

INFRASTRUCTURE INSPECTION



Using bathymetric LiDAR for aquatic infrastructure monitoring



DEBRIS BUILDUP

EDGE 2-in-1 bathymetric lidar conducting a survey for bridge inspection. The system can monitor scour around bridge supports and debris buildup - two major causes of bridge damage.



With more than 10% of bridges rated as “structurally deficient”, there is an urgent need for an easier and cost-effective way to perform bridge inspections.

According to the Underwater Bridge Inspection Publication No. FHWA-NHI-10-027: “The National Bridge Inventory (NBI) of the United States includes geometric and condition data for approximately 603,000 highway bridges. Of those, approximately 502,000 bridges, or about 83 percent, are built over waterways. A great many of these bridges have foundations underwater, and most bridge failures occur because of underwater issues.”

The main challenge in bridge inspections is the underwater section, where most of the problems and greatest uncertainty exist.

According to a report from the Federal Highway Administration: “The most common cause of bridge failure is from floods scouring bed material from around bridge foundations. Scour is the engineering term for water-induced erosion of the soil surrounding bridge foundations, piers, and abutments.

Orion Space Solutions, an Arcfield Company has performed surveys that produced highly accurate LiDAR point clouds that capture the pylon scouring under bridge supports and river cross sections. This can be compared to historical data to determine changes over time. It also establishes a baseline for any future comparisons.

BEST PRACTICES

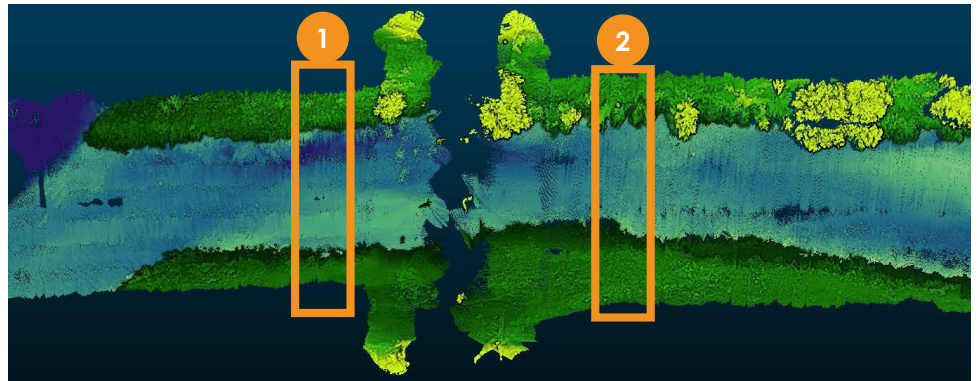
EDGE LiDAR makes it possible to capture the underwater foundation elements as well as their condition where they meet the river bottom. The centimeter-level resolution of the system can detect features like scour, displaced riprap and other anomalous conditions.

All of this is accomplished without putting personnel or equipment in the water, resulting in significant cost savings and lowering the risks associated with the inspection. While regular bridge inspections are mandated (not to exceed five years), the resulting savings, combined with the relative ease and logistical flexibility of deploying a UAV LiDAR inspection, changes what is possible. Now, municipalities, civil engineering and infrastructure inspection companies can increase the frequency of inspection, especially after high water or severe weather events where debris buildup threatens supports, or severe scour may have occurred.



SCOUR DETECTION

By analyzing the detailed bathymetric scans, EDGE data can precisely identify changes in the riverbed morphology, indicating potential scour development. This capability enables the user to proactively assess the integrity of bridge foundations, mitigate risks associated with scour-induced structural failures, and ensure the safety and longevity of critical infrastructure. Leveraging this advanced technology, we empower engineers and authorities with timely insights for effective maintenance and strategic decision-making regarding bridge safety.



CROSS-SECTIONS

The figure above represents a full point cloud taken using EDGE LiDAR system from two flights: one downstream (to the left) and another upstream (to the right) of the bridge pictured on the previous page. The recommended practice for inspection is to measure river cross-sections upstream and downstream from the bridge, as well as an inspection of the in-water foundation elements. The scour inspection of the foundation elements almost always requires personnel and/or equipment in the water, and divers for deep channels. Consequently, cross-sections and foundation scour inspections are costly, time-consuming and dangerous for both personnel and equipment.

