

Research at a Glance

Technical Brief

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Calibration/Development of Safety Performance Functions for New Jersey

Background

Safety Performance Functions (SPFs) in the Highway Safety Manual (HSM) were developed using historic crash data collected in different states. To make the SPFs better accommodate the local data, two strategies are usually undertaken: the first strategy is to calibrate SPFs provided in HSM so that the contents of HSM can be fully leveraged and the second strategy is to develop location-specific SPFs regardless of the predictive modeling framework in the HSM.

Research Objectives

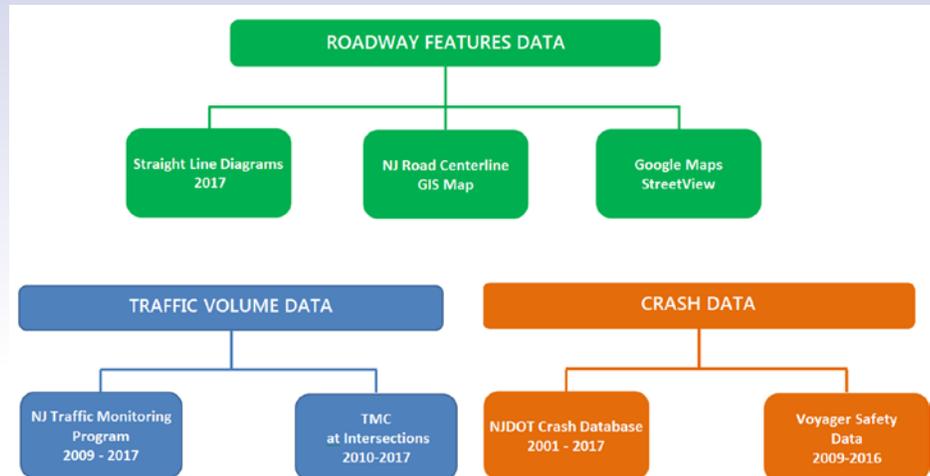
The main objective of this research project is to (1) calibrate the SPFs provided in the HSM using New Jersey (NJ) data and (2) develop new NJ-specific SPFs as appropriate. The facility types considered for this research project include segments and intersections of rural two-lane two-way, rural multilane, and urban and suburban roads. The following tasks were completed to achieve the main project objective:

- Conducted an in-depth review of the relevant studies in the literature
- Identified the key sources of data required for calibration and development of SPFs. These include roadway characteristics data, traffic volume data, and crash data.
- Developed a computer code to read and process the compiled database to (a) filter out inconsistent data entries, (b) identify facility types, (c) execute roadway segmentation process, (d) assign crash statistics for each facility, and (e) generate a complete database for each facility type to be used in calibration and/or development of SPFs.
- Provided recommendations to improve data collection and recording practices that would facilitate easier data extraction required for the SPF calibration/development process.

Methodology

Calibration and development of SPFs are highly data driven tasks and that the quality of data is of utmost importance to ensure the validity of results. The research team was able to identify the available data sources. As mentioned in the Available Data Sources section, existing data are grouped into three categories by type: (1) traffic volume, (2) roadway features, and (3) roadway crashes.

Traffic volume data include the sensor database maintained by the New Jersey Traffic Monitoring Program at NJDOT, and hourly turning movement counts collected at various intersections. Roadway features data were extracted from three data sources: the Straight Line Diagrams (SLD) database, Geographic Information Systems (GIS) maps, and Google Street View.



Research Project Manager

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NJDOT's SLD database is the richest source of information for roadway features. This database was provided by NJDOT in MS Access[®] format. It includes various tables on different geometric and operational aspects of NJ roadways. The crash data include both the raw crash database from 2001 to 2017 and the Voyager Safety crash database provided by NJDOT for 2011 to 2015.

The research team conducted an extensive cleaning process for these three available datasets. The project report discusses various observed inconsistencies and inaccurate information in the available data sources. The most time-consuming tasks in this process were preparing the final intersection database and crash databases. Among the required dataset by the HSM, the horizontal curvature data for two-lane two-way rural roadways stood out as the most problematic. The research team developed a clustering method for automatically estimating horizontal curvature data and CMFs using GIS roadway shapefiles.

Results

Using the gathered and processed New Jersey specific data the research team estimated calibration factors for 13 facility types, including rural two-lane two-way segments and intersections, rural multilane highway segments, urban and suburban segments and intersections. The Calibrator tool developed by the FHWA was utilized to calculate the calibration factors and measure their goodness of fit.

Using the same data used for calibration, the research team developed NJ-specific SPFs for 11 facility types, including rural two-lane two-way segments and intersections, urban segments and intersections with a sufficient number of data points using the Voyager Safety crash data from 2011 to 2015. SPFs were estimated based on the negative binomial model suggested by the HSM. The team used the R statistical package to estimate the model parameters and their statistical significance. The research team also modified the spreadsheets developed by the HSM, which are being currently used by the NJDOT staff. The calculated calibration factors and the developed SPFs are embedded in these spreadsheets. The users can now select whether to use the HSM SPFs with the calculated calibration factors or to use the New Jersey specific SPF in their analyses.

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