

Request for Research Funding for FY 2022-2023

SPR Subpart B Project: TEO-23-19

Requesting Office	District 5 Traffic Operations	Priority	19 of 23
Proposed Title	A Deep Learning-based Network-wide Traffic Prediction Model for Integrated Corridor Management Systems		
Justification	<p>Currently, in an Integrated Corridor Management (ICM) system, a costly simulation-based approach (relying on mesoscopic dynamic traffic assignment [DTA] simulation model) is used to generate network-wide traffic prediction and evaluate traffic management plans. The approach does not fully use the real-time data as it merely matches such data to a set of pre-determined traffic patterns. Once a traffic pattern is matched, it draws a demand profile associated with the pattern and run a DTA model using that demand matrix. Removing the DTA simulation from the ICM modeling workflow will allow to directly use the real-time data to generate network-wide traffic prediction. It would also save a significant amount of cost required for running a DTA simulation model. Additionally, running a simulation model delays response plan activation after an incident occurs, where a machine learning model could provide more immediate results.</p> <p>For this purpose, in this proposed project, a deep learning-based network (i.e., a data-driven dynamic traffic assignment model) will be developed using large-scale historical traffic information as training data. In this approach, traffic network dynamics will be learnt based on historical data and network-wide traffic predictions will be made using real-time data and O-D demand from the regional demand model (CFRPM) as inputs. Furthermore, a transfer learning approach will be developed to predict the impact of a crash on the network and the improvement due to planned responses. This research will test the approach by creating a traffic network considering I-4 as the major corridor and surrounding freeways and arterials (subject to data availability). It will incorporate historical traffic data from District 5 databases and O-D demand from CFRPM model.</p>		
Impact	<p>The results of the research will be used to create an alternative approach for integrated corridor management saving the cost of running simulation-based DTA models for traffic prediction. The approach will be more robust (against demand changes due to the full use of real-time data), precise (allows reliable comparisons of response plans), and cost-effective (does not need to run any proprietary simulation software) compared to the current practice. A better approach for integrated corridor management will reduce delays, fuel consumption, and emissions.</p> <p>The implication of not doing this research is to continue to spend an excessive amount of funds to request the service for simulation runs.</p>		
Affected Offices	State Traffic Engineering and Operation, District Traffic Operations, Forecasting and Trends Office		
Existing Work	Based on the search results in TRID and TRIP, it is found that no research project has focused on developing an alternative data-driven network wide traffic prediction model that can be used in an Integrated Corridor Management system.		
Keywords Used In Existing Work Search	Data-driven integrated corridor management; data-driven traffic prediction		
Related Contracts	None.		
Funding Request	\$350,000	Anticipated Duration	24 months
Project Manager	Jeremy Dilmore, PE Raj Ponnaluri (Co-PM) Thomas Hill (Co-PM)	Contracting Method	University of Central Florida (Dr. Hasan)
Equipment	N/A		
Urgency	3	There is an existing functional solution. This research would use the latest in technology to reduce costs and improve the timeliness of updates, but if it is not executed the existing solution is suitable.	

Implementability	2	The research team will provide a stand-alone cloud-based tool with an easy-to-use map-based visualization display. It can be integrated/deployed within the existing cloud-based services of the agency. Coordination has occurred to insure APIs are understood, but there is always a risk of API modification.
<p>Project Benefits (Succinct, complete explanation)</p> <p>A successful implementation of the project will enable District 5</p> <ol style="list-style-type: none"> 1. Enhance its Integrated Corridor Management System for I-4 corridor 2. Reduce delays due to recurrent congestion or non-recurrent congestion 3. Reduce the cost of Integrated Corridor Management system services by removing the simulation from the loop. 		
Project Benefits (Select all that apply and explain)	Quantifiable Benefits (units, dollars, etc...if applicable)	Methodology or Data Sources Used to Determine Quantifiable Benefits. If not applicable, please give justification of project benefits
○ Materials Enhancement	N/A	
○ Materials Savings	N/A	
○ Time Savings	\$150K annually	The research will develop a new tool that will provide traffic prediction when needed. The benefits can be quantified by the accuracy of predicted traffic flows and travel time, and cost savings to replace the API requests from the agency for similar services.
○ Lives Saved/Injuries Prevented	N/A	
○ Other (Explain)		The cost benefits are based on expected costs for mesoscopic model maintenance in one District. This would potentially extend to other Districts and offset any operational mesoscopic modeling they would engage in. Note this is not a point to offset demand modeling work which is substantially more costly.

*Comments should explain and support urgency, financial benefit, and implementability scores