

Road Safety Audit to Assess Safety Performance of Tonk Road, Jaipur

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Abstract—Road safety audit is the procedure for evaluating probable accidents and safety performance in the planning of roads, advancement of existing roads. The roads selected for the audit is Tonk road (17.2 km), Jaipur. The number of road accidents recorded on tonk road was 252 in 2012 total accidents in Jaipur in 2012 was 2848. The data compiled by the national crime records bureau (NCRB) claims that the number accounts 8.85% of the total cases of road accidents registered in the Tonk road, Jaipur.

The aim of the audit is to study the performance and effect of roadway geometrics, traffic problem and conditions on the road stretch. The objective of road safety audit is to ensure the relationship between road safety features and functional classification of road. The role of audit team is to point out the probable problems of road project by running the site assessment and collecting important information from various departments and analyzing the crash data, whereby the team make a standard judgment to important measures. After conducting RSA, the current situation of existing road is average. The rating of road is 3.26 out of 5 are given on the basis of parameters such as Speed, Footpath & pedestrian accessibility, Lighting, Signage, Motorized vehicles safety, Intersections and midblock.

Keywords: Road safety audit, Road safety improvement, Human factors, Freeway road inspection.

1. INTRODUCTION

The road accidents deaths and injuries are global phenomena but more severe situation in mixed traffic condition as prevailing on Indian multilane highways. Concept of quality management and sustainable safety have gained ground in the past two decades and may have been among the factors that led policymakers and project managers to realize the need for purely safety-oriented tools. Road Safety Audit (RSA) is one of the best tools for improvement of road safety; in which experts attempt to identify potentially dangerous features on the highway environment and suggest remedial measures. Road Safety Audit can be defined as a systematic approach for evaluation of existing or new roads by an independent audit team at the stages of planning, design, construction, operation & maintenance to achieve accident free roads and to enhance overall safety performance.

Road Safety Audit (RSA) was originated in Great Britain (1980) is now spread in several countries around the world.

The RSA system established in UK spread to USA, New Zealand, Australia, Denmark, Canada, Malaysia, China, Japan and Singapore and now it is used as a model in many countries.

For the formulation of guidelines and planning of their trunk roads. It is at varying stages of implementation in developing

Countries like India, South Africa, Thailand, Egypt, Pakistan and Bangladesh.

2. OBJECTIVES OF THE STUDY

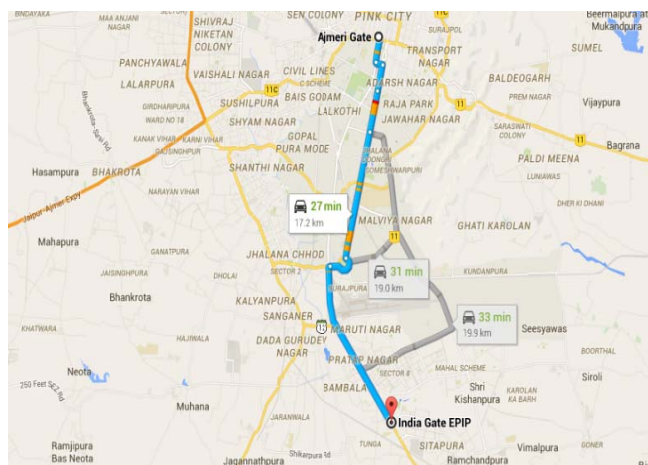
This type of investigation will help to identify some of the causative factors responsible for accidents and to give relative importance. The results of the study could be employed advantageously to take up preventive measures to reduce the accidents.

The objectives of the present study are

- Identification of accident prone areas on the Tonk road.
- To study the effect of roadway geometrics and traffic conditions on this road stretch.
- Give weightage to the parameters such as speed, footpath & pedestrian accessibility, lighting, signage, motorized vehicles safety, intersections and midblock.

3. STUDY AREA

The stretch of Km 17.2 of Tonk road had been selected for candidate analysis. The two important obligatory points on the study area are India gate to ajmeri gate of the Tonk road in the district of Jaipur, Rajasthan, India. The road stretch traverses through a flat urban settlement land. The location map is shown in Figure



4. METHODOLOGY

RSA team assessed the data and the documents. RSA team inspected the site and discussed the findings with the operator and the designers. RSA wrote a report with their findings and relevant recommendations for improvements. The operator responded to RSA report.

4.1 RSA team

The RSA was carried out by an independent team for the particular project. They had considerable knowledge about transportation engineering, traffic management and human factors.

4.2 Pre-audit meeting

Before the field inspection, a commencement meeting was held in which the RSA team with project guide. The meeting was necessary for the operator to become familiar with the audit process and for the audit team to obtain the necessary background for the project and receive information regarding road safety concerns and problems, issues and constraints requiring specific consideration.

4.3 Field Inspection and checklists

The Road Safety Audit team conducted the RSA with the goal to identify potentially dangerous roadway or traffic features of the freeway operating environment, as well as potentially misleading or missing information by the application of safety principles of positive guidance and self-explaining roads while recognizing the potential influence of human factors such as road users' limitations in capabilities or unfamiliarity. The freeway was inspected in daylight and at night-time in wet and dry conditions and included all movements at each interchange. Inspections were scheduled during typical or representative traffic conditions. The RSA findings were recorded in the RSA report together with recommendations for implementation. The RSA recommendations were implemented shortly after the RSA was completed.

4.4 Speed of the vehicle

The speed is very important factor for the accident generally max accident is caused by the speed of the vehicle. The road standards are permitting speed 50kmph. The average speed of vehicles was 60-80 Kmph at the tonk road. If the speed of the vehicle is less than 50kmph than it's kept in good. It is fair when the speed of the vehicle is more than 50kmph & it is poor when speed is more than 80kmph. As per Indian Road Congress specification, it is necessary to provide road hump with necessary sign boards on minor arms at a distance of 10m from the edge of main carriageway to regulate the speed of vehicles entering the project road. The speed at which drivers operate their vehicles directly affects two performance measures of the highway system—mobility and safety. Higher speeds provide for lower travel times, a measure of good mobility. However, the relationship of speed to safety is not as clear cut. It is difficult to separate speed from other characteristics including the type of highway facility. Still, it is generally agreed that the risk of injuries and fatalities increases with speed. Designers of highways use a designated design speed to establish design features; operators set speed limits deemed safe for the particular type of road; but drivers select their speed based on their individual perception of safety. Quite frequently, these speed measures are not compatible and their values relative to each other can vary. This guide discusses the various speed concepts to include designated design speed, operating speed, speed limit, and a new concept of inferred design speed. It explains how they are determined and how they relate to each other.

Table 1

Indicators		Quality			Total	Remark
		Present/ Yes (1 pt)	Good	Fair	Poor	
Speed measures for roads		Absent/ No (0 pt)	(1 pt)	(0.5 pt)	(0.2 pt)	
Existing Speed Variation (Total km/hr)	Truck Multi-Axle					
	Truck					
	Bus					
	LCV					
	Car/Jeep					
	Auto Rickshaw					
	Scooter/Mot or cycle					
Overall						

Table 2

Indicators	(A)	(B)Quality			Total	Remark
Footpath	Present / Yes (1 pt)	Good	Fair	Poor	(A)X(B)	
	Absent/ No (0 pt)	(1 pt)	(0.5pt)	(0.2 pt)		
Pavement type						
How wide are the footpaths?						
Height of footpath (standard size is 150 mm)						
Cleanliness and maintenance of footpath						
Provision of amenities for pedestrians for path way (Hawkers exclusive zone, cover from sun and rain, etc.)						
Provision of Disability friendly Infrastructure (tactile flooring, audible signals, railing)						
Barrier free footpaths (obstructions such as trees, parking vehicles, hawkers and vendors etc. should be absent)						
Availability of Crossings (frequency of crossings)						
Type of Crossing						
Difficulty in crossing / Time taken for crossing						
Overall						

4.5 Signage

Road signages are important to ensure smooth traffic flow without any obstruction or accident. Road signs give out a number of messages regarding the road and what you as a driver should expect on the road. If followed properly, road signs help maintaining discipline on the road. If the signage

for the 2w, cars, and trucks is present at the particular road than it is rated as good.

4.6 Drainage

Pucca Drain is provided in Urban Areas / Service Roads which are in progress. It is noted that Gratings are to be provided for outfall of water in the drain. These drain should be covered to ensure safety of pedestrian.

4.7 Footpath and pedestrian accessibility:

The type of pavement is important for the vehicle if the quality of pavement isn't good than its cause the accident. at the tonk road the type of pavement is good when the concrete /interlocking block/tar/asphalt is used. It is fair when tiles is used and poor when use the unpaved surface. And height of the pavement is also important. Generally the standard size of

The pavement is 150mm. if the height of pavement is used at the road is more than 150mm than it's not good. cleanliness and maintenance of footpath is also important factor for the road safety.

Table 3

Signage	Yes (1 pt)	No (0 pt)
Signing for Pedestrian		
Signing for bicyclists		
Signing for Cars and 2W and Trucks		
Does the signing make clear the intended use facilities?		
Speed limit signage		
Overall		

4.8 Motorized Vehicles safety

Table 4

For Motorized vehicles	If applicable (1)	Yes	No
	If not applicable (0)	(1 pt)	(0 pt)
Speed Limits sign is provided			
Does safety measures provided for construction at road sides			
Is the median sign is provided			
Kerb design safe?			
Is kerb free of vertical hazards?			
Is approach of Flyover safe?			
Overall			

4.9 Intersection

An intersection in a traffic flow may be of different types such as Signalized, Manually controlled and Un-signalized. in Signalized type of intersection if Pedestrian phase is provided then it is rated as good otherwise rated as poor. in manually controlled intersection if Police controlling is present then it is

good otherwise rated as poor. in un-signalized if stop sign is provided then rated as good otherwise rated as poor. He intersections encompassed by a roundabout are considered as safe intersections. Roundabouts minimize the number of movements and conflict points within the intersection in order to reduce the possibility of crashes and decrease delay the performance of a signalized intersection is judged on the basis of its signal timings.

Table 5

Indicators	(A)	(B)Quality			Total	Remark
Type of intersection	Present/Yes (1 pt)	Good	Fair	Poor	(A)X(B)	
	Absent/No (0 pt)	(1 pt)	(0.5 pt)	(0.2 pt)		
Signalized						
Round about						
Manually controlled						
Unsignalized						
Score						

4.10 Lighting arrangement

Light after dark (visibility to walk) is good if the pole to pole distance is 20m and it is fair when distance is 20-40m and it is poor when the distance is more than 40m.

Table 6

Indicators	(A)	(B)Quality			Total	Remark
Footpath	Present/Yes (1 pt)	Good	Fair	Poor	(A)X(B)	
	Absent/No (0 pt)	(1 pt)	(0.5 pt)	(0.2 pt)		
Light after dark (Visibility to walk after dark)						
Provision of lighting for Pedestrians for crossing						
Overall						

5. SPECIFIC LOCATION OBSERVATIONS

S No	Access Mode Type	Score	Weight
1	Speed	3	5
2	Footpath and pedestrian accessibility	2.8	5
3	Lighting	3.75	5
4	Signage	3	5
5	Motorized vehicles safety	3.34	5
6	Intersections and midblock	3.687	5
Total		3.26	5



Location: Gandhi nagar railway station

An Informatory sign obscured by overgrown vegetation



Location: Gaushala road

The shoulders are not paved but may be used for broken down vehicles. The transition between the surfaced traffic lane and the shoulder, however, is hazardous.



Location: sector-8, pratap nagar

Median had been damaged during a crash and not repaired by longtime

6. RESULT

After conducting RSA, the current situation of existing road is average. The rating of road is 3.26 out of 5 is given on the basis of parameters such as Speed, Footpath & pedestrian accessibility, Lighting, Signage, Motorized vehicles safety, Intersections and midblock. Rating of parameters include performance of road stretches. Combined Rating is to be given

On the basis of accessibility and analysis of data. good and poor rating of road decided by observation of road from 1 to 5.

7. CONCLUSION & RECOMMENDATION:

- Proposals include elimination of old markings; installation of advance warning signs installation of rumble strips before and after a sight-restricting curve ;installation of speed limit signs and speed radar for speed limit enforcement.
- Continuity of roadside safety barriers at locations where there are short gaps between consecutive barriers and installation of road safety barriers in front of road equipment inspected regularly by roadway personnel.
- The road standards are permitting low speeds 50kmph. The average speed of vehicles was 60-80 Kmph at the tonk road its causes the accident.
- The lighting condition is good at the tonk road, the light is visible to walk after dark and pedestrian crossing.
- Footpath and pedestrian accessibility condition like as pavement type, height of footpath, cleanliness and maintenance of footpath, availability of crossing etc. isn't good. They need to repair.
- From data simulation, it found that Road Markings, Condition of Shoulder, Spot Speed, Median Opening and Carriageway condition were main parameters for causing accidents. It was also seen that slow moving traffics were creating traffic hazards for fast moving traffic as it always occupied the innermost lane of highway. Therefore service roads should be provided for the entire length of four lane roads in order to separate slow moving traffic from fast moving traffic. All unauthorized median openings should closed and adequate provisions for crossing local people be made on priority. All undeveloped major and minor intersections must be developed with adequate lighting provisions as quickly as possible since maximum accidents were observed on these locations. Pedestrian guardrail should be provided all along the footpath of service road and at bus stops.
- The pedestrian are not clean so our team recommend The JDA for the cleaning and maintenances of the pedestrian.
- At the tonk road there is need of manually controlled at many location like as kumbha marg, partap nagar etc. so we recommend the police department for the control of the accident prone area.

- Informatory sign are obscured by the overgrown vegetation , shoulder aren't paved , police booth is damaged at the kumbha marg, and median is damaged. So our team recommends the JDA for the implement.
- Parking area aren't available at many location but there parking is available where is more encroachment like as hawkers, vendors etc. so we recommend to the traffic police department for the control of the this.
- Buses aren't stopped at the bus stop because the bus stop is encroachment the mini buses and auto rickshaw. So stop at we recommend the police department for the control.
- Amenities for pedestrian for path way aren't provided so we recommended the JDA for providing path way (Hawkers exclusive zone, cover from sun and rain etc.)

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