Research Paper on Road Safety Analysis of Gurgaon-Faridabad Road

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ABSTRACT

The critical aim of this paper is to study and investigate the effect of road safety aspects and safety assessment of Gurgaon-Faridabad four lanned road. Road network of any country has a notable role to play for country’s economy and growth. Transportation through road networks satisfies the basic needs of people. Many lives are lost and huge amount of property damage occurs due to accidents. This study is an attempt to analyze the traffic safety situation on Gurgaon Faridabad road (MDR 137), Ballabgarh Sohna road (MDR 133) and few other connecting roads in Gurgaon and Faridabad Districts of Haryana (India) and to identify counter measures for stretches in which the total harm caused by crashes can be substantially and readily reduced. The scope of this study is identifying road safety aspects and carrying out safety assessment of four lanned road of Gurgaon – Faridabad road MDR 137 and Widening of Ballabgarh Sohna road MDR 133 and few other connecting roads in Gurgaon and Faridabad District of Haryana.

The length of project road is 66.185 kms which was started in June 2009 and completed in June 2012. This was developed on BOT mode of delivery by M/S GF TOLL ROAD PRIVATE LIMITED a subsidiary (SPV) of M/S Reliance Infrastructure Ltd Mumbai. The necessity of this study arises from the fact that any project of this size should be examined at various stages to achieve the objective of safe operation of highway. It ensures safety for all road users and minimizes the risk and severity of accidents with minimal cost and high benefit-cost ratio.

INTRODUCTION

Up-gradation of Highways have provided, great mobility but with no added safety. The increase in number of vehicles coupled with higher speed and neglect of vulnerable road users at planning and design stage have enhanced the threat of exposure to road accidents. Road accidents are now one of the greatest hazards to human safety today and kill more people than most of the deadly diseases. Number of injuries and deaths due to road accidents has steadily increased globally and in India as well. Road fatalities have emerged as a serious threat to human life and are causing a serious challenge to highway planners, designers and construction agencies. This has placed the added responsibility on all the stakeholders in highway sector to think seriously in providing safe roads by all means.

Road network has expanded since last many years to cater to the increasing demand of transportation of people and goods but the safety aspects came to focus when the accident rate continued ascending trend. For the first time in two consecutive years, i.e. 2015 and 2016, there was a decline in the number of road accidents, the number of persons killed and the number of persons injured in road accidents. The total number of road accidents declined from 5,20,135 in 2015 to 5,11,364 in 2016. Not only was there a decline in the absolute number of road accidents in the country during 2016, as compared to 2015, there was also a decline in the number of accidents per lakh population from 42.8 in 2015 to 41.3 in 2016. The number of persons killed in road accidents too declined to 1,39,723 in 2016, in comparison to 1,40,185 in 2015.[1].

In terms of total number of persons killed in road accidents per lakh population, there was a reduction from 11.2 in 2015 to 11.0 in 2016. The number of persons injured in road accidents reduced both in absolute as well as relative terms. In 2015, as many as 5, 29,667 had got injured in road accidents, in 2016, there were 4,98,739
persons injured. The number of persons injured in road accidents per lakh of population declined from 41.4 in 2015 to 39.6 in 2016.

DESCRIPTION OF PROJECT

The project starts at Km 0.00 (village Sikanderpur on M.G road) and ends at Km 24.310 near Faridabad, where four lanning has been provided. Pali Crusher zone and Suraj Kund approach road takes off from km 20.300 of G.F road having length of 3.10 kms and 6.10 kms. On Pali crusher zone road four lanning has been done where as Suraj Kund road has been widened to 10 m width. Ballabgarh Sohna road takes off from Delhi Mathura road km 35.00 and ends at village Lakhwas on Palwal Sohna road N.H km 53.50 in which widening of the existing road was done two lane plus 1.5 m wide paved shoulders on both sides.

The total right of way is 30 m wide in full length. At some locations the radius of curve is less than 360 m therefore the designed speed has been compromised from 100 km per hour to even up to 30 km per hour at some locations due to land constraints. The strata are rocky in most of the length and no. of small revaluates crosses the road. There are two no. existing minor bridges on Gurgaon Faridabad road five no. minor bridges on Ballabgarh - Sohna road in addition to sixty five culverts across the project road. 24 no’s addition culverts has been provided for proper drainage along the project road. The summer season temperature varies between 22oC to 45oC. The average maximum temperature is 42oC and the average minimum temperature is 25oC. The temperature in cold season varies between 28oC & 5OC. The average temperature is between 34oC to 16oC. [6].

![Fig. 1: Accidents site on Gurgaon Faridabad road](image1)

![Fig. 2: cause of Accidents of two vehicle on Gurgaon Manesar road](image2)
Traffic scenes on road

Road injuries and fatalities cause huge economic burden on developing economy like India which is estimated to be 3% of GDP (Tenth Five Year Plan Vol-II). Vulnerable Road Users (VRUs) like pedestrian, bicyclists and two wheeler users constitute 60-80% of all traffic fatalities. More than half of the road accident victims are in the age group of 25-65 years, the relevant wage earning and child raising group. The loss of main bread earner and head of house hold due to death or disability can be catastrophic, leading to lower standards and poverty, in addition to the misery and bereavement. The details given below herein explain the degree of seriousness of this problem. Various charts show the current situation of accidents in India which has been prepared by Ministry of Roads Transport and Highways, GOI. [8].

Litsas (2002), In theory, by reducing delay through the intersection, vehicles use less fuel on average passing through the intersection, thus emissions are reduced across the intersection. The emission savings per vehicle may not seem very significant, but when scaled to account for all vehicles passing through the intersection, the total savings can be significant. There are also potential economic and social benefits from reducing delay time and smoother traffic flow through the intersection [21].

In terms of road safety, Tang & Levett (2009) find one advantage of the seagull layout i.e. the separation of conflicting vehicle paths. Motorists turning right from the stem of the T-junction only need to worry about traffic from one direction at any time. Therefore, the aims of installing seagull intersections has often been to reduce certain type of crashes, especially right angle crashes [23].

METHODOLOGY & DATA ANALYSIS

The geometry of the road influences the road user behavior. The defective geometric design like inadequate width of carriageway & shoulders, improper super elevation, sharp embankment slopes, inadequate sight distance, poor horizontal/vertical geometry, blind intersection, narrow & weak bridges, absence of signs, improper lighting, etc. cause accidents. In addition, the physical condition of road such as riding surface, skidding, potholes, ruts or any other constraints of space by the structures which could not be shifted during the improvement of the road, the geometric standards get compromised, leading to road accidents. If proper warning signs are not installed on these vulnerable locations, the possibility of accidents always remains on these locations.

The road engineering measures are physical improvement of the existing road system by identifying all high accident locations available with police record to ensure effective sight distance, geometrics improvement, skid resistance, intersection features, decongestion by providing bypass or grade separator, separation of traffic flows, providing pedestrian over/under bridge, road lighting etc. [16].

At design stage, the objective of functional design is to arrange the physical elements of the road so as the best suit the requirements of the user and the vehicle in providing inherent safety & efficiency. The elements that make up functional design are vehicle speed, human reaction time, space & time, right of way, centrifugal force, spirals, curvature, super elevation, grades, pavement width, shoulders, channelization, roadway cross section, guard rail, roadside furniture, reflectorisation, traffic signs and electrical illumination. Skilful utilization of these elements in proper combination is the task of a highway engineer considering safety of all road users and provides long term solutions.

Assessment Report

In the recent decade the districts of Gurgaon and Faridabad have emerged as new economic centers and growing at very rapid pace. Also the tourists from all over India and abroad coming from Delhi side use these roads to reach Surajkund Craft Fair, Damdama Lake, Tourist Complex Sohna, Bird Sanctuary Sultanpur and to reach Rajasthan to see the historical places. The 140 crushers in these two districts generate large volume of heavily loaded trucks carrying quarry material/ crushed material and use the project roads to reach their different destinations.

On account of above prevailing conditions, the existing connectivity in these two districts especially between Gurgaon-Faridabad, Ballabgarh-Sohna and few of the connecting roads seem to be shrinking. Citing this situation, the Haryana Government has under taken the work for development of these roads on BOT basis.

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Gurgaon Faridabad (GF) roads start from Gurgaon Mehrauli Road about 2 km west of Delhi border at Sikanderpur and ends at its junction with Pali Bhakri road. Length of this stretch of the project road is 24.31 km. The MCF road having length of 6.10 km take off from Km 21 of Gurgaon – Faridabad road leading to Surajkund, New Delhi. The crusher zone road of approximately 3.10 km length is also included in project road. Thus the total length of the Gurgaon – Faridabad project road comes to 33.510 km. [23].

Ballabgarh-Sohna (BS) road starts from Ballabgarh situated at km 35 of Delhi – Mathura Road NH-2 and ends at its junction with Rewari - Palwal at km 53.5 of NH-71B. The length of this road is 28.575 km with zero at Ballabgarh and passes through Pali, Dhaui & Sirohi and terminates near Sohna situated on NH-71B. The stretch of road having length of 4.10 km from Pali village to its Junction with Faridabad – Gurgaon Road is also considered as part of this road. Thus length of BS project comes to 32.675 km. [24].

Thus, total length of this package comprising of GF and BS roads comes to approximately 66.185 km. For the fulfillment of the above mentioned project, a Concession Agreement between the Government of Haryana through the PWD B&R Branch (Client) and GF Toll road Pvt. Ltd (Concessionaire) was signed on 31th January, 2009. CES India Pvt. Ltd. was appointed as the Independent Consultant for the project who has now been replaced with M/S AECOM Asia CO. Ltd for completing the balance work and during the OMT period of the project.

The Project will be entirely funded by the Concessionaire.

The date of issue of provisional certificate is 29th June- 2015. This provisional certificate is issued with the approval from Haryana PWD (B&R) Branch Pursuant to Sub-clause 16.5 of the Concession Agreement[25].

RESULTS AND DISCUSSIONS

Most developing countries including India have a serious road accident problem. Fatality rates (defined as, road crash deaths per 10,000 vehicles) are quite high in comparison to developed countries. While in Europe and North America the situation is generally improving, many developing countries face a worsening situation. Apart from the humanitarian aspects of the problem, road accidents cost countries of developing world at least one percentage of their Gross National Product (GNP) each year – sums that those can ill afford to lose. Compared to cause of death more commonly associated with the developing world, deaths from road accidents are by no means insignificant. The nature of problem in developing countries is in many ways different from that in industrialized world. The proportion of commercial and public service vehicles involved in road accidents are often much greater. Pedestrians and cyclists are often the most vulnerable. Lack of medical facilities in these countries is considered to be an important factor leading to high death rates.

![Percentage Share of various causes of deaths during 2010](image)

**Fig. 3: Percentage shares of various causes of death**
From the reports of the National Crime Record Bureau, it is ascertained that the road accidents are the major causes of deaths in India, which shares 34.8% of the total deaths (NCRB data '2010).

The numbers of road accident deaths in India are increasing over the years. The data from the year 2005 upto the year 2016 are as follows:

Table 1: Year wise Accidental deaths

<table>
<thead>
<tr>
<th>Year</th>
<th>Total unnatural deaths</th>
<th>Total road accident deaths</th>
<th>Increase in road accident deaths over the previous year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>271760</td>
<td>98254</td>
<td>--</td>
</tr>
<tr>
<td>2006</td>
<td>293202</td>
<td>105725</td>
<td>7.6%</td>
</tr>
<tr>
<td>2007</td>
<td>315641</td>
<td>114590</td>
<td>8.4%</td>
</tr>
<tr>
<td>2008</td>
<td>318316</td>
<td>118239</td>
<td>3.2%</td>
</tr>
<tr>
<td>2009</td>
<td>334766</td>
<td>126896</td>
<td>7.3%</td>
</tr>
<tr>
<td>2010</td>
<td>359583</td>
<td>133938</td>
<td>5.5%</td>
</tr>
<tr>
<td>2011</td>
<td>365469</td>
<td>153265</td>
<td>6.2%</td>
</tr>
<tr>
<td>2012</td>
<td>375632</td>
<td>162548</td>
<td>6.9%</td>
</tr>
<tr>
<td>2013</td>
<td>391235</td>
<td>179853</td>
<td>7.5%</td>
</tr>
<tr>
<td>2014</td>
<td>402315</td>
<td>183256</td>
<td>7.9%</td>
</tr>
<tr>
<td>2015</td>
<td>413236</td>
<td>181235</td>
<td>7.6%</td>
</tr>
<tr>
<td>2016</td>
<td>432564</td>
<td>189653</td>
<td>8.1%</td>
</tr>
</tbody>
</table>

The need to look at the entire system

Traditionally, analysis of risk has examined the user, technology and environments separately. Furthermore, there is a tendency by researchers and practitioners to look for one or a few factors, when in actual fact, they should be analyzing a multiplicity of factors. The essence of using a systems approach is to consider, not only the underlying factors, but also the role of different agencies and actors in prevention efforts. For example, if road traffic crashes are reduced to one "cause" only, it is obvious that the components of the system - human, infrastructure and vehicle factors - are necessarily considered as independent. Measures addressing either group can thus be implement desperately, which makes things easier as the decision-makers responsible for each area of intervention do not have to coordinate with the others. However, opportunities to influence one type of factor through another (for example, to obtain more adequate driver behavior through changes in road design) are entirely ignored.
Table 2: The various crash analysis findings

<table>
<thead>
<tr>
<th>Reference from Table No.</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td>ASI Thrsh hold Value Based on Fatal &amp; Grievous Accidents for Gurgaon –Faridabad road is 104.73. Therefore Stretches having ASI values more than 104.73 are considered as Black Spots. On the basis of seven years Accident Data. Km 0.00 to 1.00, 2.00 to 3.00, 3.00 to 4.00, 7.00 to 8.00 and Km 9.00 to 10.00 have been identified as Black Spots and maximum accidents have been found occurred on these locations. In Km 1, 2 the Highway passes through City, where no Service Road, Foot path and RUB or FOB has been provided. Which is the main reason of accidents. In Km 4 i.e. in Km 3.00 to Km 4.00 there is a major Junction which do not have any traffic control device, the traffic has not been controlled at this location by installation of traffic light. Due to lack of enforcement traffic movement is not streamlined and is main reason of accidents. In Km 8 and 10 road Passes through hills and have very sharp curves having radius less than 50 m. Neither any speed control device has been provided nor advance sign for the information of road users, which is main reason for the fatalities.</td>
</tr>
<tr>
<td>4.3</td>
<td>ASI Thrsh hold value for Ballabgarh Sohna road is 74.6 and the stretches having ASI value more than 74.6 has been considered as Black Spots Km 29 i.e. Km 28.00 to Km 28.550 has been found as Black spot. 8 no persons have been Killed and 34 person have been injured at this location during last seven years from Jan. 2008 to Oct. 2014 which is very serious matter. This location is a Major Junction of Ballabgarh Road with NH 71 B at Lakhuwas where the T junction has not been developed properly, and do not have adequate sight distance, due to presence of buildings on all the corners on this road. The number of Fatal accidents and Grievous accidents are maximum at this location in complete length of the corridor.</td>
</tr>
<tr>
<td>4.4</td>
<td>On Pali Crusher Zone road the ASI Thrsh hold value is 14.175 and the stretches having ASI more than this value are Black Spots. Km 1, 3 and 4 have been found as black spots, where the severity of accidents is high. Out of 27 accidents 6 fatalities and 10 grievous injury have been noticed on this road. None development of intersection at Km 0.00 i.e. start of road is major cause of accidents.</td>
</tr>
<tr>
<td>4.5</td>
<td>ASI thrsh hold value on Suraj Kund Approach is 25.55 and Stretches having ASI more than this value are identified as Black Spot. Km 2 i.e. Km 1.00 to Km2.00 have been found with ASI value as 48 where 3 fatalities and 9 grievous injury have been noted during Jan, 2008 to Oct. 2014.</td>
</tr>
<tr>
<td>FIR Table</td>
<td>It is observed that maximum accidents have occurred during day time..</td>
</tr>
<tr>
<td>--Do--</td>
<td>The maximum vehicle involved in accidents is motor cycle with Trucks or Dumpers, when fatal accidents occurred.</td>
</tr>
<tr>
<td>---Do---</td>
<td>Maximum numbers of accidents were due to Head on and then Rear and overturning followed by side collision accidents</td>
</tr>
<tr>
<td>--Do--</td>
<td>Driver fault and over speeding is main cause of accidents.</td>
</tr>
</tbody>
</table>

CONCLUSIONS

This project being on BOT mode of delivery, detailed design was the responsibility of the Concessionaire which was to be audited by the Independent Consultant’ appointed by Haryana PWD B&R as Employer. No
safety Consultant was appointed, being no provision in the concession agreement. The feasibility study was carried out by Consultant which was not planned for any safety assessment. The development of project was based on the feasibility study and report by Consultant and technical parameters were laid down leaving little room for changes at later stage. The RSA at various stages was not carried out. It is found in this study that certain standards like design speed, curve radius and development of intersections have not been adhered to. No facility for pedestrians and the non motorized vehicles (VRU’s) have been provided. The movement of cattles along the corridor length has not been regulated by providing fencing. No arrangement has been made to segregate the mixed traffic on the road. The Gurgaon Faridabad road passes through rolling terrain, where delineators in the central verge and on the shoulders are essentially required which have completely vandalized from the site. All the road markings have faded away which should be re-marked with thermoplastic paint, proper cat eyes and delineators should have been provided. The Unauthorized gaps in central verge in four laning portion should be plugged immediately, bushes and shrubs should be planted in the central verge to avoid head light glare during night. The speed breaker is not of proper shape and design which should be reconstructed as per IRC standards. The shoulders are full of wild jungle growth and puddles. The pot holes developed in road crust require to be repaired immediately. The assessment would have identified such issues in time leaving scope for making due amendments to update the design parameters in tune with standards and specifications. At this stage only compromise solutions could be put in place taking a toll on operational efficiency and safety.

REFERENCES

[2]. Accidents report of India 2016 by MORT&H Govt. of India.