

OPT, Japan - Measuring Scour in Shallow Water Environments

The Situation

Rivers throughout the world are subject to varied flow levels that can dramatically affect the integrity of bulkhead structures along cut banks. Scour, caused by swift moving water can scoop out holes along and under the bulkheads engineered to reinforce natural river banks, compromising the integrity of the structure. Additionally, visualizing and measuring the effects of flood induced erosion on critical areas is an important factor in preventing structure failure.



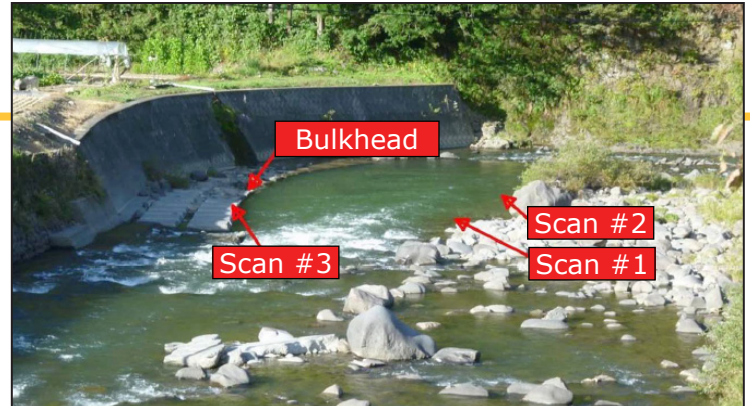
This photo shows a typical concrete bulkhead on a river cut bank. During flooding the structure may not sustain visible damage, but the base and fill area behind bulkhead may scour and weaken the entire structure and potentially destabilize the area.

However traditional underwater survey equipment is generally not well suited for this task due to remote locations, tight working quarters, and shallow (1 - 2 meters) water conditions. Additionally, traditional underwater survey equipment cannot provide the critical side-elevation data required for a detailed analysis of the structure.

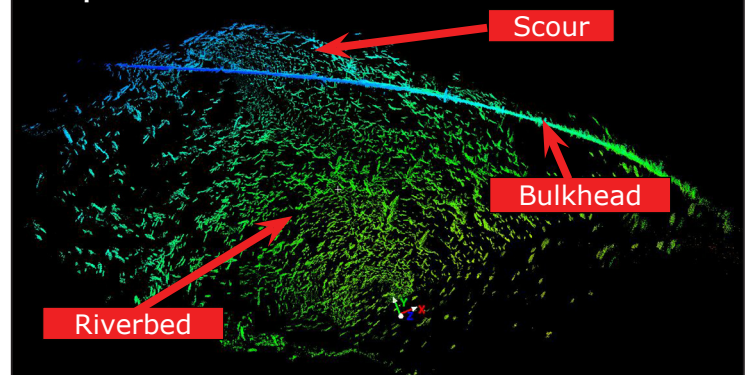
The Solution

OPT Technologies Co., Ltd. a leading 3D laser scanner consulting and manufacturing company in Japan and Canada sought to test the BlueView BV5000 system for detailed underwater inspections. Discovering the need for a portable, accurate underwater 3D system OPT saw the BV5000-1350 as the perfect solution for underwater structure inspections, especially in areas where visibility was limited. OPT technicians found the compact size, deployment ease, and straight-forward operation of the BV5000 compelling, and the ground-vantage point provided the data collection from the unique perspective they needed.

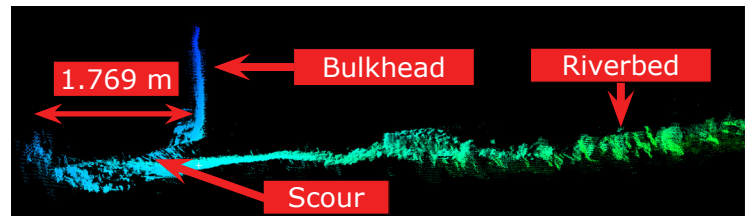
OPT used the BV5000 for the shallow-water inspection of the bulkhead pictured above on the Susobanagawa river in Japan. To provide the required perspective view point, OPT technicians fixed the BV5000-1350 to a flat metal plate and positioned it on the riverbed to locate and capture the morphology of any scour holes that exist along the bottom of the bulkhead. The low angle of view ensured that critical measurements would be captured to determine what steps would be necessary in a renovation plan.



3D top-down view of the area



Using standard topographic laser scanning software 3 individual scans taken with the BV5000-1350 were merged together into this fully rotational mosaic 3D image for analysis and renovation planning.



The above rotational 3D "slice" reveals the full depth of the scour hole as it extends under and behind the bulkhead. Critical measurements of the scour hole can be made to understand morphology and help determine a proper course of action.

The Results

The BV5000-1350 was placed in three different positions and the individual point clouds were merged together into a single, fully rotational 3D image. Note that scan positions 1 and 2 were very close to the shore, with the BV5000 placed on the riverbed at a depth of less than 1 meter to scan across the river toward the bulkhead.

The inspection revealed a deep scour hole under the bulkhead, extending more than 1.7 meters back and across more than half of the bulkhead, severely undermining its integrity. The data was provided to officials that managed the structure for additional analysis and renovation planning.

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About the BlueView BV5000 3D Mechanical Scanner

BlueView uses new high-resolution profiling sonar technology to create an easy-to-use underwater 3D scanner, the BV5000 system. The compact, lightweight BV5000 works much like a topographic laser scanner, and uses high frequency sound beams instead of lasers to create extremely detailed 3D imagery and collect accurate measurement data. Designed for high portability and easy integration, the BV5000 system can be deployed on a tripod, ROV, or fixed mount. Operating from a stationary position, the BV5000 creates full 360° rotational scans. Multiple overlapping scans can be registered with or without navigation data to create mosaic images of large structures or areas.

All BV5000 3D Mechanical Scanning Systems include BlueView's ProScan® software and 3D viewer. The BV5000 data is stored in both raw format for post processing, and a standard .xyz point cloud format for easy import to multiple 3D viewing programs. BlueView is an authorized Leica Geosystems distributor, providing access to its powerful Cyclone software to create 3D mosaic imagery and model standard components for CAD export.



BV5000-1350

The perfect balance between range and resolution. The BV5000-1350 is specifically designed for imaging complex underwater structures and areas with an operating frequency of 1.35 MHz that enables ranges of 1 – 30 m (3.2 – 98 ft.).

BV5000-2250

Engineered for ultra-high 3D resolution, the BV5000-2250 delivers unprecedented imagery and detail at close range. The 2.25 MHz operating frequency enables ultra-high resolution 3D scans with ranges of 0.5 – 10 m (1.6 – 32 ft.).



Typical 3D Mechanical Scanning Applications:

- 3D Site Survey
- 3D Structure Survey
- 3D Structure Inspection
- Structure Decommissioning
- Bridge Inspections
- Dam Inspections
- Seawall and Pier Inspections
- Condition Monitoring
- Scour and Erosion Monitoring
- Spool Piece Metrology
- Archeological Site/Structure Mapping
- Ship Hull Inspections and Mapping



The BlueView BV5000 can be integrated onto any work-class or mid-size inspection class ROV to enable easy 3D scanning of complex structures and areas, even in deepwater (up to 4,000 meters) environments. Combine the BV5000 with an ROV to collect 3D data from unique vantage points, providing unmatched visibility into and around the target structure or area.



The highly portable, lightweight BlueView BV5000 is easily lowered into position around complex structures, or in remote, hard-to-reach areas from waterside structures or small surface vessels. When combined with BlueView's lightweight tripod the BV5000 weighs approximately 40 lbs., and is perfectly suited for one-man deployment and operation.

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