



New England Transportation Consortium

NEW ENGLAND TRANSPORTATION CONSORTIUM RESEARCH PROBLEM STATEMENT FORMAT

Due to netc@ctcandassociates.com by January 22, 2021

I. PROBLEM TITLE

Network-Level Guardrail Inventory and Condition Evaluation

II. RESEARCH PROBLEM STATEMENT

The presence and condition of traffic barrier systems, and specifically guardrails, is critical for roadway safety. Public transportation agencies are responsible for a large inventory of guardrails and are responsible for making timely repair or replacement of damaged or missing components. The recent issuance of the Manual for Assessing Safety Hardware (MASH) by the American Association of State Highway and Transportation Officials (AASHTO) also presents a need for modernization of the inventory. For contracts on the National Highway System with a letting date after the (final sunset date: December 31, 2019) dates, only safety hardware evaluated using the 2016 edition of MASH criteria will be allowed for new permanent installations and full replacements with limited exceptions. State departments of transportation (DOTs) are actively working with FHWA on the implementation of MASH hardware. It is critical for state departments of transportation to develop a comprehensive guardrail inventory to better support in-service performance evaluations (ISPE) of guardrails to meet MASH, NCHRP 350 and other criteria. Developing a transportation agency data collection methodology for guardrails has become a pressing need for state DOTs to plan and manage MASH upgrades and integrate the guardrail asset class within the State transportation asset management plan.

Traditionally, manual field or windshield surveys are used for inventorying and updating guardrail information. However, such a practice often leads to time-consuming effort and may expose the field engineers to a dangerous working environment. With the advancement and wide availability of remote sensing technologies, such as video log images, mobile LiDAR, global position systems (GPS), etc., it becomes feasible for state transportation agencies to leverage these technologies and data for a more cost-effective and efficient method for inventorying and updating guardrail information.

III. RESEARCH OBJECTIVES

This proposed study is aimed at developing new automated methodologies for identification and extraction of in-service guardrail and then for evaluating the condition and compliance of the guardrails, using video log images and mobile LiDAR. The detailed anticipated objectives include:

- 1. To develop an automated methodology (including algorithms and procedures) for identifying the presence of guardrails along the roadway and for extracting the critical information, e.g., starting and ending points, terminal types, lateral offset, height, etc.*
- 2. To develop an automated methodology (including algorithms and procedures) for identifying typical conditional changes for guardrails, e.g., face dentation, terminal damage/missing, support deficiency, etc.*
- 3. To develop processing and integration processes that will seamlessly integrate the derived guardrail inventory and condition information with the existing databases, systems, or programs in state DOTs for evaluating the MASH compliance, and for supporting network-level maintenance strategy, through case studies with New England DOTs.*

IV. COST ESTIMATE

\$200,000

V. RESEARCH PERIOD

24 Months

VI. URGENCY AND PAYOFF POTENTIAL

If successful, automated methods leveraging remote sensing technologies will become a cost-effective and efficient means for inventorying guardrail information on a network-level. The form of the research implementation is methods (containing automated algorithms and procedures) that will provide comprehensive and accurate guardrail information more efficiently, comparing to the traditional manual field survey methods. The implementation of the automated methods from this research will provide state DOTs in New England a powerful and cost-effective tool to both address the pressing need for MASH compliance and to support the routine guardrail maintenance program.

If implemented, the anticipated productivity of the automated methodologies using images and mobile LiDAR will be significantly improved comparing with the conventional manual survey, with much higher precision and data comprehensiveness. While a return on investment (ROI) cannot be accurately calculated, it is anticipated that the acquisition and processing time of inventorying guardrail will be 5-10 times faster than the conventional method (walking speed + data key-in vs. driving speed + automated processing), which will create significant payoff considering the large roadway networks managed by state DOTs. The payoff potential can be even more attractive, especially because this research will lay a strong foundation for the state department of transportation's continuous transportation asset inventory and condition evaluation effort.

VII. IMPLEMENTATION POTENTIAL

- **The intended DOT audience(s) for using the research products.**
 - The intended DOT audiences will include asset management, roadway safety and GIS data.
- **Type of implementation anticipated as a result of the project.**
 - The anticipated outcome of this project will include automated methodologies for collecting the presence, condition and compliance information of the in-service guardrails and pilot network of roadways with detailed guardrail information.
 - The implementation of the methodologies will help state DOTs in New England a large network-level guardrail inventory to support efficient and cost-effective in-service safety hardware performance evaluation, including MASH compliance and transportation asset management.
- **Activities to facilitate implementation to help create awareness and facilitate the implementation of the research results.**
 - The activities to facilitate implementation will be carried out via training workshops and pilot test projects.
- **Anticipated barriers or constraints to implementation and ways to overcome them.**
 - One of the anticipated barriers to implementation would be the integration of the new automated methodologies with the existing asset management practice in different state departments of transportation in New England. Such a barrier can be mitigated through effective communication, training process, and technical supports.
 - The case studies can be included in this research to demonstrate how the outcome of this study may be integrated with the existing databases, systems and programs in state DOTs in New England.

- **Methods of tracking and measuring the impacts of implementation.**
 - *The impacts of implementation can be measured based on the successful deployment of the methods in the MASH compliance effort and/or the percentage of the inventory for the routine guardrail maintenance practice and asset management in different state DOTs in New England.*

TWO TRANSPORTATION AGENCY STAFF ENDORSEMENTS ARE REQUIRED

(To be signed by separate individuals.)

VIII. ENDORSEMENT BY THE SPONSORING TRANSPORTATION AGENCY REPRESENTATIVE TO THE NETC ADVISORY COMMITTEE

By signing the endorsement, the transportation agency representative is certifying that:

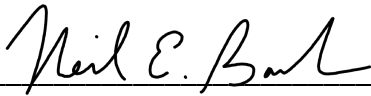
1. *The Research Problem Statement follows the required format.*
2. *The Research Problem Statement addresses a transportation issue of relevance to NETC and does not duplicate another Research Problem Statement being submitted at this time.*

Nicholas Zavalas	MassDOT - OTP Research
Name	Transportation Agency
<i>Nicholas Zavalas</i>	1/22/2021
Signature*	Date

ENDORSEMENT BY THE SPONSORING TRANSPORTATION AGENCY RESEARCH PROBLEM STATEMENT AUTHOR/SUBMITTER

By signing the endorsement, the transportation agency Research Problem Statement author/submitter is certifying that:

1. *I have technical knowledge of the project topic and will be committed to the research outcome.*
2. *I agree to serve as Chair of the project's Technical Committee if this Research Problem Statement is selected for funding by NETC.*

Neil E. Boudreau, Assistant Administrator	MassDOT / Highway Division
Name	Transportation Agency
	01/19/2021
Signature*	Date

*Electronic signatures are acceptable.

NOTE: To expedite the processing of Research Problem Statements, NETC requires submittal by e-mail from signing Advisory Committee member to (netc@ctcandassociates.com) by January 22, 2021.