

CASE STUDY AEC

Project

BRIDGE INSPECTIONS

KEY ACHIEVEMENTS



Up to 25% better coverage



Improved safety for the survey/inspection team and equipment



Complete outputs for bridge inspections



Increased quality and quantity of usable images



GEOZICHT ACHIEVES ENTIRE TRAFFIC BRIDGE INSPECTION

OVERVIEW

Bridges are a critical component of urban infrastructure. A failure can have catastrophic consequences, making inspections to identify potential defects an integral and recurring asset management component.

CHALLENGES IN GETTING UNDER THE DECK

As the bearer of the highest stress load, the deck and its supporting superstructure are considered critical inspection areas for maintaining a bridge's structural integrity.

However, they also represent the elements that are the hardest to reach and require substantial amounts of auxiliary accessibility equipment to be inspected by inspection personnel. Conducting such inspections using drones provides more flexibility while reducing hazards for personnel, but the GPS-denied environment, especially over water, can introduce additional challenges and cause erratic and unstable flight, at best preventing the collection of sharp inspection images, and at worst, resulting in a crash or the loss of the drone.

The inability to access these areas in a relatively easy and safe manner results in deliverables with blind spots or incomplete visual information for the necessary assessment. This, in turn, increases the chances of potential structural integrity issues to go unnoticed.

GeoZICHT, a leading drone services provider in the Netherlands and specialist in bridge inspections, sought out a tool to enhance the collection of complete visual inspection data for bridge inspections while also increasing the overall safety of the underlying process.



“WITH HOVERMAP, WE ARE NOW ABLE TO COLLECT INSPECTION IMAGES AT LOCATIONS THAT WE PREVIOUSLY COULDN'T REACH OR ONLY IN PERFECT WEATHER CONDITIONS.” BOB VAN DER MEIJ, GEOZICHT CTO & FLIGHT OPERATIONS MANAGER

COLLECTING ACTIONABLE INFORMATION

In 2020 GeoZICHT was introduced to Hovermap, a LiDAR autonomy and mapping payload. When attached to a drone, Hovermap enables GPS-denied, beyond line of sight flight capabilities. GeoZICHT was impressed by its ability to autonomously navigate in difficult to access areas - making it an ideal tool for bridge inspections, where flying below the deck and over cater can be complex.

“With Hovermap, we can fly under the bridge and collect data from areas right where we need to and from a closer distance. Depending on the bridge, we are able to capture between 10 and 25% more data than using previous methods.”

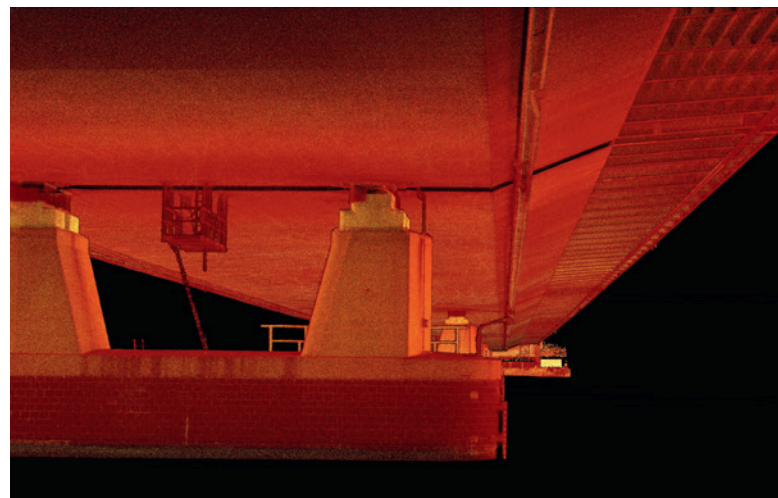
Bob van der Meij, GeoZICHT CTO & Flight Operations Manager

CAPTURING A TRAFFIC BRIDGE IN ITS ENTIRETY

In the summer of 2021, GeoZICHT was tasked with the collection of visual inspection images of the Moerdijk traffic bridge by Rijkswaterstaat (part of the Dutch Ministry of Infrastructure and Water Management) as well as the engineering firm commissioned to complete the inspection.

Moerdijkbruggen (Moerdijkbridges) refers to three parallel bridges that cross the Hollandsch Diep river, south of Rotterdam in the Netherlands, incorporating a rail bridge, a high-speed rail bridge, and a traffic bridge connecting the provinces of Zuid-Holland and Noord-Brabant, respectively.

The traffic bridge, GeoZICHT's area of focus, contains three lanes, an emergency lane, and a cyclist/pedestrian lane in both directions, making it 44 meters (144 ft) wide. It is over a kilometer (3,281 ft) in length, making it one of the largest bridges in the Netherlands. The clearance below the bridge varies between seven and 11 meters (23 and 36 ft).



GeoZICHT captured sharp inspection images under the bridge deck thanks to a stable drone flight enabled by Hovermap's GPS-denied flight capabilities.

As well as the usual accessibility issues, the size of the Moerdijk traffic bridge further increased the complexity of the data collection process. In addition, the superstructure is made entirely from steel, which increases the likelihood of erratic and abnormal flight behavior due to a partial loss of stable GPS signals, as well as compass interference issues when flying under the deck. The bridge also crosses a busy shipping lane, with container ships and leisure vessels passing every minute or so.

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GeoZICHT spent three days capturing the inspection data for the bridge. To do this, they used Hovermap mounted beneath a DJI Matrice 300 RTK to provide position control with a high resolution RGB camera on top to capture the images. Hovermap acted as a virtual safety bubble around the drone to prevent contact with the bridge while also enabling stable flight behavior and, as a result, the collection of sharp and actionable inspection data.

Prior to the first flight day, one of GeoZICHT's surveyors marked visual ground control points on both bicycle paths on top of the bridge to georeference the collected data. For the actual drone inspection flights, the flight crew set themselves up on a barge positioned beside one of the bridge's many pillars. From there, they covered an overpass across two separate flights in both directions. From the barge, they were able to access under the deck and the top side of the bridge at an angle so as not to pass over traffic. Once that area of the bridge had been captured, they moved the barge to another pillar to repeat the process, completing 44 20-minute flights and scans over three days to capture the entire bridge.

"A similar drone inspection without Hovermap would have been significantly riskier, increasing the chances of the drone ending up in the water due to the unpredictability of drone behavior in GPS-denied areas."

Bob van der Meij, GeoZICHT CTO & Flight Operations Manager

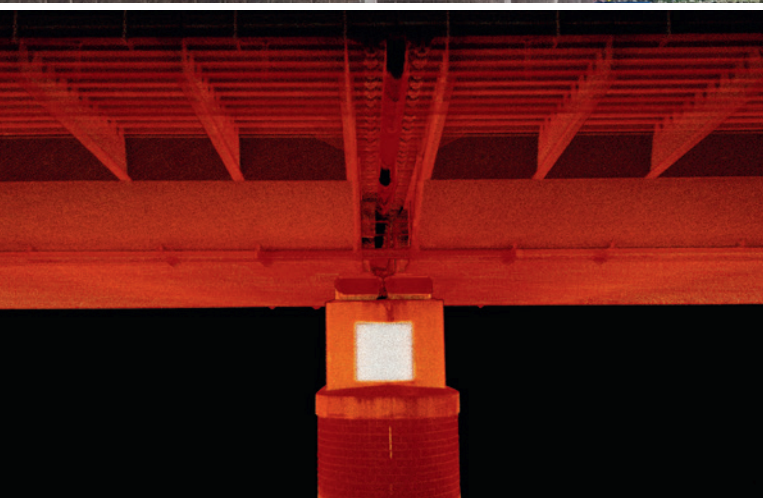


With Hovermap mounted beneath the drone and a high resolution RGB camera on top, GeoZICHT captured sharp and actionable inspection data of the complete bridge.

GPS-DENIED FLIGHT FOR COMPLETE CAPTURE

By adding Hovermap to their toolkit for this job, they were able to scan the entire underside of the bridge, using the GPS-denied capabilities to maintain a stable and controlled flight.

Hovermap's Pilot Assist mode provided the team with collision avoidance that allowed them to maintain a safe standoff distance from the bridge while still getting close enough to collect sharp and detailed images for an optical inspection.



Hovermap acts as a virtual safety bubble around the drone, preventing contact with the bridge.

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DELIVERABLES

The safe and stable flight provided by Hovermap allowed the GeoZICHT team to capture well over 20,000 high resolution photogrammetry images of the entire bridge, including the underside of the deck. Previously, the underside of the deck could only be partially captured and involved a higher risk level. These images were then processed into an accurate 3D mesh using the ground control points on top of the structure during alignment for georeferencing. The 3D mesh model, together with the original inspection images, was provided to the engineering firm as an intuitive-to-use 3D navigation tool to aid their inspection.

In the future, GeoZICHT plans to add nonvisual object information such as inspection reports, PDF files, spreadsheets with measurement data to provide a working BIM of the bridge.

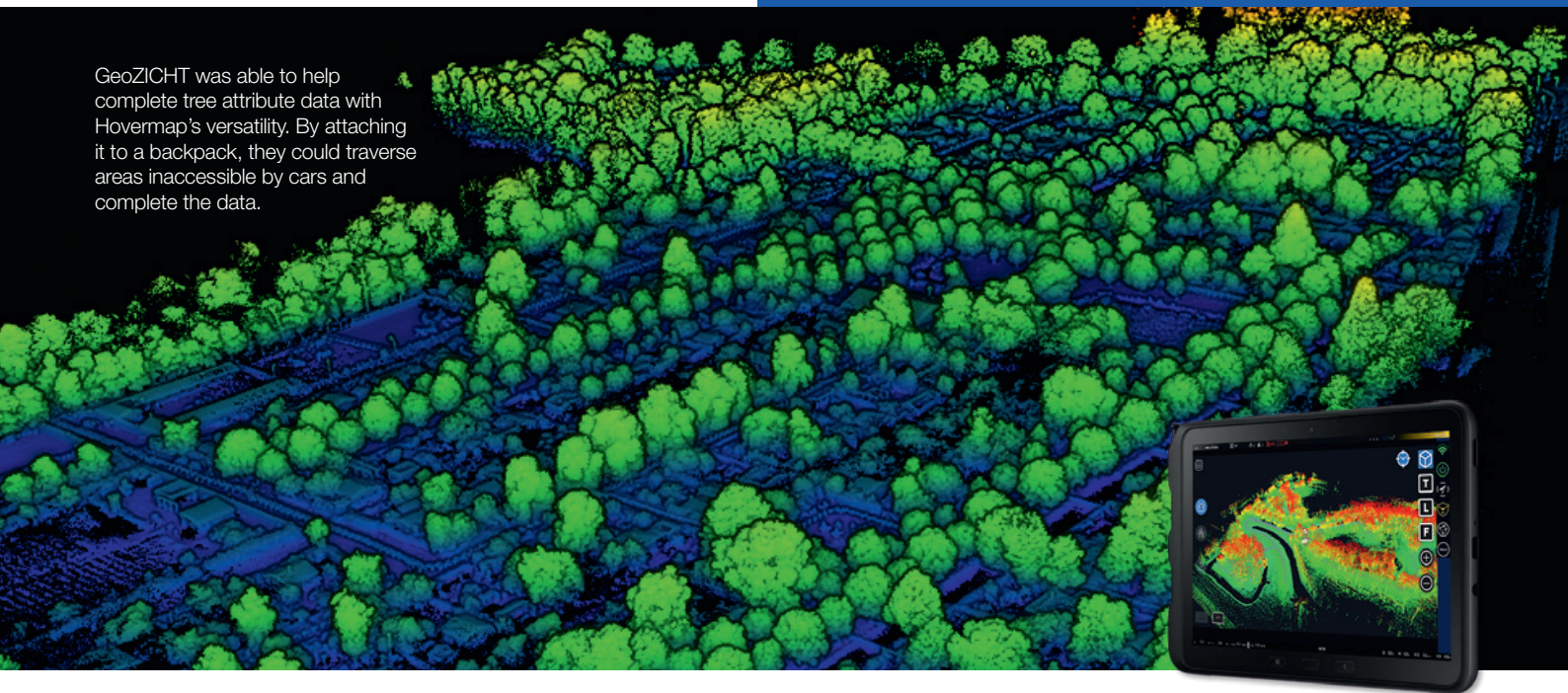
A REPUTATION FOR COMPLETENESS PROVIDES BONUS WORK

When word got out that GeoZICHT had a solution with the versatility to completely capture areas, they were quickly contacted by another firm working to characterize tree attribute data for municipalities and the like in areas with limited accessibility. The municipality was looking to capture tree location, diameter, height, and biomass volume.

While the majority of municipal areas were already being scanned through mobile laser scanning from a motorized vehicle, there remained some blind spots that could not be accessed by car, such as city parks, cemeteries, and allotment gardens.

In order to circumvent these accessibility constraints, GeoZICHT mounted their Hovermap unit to a backpack. By walking or cycling through the areas that couldn't be accessed by car, they could successfully collect complete LiDAR point cloud data in a timely manner that, until recently, still proved rather hard to access.

GeoZICHT was able to help complete tree attribute data with Hovermap's versatility. By attaching it to a backpack, they could traverse areas inaccessible by cars and complete the data.



GeoZICHT is a geodetic consultancy firm based in Houten, in the Netherlands. Established in 2016, they provide advanced 3D surveying and inspection services of assets using drones for a wide variety of clients, including local, regional, and national governments, engineering firms, and contractors, among others, with a focus of providing them with actionable information. They operate in the European 'specific' category for which they have been issued an Operational Authorisation by the national competent authority (CAA-NL), which grants them access to an array of privileges for professional drone operations.

Our flagship product Hovermap, is a smart mobile scanning unit that combines advanced collision avoidance and autonomous flight technologies to map hazardous and GPS-denied environments. Hovermap is uniquely versatile, it can be mounted to a drone, cage, backpack or vehicle to map challenging, inaccessible areas. With a wide range of applications, Hovermap is being used by customers around the world.