

**ARKANSAS DEPARTMENT OF TRANSPORTATION
SYSTEM INFORMATION AND RESEARCH DIVISION
FISCAL YEAR 2023
REQUEST FOR PROPOSAL
RESEARCH PROJECT NO. TRC2301**

TITLE: Smart Work Zone (SWZ) System Design, Specifications, Estimates, and Implementation Guidelines

ARDOT POLICY

All proposals shall be submitted electronically per the Proposal section of this Request for Proposal. All research project contracts will be managed utilizing Infotech's Doc Express paperless contracting platform. All information on the utilization of this platform for research projects can be found at <https://www.ardot.gov/divisions/system-information-research/research/forms-and-resources/> or from the Research Section.

PROBLEM STATEMENT

The existing Automated Work Zone Information System (AWIS) special provision has required frequent revisions over the last few years. ARDOT recognizes the importance of AWIS in reducing end of queue crashes and providing advance notification to drivers to allow for decisions to choose alternate routes. However, concerns have arisen with ARDOT's process, including:

- Occasional inaccurate queue and speed messaging,
- Changeable Message Sign (CMS) placement and messaging to give sufficient queue warning,
- Decisions to add AWIS/SWZ technology to construction projects late in the design process lead to workflow challenges,
- Quantifying the safety benefits of AWIS/SWZ systems,
- Quantifying and estimating costs of AWIS/SWZ elements, deployment, and device repositioning due to construction staging,
- Coordinating adjacent projects in a single corridor or construction on parallel corridors to minimize traffic impacts,

**ARKANSAS DEPARTMENT OF TRANSPORTATION
SYSTEM INFORMATION AND RESEARCH DIVISION
FISCAL YEAR 2023
REQUEST FOR PROPOSAL
RESEARCH PROJECT NO. TRC2301**

- Using AWIS/SWZ devices to their full potential, including providing early information to the public of potential delays, informing the Transportation Management Center (TMC), and providing traffic data collection and performance feedback.
- The Work Zone Data Exchange (WZDx) specifies the data format delivered to third-party providers. Additional input is needed on how ARDOT AWIS/SWZ data can be made compatible.

New and evolving technologies related to Smart Work Zones (SWZ) may benefit motorists in Arkansas. A national architecture is being established for connected work zones, which may change how vehicles and infrastructure communicates.

ARDOT staff must identify the need for AWIS in a construction job, specify components and quantities, and estimate AWIS costs, often as final plans are being prepared. Systematic consideration of traffic impacts early in the project development process would better inform decisions. A better understanding of emerging AWIS/SWZ technologies is needed, and institutional barriers to applying and using these technologies should be considered.

AREA OF STUDY

The entire selection and implementation process for SWZ intelligent transportation system (ITS) strategies should be consistent with 23 CFR 940. The objectives of this study are to:

1. In a facilitated workshop with the Subcommittee and Stakeholders, draft an SWZ/AWIS Concept of Operations (CONOPS) including goals and objectives to guide the direction of TRC2301.
2. Review probe, crowdsourced, and third-party provider data as a supplement to AWIS/SWZ devices.
3. Assess the effectiveness of AWIS used in Arkansas construction zones.

**ARKANSAS DEPARTMENT OF TRANSPORTATION
SYSTEM INFORMATION AND RESEARCH DIVISION
FISCAL YEAR 2023
REQUEST FOR PROPOSAL
RESEARCH PROJECT NO. TRC2301**

4. Prepare a decision tree incorporating AWIS/SWZ system decisions earlier in the project planning, transportation management plan (TMP), and project development processes.
5. Review the type of projects where AWIS has historically been used and recommend project selection criteria that consider recommendations from this research and the use of new data sources as described in Item 2 above.
6. Provide standard procedures for designing AWIS/SWZ systems and estimating costs.
7. Recommend updated text for the AWIS/SWZ Special Provisions and, if needed, to the Maintenance of Traffic (MOT) Special Provision.
8. Ensure that SWZ efforts are fully integrated with other ARDOT TSMO systems. A key focus of this effort should be to ensure that SWZ efforts are integrated with other ARDOT efforts such as the TMC, IDriveArkansas, etc. for maximum effectiveness.

An ARDOT consulting contract to develop Transportation Systems Management and Operations (TSMO) protocols is underway. It may eventually offer opportunities to integrate individual AWIS/SWZ project components through the TMC. This research is intended to provide recommendations to incorporate technologies and devices not currently used in Arkansas and recommend approaches to test and use these technologies. The results of TRC2301 research should be compatible with TSMO protocols.

METHOD OF STUDY

The project will include but is not limited to the following tasks to ensure the research objectives are met:

1. Conduct a literature review of comparative research, manuals, specifications, and TMP best practices. Current editions of the Manual for Uniform Traffic Control

**ARKANSAS DEPARTMENT OF TRANSPORTATION
SYSTEM INFORMATION AND RESEARCH DIVISION
FISCAL YEAR 2023
REQUEST FOR PROPOSAL
RESEARCH PROJECT NO. TRC2301**

Devices (MUTCD), Work Zone ITS Implementation Guide, Highway Capacity Manual (HCM), Work Zone Data Exchange (WZDx), and the Code of Federal 23 CFR 940 must be used as references. The Work Zone ITS Implementation Guide “illustrates how a systems engineering process should be applied to determine the feasibility and design of work zone ITS for a given application, regardless of its scale, by walking through the key phases, from project concept through operation.”

2. Facilitate and document a CONOPS workshop to collect input from the Subcommittee and representative stakeholders.
3. Assess ARDOT's work zone queue length estimation process and recommend efficiencies, reasonable assumptions for traffic diversions, and acceptable queue lengths or travel delays.
4. Review work zone ITS devices. Recommend selection criteria for devices, deployment strategies, and methods to assess effectiveness. Note that equipment will not be purchased for this research.
5. Evaluate the ability of probe or third-party data to supplement or replace ITS devices. Include the feasibility of using vehicle probe or third-party data for construction or maintenance projects for which the current AWIS system data can't be used.
6. Review existing and recommended work zone strategies and TMP processes to assure that ITS systems align with other TMP strategies.
7. Analyze historical AWIS data to quantify traffic safety impacts and determine opportunities for capturing additional work zone traffic data, including adding enhanced data collection capabilities. Use of the National Performance Management Research Data Set (NPMRDS) is allowed if AWIS data is insufficient, provided that the data sets report speeds and other key attributes in a consistent manner.
8. Review and recommend updates to AWIS/SWZ design, layout, and special provisions, including methods to quantify devices and develop cost estimates.

**ARKANSAS DEPARTMENT OF TRANSPORTATION
SYSTEM INFORMATION AND RESEARCH DIVISION
FISCAL YEAR 2023
REQUEST FOR PROPOSAL
RESEARCH PROJECT NO. TRC2301**

9. Document all tasks and findings in interim reports to be included with each Quarterly Report, annual Benchmark Reports, and the Final Report.

Information from the following references, at a minimum, should be considered in the development of the Proposal. Research should be built upon State and national best practices:

- ARDOT Policy for Work Zone Safety and Mobility:
 - <https://www.ardot.gov/wp-content/uploads/2021/12/2021-WZ-Final-Rule-Policy-ARDOT-11-24-21.pdf>,
- Work Zone Intelligent Transportation Systems Implementation Guide, FHWA, January 2014,
- FHWA WZ Management Program website: Intelligent Transportation Systems (ITS) & Technology:
 - <https://ops.fhwa.dot.gov/wz/its/index.htm#its>,
- National WZ Safety Information Clearinghouse
 - <https://www.workzonesafety.org/swz/swztechnology-application/outreach/>.

The Proposal should include a discussion of ARDOT staff input needed to achieve the best research results.

BENEFITS

- Construction contracts often include AWIS Special Provisions to mitigate end of queue crashes, particularly on high-volume primary highways. This research would recommend revisions to AWIS/SWZ design, processes, estimates, and implementation to mitigate adverse construction impacts.
- Minimize work zone traffic delay and enhance safety for the traveling public.

**ARKANSAS DEPARTMENT OF TRANSPORTATION
SYSTEM INFORMATION AND RESEARCH DIVISION
FISCAL YEAR 2023
REQUEST FOR PROPOSAL
RESEARCH PROJECT NO. TRC2301**

- Minimize freight transportation delays due to work zones.
- Data collected using AWIS is not currently used to inform future highway work zone capacity and queue analysis, including road user cost analysis. If properly collected and validated, this data could provide feedback regarding accurate construction work zone lane capacity.
- With better lane capacity inputs, the Maintenance of Traffic Special Provisions time-of-day lane use and closure criteria could be more accurate. This might allow for better work contractor hours, where possible.

TIME AND FUNDING OF STUDY

Work will begin no earlier than January 1, 2023, contingent upon the Proposal's acceptance and availability of research funds. The length of the project shall be 24 months.

Up to 25% of the estimated project costs will be withheld pending final acceptance of the final report. Failure to deliver the required Final Report at the end of the project will result in the project's cancellation, and the Department will retain 25% of the total project cost.

REPORTS

All reports must be in accordance with the most current Research Manual (available at <https://www.ardot.gov/divisions/system-information-research/research/> or from the Research Section). All reports are required to be submitted through Doc Express. An Implementation Report which details the recommended means/techniques for using the project results shall be submitted to the Department within two (2) weeks of the research project's Final Report. All reports are required to be reviewed by a technical editor before submission to the Department.

**ARKANSAS DEPARTMENT OF TRANSPORTATION
SYSTEM INFORMATION AND RESEARCH DIVISION
FISCAL YEAR 2023
REQUEST FOR PROPOSAL
RESEARCH PROJECT NO. TRC2301**

Final reports must also be Section 508 compliant. Federally funded research with public-facing PDFs must be accessible as of March 23, 2018, according to the final federal rule for the Information and Communication Technology (ICT) refresh under Section 508. This ensures that federal employees with disabilities have comparable access to and use of information and data just like federal workers without disabilities. The law also ensures that members of the public with disabilities receive comparable access to publicly available information and services. All researchers should use the accessibility tracker in Microsoft Word before submitting final reports.

An oral report to the Transportation Research Committee may be required. In addition to reports and publications, the Department shall be furnished one (1) copy of any master's thesis or doctoral dissertation which is a result of any investigation or study on this project. The submitting of any report to be published by an outside publication or presentation on this project before its completion shall be submitted for the Department's approval before submission.

PROJECT DELIVERABLES

The proposed research will provide ARDOT with the following:

- An assessment of national best practices for work zone transportation management and SWZ special provisions,
- Facilitation and documentation of a Concept of Operations workshop for AWIS/SMZ goals and objectives,
- Traffic safety analysis and AWIS device data and operations assessment for up to twelve construction projects,
- Draft SWZ/AWIS Special Provisions, and recommendations for updates to the MOT special provisions if needed,

**ARKANSAS DEPARTMENT OF TRANSPORTATION
SYSTEM INFORMATION AND RESEARCH DIVISION
FISCAL YEAR 2023
REQUEST FOR PROPOSAL
RESEARCH PROJECT NO. TRC2301**

- Quarterly Reports and annual Benchmark Reports that include text documenting interim milestones, and
- A Final Report documenting the effort, research findings, and recommendations, and an Implementation Report recommending actions to integrate the research into ARDOT workflow processes.

AUTHORIZATION TO BEGIN WORK

A letter separate from the contracting documents authorizing the beginning of work will be transmitted through Doc Express initiating the project. Any cost incurred before the authorization letter is received will not be eligible for reimbursement. The project will begin work no earlier than January 1, 2023.

EQUIPMENT

A complete physical verification of all software and equipment purchased or built for use on this project and the actual location of the equipment will be made each year. An Equipment Capitalization Notice is available from the Research Section for the reporting of software or equipment purchased during the project. All software developed on the project will be completed in an open-source format, and ARDOT shall be provided a copy of the source code. If non-expendable or special equipment is purchased with project funds, the equipment is owned by ARDOT and disposition of the equipment will be determined by ARDOT at the project's closeout session.

All rental rates shall be approved by ARDOT before the approval of the proposals. Should a subcontract be part of the Proposal, ARDOT will not approve the purchase of any equipment in the subcontract. Any equipment purchased through ARDOT's Transportation-Related Research & Workforce Development Grant Program is not eligible for rental rate charges.

**ARKANSAS DEPARTMENT OF TRANSPORTATION
SYSTEM INFORMATION AND RESEARCH DIVISION
FISCAL YEAR 2023
REQUEST FOR PROPOSAL
RESEARCH PROJECT NO. TRC2301**

All equipment shall be purchased in accordance with the State of Arkansas purchasing laws. No equipment purchase is anticipated.

PROPOSALS

Proposals shall be submitted in a word document utilizing the provided template to research@ardot.gov no later than the end of business on June 3, 2022. No proposals will be accepted after this date. All procedures shall be in accordance with the most current Research Manual and Federal-Aid Policy Guide (FAPG). In the event of policy contradiction, the FAPG shall govern.

Upon approval of the Proposal by the Project Subcommittee, the Project Manager will initiate the process within Doc Express to acquire the appropriate electronic signatures from all parties.