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RESEARCH PROJECT TITLE

Effective Signing Strategies and Signal Displays for Work Zone Driveway Assistance Devices (DADs)

SPONSORS

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The Smart Work Zone Deployment Initiative (SWZDI) is a transportation pooled fund that supports research investigations into better ways to improve the safety and efficiency of traffic operations and highway work in work zones. The primary objective is to promote and support research and outreach activities that focus on innovative practice-ready policies, processes, tools, and products that enhance the implementation and constructability, safety, and mobility impacts of all types of work zones. The fund is administered by Iowa State University's Institute for Transportation, and the lead agency is the Iowa Department of Transportation.

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Effective Signing Strategies and Signal Displays for Work Zone Driveway Assistance Devices (DADs)

tech transfer summary

This project conducted a nationwide survey and field evaluation related to the use of driveway assistance devices in work zones to help determine best practices for their design and develop guidelines for their deployment.

Background and Potential Benefits

Driveway assistance devices (DADs) have been developed to help guide drivers entering one-lane, bi-directional work zones from driveways or minor side streets to proceed in the proper direction of travel. The limited amount of prior research indicates a DAD could be a potentially low-cost and promising alternative to flaggers or other traffic regulators at low-volume access points, providing potential cost savings, productivity benefits, and increases in worker safety.

Goal

This research project aimed to determine best practices related to DAD design and develop guidelines related to the use of DADs.

Objectives

- Determine the DAD display design that best directs motorists to safely enter one-lane, two-way work zones and proceed in the proper direction of travel
- Develop guidelines regarding the design and utilization of DADs



Example of a DAD

Problem Statement

Given that DADs are relatively new and an under-researched treatment, much is still unknown about their performance, including motorist comprehension and compliance, optimal designs of the signal heads and auxiliary signage, and appropriate conditions for use. As a result, the use of DADs continues to be an experimental traffic control treatment, and formal Federal Highway Administration (FHWA) approval is required prior to field implementation.

Project Description and Methodology

The research project used two distinct methods to determine best practices related to DAD display and other design features:

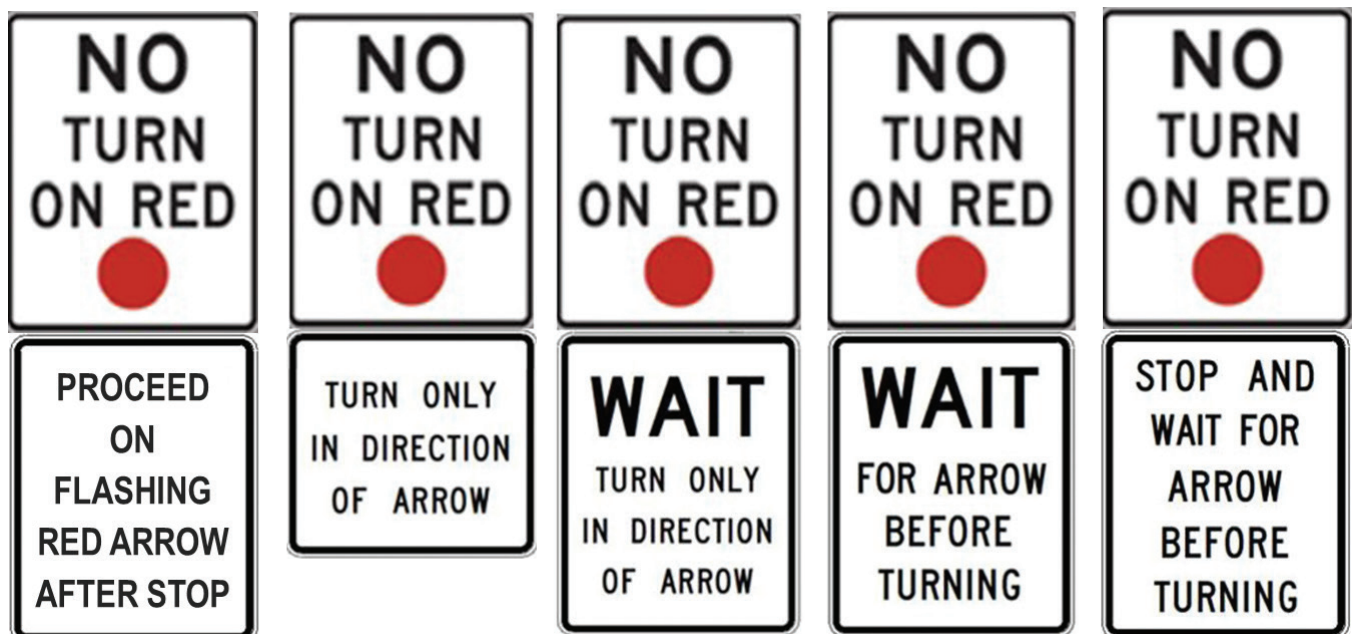
- Nationwide online driver survey
- Field evaluation of DAD deployment on US 31 in Benzonia, Michigan

The nationwide survey was particularly useful in determining the signal-head arrangements and auxiliary sign messages that provided the greatest comprehension. These were further evaluated in the subsequent field study.

The field study focused on assessment of driver compliance with the DADs as a function of the auxiliary signage utilized in conjunction with the DAD at multiple access points. Building on the recommendations of prior Texas and Michigan evaluations, the field study included several higher volume commercial driveways to assess the most effective use of DADs at access points where queuing may occur.

Key Findings

- Use of a DAD generally resulted in a high proportion of safe movements during the field study, with an overall safe movement rate of nearly 93 percent, which was consistent with the rates experienced in previous evaluations. Although the overall legal movement rate was lower than observed in prior studies, this could possibly be attributed to DADs being employed at commercial driveways and minor side-streets with comparatively higher traffic volumes and longer wait times.
- Survey results suggested that signs more effectively conveyed the proper driver action if they included the word “Turn” as opposed to “Yield.” Furthermore, the message effectiveness was further strengthened if it included prominent “WAIT” text at the top of the sign, and this result was consistent between the survey and the field study.
- Perhaps the strongest signing-related component for the DADs was the inclusion of the No Turn on Red (NTOR) sign, which was found to improve the message effectiveness in all cases and increased the rate of proper response to the circular red indication.
- Yellow flashing arrows contributed to an improved response rate over red flashing arrows in terms of proper driver action when encountering a DAD signal. The red flashing arrows seemed to present considerable uncertainty amongst the survey respondents, as evidenced by the red arrows being greater than six times more likely to result in an “Unsure” response for the appropriate driver action compared to that for the yellow arrows.



Auxiliary DAD signs included in the field study

- Survey respondents indicated that horizontal and doghouse signal head configurations more effectively conveyed the proper driver action compared to the red-over-yellow arrow configuration. This result is not surprising due to the level of implementation of such signal configurations nationwide.



Recommended DAD signal head configuration alternatives (doghouse and horizontal)

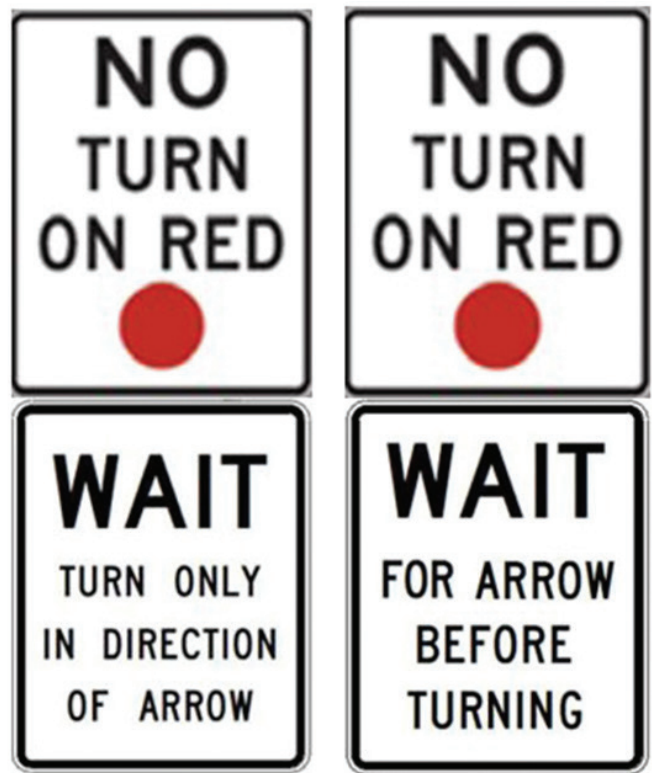
Implementation Recommendations

Auxiliary signage should be implemented in conjunction with any implementation of any DAD signal. Such signage should utilize messages that provide direction on what action drivers should take both during the flashing arrow phase and the steady circular phase.

For the flashing arrow phase, sign messaging should include “Turn” rather than “Yield.” For the steady circular red phase, a separate NTOR sign should be utilized in combination with any auxiliary sign, or as a standalone sign if no other auxiliary sign is provided. A prominent “WAIT” message may be included above the auxiliary sign to further enhance the appropriate action during the steady circular red.

With respect to the signal confirmation, horizontal and doghouse signal configurations are recommended for future DAD implementations. Further testing of red-over-yellow arrows is recommended prior to further implementation.

Additionally, although yellow flashing arrows contributed to an improved response rate and decreased uncertainty compared to red flashing arrows in terms of proper driver action when encountering the DAD signal, the researchers do not make a recommendation on flashing arrow color. Rather, the decision to use flashing red or flashing yellow directional arrows should remain at the discretion of the particular agency based on the policies and practices within the jurisdiction.



Recommended DAD auxiliary signage alternatives

Implementation Readiness and Benefits

The research plan was devised with the intent that any positive findings may be used to support the adoption of DADs into the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD). The findings from this research provide further support for interim approval and subsequent adoption of DADs into a future version of the MUTCD.

Given that DADs are not currently included in the MUTCD, they remain an experimental traffic control treatment, and formal FHWA approval is required prior to field implementation. Thus, DADs are recommended for continued experimental use in work zones that include one-lane, two-way traffic where it is not practical or feasible to provide continuous flagger operation.