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DEPARTMENT OF TRANSPORTATION

OFFICE OF RESEARCH & INNOVATION

TECHNICAL SUMMARY

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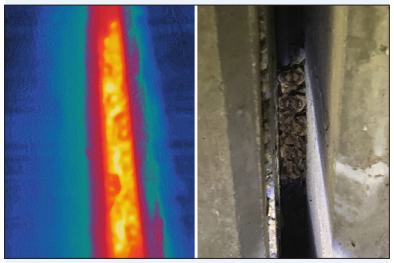
PROJECT COST:
Minnesota State University, Mankato: $30,606
Iowa State University: $112,684



Thermal imaging (left) located bats under studied bridges and photographs (right) confirmed their presence.

Ultrasonic Devices Deter Bats During Bridge Repair

Researchers tested ultrasonic bat deterrence devices at two MnDOT bridges, tracking bat activity with acoustic echolocation recorders and field inspections. Used in short-term and long-term trials, deterrence devices dramatically reduced bat activity at bridge sites. Analysis showed that bats return promptly when devices are turned off.

What Was the Need?

Bridges draw bats, which like to roost in expansion joints. Temporarily preventing such roosting requires physical barriers that are difficult to establish effectively on many bridges. More importantly, MnDOT does not necessarily want to keep bats away permanently because bat populations throughout the continent are in serious decline.

White-nose syndrome, a fungal disease, has killed more than 5.7 million bats in eastern North America since 2005. Wind turbines kill hundreds of thousands of bats in North America each year, according to the U.S. Geological Survey. Habitat loss has been another deadly influence on bat populations. In 2015, the U.S. Fish and Wildlife Service listed the northern long-eared bat, a species familiar in Minnesota, as threatened.

Regulatory requirements that protect bats also shorten maintenance period options during the construction season. Crews must avoid any bats present, which impacts cleaning, painting or other maintenance work. The presence of bats disrupts bridge work timelines and budgets, and work upsets habitation for species struggling to survive.

What Was Our Goal?

MnDOT sought to examine the use of ultrasonic deterrence devices developed for use with wind turbines to determine how feasible and effective they may be at temporarily deterring bats at bridge sites.

What Did We Do?

In 2019, working with the project's Technical Advisory Panel (TAP), the Minnesota Department of Natural Resources and the U.S. Fish and Wildlife Service, researchers selected two bridge sites for testing the ultrasonic deterrence devices. At each site, the research team installed four battery-operated echolocation recording devices to monitor bat activity before, during and after the use of deterrence devices.

The first site was in the Red Wing, Minnesota, area on U.S. Highway 61. Researchers set up generator-powered ultrasonic deterrence devices on six tripods 25 to 30 feet away from the north abutments; the devices were aimed at areas beneath or near the bridge deck.

The second site, a single-span bridge on State Highway 43 near Rushford Village, entailed seven beam-mounted deterrence devices hanging 20 to 25 feet from and mostly facing the abutment on the south side of a small creek.

What Did We Learn?

At both sites, the devices worked well at keeping bats away until they were turned off, at which point bats quickly returned. Acoustic data showed few bat calls while deterrents were running, and more importantly, site visits during deterrence definitively confirmed an absence of bats.

Site One. Deterrence ran for 10 days. Bat calls were recorded from 12 days before the deterrence period through 11 days after.

continued

"This project was innovative. We worked with a technology that wasn't really on the market yet for real-world applications in anticipation of its availability."

—Christopher Smith,
Wildlife Ecologist, MnDOT Office of Environmental Stewardship

"We were very happy to identify potential solutions for MnDOT. This technology temporarily deters bats without causing harm."

—Başak Bektaş,
Assistant Professor, Minnesota State University, Mankato Department of Mechanical and Civil Engineering

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A Minnesota crew works with researchers to install ultrasonic acoustic bat deterrence devices under the deck of a bridge in Rushford Village, Minnesota.

- At three recorded locations on the deterred side, the predeterrent period for the three recorders captured between 6,008 and 7,227 calls.
- During deterrence, 22 calls were detected.
- After deterrence, the call number ranged from 3,162 to 5,564.
- At the one recording device on the nondeterred abutment, 6,184 calls were detected before the deterrents were turned on across the waterway; 3,373 during deterrence; and 5,665 after.

Site Two. Deterrence ran for 21 days, was off for seven days and back on for 24 hours. Bat calls were recorded from 12 days before the deterrence periods through 14 days after.

- At three recorded locations on the deterred side, the predeterrent period for the three recorders found between 6,308 and 9,734 calls.
- During deterrence, eight calls were detected, none in the second period.
- After deterrence, the call number ranged from 10,432 to 14,826.
- At the one recording device on the nondeterred abutment, 10,212 calls were detected before the deterrents were turned on across the waterway; 23 during deterrence (with none during the second deterrence period); and 14,341 after.

Species distribution was similar at both sites, with a large number of calls by little brown bats followed by big brown bats at site one; at site two, big brown bats composed the largest group, and little brown the second largest. Other common Minnesota bat species were also detected at the sites.

What's Next?

MnDOT will likely develop a procedure for deploying this technology when needed and determine associated expenses. Further research could consider the technology in different configurations and environments, test the devices at many bridges around the country, and conduct cost–benefit analysis. Research could also compare the relative impact of the acoustic deterrents on specific bat species.

This Technical Summary pertains to Report 2020-26, "Use of Innovative Technology to Deter Bat Bridge Use Prior To and During Construction," published October 2021. The full report can be accessed at mndot.gov/research/reports/2020/202026.pdf.