

ROAD SAFETY LAPSES AND ITS REMEDIES A CASE STUDY OF SAFETY AUDIT

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ABSTRACT

The topic entitled the '**Road safety Lapses and its remedies A case study of Safety Audit**' *about issues involved during processes of investigation of Road safety norms compliance as per specifications and recommending appropriate remedial measures.* It also explains about Safety requirements apply to all phase of construction, operation and maintenance with emphasis on identification of factors associated with accidents. It also gives attention towards Safety requirements include measures associated with traffic management and regulation such as road sign, pavement marking, traffic control devices, road side furniture, highway design elements, enforcement and emergency response.

KEYWORDS: Road Safety, Signage, Safety Regulations, Traffic Management

INTRODUCTION

Road Safety is a multi-sectoral and multi-dimensional issue. Road accident results in huge Economic lose and accidents are a major socio economic cost that can typically amount to 1-2% of annual GDP in each country. There is a need to identify the existing hazardous locations scientifically and analyze the appropriate remedial measures to be implemented to eliminate or reduce accident risk at such locations. India has the second largest road network in the world with over 3 million km of roads of which 46% are paved. These roads carry an estimated 60% of freight and 80% of passengers and they make a vital contribution to India's economy. The road traffic contains an incredible mix of pedestrians, animal drawn vehicles, bicycles, motorcycles, cars, buses and trucks. On the whole the facilities for the large number of non-motorized road users are poor and the 40 million vehicles using the roads have a terrible toll on human life, killing over 80,000 people with over one third of a million victims requiring hospital treatment. These crashes not only cause considerable suffering and hardship but they also have a major impact on the country's economy, costing an estimated Rs 300 billion or more than 3% of India's GDP every year.

According to the WHO statistics (year 2002) about 11.8 lakh people die every year in road accidents, the world over, of which 84,674 deaths are reported to take place in India. In 2004 the number of deaths had increased to 92,618. The mortality rate in India is 8.7 per hundred thousand populations as compared to 5.6 in UK, 5.4 in Sweden, 5.0 in The Netherlands and 6.7 in Japan. In terms of mortality per 10,000 vehicles, the rate in India is as high as 14 as compared to Less than two in developed countries. The cost of road crashes has been assessed at one to two Per cent of GDP in developed countries. A study by the Planning Commission in 2002 estimated The social cost of road accidents in India at Rs.55, 000 Crore annually (2000 prices), which Constitutes about 3% of the GDP With massive investment in roads and the exponential growth In the number of vehicles it has become necessary to have a system, which integrates all Disciplines that influence road safety and which at the same time would have linkages with Established institutions that cater to the different aspects of road safety viz. engineering, Education, enforcement, medical and behavioral sciences.

SCOPE OF WORK

The focus of this present work is to study the Road safety norms and its compliances as per specifications. The project contains one case study, which is as follows. The author participated during safety audit on behalf of Independent Engineer

Scope of the Project

The Project Road is State Highway No. 1 which starts at Shameerpet (km 28+200) in Rangareddy District from Outer Ring Road Interchange and passes through Siddepet, Karimnagar, Peddapally & Ramagundam and joins at NH - 63 Jagdelpur - Manchiryl Road Adilabad District. For convenience in execution of works, the Concessionaire has divided the Entire project road length 4 Sections mentioned below;

Table 1

Homogeneous Section of Project				
Section	Location (Km)		Total Length (Km)	Remarks
	From	To		
Section - I	28+200	82+000	53+800	
Section - II	82+000	144+000	62+500	
Section - III	144+000	197+000	52+500	
Section - IV	197+000	235+058	38+058	

Table 2: Salient Features of Project

Salient Features of Project	
Item	Description
Name of Project	Design, Construction, Finance, Operation and Maintenance of Four-Laning of Hyderabad-Karimnagar - Ramagundam Road (SH-1) from km 28.200 to 235.058 in the state of Andhra Pradesh under Public Private Partnership on DBFOT (Toll) Basis
Project Road Length	206+858 Km (Existing Road Length) (Designed Road Length is 208+452 Km)
Project Cost as per CA	1358.19 Crores
Project Cost as per Financial Closure	Rs. 1750.0 Crores
Employer	Andhra Pradesh Road Development Corporation (APRDC)
Independent Engineer	The Louis Berger Group Inc. USA in Association with The Louis Berger Consulting Engineering Pvt. Ltd.
Concessionaire	HKR ROAD WAYS LIMITED, HYDERABAD
Project Management Consultant	HKR Roadways Limited, Hyderabad
EPC Contractor	<i>1. Gayatri Projects Limited (GPL)</i> <i>2. Megha Engineering Infrastructure Limited (MEIL)</i>
Design Consultant	M/s HBS Consulting Engineers, Hyderabad
Date of Signing the Concession Agreement	August 20, 2010
Financial Closer	February 16, 2011

Table: 2 Cond	
Appointed date	February 16, 2011
Construction Period	910 Days (from Appointed Date)
Scheduled 4-Laning Date	August 14, 2013 (910 Days from Appointed Date)
Concession Period	25 Years (from Appointed Date)
End of Concession Period	February 10, 2035
Construction Period	910 Days (from Appointed Date)
Construction Period	30 Months from the Appointed Date
Concession Period	25 years including Construction Period
PROJECT MILE STONE	
Mile Stone –I	June 16, 2011 (120th day from Appointed Date) (Construction works commenced and minimum expenditure is 10% of total capital cost)
Mile Stone –II	March 22, 2012 (400th day from Appointed Date) (Construction of all Bridges commenced and minimum expenditure is 40% of total capital cost)
Mile Stone –III	February 15, 2013 (730th day from Appointed Date) (Construction of all Project Facilities commenced and minimum expenditure is 70% of total capital cost)
Scheduled Four Laning Date	August 14, 2013 (910th day from Appointed Date) (Four Laning Completed in accordance with CA)

SALIENT FEATURES OF PROJECT HIGHWAY

- **Road Width:** Bituminous Carriageway = 2 x 7.25 m
- Central Median Width = 1.50m
- Paved Shoulders = 2 x 1.50m
- Earthen Shoulders = 2 x 1m

Pavement Composition (New Constructions)

- Bituminous Concrete = 40 mm
- DBM = 95-125 mm
- WMM = 250 mm
- Granular Sub base = 200 mm
- Sub grade (CBR 10%) = 500 mm

Pavement Composition (Strengthening) Over Existing Road

- Bituminous Concrete = 40 mm
- DBM = 50 mm

Pavement Composition for Service Road

- Bituminous Concrete = 40 mm

- DBM = 60 mm
- WMM = 250 mm
- Granular Sub base = 200 mm

Pavement Composition for Rigid Pavement

- Pavement Quality Concrete (M40) = 280mm
- Dry Lean Concrete (M15) = 150mm
- Granular Sub base = 200 mm

Table 3: Details of Structures, Road Junctions and Project Facilities

Sl. No.	Descriptions	As Per CA	As Per Site
1	ROB	01 (Km 210+410)	02(Km. 210+411 & Km.232+911) Km. 232+911 (Change of Scope)
	RUB	02 (Km 167+120 & Km 215+727)	02 (Km 167+120 & Km 215+727)
2	Major Bridges	09	09
3	Minor Bridges	32	32
4	Box/Slab Culverts	229	229
5	RCC Pipe Culverts	156	156
6	Underpasses	20	07 (Remaining Deleted –Under Change of Scope)
7	Major Junctions	03	03
8	Minor Junctions	68	68
9	Approach Roads	-	-
10	Toll Plaza	03 (Km 92, Km 142 & Km 208)	03 (Km 91+450, Km 140+050 & Km 208+100)
11	Wayside Amenity Complex	04 (Km 40.000, Km 97.000, Km 123.000 and Km 215.000)	04 (Km 37+850, Km 84+950, Km 122+100, Km 7+100 (Peddapally Bypass)
12	Bus Bays and Shelters	64	64
13	Truck Lay Bys	Km 34+250, Km 61+250, Km 99+300, Km 123+200, Km 162+500, Km 184+200, Km 213+200,	Km 37+700, Km 61+500, Km 99+000, Km 127+605, Km 155+500, Km 184+500, Km 7+200 (Peddapally Bypass),
14	Highway Lightings	As per Site Condition	As per Site Condition
15	HTMS Works	As per Site Condition	As per Site Condition
16	Tree Plantation	As per Site Condition	As per Site Condition

APPROACH AND METHODOLOGY

General

The Safety Audit during pre-opening stage is a review of the finished construction, to check From the standpoint of road safety that it is ready to be opened for traffic.

The project is designed for high speed traffic flow. However, project comprises different type of road users which use the project road in different manner as their requirement. So it is required to critical review the all aspects associated the safety of these different road users as under:

Prime Road Users

It is mainly main line traffic which is prime users of the project Highway. It includes the traffic mainly long route traffic like commercial traffic, Car/Jee And use main carriageway specially. This traffic may use either entire project highway or some part with merging and diverging from appropriate location. The main requirement for this type of traffic is to facilitate them to maintain their desired speed smoothly which is prior requirement for the development of project highway.

Public Transport

Public transport vehicles are also type of prime road users and use Main carriageway as well as service road. This traffic may use either entire project Highway or some part with merging and diverging from appropriate location. Hence The main requirement for the public transport on project highway as under:

- Facility to picking and dropping safely to the passengers.
- Separate space for passengers to wait for public transport inside the road. The requirements for prime users are also applicable for the public transport category.

Secondary Road Users

This category includes the traffic mainly 2-wheeler, cyclist, Agriculture motorized and non-motorized vehicle. This traffic can enters on project highway anywhere and they use the project highway in some part mainly. Generally this category vehicles, origin and destination are mainly villages along project periphery. The driver of this category vehicles mainly villager who don't have knowledge of traffic sign, safety devices, traffic rules. Their behaviors are sudden change to enter on project highway and try to fly on high speed. These category vehicles are mainly involve in road accident on high speed road.

Vulnerable Road Users

This category includes pedestrian, road side villagers, animals, etc. They are use the highway mainly for crossing the road. This category is involved in accident as victim.

METHODOLOGY FOR SAFETY AUDIT FOR THE STRETCHES UNDER PRE-OPENING STAGE

Road safety audit during pre-opening stage need to critical review of item described as under:

Road Signage: The purpose of road signs is to promote road safety and efficiency by providing for the orderly

movement of all road users on the roads in both urban and nonurban areas. Road signs notify users of regulations and provide warning and guidance needed for safe, uniform and efficient operation. During safety audit, the safety team has reviewed requirement, visibility in day as well as night, placement etc. of following type of road sign on the project highway as per IRC:67:

- Informatory Sign: Place identification sign, Project facility information sign, direction sign, route marker sign, advance direction sign, toll plaza information sign, Public utility information sign etc.
- Cautionary Sign: Curve sign, hazardous marker, gap in median sign, school sign, intersection sign, start and end of dual carriageway sign, pedestrian crossing sign, Chevron marker sign etc.
- Prohibitory Sign: Keep left sign, overtaking prohibited sign, speed limit sign etc.
- Stop and Give way sign.

Pavement Marking: Pavement markings perform an important function of guiding and Controlling traffic on a highway. The pavement marking serve as a psychological barrier and signify the delineation of traffic path and its lateral clearance from traffic hazards for safe movement of traffic. Road markings are, therefore indispensable to ensure smooth and orderly flow of traffic and for promoting road safety. Pavement marking is also improved visibility during night time, rainfall. The safety team has reviewed followings type of pavement marking as per IRC:35:

- Longitudinal pavement marking.
- Pavement marking on at-grade intersection.
- Zebra crossing at pedestrian crossing.
- Chevron marking at hazardous location.
- Pavement marking at project facilities like bus bays, truck lay byes, service road,toll plaza etc.

Road Delineator: The role of delineators is to provide visual assistance to drivers about alignment of the road ahead, especially at night. Delineators are particularly effective in the case of complex locations involving changes in horizontal/vertical geometry, and during severe weather conditions such as heavy rain, fog or snow. Normally, reflectors are used on the delineators for better night time visibility. The safety team has reviewed the following type of road delineators as per IRC:79:

- Roadway indicator.
- Hazardous marker.
- Object marker.

Safety barrier: Traffic barriers are also installed at the road side to prevent errant vehicles from traversing steep (non-recoverable) slopes at high embankment or entering deep water. Traffic barriers are installed within medians of divided highways to prevent errant vehicles from entering the opposing carriageway of traffic and help to reduce head-on collisions. Some of these barriers, designed to be struck from either side, are called median barriers. Crash barriers can also be used to protect vulnerable areas like school yards, pedestrian or fuel tanks from errant vehicles.

During safety audit, the safety team has reviewed the following type of safety barrier on Project highway as per IRC:SP-84:

- Road side w-beam crash barrier at High embankment.
- Concrete crash barrier at Bridges.
- Median Crash barrier.

Pedestrian Railing/Guard Rails in habitation portion as per IRC:SP-84.

Solar Base Beacons or Flashing Signals at median opening as per IRC:SP-84.

Object painting: Physical obstruction in or near a carriageway including installations of designed for the control of traffic constitute a serious hazard and to be adequately marked. Typical obstructions of this type are, underpasses, piers, abutments, monuments, traffic islands, median, channelize ends, sings, signal supports, posts of narrow bridges, subway piers and abutments, cross drainage structure head wall, poles, trees and structure having restricted vertical clearance.

During the safety audit, safety team has assess adequacy of object painting on the project highway as per IRC:35.

Raised Pavement Markers (RPMs/Cat Eye's/Road Studs): Raised pavement markers are used to amplify, augment and, in some instances, to simulate painted marking for following purpose:

- Provide day and night visibility during adverse weather conditions.
- Provide an audible and tactile warning when traversed by vehicles..
- Improve road safety by providing direction cues by the reflected colour

During the safety audit, safety team has reviewed the installation of raised pavement

Marker on project highway as per IRC: SP: 84.

- Emergency Response: The followings situations warrant emergency operations;
- Accident involving vehicles, pedestrian and other road users
- Partial or full blockage to highway by floods and stroms,
- Earthquakes resulting in damage
- Sudden obstructions like fallen trees, electric posts, etc;
- Partial or complete failure of a culvert or a bridge and.
- Failure of a drainage system beneath the carriageway.

The concessionaire is required to develop and apply an emergency preparedness and Response plan in coordination with the local administration and other agencies that Provides the basis for how the concessionaire responds to any and all of the above Emergency situations.

During the safety audit, safety team including author has reviewed the following arrangements made by Concessionaire for emergency response:

- Traffic aid post.
- Medical aid post.
- Advanced Traffic Management System (ATMS) including Emergency Call Boxes (ECB) for Road Users and Central Control System.
- Traffic Marshal.

During the audit, safety team inspects all toll plaza locations to review emergency response system. Safety team observed that all necessary arrangements, as per provision of concession agreement, have taken by concessionaire to ensure emergency response during any incident on project highway.

CONCLUSIONS

- At the locations of petrol filling stations there are no proper drainage arrangements to let off the rain water. The concessionaire representative has mentioned that the issue was already under correspondence with the authorities to pursue with.
- The left over gaps where land acquisition problems are there need to be taken over by the department is still pending with completion of work.
- In general the kerb painting and road marking on the project highway is found satisfactory.
- Speed Restriction End sign board should be installed at restriction end location
- Reflective should be provided at all delineators and road side barrier.
- Unauthorized median opening have been forcefully made by local public. It may dangerous for safe movement of high speed traffic. It is recommended to Authority's action with the support of Administration required to close the unauthorized opening. Meanwhile, concessionaire to be taken interim safety measures, proper safety precautions till such time these opening are closed.
- Hazards marker are missing at traffic face of Island of junctions at many places.
- It is recommended that concessionaire have to organize road safety awareness programme at all road side schools regularly.

The Road safety audit has been conducted and necessary aspects which are required have been pointed out by the safety team which describes earlier. Although, the safety team is in opinion that the project highway safety measures adopted during 1st O&M year of project highway are found satisfactory except the package of recommendations to ensure safety on project highway.

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