Abstract

Road safety is a major public health concern throughout the world. To make roads safer, within budgetary constraints, it is important to identify inherently unsafe locations (or hotspots) and focus improvement efforts towards them. Thus, it is important to have a sound and rigorous method for hotspot identification (or HSID method) to identify an exhaustive list of road locations (sites) with safety problems ensuring minimum false identifications.

Different HSID methods uses different metrics to rank sites and the choice of appropriate metric for ranking is much debated. Expected total crash count is the commonly used metric whereas few researchers have used crash counts at various severity levels. The other important metric Accident Reduction Potential has also been suggested and used by researchers for efficient utilization of funds. Each of these suggested measures has its advantages and limitations and none of the HSID metrics provide the combined advantage of all the relevant metrics and available information to assess the underlying safety. As a result, there can be significant inconsistency in final selection of sites even after following a model based HSID approach as shown in a recent research. Additionally, for detailed site investigation, only a top certain percentage usually 2%-5% or top 10 or 20 sites are selected, which leads to different subsets of sites to be selected for treatment based on the metrics adopted for ranking. It is also argued that no site is perfectly safe or unsafe and each site has certain element of hazard. The degree of hazard varies making a site comparatively more unsafe or less unsafe. Therefore, a classification method using fuzzy cluster technique was chosen and a comprehensive model based HSID method was proposed to systematically identify and demarcate a set of hotspots.

This work develops a new hotspot identification model using a fuzzy clustering method to assess safety of sites based on all existing metrics namely, crash count, severity, expected severity and expected crash count. The model divides sites into fuzzy groups based on various assessment criteria. The proposed HSID method identifies an exhaustive list of sites as hotspots, doing away with subjectivity in the choice. For the purpose of model development and demonstration of the methodology, five years crash history data along with geometric and traffic details of National Highway- 6 between Bally to Kolaghat, in Howrah,West Bengal, India are used.

The developed HSID model uses expected crashes. Safety Performance Functions (SPFs) have been developed for crash prediction for Indian highways and these models can be used for other highways with proper calibration. The SPFs are developed as a function of traffic volume of

different types of vehicles. SPFs using roadside geometric details and roadside activities are also developed which can be used for crash prediction in the absence of traffic volume data.

The developed HSID method also uses expected severity outcome of crashes. Discrete choice logistic regression crash severity prediction models are developed for Indian highways. The suitability of use of random parameter ordered model in crash severity modeling is also examined in comparison to other popularly used models. The factors influencing crash severities are also identified using Classification Tree based techniques. The findings of the crash severity patterns and factors will help in designing countermeasures and formulation of suitable policies for road traffic crash related injury reduction.

Thus, along with proposing a model based comprehensive HSID method to identify a group of unsafe locations, this research also develops SPFs and crash severity models for Indian highways. Finally, special attention has been given to identify crash patterns leading to higher severities and formulation of suitable measures and policies for injury reduction.