

Effect of Highway Situation, Traffic and Constructed Features on Road Safety

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Abstract: - Highway is one of the major connectivity from one place to another place which caters to the need of transportation of light goods to heavy goods and passengers. The no of accidents is rising up every year due to increasing vehicles population. The location in a roadway where the traffic accident often occurs is called a black spot. The accident data is analyzed using accident frequency and severity index method. The safety deficiencies were detected to minimize accidents and save the road users. The accessible literary works on mishap examination show that 77.5 percent of street mishaps in India are caused because of driver's blunder. Heavy vehicles like truck are engaged with most extreme no of mishap on two-path streets. It is assessed that fatalities brought about by truck is 59 % followed by other (26%) and bicycle (7%) and jeep (5%) and transport (3%). Road security mindfulness ought to be raised among street client.

Keywords:- Highway, Traffic, Road Safety

I. INTRODUCTION

Road crashes remove the right to life of 3,000 individuals consistently. This is a worldwide philanthropic calamity, and it is man-made. (Worldwide Road Safety Partnership Annual Report 2011)

Street wellbeing is one of the main issues in our general public. Consistently 1.2 million of individuals are killed and somewhere in the range of 20 and 50 million individuals are harmed in street mishaps. Assuming latest things proceed with street car crashes are anticipated to be third driving supporter of the worldwide weight of Disease and injury by 2020 (Torregrosa et al., 2012)

India had procured the questionable qualification of having more number of fatalities because of street mishaps on the planet. Street wellbeing is arising as a significant social worry all over the planet particularly in India (Shivkumar and Krishnaraj, 2012).

Mishaps are a channel on the public economy and may prompt disablement, demise, harm to wellbeing and property, social affliction and general debasement of climate.

To limit the no of accidents by any sort and seriousness expected to happen on the element during a particular period is known as street security. Mishaps and the fatalities on street are the aftereffect of between play of various variables. Street clients in India are heterogeneous in nature, going from walkers, creature driven trucks, bicycles, carts, pushcarts and farm hauler streetcars, to different classifications of two/three wheelers, engine vehicles, transports, trucks, and multi-pivot business vehicles and so on, The vehicle populace has been consistently expanding a direct result of progress in the way of living of individuals. Expansion in vehicle populace with restricted street space utilized by a huge assortment of vehicles has uplifted the need and earnestness for a thoroughly examined arrangement on the issue of street security. In India the pace of mishap is straightforwardly relative to development of vehicle populace.

Street mishaps are a human misfortune, which include high human affliction. They force a gigantic financial expense as far as inauspicious passings, wounds and deficiency of possible pay. The consequences of street mishaps can be enormous and its adverse consequence is felt on people, their wellbeing and government assistance, yet additionally on the economy. Thusly, street security has turn into an issue of public concern. Street Safety is a multi-sectoral and multi-faceted issue.

Table 1: Road accident in India (2002-2011)

| Year | Number of Road Accidents and Number of Persons Involved: 2002 to 2011 | | | | Accident Severity |
|------|---|----------|----------|----------|-------------------|
| | Total | Fatal | Killed | Injured | |
| 2002 | 4,07,497 | 73,650 | 84,674 | 408,711 | 20.8 |
| 2003 | 4,06,726 | 73,589 | 85,998 | 435,122 | 21.1 |
| 2004 | 4,29,910 | 79,357 | 92,618 | 464,521 | 21.5 |
| 2005 | 4,39,255 | 83,491 | 94,968 | 465,282 | 21.6 |
| 2006 | 4,60,920 | 93,917 | 105,749 | 496,481 | 22.9 |
| 2007 | 4,79,216 | 1,01,161 | 114,444 | 513,340 | 23.9 |
| 2008 | 4,84,704 | 1,06,591 | 119,860 | 523,193 | 24.7 |
| 2009 | 4,86,384 | 1,10,993 | 125,660 | 515,458 | 25.8 |
| 2010 | 4,99,628 | 1,19,558 | 134,513 | 527,512 | 26.9 |
| 2011 | 4,97,686 | 1,21,618 | 1,42,485 | 5,11,394 | 28.6 |

It consolidates the turn of events and the board of street framework, arrangement of more secure vehicles, regulation and regulation requirement, versatility arranging, arrangement of wellbeing and medical clinic administrations, kid wellbeing, metropolitan land use arranging and so on. As such, its ambit traverses designing parts of both, streets and vehicles on one hand and the arrangement of wellbeing and clinic administrations for injury cases in post-crash situation. Street mishap in India is displayed in Table 1.

II. HIGHWAY SAFETY & VARIOUS CAUSES OF ACCIDENT

Street traffic wellbeing alludes to strategies and measures for lessening the gamble of an individual utilizing the street network being killed or genuinely harmed.

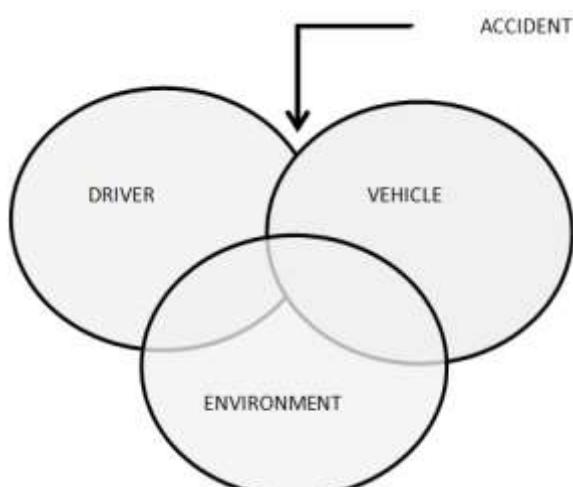


Fig. 1: Causes of Accident

The details of these factors are shown in Table 2 below

Table 2: Various Factors Related to Accident

| Driver-Related | |
|--------------------------------------|-----------------------------|
| Alcohol and drugs | Sickness |
| Unsafe speed | Cell Phone Use |
| Drowsiness or Fatigue | Distraction |
| Fatigue | Improper Passing or Turning |
| Disregard traffic controls | Non Use of Restraint |
| Vehicle-Related | |
| Over Loading | Steering defect |
| Brake defect | Tire failure |
| Light defect | Improper wheel alignment |
| Environmental-Related | |
| Road side hazard | Vision obstruction |
| Ruts | Improper traffic control |
| Debris or Garbage on the road | Road Side Hazard |
| Smoke or fog | Fixed Objects |
| Glare | Water ponding |
| Improper/nonworking traffic controls | Shoulders defective |

The clients of a street incorporate people on foot, cyclists, motorists, their passengers, and passengers of on-street public vehicle, mostly transports and cable cars. Best practice street security systems center upon the anticipation of genuine injury and demise crashes disregarding human unsteadiness. Safe street configuration is currently about giving a street climate which guarantees vehicle rates will be inside the human resistances for genuine injury and demise any place struggle focuses exist. The different reasons for mishaps might be because of three variables displayed in fig. 1.

- i Driver
- ii Vehicle
- iii Environment

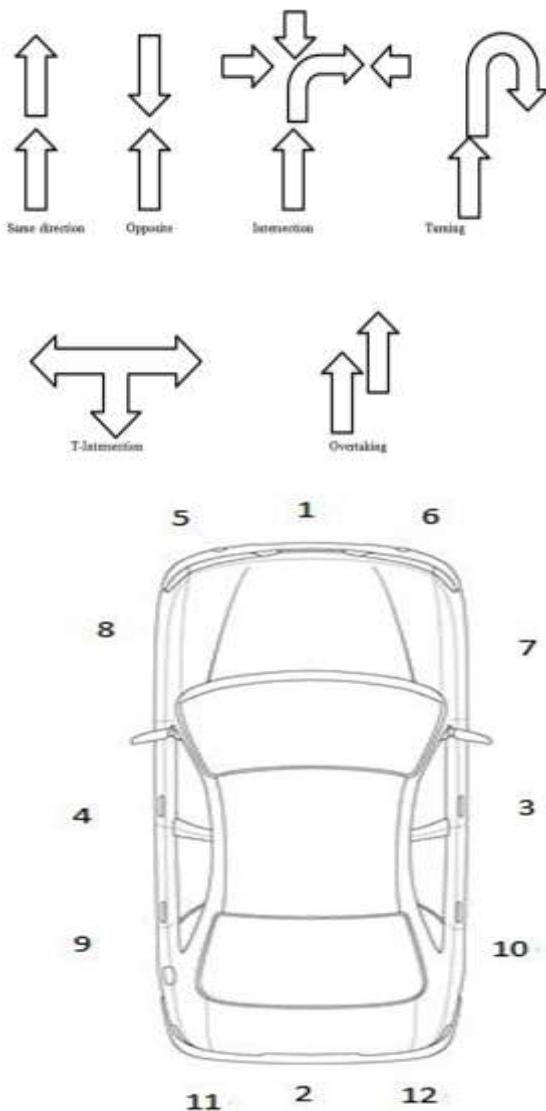


Fig. 2: Position of vehicle and points on vehicle where object collides

III. ACCIDENT INVESTIGATION

Accident no-1

Accident type: Head-on collision

Location: Captive power plant gate, Nalco Angul
Date and Time: MAR 30, 2013; 4.30PM

Vehicle 1: Tata Truck no OR-06/B-6545

Vehicle 2: Bajaj CT- 100 motor cycle no OR 05/U-3323

Fatalities/Injuries: One person dead and one person severe Injured.

Portrayal: On 30th walk 2013 one Bajaj engine cycle with two man slammed into an aluminum stacked truck before hostage power plant Nalco entryway around 4.30PM. The engine cycle was coming from hostage power plant and truck was continuing on thruway. The engine cycle hurried to the right half of truck front. The truck applied brake and turned towards left side. The bicycle tumbled down under the back right wheels. The casualties were seriously harmed. The rider lost his right leg totally and left leg scratched while different was under truck with serious knee and head wounds. The rider had utilized protective cap and saved from head injury. The rescue vehicle came following 30 minutes and took casualties to the medical clinic. The casualties were two siblings from Jajpur town and rider lost his life following two hour of episode. Reason for mishap was because of quality of old banyan tree at the intersection of T-intersection and trenches of shoulder was loaded up with water. The engine cycle couldn't see the truck because of that huge tree and crashed into truck on the thruway. The tire slip mark length was 11mt. The mishap outline is displayed in fig 3.



Fig. 3: Accident diagram and photos of stretch II

Accident no: 2

Accident type: collision with tree

Location: In front of police station Angul

Date and Time: JUN 13, 2012; 12.30PM

Vehicle 1: Asok Leyland trailer

Vehicle 2: Bajaj Auto

Fatalities/Injuries: Two person minor Injured

Depiction: The trailer was on the roadway with typical speed. At a T-intersection one auto with nine traveler was altering course (left turn) from transport stop street to expressway. Both vehicles became front to front. The trailer driver applied abrupt brake and struck the vehicle with an old tree present at corner of intersection. The auto was gotten away from impact. Driver and assistant became harmed. The mishap graph is displayed in fig. 4.

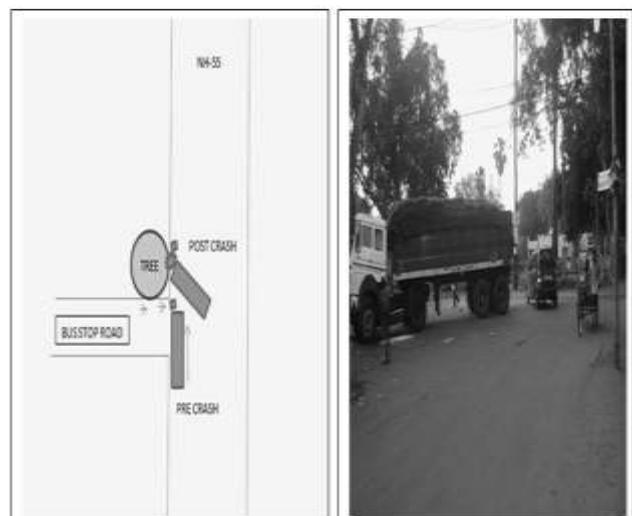


Fig. 4: Accident diagram and photos of stretch I

Accident no: 3

Accident type: collision with tree and compound wall

Location: Smelter traffic post Angul

Date and Time: JUN 12, 2012; 6.10AM

Vehicle 1: Tata truck

Fatalities/Injuries: One person severe Injured and one minor injured

Portrayal: The truck was continuing on NH-55. Near traffic post the transporter couldn't see traffic middle because of nonappearance of sign post and sign. The truck ran over middle and hit with a tree lastly hit with compound divider. The driver became extreme harmed and partner became minor harmed. The vehicle, tree and the compound divider were totally crushed. The mishap chart is displayed in fig. 5.

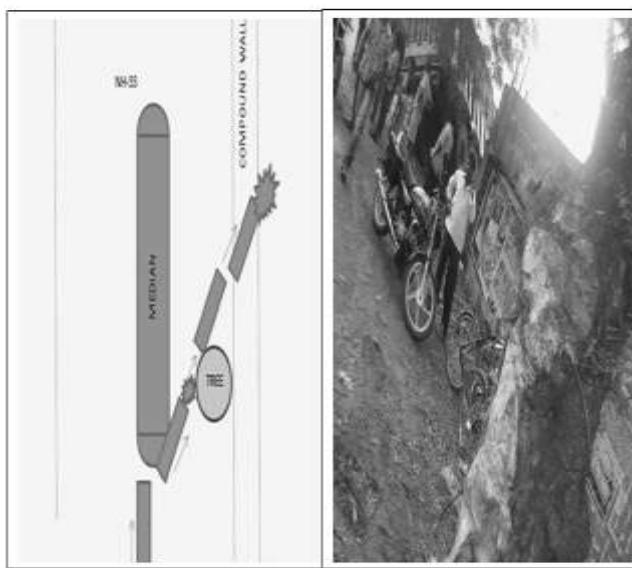


Fig. 5: Accident diagram and photos of stretch II

IV. ACCIDENT PREDICTION MODEL

Calibration of Model

The mishap each year was relapsed with ADT and Road side highlights. The overall type of condition with zero capture is addressed as

No of mishap = $0.504 \times \text{Vol} + 1.825 \times \text{No of Trees and Poles on Shoulder} + 19.87 \times \text{No of bends} - 59.49 \times \text{shoulder condition}$.

The above condition shows that mishaps increments with expanding in ADT, No of Trees and Poles on shoulder and no of Curves. The mishap diminishes with expansion in shoulder condition. Thus customary support of street ought to be finished. Old bigness trees ought to be eliminated.

Validation of Model

Table 3 and Fig 6 show the statistical validation of the fitted model.

Table 3: Statistical Validation of Model

| Name of Stretch | Actual Value(Y ₁) | Value from Model(Y ₂) | Error (e) | e ² |
|-----------------|-------------------------------|-----------------------------------|-----------|----------------|
| 1 | 16 | 15.28 | -0.72 | 0.5184 |
| 2 | 21 | 20.6 | -0.4 | 0.16 |
| 3 | 2 | 1.83 | -0.17 | 0.0289 |
| 4 | 28 | 27.76 | -0.24 | 0.0576 |

Co efficient of determination $R^2 = \frac{SS_R}{SS_Y} = \frac{\sum Y^2 - (\sum Y)^2/n}{SS_E}$

$$SS_E = \sum e^2 \quad SS_R = S_{YY} - SS_E \quad R^2 = \frac{SS_R}{S_{YY}}$$

For the above data $R^2 = 0.99$. Model holds a good fit.

Chi-Square Test

H_0 =No significant difference between expected and observed data

$$\chi^2_{\text{cal}} = 0.059561$$

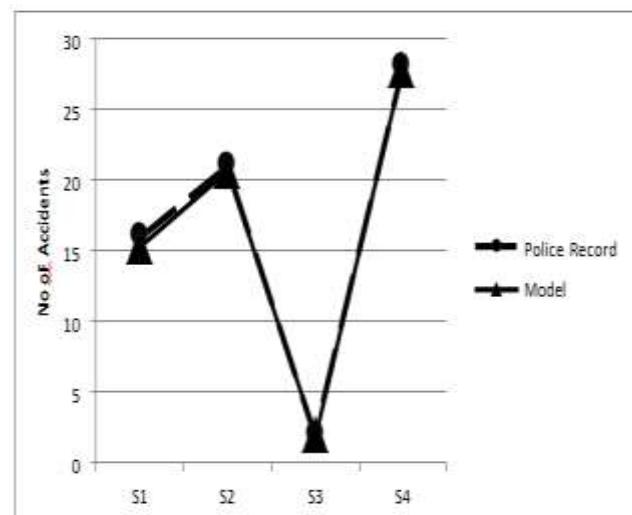


Fig. 6: Comparison of observation and model data

V. CONCLUSION

- Stretch IV has the most noteworthy no of mishaps which represents 34.1% of all out mishaps .The mishap rate can be diminished by street side leeway, legitimate upkeep of shoulders, lighting, and intersection improvement. Speed cutoff ought to be brought somewhere around giving protuberances close to mishap spots. Sight distance close to bends ought to be without block.
- Stretch I have the second most noteworthy no of mishaps represents 32.5% of absolute mishap. The Accident rate can be decreased by giving signalized intersection, intersection improvement, and shoulder Clearance, establishment of mounds, moving of posts, and evacuation of trees close to the edge of asphalt and so on.
- No of mishaps in stretch II records for 29.6% of all out mishaps. The mishap rate can be minimized by cleaning up shoulders, diminishing velocity limit, intersection improvement, giving Signals on the middle, moving constructions on the shoulder.
- Stretch III has least no of mishaps represents 3.7% of complete mishaps. Speed limit decrease close to intersection ought to be diminished to forestall mishaps.

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