

# Orbit 3DM<sup>®</sup>

Reality Modeling for Communications, Digital Cities,  
Mapping and Surveying, Transportation, Utilities, and Water



# Digital Twins Need Digital Context

Efficiently manage, analyze, and share your reality data to provide accurate 4D digital context that improves how you design, construct, operate, and collaborate.

A **digital twin** is a digital representation of a physical asset, process or system as well as the engineering information that allows is to understand and model its performance. A digital twin enables users to visualize the asset, check status, perform analysis, and generate insights in order to predict and optimize asset performance.

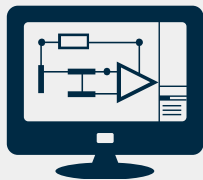
A key process adopting digital twins **is maintaining an updated digital context** made by a combination of captured reality data types such as image-based reality meshes, LiDAR point clouds, digital terrain models, mobile imagery, and GIS sources. This digital context always needs to be up to date so that you can visualize the asset, check its status, perform analyses, and generate insights to predict and optimize the performance of their digital twin.

Because of the continuous updating process, there is a strong shift to more dynamic mapping systems that use multiple sensors while capturing reality data. Users are collecting data while walking, driving, and flying, as well as scanning images and LiDAR data at the same time and over different periods. The faster data capturing process, built from multiple reality data sources, challenges our data management process like never before.

This leads to the need for new solutions that can organize and manage large volumes of reality data, update reality data at any time, and bring digital context to everyone on your team. Bentley's Orbit 3DM applications help owner-operators and engineering companies to:

- **MANAGE** their high volumes of captured 3D that come from a variety of capturing 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.

In this e-book, you will learn how your peers are making complex data easy to use with Bentley's reality modeling solutions and make informed decisions based on an up-to-date single data environment.



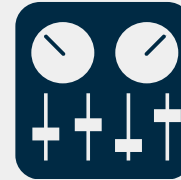
## Design Workflows

Accelerate design and manage constructability risk.



## Construction Workflows

Monitor sites for change and to verify design.



## Operations Workflows

Document existing conditions and manage assets in real time.



## Inspection Workflows

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

## Optimized Procedures for Slope Inventory in Phoenix, Arizona

*BPG Designs*

Phoenix, Arizona

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 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](#)

“The time savings, repeatability, and documentation allowed BPG to provide an accurate, quality result for over 630 centerline miles that was delivered on time and exceeded the expectations of the clients.”

– Gentry Nissen, GIS Specialist, BPG Designs





## Mobile Mapping to Create Autonomous Vehicle Maps in Singapore

### *GPS Lands Singapore*

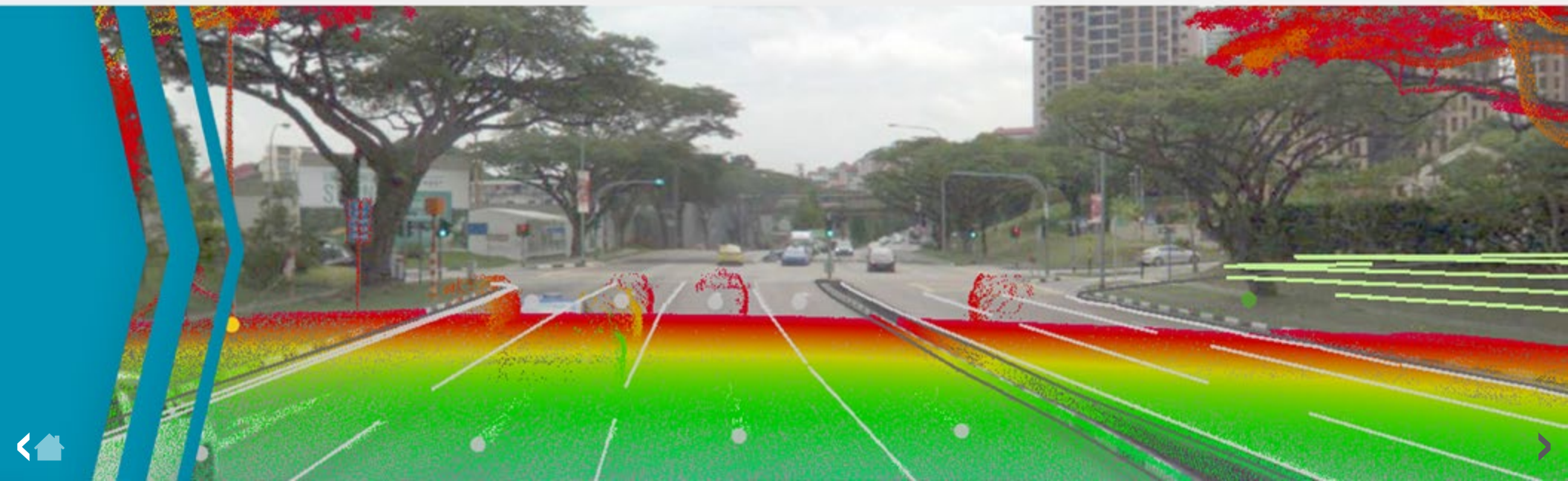
Singapore

Singapore's Land Transport Authority and Jurong Town Corporation designated the One-North tech hub as a trial area for testing autonomous vehicles (AVs). However, to help AVs navigate and ensure safety, the project needed accurate information about all aspects of the test environment. GPS Lands Singapore was contracted to produce highly detailed maps of routes totaling 55 kilometers. The planning, image capture, and data extraction process took GPS Lands Singapore four months to complete.

GPS Lands Singapore used Orbit 3DM Content Manager to capture and process all acquired image and point cloud data to the highest possible accuracy. After the team generated the optimized detection parameters, Orbit 3DM Feature Extraction

Pro automatically identified road features such as lane markings and curb lines. By adjusting auto-detection capabilities within Orbit 3DM Feature Extraction Pro and filtering out false detections, GPS Lands Singapore reduced the time needed to manually search for specific features within the data. The completed AV guidance map will be used to help other map providers or AV companies develop their own AV mapping data to suit specific needs.

[Project Playbook: Orbit 3DM Content Manager, Orbit 3DM Feature Extraction](#)



## Mobile Mapping Pavement Marking Inventory in Ohio

*MasterMind LLC*

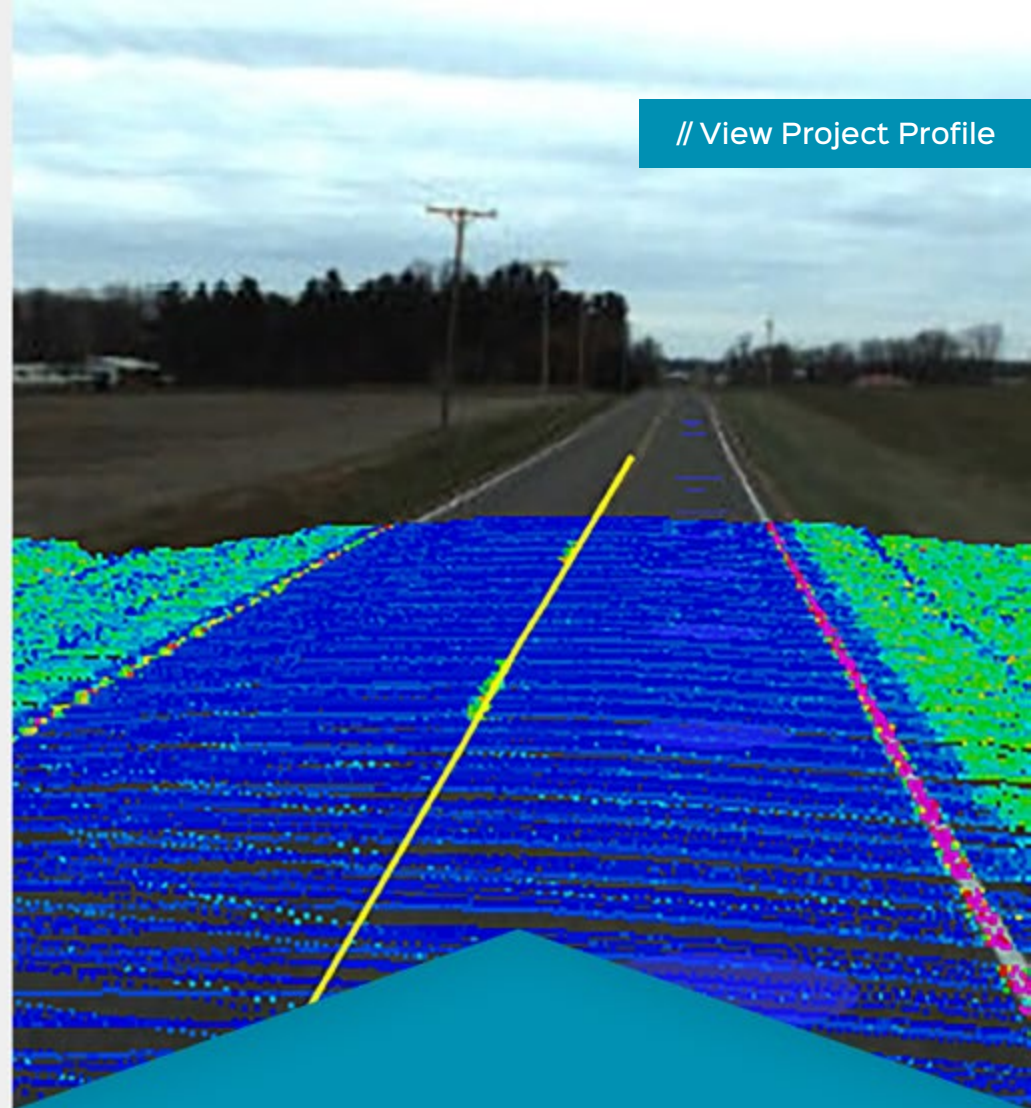
Mansfield, Ohio

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**

// View Project Profile



“

Orbit 3DM Content Manager provided ease of integration for our MasterMind custom mobile mapping system. The Orbit 3DM Feature Extraction application offered an extensive amount of asset inventory capabilities.

– Nicholas Hickman, President and Co-founder, MasterMind LLC

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## Mobile Mapping to Improve Water Utility Services

### *CIVIS Bolivia*

Cochabamba, Bolivia

For many years in metro Cochabamba the population of over 1 million people endured enormous difficulties accessing water, with up to a third of the population lacking regular access. Since the Bolivian government has heavily regulated water rates, water utility company SEMAPA had to prioritize its investments while facing a tight budget. To improve access, SEMAPA contracted CIVIS Bolivia to update the water network database and its management platform. The organization used mobile mapping technology to quickly capture geospatial data across 3,000 hectares.

With Orbit 3DM Content Manager, mapping teams processed captured image data and produced a 3D map of the entire water system with 360-degree high-resolution images and 3D point clouds. SEMAPA incorporated all the image

data into a web-based GIS using Orbit 3DM Publisher, which allowed the utility to move its network information from multiple open-source applications to a single platform. Web-based access to organized data helps workers locate, diagnose, and respond to any problems or equipment failures, significantly speeding up response time. A centralized network of data also encourages collaboration and speeds decision-making throughout the organization, improving workflows and feasibility studies for building out the network.

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

Orbit 3DM Publisher has proven to be the ideal solution to share and manage all those terabytes of information effortlessly, and easily combines imagery, point cloud, vector, and raster data.

– Fernando Terrazas, COO, CIVIS Bolivia





# Reality Modeling in Digital Cities

## Singapore Digital Twin

### *GPS Lands Singapore*

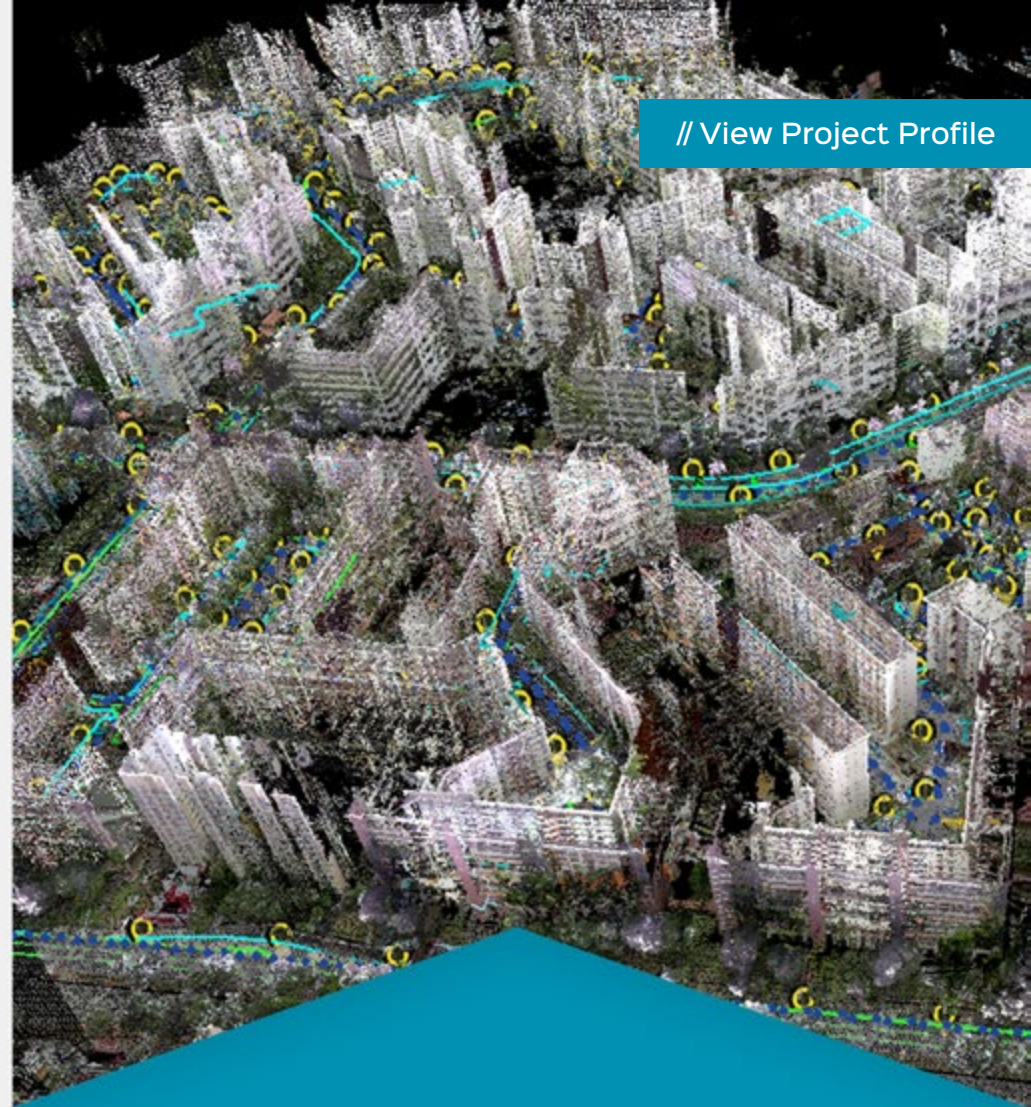
Singapore

The Singapore Land Authority (SLA) manages land use on the small island nation for continued development. With aboveground and belowground buildings and infrastructure growing and overlapping, 2D maps can no longer convey accurate GIS information for the nation. GPS Lands Singapore approached SLA with a solution that would create the Singapore Digital Twin platform, which gathers highly detailed 3D geospatial data for the island into a single platform. GPS Lands Singapore captured aerial and street-level image data, then combined the data into a single platform with Orbit 3DM Content Manager.

The mapping team used Orbit 3DM Content Manager to verify large-scale data sets to detect and resolve any mismatched data, as well as manage datasets by grouping them separately when needed. Orbit 3DM Feature Extraction enables the mapping team to create reports and share information with government stakeholders. Singapore Digital Twin now displays all parts of the nation in highly detailed 3D representations. In addition to showing buildings and terrain, Singapore Digital Twin accurately displays small features like trees, lamp posts, and manholes. The full map can be incorporated into existing 2D GIS data and is now shared with various government agencies to help with asset management and decision-making.

**Project Playbook: Orbit 3DM Content Manager, Orbit 3DM Feature Extraction, Orbit 3DM Cloud**

// View Project Profile



Orbit 3DM's ease of use and its interaction of high-quality datasets have opened up many possibilities for government stakeholders to efficiently manage features and assets of interest.

– Johnson Ang, Project Manager, GPS Lands Singapore



## Reality Modeling for Al-Madinah Al-Munawwarah *Ala Abdulhadi & Khalifa Hawas Consulting Engineering Company*

Al-Madinah Al-Munawwarah, Madinah, Saudi Arabia

Each year millions of Muslims make pilgrimages to the holy city of Medina, Saudi Arabia, and its three prominent mosques and other areas of religious and historical significance. The Kingdom of Saudi Arabia wants to accommodate an increase in pilgrimages from 8 million to 30 million by 2030. Ala Abdulhadi & Khalifa Hawas Consulting Engineering Company (AHCEC) was tasked with designing the plan, which includes expanding transportation systems and hospitality facilities while preserving historical sites. They captured images of the city and established a reality model of 55 square kilometers using ContextCapture™.

Once they created the reality model, AHCEC used Orbit 3DM Content Manager, Orbit 3DM Feature Extraction, and Orbit 3DM Publisher to effectively manage and feature extract content, as well as publish mobile mapping data. These applications implemented data from existing point clouds. Reality modeling provided the team with a reliable survey technique that minimized modeling time and costs while streamlining decision-making and visualization. The applications helped them complete the objective in nine months, saving over a year in surveying time and more than SAR 42 million. The interoperability of the applications allowed the model to be exported in web-ready formats for easier approvals from the government and other stakeholders.

**Project Playbook:** Orbit 3DM Content Manager, Orbit 3DM Feature Extraction, Orbit 3DM Publisher, ContextCapture



“Compounded with exceptional support, Bentley’s ContextCapture provided features to enable multi-engine processing using not just images but point clouds, something that none of the other software provided. ContextCapture proved to be consequential in completing the project with such good quality and high client satisfaction.”

– Khalid Farid Sallam, Geomatics Manager,  
*Ala Abdulhadi & Khalifa Hawas Consulting Engineering Company*





## Mobile Mapping Application Integration

### *BPG Designs*

Phoenix, Arizona

The mapping group at BPG Designs provides a variety of services to clients, including survey, mobile mapping, LiDAR, unmanned aerial vehicle dataset processing, and custom GIS solutions. As a result, they used a growing variety of software packages that were not compatible with one another, which eventually became difficult to manage. BPG Designs wanted to integrate these systems and break down data silos, but they found the process difficult.

By using Orbit 3DM Feature Extraction, they could accept and process LiDAR data from multiple mobile systems and processing packages without any problems. They exported extracted data in a variety of different formats, which

helped them maintain their existing workflow. Orbit 3DM Publisher helped them improve the quality of their presentations to end users within the GIS web applications they were comfortable using. BPG Designs also used Orbit 3DM Feature Extraction to combine databases and carry out feature extraction in real time. Orbit 3DM applications have become a cornerstone of the mapping group as they integrate their processes without requiring them to alter how they work.

**Project Playbook: Orbit 3DM Feature Extraction, Orbit 3DM Publisher**

“Orbit Feature Extraction has now gone from ‘just an extraction software’ to the highly integrated backbone of our department. Orbit did not drive, or change, our workflow. Instead, it nestled itself right into all aspects of it, and in some places that we did not even anticipate. Orbit even managed to integrate aspects of our work that we could not have done without it.”

*-Nikolas Smilovsky, Mapping Department Manager, BPG Designs*



## Flemish Street Mapping

### *Image-V*

Flanders, Belgium

The Flanders Geographical Information Agency wanted to improve its 3D street-level maps of the city based on lessons learned when establishing them, including issues with variations in quality, precision, capture speed, data volume, and privacy. They also wanted to improve privacy by blurring sensitive portions of images such as faces and license plates, as well as take advantage of available improved technology to produce higher-quality images. Image-V, a joint venture between Teccon and Sweco, was contracted to capture spherical imagery and LiDAR data for 65,000 kilometers of roads in the city and produce an updated, web-accessible map that included the original images for comparison.

Image-V determined that Orbit 3DM applications could help them deliver the project on time and meet all expectations. Orbit 3DM Content Manager helped them establish a production workflow and blur sensitive areas. With Orbit 3DM Publisher, they published the image and LiDAR data online to allow for detailed measurements and feature extraction. Now, users like public authorities can adopt the mapping data into their workflows and develop their own plugins. In the end, Orbit 3DM applications helped Image-V capture and process nearly 13 million images and, including LiDAR data and the original images, 250 terabytes of data.

**Project Playbook:** [Orbit 3DM Content Manager](#), [Orbit 3DM Publisher](#)





# 2020 Going Digital Award for Advancements in Digital Cities Nominee

## Reality Modeling in Digital Cities

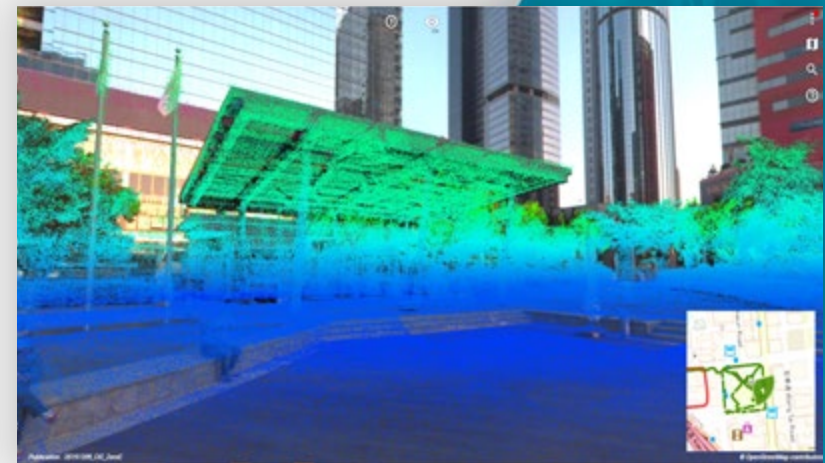
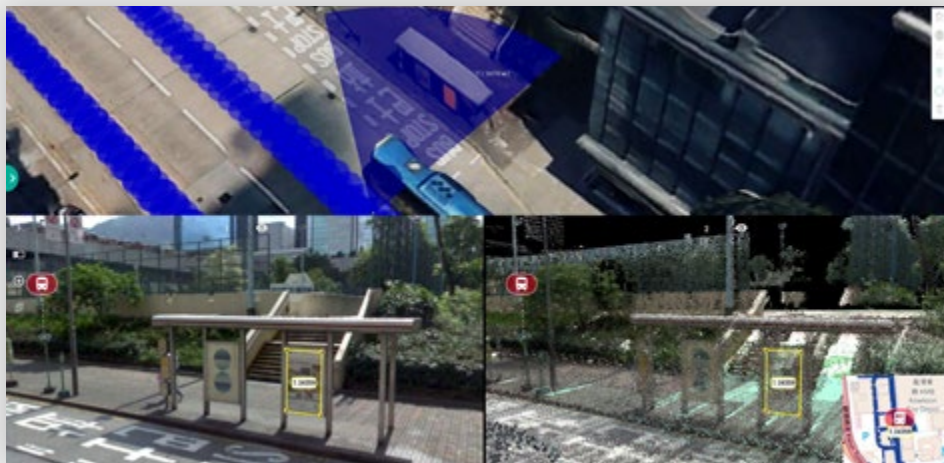
### Development of Common Spatial Data Infrastructure and 3D Digital Map Land Information Center, Lands Development Survey and Mapping Office, Hong Kong

Hong Kong, China

Aligned with developing Hong Kong as a world-class smart city, the Development Bureau is dedicating HKD 300 million to establish a common spatial data infrastructure (CSDI) and 3D digital maps as a geospatial, cloud-based platform. For many buildings, there are only outdated 2D construction plans that could result in expensive issues when the city needs to modify and expand existing facilities. The project team faced significant challenges in collecting, managing, and integrating the various resources' spatial data with environmental, operational, and facility maintenance tools.

They chose 3D laser scanning and photogrammetry to produce accurate 3D models and realized that Orbit 3DM was the best solution to manage the point clouds and images. The application allowed data captured from multiple sensors and different vendors to be simultaneously published in a digital, cloud-based environment. The CSDI is an open-data technology platform that is expected to expand the scope and application of digital services to optimize the city's urban planning and management.

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



### Response on Taskforce to Promote Digital Twins to Work from Home during COVID-19

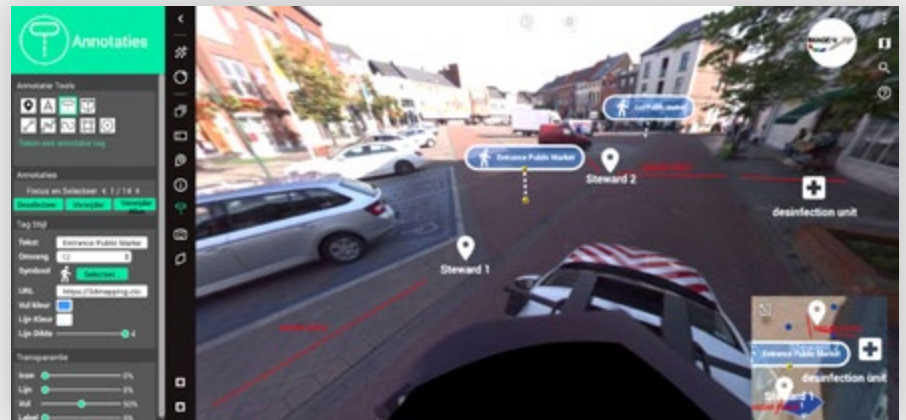
*Orbit Geospatial Technologies Belgium*

Flanders, Belgium

The COVID-19 pandemic opened new perspectives for using digital platforms to support work-from-home initiatives during lockdown. The Flemish government, therefore, set up a taskforce to promote digitalization, helping local and regional authorities work remotely. They already had a database with all 65,000 kilometers of Flanders' roadways but needed to find a user-friendly digital platform to share over 90 terabytes of data with diverse users that have varied levels of technology experience.

They selected Bentley's Orbit 3DM Cloud to make the digital twin accessible at no cost to city employees, the police force, and security teams so they could continue efficient planning, analysis, and management efforts during the pandemic lockdown. They saw 50% of municipalities subscribing to the platform. The digital solution was so successful that users have already requested quotations for continued use after free access expires. Using a digital twin has been paramount to analyzing the public environment and developing a phased strategy to safely reopen the region.

#### Project Playbook: Orbit 3DM Cloud





# 2020 Going Digital Award for Advancements in Reality Modeling Nominee

## Reality Modeling in Digital Cities

### 3D Mapping Project of the Whole Kulangsu Island

#### *Xiamen Planning Digital Technology Research Center*

Xiamen, Fujian, China

Kulangsu Island, off the coast of southeast China, is a UNESCO world cultural heritage site and one of the country's most visited tourist attractions. Xiamen Planning Digital Technology Research Center undertook building a digital database of the island and needed to provide reality capture and 3D mapping to contribute to Xiamen's digital city construction. They realized that to efficiently generate an accurate digitalization of ancient architecture, they needed an integrated data capture and processing technology solution.

They used ContextCapture to develop a 3D reality mesh from aerial images and laser scanned point clouds, as well as developed a 3D mapping software based on MicroStation® and Orbit 3DM. The software provided a complete solution for full-process digitalization. They completed data capture and processing to deliver the 3D model within one month, compared to six months using manual methods. The model accuracy exceeded their expectations, and the successful technology implementation will provide technical support for city-level application.

**Project Playbook:** ContextCapture, MicroStation, Orbit 3DM



# 2020 Going Digital Award for Advancements in Reality Modeling Nominee

## Reality Modeling in Campuses

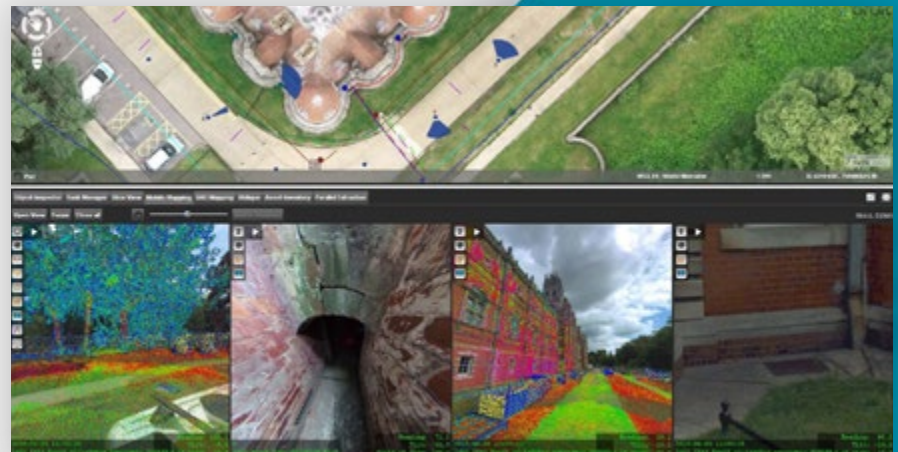
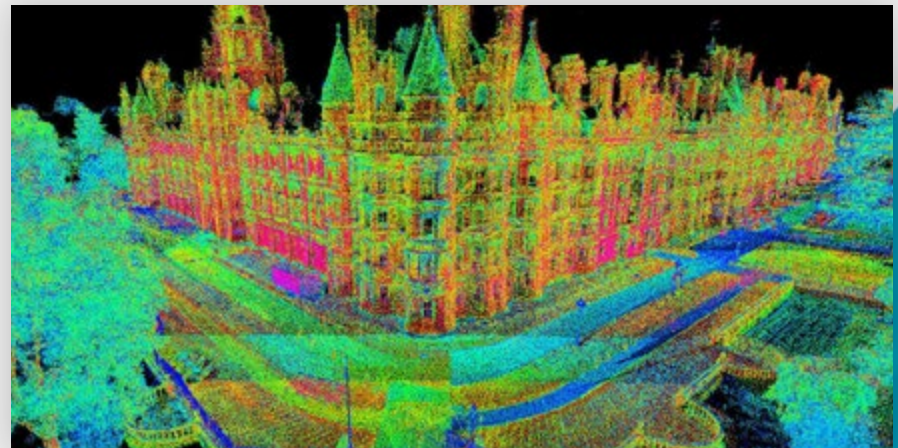
### RHUL Integrated Survey *LandScope Engineering*

Royal Holloway, University of London, Egham,  
Surrey, United Kingdom

To help Royal Holloway, University of London (RHUL) establish an accurate, single 3D GIS system of all campus assets, LandScope used 3D mobile mapping to complement traditional data capture and survey of the entire campus, aboveground and belowground. They faced data integration issues with RHUL's current 2D system and accessibility challenges. To incorporate the voluminous multidiscipline survey data sets in a universally accessible environment, they opted for an interoperable solution.

They chose Orbit 3DM Content Manager and Orbit 3DM Feature Extraction because of their ability to accommodate 2D and 3D GIS data sets in one system. Having all the data up to date and easily accessible for visualization in a single 3D digital platform accelerates search queries, improves productivity, and eliminates rework, saving time and operational costs. Additionally, using Orbit 3DM Publisher, LandScope provided all stakeholders with digital access to campus structures both aboveground and belowground, offering invaluable insight that will improve campus decision-making for asset management, operations, and new infrastructure projects.

**Project Playbook: Orbit 3DM Content Manager, Orbit 3DM Feature Extraction, Orbit 3DM Publisher**





# 2020 Going Digital Award for Advancements in Reality Modeling Nominee

## Reality Modeling in Transportation

### Smart Road Management Switzerland

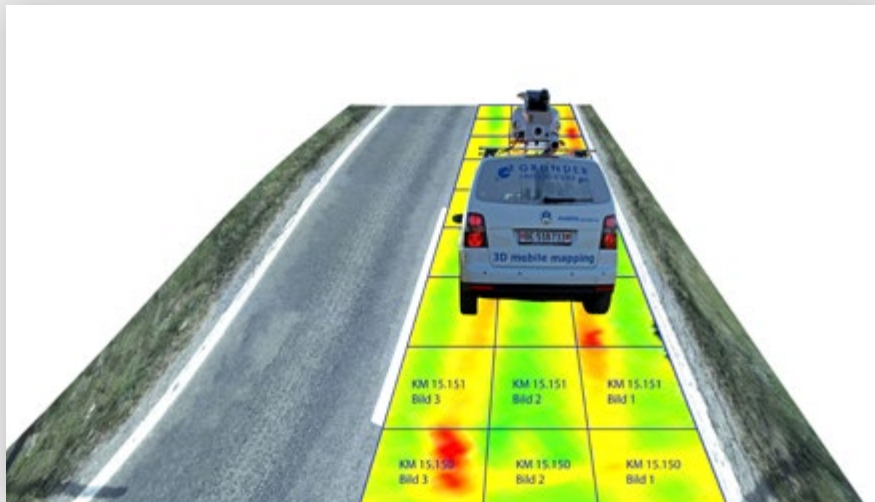
Gründer Ingenieure AG

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, Gründer 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 products to integrate the voluminous captured digital data with the public authority's existing roadway management software. Using Orbit 3DM Publisher 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 Content Manager, Orbit 3DM Publisher



# 2020 Going Digital Award for Advancements in Utilities and Communications Nominee

## Reality Modeling in Utilities and Communications

### TOGO – LiDAR Mobile Solution for Utilities and TELCOs

#### XYGO-Business Solutions

Bogota, Cundinamarca, Colombia

The electrical utility company for Bogota, Colombia retained XYGO-Business Solutions to survey and digitalize its electrical distribution system to improve their network management. XYGO faced the challenge of accurately capturing large volumes of data to model low and medium voltage power grids, as well as needing to meet integration and publication requirements. They needed to use state-of-the-art data capture methods and establish a cloud-based platform to generate a digital twin that is accessible to all utility users.

They used LiDAR scanning and high-definition cameras to capture point clouds and panoramic photographs, and Orbit 3DM Content Manager, Orbit 3DM Feature Extraction, and Orbit 3DM Publisher to automatically process, publish, and integrate the information with the utility's management platform for visualization and analysis. Using Orbit 3DM for mobile mapping allowed virtual inspections to be carried out, saving the client 30% in costs and reducing risks associated with on-site surveys. The digitalized network enables full asset management, preventive maintenance, and planning through the digital twin.

**Project Playbook: Orbit 3DM Content Manager, Orbit 3DM Feature Extraction, Orbit 3DM Publisher**





## About Orbit 3DM

Bentley's Orbit 3DM solutions help users manage, analyze, and share massive amounts of point cloud, imagery, textured mesh, and traditional GIS resources for use with reality modeling and digital twins.

Orbit 3DM enables you to easily access, update, and manage reality data of any size from any system. The solution enables you to ensure the accuracy and detail of your aboveground, belowground, or indoor reality data acquired from terrestrial, mobile, UAS, oblique, and aerial mapping systems. You can complete simple and complex measurements, extract features, and perform advanced analysis using massive amounts of reality and efficiently share them internally, externally, or embedded in a third-party application.

Hardware-neutral, Orbit 3DM gives users a full 3D 360° view of the world by enabling the real-time fusion of various reality data resources of any size from any system.

Engineers, geospatial professionals, and infrastructure owner-operators can address current project needs for increasingly accurate, versatile, manageable, and embedded use of digital twins with 4D surveying facilitated by Orbit 3DM solutions.

[Tell Me More >](#)

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## 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, and industrial facilities. Our offerings

include MicroStation-based applications for modeling and simulation, *ProjectWise* for project delivery, *AssetWise* for asset and network performance, and the *iTwin* platform for infrastructure digital twins. Bentley Systems employs more than 4,000 colleagues and generates annual revenues of more than \$800 million, in 172 countries. [www.bentley.com](http://www.bentley.com)

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