Traffic safety has been considered one of the most important issues in the transportation field. With consistent efforts of transportation engineers, Federal, State and local government officials, both fatalities and fatality rates from road traffic crashes in the United States have steadily declined from 2006 to 2011. Nevertheless, fatalities from traffic crashes slightly increased in 2012. We lost 33,561 lives from road traffic crashes in the year 2012, and the road traffic crashes are still one of the leading causes of deaths, according to the Centers for Disease Control and Prevention (CDC). In recent years, efforts to incorporate traffic safety into transportation planning has been made, which is termed as transportation safety planning (TSP). The Safe, Affordable, Flexible Efficient, Transportation Equity Act - A Legacy for Users (SAFETEA-LU), which is compliant with the United States Code, compels the United States Department of Transportation to consider traffic safety in the long-term transportation planning process.

Although considerable macro-level studies have been conducted to facilitate the implementation of TSP, still there are critical limitations in macroscopic safety studies are required to be investigated and remedied. First, TAZ (Traffic Analysis Zone), which is most widely used in travel demand forecasting, has crucial shortcomings for macro-level safety modeling. Moreover, macro-level safety models have accuracy problem. The low prediction level may be caused by crashes that occur near the boundaries of zones, high-level aggregation, and neglecting spatial autocorrelation. In this study, several methodologies are proposed to alleviate these limitations in the macro-level safety research.

In this study, several methodologies are proposed to alleviate these limitations in the macro-level safety research. TSAZ (Traffic Safety Analysis Zone) is developed as a new zonal system for the macroscopic safety analysis and nested structured modeling method is suggested to improve the model performance. Also, a multivariate statistical modeling method for multiple crash types is proposed in this study. Besides, a novel screening methodology for integrating two levels is suggested. The integrated screening method is suggested to overcome shortcomings of zonal-level screening, since the zonal-level screening cannot take specific sites with high risks into consideration. It is expected that the integrated screening approach can provide a comprehensive perspective by balancing two aspects: macroscopic and microscopic approaches.