Emergency Bridge Surveys Responding to Flash Flooding Events

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Key words: Bridge surveying; Engineering survey; GNSS/GPS; Laser scanning

SUMMARY

Abstract: Responding to new global climate conditions, surveyors should anticipate the need for full 3D surveys after natural disasters caused by flash flooding emergencies. In July of 2022, flash flooding swept across Eastern Kentucky, USA affecting more than 10 counties because of estimated 0.5-meter rainfall in less than 2 days. The USA National Weather Service estimated that this volume of rainfall (600% above normal) occurring in such a short period of time had a 1:1000 chance of happing in any year. Living in the modern era, we all need to be ready for more natural disasters. The flash flooding that resulted in washing through creeks and rivers while at the same time destroying roadways, bridges and homes. More than 40 deaths are attributed to this one event.

Qk4, inc. had been surveying bridges for the Kentucky Department of Transportation under a private consulting contract which consisted of 1000 individual bridges in the state inventory. Because of the experience of the Qk4 survey team and the ability to respond quickly with existing contracts, the surveyors arrived on bridge sites within one week of the flooding. Modern survey equipment such as robust GPS receivers, robotic total stations, 3D laser scanners, and drones, the survey team was able to establish geodetic survey control and collect all the existing site conditions of the bridge sites in just 2 or 3 days. All features related to the bridge were located including remaining bridge components, utilities, roadway, creek limits, drainage structures and more. These trained survey technicians had the exact experience necessary to accomplish the emergency response. Each survey was collected in 3D and modeled in a digital format for transmission to dozens of engineers worldwide.

Extreme environments do not always require extreme land surveys if companies prepare for natural disasters with good planning and technician training. What we learned through this one flooding event is that the resilience of the human spirit can accomplish great things for communities which

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are recovering from destruction. We may not consider land surveyors as first responders, but for the people of Eastern Kentucky, the surveyors started sustainable reconstruction of their bridges in less than a week's time. The bridges for these replacements were designed and built with a 75 year sustainable lifespan expecting more flooding in the future. Because of the effort of the surveyors, engineers and contractors, communities now have bridge security for their families in Kentucky.

Course Objectives:

1)Learning what to expect in post-flood bridge site situations to plan for survey needs

2)Learning how to establish geodetic survey control quickly to capture disaster conditions into a usable 3D survey for new bridge engineering.

3)Learning methods on combining traditional survey data with drone mapping for context and 3D laser scanning for high resolution critical bridge components

Keywords:

Climate, Flood Response, Bridge Surveying, Natural Disaster, 3D Digital Survey, Emergency, Infrastructure, Drones, GNSS/GPS, Engineering Survey, Laser Scanning