Customer Story

Real-Time Certainty Flows in the Colorado River

How Trimble RTX correction service solution provided confidence and efficiency on land, air and water

GNSS Correction Service

Trimble

Overview

Providing consistent, precise measurements on long, linear surveys can be a challenge. That challenge becomes even more acute when that linear survey is in a super remote river corridor. That's what one river engineering company faced for an aerial lidar topo-bathymetric survey. Using Trimble's CenterPoint RTX positioning, the company is proving that PPP technology is a solid bet, whether it's across remote lands, open skies or vast rivers.

MILES OF THE RIVER SYSTEM:

342

NATION'S WINTER VEGETABLES CROP THAT DEPENDS ON RIVER

90%

Challenge

One would be hard pressed to find a river more important to a region than the Lower Colorado River in the United States — reportedly the river irrigates almost 90 percent of the nation's winter vegetable crops. And yet, in April 2022, the Colorado River was designated the most endangered river in the country.

Recognizing the waterway's unique significance and impact, the US Bureau of Reclamation (BOR) Lower Colorado Region issued a request for solicitation to survey and collect bathymetric and sediment data on 342 miles of the river system between Hoover Dam and Mexico.

Approach

In June 2021, RiverRestoration, a river engineering company based on Carbondale, Colo., launched the Lower Colorado River Assessment Project, a complex undertaking that would require diverse expertise in land surveying, aerial topo-bathymetric lidar, bathymetry, riverbed data collection, and Trimble's CenterPoint® RTX PPP technology. Of critical importance to the measurable success of the project was the ability to establish a ground control network accurate to 2 cm (0.06 feet) horizontally and 3 cm (0.1 ft) vertically to tie the whole 342 miles of distance together.

To achieve consistently high accuracy over such a long distance, crews from Precision Surveys set either a Trimble R10 or Trimble R12 GNSS receiver and acquired static observations for 1.5 hours. For redundancy, they raised their 2 m rod to 2.5 m and ran a second static session. Simultaneous to the static observations, they set up an R10 or R12 unit and established a secondary control point using their rover receiver a few hundred feet away, collecting differential RTK data for 3 minutes and then repeating the process at the elevated 2.5 m height for another 3 minutes. They then took 30 second shots of each of the two control points with the Trimble RTX -compatible R10 and R12 receivers to have a quality control check for later comparison. To ensure they could tie the morning work to the afternoon work, one surveyor occupied a primary control point for the entire day.

Every night the GNSS data was post-processed with Trimble Business Center (TBC). Once all the data was processed using the precise ephemeris, TBC network adjustment tools were used to integrate CORS data from the National Geodetic Survey and perform a final processing of the static and RTK measurements. This created a geodetic control network precise to 2 cm horizontally and 3 cm vertically, both at a 95 percent confidence level. As a final step, the real-time RTX correction data was compared with the results and found to be within a 1/2 inch horizontally and 3/4 inch vertically.

> Having used Trimble's CenterPoint RTX before, we were confident it would be good, but we didn't know it was going to be that good.

said Larry Medrano, president of Precision Surveys based in Albuquerque, New Mexico.

To support the aerial lidar topo-bathymetric survey, teams used R12 receivers and CenterPoint RTX to check into pre-established control monuments and collect a series of bathymetric ground control shots both underwater and at the water's edge. They used Trimble Applanix's POSPac post-processed Centerpoint RTX internet-based service to post process the GNSS-inertial trajectory.

With the corrected lidar data, an aerial "voids" map was developed for areas where the river was more than 30 ft deep and lidar returns were not accurate. Based on that map the RiverRestoration group criss-crossed 60 square miles of the Colorado River—roughly two-thirds of the project area—to acquire bathymetric data and sediment samples.

Vessel "SeaArk" surveying the Colorado River with the Trimble R12i, Trimble RTX and TSC7 controller.

Given the environment and survey area, setting up RTK base stations would have been extremely difficult and time consuming. So, instead they used the beta version of Applanix's Wavemaster II marine positioning solution with CenterPoint RTX real-time corrections.

RiverRestoration equipped three boats with Multi-Beam Echo Sounder instruments that incorporate dual GNSS receivers for position and headings and the Wavemaster II. For redundancy, and for control checks, each of the three boats carried a Trimble R10 with real-time CenterPoint RTX. A fourth boat had a single beam solution with a Trimble R12i GNSS receiver, which has both RTX and an integrated inertial measurement unit.

Each morning they initialized the CenterPoint RTX corrections and checked into the pre-established control network to confirm the real-time data was accurate. Guided by the void maps

installed on Trimble TSC7 data controllers, they navigated to each of the void areas, checking into control every 10 miles while maintaining speeds of about six miles per hour. In total, the vessel survey campaign took about five months to complete—a time commitment that would've been significantly longer with traditional RTK.

Results

> This was a massive, complex project, and one that I don't think has ever been undertaken to this level of accuracy before. CenterPoint RTX quickly proved to be the right solution for it.

With Trimble RTX, once it converged to an accurate position, we maintained accuracy throughout the entire day," said Jason Carey, principal river engineer at RiverRestoration. "Not having to move a base station every few miles saved us countless hours in the field."

Since finishing the boat survey, the project team has been processing the remote sensing lidar and echosounder data and stitching both datasets together to create a seamless, 3D map of the bathymetry of the Colorado River system from Hoover Dam to Mexico. Although BOR's accuracy requirements for the bathymetric mapping is 10 cm RMS and 19.6 cm 2 sigma, Carey says preliminary results indicate their final data, when delivered in October 2022, will be more precise than requested.

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