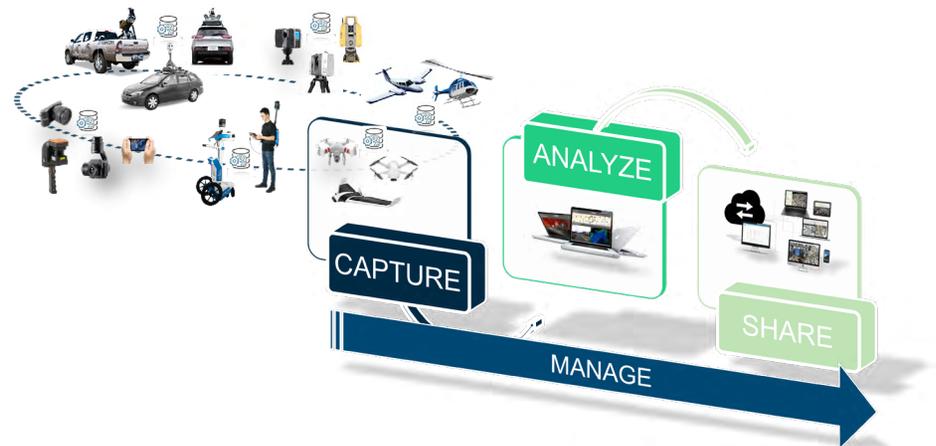
North America

**Alabama Department of Transportation**
Mobile River Bridge
Mobile, Alabama, United States

The Alabama Department of Transportation (ALDOT) was tasked with increasing capacity on Interstate-10 between the existing Wallace Tunnels and the Eastern Shore, which is experiencing some of the worst congestion in the state. The estimated USD 2 billion project required ALDOT to use integrated 3D modeling and visualization applications to simply communicate its proposal to stakeholders and the public.

With Bentley applications, ALDOT could capture 3,075 photos and use them to create a digital twin of the bridge and surrounding area. ALDOT used OpenRoads to model the project, which increased project delivery by 30 days. It allowed the team to quickly and efficiently make changes to the 3D models, reducing resource hours and keeping the project on schedule. Using ContextCapture, ALDOT reduced visualization production time by 80%. Currently in the planning stage, ALDOT is expected to begin construction in late 2020 to early 2021 and complete the project in 2026.

Project Playbook: ContextCapture, LumenRT, MicroStation®, OpenRoads™
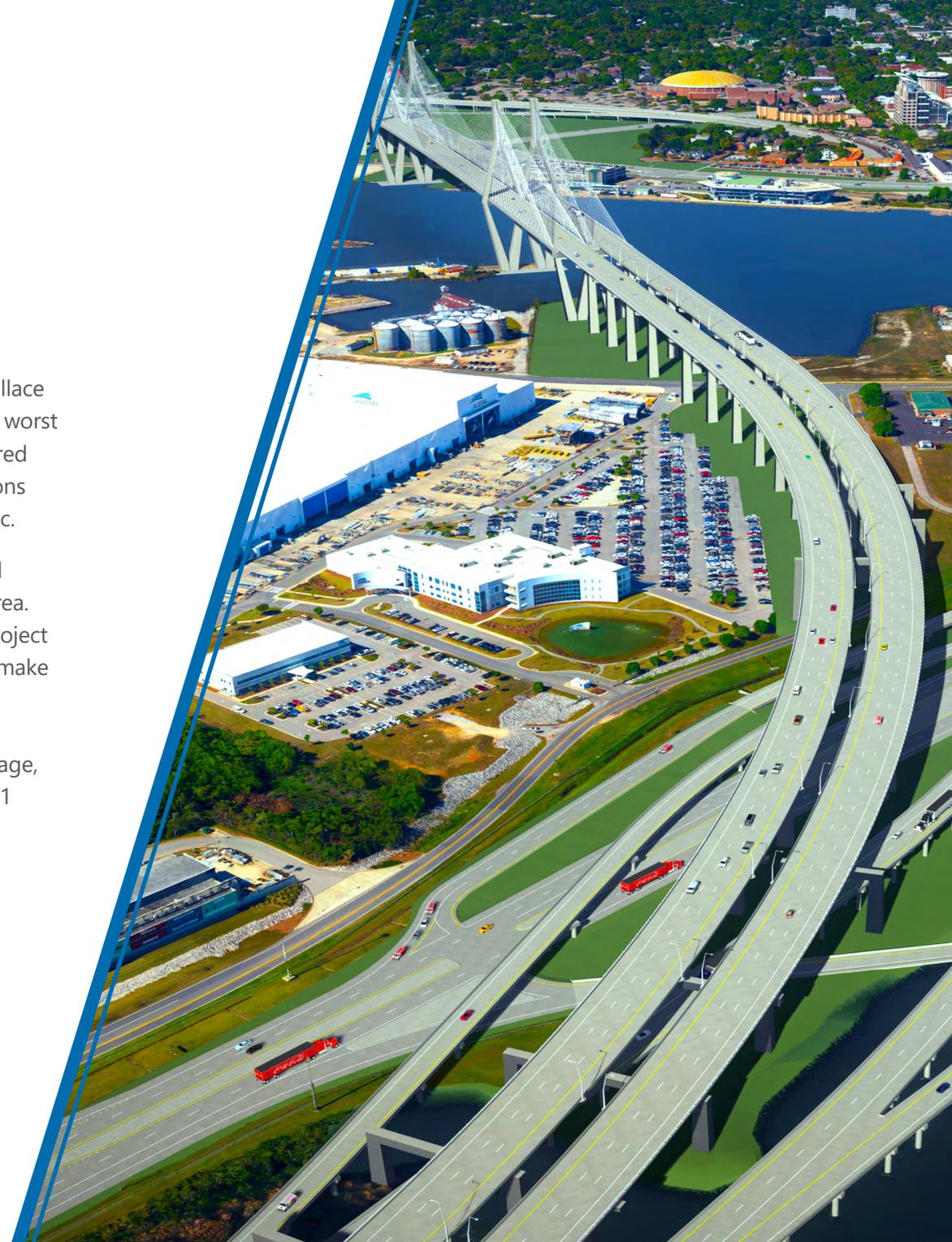
MasterMind LLC
Mobile Mapping Pavement Marking Inventory in Ohio
Mansfield, Ohio, United States

The Richland County Engineer's Office in Mansfield, Ohio, found that its inventory of pavement markings on county roads was out of date. Since updated pavement marking inventories can help government agencies plan striping projects more effectively and save money, county officials reached out to traffic services company MasterMind LLC to inspect and inventory 347.7 miles of roads. MasterMind equipped a Fiat 500 with multiple LiDAR units, a spherical camera, and a GPS inertial measurement unit to produce a 360° video of each roadway.

The mapping team then imported roadway image data into Orbit 3DM Content Manager for handling and quality processing, including incorporating metadata and removing ghosts. By creating asset items such as centerline and auxiliary inventory data within Orbit 3DM Feature Extraction, they could use a combination of manual and automatic capabilities to define assets and detect pavement markings. County officials can now access detailed pavement marking data, including line contours and altitudes, on mobile devices. The inventory also allows county officials to view and assess all pavement marking assets without leaving the office, which saves time and money.

Project Playbook: Orbit 3DM Content Manager, Orbit 3DM Feature Extraction
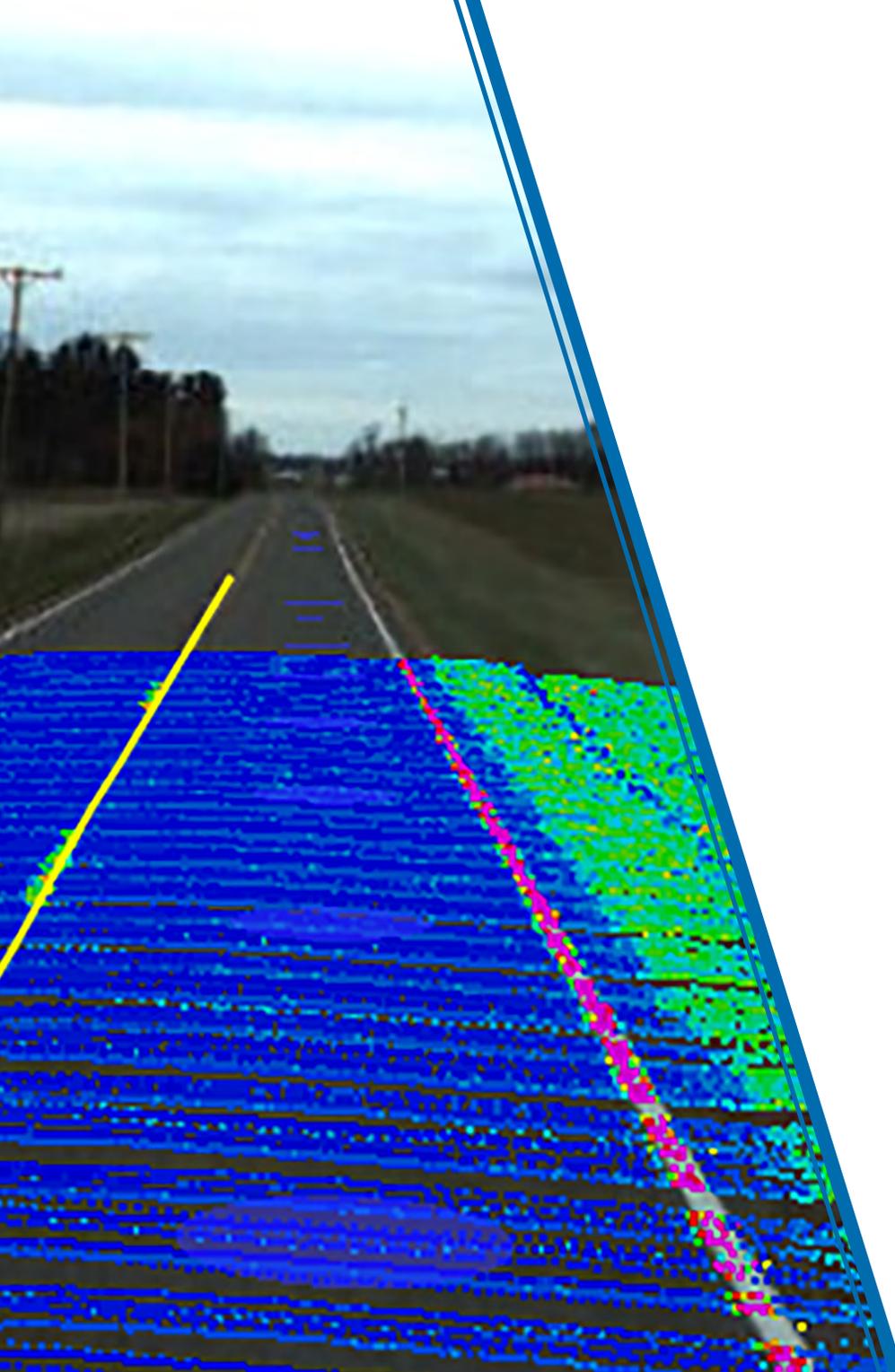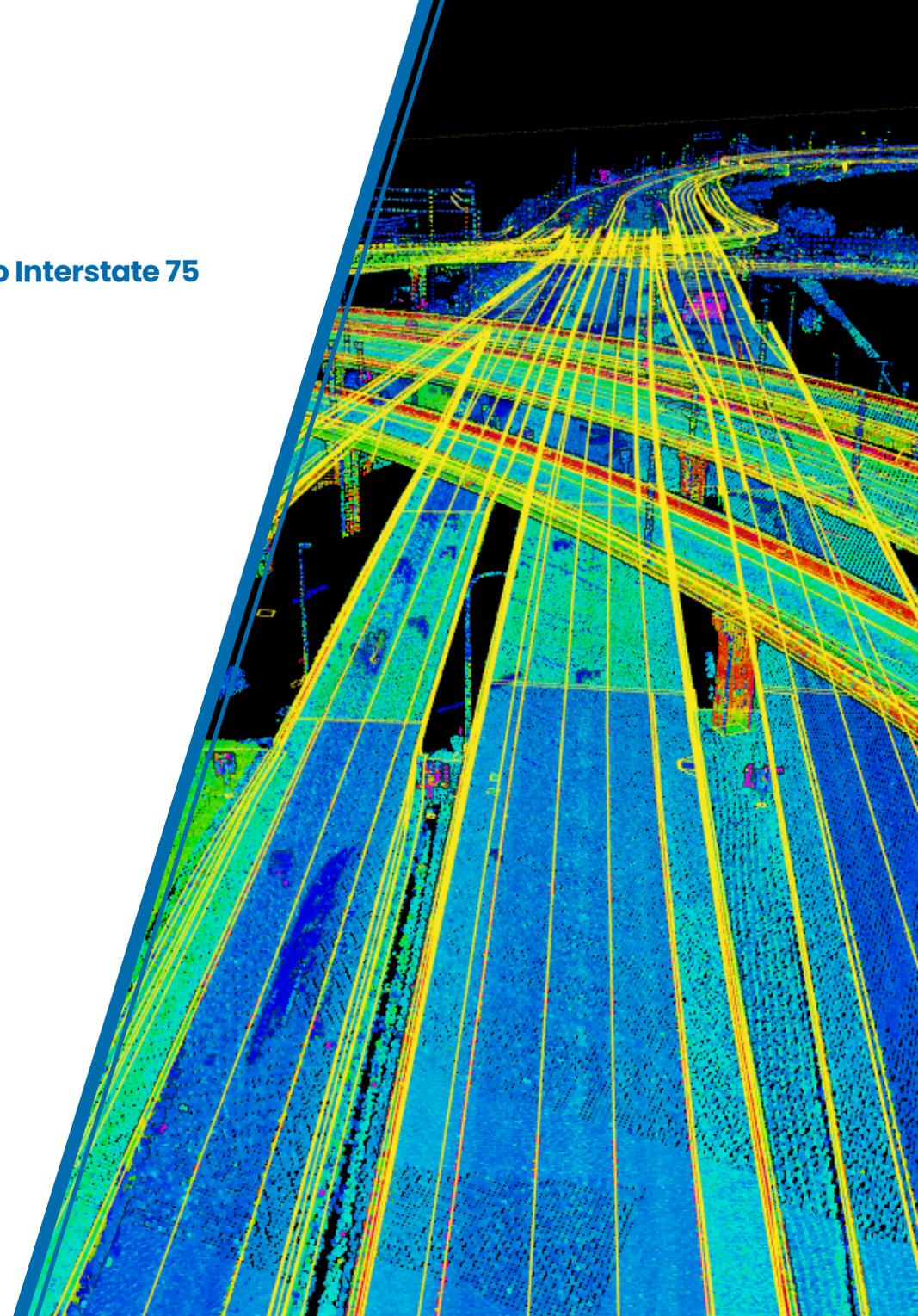
North America

WGI

East Selmon Expressway from North Morgan Street to Interstate 75

Tampa, Florida, United States

Part of the Tampa Hillsborough Expressway Authority's project development and environmental study of the East Selmon Expressway, WGI was tasked with performing a design survey for widening a nine-mile highway section. The complex roadway features a four-lane limited access highway and a three-lane raised toll expressway, 46 bridges, and 34 ramps, making it challenging to survey. WGI needed an integrated technology solution to survey and process multisourced captured data into a 3D digital model to share with the client.

They selected MicroStation and Orbit 3DM to integrate and merge the point clouds into a 3D model and create a digital database. Using Bentley's integrated applications provided a unified environment to combine feature extracted data from MicroStation with data from different LiDAR technology to generate a digital twin accessible to the client. The digital solution reduced staff survey time on site during COVID-19, improving safety and reducing labor costs associated with site visits.

Project Playbook: MicroStation, Orbit 3DM, ProjectWise®

Collins Engineers, Inc.
Stone Arch Bridge Rehabilitation
Minneapolis, Minnesota, United States

Collins Engineers was tasked with inspecting and designing the rehabilitation of the iconic Stone Arch Bridge in Minneapolis. The 22-span masonry arch bridge opened in 1883 and is 2,100 feet long. Originally built as part of the Great Northern Railroad, it became a pedestrian bridge in the 1980s and is the most historically significant bridge in Minnesota. With its age and size, the team faced challenges when developing repair plans that traditional data collection could not accommodate. The bridge is in a busy urban environment, making access to the bridge difficult. They used reality modeling previously, but it lacked the quality required for inspecting and modeling complex structures, especially large masonry bridges. To collect sufficient data and accurately model the bridge, they needed an integrated survey, modeling, and inspection solution.

Collins Engineers selected ContextCapture to generate a high-fidelity 3D model from over 13,000 images, improving quantity and quality of data. By creating a digital twin, the team could record field inspection notes directly in the model, removing the need to sketch or describe defect locations for improved accuracy. Using iTwin applications facilitated real-time model access, saving 20% of field time. The solution is expected to save 10% to 15% in construction costs due to improved project and bid data. Because of the high level of detail in the digital twin, they will use it throughout the bridge's lifecycle for future planning and maintenance decisions. The digital twin was so accurate that Microsoft used it as part of their keynote address at their Ignite conference.

Project Playbook: AssetWise® Inspections, AssetWise Digital Twin Services, ContextCapture, ContextCapture Insights, iTwin® Immersive Asset Service, MicroStation, ProjectWise
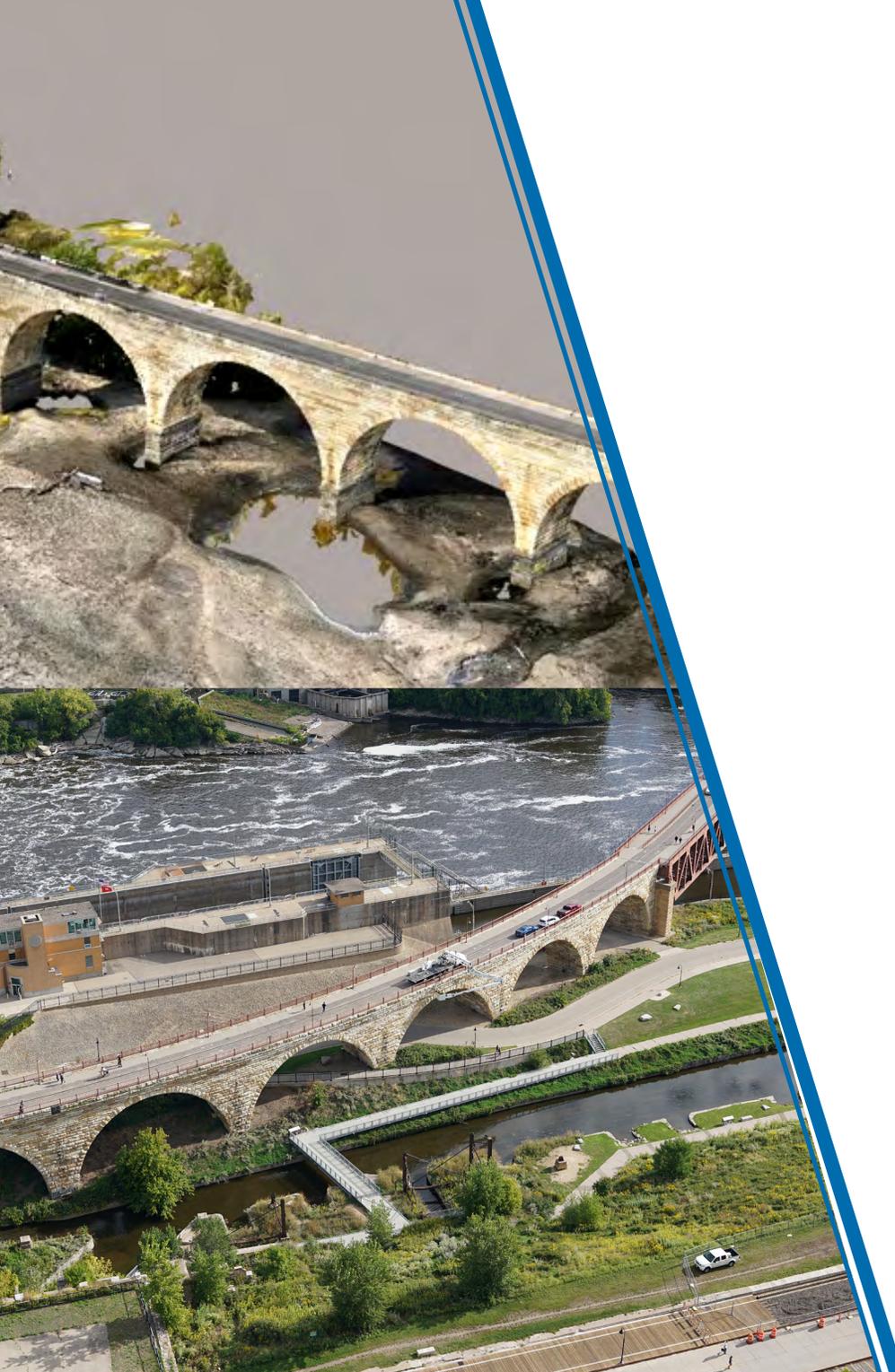
BPG Designs
Optimized Procedures for Slope Inventory in Phoenix, Arizona

Phoenix, Arizona, United States

The Americans with Disabilities Act (ADA) includes Public Right of Way Accessibilities Guidelines to ensure the mobility impaired do not face any transportation barriers, including steep slopes. To meet those standards, the Phoenix municipal government partnered with BPG Designs to determine noncompliant roads and sidewalks. BPG Designs measured the slopes of area roadways and sidewalks with a car-mounted LiDAR system. These images were combined into a 3D model of the city's street assets with Orbit 3DM Content Manager. BPG used Orbit 3DM Feature Extraction to manually draw slope lines where needed and fine-tune measurements to determine the optimal method for automated slope measurement.

By combining captured images and automated scripts that could automatically detect and measure slopes in roads, BPG created a slope inventory of Phoenix roads that is free of errors in classification, measurement, or variability. The combined system significantly shortened the time needed to measure road networks and eliminated the need for any on-site remeasurements. The city of Phoenix can now use this information to improve sidewalks and right of ways, ensuring that they can be used by the mobility impaired. BPG plans to use Orbit 3DM applications on future projects to ensure consistency and repeatability.

Project Playbook: Orbit 3DM Content Manager, Orbit 3DM Feature Extraction, Orbit 3DM Publisher
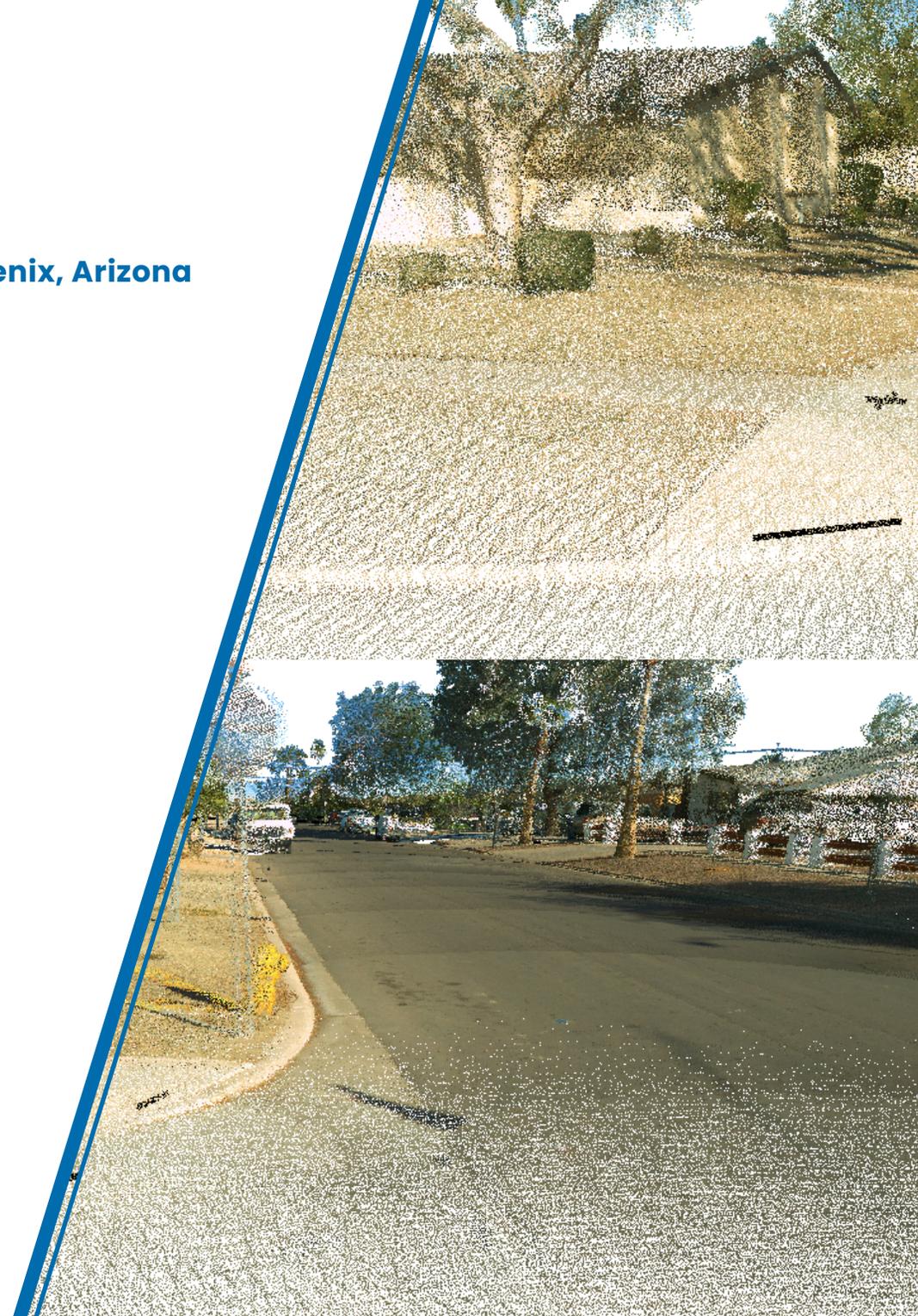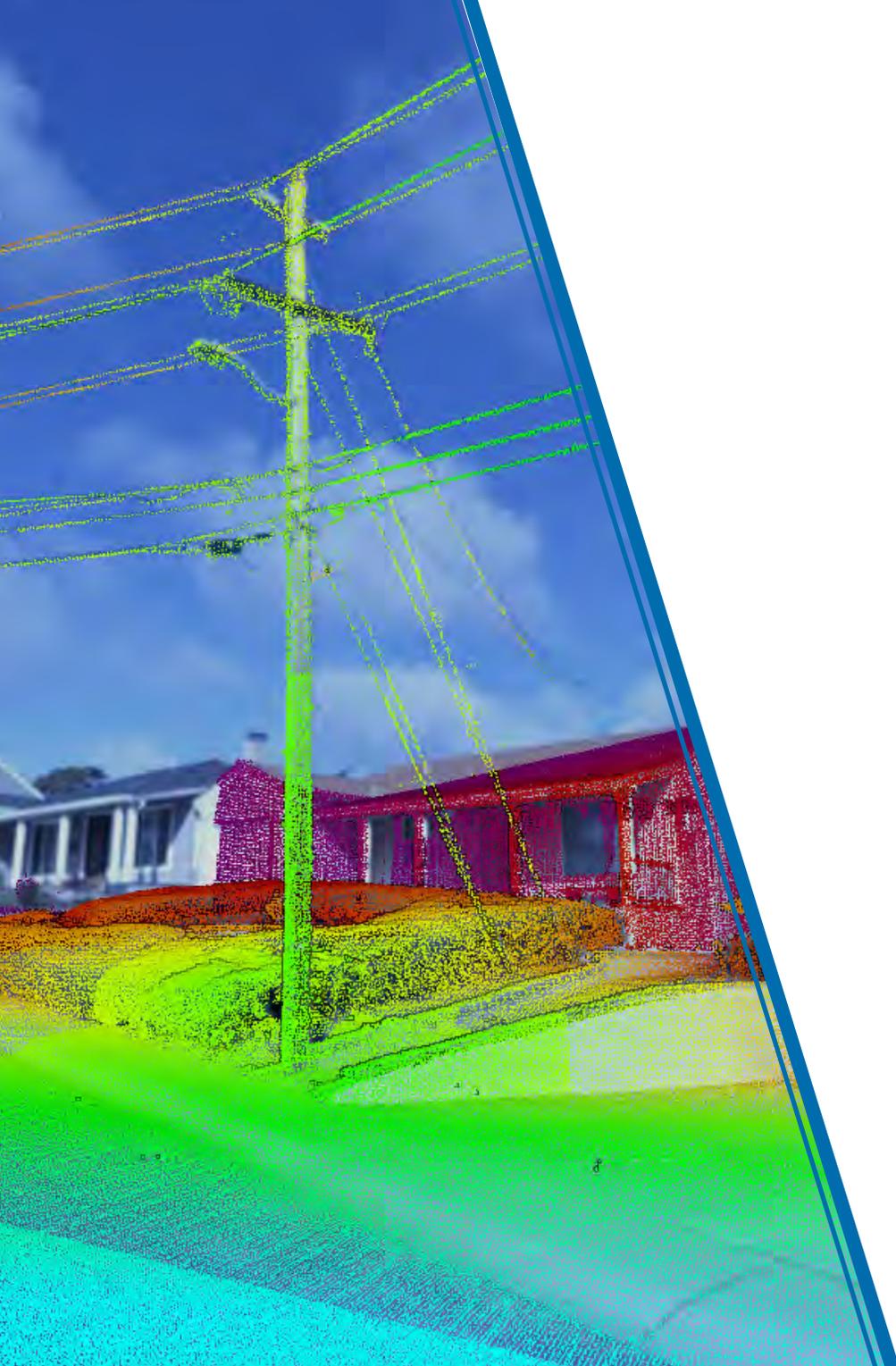
Michael Baker International
Large-scale Mobile LiDAR on US Roads

Pittsburgh, Pennsylvania, United States

Michael Baker International, a provider of engineering and consulting services, offers comprehensive asset data collection capabilities on the US road infrastructure. They wanted to ensure clients could maximize their resources and wanted to implement web-based access to mapping data on its custom data environment. Previously, Michael Baker used a piecemeal system of panoramic image viewers and CAD-based point cloud rendering tools, which required significant effort when disseminating data into one source for customers. They wanted a more efficient solution, but any new application they used would have to handle extremely large amounts of reality data, with projects involving thousands of miles of point cloud data and millions of individual 360 degrees images.

They discovered that Orbit 3DM applications allow them to link vast amounts of 360 degrees imagery, GIS/CAD features, and LiDAR point clouds into an integrated platform that can be accessed from anywhere. With Orbit 3DM Content Manager, they could import, manage, and optimize the continuous stream of mobile mapping road data collections. Orbit 3DM Publisher allowed Michael Baker's users to have a single solution for viewing, collecting, and interacting with various forms of data, as well as observing the same location from multiple perspectives. Multiple views of the data help clients conduct spot measurements with overhead and panoramic representations, as well as toggle layers on and off while exploring GIS data. The unified data within Orbit 3DM Publisher is not only much easier to deliver to clients, it is also easier to use, as anyone familiar with an online map application can self-navigate and make meaningful observations within minutes.

Project Playbook: Orbit 3DM Content Manager, Orbit 3DM Publisher

North America

KCI Technologies

Reality Modeling Pilot for GDOT's Big Indian Creek Bridge Replacement Concept

Perry, Georgia, United States

KCI Technologies is developing roadway conceptual designs for the Georgia Department of Transportation's (GDOT) Big Indian Creek Bridge replacement. They needed to minimize any impact to park resources and avoid utility conflicts, coordinating between the client, utility owners, and stakeholders. KCI wanted to pilot reality modeling as a QA/QC tool for roadway, drainage, and utility models to communicate and optimize the roadway design concept.

They selected ContextCapture to process drone-captured aerial photos into a reality mesh of the project site. Using MicroStation, KCI integrated the mesh with the BIM models created in OpenRoads, producing a transparent digital view to determine any conflicts between the design models and the existing on-site conditions. The 3D mesh enhanced general constructability reviews and put design concerns in context, providing instant insight and fostering communication among all stakeholders and the client. They expect to extend the use of the reality model into final design, construction stages, and beyond.

Project Playbook: ContextCapture, MicroStation, OpenRoads Designer
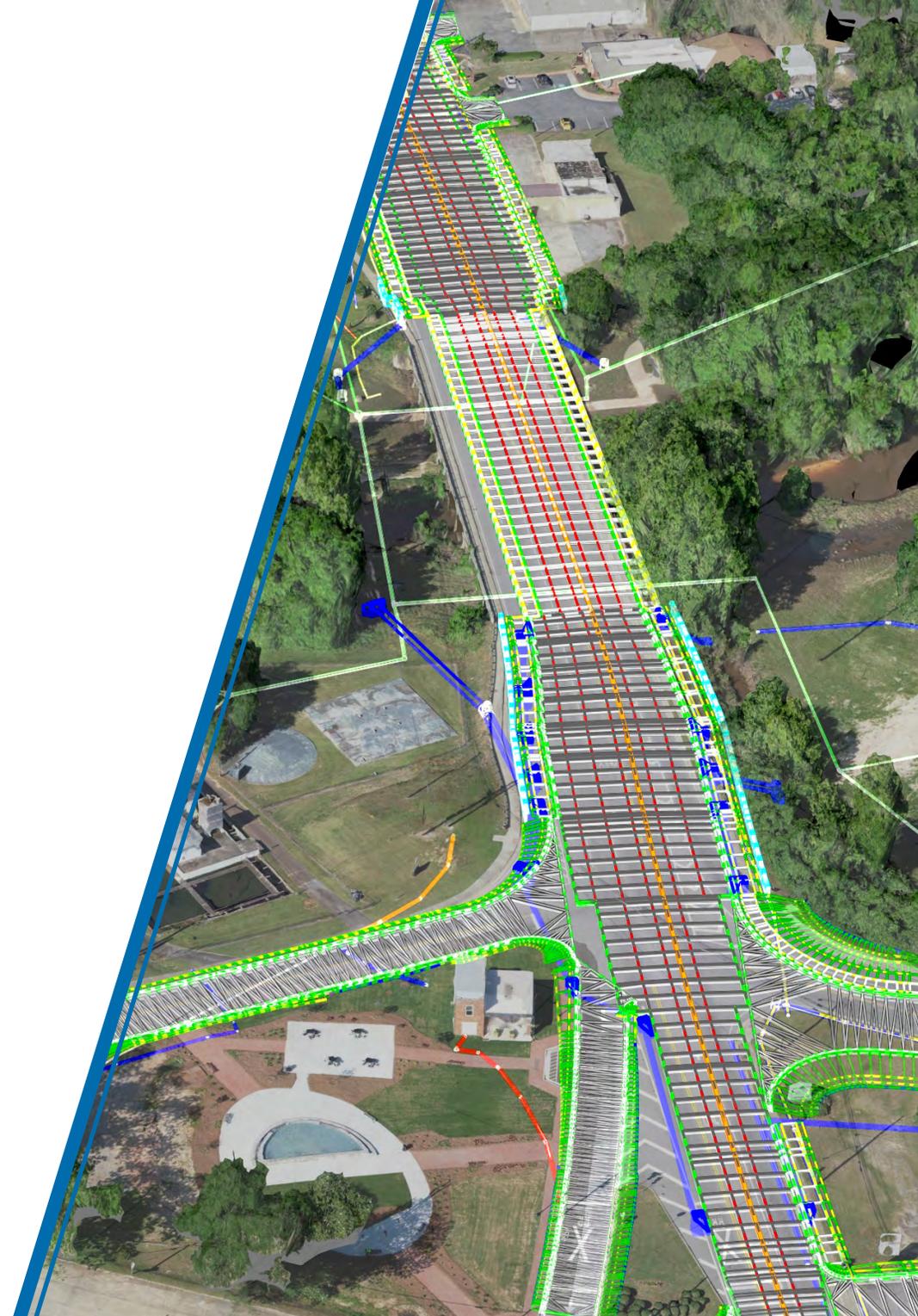
Asia Pacific

Jireh Infotech
Safety Check of Facilities with Drone
Seoul, South Korea

The city of Seoul decided to establish a dynamic and intuitive bridge safety diagnosis system. Currently, manual bridge inspections cost the city around KRW 40 million per inspection and present access limitations, making it challenging to obtain photographs and capture uniform, quality data. Jireh Infotech realized that they could control on-site risks and costs by using unmanned aerial vehicles to capture images, allowing for a digital visual inspection. However, an effective inspection would require creating a detailed reality model with the images.

They selected ContextCapture to establish a digital twin from captured images and perform a remote, virtual visual inspection on a pilot project bridge, saving approximately 20% in costs and reducing required resources compared to previous manual methods. Based on the results obtained by using Bentley's 3D reality modeling application, they expect that expanding the digital inspection methods to all bridges across South Korea can save labor and costs.

Project Playbook: ContextCapture

Chongqing Communications Planning,
Survey & Design Institute Co., Ltd., Guizhou Communications
Construction Group Co., Ltd., Guizhou Bridge Construction Group Co., Ltd.

Digital Design and Construction of Taihong Yangtze River Bridge

Chongqing, China

To construct the 1,436-meter, six-lane, CNY 900 million Taihong Yangtze River suspension bridge in Chongqing and safely support traffic moving at 80 kilometers per hour, China needed to push the boundaries of engineering data to improve construction quality and safety. Chongqing Communications Planning, Survey & Design Institute (CCPSD) realized that for a bridge of this size and complexity, traditional, paper-based data exchange and construction methods would not work. Accuracy was paramount, as many mistakes made during large bridge construction are irreversible and result in higher costs and safety issues. So, they proposed a BIM methodology to enable intelligent information management and incorporate 3D laser scanning via unmanned aerial vehicles that would ensure high levels of precision and quality.

CCPSD chose ContextCapture and MicroStation for 3D BIM and reality modeling, which improved design efficiency, reduced bridge design time by 300 hours, and saved CNY 500,000 in costs. Establishing digital workflows, creating a library of components, and simulating construction helped them complete the design 30 days ahead of schedule and shorten the construction schedule by approximately 47 days. The virtual 3D model enabled them to clearly communicate the development process and manage engineering information throughout construction and the entire project lifecycle, ensuring quality and safety. The visual model will be used to promote the industrialization of the bridge infrastructure industry throughout Chongqing.

Project Playbook: ContextCapture, LumenRT, MicroStation, OpenBridge® Designer, OpenRoads ConceptStation, ProStructures

Asia Pacific

PT Wijaya Karya (Persero) Tbk.
Design and Build Harbour Road 2 Project

North Jakarta, Jakarta, Indonesia

The Harbor Road 2 design and build project is the first elevated toll road project to use a double-decker construction. The USD 530 million bridge will span 3.98 kilometers. The complex project needed to avoid many aboveground and belowground structures, as well as work around two other projects taking place simultaneously.

PT Wijaya Karya used PLAXIS® to conduct advanced geotechnical analyses of the site. OpenRoads was used to review the design alignment while OpenBridge Modeler® helped run the design iteration, carrying out detail modeling of the three bridge structures. Bentley applications helped to limit waste and decrease movement of heavy equipment, reducing the project's carbon footprint. The project team increased its return on investment by 23% while cutting the project time by three years. When completed, the Harbour Road 2 bridge will accommodate 63,500 vehicles per day.

Project Playbook: ContextCapture, gINT®, LEAP®, LumenRT, Navigator, OpenBridge, OpenRoads, PLAXIS, ProStructures, RM Bridge

Shenzhen Municipal Design & Research Institute Co., Ltd.

BIM Design and Application in the Rapid Transformation Project of 4th Ring Road and Dahe Road in Zhengzhou

Zhengzhou, Henan, China

The city of Zhengzhou is planning a 3D transportation project that will take people around the central urban area. The CNY 40 billion project will include two expressways—a ground-level road of 93 kilometers and an elevated bridge expressway of 63.6 kilometers—that will reach 80 kilometers per hour. The project will also include 27 interchanges, 21 river-crossing bridges, and 34 rail nodes.

Shenzhen Municipal Design & Research Institute was tasked with designing this complex municipal transportation project, which required reliable communication workflows and design intention. ContextCapture was used to create a 3D reality model of the 120-square-kilometer site. OpenRoads Designer was used to build a parametric member library for over 10 different road model types. OpenBridge Modeler helped overcome difficulties in modeling the variable cross-section bridges. The project team's BIM design and workflows helped accurately manage about 50,000 prefabricated segments and reduce cost and waste by 40%.

Project Playbook: ContextCapture, gINT, LumenRT, MicroStation, Navigator, OpenBridge, OpenRoads, ProjectWise, ProStructures

C&B Information Technology
Road Facility Management Using 3D Model
Gwangju, Gyeonggi, South Korea

Efforts are being made to improve the management and inspection of road facilities and bridges along 110,000 kilometers of roadway in South Korea. Using on-site bridge checkers to manually inspect and test bridges is timely and costly and often requires lane closures, which cause traffic congestion. To overcome these inefficiencies and optimize assessments, C&B Information Technology initiated a 3D digital project using reality modeling technology.

The project team used a drone and ContextCapture to generate a high-precision 3D reality mesh of bridges that require inspection. Using the model to perform the assessment improved inspection efficiencies, enhanced worker safety, and decreased traffic congestion. Bentley's ContextCapture created accurate 3D visual models, which simplified the identification and recording of problems, which resulted in reducing inspection duration by three times and costs by five times compared to using manual methods.

Project Playbook: ContextCapture

CECI Engineering Consultants, Inc., Taiwan

Taiwan Provincial Highway 1 New Motor Lane Construction for Extension and Diversion

Changhua, Taiwan

This TWD 2 million initiative includes reconstructing a bridge and elevating it to more effectively control flood instances. CECI Engineering Consultants is responsible for bridge planning, design, and supervision. The project required a BIM methodology to be implemented during construction, and a 3D model using BIM and orthophoto mapping was generated. To verify the BIM model once construction was completed, CECI used reality modeling technology.

The team used unmanned aerial vehicles to capture images of the bridge construction in half a day and ContextCapture to process the photos and generate a 3D reality mesh. The interoperability of ContextCapture with third-party software facilitated integration of the bridge BIM design model with the reality mesh. Using the construction reality mesh, CECI compared and verified the design model. Bentley's digital visualization solution demonstrated the effectiveness of reality modeling for planning, design, and construction supervision of future projects.

Project Playbook: ContextCapture

Soarscape Technology Development (Shanghai) Co., Ltd.
Reality 3D Simulation for Self-driving Cars
Shanghai, China

Testing the safety and reliability of self-driving cars is time consuming and expensive. Soarscape Technology Development Shanghai undertook the development of a 3D data acquisition, modeling, and 3D automatic driving simulation system. The team, faced with site constraints and costly, voluminous data collection along a 10-kilometer trafficked road in Shanghai, integrated digital modeling technology to build the 3D reality model and simulate automatic driving tests.

The team used ContextCapture to perform automatic 3D reality modeling. The fully processed reality mesh was imported into LumenRT for 3D simulation and animation. The automated modeling features reduced modeling time from three months to 10 days, saving CNY 260,000 in data acquisition and associated labor costs. The applications provide a seamless solution from data production through model editing, application, and optimization, eliminating data conversion and achieving successful 3D simulation of automatic driving.

Project Playbook: ContextCapture, LumenRT, OpenRoads

Drone ID

Installation of a 3D Model for Bridge Safety Check Using Automated Drones

Seoul, South Korea

Over the next 20 years, 89% of Seoul's total infrastructure will be aged and need rehabilitation. Conventional manual methods for inspecting lower bridge portions and difficult-to-access structural areas are costly, time consuming, and unsafe for inspectors. Supporting intelligent safety inspections with artificial intelligence and digital data, Drone ID initiated a project using unmanned aerial vehicles and reality modeling to safely and efficiently check city infrastructure.

The project team used a UAV capable of 3D automated flight to capture 1,348 images, a laser scanner to obtain point clouds, and ContextCapture to process the data into a digital twin model. The integrated UAV and reality modeling solution accurately models and monitors the bridge areas that are difficult to view, identifying cracks, leaks, and other problems. The solution also predicts the progress of these defects to facilitate smart infrastructure management. Compared to time and costs for traditional, static manual methods, the return on investment increased by 75%.

Project Playbook: ContextCapture

Asia Pacific

CECI Engineering Consultants Inc., Taiwan
Bridge Construction and Diversion

Taipei, Taiwan

CECI is responsible for detailed design, road reconstruction, trench renovation, and slope protection associated with a bridge construction initiative in Taipei, Taiwan. The project is located in a collapsed area with unstable terrain, making it difficult for them to manually survey the site. They realized that using unmanned aerial vehicles and reality modeling technology, combined with BIM design processes, would help familiarize engineers with current site conditions.

CECI selected ContextCapture to build a 3D reality mesh of the terrain and used the model to monitor landslide displacement. Using Bentley's reality modeling solution helped them to reduce the time spent on conventional manual surveys and the costs associated with the process. CECI expects to integrate artificial intelligence with reality modeling in the future to help them automate terrain monitoring.

Project Playbook: ContextCapture

Huaiban Engineering Consulting Co., Ltd.

Request for Construction Supervision Technical Service for Sidewalk Improvement Project along Gongjian West Road and Junxian Road in Qidu District

Keelung, Taiwan

A TWD 18.750 million project in Taiwan involved updating and improving 1,251 meters of deteriorating sidewalks in the Qidu district of Keelung City. As the engineering consultants, Huaiban Engineering Consulting faced design, planning, and construction challenges. They originally used third-party 3D design software; however, it had resulted in time-consuming efforts to draw the surroundings into the models. They realized that they needed to digitally capture the existing site and generate a 3D reality mesh to effectively plan the redesign of the sidewalks.

Huaiban Engineering Consulting selected ContextCapture to generate 3D models of the surrounding area, visualizing differences in road elevation, and overlaid the reality meshes with the design model. Using Bentley's reality modeling software shortened modeling time, enabling them to quickly identify current conditions and design issues to improve upcoming construction works and material quantity calculations.

Project Playbook: ContextCapture

Nissin Co., Ltd.

Review Meeting for Drive Simulation-based Design

Kosai, Shizuoka, Japan

To determine traffic and pedestrian safety in a newly constructed area, the project owner needed a clear visual to present to the impacted property owners and perform comparative investigations. The project team at Nissin realized that they needed comprehensive reality modeling technology to generate a model of the existing site and create driving animations from the driver's perspective.

They selected ContextCapture to create a reality mesh of the area and imported that into OpenRoads to integrate road design data, including sidewalks. To create a simulated driving environment, Nissin used LumenRT, incorporating passenger cars, buses, and pedestrians. Using Bentley's applications, they eliminated the need for modeling buildings, saving significant associated resource hours and costs. Through dynamic modeling and visualization, they generated a highly realistic driving simulation enabling comparative investigation of the safety and driving convenience with a high degree of accuracy.

Project Playbook: ContextCapture, LumenRT, OpenRoads Designer

Chongqing Communications Planning Survey & Design Institute;
Guizhou Communications Construction Group Co., Ltd.

Integrated Application of BIM in Meitan-Shiqian Expressway

Zunyi, Guizhou, China

The Meitan-Shiqian Expressway runs a total length of 112.9 kilometers with almost 55% of the line comprised of bridges and tunnels. A large-scale project featuring numerous existing structures amid complex topography and geology, the CNY 17.88 billion initiative presented engineering design and construction management challenges. The project team needed to create a BIM model to improve construction and full lifecycle management.

Unmanned aerial vehicles were used to survey the existing site while ContextCapture helped develop a 3D reality model to accelerate design optimization, shortening the construction period by 89 days. Using OpenRoads to build a multidiscipline BIM model helped identify more than 100 collisions prior to construction. Integrating LumenRT provided an immersive, virtual experience for builders to better understand design intent. The 3D BIM model helped accumulate 61 gigabytes of digital asset data, establishing a digital twin for future operations and maintenance.

Project Playbook: ContextCapture, LumenRT, MicroStation, OpenBridge, OpenRoads, ProStructures

Geospatial Information Co.

Comparison of Geumgang Pedestrian Bridge BIM Design and 3D Model Process

Sejong City, South Korea

Set to be a landmark for Sejong City, the Geumgang Pedestrian Bridge has a total length of 1,638 meters and spans a width between 12 meters and 30 meters. To ensure the design intent and construction process were aligned, the project team wanted to compare the BIM design data with the on-site works. They tried using third-party software to capture and monitor the project site, but they lacked accuracy and clear visibility.

They selected ContextCapture to generate a 3D reality mesh from images taken of the construction site, including the collapsed slope surface, to determine the restoration works required. Using the models, they were able to quickly identify the exact location of the damaged areas at the site, guiding construction accordingly and resolving the damages. The models can be used for similar works in the future.

Project Playbook: ContextCapture, Descartes

PT Hutama Karya (Persero)

Trans Sumatera Toll Road Project Section Serbelawan–Pematangsiantar

Pematangsiantar, Sumatera Utara, Indonesia

The government of Indonesia gave PT Hutama Karya, a construction services, developer, and toll road service provider, a mandate to build the Trans Sumatera Toll Road. The USD 37.5 billion mega expressway project stretches 2,800 kilometers across Sumatra Island from the northern tip of Banda Aceh to the southern tip of Bakauheni. To accelerate project completion, PT Hutama Karya has joined with other infrastructure developers to build and operate several sections. The Serbelawan to Pematangsiantar section spans 28 kilometers and is projected to shorten travel time by 50%. Located in a remote and dense forest, the team faced data acquisition challenges while working with numerous disciplines and software platforms. Having experience using various BIM platforms, PT Hutama Karya sought interoperable digital modeling technology to accommodate large files and improve project collaboration.

They selected ContextCapture to deliver an accurate reality mesh of the remote project area in 28 days, compared to the 120 days it would have taken using conventional survey methods. Using OpenRoads and OpenBridge streamlined data and workflows, shortening coordination and approval time by up to 34 days, while PLAXIS helped avoid potential critical failure due to soft soil conditions. Bentley's integrated digital solution resolved compatibility issues and clashes, provided data continuity, and optimized collaboration to save USD 2.18 million. By May of 2021, 663 kilometers of the road had been constructed and in operation. The entire project is expected to be completed by 2024.

Project Playbook: ContextCapture, MicroStation, OpenBridge Modeler, OpenRoads Designer, PLAXIS

Europe

Multiconsult Polska Sp. z o.o.

Design and Construction of the S52 Road – The Kraków Northern Bypass

Kraków, Poland

Multiconsult Polska is the chief designer for the S52 expressway, which will provide a collision-free, fast, and safe transport route for residents of Kraków and the surrounding areas. The project includes 13 kilometers of roadway and two tunnels, as well as infrastructure reconstruction in a highly urbanized area with complex topography. To avoid inefficiencies associated with conventional approaches, Multiconsult Polska wanted to implement digital BIM methodologies. However, after struggling to standardize modeling procedures, they needed to establish a connected data environment.

Already a Bentley user, Multiconsult Polska selected OpenRoads Designer and OpenBridge Modeler to create dynamic 3D models for roadway, bridge, and tunnel solutions. They used ContextCapture to create a reality mesh of existing site conditions and OpenBuildings® Designer to generate accurate reports and bills of quantity directly from the models. The integrated modeling environment helped coordinate design processes, saving 70% in time compared to traditional methods.

Project Playbook: ContextCapture, MicroStation, OpenBridge Modeler, OpenBuildings, OpenRoads Designer

Grunder Ingenieure AG
Smart Road Management Switzerland
Bern, Switzerland

To optimally maintain and manage Bern's 2,200-kilometer canton roadway network, a condition analysis is performed every four years. For the first time, Grunder Ingenieure AG used a 3D mobile mapping system instead of a conventional measuring vehicle. They faced data integration, management, and accessibility challenges, compounded by a tight six-month timeline. They realized that to process, store, and share the 4,400-kilometer point cloud and over 10 million images, they needed a powerful, neutral visual platform.

They selected Orbit 3DM to integrate the voluminous captured digital data with the public authority's existing roadway management software. Using Orbit 3DM provided the multiple planning offices with unlimited access to the digital twin for corrective maintenance, eliminating the need for on-site inspections and extending 3D digital data application beyond road condition analysis. The combined technology strategy provides an intelligent urban management solution that they expect will benefit other areas of the country in the future.

Project Playbook: MicroStation, OpenRoads, Orbit 3DM
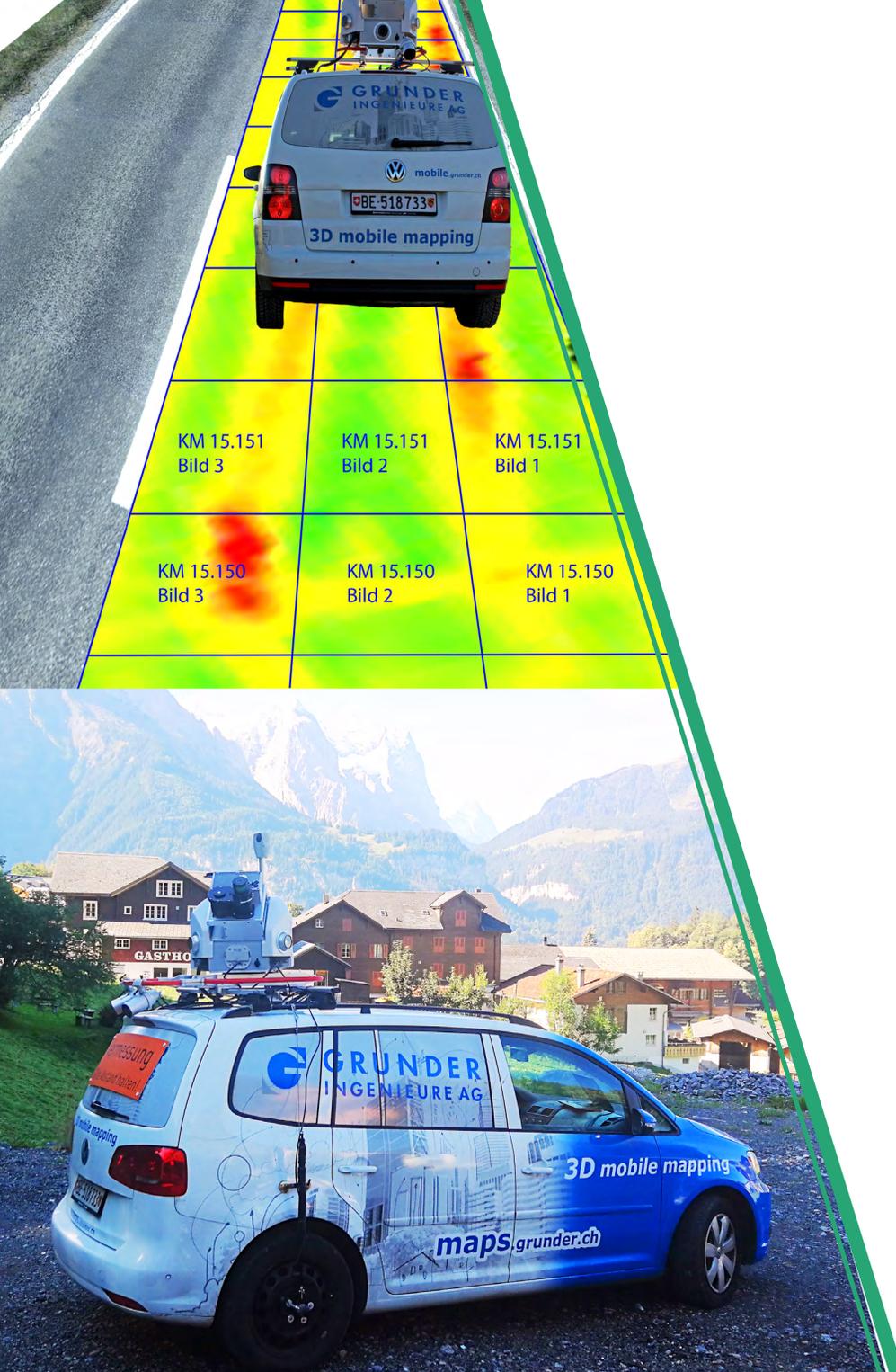
Italferr S.p.A.

RM – FI High Speed Line – Survey of the Borratino Viaduct

Reggello, Tuscany, Italy

The Borratino Viaduct is 1,300 meters long, made of reinforced concrete, and features approximately 50 spans. Italferr was tasked with surveying and modeling the structure but faced technical and coordination challenges given its sheer size and shape, requiring numerous technologies to effectively capture and model it. They needed a flexible reality modeling application and a connected data environment.

Italferr selected ContextCapture to process the voluminous amount of multisourced data, point clouds, and photos into an accurate reality mesh, and ProjectWise to enable intelligent exchange of all survey data and models. The flexibility and interoperability of ContextCapture enabled them to work dynamically and digitally, reducing processing times for a large quantity of data that was not possible with other software. OpenRail™ facilitated integration of BIM information with the reality model to generate a digital twin of the structure that they expect to use for real-time monitoring, maintenance, and asset management in the future.

**Project Playbook: ContextCapture, iTwin,
OpenRail Designer, ProjectWise**

About Bentley Systems

Bentley Systems (Nasdaq: BSY) is the *infrastructure engineering software* company. We provide innovative software to advance the world's infrastructure – sustaining both the global economy and environment. Our industry-leading software solutions are used by professionals, and organizations of every size, for the design, construction, and operations of roads and bridges, rail and transit, water and wastewater, public works and utilities, buildings and campuses, mining, and industrial facilities. Our offerings include *MicroStation*-based applications for modeling and simulation, *ProjectWise* for project delivery, *AssetWise* for asset and network performance, Seequent's leading geoprofessional software portfolio, and the *iTwin* platform for infrastructure digital twins. Bentley Systems employs more than 4,500 colleagues and generates annual revenues of approximately $1 billion in 186 countries.

For additional information, visit www.bentley.com.

Bentley's Reality Modeling Solution

Bentley's reality modeling solution help users easily capture, manage, analyze, and share terabytes of reality data of any size, from any system, into one single source of truth that provides 4D digital context to solve infrastructure challenges.

For additional information, visit https://www.bentley.com/software/reality-and-spatial-modeling/.