Develop and Evaluate Performance Measures for Intelligent Transportation Systems (ITS) in Louisiana

INTRODUCTION
This study developed performance measures for DOTD’s current ITS programs, which were used to evaluate the ITS applications. The significance of this study is that it uses data and scientific methods to identify areas with the greatest need for improvement and to create performance-driven, outcome-based indicators for decision-making regarding the need for expansion or improvements of the ITS programs in Louisiana.

OBJECTIVE
The primary objective of this research was to develop a set of performance measures for each existing ITS program in Louisiana and evaluate benefits achieved through their implementation across transportation planning, traffic operation, safety, environmental quality, sustainability, and other areas that can be evaluated.

SCOPE
Insights were gathered through literature reviews, qualitative surveys, and inputs from stakeholders, which were used to develop performance measures for each of Louisiana’s ITS applications. Available data were collected mainly for periods between 2016 and 2020 and used to evaluate the performance of sampled ITS applications.

METHODOLOGY
A literature review investigated how performance targets of ITS have been tracked, measured, and reported by DOTs. A survey and protocol were designed to obtain information on how existing performance measurements have been assimilated into ITS programs of respective agencies. An initial list of performance measures for each DOTD ITS program was developed from information gathered from the literature review and qualitative survey. Following stakeholder consultation, a final list of agreed performance measures for each DOTD ITS program was developed. An analysis of data availability for the agreed performance measures was conducted to identify where Louisiana lacked data for evaluating ITS performance. Where data existed, the analysis evaluated whether existing applications have been beneficial and reported aspects that need improvement. Due to data availability challenges and the limited time available to evaluate the performance of the programs using all performance measures, the performance measures shown in Table 1 were used to evaluate the selected programs to assess the research objective.

CONCLUSIONS
The following summarized conclusions were made under each key area of the research:

Literature Review
Responsible organizations like the FHWA and USDOT through ARC-IT have provided sufficient guidance and information to develop or incorporate performance measurement strategies into respective ITS programs.

Qualitative Survey
- ITS performance measurement has been fairly integrated into ITS programs by agencies with most organizations monitoring their ITS programs, considering it beneficial to operations and taxpayers.
- Reasons state DOTs generally do not benchmark or compare ITS performance with other agencies include lack of available data, lack of guidance or best practices on the subject, and incomparable data gathered across jurisdictions. Additionally, reasons that prevent agencies from measuring performance to greater detail and quality include lack of available data, complexity in the endeavor, fragmented and incomparable data, lack of data scientists, and difficulty assigning responsibilities when inter-agency collaboration is required.

Evaluation of ITS Performance
For each ITS program area, specific DOTD objectives were identified, and performance measures were developed to assess how the state had achieved its transportation goals. The conclusions that follow under each DOTD ITS program area were made using data mainly from 2016 and 2020 to evaluate the ITS program using the performance measures shown in Table 1.
This document, and the information contained herein, is prepared for the purpose of identifying, evaluating, and planning safety improvements on public roads, which may be implemented utilizing federal aid highway funds. This information shall not be subject to discovery or admitted into evidence in a Federal or State court pursuant to 23 U.S.C. § 407.

### Emergency Management and Motorist Assist Patrol (MAP)
Notwithstanding the need to increase the sample sizes used in the evaluations in Alexandria, Baton Rouge, New Orleans, and Shreveport, the RCTs observed on roadways with MAP are lower than the RCTs on roadways without MAP. Even though in Lafayette, Lake Charles, and Northshore, where the RCTs on roadways with MAP are not significantly lower than RCTs on roadways without MAP, road users still benefit in terms of lower mean RCTs and upper bound of the confidence interval of the RCTs observed. In general, it can be concluded that road users in Louisiana benefit from reduced RCTs on roadways that have MAP.

### Commercial Vehicle Operations
- Louisiana’s interstate highway remained reliable over the studied period, with TTRT Index scores of less than 1.50, but there exist Traffic Message Channel (TMC) segments in Louisiana that experienced maximum TTRT scores of greater than 1.50, which are together 15.47% of the interstate highway system.
- The 15.47% of the interstate highway (with a maximum TTRT > 1.50) contributed, on average, 72.34% of the statewide annual user delay cost between 2016 and 2019. The proportion dropped to 62.49% in 2020, which is still extremely high, considering the full length of the interstate highway.
- The annual crash frequencies on the interstate highway system remained relatively constant between 2016 and 2019 but declined in 2020. Even though the annual frequency of crashes remained relatively constant, the ratio of commercial vehicles saw an increasing trend between 2016 and 2020.

### Freeway Management
- The inventory of installed ITS equipment in Louisiana needs to be periodic and updated in required documents and portals for easy reference.
- The results from the safety assessment of active ramp meters in Louisiana using sampled sites in Baton Rouge were insufficient to claim the safety benefits of ramp meters to road users across Louisiana.

### Electronic Payment and Congestion Pricing
- The results from the study did not support the hypothesis that tolling operation on the southbound lane of Causeway Boulevard across Lake Ponchartrain would improve travel time reliability in terms of the performance measures used. The finding, however, supports the notion that the tolls were for commercial purposes and not for operational improvements.
- There were variabilities in the assessed performance during the night, especially in speeds, which may be from unclear road delineations, lack of lighting, or the absence of shoulders on the stretch of Causeway Boulevard.

### Traveler Information
- The spikes in monthly 511 statistics seem to correlate with the months of major weather events in Louisiana, which suggests the benefits of Louisiana’s traveler information program in the form of increased 511 services during bad weather events to users in and around Louisiana.

### RECOMMENDATIONS
The study recommended the following for future research:
- It is recommended that a study in the future can identify or predict the factors that influence RCTs on the Louisiana interstate highway system.
- A comprehensive study to reevaluate the operation of ramp meters may reveal additional information on its effectiveness.
- Future studies can assess the coverage of installed ITS devices separately.
- There exists variability in the performance during the night on Causeway Boulevard, especially in speeds, which poses a safety concern that needs investigation.
- Regarding traveler information, the performance measures can be evaluated within a short time, preferably quarterly.

### Table 1. ITS program areas, performance measures, and scope of evaluations

<table>
<thead>
<tr>
<th>Program Area</th>
<th>Objective</th>
<th>Performance Measures</th>
<th>Date</th>
<th>Data Source</th>
<th>Error of Study (186-2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Operations</td>
<td>Increase the percent of traffic received on the shoulder lane</td>
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