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CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION
TRANSFORMING IDEAS INTO SOLUTIONS

# Research Notes

# Traffic Disruption-Free Bridge Inspection Initiative with Robotic Systems

Inspecting and preserving infrastructure through robotic exploration.

Maintenance

**November 2025**

**Project Title:**
Traffic Disruption-Free Bridge Inspection Initiative with Robotic Systems

**Task Number:** 3611

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## WHAT IS THE NEED?

Currently, bridges and tunnels are visually inspected and manually maintained under traffic control with the aid of heavy lifting and access equipment. If access to the work area must be made from bridge decks, the indirect cost associated with road closure multiplies.

In such a case, travelers are frustrated with traffic congestion, and both the travelers and inspectors are subjected to a safety concern on high volume highways.

## WHAT ARE WE DOING?

The Missouri Department of Transportation (MoDOT) is the lead state for the pooled fund study TPF-5(395) to engage closely with several state Departments of Transportation (DOTs) in the bridge inspection technology development at the INSPIRE University Transportation Center (UTC).

The INSPIRE UTC (https://inspire-utc.mst.edu) at Missouri University of Science and Technology was awarded in December of 2016 by the U.S. DOT. The UTC center was created for the development and technology transfer aimed at infrastructure inspection and preservation solutions. The center is focused on the development of advanced technologies to aid in bridge inspection and maintenance.

## WHAT IS OUR GOAL?

The goals of this pooled-fund initiative are to engage closely with several DOTs in the early stage of technology development at the INSPIRE UTC, and leverage the center resources to develop case studies, protocols, and guidelines that can be adopted by state DOTs for bridge inspection without adversely impacting traffic.The national study will use

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structural crawlers and unmanned aerial vehicles (UAVs) as a mobile platform for in-depth inspection of elevated bridges.

## WHAT IS THE BENEFIT?

The study will demonstrate the benefit of automated bridge inspection and preservation of bridges with sensors, nondestructive evaluation devices, multi-modal robots, and data analytics. The study will provide cost-effective, consistent, and reliable solutions in bridge condition assessment and maintenance. It will provide training to a diverse transportation workforce so they can master the advanced technologies.

## WHAT IS THE PROGRESS TO DATE?

As of November 2025, the current progress is: Pilot training for six types of Unmanned Aerial Vehicles (UAVs) has been completed. A mock bridge was constructed from four full-scale reinforced concrete deck panels to test the bridge inspection protocol in a semi-controllable environment. This intermediate step between laboratory and field work is important to ensure flight safety and inspection quality at bridge sites. Field test protocol using UAVs for bridge inspection has been drafted, following the terminology and documentation guidelines in the American Association of State Highway and Transportation Officials (AASHTO) Manual for Bridge Element Inspection.

## IMAGES

**Image 1:** Unmanned aerial vehicle inspecting infrastructure