Identification of Accident Prone Stretches in urban Area a Case Study of Rajkot City

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Abstract— Road traffic accidents can be defined as “An accident that occurred on a road open to a public traffic; resulting in personal injury, damages to the property and loss of life in which at least one moving vehicle was involved.” Thus, road traffic accident is collisions between vehicles, between vehicles and pedestrians, between vehicles and animals, or between vehicles and geographical or architectural obstacles. Accident prone location should be identified so the accident can be reduced with proper action on the sever locations. This study is of better relevance in this context for mitigating accident problems on city roads through systematic identification, analysis and measure of accident prone stretches. Based on Accident Severity Index(ASI) method the top most three accident prone stretches are identified.

Key words: Road Accident, Accident Prone area

I. INTRODUCTION

Accidents cannot be totally prevented but through scientific analysis and proper engineering measures their frequency and severity can be reduced. Therefore, traffic engineer has to carry out systematic accident studies to investigate the causes of accidents and to take preventive measures in terms of design and control. It is essential to analyze every individual accident and to maintain zone wise accident records. The statistical analysis of accidents carried out periodically at critical locations or road stretches or zones will help to arrive at suitable measures to decrease the accident rate effectively.

Traffic Accidents in the country have marginally increased by 1.3% during 2014 compared to 2013. 4,81,805 Traffic Accidents resulted in injuries to 4,81,739 persons and 1,69,107 deaths during 2014. India has a road network of over 48,65,394 kilometres+ as on 1st March, 2012. For the first time, an effort has been made by the Bureau to capture a comprehensive data on road accidents using the revised preformed. ‘Road Accidents’ cases in the country have increased by 1.8% during 2014 (4,50,898 cases) compared to 2013 (4,43,001 cases). The fatalities in road accidents have increased by 1.3% during 2014 compared to 2013. During 2014, a total of 4,89,400 road accidents were reported by all States/Union Territories. Of these 25.7 per cent (1,25,828) were fatal accidents.

The number of persons killed in road accidents were 1,39,671 i.e. an average of one fatality per 3.5 accidents. The number of road accidents, road accident fatalities and persons injured in road accidents in India during 2003 to 2014

II. LITERATURE REVIEW


R.R.Sorate et. Al. analysed that The 34-km stretch of Mumbai-Bangalore highway in the Pune city limits has seen 110 fatal accidents in the last three years claiming 111 lives. Thus the primary aim of the project is to identify the accident black spots on National Highway-4 spanning 14.5Kms from New Katraj Tunnel to Chandani Chowk and to suggest remedial measures. Methodology adopted includes collecting the secondary data from respective authority, conducting physical survey (primary data) and analyzing them by method of ranking and severity index, accident density method, weighted severity index. Locations appearing in all the three methods were termed as black spots. Further corrective measures were suggested.

B. Pavan R Vyas Et. Al.(2015) “Identification Of Black Spots For Safe Commuting Using Weighted Severity Index And GIS”

Pavan R Vyas et. Al. studied the present state of traffic accident information on SH-85 from Tavarekere to Magadi Town in Karnataka State. In this study, the various factors, which tend to influence the occurrence of accidents on roads, are assigned weights on a scale of 1-10 in such a manner that the factor, which tends to increase the probability of the accidents are assigned lower weights. The entire stretch is segmented using dynamic segmentation tool in Arc GIS After the analysis, most of the hazardous locations were obtained in the map. The Weighted Severity Index (WSI) method was used to rank the probable-accident locations.
**III. DATA COLLECTION**

For the present study accident data, vehicle registration data and other data of study area are required, which is a huge and laborious work. Global and national level data are obtained and from various journals and technical published papers. State level data are collected and compiled from State Traffic Branch. Vehicle registration data is collected from Regional Transport Office of study area. Population, land use pattern, physical features of various roads, map of study area etc. are collected from municipal corporation office. The accident data of last five years will be collected from police stations for the research work.

Road accident statistics of Rajkot city from the year 2010 to 2015 is shown in Table 2. Accidents are categorized in fatal accidents, grievous injury accidents, minor injury accidents and non injury accidents. In the year 2010 the total number of accidents was 1530 and in the year 2015 the total number of accidents was 1559. During these six years the population and vehicle ownership has increased but the number of total accidents and fatal accidents has remained approximately constant in the city. This may be because of improved quality of roads, introduction of new roads, increased width of roads, installation of traffic control devices at junctions, channelising island at intersection, introducing medians on roads and improvement in geometrics of roads of the city. This may also be due to increased traffic sense in the people and strictly implementation of traffic rules by traffic police of Rajkot city.

**Table 2: Accidents Classified According to the Year from 2010 to 2015**

<table>
<thead>
<tr>
<th>Year</th>
<th>Fatal (F)</th>
<th>Grievous Injury (G1)</th>
<th>Minor Injury (M1)</th>
<th>Non Injury (N1)</th>
<th>Total</th>
<th>Killed</th>
<th>Injured</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>92</td>
<td>120</td>
<td>1115</td>
<td>203</td>
<td>1530</td>
<td>96</td>
<td>1576</td>
</tr>
<tr>
<td>2011</td>
<td>108</td>
<td>110</td>
<td>1197</td>
<td>176</td>
<td>1591</td>
<td>111</td>
<td>1634</td>
</tr>
<tr>
<td>2012</td>
<td>113</td>
<td>119</td>
<td>1137</td>
<td>195</td>
<td>1564</td>
<td>122</td>
<td>1616</td>
</tr>
<tr>
<td>2013</td>
<td>106</td>
<td>109</td>
<td>127</td>
<td>185</td>
<td>1617</td>
<td>110</td>
<td>1654</td>
</tr>
<tr>
<td>2014</td>
<td>114</td>
<td>129</td>
<td>1184</td>
<td>194</td>
<td>1621</td>
<td>119</td>
<td>1662</td>
</tr>
<tr>
<td>2015</td>
<td>106</td>
<td>133</td>
<td>1128</td>
<td>192</td>
<td>1559</td>
<td>121</td>
<td>1597</td>
</tr>
<tr>
<td>Total</td>
<td>639</td>
<td>720</td>
<td>6978</td>
<td>1145</td>
<td>9482</td>
<td>679</td>
<td>9739</td>
</tr>
</tbody>
</table>

**A. Accident Severity Index Method**

Accident Severity Index (ASI) suggest average accident weightage points of a stretch per km per year. In this study, this method is employed for ranking the most severe stretches, as it involves all type of accidents with proper weightage. For computation of Accident Severity Index, the accidents are classified into four groups namely, fatal, grievous injury, minor injury and non-injury accidents. Weightage is assigned to categories based on relative cost of accidents. As Chakraborty et. al (1995) has given weightage points as follows:

- Fatality = 6
- Grievous Injury = 3
- Minor Injury = 0.8
- Non-Injury = 0.2

Using the above weightage points Accident Severity Index is calculated by the following formula:

\[ I = \frac{n_1 w_1 + n_2 w_2 + n_3 w_3 + n_4 w_4}{5L} \]

Where

- \( I \) = Accident Severity Index
- \( L \) = Length of road
- \( n_1, n_2, n_3, n_4 \) = Number of fatal, grievous and minor injury and non injury accidents.
- \( w_1, w_2, w_3, w_4 \) = Corresponding weight age points for each kind of accidents.

Based on ASI ranking of the accident prone stretches are done. Higher the value more severe is the stretch. In Traffic police department fatal and total accidents details according to different stretch are available. Ranking of accident prone stretches is based on accident rate and accident severity index method is shown in Table 3. In this study, the top three most severe stretches are identified as below:
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Table 3: Accident Prone Stretches

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Stretches</th>
<th>Length (in Km)</th>
<th>(ASI)</th>
<th>Ranking of Stretches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kalawad road</td>
<td>5.85</td>
<td>38.67</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>150 ft Ring Road (Madhopar to KKV Hall)</td>
<td>10.7</td>
<td>34.21</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Javahar road</td>
<td>1.07</td>
<td>33.05</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Aamrahi Main Road</td>
<td>1.7</td>
<td>27.48</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>80 feet road</td>
<td>1.8</td>
<td>26.71</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Palace road</td>
<td>6.89</td>
<td>25.75</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Race course road</td>
<td>2.9</td>
<td>25.75</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Ramanandji Main Road</td>
<td>1.4</td>
<td>25.20</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Nile garden road</td>
<td>1.97</td>
<td>23.56</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>Tamangar road</td>
<td>4.65</td>
<td>24.98</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>Lakhrapar road</td>
<td>0.95</td>
<td>24.00</td>
<td>11</td>
</tr>
</tbody>
</table>

Kalawad Road

This is a fully divided road starting from Mahila college chowk, leading towards Kalawad village. The length of Kalawad Road is 5.85 kms. Effective carriageway width is 7.45-15.75 meters and right of way is 24.70-37.10 meters.

1) Problem Identification

Based on field survey of this road following problems are identified:

1) At KKV hall 150 feet Ring road meets to the Kalawad road. The surrounding area of Kalawad road at this junction is built-up with high rise buildings. So there is very heavy traffic volume congestion during peak hours on this road. Rotary intersection is provided at this junction but it is observed that rotary is locked-up very often.

2) At KKV hall large hoardings on both the side obstruct the visibility. This increases the reaction time of driver.

3) Absence of channelized Intersection at KKV hall junction and BAPS Swaminarayan temple junction leading to vehicular conflicts to the road users.

4) Encroachment on Both the side also make conflicts.

5) BAPS Swaminarayan temple junction is uncontrolled intersection on Kalawad road. The roads from this junction lead to Swaminarayan temple, Amin Marg, Mahila college chowk and Koteshwara chowk on north, south, east and west sides respectively. During the religious festival season, high intensity of pedestrian movement across the Kalawad road towards Swaminarayan temple would take place. This is reason of traffic jammed condition.

6) No pedestrian facilities provided on Kalawad Road.

7) Traffic control devices are inadequate at Swaminarayan temple junction.

8) High on-street parking at Swaminarayan temple reduces the effective carriageway for smooth movement of traffic.

9) In monsoon season, rain water spills over the road of under bridge of Mahila college chowk due to poor drainage facilities.

10) Road signage and markings are generally missing to warn the road users in advance at many places on this stretches.

11) There is high commercial vehicle movement on this road. So heavy vehicle conflicts are observed.

12) Irregular traffic signals at KKV hall junction.

Inadequate and Illegal Rickshaw parking is at KKV hall junction which affect the road users.

Fig. 1: Stretch of Kalawad Road

B. Javahar Road

This is a peripheral road in central area joining Hospital chowk and Trikon bag main CBD area of Rajkot city. It is partly divided and 1.07 kms. Long stretch. Its effective carriageway width is 11.00-16.90 meters and right of way is 15.90-28.50 meters. The road width 11.00 meters is observed at the undivided two way section.

Problem Identification

From the field survey of this road, problems identified are enlisted below:

1) There are vehicular conflicts at Hospital chowk result in significant delay to road users at the rotary.

2) Foot path width is inadequate and inconsistent on either side of Hospital chowk.

3) Near Lal Bahadur Shastri stadium, vehicular and pedestrian conflicts exist at city bus control point.

4) Near Hospital chowk, Auto Rickshaw and chhakdas are parked very close to the intersection which is obstructing smooth traffic flow.

5) On-street parking at Trikon Baug to Jubeli Chawk obstructing on to the carriageway.

6) Several major institutions like school, bank, and shopping centre have very poor parking facilities in their own premises.

7) Jubeli Area is having a vegetable market so In evening periods there are more chances of conflicts.

8) RMTS Bus stand is on this road which affect adversely to the effectiveness of carriage way.

C. 150 Ft. Ring Road

150 Ft. ring road is four lane road with Exclusive bus lane for BRTS starting from Gondal Chokdi to Madhapar Chawk. Length of this Stretch is 10.7 km.

1) Problem Identifications

From field survey following problems are identified.

1) Absence of Road signal on almost Intersection of the road.

2) Raia Circle meets with heavy traffic on morning and evening peak hours from four different way
Raiya Road, Aamrapali Road, 150 ft ring road respectively.

3) Very heavy traffic observed at KKV hall junction which also effect the traffic flow movement of 150 ft. ring road.

4) No Pedestrian walk way on throughout the road.

5) Heavy Vehicle movement make a conflicts in Traffic at intersection.

6) Auto rickshaw, Hawkers make a Congestion at Madhapar intersection on the stretch 150 ft. Ring Road.

7) No Channelized at Mavdi Intersection which is one of the most heavy traffic intersection.

8) BRTS route meets with regular traffic flow. On 10.7 km Stretch there are 18 Bus terminal for BRTS which may also Cause Traffic.

9) Some slots of the stretch are not assembled with foot path. This imposes the pedestrian to use carriageway.

10) Carriageway width available at Mavdi circle is inadequate due to heavy traffic, results into side swiping and rear end collision of vehicles.

Encroachment should be restricted or shifted else where from the road.

On-street parking should be controlled and it is required to make a compulsion to park the vehicle on the specified parking slots.

Median openings to be provided with signal along minor streets.

Foot path should be provided throughout the road.

Proper traffic control devices like pavement markings and traffic sign and Signals should be provided at suitable locations.

Haphazard on-street parking at Mavdi Circle road reduces the effective carriageway for movement of traffic.

On-street parking should be controlled and it is required to make a compulsion to park the vehicle on the specified parking slots.

There should be a provision of channelisers to stream line traffic movement.

The electrical poles should be removed and to be made underground cable systems.

V. CONCLUSION

The study presented in the paper has been conducted to identify the accident prone locations on the selected stretch and improvement suggested.

- There should be a provision of channelized Intersection to stream line traffic movement.
- Medians should be provided on all approaches of KKV hall junction and BAPS Swaminarayan temple junction for controlled directional traffic and to avoid crisscross movement on approaches of the stretches.
- Traffic signal system is proposed at BAPS Swaminarayan temple junction for safe movement of vehicular and pedestrian traffic and to optimize the intersection performance.
- Proper action should be taken against large hoardings.
- Proper drainage facilities at under bridge of Mahila college chowk should be introduced
- Pedestrian facilities, foot path with guard rails in the intersection area should be provided on throughout the stretch.
- Frequent cleaning of foot path is required.
- Road signage and markings should be introduced at appropriate places.

REFERENCES


