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Caltrans Division of Research, Innovation and System Information

Research Results

Planning, Policy and Programming

SEPTEMBER 2021

Project Title:
Development of Operations Analysis Tools

Task Number: 3294

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Completion Date: February 28, 2021

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Development of Operations Planning Toolbox (OPT) Software

Discover applicable solutions to the problem of autonomous lane changing in a highway scenario with connected vehicles.

WHAT WAS THE NEED?

This project supports the development of the Operations Planning Toolbox (OPT), a user-friendly, well-documented, open-source, multi-modal transportation modeling software for quick quantitative assessment of operational scenarios in terms of mobility and safety, provided as a desktop application, supported by the University of California, Berkeley (UCB) Partners for Advanced Transportation Technology (PATH) program.

WHAT WAS OUR GOAL?

This is a study to improve operational analysis tools. The goal was to produce a practical tool with a simple interface that can accept multiple data sources.

WHAT DID WE DO?

The project ended in February 2021 and the researchers delivered a documented mesoscopic simulator with the features and benefit of FREQ. It is called OPT and has the following features:

- Configuration module with intuitive user interface that allows building the road network; setting up input demand and outgoing traffic flows; modeling different types of traffic (e.g., Single Occupancy Vehicles (SOVs), High Occupancy Vehicles (HOVs), trucks) defining policies for managed lanes, including HOV and High Occupancy Toll (HOT); setting ramp metering.

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Connected Autonomous Vehicles:
Safety During Merging and Lane
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- Simulation module that handles multimodal traffic implements lane changing behavior; and accepts outgoing flows in two formats – as off-ramp flows and as split ratios that determine portions of traffic to be directed to off-ramps.
- Reporting of simulation results in the form of pie charts for summaries; timeseries charts; and contour plots for spatio-temporal data. Simulation results can be exported to Excel.
- User can set their preferences about simulation setup, duration, and reporting granularity.

Currently we are developing:

- Emissions' calculation based on EMMFAC tables.
- Traffic events – allowing the user to assess the impact of accidents and temporary traffic control failures.

The OPT is free of charge to the users. The tool was designed within the Transportation Open Environment for Data and Simulation (TOEDS) paradigm that enables easy sharing and exchange of input and simulation data between transportation practitioners. TOEDS ensures that OPT is fully extensible and scalable.

WHAT WAS THE OUTCOME?

OPT Deliverables include:

1. An openly available user guide
2. Instructional videos on how to use this tool
3. A hands-on demonstration of OPT 1.0 at an open webinar
4. OPT 1.0 is a clean, accessible, and self-explanatory user interface
5. OPT 1.0 provides an easy and efficient way of building and modifying road networks
6. OPT 1.0 provides a calibration capability for easy and efficient tuning of simulation parameters (e.g. freeway capacities) according to established criteria.

7. OPT 1.0 is based on TOEDS – an open and extensible environment for processing heterogeneous traffic data and building hybrid transportation simulation models. TOEDS include procedures for dealing with gaps and inaccuracies in data sources.
8. The user group included Traffic Operations engineers and Transportation Planners from the California Department of Transportation (Caltrans), engineers and/or planners from Caltrans' partner agencies, transportation researchers from UCB and practitioners from the consultant – System Metrics Group.

WHAT IS THE BENEFIT?

OPT 1.0 is a revolutionary new product, developed with input from the transportation community, leveraging UCB's previous work effort with Caltrans and taking emerging transportation technologies into account. The OPT is a project to develop a user-friendly, well-documented, open-source, multi-modal transportation modeling software for quick quantitative assessment of operational scenarios in terms of mobility and safety, provided as a desktop application, supported by UCB PATH. This new software, a mesoscopic simulator, will support the fast execution of the analysis of freeway and corridor operations as well as highways and multi-lane road analysis.

OPT is a corridor simulation program designed to quickly assess the effectiveness of traffic management techniques such as ramp metering and managed lanes. OPT incorporates all of the functionality of its predecessor -FREQ – and also adds new functionality, such as HOV lane policies. OPT incorporates all of the functionality of its predecessor program – FREQ – and also adds new functionality, such as HOT lanes policies.

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LEARN MORE

Traffic Operations Analysis Report: Planning for Operations Assessment in City of San Luis Obispo and Pismo, San Luis Obispo County and Appendices by Sam Toh, 2019. This is an excellent example of FREQ application in California Department of Transportation, District 5.

Resources:
- OPT website: https://opt.ucbtrans.org
- Release to be downloaded: https://opt.ucbtrans.org/downloads
- Tutorials: https://opt.ucbtrans.org/documentation/tutorials
- HOWTO videos: https://opt.ucbtrans.org/documentation/users-manual
- Webinars: https://opt.ucbtrans.org/materials/webinars
- Source code: https://github.com/ucbtrans/opt