

## Surveying Around Bridges with Temporary GNSS Loss

*How the CEESCOPE™ allows bathymetry data collection even during brief GNSS outages, useful for surveys around bridges for scour monitoring.*

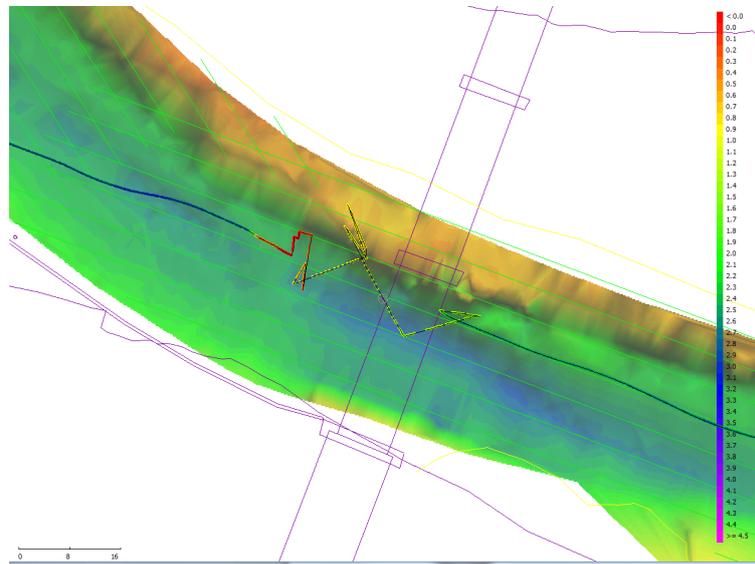
Many river surveys are conducted near bridges, often to evaluate the degree of scour that has taken place particularly after flooding events. Any obstruction blocking the GNSS or GPS antenna view of the sky can lead to a degraded or complete loss of position data; being located directly under a bridge will rarely allow a useable position fix. One way to collect position data is to use a total station on shore and track the survey boat while simultaneously recording echo sounder data. While possible, this requires substantial extra equipment, manpower, and time compared to a hydrographic survey from a manned boat.

A project in Australia required a bathymetry survey on a river that included a road bridge in the survey area, large enough so that GPS coverage was not available under the structure. In this case, the CEESCOPE™ was used to collect data under the bridge while avoiding the need for any additional hardware.

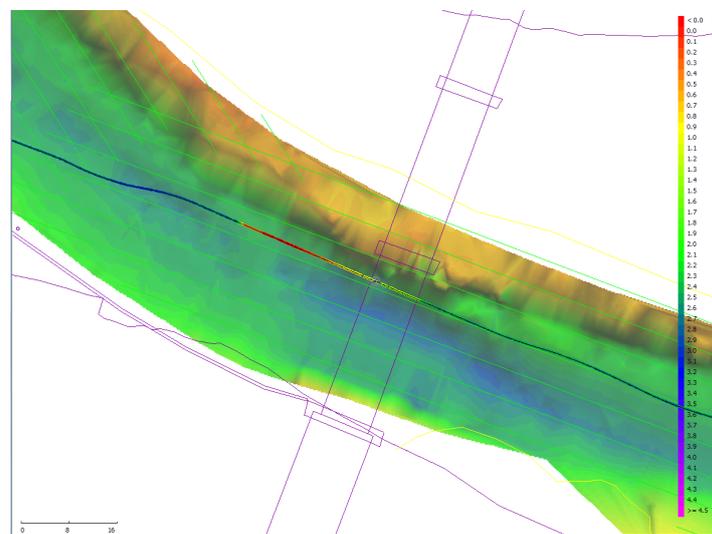
The survey equipment used was a CEESCOPE 100 RTK survey system that is able to supply RTK GNSS positions and single frequency (200 kHz) bathymetry data. The GNSS receiver was configured to supply positions at a rate of 5Hz and receive corrections via a UHF radio link to the base station. The echo sounder was configured for 20 Hz data output rate with full water column display of the echogram available in real time view and post processing analysis. To survey the area the boat operator had to drive along a path from one side of the bridge to the other at a constant heading and speed – not particularly hard to do over relatively small distances. The key was to allow the GNSS receiver to recover a fixed RTK solution before changing course after passing under the bridge. In this instance there was sufficient water depth around the bridge to allow this to happen. The raw data can be seen in Figure 1, with the GNSS loss and multi path errors clearly visible.

The CEESCOPE continues to output and record depth data while the GNSS is unable to supply the required position data. As data from the echo sounder and GNSS is precisely time stamped by the CEESCOPE and time-stamped depth data continues to be available even without GNSS, the data can be recompiled after the survey using software such as HYPACK®. The boat position as it moves under the bridge is interpolated based on elapsed time and the raw, inaccurate boat position data are replaced with a calculated position.

While errors are clearly larger than under normal operations, this simple technique may offer adequate results for many reconnaissance survey scenarios.



**Figure 1: Raw survey results.**



**Figure 2: Results after time-based interpolation based on course and speed.**