Predicting Traffic Volumes in Indiana

Abstract

In today's fast-paced data-driven world, accumulating and organizing streams of high-resolution information plays a vital role in numerous decision and design tasks. The transportation infrastructure is a prime example of this. Fine-scale information on traffic exposure for a given observation period is critical to the successful analysis of road safety. Annual Average Daily Traffic (AADT) and hourly traffic volumes provide essential statistics to predict crash risk under time-dependent conditions, such as, weather, temporal, and seasonal traffic variations. Although Indiana Department of Transportation (INDOT) collects traffic count data from various permanent and coverage count stations, however, less than ten percent of the local-administered road segments in Indiana are included in their database. To compensate for the missing data, predictive models that can accurately forecast AADT and consequently, hourly traffic volumes, will be of great value.

In this thesis, a new methodology has been proposed to predict traffic volumes in different classes of urban road segments in Indiana. Two sets of regression models have been developed: (1) AADT Estimation Model, and (2) Hourly Traffic Volume Model. These advanced statistical models take into consideration the previously overlooked effects of spatial and temporal variations, land-use, road characteristics and nature of road network connectivity. These, in turn, address specific research questions such as, how trips are generated and how people choose routes. The spatial and temporal effects that have been included in this analysis are road class, travel propensity, travel time excess index, hour of day, day of week and seasonal variations. While travel propensity captures particulars of land-use characteristics in traffic analysis zones (TAZ) and network connectivity, the travel time excess index justifies route choice of commuters. The estimation results indicate that all these factors are strongly correlated to traffic volumes on roadways. In addition to aiding with the safety analysis, the short-term predictions made by the models can help highway agencies alleviate traffic congestion through imposition of appropriate warnings and controlled access.