

Sign Effectiveness Guide

tech transfer summary

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RESEARCH PROJECT TITLE

Guidance on Traffic Sign Effectiveness, Installation, and Removal

SPONSORS

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The mission of the Institute for Transportation (InTrans) at Iowa State University is to develop and implement innovative methods, materials, and technologies for improving transportation efficiency, safety, reliability, and sustainability while improving the learning environment of students, faculty, and staff in transportation-related fields.

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Signs play a critical role along roadways, and their proper use is essential in garnering drivers' respect and compliance. The overuse of signs can lead drivers to disregard them.

Goals

The goals of this project were to compile information on traffic sign effectiveness and impacts (while also considering the robustness of research results) and provide guidance on the installation, maintenance, and removal of signs.

Background and Problem Statement

A large number of sign installation decisions based on engineering judgment are allowed by the *Manual on Uniform Traffic Control Devices for Streets and Highways* (the MUTCD). The information needed to make these decisions can depend on the content of the MUTCD, field characteristics, and knowledge of the expected impact of a particular sign on human behavior, traffic operations, and/or roadway safety, among other things.

Signing represents a significant investment for all government agencies, and this has become more obvious with the requirement to implement an assessment and management plan for the maintenance of minimum sign retroreflectivity. The amount of sign replacement (due to retroreflectivity requirements) will likely increase, and, as a result, a need existed to summarize the available information on the effectiveness, installation, maintenance, and removal of signs, in general.

Research Description

The focus of this project was on compiling and critically reviewing information regarding the safety and operational effectiveness and impacts of signs. The research team collected and reviewed information on sign effectiveness, including the purpose of each sign; relevant information from the MUTCD; potential safety (e.g., crash frequency or severity), operational (e.g., speed), and/or behavioral (e.g., increased attention or compliance) impacts as identified by past research; alternatives (increased enforcement, pavement markings, etc.) that could be considered in lieu of a particular sign; and removal suggestions. The researchers also assigned robustness ratings to the research results that they reviewed.

The research team reviewed, summarized, and, finally, rated published safety and operational research results for 11 different static or enhanced signs and warning systems to characterize the level of confidence placed on the robustness of the findings. The safety research ratings were based on the star rating approach employed by the Crash Modification Factors (CMF) Clearinghouse. The researchers used a similar approach to rate operational research and focused on how rigorous the analysis was and the application value of the results. In both cases, studies were assigned Low, Medium, or High ratings to provide a subjective measure of the research-based value of the results from each particular study.



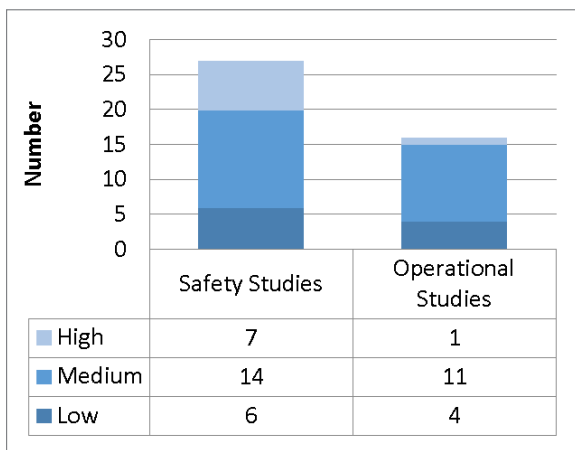
The researchers documented the following static or enhanced signs and warning systems in the guide that they developed: stop, yield, speed limit, horizontal alignment warning (chevrons, curve warning, etc.), playground and children at play, deer crossing, ice warning, road may flood, enhanced stop, unsignalized intersection conflict warning, and signalized intersection advance warning.

The researchers also documented the different aspects that may factor into sign installation and maintenance: sign program policies, approaches to sign inventories, retroreflectivity requirements, and additional signing considerations.

They also obtained and reviewed a summary of legal information related to traffic control devices in Iowa, and included it in the guide. Finally, they reviewed *Iowa Traffic Control Devices and Pavement Markings: A Manual for Cities and Counties* to identify content that needs to be updated or revised.

Key Findings

- The safety and operational impacts of very few signs that are commonly used by local jurisdictions have been studied—to any great extent—with a research approach that would meet the current state-of-the-practice for highly robust results.
- A review of 48 research documents that focused on the potential safety and/or operational impacts of the 11 static or enhanced signs and warning systems resulted in ratings of Low, Medium, and High for 6, 14, and 7 of the safety studies, respectively, and 4, 11, and 1 of the operational studies, respectively. (Some of the 48 documents that were reviewed either were not referenced in the guide or did not get rated). The ratings showed a wide range of research robustness for each of the 11 static or enhanced signs and warning systems.



Summary of robustness ratings for safety and operational studies reviewed, summarized, and rated in the guide

- The lack of a documented research study focused on the safety or operational effectiveness of a sign, however, does not mean that it is not effective in the accomplishment of its objective(s). A number of static and enhanced signs are currently being studied, and it is expected that many more will be in the future (particularly with the relatively new driver behavior databases being created).
- In addition to the safety and/or operational impacts a sign may be expected to induce, signs may or do produce other driver behavioral changes and impacts that are not as easy to measure. These changes and impacts could be changes in decision-making, acknowledgment of the additional and expected notification of a hazard, and general increase or heightened awareness of a specific regulation or hazard that is essential to the safety and operations of the transportation system.
- Sign removal has not been discussed to any great extent in past research or guidance documents. The information available on the processes or policies used to remove signs and the potential impact of sign removal is very limited. However, some suggestions found for the removal of stop signs and the MUTCD's summary of components related to signal removal included the following general components: implement a policy, conduct engineering studies, provide notice of an upcoming change, and conduct a post-removal evaluation.
- Retroreflectivity is a critical component of roadway signage and the assessment and management approaches available to agencies to meet MUTCD requirements include the following: comparison panels, consistent parameters, retroreflectometer measurement, expected sign life, blanket replacement, and control signs. The selection of a particular approach will vary depending on agency needs, resources, etc.
- The sign assessment or management approaches used by Iowa counties that had their policies reviewed included the calibration signs assessment method and the expected sign life management method; however, other methods are also used by counties in the state (e.g., direct measurement using a retroreflectometer).
- General sign maintenance, including cleaning, repair, etc., is an important component of a sign program to extend the useful life of a sign in the accomplishment of its intended purpose.
- The legal consideration or input provided to the project team about traffic control devices appears to be generally common knowledge to local agency personnel in Iowa. The information provided focused on jurisdictional immunity and the maintenance of traffic control devices once they are installed.

Implementation Readiness and Benefits

The guide that was developed includes the available information on sign effectiveness and/or impacts, while also considering the value and applicability of research results. It also provides guidance on the installation and removal of signs. The document includes a critical evaluation and summary of the documented safety, operational, and/or behavioral research for a variety of signs used by local public agencies in Iowa. It also presents information on sign installation, maintenance, removal, and alternatives.

The guide, along with the MUTCD and field evaluation, can be used by transportation professionals during their determination of whether a particular sign can be expected to produce an impact on safety and/or operations. The project team recommends that the information in the guide related to the results of the research completed on sign impacts, along with new research results as they are published, be used as part of sign-related decision-making.

The results are generally applicable to situations similar to those that were studied (e.g., high speed rural settings, lower speed urban settings), and should be useful to those making sign-related decisions (e.g., installation, removal) on a case-by-case basis, as long as the robustness ratings of the research results are also considered.

The guide may help agencies to better manage their signing budgets. The information provided in the guide focuses on the needs of local roadway agencies, but it is also relevant to many other users.

Recommendations for Future Research and Development

- The research team recommends that an investigation be completed to gather and summarize sign removal policies from throughout the US. An evaluation of the steps included and a study of the potential or actual operational and safety impacts of applying those steps may be of interest also. The research should be done in a robust manner and follow currently accepted state-of-the-practice approaches for safety analysis. The team also recommends that an investigation be completed that considers the need for different removal policies for different types of signs and/or pavement markings.
- The researchers recommend that the results of the suggested sign removal policy investigation be used by a local agency steering committee to develop sample sign removal procedure policies. This information would need to be reviewed by legal counsel, but should be of value to local agencies.
- The MUTCD has required agencies to use a minimum retroreflectivity assessment or management method since June 1, 2014. The team recommends that the advantages and disadvantages experienced in the field by local agencies be explored for the various approaches in use. The information developed could be useful to local agencies in their future decision-making about this requirement.
- Based on a cursory review of *Iowa Traffic Control Devices and Pavement Markings: A Manual for Cities and Counties*, a number of updates and revisions are needed. An update of this document was beyond the scope of work for this project, and the team recommends that a more comprehensive review and update be completed in the near future.