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In Service Performance Evaluation of Guardrail End Treatments

The end of a length of guardrail must be designed so that it is not a hazard to occupants of a vehicle striking it. Highway agencies install end treatments in a variety of forms intended to absorb energy in a crash and to redirect the vehicle into a safe trajectory.

The Transportation Research Board, part of the National Academies of Sciences, Engineering, and Medicine, formed a committee with the sponsorship of the National Cooperative Highway Research Program (NCHRP) to develop a research design for evaluating the in-service performance of guardrail end treatments, determine the data required for the analysis, examine state data systems to determine whether the required data would be available, and identify next steps for carrying out evaluations.

The performance of guardrail end treatments and other roadside safety devices (including guardrails, other types of barriers, and sign supports) is evaluated by laboratory crash testing. The purpose of the committee's study was to aid highway agencies in supplementing crash testing with evaluation of the safety performance of these devices in use on roads.

The guidance document that highway agencies follow for crash testing of roadside safety devices advises the conduct of in-service evaluations to monitor the field performance of the devices. Also, the 2015 report of a joint federal–state task force that examined crashes with end treatments recommended a program of national and state-level in-service evaluations of end treatments. Despite such recommendations, evaluations have rarely been carried out. The committee found that highway agencies are not prepared to commit resources to systematic in-service evaluation for reasons including limitations of data systems, lack of funding and staff, and lack of perceived benefit. Agencies are unlikely to invest in evaluation capabilities without evidence that the results can be useful for supporting decisions on selection, maintenance, and replacement of devices.

The committee concluded that in-service evaluation can help to ensure that roadside safety devices effectively reduce the risk of injuries and fatalities. Crash testing cannot reproduce the variety of characteristics of crash dynamics, sites, and installations that affect crash outcomes. In-service data are necessary to determine the frequencies of various crash, installation, and site characteristics so as to determine the crash conditions that should be included in crash tests. In-service evaluation also is necessary to verify that devices in the field perform as they do in testing. Data collection for evaluation is more likely to be cost-effective if it addresses multiple device categories rather than end treatments alone.

Trials to demonstrate in-service evaluation methods and applications are a necessary first step toward establishing capabilities. More information about the benefits and practicality of routine in-service evaluation is needed before new data collection and analysis programs can be launched. Results of initial studies of modest scale would indicate whether the potential benefits justified further investment.

RECOMMENDATIONS

Validation of Crash Test Procedures

The U.S. Department of Transportation (U.S. DOT) and the state departments of transportation should cooperate in undertaking a research program to validate and refine crash testing of guardrail end treatments and other roadside safety devices through in-service evaluation and simulation modeling. The analysis for

validating crash test procedures should have two components: comparison of actual crash circumstances with circumstances in the tests, and comparison of the outcomes of actual crashes that match test circumstances with test outcomes.

The crash test validation research program should include assessment of the usefulness of simulation models in conjunction with crash testing to certify new device designs.

Demonstration of Evaluation Methods for Routine Highway Agency Use

The state departments of transportation, or the U.S. DOT and states acting cooperatively, should conduct a demonstration of methods suitable for highway agencies to use for routine in-service evaluation of roadside devices. The demonstration should determine whether evaluation can be useful for improving the safety and cost-effectiveness of highway programs.

Evaluating Effects of Design, Installation, and Maintenance Practices on Performance

The U.S. DOT and the state departments of transportation should begin exploratory data analysis toward development of a statistical modeling approach to measurement of the effects of device design, installation, maintenance, and site characteristics on the performance of guardrail end treatments and other roadside safety devices. This analysis should begin with the data collected in the crash test validation study. The exploratory analysis will provide a basis for deciding the appropriate scale and direction of future research on development and application of crash severity models.

Organization of the Nationally Coordinated Evaluation Research Program

The U.S. DOT and the states should consider at least two alternative organizational forms for planning and oversight of the nationally coordinated evaluation research program:

- Extension of the charge and term of the American Association of State Highway and Transportation Officials–Federal Highway Administration (AASHTO–FHWA) Task Force on Guardrail Terminal Crash Analysis
- An AASHTO-led effort conducted through NCHRP.

The entity overseeing the evaluation program should first develop a plan that defines the objectives, scope, funding needs, and schedule of the evaluations. The entity also will be responsible for obtaining cooperation of the federal, state, and local agencies that would be involved, and for monitoring the conduct of evaluations and applications of results.

COMMITTEE FOR THE STUDY OF IN-SERVICE PERFORMANCE OF W-BEAM GUARDRAIL END TREATMENTS, PHASE 1

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