Abstract

Developing countries have been augmenting its highway network and developing freight corridors to enhance mobility, which is targeted to improve freight connectivity by reducing travel time and cost. However, freight vehicles on highways have witnessed a high percentage of crashes per kilometer. The operational and safety issues facing the existing corridors and their interrelation with planning and design of highways merit a better understanding of both traffic operations and safety on highways.

The first step in the analysis of operations and safety on highways is to collect data from existing corridors such that useful insights may be obtained to make informed decisions. However, such data are often unavailable. Hence, alternative approaches to obtaining data such as in-vehicle Global Position System (GPS) device data becomes necessary. While studies have utilized GPS data to derive operational measures for monitoring highway performance, a comprehensive method to assess the issues related to the safe operations on highways using GPS data is yet to be developed. Further, to use GPS data effectively, a GIS program with a road network database and a high-performance computer is a prerequisite, which could be a challenge in developing countries.

To overcome these challenges, the present study begins with an approach to develop the highway network map relying solely on GPS data. The study demonstrates various techniques for highway map developing and reveals that the path of least resistance technique as the better alternative to the current practices. Subsequently, the map is used to develop a continuous speed profile of the highway, which in turn is used for both operational and safety performance assessment.

The study observes that different infrastructure shows unique speed profile patterns. A decision tree was used to classify different types of infrastructure. Additionally, it was observed that vehicles travel in different speed regimes. The findings suggest that the volume of traffic under each speed regime and the difference in mean speed between the regimes, which is termed as interaction, as a suitable surrogate measure for predicting crash frequency. This study demonstrates the potential of GPS data as a secondary data source in the monitoring and improvement of highway operations and safety performance.

Keywords: *development of highway network map, path of least resistance, speed regimes, decision tree classifier, interaction, and crash modelling*