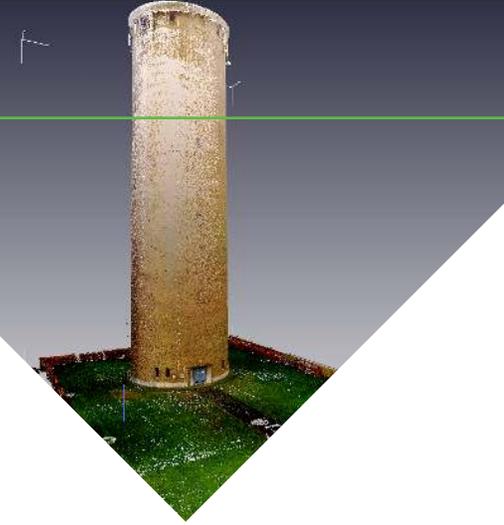


La Société Wallonne des Eaux Creates Digital 3D Database of Company Assets

Bentley Applications Enable Long-term Planning and Preventative Intervention by Automating Crack Detection



OPTIMIZING MANAGEMENT OF WATER ASSETS FOR RELIABLE WATER SUPPLY

La Société Wallonne des Eaux (SWDE) is a regional water corporation that owns and maintains a series of water towers throughout Belgium. The organization is the dominant producer of drinking water in the Wallonne region, supplying almost 2.5 million people with 1,317 water tanks and towers. The overall goal of SWDE is to provide reliable access to water for individuals and businesses as the population and economy of the region grow.

Some of the structures that SWDE utilizes are very old, so the data on those structures was no longer accurate or, in some cases, available at all. To improve and streamline the management of all SWDE infrastructure, SWDE needed a database to increase the accessibility and accuracy of information about the company's assets. This goal would lead to more reliable water, higher quality food safety, prevention of structural defects, and a lower cost of structural interventions.

SWDE tower, built in 1981 in Juprelle, Belgium, was deteriorating and in need of support. The tower has a storage capacity of 500 cubic meters, and is supported by eight columns and beams. The tower's exterior features siding brick connected by galvanized metal anchors to a supporting wall constructed from terracotta. The concrete helped to reduce the amount of stress put on the brick and to link the exterior and inner structure; however, it also caused some challenges. The concrete caused condensation on the interior walls, which led to significant degradation over time. The degradation included burst joints, cracks, and the separation of edifice bricks. Operating inspectors have also seen superficial cracking on the brick siding. To ensure safe and reliable water service to the area, SWDE needed to repair the tower.

"Water towers are generally tall, imposing structures. A manual inspection from the ground does not allow proper diagnosis, and a complete inspection takes a long time," said Christophe Taelman, engineer at SWDE. Typically, SWDE would conduct a survey of the damage using traditional manual surveying methods, including taking photographs from the ground or using elevators to lift workers up onto the tank. Given the challenges presented by the tower's size, SWDE quickly realized that their traditional approach did not provide a complete or efficient solution.

MANUALLY ANALYZING DRONE FOOTAGE

SWDE decided to use drones to survey the damage, as that would allow them to provide a more complete picture of the damage without asking workers to spend as much time. They began to apply photogrammetry by using a Blade Chroma drone to take videos of the tower. Over 3,000 images were extracted from the drone video. However, they faced another roadblock while using drones: the vantage points gathered by the drones still required human interpretation, which came with a significant risk of error, as workers looking at drone footage could easily overlook small cracks. SWDE needed to find a way to ensure that cracks of all sizes could be identified efficiently so that necessary intervention could be taken early on to mitigate long-term deterioration and maintain a reliable and safe water network.

APPLYING TEXTURE SKIN IMAGES TO DEVELOP AUTOMATED CRACK DETECTION SOFTWARE

SWDE discussed their options with Bentley Systems representatives, who worked with SWDE to develop technology specifically to meet their need for automated crack detection. SWDE determined they could create a 3D plan for the structure of the water

PROJECT SUMMARY

ORGANIZATION

La Société Wallonne des Eaux

SOLUTION

Water and Wastewater

LOCATION

Juprelle, Belgium

PROJECT OBJECTIVES

- ◆ To create a database of water asset models for future analysis of degradation.
- ◆ To sustainably ensure an accessible water supply throughout the region by identifying cracks in the infrastructure early.

PROJECT PLAYBOOK

ContextCapture, ContextCapture Insights, MicroStation[®], Pointools

FAST FACTS

- ◆ La Société Wallonne des Eaux (SWDE) is a regional water corporation that owns and maintains a series of water towers throughout Belgium.
- ◆ While an unmanned aerial vehicle gathered high resolution images of the tower, manual analysis of the images failed to detect small cracks.
- ◆ The automatic crack detection technology in ContextCapture helped quickly find cracks as small as 0.1 millimeters.

ROI

- ◆ The automatic crack detection technology created using Bentley applications resulted in a 600% faster process of crack detection and analysis.
- ◆ SWDE's solution was twice as reliable as manual surveying methods.
- ◆ Using Bentley's software, SWDE saved more than EUR 2 million on this complex project.

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

– *Christophe Taelman, Design Engineer, La Société Wallonne des Eaux*



tower in MicroStation. Once this model was complete, the next step was to refine a deep learning approach to analyze images and automate crack detection. They used Pointools to clean up and export the plan as a model in ContextCapture. While ContextCapture does not have crack detecting capabilities, Bentley developers worked with SWDE to refine an artificial intelligence (AI) capability for that purpose.

“With this new analysis using artificial intelligence on the 3D photo reconstruction in ContextCapture, we were able to detect cracks faster and more accurately in both masonry cladding and concrete,” said Taelman. The 3D visualization allowed them to see all angles clearly and analyzed cracks precisely in real time. The precise and efficient crack detection system allowed SWDE to automatically identify cracks with diameters as small as 0.1 millimeters, and the software helps to predict further development of these small cracks. An algorithm quantified the length, width, and depth of each crack and categorized them by their size and trace patterns. The resulting statistics contributed to an analysis of the overall condition of the water tower.

SWDE tested the module on the damaged water tower, by capturing 3,000 images with drone surveys and then using ContextCapture to create a reality mesh of the tower. They then used the AI capability to scan the reality mesh and detect cracks. The scan detected 1,704 cracks in the tower, 520 of which were less than 2 millimeters and, therefore, could not easily be detected by the human eye. The AI also detected that the façade had detached more than 10 centimeters from its original placement, which the human eye also would have overlooked.

SUSTAINABILITY THROUGH PREVENTION AND SAVINGS

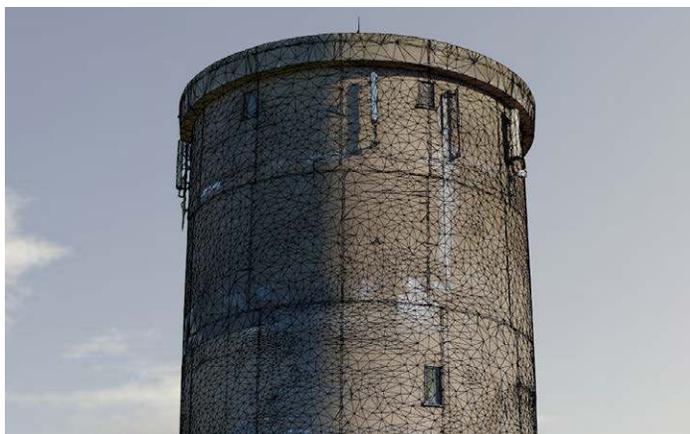
This project was a pilot for SWDE, resulting in a new method to efficiently, accurately, and safely detect cracks in infrastructure. The technology used on the project allows for faster and better-informed decision-making on renovation plans and techniques, ultimately saving costs. The solution reduces the time needed for surveys by 66% and saves significant costs by helping SWDE identify and plan for any necessary renovation work. “The collaborative work with Zheng Wu has allowed us to go beyond our intended aim and be able to calculate the lengths of cracks and classify them by width,” said Taelman.

The accurate digital renderings have also established a baseline that SWDE can compare to future surveys to identify any degradation, helping them be proactive about preventing any risks of interruption to the water supply. In a comparison of the ContextCapture AI technique and on-site measurements using an electron microscope, SWDE found that Bentley’s software was twice as effective and reliable. They determined that the automated crack detection sped up the diagnostic process by more than 600% and increased detection reliability by 100%.

The organization also estimates that the automated approach saved more than EUR 2 million in initial costs. The software works for damage prediction, decision-making, and cost reduction. The solution contributes greatly to SWDE’s broader goal of secure, efficient, and reliable management and provision of water resources. By saving time and costs, the automatic crack detection software helps SWDE sustainably maintain millions of households’ access to clean drinking water.



The automatic crack detection technology resulted in a 600% faster process of crack detection and analysis.



The automatic crack detection technology can quickly detect cracks as small as 0.1 millimeters.