ROAD SAFETY AUDIT AND EVALUATION FOR CITIES

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Every day thousands of people meet with accidents on roads and out of them many succumb to injuries or suffer permanent disability. According to a survey if you are walking on a road, your chances of sustaining an injury is eight times higher than when you are at home. According to WHO, 1.2 million people worldwide die in road accidents each year. Deaths from all types of injuries projected to increase from 5.1 million in 1990 to 8.4 million in 2020.

Indian transport system is rated as one of the most accident prone system with more than 14 accidents per thousand vehicles every year. Nearly 80,000 people die of road traffic accidents and 1,60,000 people become partially or totally disabled every year in India. Increased traffic and badly maintained pavements are making life for pedestrians a nightmare.

Road safety audit is a process in which experts try to identify potentially dangerous features in the highway environment. Safety audit methodology can be used successfully to minimize the risk and severity of accidents in developing countries like India.

This paper highlights an attempt to propose a methodology for conducting Road safety audit and evaluation for a city. The expert opinion on road accidents has been taken for developing the road safety evaluation procedure and checklists for conducting the Road safety audit.

1. INTRODUCTION

Growth in urbanization and in number of vehicles has led to increased traffic congestion in urban centers and CBD areas thereby increasing the traffic accidents on road networks that were never designed for the volumes and type of traffic which they are now required to carry. In addition the unplanned urban growth has led to incompatible land uses with high levels of passenger pedestrian / vehicle conflicts. The drift from rural areas to cities often resulted in large number of new urban residents unused for such high traffic levels. As a result there had been a severe deterioration in driving conditions and significant increase in the hazards to and competition between different classes of road users of the road system. In urban areas motor vehicle occupants constitute 5-10 per cent of the fatalities and the rest are vulnerable road users. On highways, the proportions are 32 and 68 per cent respectively. Though the motor vehicle fatalities are higher on highways than in urban areas, as would be expected, the differences are not as high as in western countries. A vast majority (68%) of those getting killed on high ways in India comprises vulnerable road users and this fact should be the guiding factor in future designs considerations.

In the view of the alarming situation prevailing in cities due to road accidents an effective programme for road safety has to be implemented in cities. Road safety audit can be used as an effective and powerful tool to aid the local agencies in developing a consistent roadway, minimizing the accident risk and implementing cost effective improvements based on solid traffic safety principles.

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2. ROAD SAFETY AUDIT

2.1 DEFINITION

Road safety audit has been defined as a formal examination of an existing or future road or traffic project, or any project that interacts with road users, in which an independent, qualified examiner looks at the project's accident potential and safety performance.

The objectives of road safety audit are to identify potential safety problems for road users and others affected by a road project, and to ensure that measures to eliminate or reduce the problems are considered. Safety audit aims to:

- Minimize the risk and severity of road crashes that may be affected by the road project at the site or on the nearby network.
- Minimize the need for remedial works after construction.
- Reduce the whole-of-life costs of the project.
- Improve the awareness of safe design practices by everyone involved in the planning, design, construction and maintenance of roads.

2.2 APPLICATION OF ROAD SAFETY AUDIT

Road safety audit may be carried out at any or all of several stages of a project. These include the following: (ITE Technical Committee)

Stage 1: Feasibility

As an input to the feasibility stage of a scheme, a safety audit can influence the scope of a project, route choice, selection of design standard, impact on the existing road network, route continuity, provision of interchanges or intersections, access control, number of lanes, route terminals stage development, and more.

Stage 2: Layout or Preliminary Design

This audit stage is undertaken on completion of draft plans or a preliminary design.

Stage 3: Detailed Design

This audit stage occurs upon completion of detailed design, but normally before the preparation of contract documents. Typical considerations include line markings. Signing, delineation, lighting, intersection details, clearances to roadside objects etc.,

Stage 4: Pre-opening

Immediately before the opening of a scheme to traffic, the audit would involve driving, riding and walking through the project to check that the safety needs of all road users are adequate.

Stage 5: In-service

This stage involves a systematic examination of sections of the existing road network to assess the adequacy of the road, intersections, road furniture, the roadside, and so on from an explicit safety viewpoint.

2.3 AUDIT OF EXISTING ROADS (ITE Technical Committee)

A formal program of road safety audit of existing roads can be an important component of the overall audit procedure (stage 5 as mentioned above). For example, the Austroads guidelines state that the aim of this audit stage is " to identify any existing safety deficiencies of design, layout, and street furniture which are not consistent with the road's function. There should be consistency of standards such that the road users perception of local conditions assists safe behavior". These guidelines suggest a different approach depending upon the length of road. For short lengths (fort instance, less than 30Km), a detailed inspection is suggested, highlighting specific issues and making specific recommendations. For longer lengths, a two-part inspection is suggested, with the first being a broad

assessment of the route highlighting what major problems exist and where they are located. Then only these locations are subject to the more detailed audit, as in the approach suggested for shorter lengths.

3.0 PROPOSED METHODOLOGY FOR RSA AND ROAD SAFETY EVALUATION

3.1 METHODOLOGY FOR RSA

3.1.1 Prioritisation of roads and field studies

Before starting the safety Audit in the city, the analysis of accident data of the whole city may be used to decide which roads are to be audited first. For this the accident data collected from police records should be analyzed to locate the black spots. The causes for the accidents are analyzed from the data. The most causative factor is given importance while preparing the checklist.

As a part of the field studies the spot speed studies are carried out at different mid block sections and approach speeds are found at intersections. As the basis of the speed characteristics the existing geometric features could be evaluated for their ability to provide safety to vehicles. The volume studies are to be conducted at different points of the city roads. The locations are to be identified where the traffic volumes are exceeding the capacity.

3.1.2 Preparing the checklists

The checklist is prepared in order to help the auditor not to overlook something important. This checklist helps an auditor or a designer in identifying potential safety problems and knows the types of issues an auditor will addresses. A set of checklist has been presented at the end which has been proposed for a medium city. It is inevitable that these general checklists will not cover every issue for every country, so as experience build up, local planners and engineers should add their own additional questions and modify other where necessary to tailor the checklists to their needs.

3.1.3 Conducting the safety audit

Ideally it is preferred to have an audit team comprised of two or more members knowledgeable in the areas of traffic safety and management, road design, human factor analysis, and crash investigation and prevention. It is important that auditors should be trained and experienced moreover they should be unbiased and able to review the city roads in independent and objective manner (Austroads 1994). The safety audit of roads in the city must start with a systematic process of reviewing all street facilities. Then an onsite inspection is then to be conducted. It is important to evaluate the safety of existing network considering all road users and the roads function and use.
The major intersections, areas with pedestrian / vehicle interaction, mid block sections and analyzed black spots are good places to perform an audit.

3.1.4 Preparation of safety report and follow up evaluation

After completion of the safety audit of the each road, a final report is produced providing a description of the identified safety needs. The report should be a concise, brief document setting out a summary of measures to be taken and items identified that require remedial measures.

The completion meeting improves the auditors and individuals with jurisdiction over he rod network of the city and those responsible for the budget (funding) of improvement of that roads. Documenting the safety actions and project scope, identified needs is recommended. Once the corrective action report has been finalized, the agreed actions need to be implemented.

3.2 ROAD SAFETY EVALUATION:

The process of Road Safety Evaluation is totally different from the Road safety Audit procedure. In the RSA process we will not quantify any of the parameters of the highway that may contribute to road accidents or checking the compliance with standards or rating a project good/ bad. In RSA basically we try to eliminate or mitigate the potential safety problems for road users and others affected by the road project

In the Road Safety Evaluation, we evaluate the particular stretch of a road by giving some index to it. For this we had collected the expert opinion regarding the contribution of certain parameters to road accidents. From this we get the standard score for each parameter. After conducting the study on a particular stretch we give scores by observations and compare with the standard score to obtain the safety index of the particular stretch.

The following are factors identified which may cause accidents. These are grouped and framed as a questionnaire to collect the opinion about contribution of each factor to the accidents.

3.2.1 Questionnaire Format

Questionnaire A

Six broad based groups viz General, Roadway Characteristics, Intersections, Traffic Signs & Markings, Pedestrian Facilities, Lighting and Road Side Objects are identified which may be responsible for accidents. To know the importance of each one, you are requested to evaluate out of 100 scale all put together.
Example:
Out of 100: General –28, Roadway Characteristics-22, Intersections-18, Traffic signs & Markings-11, Pedestrian Facilities -9, Lighting & Roadside objects-12.

Questionnaire B

Within among each group several factors are listed which are considered to strongly affect the accidents. This will be evaluated individually. You are to evaluate the each factor for their contribution to accidents using 0-5 scale. You award 0 points if the factor is not contributing to the accidents to 5 points if the factor is the most causative factor and accordingly in between. Tentatively various factors which are listed may be strong/weak parameters. Please suggest any other factors, which can be considered apart from these.
Example
Footpath/Shoulders adequacy ____ 4
Bus stop Location ____ 3
Parking ____ 2
Speed ____ 4

- Your city name __
- Your city population (approximate)__
- Your city vehicular population (approximate)__

Questionnaire A

I. General ____
II. Roadway Characteristics ____
III. Intersections ____
IV. Traffic Signs & Markings ____
V. Vulnerable Road Users ____
VI. Lighting & Road Side Objects ____

Questionnaire B

I. General
- Lane adequacy ____
- Presence of Median ____
- Carriageway width ____
- Bus stop Location (i.e., placement from intersection, whether bus bays are provided or not)
- On Street Parking interfering with the traffic ____
- Speed (Over speeding of vehicles beyond speed limit) ____
- No. Of Horizontal curves within the stretch

II. Roadway characteristics
- Potholes

- Surface friction ____
- Speed breakers placement ____
- Gradient ____
- Light reflecting characteristics ____

III. Intersections
- Type of intersection ____
- Intersection visibility ____
- Unexpected intersections ____
- Sight distance requirement ____
- Pavement markings & Intersection control signing ____
- Placement of Kerbs, Traffic Islands & Medians ____
- Intersection spacing ____

IV. Traffic Signs & Markings
- Visibility ____
- Signs & Signage ____
- Clarity of message on signs ____
- Pavement Markings ____

V. Pedestrian Facilities
- Footpath, Shoulder width adequacy ____
- Condition of foot paths (Undulations etc.,) ____
- Encroachment of footpaths ____

VI Lighting & Road Side Objects
- Illumination at Intersections, Roundabouts & Pedestrian Crossings ____
- Street lights conflicting with signals ____
- Electric & Telephone poles interfering with traffic ____
- Advertising boards distracting the attention of drivers ____
- Roadside trees ____

4.0 CONCLUSIONS

Road safety audit is a low cost, high benefit process that assists in producing safer roads. In this paper an attempt was made to develop a methodology for Road safety audit and evaluation for a city. The alarming increase of fatalities due to the road accidents is to be considered seriously and the Road safety programmes have to be developed to meet the basic safety needs of India. RSA can start at minimum cost and with minimum disruption to existing programmes. Mandatory and cost-beneficial safety audit procedures are to be programmed for the existing roads of cities to prevent the road accidents.

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