MPC-403
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Project Title:

Web-based Decision Support Tool for Traffic Management and Work Zone Analysis

University:

University of Utah

Principal Investigators:

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Research Needs:

Traffic congestion mitigation is one of the key challenges transportation planners and operations engineers face when planning for construction and maintenance activities. Several tools are available for analyzing work zone impacts, including CA4PRS, QuickZone, and VISUM. However, these analysis tools may not fully capture the dynamic nature of drivers' responses to traffic management techniques and significant changes in the transportation network. In this case, performing analyses with a Dynamic Traffic Assignment (DTA) engine, or a similar traffic estimation method, may meet this need while providing additional analysis details (e.g. network, path, OD, and link analyses) for local engineers to justify their decisions/actions.

At the same time, technical expertise, data management, and software licensing often become significant barriers to entry for incorporating this type of analysis into every-day operations. To address these issues, this research will develop a simple, open source Google Maps/Google Earth interface for scenario-based traffic simulation analysis, primarily focused toward traffic management and work zone analysis. Engineers may use the simplified interface to prepare different scenarios without interacting with the calibrated model input data, which will be prepared in this project by the local MPO. Input data will be hosted remotely, and the simulation engine is offered as a web-application/service to simplify data preparation and improve computational efficiency.

This work is an important step toward implementing online DTA for Advanced Travel Demand Management in daily practice. First, providing the traffic estimation tool as a backend computational engine can significantly shorten analysis time. Offering a simple user interface in a familiar software package like Google Maps or Google Earth makes it easier to perform this type of analysis, and their built-in visualization tools may be extremely useful for interpreting analysis results and preparing presentations/reports for decision-makers and stakeholders. Additionally, storing the planning and traffic sensor data sets at a remote host reduces the time and effort spent preparing input data and requires less training for engineers using the software.

Research Objectives:

The major research objectives include

- Identify features and tools needed for traffic management/work zone analysis and visualization;
- Enhance existing traffic estimation tool for web-based application/service with Google Maps/Google Earth interface;
- Calibrate/validate planning and traffic sensor data sets for analyzing work zone impacts and traffic management strategies for UDOT operations.

The major tasks to accomplish the above research objectives are listed in the following.

1. Review current/existing analysis tools implemented within UDOT, and meet with UDOT personnel to identify targeted features for development
2. Develop a Google Maps/Google Earth user interface with traffic simulation backend computational engine and integration with centralized data storage systems
3. Draft user's guide for software tool
4. Collect and prepare calibrated regional planning and traffic sensor data sets
5. Setup remote server for data storage/management
6. Conduct case study for calibrating/validating software application in southern Salt Lake Valley
7. Prepare training material and offer hands-on training for UDOT personnel

Research Methods:

This research will adopt an open-source dynamic traffic assignment package, DTALite, to effectively provide advanced dynamic traffic analysis output. DTALite has been developed at the University of Utah, and it uses a computationally simple but theoretically rigorous traffic queuing model in its lightweight mesoscopic simulation engine. DTALite requires a minimal set of static traffic assignment data in addition to time-dependent demand estimates. Its built-in parallel computing capability dramatically speeds-up the analysis process by using widely available multi-core CPU hardware.

Expected Outcomes:

The expected research project include (1) Web-based application/service for traffic management and work zone analysis, and (2) User's guide and related training materials.

The software produced as a result of this research may be directly incorporated into every-day use by engineers in the UDOT Operations Group, Division of Planning, and other relevant UDOT divisions for analyzing traffic management strategies and work zone impacts. Specific potential applications may include modeling work zone detours and evaluating incident impacts

on congestion. As a free, open source analysis tool using Google Maps and/or Google Earth, this software application will use standard Google Earth/KML files, meaning that this tool may be used by both UDOT personnel and consultants working on UDOT projects.

Relevance to Strategic Goals:

This research will provide transportation planners and engineers with a rigorous and computationally efficient tool to assess corridor and network-wide effects of work zone strategies. Traffic mobility and sustainability -oriented performance measures will be systematically provided for individual work zone scenarios, so the research results can be directly applied in planning and operational decision-making processes.

Educational Benefits:

The prepared open-source software and related guidebook will effectively teach students how to systematically assess impacts of work zone scenarios on metropolitan areas. This research will provide involved graduate students an opportunity to understand the complex decision-making process in state DOT and metropolitan planning agencies, and the guidebook will be used to teach undergraduate students in the transportation planning class several important practical skills in transportation modeling.

Work Plan:

Performance period: 07/01-2012 to 12/31/2013 (18 months)
1st quarter:
Literature review and kickoff meeting, prepare software system design
2nd quarter:
Deliver the first prototype, provide an early software release for testing (with a possible case study in I-15 core project)
3rd and 4th quarters
Finalize Google Maps/Google Earth user interface, provide draft user's guide for software tool
Host traffic simulation backend computational engine at University of Utah and WFRC
5th quarter:
Collect and prepare calibrated regional planning and traffic sensor data sets
Conduct case study for calibrating/validating software application in southern Salt Lake Valley
Setup remote server at Utah Traffic Lab for data storage/management
6th quarter:
Prepare training material and offer hands-on training for UDOT personnel

Project Cost:
Total Project Costs: $100,000K
MPC Funds Requested: $50K
Matching Funds: $50K
Source of Matching Funds: Utah Department of Transportation

TRB Keywords:

transportation systems, network analysis, road construction traffic measurement