

## Building Resilience against Karst Hazards: A case study of the National Corvette Museum Sinkhole

Jason S. Polk<sup>1</sup>, Ric Federico<sup>2</sup>, Brian Ham<sup>2</sup>, Daniel Nedvidek<sup>2</sup>, Kegan McClanahan<sup>1</sup>,  
Leslie A. North<sup>1</sup>, Pat Kambesis<sup>1</sup>, and Mike Marasa<sup>3</sup>

<sup>1</sup>Western Kentucky University, Department of Geography and Geology, Bowling Green, KY 42101

<sup>2</sup>EnSafe, 1148 College Street, Bowling Green, KY 42101

<sup>3</sup>Hayward Baker, Inc., 53 Century Blvd, Suite 200, Nashville, TN 37214,

Sinkholes are a common part of life in south-central Kentucky, but when a major collapse occurred on February 12<sup>th</sup>, 2014 at the National Corvette Museum (NCM) in Bowling Green, (Figure 1) residents and the media alike took notice as it received significant attention around the world. The collapse occurred inside the Skydome portion of the building (Figure 2), where eight rare Corvettes fell into the hole that opened in the concrete floor. The Museum immediately began to provide details to the public and made the decision to share information for the sake of transparency and invite help from the community to deal with the unexpected event. Investigation of the sinkhole collapse began immediately while the Corvettes were extracted from the void. Due to the complex nature of the sinkhole's location inside the

building and threat of further damage and safety concerns, a multi-disciplinary approach was used to collaboratively bring cave and karst geoscience, geology, engineering, hydrology, construction, and geophysical methods together to investigate and explore the sinkhole and underlying cave passage.

During this time, Western Kentucky University (WKU) worked with the City of Bowling Green, Warren County, and the Museum to disseminate information to the public about the sinkhole. This included educating people that it is not uncommon for landforms like caves, sinkholes, and springs to be found in locations where many people live and thrive everyday. In fact, more than 6,500 sinkholes were reported in the United



**Figure 1.** The Skydome is located near the contact between the Ste. Genevieve and St. Louis limestones on the Pennyroyal sinkhole plain. Data from the KGS Map Information Service.

States over the last 60 years, with many occurring in Florida, Kentucky, New Mexico, Virginia, and elsewhere. The NCM sinkhole was a less common type of sinkhole, offering a chance to explore and document its investigation and remediation from start to finish.

WKU worked with the City of Bowling Green to provide information through its joint UnderBGKY groundwater awareness campaign, which provided an avenue by which the public could learn more about karst landscapes and the role and formation of sinkholes. To date, the team has created a series of educational resources, including a website, infographics, short videos, and karst visualizations, along with written descriptions of various aspects of living on karst terrains.

There were over 8.5 billion media hits on the NCM sinkhole, which provided an opportunity to engage the public and private sectors in a conversation about sinkhole hazards, including the implications for building codes, insurance, and storm water management in several major karst areas of the U.S. and abroad. Several talks, documentaries, and other events were held to engage the public and interested stakeholders in learning more about karst hazards and their mitigation. Researchers from WKU are also using this trigger to initiate research on ways to learn more about the most effective tools and techniques for educating about karst landscapes, since they are often widely misunderstood.

Through collaborative work within the NCM sinkhole team, a thorough and ro-

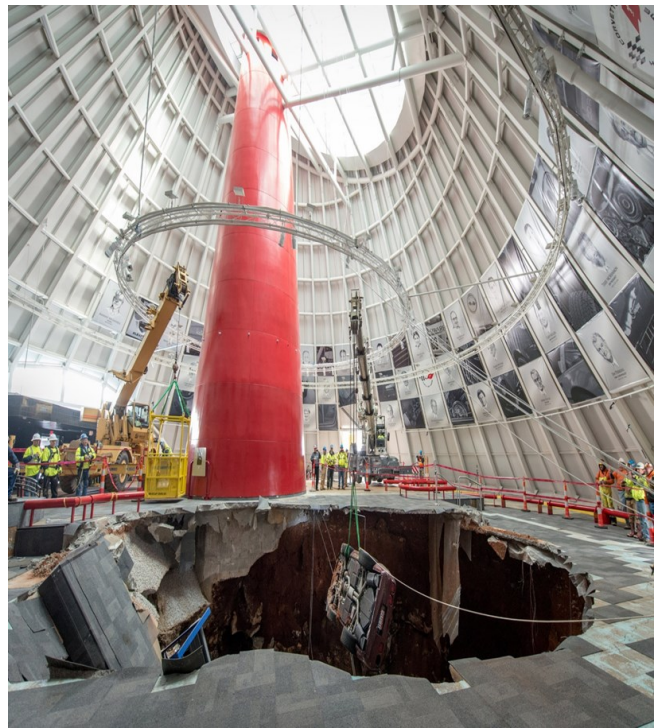


Figure 2, Collapse at Corvette Museum Skydome

bust investigation of the sinkhole collapse has provided additional data about its formation, impacts, and remediation.

WKU is working with the Museum and an outside consultant to develop a highly detailed, unique, interactive educational exhibit about the sinkhole and karst landscapes that will provide visitors an opportunity to experience firsthand how sinkholes form and get accurate scientific knowledge about karst landscapes.

Collectively, this has highlighted the importance of collaborative karst geotechnical investigations to better understand and remediate karst hazards, such as sinkholes, and the