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CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION
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Research Notes

SIDRA Calibration for Roundabouts in California

Development of procedures for calibration of the Signalized Intersection Design and Research Aid (SIDRA) software model used by the California Department of Transportation (Caltrans) for the design and analysis of roundabouts.

Design/ Construction

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Project Title: SIDRA Calibration for Roundabouts in California

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WHAT IS THE NEED?

Caltrans uses the SIDRA software to analyze roundabout operations. SIDRA is a micro analytical tool that can evaluate capacity, expected density and speed of traffic at intersections and roundabouts. To ensure trustworthy results of the roundabout analysis, one has to calibrate the corresponding SIDRA roundabout model by comparing the model output with the observed data. Model calibration is an iterative process with the goal to minimize the distance between model output and observations. First, the model is run with default values in calibration parameters. The results are compared with the observations. Then, parameters are tuned, and the model is re-run until its output matches the observations. Generally, calibration is a tedious and time-consuming process. Automatic calibration of SIDRA roundabout models would: 1) save time on the part of the modeler; 2) make roundabout studies across California consistent and their results comparable.

WHAT ARE WE DOING?

The research team will develop an automatic calibration for SIDRA roundabout model that will be used to study roundabouts in California. The purpose of this project is to study calibration of roundabout models in the software SIDRA Intersection for single lane, hybrid, and multilane environmental factors. The aim is to evaluate and compare different calibration methods, including creating an automatic calibration procedure based on optimization. For further use of the SIDRA Intersection model general settings would be useful, there for the second part of the purpose has been to test the possibility of general settings with a few models of roundabouts with different characteristics.

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Three methods for calibration of the model will be tested in this project, one automatic based on optimization and two manual ones. Studies of the software, the model, and the theory will be basis for which parameters that are chosen for calibration. The first step is to find a suitable optimization algorithm to use for the automatic calibration. The choice of method depends on how easy the method is to use, in terms of number of control variables, and accuracy and robustness of results. The calibration parameters will become decision variables in the optimization problem.

WHAT IS OUR GOAL?

The project will develop an automated calibration procedure. The procedures will be implemented in a Microsoft Excel spreadsheet that can be directly used by Caltrans engineers and external partners for SIDRA roundabout model calibration.

WHAT IS THE BENEFIT?

- The project will develop a tool that saves considerable amount of time for modelers who analyze roundabouts in SIDRA.
- The universal calibration approach, especially coming with an easy-to-use Microsoft Excel implementation, enables consistent roundabout analysis across all Caltrans districts.
- The project will establish an approach to develop similar analytic tools for intersections, merge and weaving areas.

WHAT IS THE PROGRESS TO DATE?

The whitepaper "Calibration Protocol for Roundabout Analysis in SIDRA Intersection Version 10" describing the assumptions, calibration criteria and steps is submitted.

The whitepaper presents a comprehensive and structured protocol for the manual calibration of roundabout analyses performed using SIDRA Intersection Version 10, with specific emphasis on U.S. practice and HCM-based capacity models.

Next Quarter action items: We will apply the SIDRA & HCM6 models to several test sites in the roundabout site list with entry capacity under saturated conditions, delay, queue length, and stop rate measures selected to cover a range of geometric and traffic conditions. In parallel, we will be implementing the automatic calibration tool.