



New England Transportation Consortium

NEW ENGLAND TRANSPORTATION CONSORTIUM RESEARCH PROBLEM STATEMENT FORMAT

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

I. PROBLEM TITLE

A suggested title in as few words as possible.

ATSPM Data Analytics for Improving Traffic Safety

II. RESEARCH PROBLEM STATEMENT

Clearly define the problem and provide sufficient evidence to support its importance to the New England region. The statement should discuss the gaps in current knowledge, literature, and studies that demonstrate the research need.

Several New England State DOTs have implemented or are planning to implement Automated Traffic Signal Performance Measure (ATSPM) systems. ATSPM systems allow DOTs to detect traffic signal related hardware and control plan issues in near real time and identify potential causes. This gives DOT staff the tools to efficiently dispatch staff and manage signal performance. It helps minimize the impacts of traffic signal control malfunction and improve traffic safety at signalized intersections.

ATSPM systems collect high-resolution (e.g., 0.1 second) detector and signal controller data (e.g., detector on/off, green light on) and organize it into performance measures. How to effectively utilize such data beyond standard Signal Performance Measure (SPM) is a very interesting question, which has not been adequately investigated. There are two main challenges: (1) how to automatically analyze such a huge amount of data and identify important patterns related to safety and efficiency? and (2) how to correlate those identified patterns with safety or other data sets and develop safe and efficient signal control strategies (e.g., adjust green/yellow/all-red interval during snowstorms)? Machine learning and artificial intelligence methods are well-suited for discovering patterns from unstructured data and optimal control strategies from the interactions between traffic controller and traffic. It would be interesting to explore their potential applications in this area using field ATSPM data. Statistical methods can also be used when appropriate.

III. RESEARCH OBJECTIVES

Define specific research objectives. These may be more specific than the broad need described in Section II. These should be project objectives (expected results) and not tasks or methodology.

This research focuses on safety and includes four main objectives: (1) review and summarize existing Signal Performance Measures (SPMs) and raw ATSPM data. The applicability and limitations of these SPMs and the raw ATSPM data for safety analysis should be discussed; (2) apply Machine Learning (ML), Artificial Intelligence (AI), and/or statistical methods to analyze the systemic signal safety, and identify potential traffic and signal control patterns that may reduce safety risk or require further investigation. Such patterns can then be further analyzed by traffic engineers to develop countermeasures; (3) develop models to quantify the safety impacts of various factors (e.g., SPMs, raw ATSPM data, identified patterns); and (4) based on the results of previous tasks, provide recommendations to improve traffic safety for

those identified patterns and one or more models that can be used for future analyses. Also, discuss the possibility of applying the results to intersections and arterials not equipped with ATSPM systems.

IV. COST ESTIMATE

An estimate of the funds necessary to accomplish the objectives described in Section III.

\$200,000

V. RESEARCH PERIOD

An estimate of the number of months necessary to complete the research. In addition, include preparation of a Draft and Final Report and its review by the NETC project Technical Committee (90 days).

24 months

VI. URGENCY AND PAYOFF POTENTIAL

A description of the urgency of the need for this research in relation to the transportation needs of the six New England States. A discussion of the potential benefits to be derived from the anticipated research results i.e., time/cost savings, enhanced practice/performance, improved safety, other.

ATSPM systems are attracting increasing attention from transportation agencies. Such systems are very useful for identifying hardware malfunctions and issues with traffic signal control plans. However, the high-resolution data generated by ATSPM may be used by other important purposes, such as identifying various types of safety risk and developing effective countermeasures. Having an experienced traffic engineer manually review all the ATSPM data can be useful, but infeasible given the huge amount of data generated by ATSPM.

More than 50% of the combined total of fatal and injury crashes occur at or near intersections. The proposed research will develop algorithms that can automatically detect problematic traffic and signal control patterns from ATSPM data, identify major impact factors, and recommend alternative traffic signal plans for traffic engineers to consider. The developed algorithms will help DOTs fully utilize the ATSPM data to improve intersection and arterial safety.

VII. IMPLEMENTATION POTENTIAL

To aid NETC in deciding whether to fund this project, describe:

- *The intended transportation agency audience(s) for using the research products: The results can be used by DOT staff focused on safety, traffic, Transportation Systems Management and Operations (TSMO), and ITS.*
- *Type of implementation anticipated as a result of the project (i.e. confirm existing, adopt new or eliminate current standards, specifications, processes, policies, regulations or drawings, GIS application): The results can be implemented as a computer program to assist traffic engineers with monitoring traffic, identifying risk factors, and retiming traffic signal control plans to improve safety.*
- *Activities to facilitate implementation (e.g. brochures, posters, exhibits at conferences, tech sheet summaries, webinars, presentations, training workshops, peer exchanges, pilot or demonstration project at host agency) to help create awareness and facilitate implementation of the research results: Presentations at TRB, NEITS, New England ITE, etc.; a demonstration of the case study results at host agency or as a webinar.*
- *Anticipated barriers or constraints to implementation and ways to overcome them: Close collaboration with the host agency and a letter of support might be required for each proposal. Different ATSPM systems and data systems.*

- *Methods of tracking and measuring the impacts of implementation: Number of presentations given at regional and national conferences, number of viewers of the YouTube video, and number of agencies interested in adopting the algorithms developed.*

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.*

Dale Peabody MaineDOT
Name Transportation Agency

Dale Peabody 01/21/2021
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.*

Colby Fortier-Brown Maine DOT
Name Transportation Agency

Colby Fortier-Brown 1/21/2021
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.