



Collaboration, Innovation and Resilience: Championing a Digital Generation

Brisbane, Australia 6-10 April

# Emergency Bridge Surveys Responding to Flash Flooding Events Kentucky USA

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## The Providential Preparation...



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# The Problem...

12/13/24, 1:36 PM

Historic July 26th-July 30th, 2022 Eastern Kentucky Flooding



**NATIONAL WEATHER SERVICE**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

**Historic July 26th-July 30th, 2022 Eastern Kentucky Flooding**

[Weather.gov - Jackson, KY](#) > Historic July 26th-July 30th, 2022 Eastern Kentucky Flooding

Jackson, KY  
Weather Forecast Office

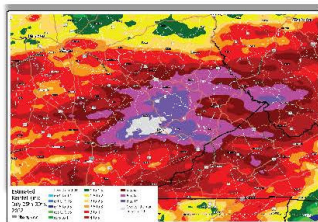
[Current Hazards](#) [Current Conditions](#) [Radar](#) [Forecasts](#) [Rivers and Lakes](#) [Climate and Past Weather](#) [Local Programs](#)

## Overview

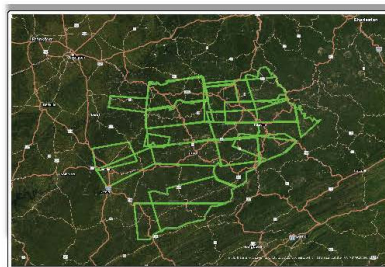
Between July 25th and July 30th, 2022, several complexes of training thunderstorms developed south of I-64 and brought heavy rain, deadly flash flooding, and devastating river flooding to eastern Kentucky and central Appalachia. These thunderstorms, at times, caused rainfall rates in excess of 4"/hr across complex terrain that led to widespread devastating impacts. While it did not rain continuously during this 4-day stretch, the overwhelming amounts of rain and resultant flooding led to 39 deaths and wide-spread catastrophic damage. Entire homes and parts of some communities were swept away by flood waters, leading to costly damage to infrastructure in the region. Over 600 helicopter rescues and countless swift water rescues by boat were needed to evacuate people who were trapped by the quickly-rising flood waters. In total, 24 Flash Flood Warnings were issued between July 26th and July 30th. Between the evening of July 27th and the mid-morning hours on July 28th (the peak of the event), 13 warnings were issued, 3 of which were upgraded to a Flash Flood Emergency.

Radar-based rainfall estimates suggest that upwards of 14-16" of rain fell during this 5-day period in a narrow swath, with many more locations receiving 6-10" of rain. Most of this rain fell during the night of July 27th into the morning of July 28th, which is when the most devastating impacts were felt. The highest totals occurred across an axis that stretches from northern Clay and southern Owsley counties, east through southern Breathitt and northern Leslie counties, into Perry, Knott and Letcher counties. The highest rainfall total report was from southern Knott County, where 14.00" fell between July 25th and July 29th. This site, a cooperative (COOP) observer at Carr Creek Lake, reported 6.71" from 7am July 28th to 7am July 29th, following a report of 6.50" at that site on the previous day. Another COOP site in Buckhorn reported 8.00" of rain for the 24-hour period ending 7am on July 28th. The rainfall total in Buckhorn from July 25th to July 29th was 11.76". These rainfall values occurring in such a short period of time are incredibly rare; there is less than a 1 in 1000 chance for this much rainfall over five days in a given year.

The incredible rainfall also led to significant rises and flooding on many rivers in eastern Kentucky including on the main stem of the Kentucky River; North, Middle and South forks of the Kentucky River, Red River and Licking River. At Whitesburg, the North Fork of the Kentucky River swelled well above major flood stage, reaching close to 21' before gauge failure (the previous flood of record was 14.7' in 1957). The North Fork of the Kentucky River at Jackson also reached major flood, setting a new record crest of 43.47' (the previous record was 43.1' set in 1939). The river flooding caused a second round of destruction for communities in the region, and caused flooding in downstream areas that did not receive as much rainfall.



Estimated rainfall totals from July 25th through July 30th, 2022 via NCEP Stage IV precipitation data.



Flash Flood Warnings issued by NWS Jackson, KY from July 26th through July 30th, 2022. **Three of these warnings were "Flash Flood Emergencies."** This type of Flash Flood Warning is reserved for catastrophic flash flooding events.

- July 2022 Sudden **flash flood** – Eastern KY
- Exit routes along the creek bottoms **under water**
- 1 : **1000-year** flood event
- North Fork of the Kentucky River crested at **new records**: 47.5 feet (14.5 meters)
- Homes and bridges destroyed leaving **communities** stranded





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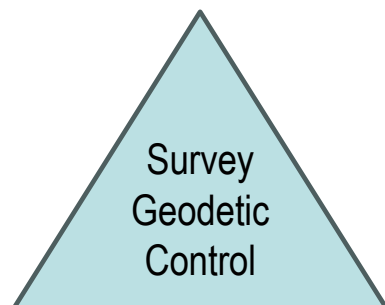
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## The Process...



Existing Conditions  
Documentation

Utility Location  
Survey

Topographic Detail  
Survey

Flood Levels

3D Office  
Processing  
into Existing  
Conditions  
Model

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# The Process... ... Perry County













## The Proposal...

Be Open Minded

Be Prepared

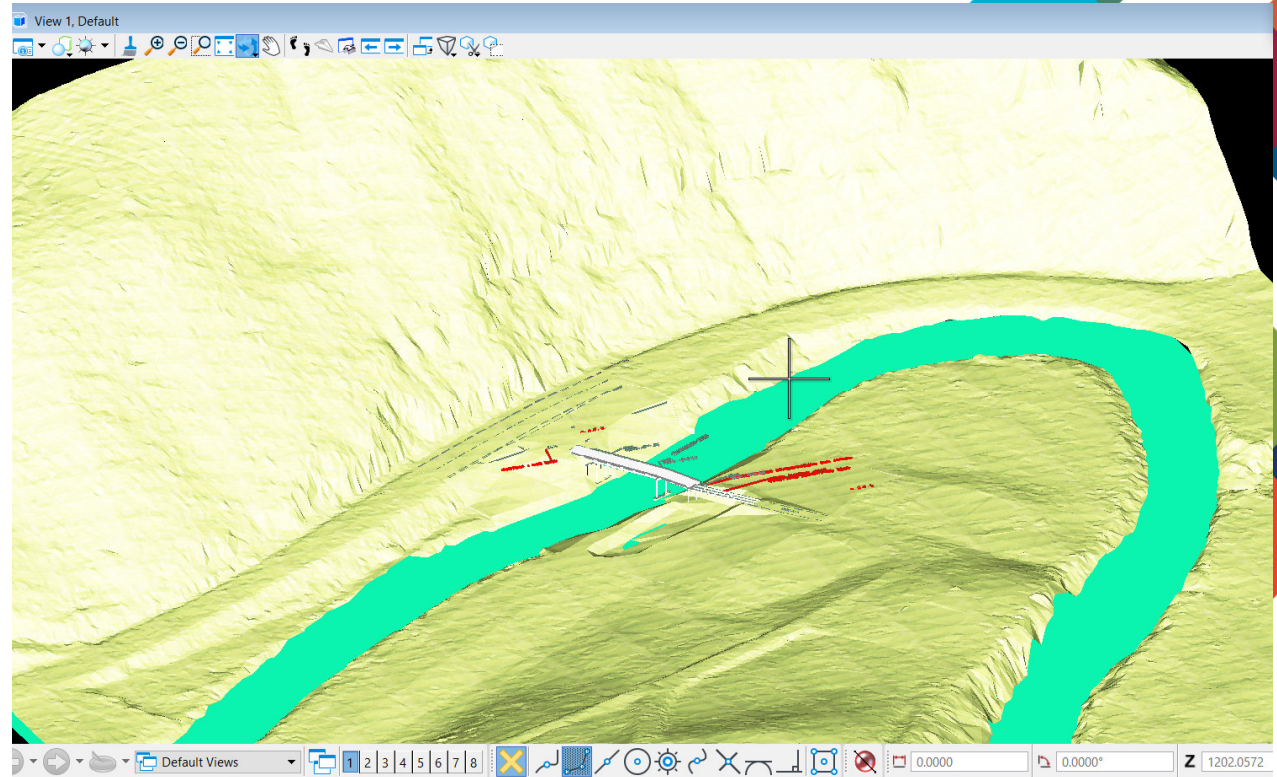
Be Quick





## The Benefits of a Digital Twin...

Parametric Modeling  
Finite Element Analysis  
Clash Detection  
Visualization Tools  
Complex Geometry  
Collaboration Tools





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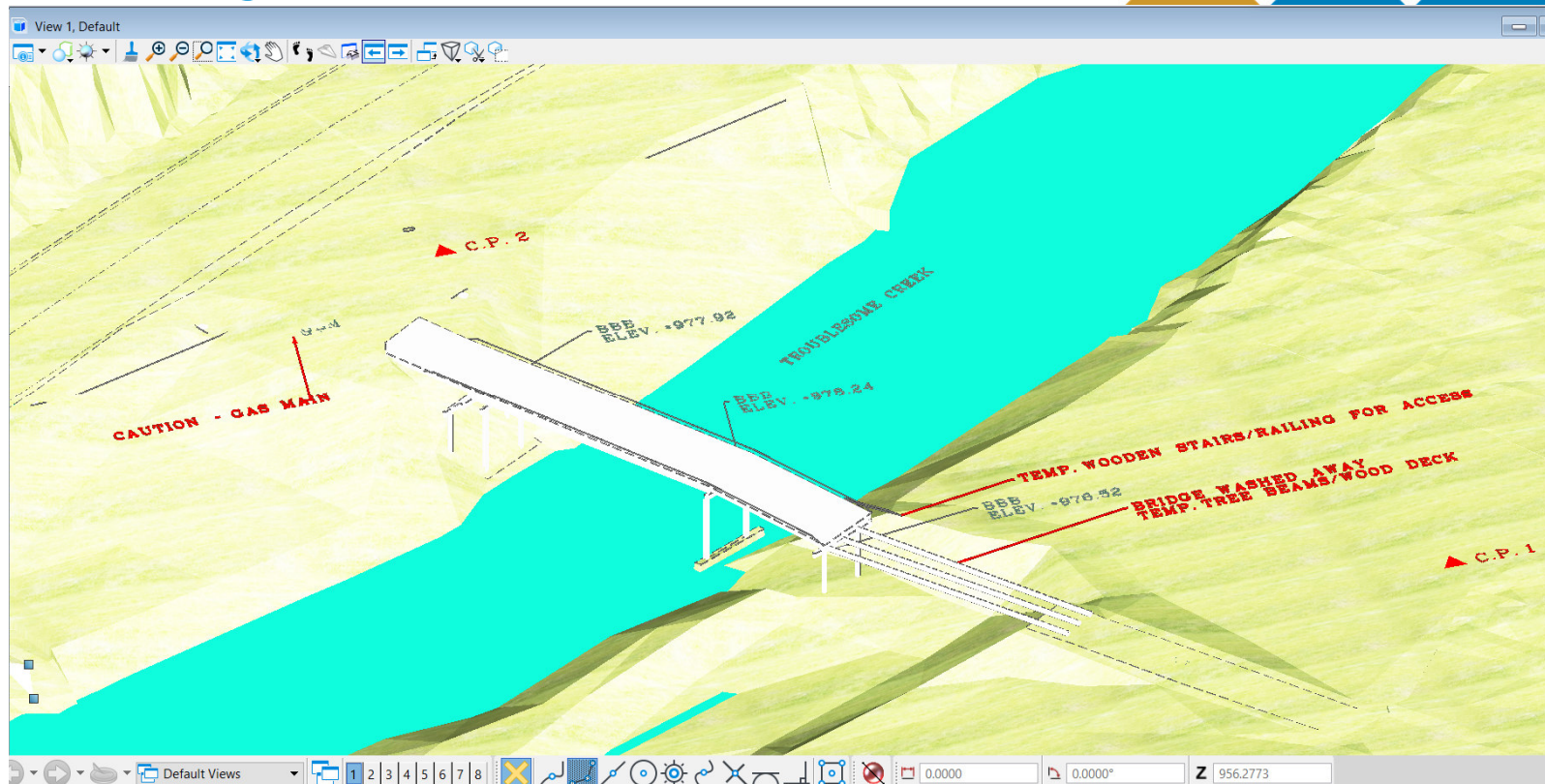
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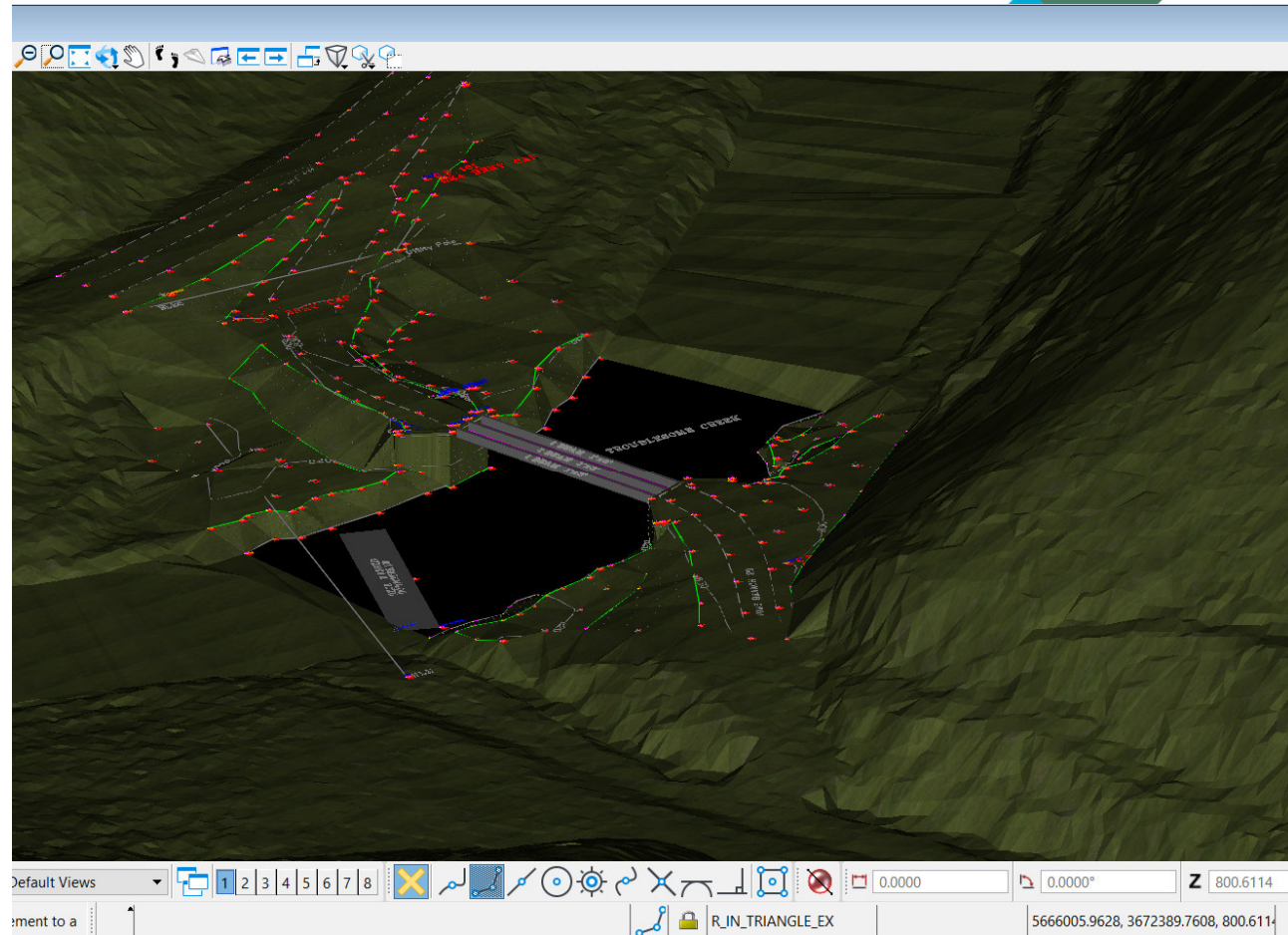
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## The Benefits of a Digital Twin...

Parametric Modeling  
Finite Element Analysis  
Clash Detection  
Visualization Tools  
Complex Geometry  
Collaboration Tools



## The most relevant SDGs related to the presentation and theme of this session

**9** INDUSTRY, INNOVATION  
AND INFRASTRUCTURE



1st relevant  
SDG

**11** SUSTAINABLE CITIES  
AND COMMUNITIES



2nd relevant  
SDG

**13** CLIMATE  
ACTION



3rd relevant  
SDG

**SUSTAINABLE  
DEVELOPMENT GOALS**

International Federation of Surveyors supports the  
Sustainable Development Goals



Predict the Future...

Bridge Security

Think Community

Learn Now to Respond

Be a Global Surveyor

