Rural Speed Safety Pilot Project

The U.S. Department of Transportation's (DOT) vision for the Safety Data Initiative (SDI) is to integrate newer big data sources with traditional datasets to enhance the general understanding of crash risk and potential to anticipate and mitigate future crash occurrences. As part of the SDI, Texas A&M Transportation Institute (TTI) led the pilot project on "Rural Speed Safety". This study examined the prevailing operating speeds on a large scale to develop models for rural roadways by incorporating operating speed and weather data. The research product "Interactive Decision Support Tool" (beta version) provides opportunity in generating risk scoring for rural roadways.

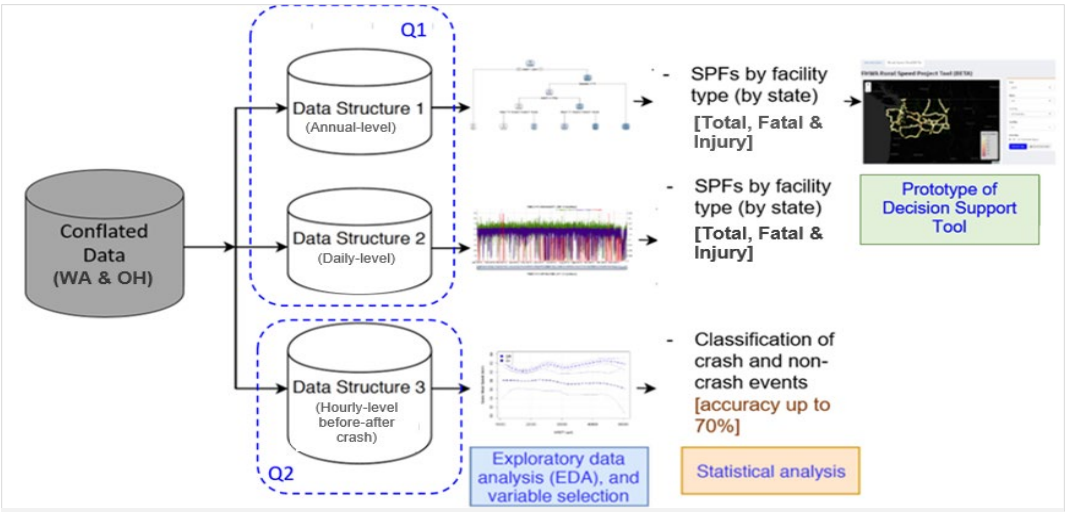
Key Highlights

- Variability in daily average traffic speeds was associated with increased traffic crashes.
- Differences in traffic speeds between weekdays and weekends was correlated with increased traffic crashes
- The beta decision support tool was developed to interactively visualize segment-level risk that includes speed variables.
- The current study is a starting point for more in-depth investigation and continued progress in incorporating speed-related factors into crash predictive models.

Project Summary

Current crash prediction methods, such as those in the first edition of the Highway Safety Manual (HSM) use traffic volume data along with geometric characteristics to predict the annual average crash frequency of roadway segments and intersections. One limitation of the HSM is the omission of speed-related factors from all aspects of safety predictive methods. Recent research has made little substantive progress in incorporating speed-related factors into crash predictive models. To advance the state of practice, this study begins the work of investigating the association between crash risk and traffic speeds using traffic speed information from rural roadways of two states: Washington (WA) and Ohio (OH).

This study developed databases for two states by incorporating several data sources. The databases used in this study include 2015 crash data from the Highway Safety Information System (HSIS), travel speed data from the National Performance Management Research Data Set (NPMRDS), and roadway information from the Highway Performance Monitoring System (HPMS). The models combine traffic speed data with roadway geometrics, traffic

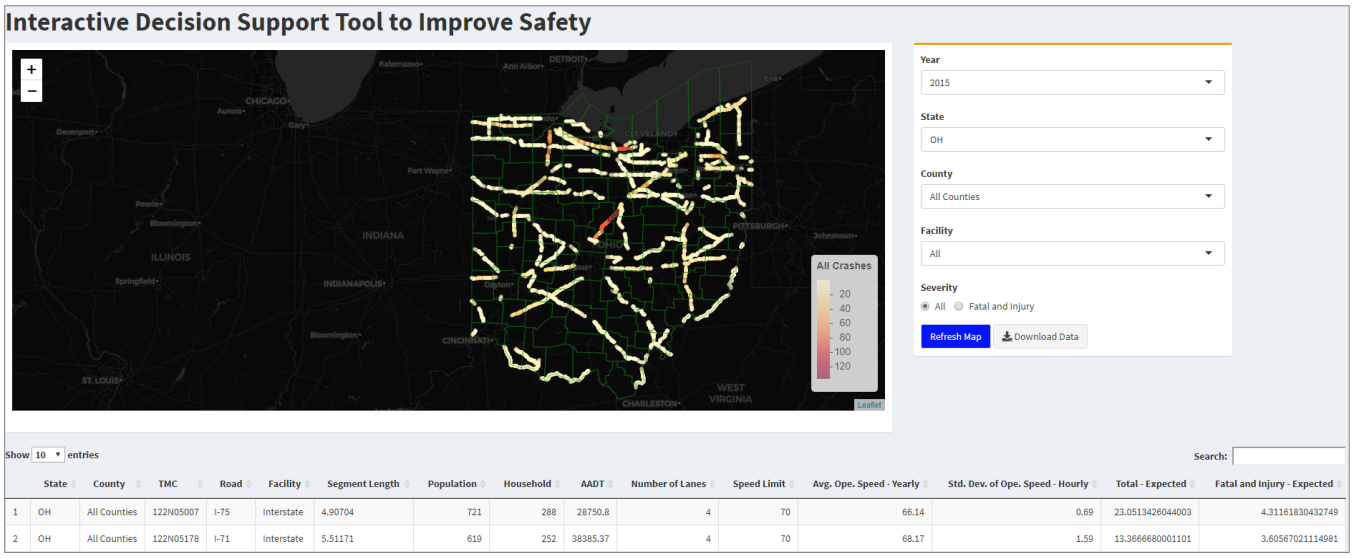


Flowchart showing the methodology developed in this study to examine two major research questions: Q1) do different speed measures contribute to crash outcomes? Q2) is there more variability in speeds just prior to a crash?

operations, and weather data to generate annual and daily crash predictions on roadway segments for different rural roadway facility types (i.e., rural two-lane roadways). One of the products of this project is a decision support tool that shows heatmaps of rural roadways based on the model outcomes.

Findings

Certain speed measures were found to be beneficial in quantifying safety risk. **Annual-level crash prediction models** show that increased variability in hourly operating speed within a day and an increase in monthly operating speeds within a year are both associated with a higher number of crashes. This model also shows that when operating speed difference between weekends and weekdays is greater, all rural facility roadways (rural two-lane, rural multilane, and rural interstate) experience a higher number of crashes. **Daily-level crash prediction models** show that a segment with high variation in daily average speeds is expected to experience a higher number of crashes than a segment with a lower variation in daily speeds. The strength of this finding is one of the biggest insights gained from this study. **An exploratory examination of time before and after crashes** shows that speed variation increases significantly before a crash event compared to a non-crash traffic flow condition. Overall, this study shows benefit in incorporating speed data in safety modeling to more effectively identify locations that would benefit from additional safety treatments and countermeasures.



	State	County	TMC	Road	Facility	Segment Length	Population	Household	AADT	Number of Lanes	Speed Limit	Avg. Ope. Speed - Yearly	Std. Dev. of Ope. Speed - Hourly	Total - Expected	Fatal and Injury - Expected
1	OH	All Counties	122N05007	I-75	Interstate	4.90704	721	288	28750.8	4	70	66.14	0.69	23.0513426044003	4.31161830432749
2	OH	All Counties	122N05178	I-71	Interstate	5.51171	619	252	38385.37	4	70	68.17	1.59	13.3666680001101	3.60567021114981

Beta interactive decision support tool, RuralSpeedSafetyX[1], contains a dashboard with various dropdown lists to generate estimated annual crashes on WA and OH roadway segments.

Key Outcomes

This pilot project establishes a framework of data integration and analytical procedure that will help to address the effect of operating speed measures on safety. The framework developed in this study can be applied to other states. The major outcome of this project is the safety prediction models (annual and daily) that incorporate speed and weather data. Another outcome of this project is a beta version of an interactive decision support tool that shows segment-level annual crash estimates using Washington and Ohio data. Subsequent study may examine some limitations found in this study, particularly some missing data in the current version of NPMRDS and zero inflation in short-term crash prediction, to see if those limitations can be overcome by revised versions of the data, additional data sources, and refinement in modeling.

[1] Decision Support Tool from Rural Speed Safety Pilot Project: https://subasish.shinyapps.io/RuralSpeedSafetyX