MICRO LEVEL STUDY OF ACCIDENTS FROM PANTHA CHOCK TO SINGHPORA PATTAN.

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Key words: Road Accidents, Crash Patterns, Block Cracking, Hungry Surface, Potholes, Loss of Aggregates, Stripping Reflection, Cracking Ravelling ,Frost Heaving, Los Angles Abrasion Test, penetration test, ,vertical and horizontal alignment , sight distance, driver characteristics.

ABSTRACT

Road networks are the life line for the movement of people and freight and play an important role in the development of a region but road accidents cause heavy burden on financial and social setup of an economy. According to a WHO report, Road Accidents will become the **fifth leading cause of death by 2030.** Despite lot of effort from various agencies in curbing traffic accidents, they are on the rise in developed country in general and developing countries in particular. The locations in a road stretch where higher numbers of road accidents occur are called Black Spots.

Accidents in the present era are contributing to major deaths worldwide due to increase in vehicular density.it has been estimated that every 1.37 lakh people die, 3 lakh lose their limbs and 4 lakh people get injured in road accidents in India. Our country incurs a loss of 55,000 crore each year due to road accidents.

Now Government of India has declared the current decade as the decade of innovation for inclusive growth and the U.N. has declared this decade as the "Decade of Action for Road Safety 2011-2020". The focus is now being shifted on the people and services for inclusive growth and the road safety. Globally, road crashes result in fatalities of 1.3 million a year and India alone accounts for 11 per cent of the global road crashes. In the year 2013, we had about half a million road accidents resulting in 137,572 fatalities and 4, 90,000 serious injuries. This means one fatality on our roads every four minutes. The total socio-economic loss due to road accidents is estimated at 4 per cent of Gross Domestic Product (GDP).

INTRODUCTION

General:

The no of vehicle is India is shown in table 1. This data s how that total no of vehicles increased from 37 million in 19 97 to 73 million in 2004, This represents average increase of 11% of motorised two wheelers and cars and 7% for trucks and buses, However all of the vehicles remain in official rec ords but only 60 to 70% of them ply on roads. Table 2 show s the sales figure in 1997 and 2007, it also shows the annual increase of 10-12% per year

Table 3 shows the no of road traffic fatalities and the population of India from1997 to 2007.The no of fatalities increased at an avg rate of 4% per year from 1997-2003 and the rate has increased 8% per year since then, The no of fatalities per year remained 79-83 in period 1997-2003 and has since increased to 101.Traffic fatalities per million population has been taken as an indicator of the health burden of road traffic crashes on society at the city , regional, or national level ,at the individual level risk injury per trip is a consequence and the no of trips in proportional to population ,Therefore traffic fatalities per unit population can be taken as rough indicator of risk faced by individuals ,The risk of being involved in fatal road traffic crash obviously been increasing for Indians over the past few years .while some of this increase can be attributed to increase in motor vehicle per capita in India ,However

increasing vehicle ownership need not result in increased fatality rates if adequate safety measures are implemented.

Accident Situation in India: It is estimated that in the U.S.A, about 44000 persons are killed and 3 million injured every year. This figure is alarming. The accident situation is more serious in India because of the rapid growth of motor vehicles in the past few years and inadequacy of many of our roads and street to cope up with this traffic. The mixed traffic conditions prevailing on the roads in India make the matters much worse.

Table 1: Road Accidents in India, 1970-2001

(Source LR Kadyali)

Year	Road accidents	Persons Killed	Persons Injured
1	2	3	4
1970	114.1	14.5	70.1
1971	120.2	15.0	70.7
1972	122.3	16.1	76.4
1973	121.6	17.6	79.3
1974	114.3	17.3	76.7
1975	116.8	16.9	77.0
1976	124.7	17.8	82.5
1977	135.4	20.1	95.6
1978	146.3	21.8	99.5
1979	144.4	22.6	102.9
1980	153.2	24.6	109.1
1981	161.2	28.4	114.0
1982	166.2	30.7	126.0
1983	177.0	32.8	134.1
1984	195.0	35.1	156.2
1985	207.0	39.2	163.4
1986	215.5	40.0	176.4
1987	234.0	44.4	189.0
1988	246.7	46.6	214.8
1989	270.0	50.7	229.7
1990	282.6	54.1	244.1
1991	293.4	56.4	255.0
1992	260.3	57.2	267.2
1993	280.1	60.7	287.8
1994	320.4	64.0	311.5
1995	348.9	70.6	323.2
1996	371.2	7406	369.5
1997	373.7	77.0	378.4
1998	385.0	79.9	390.7
1999	386.4	82.0	375.0
2000	391.4	78.9	399.3
2001	405.6	80.9	405.2
2002	407.5	84.7	408.7
2003	406.7	86.0	435.1
2004	429.9	92.6	464.5
2005	439.2	94.9	465.2

Table 2: Motor Vehicle Registration in India

Year	**MTW***	**Cars/ Jeeps**	**Trucks**	**Buses**	**Others****	**Total**
1997	**25,729 (69)****	**4,672(13)**	**2,343(6)**	**484(1.1)**	**4,104 (11)**	**37,332 (100)**
2004	**51,922 (71)**	**9,451(13)**	**3749 (5)**	**768(1.3)**	**6,828 (09)**	**72,718 (100)**
Growth per Year (%)	**10.6**	**10.6**	**6.9**	**6.8**	**7.5**	**10.0**

*Motorised two wheelers

**Other including tractors, trailers, three wheelers and miscellaneous vehicles

***Numbers in parentheses represent row percentage

Table 3: Vehicle Sales in India

Year	Fatalities	Population(million)	Fatalities/million persons
1997	77,000	995	81
1998	79,900	971	82
1999	82,000	987	83
2000	78,900	1,002	79
2001	80,900	1,027	79
2002	84,059	1,051	80
2003	84,430	1,068	79
2004	91,376	1,086	84
2005	98,254	1,103	89
2006	105,725	1,120	94
2007	114,590	1,136	101

Table 4: Road Traffic Fatalities in India

Year	Motorised two-wheeler	Three wheelers	Cars	Commercial vehicles	Total
1997	2,885,004 (79)	216,729	396,450	169,937	3,668,120
2007	7,416,191 (78)	380,663	1,273,893	479,593	9,550,340
Growth/ Year (%)	10	6	12	11	10

1. Crash Patterns:

Details of traffic crashes are under different crash patterns, while the official road traffic fatality data may be close to actual number, the injury data are gross estimates .In this report only fatality data are used for analysis as non –fatal data may suffer from many biases.

2. Road User Category:

Official road traffic crash data do not include fatalities by road user category in India. Such data are only available from a few cities and research studies done on selected locations on rural highways .Table 4 shows traffic fatalities by category of users in Delhi and selected locations on national highways. These data show that car occupants were a small proportion of the total fatalities, 3% in Delhi and 15% on rural highways. Vulnerable road users (pedestrians, bicyclists, and motorized two-wheeler riders) accounted for 84% deaths in Delhi and 67% on highways. This pattern is very different from that obtained in all high-income countries. At present vulnerable users may likely remain the dominant mode for next few decades. The fatalities can be controlled in coming years if road safety policies put a special focus on the safety of vulnerable road users.

Table 5: Traffic fatalities by category of road user in Delhi and Selected locations on National highways

Type of road user	Delhi (2001-2005)	Highways (1999)
Truck	2	14
Bus	5	3
Car	3	15
Three-Wheeled Scooter	3	-
Motorized two-wheeler	21	24
Human and animal powered vehicles	3	1
Pedestrian	53	32
Total	100	100

3. Age and Gender:

Figure 1 shows the distribution in road traffic fatalities in 2007 by age group and gender. In 2007, 15% victims were females. This is because of low exposure and representation of women on roads. Children and 14 years and younger compromise only 6% of the fatalities, though their share in the population is 32%.The fatalities in the age groups 15-29 and greater than 60 years is similar to their representation in the population, but the middle aged groups 30-44 and 45-59 are over represented by about 70%.The low representation of childr

en (2 fatalities per 100,000 person) is curious because no of children's walk and use bicycle for travelling purpose.

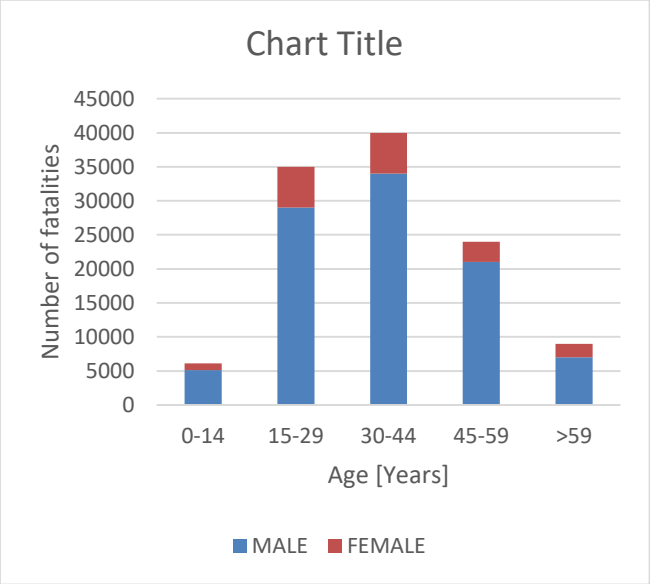


Figure 1: Distribution in road traffic fatalities in 2007 by age group and gender

4. Time of Day:

Figure 2 gives the proportion of fatalities by time of day in 35 cities of India (population>1 million) and in the rest of the country including rural roads. In the period 9:00 to 21:00 the proportions remain high and similar both in the large cities and elsewhere. In the late night hours (21:00-24:00) traffic volumes are lesser then the peak day time rates, but fatality rates do not reflect this. In early morning the traffic flow is much lower than in large cities, but relatively higher in the rest of country .We can summarize that high rates in night could be due to higher speeds, when traffic volume is higher /lower and speed of driving is higher under the influence of Alcohol .Alcohol comes from hospital study in Delhi where 29 % two wheeler drivers admitted they were drunk before crash ,in Bangalore 29% admitted crash before driving in night time ,and 35% checked were under the influence of alcohol in night time

Figure 2: Road traffic accidents (%) by time of day in 35 cities with more than 1 million population and those in rest of India.

5. Fatalities on Rural Highways:

The detailed data is not available for national and state levels for crashes' study collected on modal shares, vehicle speeds, and traffic crashes on selected locations on national and state highways around the country in late 1990's Table 4 (ref to page 11).Table 4 shows the type of road user killed on highways. The study reports that 65% trucks were part of fatal crashes ,Other study reports say majority of crashes involve buses ,and 25% victims were pedestrians, rear-end crashes comprised 40% of total crashes with increasing rate of 3.9% per year .

Various types Of Accidents:

1) Road accident: An accident (collision, overturning or slipping) which occurred or originated on a road open to public traffic resulting in either injury or loss of life, or damage to property, in which at least one moving vehicle was involved.

2) Person killed: Any person who was killed outright on the spot in the accident or whose death could be directly traced to the injury received in accident.

3) Fatal accident: An accident where one or more person(s) were killed.

4) Grievous injury accident: An accident in which person(s) were grievously injured.

Types of Collision:

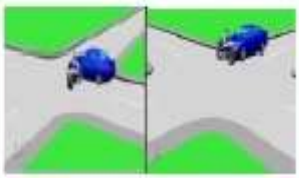
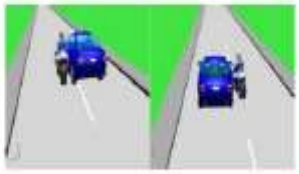
Accident Configuration	% Fatal & Serious Accidents	Illustration
1. Motorcycle single accidents: accidents which involved just one motorcycle on a rural road: run-offs, rollover on the carriageway and collisions with road restraint systems.	27%	
2. Front-side accidents in rural and urban junctions between motorcycles and passenger cars.	15%	
3. Side-side accidents in rural and urban non junctions between motorcycles and passenger cars.	5%	
4. Rear-end accidents in rural and urban non junctions between motorcycles and passenger cars.	5%	
5. Moped single accidents: Accidents which involved just one moped on a rural or urban road: run-offs, rollover on the carriageway and collisions with road restraint systems.	21%	
6. Front-side accidents in rural and urban areas (junction and non junction) between mopeds and passenger cars.	30%	
7. Head-on accidents in rural and urban areas (junction and non junction) between mopeds and passenger cars.	8%	

Figure 3: Types of collision

LITERATURE REVEIW:

1. Accident Data Analysis To Develop Target Groups For Countermeasures, By Max Cameron, Monash University Accident Research Centre:

Introduction: An important issue which emerged during the development of the 1991 Road Safety Strategy for Victoria was the need for new and better definitions of target groups for countermeasures. Research to define new targets has not kept up with the rapid implementation of countermeasures. This Report describes a major project which aimed to further develop methods of identifying target groups, and to demonstrate those methods by application to a number of key road safety problems.

The general objective was to rectify the road accident problem using mass accident data to find groups of road users, vehicles and road segments which would be suitable targets for countermeasures.

Methods: Mass accident data needs to be analysed to find target groups for countermeasures in a way which maximizes the chances that the countermeasure will be cost effective. The study has developed general principles for analysis which meet this aim. These have led to four specific methods of mass data analysis, depending on the nature of the road trauma problem being addressed in the search for countermeasure target groups, namely

- High Risk Groups (groups with high rates of accident involvement per opportunity to be involved)
- High Severity Groups (groups with high rates of severe injury per accident involvement)
- Accident Involvement Clusters(Groups involved in accidents who are homogenous on a number of factors relevant to countermeasure design and as large as possible)
- Severe Injury Clusters (groups associated with severe injury who are homogenous on a number of factors relevant to injury countermeasures design and as large as possible).

2. Examining Determinants of accident/Injury Rates: A Micro Level Study In Automobile Industry, by Hendre Rajesh war Wamanrao:

Introduction: This Research examines contribution of determinants arrived from duties of various stakeholders and literature review in predicting accidents/injuries. There has been fundamental shift in safety management research carried out in many countries and across diverse industries, which aims to measure the impact of additional dimensions on occupational safety. The traditional approach focuses of the technical aspects of engineering system and processes. Many researches in the safety management conclude that 80% accidents and injuries are attributed to unsafe human factor and remaining 20% to the technological factors and working conditions. National policy of Labour recommends conducting the researches in the field of safety, health and environment at workplace based on social and psychological factors which will help in establishing standards.

Methodology: This study is conducted in 28 of five automobile companies situated in and around Pimpri-Chinchwad Industrial Area, Pune, and Maharashtra. Total 223 Supervisors 'and 171 Managers' options are taken on the 5 point Likert scale to determine implementation level of HR practices. Similarly Awareness level is derived using responses of workers (1331 Nos. 6.5% of population) based on questions relating to above mentioned variables. FSI is calculated by combining three years FSI rates assigning 60%, 30% and 10% weight age to the most recent year. The hypothesis of the study is stated below.

H1: The higher level of implementation of HR practices will reduce accidents/injuries.

H2: Higher number of safety personal per 1000 employees will reduce accident / injuries.

H3: Higher the derived Awareness Level lower will be accidents/injuries.

H4: Accident/injury rate is negatively and significantly associated with Number of operators working in a shop.

Suggestions: As higher level of HR practices, number of safety personnel and higher awareness level are major causes in reducing accident/injury rates, employers and top management should maintain those at higher level. The continuous improvement with the participation of operators will reduce the accident/injury rates.

3. Accident Analysis and Modelling on NH-55 (India) by A.N Dehury, A.K. Patnaik, A.K Das, U.Chattraj,P Bhuyan, M. Panada:

Introduction: A very important problem in our society is Road Safety. Every Year almost 1.2 million people are killed and between 20 to 50 million are injured in road accidents. If current trends continue road traffic accidents are predicted to be third leading contributor to the global injury rate in 2020, India had earned the distinction of having more number of fatalities due to road accidents in the world. Road safety is emerging a major social concern around the world especially in India.

Results and Discussions: The study area here is divided into equal stretches each measuring 5km length, The accident was collected and plotted in Ms Excel of last ten years, The annual variation of all the accident stretches were plotted and correlated with each other , Monthly variations and hourly variations were plotted and showed that more accidents occur during peak hour traffic from 8pm to 9pm reason is Truck over speeding also drink and drive cases are most there ,Marijuana is also one more factor of that which increases reaction time and loss of control occurs, Overloading of vehicles results in uncontrolled driving resulting accidents, The vehicles involving in Fatalities are mostly truck drivers that is 6 percent, followed by 20 percent unknown drivers, 7 percent by motor cycles, 5 percent by car and jeep, 3 percent by bus buses (consume alcohol and drugs for long journey resulting increase in reaction time and loss of control).

Causes of accidents:

- Vehicle
- Driver
- Road Environment

Need and Objectives of Study:

❖ To study annually monthly and hourly variation of accidents

- To study effect of traffic volume and density.
- To study maintenance of road surface and shoulders.
- To develop an accident prediction Model based on Density and road Condition.

4. Accident Study On National Highway-5 Between Anakapalli To Vishakapatnam By B.Srinivas Rao, E.Madhu, Santosh Jalihal, T.S reddy:

Introduction: In an area of traffic safety 'Accidents are not natural but they are caused' is a common cliché. Thus, if the accidents are caused by some, surely remedial of measures can be developed and implemented to the extend feasible. Analysis Of previous accidents shows that 66% of accidents occur due to human error and 33% occur due to road parameters such as road and vehicle interactions, other road user and environment factors. India has road network of 3.3 million kilometres consisting of all kinds of roads. National Highway constitutes 2% of the total road length which carries 40% of passenger vehicles and 85% of goods carrier, accounting 20% more accidents then other roads.

Accidents, tragically, are not often due to ignorance, but are due to carelessness thoughtlessness and over confidence. William Haddon had pointed out that road accidents were associated with numerous problems each of which needed to be addressing separately. Human Vehicle and Environment factors play roles before, during and after trauma event. Accidents therefore can be studied in terms of agent host and environmental factors and epidemiologically classified into time, place and person distribution.

Results and Discussions: The study on accidents is along Anakapalli to Vishakapatnam where various traffic like urban ,sub-urban and regional traffic pledges daily , Development alongside the highway indicates the land use on both sides of the highway is mixed with urban and rural and mainly consists of commercial residential and industrial establishment, From the survey it was concluded that the road stretch under consideration carries highly mixed traffic of both fast moving vehicles and slow moving vehicles. The average daily traffic (ADT) varies from 11130 (00 kms) vehicles to 64400 (371 kms) vehicles .The higher ADT was observed within the urban areas and as expected the ADT decreased on semi urban/ rural stretch of highway.

To access the accident scenario, the data was collected from nearby police stations and it was seen that 376 accidents were occurred in 2002 on NH-5 , Further analysis of data shows that 66 persons were killed and about 389 were injured in the same year ,A close look on the total accidents on all types of roads in the vishkapatnam city has revealed that the accidents on NH-5 (study stretch) alone are around 34% which is significant part and a major reason for concern .The analysis show that accidents occurring during day time (56%) is slightly more then what is happening in night time, whereas fatal accidents were slightly more during night hours ie about 58% ,The fatality on NH-5 is about 19 percent. The most frequent accident configurations involved two wheelers (35%), followed by goods vehicles (23%), cars (17%), autos (15%), Buses (9%) and unknown vehicles (1%)

Conclusions: From the accident analysis, it can be concluded that the accidents are occurring almost uniformly during day as well as night hours but severity index is very high into the night hours. This may also be attributed to poor illumination and absence of warning measures such as delineation and retro-reflective material. It can also be seen from the analysis that two wheelers and trucks contribute to the majority of the accidents. This is mainly because of discontinuous service roads leading to wrong side movement of traffic in avoid long turns. Poorly designed access road from the adjacent areas of highway is leading to frequent conflicts between local traffic and through traffic.

5. Road Accident Analysis of Patna city by Sanjay Kumar Singh, Ashish Mishra:

Introduction: Urban transport facilities are deteriorating from couple of years in India. The public transport lacks behind development in quality and quantity as per traffic demand, this is the reason of increase in personalised transport such as two wheelers and IPT is growing rapidly. Roads and Footpaths today are heavily encroached by parked vehicles, hawkers, forcing pedestrians to walk on

road resulting their life in risk of accident ,besides this the roads of Indian cities are substandard ,lane marking and traffic signs are usually missing, and intersections often require geometric corrections.

As you would expect one of India's poorest and densely populated city Bihar's capital Patna, is noisy, crowded, polluted, and typically chaotic. The existing Road Network in city is inadequate. Functionally the roads do not have and hierarchy as individual road changes its characteristics after a short distance. A t present around 4.6 percent of the total development area is devoted to roads which are much below the desired level; Moreover Vehicle population Growth is quite high, with just 4384 registered vehicles in 1981 to 294164 in 2001, and increase around 67 fold in a time span of two- decades. Further the lack of effective mass transport system has given rise in tremendous increase in IPT Models and Personalised Vehicles.

Results and Discussions : Many developing countries including India have a serious road accident problem. Fatality rates (defined as, road accident deaths per 10,000 vehicles) are quite high in comparison to developed countries. The road accidents in India from 1991 to 1998 have increased at a rate of 4.4percent per annum while the population of the country has increased by 1.92 percent per year , The study reveals that trucks and buses are responsible for highest number of accidental deaths,25.7 and 17 percent causalities happened due to trucks and buses, respectively.

Discussing some Accident Issues of our country, let's move to Patna. The existing Circular pattern road is of linear type. At present 4.6% of the total developed area is devoted to roads which are much below the minimum requirement for a city. From the year 1996 to 200, total number of accidents has decreased from 281 to 241 mainly due to reduction in non-fatal accidents. There were 202 non-fatal accidents during 1996 which has gone down to 133 in 2000, a reduction of around 34% has been observed, In a quantitative terms , total number of fatal accidents has increased by around 37% in the span of just four years, from 79 in 1996 to 108 in 2000. The accident severity index shows that persons killed per 100 accidents have increased over the years from 29 in 1996 to 45 in 2000; it seems to be lack in quality medical facilities of city. The fatality rate of Patna per 10,000 vehicles shows that there is increase on 3.59 in 1996 to 3.85 in 2000. Its noted fatality rate of Patna is well below the fatality rate on India, because of density of slow moving vehicles which reduces the average speed of vehicles and severity of accident a well.

Conclusion : The problem of deaths and injuries as a result of road accidents in Indian cities is serious enough to demand attention of respective administrative authorities. Apart from the humanitarian aspects of reducing road deaths and injuries, a strong case can be made of reducing road crash deaths and economic grounds alone. It is estimated that the total economic loss due to road accidents is of the order of Rs. 60 billion each year in India.

Patna is also suffering from the problem of deaths and injuries on its roads. The total number of fatal accidents as well as related fatality in the city is increasing over the years. Persons killed per 100 accidents are alarmingly high as 45 during the year 2000. Although fatality rate is low in Patna, fatality risks are higher than Indian average. Pedestrian deaths as a percentage of all road fatalities are extremely high in the city. During the recent years, they constitute more than 90% of all road fatalities.

Analysis of Accident Data:

i. Accident Rate per Kilometre: On this basis the total accident hazard is expressed as the number of accidents of all types per km of each highway and street classification.

R = A/L

Where,

R = total accident rate per km for one year

A = total number of accident occurring in one year

L = length of control section in kms only)

ii. Accident involvement Rate: It is expressed as numbers of drivers of vehicles with certain characteristics who were involved in accidents per 100 million vehicle-kms of travel

R = N x 100,000,000 /V

Where,

R = accident involvement per 100 million vehicle-kms

N = total number of drivers of vehicles involved in accidents during the

Period of investigation

V = vehicle-kms of travel on road section during the period of investigation

iii. Death rate based on population: The traffic hazard to life in a community is expressed as the number of traffic fatalities per 100,000 populations. This rate reflects the accident exposure for entire area.

R = B x 100,000 / P

Where,

R = death rate per 100,000 population

B = total number of traffic death in one year

P = Population of area

iv. Death rate based on registration: The traffic hazard to life in a community can also be expressed as the number of traffic fatalities per 10,000 vehicles registered. This rate reflects the accident exposure for entire area and is similar to death rate based on population.

R = B x 10,000 / M

Where,

R = death rate per 10,000 vehicles registered

B = total number of traffic death in one year

M = Number of motor vehicles registered in the area

Causes of Road Accidents:

- **Road Users:** Excessive speed and rash driving, violation of traffic rules, failure to perceive traffic situation or sign or signal in adequate time, carelessness, fatigue, alcohol, sleep etc.
- **Vehicle:** Defects such as failure of brakes, steering system, tyre burst, lighting system.
- **Road Condition:** Skidding road surface, pot holes, ruts.
- **Road design:** Defective geometric design like inadequate sight distance, inadequate width of shoulders, improper curve design, improper traffic control devices and improper lighting,.
- **Environmental factors:** Unfavourable weather conditions like mist, snow, smoke and heavy rainfall which restrict normal visibility and makes driving unsafe.
- **Other causes:** Improper location of advertisement boards, gate of level crossing not closed when required etc.

METHODOLOGY:

1.1. ROAD AND ITS EFFECTS ON ACCIDENTS

I. I . Pavement Surface:

Accidents are most common in this time of era due to rapid increase of traffic and the carriageways are not indeed meet the demands of this heavy traffic, Keeping the view of all aspects, The study of Accidents are carried out on the Stretch from (Pantha Chowk to Singhpora Pattan on NH1A), further starting our work we are going to first focus on the Pavement and study the defects and testing the material Used in this pavement, Following below mentioned defects were found and analysed ,further the Results and Discussions were done on this for future better of road.

a) Alligator Cracking or Fatigue Cracking
b) Block Cracking
c) Hungry Surface
d) Formation of Corrugations
e) Depressions
f) Fatty surface or Bleeding
g) Formation of Potholes
h) Loss of Aggregates
i) Stripping
j) Reflection Cracking
k) Ravelling
l) Frost Heaving

m) Longitudinal Cracking

RESULTS AND DICSCUSSION

1 Aggregate Crushing Value Test:

Total weight of the sample (A) taken= 4.1kg

Weight of the sample (B) passing through 2.36 mm sieve after application of load=0.50kg

The Aggregate Crushing Value =B/A × 100

=0.50/4.1 × 100

=0.12

DISCUSSION

BIS and IRC have certified that the crushing value of aggregates to be used in cement concrete pavement should not exceed 30%. The standard size aggregates to be used crushing strength test is the fraction passing through 12.5 mm sieve and retained on 10 mm sieve. When aggregates having size larger than 12.5 mm are used, it will give higher crushing strength value and use of aggregates having size less than 10 mm will give low aggregate crushing value.

2 Penetration Test:

The difference between initial and final penetration reading is taken as penetration value. The mean value of not less than three consistent penetration measures is reported as penetration value.

Bitumen Sample	Initial Reading	Final Reading	Penetration (mm)
Test 1	210	272	62
Test 2	272	340	68
Test 3	340	404	64
		Mean	65

DISCUSSION

It is concluded that penetration value is influenced by various factors such as:

- Temperature at which sample is poured
- Size of the penetration needle
- Weight to be placed on the needle
- Temperature at which test is to be performed
- Period of cooling the sample

If the temperature at which test is being performed is higher than 25*C, the penetration value obtained will be much higher. If the weight of needle assembly is higher than the specified value of 100g, then the penetration value so obtained will be higher. Higher pouring temperature may cause hardening of bitumen and lead to lower penetration value. The duration of releasing penetration needle should be equal to 5 seconds.

2. Los Angles Abrasion Test:

Weight of aggregate sample taken (W1) = 2.5kg

Weight of aggregate sample retained (W2) = 1.60kg

Weight of aggregates passing through 1.70 mm IS sieve =W1-W2

=0.9kg

Los Angeles Abrasion Value = (W1-W2)/W1 × 100

=0.9/2.5 × 100

=36%

DISCUSSION

The aggregates needed to be used in surface course of WBM roads should have maximum 40% Los Angeles Abrasion value. This test is used to identify the quality of aggregates to be used in construction of a particular pavement. It is a suitable test to check the hardness of aggregates. This is the test where resistance to abrasive action and impact can be determined simultaneously, due to presence of abrasive charge.

3. Usual Causes Of Pavement Failure:

- Defective materials used in construction of pavement
- Poor quality control and in-appropriate method of construction

- Stagnation of water in subgrade due to inadequate drainage conditions
- Rapid increase of traffic volume in excess of design capacity
- Settlement of foundation of the embankment of the fill material
- Environmental factors including heavy rainfall, soil erosion, high ground water table, frost action etc

Future Scope and Recommendation:

A distressed pavement requires maintenance when failures are severe. Maintenance measures constitute fresh material installation over the pavement to rectify the existing problem. When a pavement is properly designed keeping in consideration future distresses that may occur due to various reasons, the life cycle cost of pavement reduces and it behaves well during its service life, The wear tear of the vehicles will be decreased which results in safe vehicle movement and the pavement surface will be so good that uneven pot holes ,longitudinal cracks and many more defects results in sudden braking application , tilting of speedy vehicles, causing mishaps on roads and results in Fatal and Non- Fatal Accidents.

Possible surface maintenance measures for some pavement failures are as under:

- Block cracking: Application of new bituminous coat
- Corrugation : Scarification of elevated part by use of mechanical blades and rolling
- Depression : To apply profile corrective course
- Hungry surface : Application of slurry seal or fog seal
- Loss of aggregates : Application of seal coat, surface dressing or fog coat
- Pot hole : Patching or partial re-construction when pot holes are severe
- Rutting : Milling of protruded portion and profile corrective course laying
- Stripping : Replace the affected part with new one i.e. fresh mix

II. Sight Distance:

The safe and efficient of vehicles on roads depends, among other factor on the road length on which an obstruction, if any, becomes visible to driver in the direction of travel. In other words feasibility to see ahead or the visibility is very important for safe vehicle operation on highway.

Sight distance required by drivers applies to both geometric design of highways and fro traffic control.

Three sight distance situations are considered in design:

a) Stopping or absolute minimum sight distance.
b) Safe overtaking and passing sight distance.
c) Safe sight distance for entering into uncontrolled intersections.

The standards should satisfy the following three conditions:

i. Driver travelling in the design speed has sufficient sight distance or length of road visible ahead to stop a vehicle, in case of any obstruction on the road ahead without any collision.
ii. Driver travelling at the design speed should be able to safely overtake, at reasonable intervals, the slower vehicles without causing obstructions or hazard to traffic of opposite side.

Driver entering an uncontrolled intersection has sufficient visibility to enable him to take control of his vehicle and to avoid collision with another vehicle.

The sight distance on road to a driver depends at any instance depends upon:

1. Features of the road ahead
2. Height of drivers eye above the road surface
3. Height of the object above the road surface.

The distance within which a motor vehicle can be stopped depends upon the factors listed below:

1. Total reaction time of driver
2. Speed of Vehicle
3. Efficiency of brakes
4. Frictional resistance between the rod and the tyres and
5. Gradient of the road ,if any

III. Vertical Alignment:

The vertical Alignment should be designed with a provision of suitable shock-proof vertical curves. The vertical curves should be made to blend homogenously with the horizontal curves. It is good practice to make a vertical curve to be fully contained with the horizontal curve.

Since my case study is between Pantha Chowk to Singhpora Pattan there are no such curves where the alignment needs to be at its perfection , But the curves which are there are perfectly aligned and there is no accidents because of this very cause, So this case of study can be neglected for the cause of accidents on this stretch .

IV .Superelevtion:

In order to counteract the effect of centrifugal force and to reduce the tendency of the vehicle to overturn or skid, the outer edge is raised with respect to the inner edge, thus providing a transverse slope throughout the length of horizontal curve. For a Vehicle to negotiate any curve at the desired speed, the road should have adequate superelevation. Deficiency in super elevation can cause serious effects.

The road from Pantha Chowk to Singhpora Pattan is plain terrain with no long curves ,Therefor superelevation can be neglected here for a cause of accidents, But at some places the superelevation is give ,like near HMT Shaltang there is a superelevation ,but the design of that superelevation is totally satisfactory as per the information given by SOMA authorities for design speed of 90 kmph for Cars and 60 kmph heavy duty vehicles , So there is no concern of superelevation on this stretch of NH1A for cause of accidents .

V. Narrow Bridges and Culverts:

Narrow Bridges and culverts can cause serious accidents, especially when the roadway is wide. Widening of such narrow structure should be undertaken if accidents are frequently caused at the location. Posting proper warning signs can also save ugly accidents

Since we are discussing about the narrow bridges and culverts ,Yes this is the cause of accident on this Stretch , there are many culverts on this highway where no warning signs are provided for information ,there is a narrow bridge after crossing HMT where most of the accidents happens ,But thankfully government is working on that right now ,its is prone accident area, So I suggest that the culverts or we can say under passes should be provided with warning signs ,So that coming vehicles can reduce their speed ,further collisions can be minimized.

1.2. VEHICLE AND ITS EFFECT ON ACCIDENTS

I. Braking System:

Brakes are needed to bring the vehicles to stop whenever a driver comprehends immediate danger. A good braking system should achieve the objective without resulting in the driver's loss of directional control of the vehicle. The interaction between the tyre and the road surface governs largely the ultimate braking performance of vehicles, although factors such as the braking system itself are significant. A detailed treatment of the subject of the interaction between the tyre and the road surface is given under section of Skidding.

II. Vehicle Lighting System:

The lighting system of vehicles consist of headlights, (driving main beam or a dipper beam), side lamps, parking lights, rear lights, direction indicators and stop lamps. An efficient and reliable system of lighting the vehicle is desirable for averting accidents.

The headlights should perform two functions: to provide a main beam for enabling the driver to see the road ahead for sufficiently long distance and to provide a dipper beam which must avoid glare to the opposing traffic, while at the same time providing sufficient visibility to the driver. Glare is a serious problem when two vehicles approach each other and can blind the drivers vision. It should be avoided by

properly designing the dipper beam. Polarized headlights offer interesting break- through in this regard.

Rear lamps give indication to the driver flowing a vehicle about the presence of a vehicle in front him. There efficient design and functioning can avert front to rear collisions

Direction indicators give adequate notice of the intensions of the driver to turn or to stop. The usual type of direction indicators are the flashing type. The position, type and color of the indicators should be such as to visible to the flowing drivers easily. The direction indicators are usually amber in color, and preferably they should be mounted at the side of the vehicle approximately at the level of the driver's eye. Semaphore arms may not be fully suitable to large vehicles, and in such cases extra amber lights may be installed at the rear.

III. Vehicle Body and its features:

In the design of motor vehicles for safe driving, an aspect which has been receiving increasing attention is the features and dimensions of the vehicle body. Extensive work has been done in regard by Howards school of public health.

Factors that need to be considered are:

a) The shape of the dimensions of the driver's seat.
b) Arrangement of dials on the dashboard.
c) Positioning of controls in relation to the driver's seat.
d) Visibility of the driver from the seat.
e) Noise levels in the vehicle.
f) Concentration of carbon monoxide inside the vehicle.

IV. Tyres:

Tyres are an important aspect of vehicle design from the point of view of safety. The performance of tyres relative to puncture, blow outs, vulnerability, to damage by sharp objects, braking and road surface characteristics are areas where considerable research has taken place. Skidding is a phenomenon which is governed by interaction of the tyre, brakes, road surface, speed and the wetness of road surface. Because of its extreme importance in traffic accident prevention, thus aspect is treated in greater deal elsewhere.

V. Vehicle Inspection and Maintenance:

Frequent Inspection of vehicles and testing them is an important requirement. Such periodic tests identify the mall functioning of the important parts and facilitate easy maintenance. This assumes added significance in India where old vehicles are used to there maximum and their life is made to stretch to the last. Most important items that need periodic inspection are the brakes, lightening system and Steering Mechanism. Additional features that could form part of routine inspection could be the tyres, Suspension system and the windscreen. Legislative enforcement of an effective inspection system will be yield good results in safely. Some countries have made compulsory for testing the vehicle periodically, U.K being one of them. Some states in USA has also provision for compulsory periodic testing. The Motor Vehicles Act in INDIA contains provision for the states to enact rules to require [periodical testing and inspection of vehicles.

1.3. DRIVER AND ITS EFFECT ON ACCIDENTS

I. I. Driver:

The driver is the key factor in most of the accidents. He is the human element in charge of the machine. He drives it, steers it, accelerate it, decelerate it, brakes it and stop it. As such a study of drivers behavior offer a very deep insight in the cause of accidents and provides a valuable guidance for avoidance of accidents.

II. II. Driver judgment, Skill and Emotional Behavior:

When a driver perceives a danger, he immediately reacts to it. The time it takes to comprehend the danger depends upon his individual mental makeup and is called perception time. Once the information is fed to him, Sometime must elapse before he can react to the stimulus. This time is called its reaction, the perception time and reaction time vary from driver to driver.

III. Age of Drivers:

It is generally Observed that young drivers cause more accidents than that would be caused by mature diverse with considerable driving experience. Similarly, Old drivers also seem to cause more accident than middle aged driver. The minimum accident are caused by middle aged group, say 40-50 years, while inexperience is cause of higher accident rates amongst the younger age group, physical illness leads to higher accident amongst to old age group.

IV. Sex of the Drivers:

It is generally seen that males have more accident and conviction than females, but when miles driven are taken into account this difference essentially disappears.

V. Marital Status:

Generally speaking, married persons (both male and female) have been observed to be better drivers.

VI. Alcohol and Drugs and the Drivers:

A subject of research on road safety that has received a large measure of attention and rightly so is the effect of alcohol and drugs on the driving capability. The judgment and scale of the driver can be exercised only so long as he is sensory faculties are functioning unimpaired. Alcohol and drugs are known to be positively dangerous in this respect.

Blood Alcohol Concentration and Accident Risk

Blood Alcohol concentration	Accident Risk
0-20 mg/100 ml	In some subjects there is deterioration in the special skills resembling driving.
20-40 mg/100 ml	Progressive deterioration in a special skill is noticed.
40-50 mg/100 ml	Significant increase in accident involvement is noticed as the blood alcohol level approaches and passes 50 mg/100 ml.
50-80 mg/ 100 ml	Overall accident risk increases rapidly. At a concentration of 80 mg/ 100 ml, Alcohol emerges as the dominant factor in accident.
Greater than 80 mg/ 100 ml	The accident probability of drivers at a blood alcohol concentration of 100 mg/ 100 ml is 6 or 7 times that of drivers with less than 10 mg/ 100 ml

Uses of Accident Data:

- ✓ **Engineering Uses**:
  - Determining the adequacy, size, shape and visibility.
  - In determining justification for traffic control device
  - Planning pedestrian and safety features.
  - Determining speed zoning and speed control.
  - Precaution regarding parking
  - Safe and efficient lighting
  - Redesigning intersection
  - Improving horizontal and vertical alignment
  - Deficiency of rite of way.
- ✓ **Enforcement uses:**
  - Directing enforcement effort
  - Controlling pedestrian behavior
  - Safe and efficient operation of traffic control device
  - Enforcing vehicle inspection measure
  - Parking regulation
- ✓ **Administrative and policy issue:**
  - Initiating and administering traffic safety program
  - Evaluating the success of traffic safety program.
  - Determining accident cost.
  - Amending the legislative measure.
- ✓ **Educational Uses**:
  - Planning and organizing school safety school educational program.

- Planning and organizing driver safety education al program.

✓ **Uses for motor vehicle administrator:**

- Reviewing the procedures for licensing driver.
- Reviewing the procedures for registration and licensing of vehicles.

✓ **Requirement of Accident Data:**

- If the accident records are to be used, they should be accurate, comprehensive.
- Accident must be reported on a standard form so that uniform procedure is followed.
- The term describing accident must be accurately defined
- The facility of being analyzed by a computer, the data should be coded properly.

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