RESEARCH ARTICLE OPEN ACCESS

Analysis Of Road Accidents On Nh 4 From Walaja Tollgate To Poonamallee On The Year Of 2015 & 2016

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Abstract:

The main aim of this paper is to analyze the road accidents from Walaja tollgate to Poonamallee. Analysis shows that the distribution of road accidental deaths and injuries in India varies according to age, gender, month and time. Age group 30-59 years is the most vulnerable population group, though males face higher level of fatalities and injuries than their female counterparts. In general, while in many developed and developing countries including China, road safety situation is generally improving, India faces a worsening situation. Without increased efforts and new initiatives, the total number of road traffic deaths in India is likely to cross the mark of 250,000 by the year 2025. There is thus an urgent need to recognize the worsening situation in road deaths and injuries and to take appropriate action. With the support and cooperation of National Highways Authority of India (NHAI) Kanchipuram Division, we conducted detailed investigation of accidents occurring on the National Highway 4 over a 110 km stretch.The primary objective was to collect and analyze NH-4 based traffic crash data to begin to create a sound basis for decision making for improving safety on India's roadways.A secondary objective was to establish a standardized methodology using economical tools for collecting and analyzing crash data, specific to Indian roads. The collected accident data was categorized first by single or multiple vehicle crash and next by accident type based on the first accident event. The data was then analysed identify accident (crash-type, location-time), vehicle (vehicle-type , pre-crash condition) , occupants and other contributing factors , and environmental factors associated with injury severity .

Findings show that front-to-rear collisions,mainly involving trucks and buses,caused due to slowing down,stopping,breaking down or overtaking.

Keywords **— Collection of Data,Analysis of data, Identify accident (crash-type, location-time), vehicle (vehicle-type , pre-crash condition).**

I. INTRODUCTION

- The Fatalities and injuries resulting from road traffic accidents are a major and growing public health problem in India.
- Traffic accidents have now earned India a dubious distinction; with nearly 140,000 deaths annually, the country has overtaken China to top the world in road fatalities.
- Without increased efforts and new initiatives, the total number of road traffic deaths in India is likely to cross the mark of 250,000 by 2025.
- The analysis shows that during the last two years, road accidental fatalities in Tamilnadu have increased at the rate of 5% per year. while the population of the country has increased only at the rate of 1.4% per year.
- It is also found that the distribution of road accidental deaths and injuries varies according to age, gender, month and time.
- Among people of all age groups, people of economically active age group of 30-59 years are the most vulnerable.
- However, if we compare gender-wise fatalities and accidents, we found that the males accounted for 85.2% of all fatalities and 82.1% of all injuries in 2016.
- Moreover, road accidents are relatively higher in May-June and December- January which

shows that extreme weather influences the occurrence of road accidents.

- Accidents remain relatively constant and high during 9 AM - 9 PM and variable but low during mid-night and early hours of the day.

- Road accidents cannot be totally prevented but by suitable traffic engineering and management the accident rate can be reduced to a certain extent. For this reason systematic study of traffic accidents are required to be carried out.

- Proper investigation of the cause of accident will help to propose preventive measures in terms of design and control.

OBJECTIVE OF ACCIDENT STUDIES:

- To study the causes of accidents and suggest corrective measures at potential location.
- To evaluate existing design
- To carry out before and after studies and to demonstrate the improvement in the problem.
- To initiate in-depth traffic accident data collection with the support of the police.
- To establish a methodology and develop a framework for a comprehensive accident database for road accidents in India.
- To understand the nature of accidents and identify causes / problems along NH 4.
- To provide recommendations based on this study for reducing accidents on NH 4.
- Enhancing the awareness of road safety needs among policy makers and scheme designers.
- To minimize the number and severity of accidents that will occur on the new or modified road
- To avoid the possibility of the scheme giving rise to accidents elsewhere in the road network.
- To enable all kinds of users of the new or modified road to perceive clearly how to use it safely.

THE AREA OF STUDY

A 110 km stretch of the NH 4 between Walaja and Poonamalle in Kanchipuram & Chennai District was selected for the study.

- The entire stretch is a 4 lane divided highway. Road surface is asphalt.
- The divider is about 5 m in width and is usually planted with large bushes and plants, except at U-turns, intersections and bridges.
- Potholes were observed in some of the places along the highway.
- Speed limit at some sections is 60kmph and 80kmph at some sections.
- Lighting is provided only at intersections/junctions and some areas such as truck lay bays. Otherwise a good part of the highway is not lit.

The highway infrastructure also includes:

- 2 Toll booths.
- 3 Truck Lay-Bys.
- Bus stops (counting both directions).
- 10 petrol pumps.

METHODOLOGY

1.1 Accident Intimation

1.2 Scene Examination

1.3 Vehicle Examination

Researchers examined crash vehicles on-scene and/or after it was towed to the side of the road. This examinationinvolved:

- Recording direct and indirectdamages.
- Determination of Collision Deformation Classification (CDC) for cars and SUVs or Truck Deformation Classification (TDC)

fortrucks.

1.4 Injury Coding & Correlation.

1.5 Profile Of Accidents Investigated.

Over the 90 days of this project, we investigated 32 accidents. The accident data parameters are provided. Figure 4 gives the distribution of accidents by level of injury noted at the time of accident.

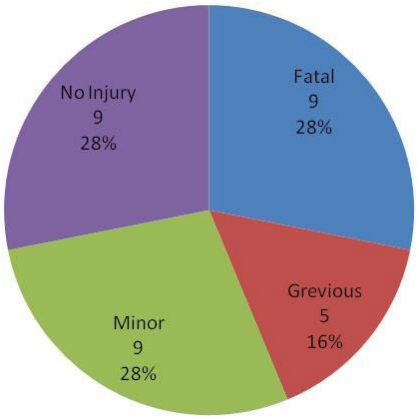

Figure 1.1(a) Distribution of accidents by injury Level.

The distribution of accidents by time is shown in figure 1.1(b) 21 of the 32 accidents (65.6%) took place between 00:00 and 09:00 hours. Maximum number of accidents recorded (10) was between 03:00 to 06:00hours.

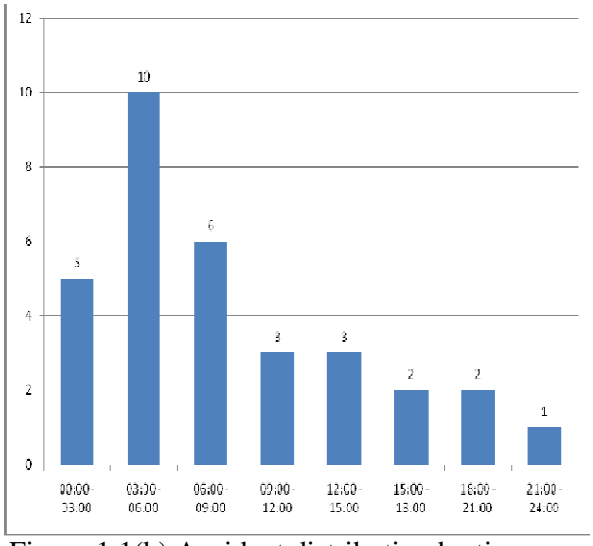

Figure 1.1(b) Accident distribution by time

Figure 1.1(c) shows the type and number of road users involved in the 32 accidents investigated. Trucks form the majority vehicle type (45.61%) followed by passenger cars(15.79%).

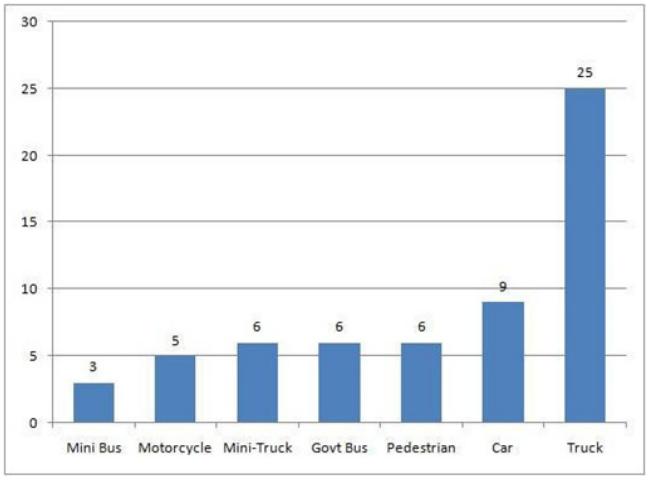

Figure1.1(c) Accident distribution by road user type.

II. ACCIDENT ANALYSIS

2.1 Accident Data Collection:

The accident data collection is the first step in the accident study. The data collection of the accidents is primarily done by the police. . Motorist accident reports are secondary data whicharefiled bymotorists themselves.the data to be collected should comprise all of these parameters:

1. General - Date, time, person involved in accident, classification of accident like fatal, serious, minor
2. Location - Description and detail of location of accident.

2.2 Accident investigation:

The accident data collection involves extensive investigation which involves the following procedure:

1.Reporting: It involves basic data collection in form of two methods:

(a) Motorist accident report - It is filed by the involved motorist involved in all Accident fatal or injurious.

(b) Police accident report - It is filed by the attendant police officer for all accidents At which an officer is present. This generally includes fatal accidents or mostly
Accidents involving serious injury required emergency or hospital treatment or whichhave incurred heavy property damage.
2. At Scene-Investigation: It involves obtaining information at scene such as measurement of skid marks, examination of damage of vehicles, photograph of final position ofvehicles, examination of condition and functioning of traffic control devices and other road equipment's.
3. Technical Preparation: This data collection step is needed for organization and interpretation of the study made. In this step measurement of grades, sight distance, preparingdrawing off after accident situation, determination of critical and design speed for curves is done.
4. Professional Reconstruction: In this step effort is made to determine from whateverdata is available how the accident occurs from the available data. This involves accidentreconstruction which has been discussed under Section No.7 in details. It is professionallyreferred as determining behavioral or mediate causes of accident.
5. Cause Analysis: It is the effort made to determine why the accident occurred from thedata available and the analysis of accident reconstruction studies.

2.3 Accident data analysis

The purpose is to find the possible causes of accident related to driver, vehicle, and roadway.
Accident analyses are made to develop information such as:
1. Driver and Pedestrian - Accident occurrence by age groups and relationships of accidents to physical capacities and to psychological test results.
2. Vehicle - Accident occurrence related to, characteristic of vehicle, severity, location and extent of damage related to vehicles.
3. Roadway conditions - Relationships of accident occurrence and severity of characteristics of the roadway and roadway condition and relative values of changes related to roadways. It is important to compute accident rate, which reflects accident involvement by type of highway.These rates provide a means of comparing the relative safety of different highway and street system and traffic controls. Another is accident involvement by the type of drivers and vehicles associated with accidents.

Month	Dates	Year	No. of Accidents
January	19,20,22,25,29,30,31	2015	15
February	3,5,11,12,15,16,17,20,22,25,26	2015	12
March	1,2,4,7,8,10,16,17,20,22,29	2015	37
April	1,6,8,10,18,19,21,25	2015	38
May	2,9,11,13,18,21,29	2015	41
June	No Safe Date	2015	48
July	No Safe Date	2015	55
August	No Safe Date	2015	28
September	No Safe Date	2015	56
October	No Safe Date	2015	39
November	No Safe Date	2015	48
December	No Safe Date	2015	43

2.3 Safe Dates in the year 2015 & 2016

Table 2.1 Accident Data Rate 2015

The above table shows that the dates mentioned are only dates that no accident occurred. In the table for the months June to December every day at-least two accidents had occurred. As seen in the table, we came to conclude that in 2015 most of the accidents are occurred in September and then July.
From June to December none of the day had a nil accident rate.

2.4 Causes of Accidients:

Figure 2.1 (a) poth holes

Figure 2.1 (b) no greeneery

Figure 2.1 (c) person crossing in wrong route

Figure 2.1 (d) no marking on sideways

Figure 2.1 (d) person crossing in wrong route

Figure 2.1 (e) person crossing in wrong route

Figure2.1(f)persontalking on the phone while driving

III DETAILED ANALYSIS

To get a deeper insight into the accidents, the accidents were categorized for analysis as shown in figure 3(a). The accidents are first divided into Multiple- Vehicle and Single-Vehicle Accidents. They are then sub-divided as per the type of accident based on the 1st accident event.

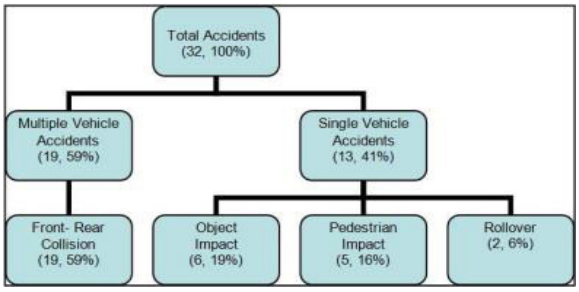

Figure 3(a): Breakup of accidents for analysis(October 2015)

Front-Rear collisions account for 59% of the accidents investigated. If pedestrian impacts are excluded that front-rear collisions comprise 70% of accidents investigated. This is the only Multiple-Vehicle type of accident that has been observed by researchers on the NH 4. Head-on collisions were not observed as this 4 lane highway has a wide center median separating traffic flowing in opposite directions. A look at the injury severity distribution in figure-3(b) gives a clearer indication of the injury contribution of each type of accident event. Front-Rear Collisions and Pedestrian Impacts dominate fatal accidents, followed by Object Impacts, while Rollovers involved no injuries in this study.

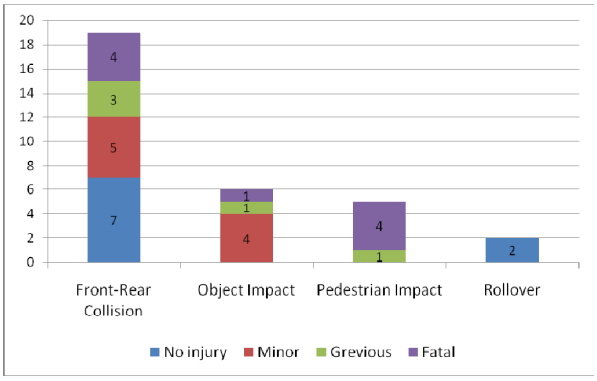

Figure 3(b)Injury severity distribution by type of accident

3.1 FRONT - REAR COLLISIONS

Based on the study of 19 Front-Rear collisions, the following are some important observations:

- Of the two vehicles involved, one is a "leading" vehicle while the other is a "following" vehicle.
- The "leading" vehicle suffers either a rear impact (13 out of 19) or a side impact (6 out of 19), while the "following" vehicle suffers a frontal impact.
- The "leading" vehicle is usually the initiator (but not necessarily the cause) of the accident, while the "following" vehicle is usually the victim of the accident.
- The "leading" and "following" vehicles are studied separately to understand their composition and effects on injury severity.

3.2 STOPPED:

Leading vehicle has stopped/parked for a reason and following vehicle crashes into it. Stopping usually occurs due to the driver/occupants deciding to take a nap or to relieve themselves during a long drive. A facility or area developed to help bus passengers and truck drivers to rest, and information regarding these areas provided well in advance to road users, can help in reducing these accidents.

3.3 Breakdown:

Leading vehicle is broken down/being repaired when the following vehicle crashes into it. Usually tyre punctures are observed and occasionally engine problems. This condition is very dangerous, as occupants are standing outside and close to the vehicle. Breakdown of trucks (need for repairs) was usually due to tyre punctures. Trucks may stop alongside the road for this, but there were instances when trucks were observed being repaired in the middle of the road without proper indications or warning signals.

3.4 BREAKDOWN:

While overtaking the following vehicle, the leading vehicle immediately gets in the path of the

following vehicle or slows down in front of it, and the following vehicle crashes into the leading vehicle. The small sample of overtaking accidents does not provide enough information to analyze overtaking conditions in detail. In general it was observed that lack of lane disciple, no signaling by drivers, overtaking from the left side and high speeds caused these accidents. Fatal accidents occurred when there was a large difference in the size of the vehicles involved. In case of motorcycles, helmet usage would seem critical to avoid fatal accidents due to head injuries; however, as noted, more overtaking accidents need to be studied, and in greater detail, to allow conclusions as to the exact conditions and nature of theseaccidents.

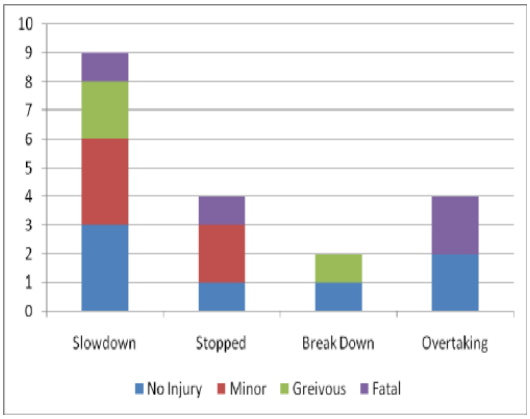

Figure 3 (c) Accident distribution of pre-accident condition of leading vehicle and injury severity of the accident.

Figure 3(c) shows the leading vehicle condition and the corresponding injury severity of the accident observed. “Slow down” condition has the maximum contribution to injuries, followed by “overtaking”, “stopped” and “breakdown” conditions.

The vehicle types involved in each pre-accident condition is shown in Figure 3(d). Trucks form the majority and slowdown condition is highest compared to other pre-accident conditions.

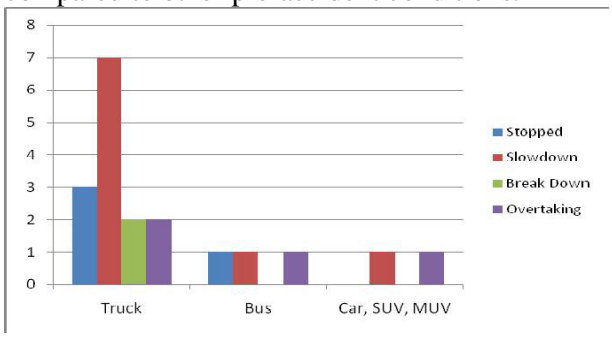

Figure 3(d) Leading vehicle type and pre-accident condition.

3.5 SAFETY MEASURES:

The ultimate goal is to develop certain improvement measures to mitigate the circumstances leading to the accidents. The measures to decrease the accident rates are generally divides in to three groups engineering, enforcement and education. Some safety measures are described below:

- Visual Guidance to the driver
- Road Reconstruction
- Channelization
- Road Sign
- Road markin
- Guide posts with or without reflector
- Guard rail
- Driver reviver stop
- Regular accident studies

3.6 Safety Measures related to Education

The various measures of education that may be useful to prevent accidents are enumerated below.

- Education of road users
- Safety Drive
- Safety Audit

IV RESULT AND DISCUSSIONS

4.1 RESULT

Road accidents and injuries occur because of human fault or vehicle fault or infrastructure fault or sometimes combinations of these factors. Each of these factors individually or in combination may cause accident. It was observed from the dataset that accidents mainly occurred because of combination of human fault and vehicle fault as shown in Table 4.1.1

Human alone factors such as “helmet and seat belt not used” are not reported in the FIRs and as such are not known. Table 4.1.1 presents top 3 contributing factors for accidents, highest being rash driving of the people.

Analysis like type of vehicles (two-wheeler, car, bus, lorry, jeep, truck, etc.) is not given in the FIR report, and as such, analysis is not done. Figures 4.1(a) and 4.1(b) present percentage distribution of accidents on various criteria, speed limit, and injury severity.

Contributing factor	Percentage of accidents (%)
Human–vehicle	83.64
Human	16.3
Infrastructure	0.06

Table 4.1.1 Contributing factors for accident

Figure 4.1 (a)Accidents by speed limit

Figure 4.1(b) Accidents by injury severity

Similar analysis is done on other criteria such as distribution of accidents by time of accidents and deceased age, distribution of accidents by month and weather during the accident, distribution of accidents by lightness and speed limit, distribution of accidents by accident type (human factors), distribution of accidents by day of accident and deceased age, distribution of accidents by deceased emotions.

K-medoids uses the cluster center to create clusters, whereas EM clustering uses the probabilities of the clusters to further calculate the optimized clusters. The results of two clusters formed from K-medoids and EM are given in Table 4.1.2

The performance of the EM clustering is low compared to K-medoids clustering algorithm, because it uses probability measures to cluster the data. The number of iterations and runs taken to cluster the data using EM clustering is more when compared with the K-medoids clustering technique. Table 4.1.3presents precision and recall values for both clustering algorithms.

Table 4.1.2 Comparison of clustering techniques based on emotion

K-medoids	C6 (age)	C	Y	M	S	NULL
	Obtained	1	28	35	43	11
	Expected	1	28	35	43	11
Expectation maximization	C6 (age)	C	Y	M	S	NULL
	Obtained	1	28	35	43	11
	Expected	1	28	35	43	11

Dataset	Precision		Recall		F-measure	
	EM	K-medoids	EM	K-medoids	EM	K-medoids
1504 tuples	0.5	0.8	0.4	0.6	0.45	0.69

Table 4.1.3 Performance measures for K-medoids and EM algorithm

From the data analysis, accident distribution is even in normal days, and it is observed to be higher in weekend. Accidents occurrence is high at cold nights compared to hot and clear conditions it is observed to be fatal accidents are high among the old-aged group and non-fatal in young-aged and middle-aged people. Accidents are high in the month of August and low in the month of June. Females involved in accidents are observed to be 20.16% of overall accidents to 73.45% of male.

4.2 Discussions

Road accidents are most common cause of death in children over one year of age. Road traffic accidents are a major cause of childhood motility. After one year of age as the age group advances, the incidence

of fatal accidents increases. Males outnumbered females in ratio of 5:1.Pedestrians and cyclist are the common group injured and Majority of fatal accidents occurred during winter season as shown in Table-4.2.1(a)and(b).

Children were at fault in majority of cases. They were either playing on the road or crossing the roads, unsupervised by adults. The cyclists were not wearing any protection helmets. None of the injured received any treatment or first aid at the site of accident.16.9% cases died on the spot and only 1.7% reached hospital within 15 minutes of accident. 3/4th of these death occurred with in first 6 hour.

Multiple injuries are a rule in road accidents. Major injury per case was 3.2 and fatal injury per case was 1.47. Head injuries alone were cause of fatalities in majority of cases (72.9%)

Type of Road User	No.	%
Pedestrian	36	61.0
Cyclist	8	13.6
Ride Motor Cycle	6	10.2
Cars Jeep	2	3.4
Passenger Bus	4	6.8
Others	3	5.1
Total (N=59)	59	100

Table 4.2.1(a) Type of road user killed

Seasons	No.	%
Winter Seasons	32	54.2
Summer Seasons	19	32.2
Raining Seasons	8	13.6
Total (N=59)	59	100

Table 4.2.1(b) Seasonal variation

4.3 Categorized Accident Data:

The data received form NHAI is categorized to know the location of accident , date & month of accident , as the Highway was four lane the accidents are categorized in RHS and LHS also to make the date clear out for the easy analysis.

Table 4.3(a) shows the accident details such as date, month & year, location of the accident happened on NH4 in 2015and 2016.

Date/ Month/ Year	Accident Location	Date/ Month/ Year	Accident Location
02-Feb-15	Hyundai company 34+750 RHS	13-Feb-15	Near Hotel Paramount 40+100 LHS
2-Feb-15	Near Hyundai company 34+650 RHS	14-Feb-15	Mavalurkuppam Junction 31+600 RHS
3-Feb-15	Nil	15,16,17-02-2015	Nil
4-Feb-15	Velappan Charadi 16+160 RHS	18-Feb-15	EVP World 27+850 RHS
5-Feb-15	Nil	19-Feb-15	ACS Collage Hospital 17+450 LHS
6-Feb-15	Hyundai company 34+800 LHS	20,21,21-02-2015	Nil
7-Feb-15	Hyundai company 34+750	23-Feb-15	Canara Bank 39+000
8-Feb-15	Chembarambakkam 26+150 RHS	23-Feb-15	HP Petrols Mambakkam 47+860 RHS
8-Feb-15	Toyota company 17+050 LHS	23-Feb-15	Thandalam Opening 32+000 LHS
9-Feb-15	Hyundai company 34+750	24-Feb-15	Near E.B.Office,pennalur 37+800 RHS
10-Feb-15	Near St Joseph Amsak Crain's 38+000 RHS	25&6-02-2015	Nil
11&12-02-2015	Nil	27-Feb-15	MTC Poonamalli 21+000 RHS

Table 4.3(a) Accident locations of February 2015 only.

Date/ Month/ Year	Accident Location
1-Feb-16	36+640, 37+210,57+400 RHS
4-Feb-16	33+220 LHS
5-Feb-16	40+000 RHS Paramount hotel
7-Feb-16	37+000 LHS Eb Pennalore
8-Feb-16	50+000 RHS Samsung company
10-Feb-16	39+250 RHSArch 1
12-Feb-16	34+000 RHS Irungattukottai
13-Feb-16	34+660LHS Irungattukottai
14-Feb-16	38+800 RHS Amsak crane
15-Feb-16	40+000 LHS Paramount Hotel
17-Feb-16	37+900 RHS Toll plaza
18-Feb-16	38+190 RHS rajiv Gandhi collage
19-Feb-16	29+680 LHS Queens land
19-Feb-16	41+350 LHS Sriperumbudur Arch 2
19-Feb-16	36+000 RHS Sakthi Weigh bridge
24-Feb-16	37+590
26-Feb-16	43+200 LHS Nokia company
27-Feb-16	37+800 LHS Toll plaza
28-Feb-16	65+640 RHS
29-Feb-16	37+800 LHS Toll plaza

Table 4.3(b) Accident locations of February 2016 only

Future Work

Future work is to make analysis on road accidents data-set by considering more features and clusters and also to use deep learning techniques so as to better cluster the records.

- Heavy trucks account for the largest number of vehicles involved in the highway accidents investigated. More in-depth datastudies are required to understand the causes of heavy truck accidents on highways.
- Networking with accident hospitals is essential to obtain injury data for coding injuries and for detailed injury analysis.

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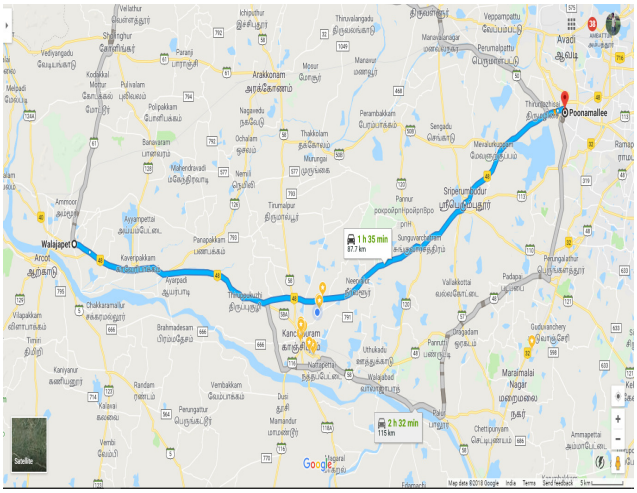
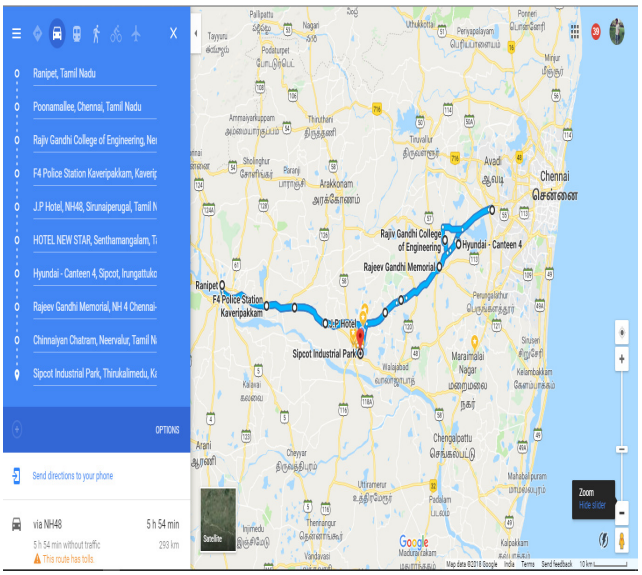
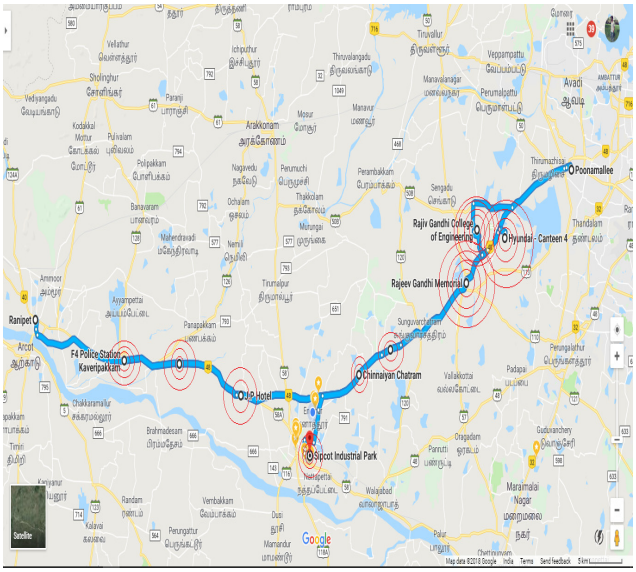
PICTURES



Picture-1 Political Map of walajapet to poonamalle



Picture-2 Political map showing major accident locations from walajapet to poonamalle



Picture-3 Circles showing accident ranges from walajapet to poonamalle