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Advancing Infrastructure

Italferr Merges Survey Data to Create Precise Reality Mesh of the Borratino Viaduct

ContextCapture and Digital Twin Applications Facilitate Data Integration, Management, and Analysis for Detailed Modeling

MODELING CURRENT INFRASTRUCTURE TO SUPPORT FUTURE PROJECTS

Italferr, a member of the Ferrovie dello Stato Italiane Group, aims to promote Italian engineering excellence in the railway sector in the national and international market. They have over 30 years of experience in infrastructure, including rail, metro, land road transport, as well as ports and stations. Italferr is driven by innovation and deep involvement throughout the infrastructure lifecycle. The organization works on a broad range of steps within the project lifecycle, including design, procurement, management, and construction supervision.

Italferr sought to update the Borratino viaduct in Reggello, and they were responsible for creating a digital representation of the structure that would support future designs. The organization used a topographic survey to create this representation, coordinating activity on site and in the office while using applications from multiple vendors. The representation needed to be a precise, 3D multiresolution reality mesh to contextualize the structure in its territory. The viaduct is 1,300 meters long and made of reinforced concrete with 50 spans, making it difficult to survey.

USING DRONE AND LASER TECHNOLOGY TO SURVEY THE STRUCTURE

Italferr wanted to guarantee that their digital reconstruction would be highly precise. Therefore, they conducted several approaches to surveying the viaduct, including a topographic survey where they used a GPS mapping network for geometric leveling of known points. This was a high-precision traverse survey. They also used aerial photogrammetry to capture color digital orthophotos, using these images to produce digital

maps of the surrounding area. Italferr then used a drone to capture images that aerial photogrammetry could not. They conducted two drone flights, capturing a total of 751 images. Italferr also placed 95 targets on the ground and georeferenced for image orientation. Additionally, they used high-precision laser scanning tools to survey the deck and piers. These instruments acquired 200 scans and measured 20 billion points. Lastly, Italferr conducted a tachymetric survey of the track and buildings being analyzed.

The viaduct's large size became an obstacle for Italferr, as it was difficult to efficiently integrate the data from several different technologies in sufficient detail. "To obtain the desired result, it was necessary to evaluate every tiny detail," said Vincenzo Conforti, head of lines, nodes, and track design at Italferr. Italferr succeeded in achieving a great degree of precision with multiple surveys employing complex technology. With a large data set from such a diverse set of sources, however, Italferr needed to ensure that they optimized all the information they had access to. This breadth of their survey data posed a new challenge in integrating it, as the company struggled to find software that offered this capability.

INTEGRATING DATA FOR PRECISE MODELING

Italfer found that Bentley applications were the most effective options for data integration and reality mesh precision. "The use of ProjectWise made it possible to manage and organize in a structured way the large amount of data involved, allowing for the intelligent and effective exchange of information," said Conforti. Italferr then created the mesh in the 3MX format using ContextCapture, allowing them to modify individual tiles. The ideal format for uploading the mesh outside of ContextCapture

PROJECT SUMMARY

ORGANIZATION
Italferr S.p.A.

SOLUTION
Reality Modeling

LOCATION
Reggello, Italy

PROJECT OBJECTIVES
◆ To create a precise high-resolution mesh of the Borratino viaduct to support future projects.

◆ To integrate and manage data from several topographic surveys simultaneously.

PROJECT PLAYBOOK
ContextCapture, OpenRail™ Designer, ProjectWise®

FAST FACTS
◆ Italferr has over 30 years of experience in infrastructure, driven by innovation and deep involvement throughout the infrastructure lifecycle.

◆ The Borratino viaduct is 1,300 meters long and made of reinforced concrete with 50 spans, making it difficult to efficiently integrate the data from several different technologies in sufficient detail.

◆ Bentley's software processed the data acquired by the drone flight and laser scans separately, while offering the user the option of later integration, resulting in a precise mesh.

ROI
◆ ContextCapture helped analyze 3 billion points simultaneously, significantly reducing the amount of time required to sift through a large amount of data acquired.

◆ Italferr used ContextCapture to merge images on three flight planes to identify overlap and millions of tie points between them, resulting in a precise, high-resolution mesh.

◆ By integrating data from a variety of surveys, Italferr achieved a mesh precision of 5 centimeters using Bentley applications.

was 3SM, so Italferr used OpenRail Design to seamlessly convert the 3MX mesh into 3SM format.

The team then used Bentley software to process the data acquired by the drone flight and laser scans separately while offering the user the option of later integration. This feature gave Italferr freedom in their analysis of the data, allowing them to view it both separately and in context together. The highly precise reality mesh helped viewers to see the degree of degradation on the piers, including exposed or damp areas. This level of clarity allowed the mesh to support future projects and maintenance.

Italferr realized that they could use the mesh to manage an iModel®, a relational database containing the elements of a digital twin. The organization could easily upload the models in a variety of formats through ContextShare on the Bentley iTwin platform. They could use the iModel to verify that the digital model created from the survey data was an accurate representation of the structure by viewing the reality mesh and its BIM model simultaneously. The iModel functioned as a database and a point of comparison for assessing future models.

FASTER, EASIER, AND MORE PRECISE MODELS

By using ContextCapture, Italferr could merge images on three flight planes to identify overlap and millions of tie points between them, resulting in a precise, high-resolution mesh. The software reduced the amount of time required to sift through the large amount of data, analyzing 3 billion points simultaneously. Italferr used two machines to run the software in parallel, reducing processing times greatly. The software processed approximately 35 billion points gathered in the survey, using about 1,000 machine hours and 200 hours of editing.

"The ContextCapture software offered the ability to work dynamically and digitally, and for the first time It was possible to manage a large quantity of data that until now had not been within the capacity of any software," said Conforti. By increasing the precision of the reality mesh while saving time, Bentley applications helped Italferr optimize their survey data to support future infrastructure management.

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