

Determining the Knowledge Gap in Performance Based Analysis of Geometric Design and Condition Incorporating Safety

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Research Question

Is there any impact of pavement condition on traffic severity?



Abstract

Incorporating safety is at the core of all performance-based analysis of highway geometric design. In transportation systems, humans can cause the breakdowns in two different ways: active and latent failures. Active failures encompass failures or violations that have an instantaneous effect, on the other hand latent failures are directed towards the effect of policy making and legislation. Safety in highway can be considered as a product of the overall highway systems. For the perspective of roadway safety, the planning process is required to include systems components like vehicle design and condition, pavement condition, roadway and traffic policies, and human factors. The association between pavement condition and traffic severity is a key issue in reaching the goal of destination zero death. In conventional traffic crash records, details of pavement conditions are not included. Inclusion of pavement condition in traffic safety record will be helpful to see the complete effect human failure in adopting the features of the geometric design in different roadways.

Background

This study merges pavement condition data with traffic crash data in Louisiana for 2004 to 2011. Exploratory data analysis tools are used to develop association between pavement condition and traffic severity to improve the safety of transportation systems. This study will help in determining the knowledge gap in performance-based analysis of geometric design incorporating safety.

Data Collection

In this study we have merged the pavement condition data with Louisiana traffic crash data for eight years(2004-2011). The data wrangling task was performed by using R statistical software package **dplyr**. A final data set from crash data was prepared before merging with pavement data.

Variable Selection

The primary data set contains nearly 20 variables from traffic crash data. Important pavement condition data are considered such as pavement condition score, IRI score, ride score, and skid score. The scores are divided into categorical groups: good, fair, and poor.

Results

- Poor pavement conditions were associated with more severe/fatal crashes compared to particularly good/fair pavement conditions.
- Very good pavement conditions were associated with relatively lesser severe/fatal crashes.
- The effects of pavement conditions on crash severity were more significant on multi-lane, non-interstate arterial roadways with higher posted speed limits.

Discussion

- This study has developed an unconventional merged data set by merging the pavement condition data and traffic severity data.
- Model development is considered as a future scope of this research.
- Data mining tools like association mining, classification trees are used to develop the deep learning rules associated with pavement condition and other components of the transportation systems.

Conclusions

To date, there has been limited research on the impact of pavement condition on traffic crashes due to the availability of prepared data set. This study has used a significant time to prepare the data set for further study. Exploratory data analysis is conducted to determine the association between pavement condition and outcome of traffic crash severity. The results show that condition of the pavement have some effect on traffic severity. An in-depth data mining research is considered as a scope of future research.

Severity for Pavement Scores

