



The Geo-Institute Embankments, Dams and Slopes Technical Committee will live-stream the session *“EDS Extreme Event - Hurricanes and Floods”* on Monday, December 8, at 2 PM EST. The talks include:

Talk # 1: *Subsurface Exploration for I-40 Reconstruction in the Pigeon River Gorge Port Hurricane Helene*
(Presented by Chris Ramsey, P.E., and Michael Senior, P.E., M.ASCE)

Following devastation caused by Hurricane Helene throughout the western North Carolina region in September 2024, North Carolina Department of Transportation (NCDOT) reached out to the engineering community for the rebuilding process under an emergency condition. As part of the RK&K design team for the reconstruction of Interstate 40 (I-40), Schnabel Engineering developed an expedited and comprehensive investigation program for the first 5-miles (8 km) in North Carolina. I-40 experienced numerous failures along the five-mile corridor which is adjacent to the Pigeon River. In order develop repair concepts and ultimately to design the permanent repairs, a subsurface exploration program was established that included desktop review of historic geotechnical data, rock probes by air track drilling, rock probes by soil nail drilling, rock core sampling with standard coring methods, optical televiewer logging, and geophysical investigations using MASW methods. A suite of laboratory testing was performed to characterize engineering properties of the subsurface soils and rock.

A large amount of data was gathered, and the need was recognized to keep the records in an organized fashion to streamline data review and meet the needs of an emergency response project where the design team and contractor's team under an alternative delivery contract are working in unison. An internally developed database system (Mortar) that integrates different applications and services was deployed. Using Mortar, data mapping and integration is possible, facilitating a more informed design process.

Talk # 2: *Helene's debris flows: Observations and new questions*
(Presented by Philip Prince Ph.D., P.G., M.ASCE)

This presentation will discuss his investigation of several debris flows that occurred during Hurricane Helene in 2024. In particular, passage of Hurricane Helene and the associated precursor rainfall event triggered thousands of slope failures in the southern Appalachian Blue Ridge from South Carolina to Virginia. Combined pre- and post-event lidar, aerial imagery, and intensive field investigation offer insight into trends in the behavior of both natural and constructed slopes within the impacted area. Debris flows initiating in colluvial soils produced the greatest impacts to life and property, with debris flows initiating on road embankments (both logging roads and engineered embankments) representing a notable

component of severely destructive slope failure incidents. Natural slope debris flow initiation patterns agreed well with modeled debris flows susceptibility, though debris flow runouts often exceeded predicted lengths and widths. Helene's impacts highlight the need to improve debris flow susceptibility modeling, particularly runout modeling, with information derived from field-supported landslide inventories (e.g., soil type, bedrock-soil interface characteristics, surface runoff patterns) supported by high-resolution remote sensing datasets.

Talk # 3: Emergency Response at Lake Lure Dam Following Hurricane Helene (presented by Brenden Stepek, P.E.)

This presentation reviews the impacts of Hurricane Helene on Lake Lure Dam in western North Carolina. It highlights the dam engineering consultant's role in disaster preparedness and response, including risk mitigation strategies and post-event support through assessment and emergency repairs. The session explores key challenges, decision-making processes, and lessons learned in protecting vital infrastructure during a natural disaster.

Talk # 4: Quantitative Assessment of Levee Breach Widening and Time-Rate Volume Loss Using Historical Overtopping Events (presented by Stefan Flynn, EI, P.E., M.ASCE)

This presentation will describe on-going efforts to leverage the USACE Levee Loading and Incident Database for improved estimation of breach occurrence and extent given riverine levee overtopping.