Title:	Leveraging Artificial Intelligence (AI) Techniques to Detect, Forecast, and Manage Freeway Congestion
The Problem:	Recurrent and non-recurrent traffic congestion on freeways cause inordinate delays in most metropolitan areas in Texas, a trend that is likely to continue due to population growth in Texas urban areas. The ability to forecast when and where recurrent congestion will start and how it will propagate, and to detect atypical events and predict their evolution is critical to improving the efficiency and reliability of the Texas surface transportation system. Artificial intelligence (AI) techniques provide an unparalleled opportunity to leverage data form agency-owned sensors and third-party providers to develop methods to support enhanced congestion management. Research is necessary for two phases of this project; 1. validating that commercial data sources are valid for planning and operations, and 2. understanding what types of models are better suited to address TxDOT needs, given data availability and desirable use cases. It is also critical to study the data models and workflows required to ensure that the proposed artificial intelligence techniques can be trained, tested, and validated sustainably.
Technical Objectives:	This research will provide a catalog of available AI models to support congestion detection, forecasting (short, medium and long term) and management, and corresponding data needs. The work to be performed shall include: 1. Review a list of commercial platforms that advertise AI-based congestion management capabilities and assess of a subset of these based on the availability of relevant information/trial versions, use by other Texas government agencies, and TxDOT's interest. 2. Develop a prototype application based on district operations to demonstrate the characteristics of a sustainable data workflow and analytic architecture. 3. Validate the commercial traffic big data; i.e., vehicle trajectories, multi-modal Google Travel time, open weather and air quality, and compare with existing TxDOT data. 4. Explore novel applications of these commercial traffic big data sets in planning and operations as well as identify their additional values to TxDOT. 5. Refine use cases based on TxDOTs input and involve the use of historical data to train models that may then be used in combination with near real-time traffic information to predict the onset and evolution of congestion on selected road sections. The models should include a wide range of features that impact traffic congestion, including land use patterns. 6. Develop guidelines, including requirements to be used in a procurement document, to support the deployment of similar methods across Texas and describe how the model outcomes may be used when planning congestion management and mitigation strategies. 7. Develop recommendations that can be integrated into existing TxDOT standards without requiring the use of a standalone platform for operations for basic functionality. The expectation of the project end product(s) shall attain a Technology Readiness Level of 6.
Anticipated Deliverables:	1. Technical memorandum for each task completed. 2. Monthly progress reports. 3. Value of Research (VoR) that includes both qualitative and economic benefits, to be included in the final research report; not a stand-alone deliverable. 4. Product: Catalog of AI methods that may be used to support traffic congestion management for different use cases and corresponding data needs. 5. Research report documenting the findings of the research, including guidelines on how to use the information provided to support planning and operations decisions, a validation of available commercial data types already used by TxDOT, and a summary of the required data workflows and architecture to support the proposed application. 6. Project Summary Report

Proposal Requirements:	1. Utilize the “Proj/Agre” and “PA_Form” templates located at the TxDOT RTI website. 2. Proposals will be considered non-responsive and will not be accepted for technical evaluation if they are not received by the deadline or do not meet the requirements stated in RTI's University Handbook, which is also located at the RTI website. 3. Proposals should be submitted in PDF format, 1 PDF file per proposal. File name should include project name and university abbreviation. 4. This project will be tracked during the life of the project using a Technology Readiness Level (TRL) scale. For more information about the use of a TRL, click.