Development of a Systematic Method to enhance Road Safety in Indian Cities through Improved Accident Data Collection, Advanced Statistical Analysis and Innovative Design

Broad Areas

- Planning and Policy
- Design and Development

Need for the Study in the Context of Future of Cities

India is going through a transitional state of economic growth and an unprecedented increase in the rate of motorization in recent years. According to Ministry of Road Transport &Highways (MORTH), Govt. of India, between 1970 and 2012the number of road accidents increased by 4.3 times with fatalities and injuries increased by 9.5 times and 7.3 times respectively. While the Government has allocated a significant amount of fund for road development, India is losing more than 3% of National GDP each year from road traffic injuries and fatalities. These simple statistics provide not only a hint at what is happening with road traffic safety in India, but also signals a potential threat to public health.

While India has realized this important problem and taken some initiatives, most notably, implementing Road Safety Audit starting from planning to construction and creating a dedicated road safety board; it is well-known that India is facing multifaceted challenges in developing effective road safety interventions through rigorous scientific analysis of accident data due primarily to poor data quality and lack of expertise in conducting advanced statistical analyses. This makes it difficult to formulate national level and state level road safety policy since the factual causes and consequences of road accidents are unknown. In this context it is worth mentioning that human error is the sole responsible factor in road traffic accidents is a *myth* and the *fact* is that human errors in combination with inadequate *road environment* and *vehicles* cause 30% of all road traffic accidents. For road traffic accidents in India, this may only be reveled from in-depth analysis of disaggregate and aggregate crash data along with geometric design details and traffic information.

Objective and Scope of Work

One of the primary goals of this proposal is to demonstrate and promote a systematic method of road accident data collection and maintenance using advanced electronic technique at the road accident site as well as at the hospitals where accident victims are

transferred. Based on data obtained from both sources comprehensive information about any road accident and the associated injuries could be obtained and matched and stored in a database. Subsequently the database will be used for rigorous scientific analysis to formulate a) suitable policies, b) training programs and interventions as well as c) designing suitable counter measure treatments appropriate in heterogeneous traffic conditions such as in India.

To that end researchers from IIT Kharagpur (IITKGP) and IIT Bombay (IITB) will work on this proposed effort and train police personnel and hospital staffs in the two major cities Kolkata and Mumbai. In addition to the two Indian Institutes, Johns Hopkins University (JHU), USA and Queensland University of Technology (QUT), Australia will be the major partners in this initiative, which will help the Indian team to interact with researchers from these two developed nations in implementing a sound road safety program starting from data collection to analysis and implementation. Such interaction will bring value to the overall project since these countries have established road safety programs for over two decades. Researchers from QUT's Centre for Accident Research & Road Safety – Queensland (CARRS-Q) will help preparing road maps for various agencies for road safety data collection, preparation of training materials and/or providing training to the staffs of these agencies. JHU's International Injury Research unit will help with hospital injury data collection such that detailed information about type of injuries and associated costs for road accident victims admitted to hospitals can be obtained. Team leaders from each institute will be involved in data analysis, inference and suitable policy formation. Road accident data collection from developed at the IIT Kharagpur will be used in this project. Accident data will be collected for roads of various functional classes in different jurisdictions of Kolkata and Mumbai. This will help the team identify major safety challenges in urban arterial roads, intersections, state and national highways as well as in access control highways. In addition to accident data collections, various traffic engineering studies such as speed and volume data and geometric design details of the roads will be collected. With these the following specific objectives will be achieved:

1. Development of a framework for data infrastructure facility to store and refine accident data from site and hospital, road geometric data, traffic volume data.
2. Identification of factors influencing higher severities of accidents on urban roads of various functional classes.
3. Identification of low cost solutions which could include enforcement of restraints, low cost geometric/traffic design solutions as well as formulation of new policies to reduce higher severity accidents by half.

4. Development of Safety Performance Function (SPF) for various functional classes of roads such that expected safety performance can be calculated which will help set criteria for acceptable maximum number of accidents or thresholds for roads of various functional classes in urban setup.
5. Design and implementation of low cost engineering countermeasures to prevent accidents of specific maneuvers leading to high severities at specific geometric conditions on roads of different functional classes.
6. Monitoring the effectiveness of the countermeasures.

Methodology

The proposed research methodology and tasks are as follows:

- Data collection: The research team will collect crash data, traffic volume data, roadway geometric data from at least two different states for at least three different functional classes, such as collector road, arterial roads and limited access roads, such as expressways or roads of similar geometry. While the primary purpose of the data collection is for model input, the collected data will also be stored in appropriate platform electronically for future use. Geographic Information System (GIS) can be used such that the roadway map could be linked with the roadway attributes. This will also help the team to have spatial display, detection and spatial analysis of such high crash sites. The data collection will be done for both road segments as well as intersections.
- Generating mean crash frequencies from field data: For the purpose of evaluation it is very important to know the mean crash frequency (MCF) for each category of road i.e. a particular rate group. Hence, under this task the research team will determine the shapes of distributions of crash means at different sites using advanced statistical techniques.
- Development of SPF: Under this task, the research team will develop SPFs for intersections and road segments as applicable for different functional classes of roads. Observed crash data for at least three years will be utilized to develop reliable and accurate safety performance functions using a Poisson or negative binomial model, whichever better fits the data. The SPFs will help compute the expected safety performance in a specific type of facility given certain geometric design and traffic conditions. These SPFs can also be used to estimate safety benefit from specific geometric design improvements.
- Estimation of safety threshold for roads of various functional classes: With expected accident frequencies and severities, the team will establish safe thresholds for roads of various functional classes in urban setup.

- Comprehensive Analysis of Accident Severities: Under this task, the research team will perform comprehensive analysis of accident data obtained from traffic police as well as hospitals to find factors associated with high severity accidents, leading to high cost. This will help identify and target areas of immediate action by proposing suitable policies and countermeasures.
- Development, implementation and checking effectiveness of countermeasures: Based on the findings from earlier stages suitable low cost countermeasures will be designed. For this purpose iRAP suggestions are to be used as starting point. Some of the proposed low cost countermeasures will be implemented in for both road segments and intersections and their effectiveness will be evaluated.

Outcomes/Deliverables

(a) Increased penetration of geo-coded electronic crash data collection processes within law enforcement community in India
(b) Development of SPF for major functional classes of roads for urban areas and estimation of threshold of Safety for various geometric and operation condition
(c) Identification of major factors contributing to high severity crashes and development of suitable policies and countermeasures to reduce high severity crashes by half
(d) Development of suitable crash countermeasures for Indian conditions and evaluation of the effectiveness of the implemented countermeasures

Team Composition

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