

## Literature Review for Road Safety Audit

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**Abstract:** Transportation plays a key role in the development of an area, but it happens only when the transportation is safe, rapid, comfortable and economy. A road is considered safe when only a few, or no accidents occur. Road and its surroundings, road users and vehicles are the elements contributing to road accidents. Pedestrians, bicyclists and two-wheeler motorized riders are the vulnerable road users. The loss of human life due to accident is to be avoided. Road safety audit (RSA) is a formal procedure for assessing accident potential and safety performance in the provision of new road schemes and schemes for the improvement and maintenance of existing roads. These Audit studies or analysis give scope for the reduction of accidents and helps us to provide safe, self-explaining and forgiving roads. By this we can save the precious human life as well as the nation's economy. The selected for this study is part of Hyderabad Outer and Inner Ring Roads, HMDA Roads. Knowledge of accidents that have occurred on roads helps us to improve the design of the roads or to influence the behavior of road users, so that similar accidents do not occur again. Literature review will be done for the safe movement of the Road safety audit and will check the merits and demerits of the techniques used previously.

**Keywords:** Accidents, HMDA Roads, Road Safety Audit, Outer ring road, Urban Road.

### I. INTRODUCTION

The area selected for this study is HMDA area. The Hyderabad Metropolitan Development Authority or HMDA is the urban planning agency of Hyderabad in Telangana. Outer Ring Road (Nehru Outer Ring Road) is a 158 kilometer, 8-lane ring road expressway encircling the City of Hyderabad, Telangana, India. It gives an easy connectivity between NH 44, NH 65, NH 161, NH 163 and NH 765 from Hyderabad to Srisailem as well as state highways leading to Vikarabad, Nagarjunasagar and Karimnagar /Mancherial.

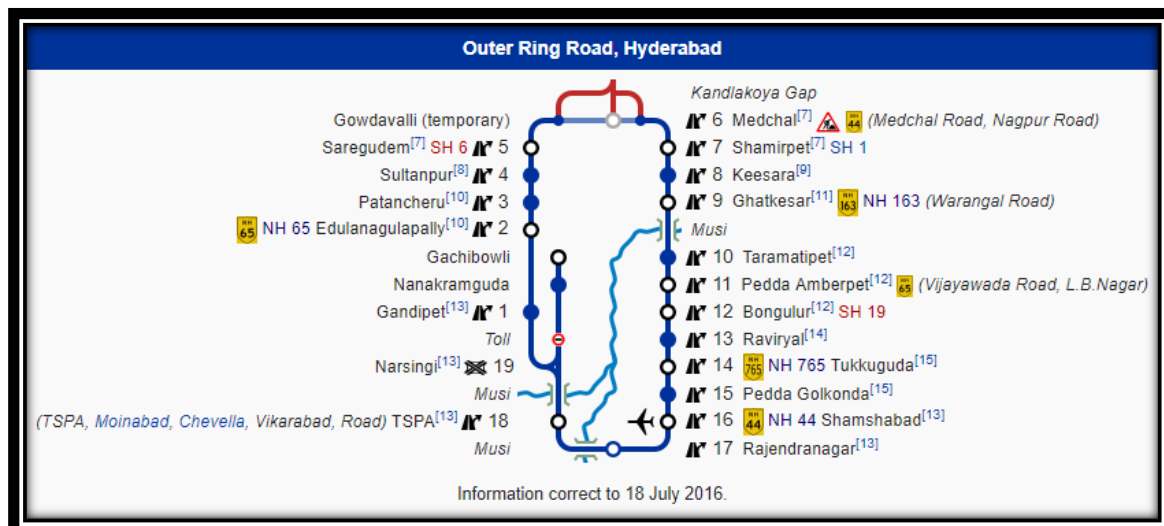


Fig 1.1: The map of the Nehru outer ring road with junctions.

The Inner Ring Road or IRR is a 50 kilometer city arterial road in Hyderabad, Telangana, India. It was built to de-congest city roads and give way for trucks and other commercial vehicles. The road passes through Medipatnam including Masab Tank, Banjara Hills, NH 65 via Punjagutta, NH 44 via Begumpet, Mettuguda, Tarnaka, Habsiguda, Uppal, NH 163 via Ghatkesar road, Nagole , L B Nagar, sontoshnagar cross roads, NH 765 via Chandrayangutta , Kurnool Highway, Rajendranagar bypass road, via SH 2 Attapur, RethiBowli. The road joins P V Narsimha Rao Elevated Expressway of 11.6 KM at Aramgarh. - Mehdipatnam.

## II. LITERATURE REVIEW

### Road Accidents: (NCRB - 2015)

Traffic Accidents' were reported during the year 2015 was 4,64,674 throughout India. Maximum number of traffic accidents occurred in the month of May (45,215) and as per time wise analysis, maximum number of traffic accidents (80,113) were reported during 1500 hrs to 1800 hrs(day) of day. 29.3% victims of road accidents were riders of 'Two Wheelers'. 'Trucks/Lorries', 'Cars' and 'Buses' have accounted for 19.4%, 12.4% and 8.3% of road accidental deaths respectively. Most of road accidents were due to over speeding accounting for 43.7% of total accidents which caused 60,969 deaths and 2,12,815 persons injured.

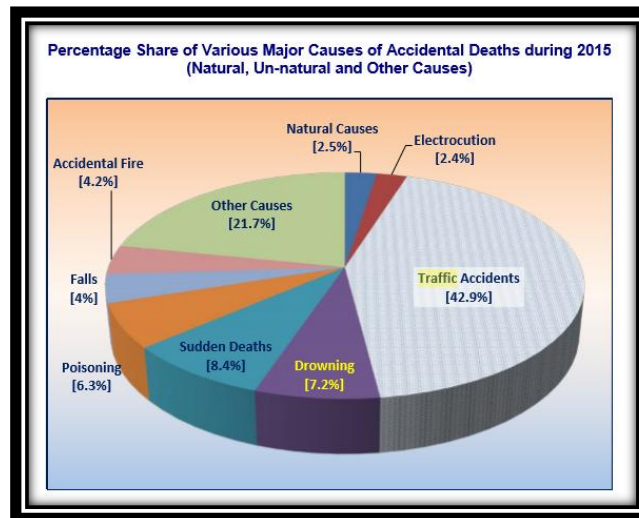


Fig 2.1: Percentage share of various accident deaths in the year 2015

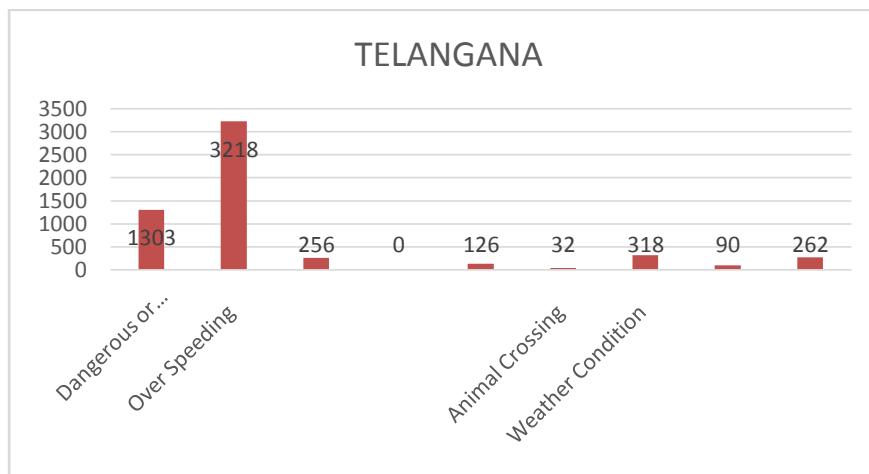


Fig 2.2: Cause – wise Distribution of Road Accidents(Deaths) during 2015

### Cyberabad Traffic Police (2017)

Data from the official website about Nehru Outer Ring Road reveals some guidelines like, the maximum speed on Lane 1 and Lane 2 of the ORR will be 120 KM per hour and minimum speed will be 80 KM per hour. (Lane1 is the one closest to the central median) The maximum speed on Lane 3 and Lane 4 of the ORR will be 80 KM per hour and minimum speed will be 40 KM per hour. The minimum speed on ORR will be 40 KM per hour. No vehicle is permitted to travel on ORR below this speed. Faster moving vehicles should move in Right Lanes (Lane 1 and 2) and slow-moving vehicles should move in Left lanes (Lane 3 and 4) within the above speed ranges. Heavy vehicles should move in Lane 3 or Lane 4 only. All vehicles which change their speed shall have to go to the lane having the concerned speed range and No Zig – Zag movement between the lanes is permitted. All vehicles wanting to change lanes as per the above speeds should do so only after using indicator lights and all precautions shall be taken while changing lanes. No Vehicle shall stop on any of the 4 lanes of ORR.

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**ZarulazamEusofe et al. Assessment of Road Safety Management at Institutional Level in Malaysia, IATSS Research**

This paper had examined the current institutional arrangements for the management of road safety in Malaysia in a systematic manner. It focused on road safety funding and seemed to provide an insight into how funding factors may affect both the effectiveness and the efficiency of road safety management. The study followed an exploratory approach based on semi-structured interviews targeting key stakeholders in road safety management such as policy makers from various government agencies, private sector representatives and academia. The analysis revealed that the efficiency and effectiveness of the road safety management system in Malaysia may be sustainably improved by addressing the current dependence of funding solely on government sources, the fragmentation of the decision-making process of this de facto multi-disciplinary area, the road safety legislative framework, public awareness, local needs and institutional capacity. An institutional model based on 2nd generation road funds is tentatively suggested to this effect. The paper presented a systematic analysis for the assessment of road safety management applicable in countries where financial resources are limited or reduced, focusing on road safety funding and seeking to provide an insight into how appropriately designed funding mechanisms may affect both the effectiveness and the efficiency of road safety management.

**Francis John Gichaga, The Impact of Road Improvements on Road Safety and Related Characteristics. IATSS Research (2016), University of Nairobi, Kenya.**

This paper presented the historical and cultural background relating to road improvement and road safety characteristics in Kenya. It discussed two case studies: one on the socio-economic impact following improvements to a 50-km, high-class, high-traffic-volume road and the other on the monitoring and evaluation of road safety aspects along the Northern Corridor in Kenya also following major road improvements. The results of monitoring and evaluation exercises on the Northern Corridor have shown that drivers are the major contributors in causing accidents, with a component ratio of 49.4%; pedestrians are next at 21.7%. Data also showed that 24% of the accidents along the Northern Corridor are fatal, which is of major concern. The study additionally indicated that most road users have not been exposed to education or training on road safety. This study presented many recommendations arising from the road safety study regarding possible improvements in aspects of road safety along the corridor and potential applications of those changes to other roads in general. The study also showed that high truck composition levels contributed to a high rate of accidents and that accident black spots were influenced by factors such as the geometric characteristics of the highway, annual average daily traffic, truck composition, and other random factors. Observations also indicated that most road users did not have basic education or training on road safety.

**Francis John Gichaga et al. Road Safety and Road Safety Audit in India: A Review. ISSN: 2347 - 4718**

This paper had reviewed the concept of the road safety audit and its stages. Objective of the RSA is to evaluate ventures for potential mishaps and lessening on the premise of road client learning, characteristics and aptitudes, day/night, wet/dry road conditions. It suggested on outline and before planning of agreement archives, to evaluate itemized intersection design, markings, signs, signals, lighting points of interest, Detail Design of junctions, Design of geometrics, Cross-fall Marking and Signs, Side drains, Embankment slopes, Presence of clear zone, Traffic Signals Lighting.

**Arun S Bagietal. Road Safety Audit (IOSRJMCE) ISSN:2278 -1684**

This study had identified accident prone areas on the road from FIR, it studied the effect of roadway geometrics and traffic conditions on the road stretch and development of statistical relationship between accident rates and numerous factors causing accidents. The scope of the study was to reduce accidents on road network, reducing severity of accidents and the need for costly remedial work is reduced. The road selected for the study is Bannerghatta road (12 km). The accident analysis was done from four years data. The V.F.Babkov's analysis is done by collecting geometric features of the road. Pedestrian safety analysis was also done. Accident prone locations are identified by the all analysis. 8 hours volume count was conducted at 2 locations of the stretch on a weekday covering both peak and off-peak hours of a day. Floating car method survey was conducted to find the speed at every kilometer of the stretch. The accident particulars pertaining to the study stretch was collected from the respective police stations. The accident data form as prescribed by IRC has been prepared to collect the necessary information such as date, time, location, whether the accident was fatal, vehicle damage and injured. The data regarding the road accidents in Bannerghatta road have been collected for a period of four years, i.e. 2008 to 2011 from the Traffic Police Station. The date, time, approximate place, types of vehicles involved etc., are entered in the First Information Report (F.I.R) and details are recorded in case diaries.

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**Xuchun S. Tu, Application of Risc For Road Safety Program Development. World Conference on Transport Research - WCTR 2016 Shanghai. 2016**

A review of the crash history has identified that the run-off-road crash is one of key crash types in Queensland, Australia. Hazards on both sides of a carriageway are identified a potential risk exposed to road users. This study says that, a proper roadside design plays an indispensable role to ensure a more forgiving road environment to reduce the likelihood and severity of run-off-road crashes. To assist road engineering practitioners in roadside design, the Queensland Department of Transport and Main Roads (TMR) developed a software application - the Roadside Impact Severity Calculator (RISC), however the applicability of RISC for developing the road safety improvement program needs to be evaluated through gaining a greater understanding of the correlation between the severity index and the crash reduction factor. The existing historical crash data indicates that run -off-road and head-on type crashes account for most of the serious crashes occurring on the roads in Queensland. Hazards on both shoulder and median sides are identified as a major risk to motorists involving run-off-road crashes. Managing road side hazards in a proper manner is key to reduce the likelihood and/or severity of run-off-road crashes. The effectiveness of a road safety treatment can be expressed as either a crash reduction factor (CRF) or a crash modification factor (CMF).

**Athanasios Galanis et al. Pedestrian Road Safety in Relation to Urban Road Type and Traffic Flow. 3rd Conference on Sustainable Urban Mobility, 3rd CSUM 2016, May 2016, Volos, Greece.**

The paper presented an analysis of the relationship between pedestrian road safety, urban road type and motorists' traffic flow. The researchers examined six urban streets of several types in the city of Volos (a medium-sized Greek city, 130,000 inhabitants). They collected data of the pedestrian traffic flow and their legal or illegal walking behavior for each road segment of the examined streets. Furthermore, they collected data of motorists' traffic flow in the same road segments of the streets in the study area. The combination of those data with the administrative ranking of each road can indicate a walkability level of an examined street or a specific route and reveal pedestrians' mobility and safety issues.

**Shalini Kanugantietal. Road Safety Analysis Using Multi Criteria Approach: A Case Study in India. World Conference on Transport Research - WCTR 2016 Shanghai. 10-15 July 2016**

In this paper a study was carried out to determine the priority of safety requirements of a certain category of rural roads, viz., Pradhan Mantri Gram Sadak Yojana (PMGSY) roads in the Jhunjhunu district of Rajasthan, India. Multi-criteria techniques were used to quantify the safety levels. Further analysis was done on the road having the worst safety features to rank various stretches. The parameters vital for safety have been selected and quantified using three multi- criteria decision-making analysis tools: Simple Additive Weightage (SAW), Analytical Hierarchy Process (AHP) and Fuzzy AHP methods and results are compared. Analysis has been done in two phases. In the first phase the prioritization of roads for safety provision was carried out considering the total length of each road as an alternative and the most critical road was identified. The parameters in the road were measured and rated (on a scale of 1-5). In the second phase, the road found critical from the first phase was considered for detail analysis. The entire stretch of the road was divided into stretches of 1 km and the stretch-wise prioritization of roads for safety provision was determined. The average values per km for the severity score of the parameters were obtained like the first phase. The methodology suggested can be used to determine the level of contribution of parameters towards safety hazard.

**YuhaHuvarinenetal. Road Safety Audit, "Organization and Traffic Safety Management in Large Cities", Spbotsic-2016, 28-30 September 2016, St. Petersburg, Russia.**

The article showed that observance of automobile roads design and construction standards does not guarantee safety of traffic. It studied the experience of the leading countries in the field of the traffic safety audit integration into technological processes of roads lifecycle. It had given the key features of the traffic safety audit methods and the model of its application in terms of the Russia/Finland project for the development of a long-run special purpose program for enhancing traffic safety in the Leningrad Oblast by the experts. In the Russian practice, the cause for an accident which occurred for the combined factor "person – road environment" in an accident card is usually specified as "the driver failed to control the car". Thus, the blame for an accident is fully laid on a road user who consciously or unconsciously violated the rules or committed an error while driving. The practice shows that accidents of such kind occur also on the sections of roads built in compliance to the design, construction, and operation standards. It means that the application of standards is the reasonable and fundamental condition but not absolute for the safety of road network and its users. As the motorization level grows, the share of unprofessional drivers not protected with the industry work and rest codes and often not informed of potential road risks increases.

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