MONROE COUNTY AIRPORT
Sinkhole mitigation and runway rehabilitation
Following a weekend of 11” total rainfall, airport maintenance staff noted the appearance of three sinkhole depressions in the runway environment.

This sink area on RW 17 west of TW A-3 measured 6’ wide and just over 5’ in depth.
Sinkholes were in an area of known karst limestone formation immediately under the runway.

Runway 35/17 construction in 1966 uncovered a cave under the proposed runway.

Runway rehabilitation and extension project in early 1990s again uncovered a large sinkhole formation under the runway near TW A-3.
INVESTIGATION PROCESS

- Geotechnical and geophysical testing began immediately on the runway to evaluate the runway integrity, and develop alternative methods to mitigate the problem.
INVESTIGATION PROCESS

- Airport sinkhole issues generated a very high community interest and awareness.
- Monroe County’s sensitivity to Karst sinkhole concerns would require a low environmental impact approach.
- A key component to gaining the community’s support of this project would be having the approval of Indiana University Geology experts.
- Hanson Professional Services Inc. offered a menu of seven repair approaches ranging from isolated concrete capping to steel reinforced concrete bridge under the runway.
- Board of Aviation Commissioners elected to accept a 5’ layer of stone filter atop the limestone, with layered fabric to protect infiltration of soils from above.
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ENVIRONMENTAL PROCESS

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Project was bid in July 2013 with a total project cost of $10,938,767.
Board of Aviation Commissioners President Dr. William Pugh received and accepted Federal Airport Improvement Program (AIP) grant on Sept. 5, 2013.

- Total project cost $10,938,767
- Federal participation $9,844,890
- Local participation $820,408
- State participation $273,469

Hanson designed — on a fast track — the sinkhole mitigation and the rehabilitation of the runway and taxiways.

Notice to proceed to Crider & Crider was given September 16, 2013.
Asphalt milling and 16” stone base removal began September 16 and lasted through Sept. 21.

Asphalt millings and stone base were recycled.
SINKHOLE MITIGATION

- Excavation began Sept. 20 to determine the depth of bedrock along the outer edges of the project.

- Core drill samples were used to determine estimated depths to bedrock and estimated excavation costs.
Next, the contractor began removing an anticipated 438,000 cubic yards of compacted earth.

The excavation area was divided into three parts. The north section (about ½ of the total area) was excavated to an average depth of 30’ to bedrock.

The middle section (¼ total project area) was excavated to an average depth of 5’–10’. Clearly the most unstable area of bedrock.

The southern section was excavated to an average depth of 15’–20’.
SINKHOLE MITIGATION

- Excavation model
SINKHOLE MITIGATION

- Mountains of excavated clay were piled in three separate areas on the airport based on moisture content and soil compounds.
Excavation uncovered multiple areas that confirmed our concerns.
SINKHOLE MITIGATION

- Excavation model
SINKHOLE MITIGATION

- Geogrid, geotextile and first layers of shot rock backfill began the week of Sept. 30. Nearly 5,500 tri-axle dump truck loads of shot rock and filter stone were moved and compacted in the excavated area. All stone was provided by a quarry less than a mile from the runway.

- The repair is expected to be a long-term solution for karst issues that may form under the runway.

- Elaborate “French drain.” Water naturally flows through the rock bridge to the bedrock cracks, keeping ground water safe.
Excavated clay backfill was lime-stabilized and compacted over the stone filter in layers of 12” or less.

Nuclear density testing ensured compaction levels to 95% of original state.

Lime stabilization necessary to reduce moisture content of clay and obtain optimum compaction. Also aided in reduction of subsidence of backfill.

Added nearly $800,000 extra to the project costs because of the loss of the sun’s drying power in September.
With final layers of compacted earth complete, another layer of geotextile fabric and 16” of stone sub-base compacted Oct. 15.

Pavement test strips were laid on Oct. 25. After positive test results, first layers of asphalt were in place by Oct. 29.
Half-coat pavement markings began Nov. 11. Complete markings were delayed until spring 2014.

Pavement grooving was scheduled for late November and early December. Runway was NOTAMed closed from 7 p.m. to 7 a.m. daily for about six days.