Effects of Roadway Condition, Traffic and Manmade Structures on Road Regulation & Safety

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***Abstract*: To this day, traffic safety in India has not achieved its potential. Accidents increase in proportion to the number of vehicles on the road. disablement, damage, and so on worrying about what may be Every four minutes, one person dies in a traffic accident. Many accidents may be attributed to inadequate roads to handle traffic and road users, as well as car malfunctions, poor road geometry, and bad weather. Road accidents are imposing significant economic damage on the nation. Improving road safety may reduce human and vehicle traffic accidents by making the road safer and more user-friendly. The study will take conducted at the Expressway in Ambala Chandigarh. First Information Report (FIR) is the sole information provided in the event of a police station accident. This may rent cars, trucks, and other conveyances. From 2002-2011, there are no risks. During the bulk of the year, the proportion of accidents is rising substantially. More advising cars means these results. entwined Accident rates have increased due to a decline in the number of commercial and non-commercial vehicles on the road. The two distinct methods used to examine a correlation between accident rate and traffic volume were put in place. An accident occurs once per km travelled, or once every year.**

***Keywords*: Traffic Safety, Car Malfunctions, Poor Road Geometry, Roadway Condition, Traffic and Manmade Structures on Road Regulation & Safety**

I. INTRODUCTION

Road traffic safety refers to ways actions to reduce a person's risk of murder or severe injury utilizing the road network. Road users include soccer players, riders, the especially trains. Good road safety practices focus on preventing serious injuries and the risk of death even if one has failed. The purpose of Safe Road Design is to provide roads that ensure that the speed of vehicles is below the tolerance of serious injuries and deaths wherever there are disputes. Three variables indicated in figure 1.1 may be responsible for the different causes of accidents driver

(ii) Vehicle

(iii) Environmental conditions

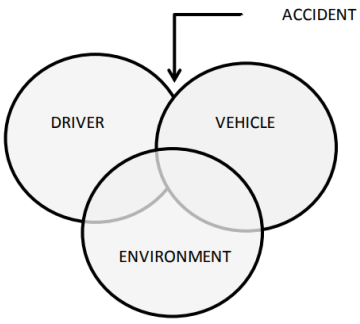

Fig 1: Causes of Accident

The details of these factors are shown in Table 1.2 below

Table 1.2 Various Factors Related to Accident

Driver-Related	
Alcohol and drugs	Sickness
Unsafe speed	Cell Phone Use
Drowsing 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

Accident types, vehicle position and consequences The cost of the accident is physical and intangible.

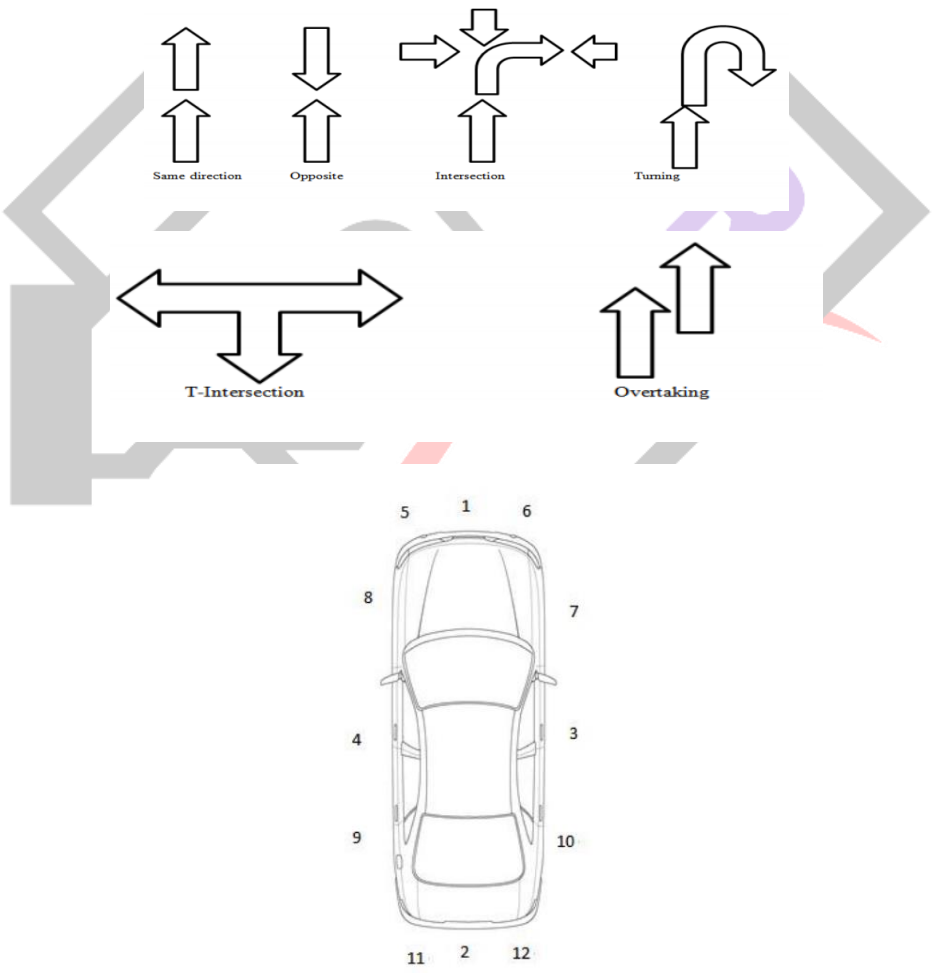

Fig. 2: Position of vehicle and points on vehicle where object collides

The main provisions the interaction the driver with traffic environment

The ergonomic test of road traffic conditions is based on the concept of the driver's communication with the vehicle environment. The impact of 90% of the environmental organization is informative (up to 1976). Information describes various types of data, data

obtained by observation or research. The details of the "river-car-road-road" program are insufficient understanding of road strategies and their effectiveness. Incomprehensible carrier, which uses the track, speed corner of the driver and the car in relation to objects, the condition of the road, the distance to the edge of the road. The primary consequence of driver speed activity and vehicle trajectory. Changing vehicle speed and trajectory, the driver changes the object's angular velocity, thus counteracting the environment for information action. In these procedures, the driver's contact with the traffic environment is essential.

It is clear that the vehicle's movement is the consequence of the driver's subjective intentional action. Interacting with the environmental movement, the driver uses driving modes to apply the principles of his behaviour. From the point of view of traffic safety interactions between its members and with the traffic environment:

• Complexity degree;

• Organizational level;

• Driver interaction indices with the traffic environment.

Due to the operating conditions of the driver, the level of tension and communication between the movement members and the environment of the vehicles can be assessed. The components of the environment movement that constitute a download driver influence its functionality, which in turn is a sign of the driver's dependability. Both low and extremely high data load drivers lead to mistakes and crises. The traffic environment should thus be deemed optimum and safe, which offers optimal speed for travel.

The model of interaction of the driver with traffic environment

Environmental mobility Ergonomic requirements standard operation of driver shift systems depending on working conditions. The purpose of the environmental movement is to make the driver's activities more reliable while minimizing the cost of intangible work, that is, to achieve the goal of less contact of the driver with the traffic environment. Golovanenko N S. (free in 1983) The cost of a driver's performance is assessed by the changed state of the body's systems, which contributes to the change in the quality of the driver's work, according to the Gavrilova ES, Golovanenko NS. and disagreements over its basic values (otherwise, 1983:

$$\Delta\Phi_r = \frac{r - r_0}{r_0};$$
$$\Delta\Phi_э = \frac{Э - Э_0}{Э_0}, \quad (1)$$

Where r, r0 – driver cardiac rate while driving along the road and in the background state; oscillator, oscillator – energy expenditure of driver's body calculated in traffic and background status (ascillator, 1976):

$$Э = 0.075S \cdot (C - C_0);$$
$$Э_0 = 0.075S \cdot C_0, \quad (2)$$

Where S – the driver's body area, m2; Č, S0 – the breathing rate, respectively, the cycle/min is moving backdrop. Unexplained pressure changes are therefore controlled by a change in the driver's heart rate, a change in the amount of physical energy spent - fluctuations in respiratory frequency. A study by Gavrilova E.S., Golovanenko N. S. has shown that frequency changes in heart rate and changes in respiratory frequency are linked to linear regression of form (since 1983):

$$\Delta\Phi_э = a \cdot \Delta\Phi_r, \quad (3)$$

Where a – is the proportionality coefficient. Golovanenko N.S. (since 1983) has acquired experimental evidence to show that this dependency is linear.

Causes & Effects of Bad Roads

Poor driving surfaces are frequently produced by combined circumstances of season and traffic. We encounter significant seasonal changes in Tennessee. These weather variations may pose risks such as sliding surfaces produced by our cars' rain and ice and oil patches. Building areas with uneven flooring are also a significant source of accidents.

How Accidents are Caused

Poorly maintained roads cause accidents in several ways, mainly because they pose a huge risk to drivers. In many cases, a motorist may try to escape a particular circumstance, such as a pothole or pooled water, which can cause a severe crash.

Some risks include:

• Clear area problems

• Disturbing signage

• Insufficient signage

• Sudden movements by the driver

Types of Bad Road Conditions

In Tennessee, there are many kinds of poor driving conditions, including:

• **Potholes:** severe accidents may occur when vast stretches of road lack blacktop or asphalt.
• **Patches on ice:** Even without rain or snow, ice patches may develop. They usually develop on the road in remote places.
• **Shoulder drop-off:** A drop-off area may be a significant hazard for vehicles.
• **Oil and chip:** these are temporary road repairs before resurfacing. When left for long periods of time, oil and chip regions may become slippery.
• **Construction work areas:** shifting lanes and uneven roadways are some of the building problems.
• **Slick roads:** slippery conditions are responsible for hydroplaning.

Road traffic safety

Modern road safety plan best practices:

The primary goal for a guarantee impact energies stay below the risk of death or severe injury in the case of a collision. Depending on the degree of protection provided to road users, accident. For example, odds of struck by a car quickly decrease of above, compared to 50 kph (accidents) a well-restrained motor vehicle occupants) (for head-on crashes).

Since no sustainable solutions for road safety classrooms are available, especially the rural lowways and private roads, the management category should be used, such as the sections used to improve occupational safety and health. Sustainable protection from serious injuries and high-risk deaths requires consideration of all areas of significant outcomes. The second stage is real-time risk reduction, which includes giving some warning to high-risk consumers to take mitigation measures. The third level is the reduction of the risk of accident, including the use of the road design principles (for example, AASHTO), improvement of driving behaviour, and enforcement.

Vehicle safety
Depending on the conveyance used, safety may be enhanced in different ways.

Buses and coaches

by means of a few basic steps to reduce risk. Avoiding speeding or staying in dangerous train, of coach or bus, improve the bus or train passenger. used on kitchens enhance, such barriers.

The most important while traveling:

• The area in time to avoid running to catch the bus or coach.
• Always follow the line at the bus stop.
• Do not board or alight at a bus stop other than a government bus stop.
• Never board or air at a red light or illegal bus station.
• Only board a bus once it stops or pushes others without rushing aboard.
• Do not sit on a bus footboard, stand or travel.
• Don't put a moving or stopped bus in any area of your body.
• Do not shout or make noise while on the bus as this could distract the driver.
• Always hold the handrail while standing on the moving bus, especially on bends.
• Always comply with safety regulations for buses.

Cars
Safety can be improved by reducing the risk of the driver making a mistake or by designing vehicles to reduce the risk of accidents. Many developed countries have a wide range of automotive equipment related to safety, systems, design and construction standards and details. These may include:
• Restrictions on passengers, such as seat belts - often included in applicable law - and airbags.
• Crash protection equipment such as lights and signals
• Driver support programs, for example Electronic Stability Control
• Crash survival design includes fire-resistant interior, fuel system integrity requirements and safety glass applications
• Motion sensors: these joints prevent the ignition key from operating while the driver is breathing and a large amount of alcohol is detected. Some commercial transportation firms utilized or recommended their usage voluntarily with chronic drunk driving offenders

Trucks

According to the European Commission's Department of Transportation, "up to 25% of truck-related incidents can be attributed to insufficient cargo." Failure to acquire property serious property, life, loss of motor vehicle and environmental damage. One of the ways to stabilize, protect and store goods while on the road is to use pit bags that are installed in the communities between the goods and are intended to prevent the change of loads during travel.

Together for Safer Roads (TSR) has established best practices for implementing corporate road safety programmes, including data management and analysis, route planning, fleet investment and maintenance, security policy and training for staff and first aid and safety training in case of accidents.

DATA COLLECTION

The FIR (First Information Report) on police stations is the sole information accessible for accident research. Data from the last decade (2000-2012) is taken from IPC records. Vehicles involved and reported to F.I.R in accidents. Tempo, car, mini-camper, minibus, tata-indica, tracker, motor bike, tanker, tailor, truck and all types of carriages.

3.1 Road selected for study

In this study, highways steel they were selected. Data collection, selected the following categories. The study area is provided with below figure.

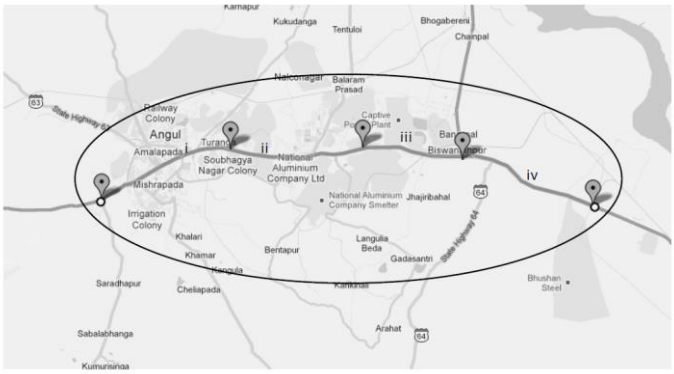

Fig 3: Study area Source: Google Map

3.2 Data Analysis from Records

approval SP involved; accident data were collected at three police stations on two lane roads.

TABLE 3.1 Record of Police stations along with road sections covered

Police Station	Road section covered under the police station
Angul	Km159/0 to km164/0 on NH-55
Nalco	Km164/0 to Km 174/0 on NH-55
Banarpal	Km174/0 to Km 179/0 on NH-55

Data from these past 10 years records were obtained from IPC NO.279/337/338/304 filed FIRs (A). Table 3.2 shows an example copy of the proforma

Table 3.2 Proforma for accident data from FIR records Date/Day/Time	Location of Accident	Details of Accident	Vehicle(s) Involved	Possible Reasons

The accident between 2000-2012 provided was carefully annually the accounts of all police stations and sorted by monthly intelligence. Table 3.4 shows the average annual decrease in accidents between 2000-2012.

Table 3.3 Details of accidents

Year	Fatal	Major injury	Minor injury
2002	15	16	37
2003	11	35	50
2004	16	25	45
2005	20	32	39
2006	21	34	40
2007	18	41	84
2008	4	24	61
2009	13	32	81
2010	18	34	84
2011	11	30	58
Total	147	303	579

Table 3.4 Details of accident stretch wise

year	Fatal				Total				Major				total				Minor				total
	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4					
2002	9	3	0	6	15	4	5	1	6	16	15	8	2	12	37						
2003	6	3	0	2	11	10	18	1	6	35	10	26	2	12	50						
2004	3	1	1	11	16	5	13	0	7	25	11	24	0	10	45						
2005	9	4	1	6	20	7	17	2	6	32	10	20	2	7	39						
2006	10	3	1	7	21	11	11	2	10	34	14	12	1	13	40						
2007	6	4	1	7	18	23	3	2	13	41	33	15	7	29	84						
2008	1	2	0	1	4	9	10	1	4	24	14	23	2	22	61						
2009	6	2	3	2	13	18	7	3	4	32	22	18	5	36	81						
2010	8	3	0	7	18	25	9	0	34	36	18	2	28	84							
2011	2	3	1	5	11	10	6	1	13	30	16	16	3	23	58						
Total	60	28	8	54	147	122	90	22	69	303	181	180	26	192	579						

S1- Stretch 1 S2-Stretch 2 S3-Stretch 3 S4-Stretch4

INTERPRETATION OF STATISTICS EXPLORATION

4.1 Accident Percentage and Frequency

Risk level = M / L

When M = Total number of stretch risks

L = Road length

Table 4.1 Accident Proportion

Name of stretch	Length	No of accidents in a year
Sum of 10 year	Accident rate	
Angul to Turanga(I)	5km	228	45.6
Turanga to CPP (II)	5km	208	41.6
CPP to Banarpal (III)	5km	26	5.2
Banarpal to Bhushan Steel(IV)	5km	239	47.8

Table 4.2 Incidence of Coincidence

Distance of origin	No of accidents (2002-2011)	Frequency	Total frequency
0-5	228	32.5	32.5
6-10	208	29.6	62.1
11-15	26	3.7	65.8
16-20	239	34.1	100
Total	701	100	

Tables above show that the incidence and intensity of accidents are higher with stretch-4 and later.

4.2Annual Disparity in Accidents

All risks for the year 2002-2011. The proportion of accidents is found to increase substantially throughout the majority of the year. The accident rate in 2007 was high and low in 2002. It may be caused by a rise in no vehicles, poor traffic conditions and a population growth.

Figure 4.6-4.10 illustrates yearly variance in four-way accidents. It is noteworthy that there are no more instances of extensions 1 and 4 than extensions 2 and 3. This is due to the high number of advisory vehicles. linked to coalmines. The stretch-1 has a significant population density, since this is Angul's major town. More accident rates are attributed to the poor traffic environment owing to no more commercial and non-commercial road vehicles.

4.3 Monthly Variation in Accidents

Figure risk variance. During the summer, that is, during March, April, and May, a major accident occurred. This is due to environmental disturbances. During these months, the problem is light, fatigue and unhealthy temperatures.

4.4 Hourly Variation in Accidents

Figure 4.17 illustrates variance in accidents on an hourly basis. More accidents may be seen between 8PM and 9PM. Start your lengthy trip with this hour-line truck (truck series). Most drivers don't use speedometer since they drive by approach. As a consequence of an accident, speed crossings restricting speed occur. They also drink and drive at night. It is very late at night using marijuana due to increased response time and loss of control. Some drivers overload the car. The capacity of the Indians is 10 tons, or 16.2 tons, but carries more than that causing.

4.5 Vehicles Involved in Fatalities

associated with deaths between 2002 and 2011 are presented in percentage pie chart. The findings reveal that 4.18 show that 59% of the deaths are caused by unknown drivers, ,. They consume long-driving drinks and narcotics. This increases the response time and causes deaths due to loss of control during fast driving.

Conclusion and Future Scope

India is a developing country, and road safety has not yet reached its full potential. The severity of accidents rises in direct proportion to the number of cars on the road. Disablement, injury, suffering, and so on Worrying about the state of the worrisome According to statistics, one person dies in a road accident every four minutes. The high rate of accidents is mostly caused by a lack of adequate roadways to meet the requirements of traffic and road users, as well as vehicle malfunctions, poor road geometry, and adverse weather conditions. Road accidents are inflicting a considerable amount of economic harm to the country. Road safety is important

for reducing the number of human and vehicle accidents on the road by making the road safer and more user friendly. It has been decided that the planned research would take place at the Express way Ambala Chandigarh. In the case of police stations, the FIR (First Information Report) is the only piece of information available for accident investigation. trucks, and other kinds of carriages are all available for hire. For the period 2002-2011, there are no hazards. Throughout the majority of the year, it is discovered that the percentage of accidents is increasing significantly. This is owing to the large number of advising vehicles on the road today. inextricably connected. Increased accident rates are ascribed to a bad traffic environment caused by a reduction in the number of commercial and non-commercial road vehicles on the road. The accident rate was given in two different ways in order to determine if there is a relationship between accident rate and traffic volume. In one instance, the number of accidents per kilometre travelled in a section is expressed as accidents per kilometre travelled per year.

References

[1] Crimmins, M., Park, S., Smith, V., & Kremer, P. (2021). A spatial assessment of high-resolution drainage characteristics and roadway safety during wet conditions. *Applied Geography*, *133*, 10247

[2] Verma, A. K., Sinha, R. K., Sardana, S., Jaswal, M., & Singh, T. N. (2021). Investigation into the Rockfall Hazard along Lengpui-Aizawl Highway, NH-44A, Mizoram, India. *Indian Geotechnical Journal*, 1-14.

[3] Kang, S., Al-Qadi, I. L., &Gungor, O. E. (2021). Impact of dynamic wheel load on roadway infrastructure sustainability. *Transportation Research Part D: Transport and Environment*, *94*, 102811.

[4] Shingloo, M. T. S. R., &Dhobale, S. (2020). A Review on Impact of Roadway Conditions, Traffic and Manmade Features of Road Safety.

[5] Abeygunawardhana, C., Sandamal, R. M. K., &Pasindu, H. R. (2020, July). Identification of the Impact on Road Roughness on Speed Patterns for Different Roadway Segments. In *2020 Moratuwa Engineering Research Conference (MERCon)* (pp. 425-430). IEEE.

[6] Singh, N. R., Mohanty, B., Sahoo, P. S., & Panda, S. (2020). Impacts Of Traffic, Manmade Features And Roadway Condition On Road Safety. *PalArch's Journal of Archaeology of Egypt/Egyptology*, *17*(9), 4235-4242.

[7] Mukherjee, S., Singla, V., Meena, G. S., Aslam, M. Y., Safai, P. D., Buchunde, P., ... &Pandithurai, G. (2020). Sub micron aerosol variability and its ageing process at a high altitude site in India: impact of meteorological conditions. *Environmental Pollution*, *265*, 115019.

[8] Pal, S., & Roy, S. K. (2019). Impact of side friction on performance of rural highways in India. *Journal of infrastructure systems*, *25*(2), 04019006.

[9] Atnafu, B., & Kaur, G. (2017). Analysis and predict the nature of road traffic accident using data mining techniques in Maharashtra India. *Int J EngTechnolSci Res (IJETSR)*, *4*(10), 1153-1162.

[10] Rao, A. M., Velmurugan, S., & Lakshmi, K. M. V. N. (2017). Evaluation of influence of roadside frictions on the capacity of roads in Delhi, India. *Transportation research procedía*, *25*, 4771-4782.

[11] Perttunen, M., Mazhelis, O., Cong, F., Kauppila, M., Leppänen, T., Kantola, J., ... &Riekki, J. (2011, September). Distributed road surface condition monitoring using mobile phones. In *International conference on ubiquitous intelligence and computing* (pp. 64-78). Springer, Berlin, Heidelberg.

[12] Omer, R., & Fu, L. (2010, September). An automatic image recognition system for winter road surface condition classification. In *13th international IEEE conference on intelligent transportation systems* (pp. 1375-1379). IEEE.

[13] Yamada, M., Oshima, T., Ueda, K., Horiba, I., & Yamamoto, S. (2003). A study of the road surface condition detection technique for deployment on a vehicle. *JSAE review*, *24*(2), 183-188.

[14] Wang, B., Guan, H., Lu, P., & Zhang, A. (2014). Road surface condition identification approach based on road characteristic value. *Journal of Terramechanics*, *56*, 103-117.

[15] Chen, S., Saeed, T. U., &Labi, S. (2017). Impact of road-surface condition on rural highway safety: A multivariate random parameters negative binomial approach. *Analytic methods in accident research*, *16*, 75-89.

[16] Iparraguirre, O., Amundarain, A., Brazalez, A., &Borro, D. (2021). Sensors on the move: onboard camera-based real-time traffic alerts paving the way for cooperative roads. *Sensors*, *21*(4), 1254.

[17] Outay, F., Mengash, H. A., & Adnan, M. (2020). Applications of unmanned aerial vehicle (UAV) in road safety, traffic and highway infrastructure management: Recent advances and challenges. *Transportation research part A: policy and practice*, *141*, 116-129.

[18] Cheng, L., Yang, S., & Li, S. (2020, March). Research and Application of Urban Road Traffic Safety Risk Evaluation Based on Regional Disaster System Theory. In *IOP Conference Series: Materials Science and Engineering* (Vol. 780, No. 6, p. 062041). IOP Publishing.

[19] Ambunda, R., & Johannes, P. (2020). Assessment of the impact of Namibian rural road characteristics on crash incidence.