

JIMMA UNIVERSITY SCHOOL OF GRAGUATE STUDIES JIMMA INSTITIUTION OF TECHNOLOGY CIVIL ENGINEERING FACULTY HIGHWAY ENGINNERING STREAM INVESTIGATION ON THE IMPACTS OF BAJAJ DRIVING BEHAVIORS ON TRAFFIC FLOW AND SAFETY

(CASE STUDY OF BISHOFTU CITY, ETHIOPIA)

A Research thesis submitted to school of Graduate studies of Jimma university in partial fulfillment of requirements for the degree of masters science in highway Engineering

BY: Tenna Tesfaye

March, 2018

Jimma, Ethiopia

JIMMA UNIVERSITY SCHOOL OF GRAGUATE STUDIES JIMMA INSTITIUTION OF TECHNOLOGY CIVIL ENGINEERING FACULTY HIGHWAY ENGINNERING STREAM

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March, 2018

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DECLARATION

I certify that this research work titled "Investigation on the impacts of Bajaj driving behavior on traffic flow and safety" is my own work. The work has not been presented elsewhere for assessment and award of any degree or diploma. Where a material has been used from other sources, it has been properly acknowledged/referred.

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Acknowledgment

First and at most, greatest thanks from the depth of my heart is to our God, for endowing me with the courage, strength as well as health throughout my time and helping and taking care of me on the process of this proposal development.

Next, my deepest gratitude and respect to my advisor Dr.Bikila Teklu for his valuable advice, sincerity, very humble way. He makes me to be practical in translating the theory in to real application with different activities.

My final gratitude goes to my parents and friends, as well as Co-advisor Mr. Girma F. (Msc.), Mr. Tarekegn K. (Msc.) for their advice.

Abstract

Transportation engineering aims at creating the best route between two locations within three considerations: safety, time, and cost. Drivers' behavior at roads is one of the main concerns for any traffic engineer for its effect on safety. To a large extent, the safe operation of any system requiring direct human control depends on the level of behavior that the human controller provides. The main objective of this topic is to Investigation on the impacts of Bajaj driving behavior on traffic flow and safety. The study area is located in Bishoftu city. The city covers 182.78km² (18278 ha) with the total population of 201408. Data were collected from survey questionnaire, where the number distributed questionnaire was 600. The number of returned from respondent was 552, 460 (83.7%) males and 92 (16.7%) females.

The participants' (drivers) real application for these behaviors, 145(78.4%) of the participant said that (rarely-Often) they drive speedy while they are angry, 20-50% of them said that they lose their temper during speedy driving. More of traffic accidents can happen at other section of the road. So LOS have not much effect on traffic accident, and the area with more accident have less traffic volume, when it compared with driving behavior effect. It show that generally of road accident and bad traffic flow is caused by human factors which refer to the behavior of driving. Bajaj vehicle factor has the highest percentages for the cause of road traffic accident. It was found that the highest driving impacts are, aggressive driving, drive out of lane, inattention, and speeding, distracted driving, angry driving and wrong turning and lane changing are identified. The main causes of bad driving habits related to Bajaj drivers are, experience of the drivers, age of driver (younger drivers), low quality of license giver agencies, road types (common road) with other vehicles. And the main causes of traffic accidents, that are related to Bajaj driver driving behavior are, close following and tailgating, lane violations and zigzag driving or passing, being unfocused and distraction.

Finally it recommended that, Increase enforcement, Education and awareness for drivers and pedestrians, separate the common roads of Bajaj and other vehicles, to force drivers who repeat traffic violations to suspend their driving license and to attend training courses concerning traffic laws and regulations, to encourage drivers to drive defensively and to obey traffic rules and regulations in all circumstances.

Keywords: Traffic flow, Safety, Bajaj, lane segment, pedestrian, driver, speed, LOS,

Bishoftu

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Acronyms

AADT	Annual average daily traffic	
ADT	Average daily traffic	
BD	Bajaj dominated	
DR	Deceleration rate	
ET	Encroachment Time	
FRA	Federal Road authority	
HRGC	Highway-rail grade crossings	
НСМ	Highway capacity manual	
HSM	Highway safety manual	
L	Left or Lane	
LW	Lane width	
LOS	Level of service	
MNL	Multi-nominal logit (model)	
PDO	Property damage only	
PCU	Passenger car unit	
PET	Post Encroachment Time	
RTA	Road traffic accident	
TFS	Traffic flow and safety	
Т	Turn	
TTC	Time -to-collision	
WHO	World health organization	

CHAPTER ONE

1. INTRODUCTION

1.1 Background

To a large extent, the safe operation of any system requiring direct human control depends on the level of behavior that the human controller provides. In the case of motor vehicle operation, the driver must sample the driving environment, select the critical aspects of the environment, determine the proper response(s), make the response(s), and evaluate the outcome(s) of the response (s [1])..

It is well known that traffic accident is high important to public health spectrum in the world. Moreover, in developing countries such as Ethiopia, the mortality rate from road traffic accident is rather high in comparison with other countries. Not only the majority of the people killed and seriously injured significantly affect the quality of life of the citizens but it has also bad influence on economic and social development in the country. [1].

Transportation researchers have long been aware of the negative effects of driver behaviors on driving performance. Researchers have devised clever experimental designs on test tracks and simulators to gain greater understanding of the effects of various sources of driver behavior on reaction time, lateral deviations, time-to-collision (TTC), etc., in both normal and unexpected driving environments.

The research is important and useful to understanding whether this driving behavior impact, it is largely unknown whether driver behavior actually decreases safety and relative crash risk on roadways.

Motor vehicle driving behavior is a major factor in serious traffic crashes and accounted 582 Bajaj in number of total roadway crashes are reported in Mekele [2]. Driver behavior is even more critical at highway crossings and lane segments because truck-involved motor vehicle accidents are usually more severe compared to other motor vehicle accidents. Investigation of Bajaj vehicle driving behavior at highway crossings and lane segment is important for public safety. In recent years, having understood the serious effects of traffic accidents to the whole society, scientific researchers, traffic engineers and policy makers in developed country many projects and researches in the field of traffic safety. Human factor is also considered as the central element in the whole system. The final target is to organize a traffic environment, which is convenient and safe for road users.

The research were investigate on the impacts of Bajaj driving behavior on traffic flow and safety. It utilizing two data sources and the aspects of driving behavior at highway crossings and load segments were investigated. As well as the association between accident injury and driving behavior based on Department of Roads Authority motor vehicle crash data and the relationship between drivers' attitudes and knowledge of safe driving at highway crossings and lane segment should have to be determined.

1.2 Statement of the Problem

Developing countries face many challenges and have many resource needs. Road safety tends not to receive due to consideration because not all road accidents are reported to the police and there is usually no system of identify cause of accident and driving habit a nationwide [3].

There are several reasons leading to traffic accidents. Driving and road geometry is now considered as one of the biggest reason for traffic accidents. However, the problem is to find out whether it is worth investing in constructing and/or upgrading roads network. Sometimes, in newly-built roads, as drivers can reach the very high speed, traffic accidents may have much more serious results.

There are a distinguishing characteristic between traffic flow in Ethiopia (and in many other African countries) and those in developed countries: three-wheeled vehicles called Bajaj have a high percentage in the road traffic system, especially in region areas [3].

Many factors contribute to traffic accidents; some involve planning, design, construction, operation, surface condition, and policing of the roadways. Bajaj dominated (BD) traffic flow is very much different from car traffic flow due to Bajaj's' distinguishing characteristics.

Therefore, there appears the need to evaluate and verify such findings and measurements concluded from car traffic flow before applying in the BD traffic flow.

The most deadly factor is human error. In most Ethiopian regions or areas peoples are use Three wheel vehicles (Bajaj) as major city transportation facilities. But now a day three wheel Motor vehicles (Bajaj) crashes and injury severities are becoming a series issues due to driving behavior.

Regarding, the effect of driving behavior on driver in of jury severities in crashes reported at highway crossings and lane changing has not been considered as a big issues before in Ethiopia/or Bishoftu. So the aim of this topic are to investigating the issue drivers driving 'behavior effects and its remedial measures. That while this study area (Bishoftu city) is selected.

1.3 Research question

- 1. What types of vehicles driving behavior will affect traffic flow and safety?
- 2. How to determine Bajaj driving behavior on traffic accidents?
- 3. What are the impacts of Bajaj drivers' driving behaviors on congestion?

1.4 Objectives

1.4.1 General Objective

The main objective of this topic is investigation on the impacts of Bajaj driving behavior on traffic flow and safety.

1.4.2 Specific Objectives

- To identify types of vehicles driving behavior effect on traffic flow and safety at selected road segments in Bishoftu city.
- > To determine the impacts of Bajaj driving behavior on traffic safety in Bishoftu city.
- To propose effective countermeasures to reduce risky driving behaviors on traffic flow and safety.

1.5 Scope and limitation

The scope of this study was limited to the Bishoftu city (three selected segment) from 'Hiwot building to mekonenoch club' segment that is part of the major road of Bishoftu and other road sections and intersections were not included in this study.

Furthermore, the analysis was segment study rather than area wide or regional study. Hence, it focuses mainly on the road segments in the city and the relative effect of consecutive intersection was not discussed. Since, the main objective of the study is investigation on the impacts of Bajaj driving behavior on traffic flow and safety, investigation of possible causes of traffic congestion and examining the effect of Bajaj vehicles on traffic stream for congestion and during congestion in the same segment. And hence, the congestion management procedures and measures were not discussed in detail and have been left for further studies in this area.

1.6 Organization of research

This paper works are organized in to five main chapters. The chapter hierarchy is aimed at making the paper to have a scientific format. The general sense of each chapter can be summarized as follow.

First chapter is introduction part. It start by discussion in general influence of road traffic crash, driving behavior impact in the world, Ethiopia and specifically study area (Bishoftu city). It also explains on awareness of the society about road safety issues.

The Second chapter is the literature review part. The discussion of this chapter mainly focuses on the review of similar studies on the subject topic from a wide range of sources of material mainly those studies done in developing countries. It represent the extent of drivers driving behavior being affecting the traffic flow and safety of the different developing countries.

Moreover the chapter explains the available driving impact and causes definitions being practiced in different nation of the world. The chapter gives large coverage for detail explanation of various driving behavior identifying methodology that have been utilized in various countries and concludes the discussion by selecting the most appropriate approach to driving behavior impacting for traffic flow and safety in Ethiopia taking into consideration the actual situation therein.

The third chapter is the methodology and data collection part. It describes in detail how to select respondent and methodology is adopted to come up with the required traffic flow and safety improvement strategies of different component therein. In addition to methodology the chapter also explains about the data required from where the data obtained and finally how it collected and represent here.

Fourth chapter is the analysis and discussion part. In this chapter the collected data are analyzed in detail for each respondent's components. It computes the respondent idea of the driving behavior in Bishoftu especially on Bajaj driver driving behavior by using SPSS software. It finally discusses the findings of the analysis.

The Fifth and last chapter is the conclusion and recommendation part. In brief the chapter present what conclusions can be drawn from this study and what lesson can be gained from the study for different stake holder and drivers who directly or in directly affected by driving behavior. The chapter conclude its discussion and giving possible recommendation on the requirement of further research on the subject matter and significant focus from decision makers.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Introduction

This chapter provides general overview on the literature review, dealing with human behavior and risk analysis (focusing on introducing both qualifying and quantifying approaches). Some researches on motorcycle traffic flow and driver behavior at intersections are also mentioned in order to provide guidelines for the whole research.

2.2 General review of driving behavior

"A driving behavior is aggressive if it is deliberate, likely to increase the risk of collision and is motivated by impatience, annoyance, hostility and/or an attempt to save time" [1]. This definition is best suited to this study case where they attempt to buy time is a reality for most Bajaj drivers.

There has been relatively little research on aggressive driving behavior. Definition of aggressive driving have been general and have tended to distinguish themselves from "road rage" (Violent exchange arising from traffic disputes where the intent is to harm other road users). A more precise definition of driving behavior would focus on deliberate and willful driving behaviors that while not to physically harm another road user shows disregard for their safety and wellbeing [4].According to Tasca review survey research indicates most driver report engaging in aggressive driving behaviors, but there is some evidence that survey response reflect a tendency to provide socially desirable response.

Factor which seem to increase the likelihood of aggressive driving behavior are:

- Being relatively young
- ➢ Being male
- Being in a traffic situation which confers anonymity and/or where escape is highly likely
- > Being generally disposed sensation-seeking or aggressiveness in other social situation
- > Being in an angry mood (likely due to events unrelated to traffic situation

- Belief that one possesses superior driving skills
- > Traffic congestion, but only if drivers do not expect it

Human behavior is the most common factor accounting for more than 85% of all traffic accident [5]. Among the risky human behaviors is driving over recommended speed. Studies has indicated that an increase of 1km/h in mean traffic speed results in 3% increase in the incidence of accident crash and a 4-5% increase in fatal crash [6].

Another risky behavior identified for road traffic accident is taking alcohol and driving [7]. Not using seat belt while driving is additional risky behavior identified [8] [9]. Mobile phoning while driving becoming one of the risker behaviors, as well as knowledge, belief, attitude on risky driving behaviors and driving experience were also important aspect of risky behavior identified with evidence [10].

According to developed crash prediction models using highway crossing crash data from Canada. They found that the expected crashes at HRGCs increased with traffic volume and that higher train speeds had a significance diverse impact on crashes at crossings with signs only, but not those with gates [11].

Similarly, also found that Highway-rail grade crossing crashes increased with traffic volume in terms of annual average daily traffic (AADT) [12]. Studies that identified the risk factors that affect crash injury severity at Highway-grade crossings can be found are used a generalized log it model to identify the significance factors affecting crash severity at Taiwan's railroad grade crossings [13], [14].

They found that increasing the number of daily trains and number of daily trucks was associated with a higher injury severity [15]. Using eight years of crash data, developed a multinomial log it model to identify the impact of explanatory variables on the crash injury severity at Highway-rail grade crossings in the United States.

According to [16] conclusion driving behavior of violating traffic regulations are the result of a continuous chain from attitudes toward s legislation with the influence of such the following parameters:

- Driver personality characteristics: attitudes towards legislation, perception capacity, cognitive elements, motivation in specific cases
- External parameters: Infrastructure; Traffic legislation, operation and management regulation; traffic flow conditions (and other road users' behavior); other surrounding parameters.

Chain of driving behavior is Describe as follow:

Source: literature review of L.t Huyen, driver behavior and traffic safety

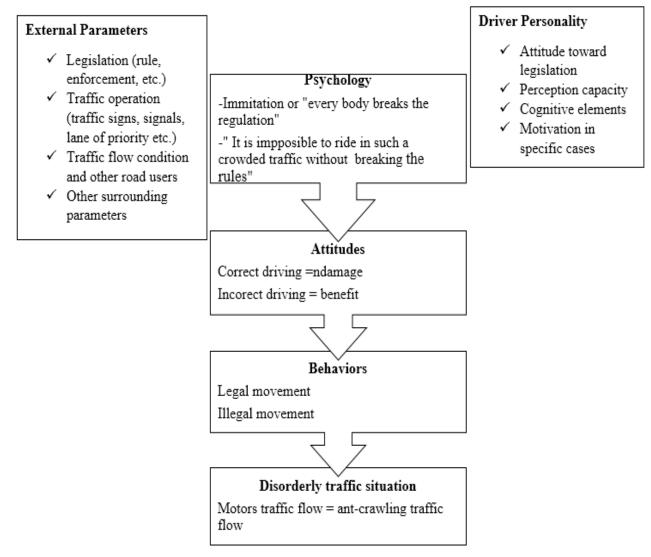


Figure.2.1. Driving behavior chain of violating traffic regulations

2.3 Conflict Analyzing Techniques

A big problem of statistical analysis of accidents is the lack of data. Accident events are very rare. To enlarge the amount of data the analysis of conflict situations started in the 1960s [17]. In Germany, gave a first overview. Using conflict analyzing techniques consequently in 1985; formulated a handbook for such topic [17].

The assumption for using that method is that situations with many conflicts have a higher probability than accidents. Trained observers regard traffic situations, classify with specific (target) criteria and count "conflicts". Conflicts are actions of road users, which may lead to problems (late braking, cutting of bends,).

Several measurements have been proposed to characterize traffic conflicts in detail. For example time to collision (TTC), deceleration rate (DR), encroachment time (ET), post encroachment time (PET), etc. are used to determine the severity of a traffic conflict objectively [18].

This technique enlarges the amount of data but the used parameters resulting from the maneuvers are not necessarily direct indicators for risk of accident and reduction of severity. Those methodologies are constructed at the aim at well understanding events which already happened. Risk analysis methodologies have the central idea of conducting diagnosis and forecasting for the future events.

As the number of motor vehicles and vehicles- miles of travel increases throughout the world, the exposure of the population to traffic accidents also increases. Highway safety is a worldwide problem; with over 500 million cars and trucks in use, more than 50,000 people die each year in motor vehicle crashes, and about million are injured [19].

Several studies have been conducted to model crash severity and investigate the impacts of various factors involved in the crashes [20].

Conducted a study and tested the hypothesis that older drivers and passengers would suffer more severe injuries than younger adults in the presence of broad side and angle collisions of automobiles on rural highways. Logistic modeling, Hierarchical Regression Analysis, and Principal Components Regression, were analysis tools applied. Injury severity levels, fatal, major, and minor, were considered as dependent categorical variables. Some of the independent variables considered were occupant age, occupant position relative to point of impact, and protection.

2.4 Risk-based methodologies

In the proposed the methodology of analyzing the whole system "road traffic" to describe the correlation between reference values and accidents. Most of these correlations are non-linear. Therefore Mohall demands on considering complex correlations: "The task of the researcher involved in risk analysis may be seen as the search for a black box in which input is exposure and in which output are accidents and their probabilities" [11].

According to the study, age-related variables were generally more significant predictors of injury severity for females than for males. It was also identified that use of lap and shoulder restraints reduces injury severity and is less certain for females. For females only, air bags deployed were reported as significant injury severity predictors.

As researcher developed crash prediction models using highway-railroad crossing crash data from Canada. They found that the expected crashes at HRGCs increased with traffic volume and that higher train speeds had a significance diverse impact on crashes at crossings with signs only, but not those with gates [11].

Similarly, also found that Highway-rail grade crossing crashes increased with traffic volume in terms of annual average daily traffic (AADT) [12]. Studies that identified the risk factors that affect crash injury severity at Highway-rail grade crossings can be used a generalized log it model to identify the significance factors affecting crash severity at Taiwan's railroad grade crossings [13], [14].

Using FRA Highway-rail grade crossing (HRGC) crash data from 2011 assessed the effects of rail, highway, traffic and driver characteristics on the frequency and severity of HRGC collisions [21].

Injury severity analysis was investigated by using an OL model. Factors that increased the likelihood of fatal injuries included train speeds greater than 60 mph, driver age over 60 years, females and motorists who did not stop at crossings [15]. 2005–2012 FRA HRGC crash data and a MNL model to explore the impacts of various explanatory variables on crash injury severity levels. Results showed that chances of fatalities increased when rail equipment with high speed struck a vehicle and when crashes were reported at higher air temperatures. Male vehicle drivers with age 25 years and above, pickup trucks, and concrete and rubber crossing surfaces were associated

With more severe crash injuries; while truck-trailers, foggy and snowy weather conditions, certain land development types and higher daily vehicle traffic volumes were associated with less severe crash injuries [22]. Distinguishes qualitative and quantitative models based on criteria of diagnosis correctness and application easiness.

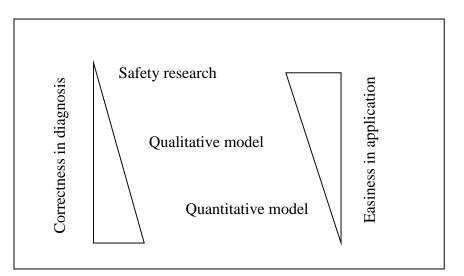


Figure 2.2 Qualitative and Quantitative models

Source: (review from W. dutch "risk analysis of road traffic engineering")

2.5 Movement characteristics of motor vehicles

So far, researches in the field of transportation and traffic engineering in general and road traffic safety in particular are normally preceded in the knowledge basement of car flow traffic.

However, in most of developing countries and Ethiopia particularly regions, Bajaj's are the dominating transportation mode, causing Ethiopian cities significantly different from other regions. These include the weather, climate, the economic and infrastructure development, population density and social/cultural environment. While providing affordable mobility to millions of people, these vehicles significantly contribute to transportation and traffic system.

Dealing with driver behavior at intersections, there are several researchers paying attention to bicycles' speed distribution [23]. Determined intersection approach speeds for bicycle traffic, then found the normal distribution of speed is closed to the field collected data [24], [25].

The speed values were classified into through and left-turning maneuvers, both of which are proved to have the normal distribution. However, the results must be reconsidered and recalculated before applying in motorcycle traffic flow as bicycles are not motorized.

2.6 Common Properties of Driver Behavior

The common property of these behaviors is that they all lead to changes in the speed of the vehicle, something that will be called driver celebration behavior. How are these accident predictors to be interpreted as celebration behavior? For acceleration and deceleration in the "normal" sense, i.e. changes in longitudinal speed, it is probably easy to see how they add to such a measure [26]. Figures out the approach speed and location of the driver from the intersection generally influence his decision of whether to stop or proceed.

Some factors influencing the driver's decision of whether to stop or clear the intersection are:

- ➢ vehicle approach speed,
- > color of the traffic signal when noticed by the driver,
- ➢ vehicle location form the stop line,
- length of phase change interval or yellow time,
- driver's perception-reaction time,
- ➢ sight distance,
- ➢ rate of deceleration,
- intersection clearing time,

- ➢ road surface conditions,
- Adverse weather conditions such as snow, fog, rain, etc.

2.7 Traffic safety indicator

There are different safety indicators for different levels of approach. In case of driving behaviors the best approach is to consider interactions between individual vehicles, rather than between vehicle flows. These indicators include, for example, time-to-collision, speed difference between (two successive) vehicles, gap distance between vehicles etc.

The Time-To-Collision (TTC) notion has been applied beneficially as a safety indicator in safety analysis [27]. A TTC value at an instant t is defined as the time that remains until a collision between two vehicles would have occurred if the collision course and speed difference are maintained).

2.8 Driving behavior impact situation in Ethiopia

The severity of road traffic crashes is likely to be much greater in Africa than where else, because many vulnerable road users are involved, poor transport conditions such as lack of seat belts, overcrowding and hazardous vehicle environments. The poor reporting system has also masked the magnitude of the problem in Africa [28].

According to federal police commission report death rate due to car accident significantly increasing among pedestrian and passengers from time to time in Ethiopia [29]. And the main cause of accident were related to human driving error.

A total of 25,110 accident and 3,415 fatalities were recorded in Addis Ababa during 2000-2009. The majority of fatalities were pedestrian, 2970 (89%) followed by passengers 297 (9%) and drivers 148 (4%) [30].

A report from traffic office of Bishoftu town (study area) indicated that in 2008, there were a total of 104 road traffic accidents (RTA) and in 2009 the total number of RTAs increased to 185. On the other hand, the report showed 97% of the causes were related to human risk driving behavior where as 3% were due to vehicle problem [31]

2.9 Summary

A crashes occurring at Highway crossing and during lane changing have a significant effect on highway user safety, and the importance of conducting research in such areas is evident. However, compared with the amount of work on general highway traffic crashes, this subject receives relatively less attention, although some research efforts have been made in this particular area. As such, the objective of this research is to investigate the effect of driver's behavior at Highway crossings and lane segment.

The level of severity is used to model the impact of various factors that include vehicle driver characteristics, environmental factors, highway crossing characteristics, highway characteristics, land use type, and more. The three levels of responses considering are fatality, injury, and no injury. The Regression model procedure will used to develop the analysis.

2.10 Research Gaps

The Previous study area were focuses only on highway-railroad crossings ,but now a day three wheel vehicles (Bajaj) crashes , injury and impact on safety and traffic flow are becoming a series issues due to drivers driving behavior. Regarding, the effect of driving on driver injury in crashes reported at highway crossings and lane segment has not been considered as a big issues before.

So the aim of this topic are to investigating the issue of drivers' driving behavior, at the consequences of such as, the driver experience, performance, the drivers' personality and socioeconomic characteristics associated with such behavior, and the corresponding safety improvement strategies must be determine.

CHAPTER THREE

3. Methodology and data collection

3.1 Introduction

This study covers area where Bajaj vehicles widely used and which need safety improvement. From the statement of the problem point of view we can understand that the issue is common in all part of the country wide. As a result, the study also deals with different areas facing different problems.

Therefore, to make the research feasible the study area were set on effect of Bajaj driver's driving behavior impact for traffic flow and safety at highway crossing and road segment.

A cross-sectional quantitative study was conducted in Bishoftu town, East shoa Ethiopia in June 2017. Bishoftu is located at the middle of Addis Ababa and Adama town. It situated around 47kms, from Addis Ababa. According to 2008 Ethiopian central statistics report, the total population of Bishoftu town is 201,408 [32].

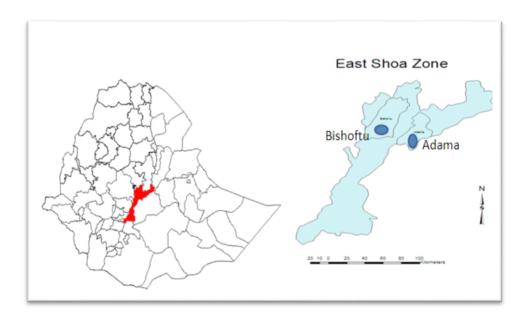


Figure 3.1 Study area (Source:-Ethio GIS data/ArcGIS Version10.0)

3.5 Study Variables

The study variables assessed in this research are both independent and dependent variables.

3.5.1 Independent variables

The following variable will be considered in this study.

Demographic Variables: The demographic variables related to driver involved are:

- > Age: it will categorize as:
 - ✓ below 18
 - ✓ 18-30,
 - ✓ 31-50 and
 - ✓ 51 and above
- Educational Background: The maximum education level attained by the driver will be recorded under one of the following categories:
 - ✓ Basic Education
 - ✓ Elementary School
 - ✓ Junior School
 - ✓ Secondary School
 - ✓ above Secondary School
- Driving Experience: This is the number of years since the driver received a driving license. This information is sometimes recorded by asking the driver since the year the driver received the first license could not be found on the current license if the driver is having higher level driving license. The information will obtained from the driver is recorded under one of the following six categories:
 - \checkmark Less than or equal to 1 year
 - \checkmark Greater than 1 year and less than or equal to 2 years
 - \checkmark Greater than 2 years and less than or equal to 5 years
 - \checkmark Greater than 5 years and less than or equal to 10 years
 - \checkmark More than 10 years

Other Variables

- ➢ Speed
- Socioeconomic characteristic-Risk occurs due to road user errors
 - Pedestrian conflict (Pedestrian-Baja,)
 - Crossing signals
- Road types
- lane width
- Conflict type (at left-turning, right -turning, crossing etc.)
- Regulation systems

3.5.2 Dependent variables

Impact of Three- wheeled vehicle (Bajaj) Driving behavior

3.2 Site selection and sampling Procedures

The following detailed methodology has been adopted for obtaining various aspects of the present study. The steps involved in the study are explained in the following sections. The study site is located in Bishoftu city. The city covers 182.78km² (18278 ha) with the total population of 201408 (male 97685 and female 103725). From this population 600 (drivers both car and bajaj, pedestrians, traffic police, police admin) are selected simple random system. To make the study specific three individual areas or segments were selected depend on field observation

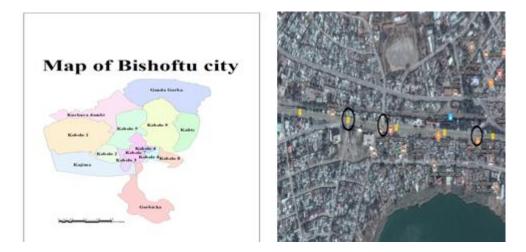


Figure 3.2. Map and road network of Bishoftu Source /www. Google maps.com

3.2.1 Area of Sampling

The criteria for selection of the sample area was the magnitude of impact of Bajaj vehicles due to driving behavior in Bishoftu city main road. It is selected since there is large amount of Bajaj traffic volume due to the presence Bishoftu lakes tourists. As it lies in the tourist area of the country, in addition to serving as a pass way of different cities, there is a higher concentration of human and vehicle populations leading to road traffic congestions and crashes. Most of the economic and social developments in the country passes through to manifest at this city and hence all the benefits and aftermath of such economic and population growth affect Bishoftu. One of the undesirable effects of such growth in the city is human behavior and traffic congestion. In order to study traffic congestion due to driving behavior in Ethiopia, Bishoftu is a best for this study due to many factors. The research focuses on the Bishoftu city and its surrounding along the selected main road segment. Hence, this section of the research describes briefly the study area and the selected corridors. It also discusses certain descriptive parameters and trends which affect the traffic congestion.

3.2.2 Sample size method

The question of how large a sample to take arises early in the planning of any survey. This is an important question that should be treated lightly. To take a large sample than is needed to achieve the desired results is wasteful of resources whereas very small samples often lead to that are no practical use of making good decision. The main objective is to obtain both a desirable accuracy and a desirable confidence level with minimum cost [33].

To determine the sample size a single proportion population formula was employed. Cars and Bajaj drivers identified with systematic random sampling were approached for the interview at their stations but the private owned cars were interviewed at their residential houses based on the information given from transport office of the town and cars and Bajaj associations.

This section of the study discusses how data was sampled, collected and extracted from the data source and also presents the gathered primary and secondary data by systematically organizing and summarizing using standard formats.

Analysis the frequency of vehicle traffic accident statistics collected from records of Bishoftu city traffic police for the past five years period from 2005-2009 E.C, 3 individual road segment with intersection and one round about for main road were arranged for study purpose. Based on the data available from various sources such as Bishoftu city Transport office, Police office, road Authority, Vehicle drivers (car, Bajaj, Motors etc.), city population is dominated.

Bishoftu city Drivers (both cars and Bajaj), pedestrians, and police officers were consulted during the data collection processes. Random selection procedure were used to gather information about driving behavior and regulation enforcement. Questionnaires for drivers (car, Bajaj), pedestrian, and police officer were distributed by sample size taken from survey formula with 95% interval and level [34].

The sample size of respondents is determined by using Eq. 3.1.and Eq. 3.2 Therefore the research desired to estimate. With 95%, confident the proportion of people asking questionnaire.

$$SS = \frac{Z^2(p)(1-P)}{C^2} - Eq.3.1$$

SS = Sample Size

Z = Z-value (e.g., 1.96 for a 95 percent confidence level)

P = Percentage of population picking a choice, expressed as decimal

C = Confidence interval, expressed as decimal (e.g., .04 = +/-4 percentage points)

New SS =
$$\frac{\frac{SS}{(1+(SS-1))}}{Pop}$$
 ------Eq. 3.2

Where Pop = population

Trained personnel collected data by using pretested questionnaire adopted from literatures [35] [36]. A questionnaire prepared in English was translated in to local language (Amharic) and back translated to check whether it translated correctly or not. The part primarily measured road traffic accident as collision between vehicles; between vehicle and pedestrian; between vehicles and animals; or between vehicles and fixed obstacle.

3.3 Study approach

Different types of data were collected for the purpose of this research mainly through primary sources and some data were acquired through secondary sources. For the primary data collection internationally reputable and recommended techniques of traffic data collection were used.

- 1. Video Recording to count vehicles
- 2. Manual Traffic Volume Count at Different Sections

In addition to the above traffic flow data collection techniques other field measurements were done to gather data on the geometrical features of the segments for capacity analysis. These include, speed measures, number of lanes, lane width, and configurations of lanes, grade, and width of median, movement policy e.tc. These measures were done for the segments whose level of service or LOS is going to be determined.

The research approach in this thesis involves both quantitative and qualitative approaches. Quantitative data and analysis were used to determine the level of service of segment section and to measure the performance levels quantitatively. Observation, direct field measurements and secondary data were the main sources of quantitative data. Furthermore, qualitative data from questionnaire were also used to determine whether the congestion in the segment is considerable or not and to assess other related parameters.

On this research, the study is descriptive research type and the goal of descriptive to describe some aspect of a phenomenon. It can help understand a topic and lead to impact analysis. Descriptive research, therefore, involves a variety of research methods to achieve its goal. The method that come under descriptive research are:

The methodologies adopted to achieve the objectives are outlined as follows:

- Review of applicable practices, research findings and other relevant information on Bajaj vehicles Driver behaviors and its impact on traffic flow and safety.
- 2. Data collection was carried out in the study area "Bishoftu city" the necessary through:-

- Observing the of transportation system when Bajaj driver uses the roadway especially at crossings and lane segments and compare with transportation regulations or each operation systems.
- Field observations: in which pedestrians are observed in the field and counted by hand.
- Video-recordings: in which camera recordings of pedestrian crossings are taken and then processed through playback and manual recording.
- Questionnaire was be filled by the users (drivers), Pedestrians police officers, traffic polices at study areas.
- Interviews data also collected depend on Sample number, type by using trained data collector.
- User assessment was conducted by distributing questionnaire for road users, drivers, stake holders that use the study area road and was filled the questionnaire; the result was analyzed from various opinions gathered from distributed questionnaire using Regression models statistically.
- 4. Determine speed of Bajaj vehicle in the traffic flow and summarize in table form to know the confidentiality level of 95% with Bajaj vehicle mean speed. This can be determined by using field video records and measuring road length to calculate each Bajaj's' speed, from distance and time relation. And finally summarized as table given below.(table 3.1)

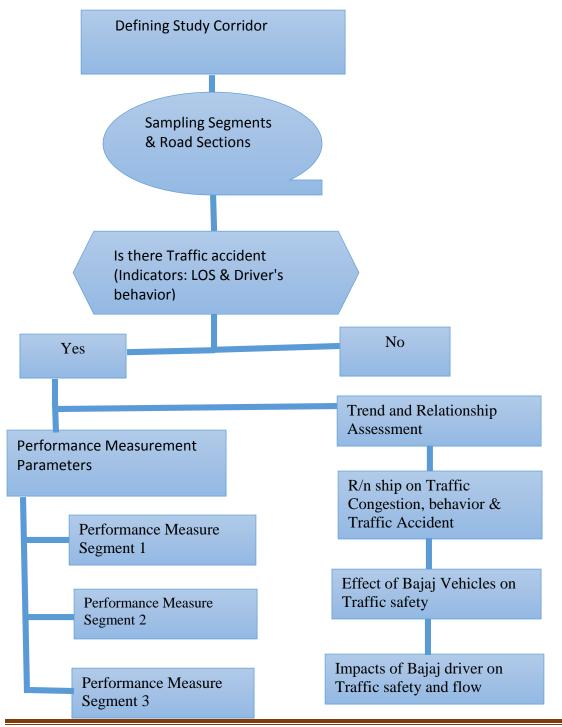
	ocation Bajaj Volume	Number	Measured Speed				
location		of	Mean	Max	Min	Standard deviation	
	volume	sampling	(km/h)	(km/h)	(km/h)	Km/h	%
1							
2							
3							

 Table 3.1. Average speed of Bajaj vehicle (examples)

5. Statistics data on traffic safety at road segment: number of accidents, location of accidents, damage level, involved party, direct causes, people who make errors (characteristics: age, gender, experience, occupation, transportation mode, ...), etc.

- Traffic and traffic safety in left-turning movement in specific lane segment and crossing or intersections: (video camera, photograph, field observation and counting): traffic flow, conflicts, accidents, etc.
- 7. Finally, possible solution for the problems was recommended.





BY TENNA TESFAYE, JIT

Figure. 3.3. Framework for Level of Congestion, behavior & LOS Analysis

3.3.1 Descriptive studies

- ➢ Survey
- Observation studies
- Case studies

Case studies

Largely emphasis on detailed background analysis of a limited number of events or conditions and their relationships. They are largely descriptive examinations, usually of a small number of sites (small town, section of road, institution). Case study can provide very attractive, rich exploration as it develops in real-world setting.

3.4 Traffic data

3.4.1 Manual Traffic volume count

Manual traffic counts were conducted at different locations (road segment) to determine the directional traffic volume and flow at every 15 min. Furthermore, vehicle occupancy study was conducted using manual count method at different road segments. However, except one week time continuous traffic count, the other traffic counts were not directly done by the researcher. The traffic counts were done by the Ethiopian Roads Authority in three seasons for each year and the raw data was availed to the researcher. The data was manipulated and transformed to the required size for the analysis.

Therefore, from this data collection the following quantitative data were generated. These include,

- Directional Traffic Volume/Flow per 15 Min of Interval for the Three Segments or Road segment and
- 2. Vehicle Composition along the Segment

In addition to the primary data acquired in the above methods, some secondary data; mainly on traffic accident, vehicle population, population and economic growth parameters were taken from other literatures and reports. The sources of these secondary data are properly acknowledged at their respective locations.

Traffic studies were required to determine current and future traffic volume AADT expected to use the different road section of the road project. On other hand the purpose of driving study on this research is important predict cause of accident and identify different effect of traffic flow and safety in different road segment.

3.5 Accident reporting

The police officers are collecting traffic accident, since the first person for witness to the accident condition and accident sight. It is essential that police force recognize and assume their responsibility with respect to accident data. The report has three aims. To create greater levels of awareness, commitment and informed decision- making at all levels of government, educational institution, industry, international agencies and non-governmental organization, proven to be effective in preventing road injuries can be implemented.

3.6 Accident data collection

3.6.1 Data collection procedure and source of data

In order to achieve the objective of the study, both primary and secondary data were used. The primary data were obtained from four different questionnaires that were distributed to Baja drivers, other vehicles driver, pedestrians and police officer/traffic police to complete the questionnaire and interview.

Information was also gathered from officials in the Bishoftu city transport office, Bishoftu city traffic police officer, Design office, pedestrian, vehicle drivers and traffic volume count on site. Secondary data were collected from Bishoftu city Transport authority and other relevant published unpublished information sources.

3.6.2 Primary data and Fields work

3.6.2.1 Distribute Questioners for driver, Traffic police and pedestrian

Information gathering by surveying, a questionnaire method is used. A questionnaire is a written list of questions, the answer to which are recorded by respondents. In a questionnaire respondents read the questions, interpret what is expected and then write down the answers. In the case of questionnaire, as there is no one to explain the meaning of questions to respondents, it is important that:

- ➢ The questions are clear
- ➢ Easy to understand
- Also, the layout of questionnaire should be such that to be easy to read and pleasant to eye.
- > The sequence of the questions should be easy to follow

A questionnaire should be developed in an interactive style. This means respondent should feel as if one someone is talking to them. In a questionnaire, a sensitive question or a question respondents may feel hesitant about answering should be prefaced by an interactive statement explaining the relevance of the question.

3.6.2.2 Method used in data collection

Video recording and manual transcription or tracing were used to collect travel time data. This method of travel data collection relies on video cameras to collect or capture the traffic flow in the field and human personnel to transcribe or trace vehicles into a database at the office after the actual time of data collection. According to travel time collection handbook; though it is costly, Video capturing techniques is preferred over the manual collection (pen and paper method) because it:

- > provides a permanent, easily-review record and show the traffic conditions at any time;
- permits the reading of required parameters in a controlled environment in which plate characters can be closely examined;

- provides additional information about traffic flow characteristics such as traffic volume and vehicle headway; and
- > Can provide a time stamp for accurate determination of arrival times.
- ➢ has better accuracy than manual methods; and
- > Enables to capture a larger sample of the total number of vehicles.

Therefore, in order to exploit the above advantage and due to its convenience video cameras with tripod were arranged at convenient height where maximum possible view could be captured and visibility was maximized. The locations for video capturing were the roof & floors of high-rising buildings alongside the study sections.

3.6.2.3 Collected Data for traffic volume

To attain the objectives of this research, different types of quantitative and qualitative data namely; traffic flow or volume data, vehicle occupancy data, road geometric data, traffic accident data and road users' congestion perception data and causes of traffic congestion regarding to driving behavior were required.

Despite the challenges, an attempt was made to collect the data using the techniques stated in the methodology and described below at each section. As there is no a trend in the country for a permanent data acquisition and computerized system in any of the field operating system, acquiring data is highly challenging and costly. Hence, it was difficult to gather primary data at all stations or congestion spots along the stretch. Rather possible representative road sections were considered along the study corridor.

Traffic volume data was gathered for the identified study locations. Direct vehicles and Bajaj traffic count was conducted on the location. Instances of such direct counts are made at Bishoftu city main road three segments and one round about.

3.6.3 Secondary Data and Office work

Four different questionnaires were prepared and distributed to vehicles drivers (Bajaj, car), pedestrians and traffic police. These questionnaires were developed based on secondary data obtained from traffic police records and other relevant literature.

3.7 System of Data analysis

The traffic count was directional and hence directional traffic flow characteristics can be easily summarized and studied. As travel time data was averaged for all vehicles type and a single travel time was considered in the 15 min time interval. As discussed before, it is also necessary that the vehicle volume count should be converted to passenger's equivalent unit to conduct congestion analysis. It's used to analysis driving behavior contribution factor for congestion in traffic flow systems.

Since the four specific objectives of the thesis are somewhat broader by themselves, the secondary sources Passenger Equivalent Factors with some conditional modifications were adopted to convert the traffic volume count in to PCU. The traffic volume in PCU is summarized and presented at analysis part and appendix.

On this part, it seen different method of identification driving behavior impact for traffic flow and safety and way of determining driving habit. Additionally, we choose this reference because it is not done only for one country road safety condition but it is done with corporation of different countries.

A structured questioner was prepared in order to gather additional information for the Bajaj driving behavior analysis. As driving behavior is a function of people's perception toward their flow and their safety purpose, it was necessary to gather information and data on how the road users (drivers', pedestrians) in this project or research corridor perceive the current traffic congestion with regard driving behavior and know can driving behavior is acceptable for them.

The questioners were distributed through face to face, through interview-questioner (the data collector interview the respondent while filling the questioner) and distributing for respondent. Accordingly, about 600 questioners (for drivers, pedestrian, other concerned body) were distributed and analyzed. The researcher believes that statistically significant samples should be considered to draw conclusion out of analysis made on such questioner data. However, due to the fact that most of the basic analyses in this research are based on the quantitative data described before and the data on the questioner are a supplement for the result, the respondent size would be sufficient for the purpose of this study.

From analysis the researcher went to identify weather Bajaj driving behavior affects traffic flow or not. Data and documents show that the traffic accident in the city is alarmingly increasing and different researches were made in this regarded. Most of these researches showed the relationship between traffic flow and traffic accident. However, none of them identify the relationship between traffic accident and driving behavior specially Bajaj vehicles drivers. Hence, in this study, in order to see the relationship between traffic accident and traffic congestion due to Bajaj driving behavior, different accident data were collected from secondary data.

CHAPTER FOUR

4. Data Analysis and Discussion

The analysis was made on the gathered quantitative and qualitative data to look in to the trend of the traffic flow with in the day and identify the peak period and peak hour volumes. The level of service for the identified road segment was analyzed using HCM manual and the segments were checked if they fall as congested or not congested due to driving behavior [37].

Impact of driving behavior on traffic flow and safety analysis also made on the sections where the travel way data was collected and the results interpreted and discussed. In the driving behavior analysis, parameters for quantifying performance were analyses based on behavior approach for each section. Finally, the relationship between traffic accidents, performance, flow and safety with driving behavior was seen and a regression equation was generated.

4.1 General Geometry configuration

According to general observation the main road geometric elements of Bishoftu city have two lane, 7.5m including shoulder. according to Bishoftu city Admistration report, the city have 27.19 km asphalt length and the "coble stone" 137.6 km were constructed.



Figure: 4.1 Geometric feature of study area segment 1 and 2

Significant observations the field survey are detail as follows:

- Relatively high traffic volume of Bajaj and pedestrian, moderate volume of truck, taxi, buses and low volume of motorcycles, during observation and data collection period.
- ➢ Most of road type are seem a flatted.
- > There is no enough road pedestrian crossing signs (not visible).
- > Conflict between vehicles and pedestrian is surely most commonly visible
- > No yield signs were present in all direction specially at intersection and roundabout



Figure 4.2. No yield signs and pedestrian crossing

Table 4.1 shows the speed of the vehicles (Bajaj) were determined by using both field measure and video record than calculate speed limit.

The Base Free - Flow Speed (BFFS) for the two sections or segments is estimated as 80km/hr since most of the segment 1 and all of the segment 2 and segment 3 were considered as rural or semi-urban sections during the construction period. But it now considered as urban road of Addis Ababa to Adama.

	Bajaj	Number	Measured Speed				
	Volume (5AM-6AM)	Number of Sampling	Min (km/h)	Max (km/h)	Mean (km/h)	Standard deviation Km/h	
Segment 1	265	85	45	65	55	14.14	
Segment 2 Segment 3	195 296	85 85	55 50	70 75	62.5 60	7.07 14.14	
Segment 5	290	85	50	15	00	14.14	

Table 4.1 Average speed of Bajaj vehicles (from field measure)

This section were determined by using field video records and measuring road length to calculate each Bajaj's' speed, from distance and time relation. And finally summarized as table given above table 4.1.

4.2 Influencing factor of driving behavior

Vehicle, road and traffic condition are influencing driver's behavior. Driving involves sequential process of perceiving and making sense of the situation, deciding on how to best respond gives the driver's knowledge and goals, and making some action. Some traffic control devices and road safety treatments are designed to provide information to drivers by means of an explicit alerting function. Such as speed limit signs and many hazard warning signs are designed to direct drivers' to road or traffic conditions and undertake recommended or required driving behaviors; the information is explicit as it is relies on a driver consciously attending, comprehending, and responding to the information.

Therefore, from the explanation selected road condition one of major influencing factor of driver behavior such as pavement marking, drainage system. In addition, pavement condition of selected road segment is not good obtained areas with crack and rutting. As a result, the condition have effect on driving behavior

4.3 Analysis of road traffic accident in Bishoftu city

The research shows briefly the review of road traffic accident analysis done on the previous 5 year data from Bishoftu city documentation office and detail record of traffic police office. This detail investigation and diagnosis show the cause of accident. Bajaj driving behavior and its impacts to give better evaluation and recommendation to improve traffic flow, safety and to minimize traffic accident

4.3.1 Distribution of accident by year and type

Table 4.1 shows there are high number of fatal traffic accidents on year 2008. Data shows that the fatal location are concentrated at straight road, intersection and Bus station crossing. These location recorded more than 3 times fatal accident recorded within 8 months.

No	Year	Fatal	Injury	Property damage	Total
1	2005	14	15	52	81
2	2006	20	5	50	75
3	2007	18	17	46	81
4	2008	29	19	61	109
5	2009	19	18	49	85

Table.4.1 Total traffic accident recorded in each year

Source. Bishoftu traffic police documentation office.

4.3.2 Distribution of accident by vehicle type and reason

According to table 4.2 the main reason of accident is human risk driving behavior which about 97% and other 3% is recorded as road users error, road quality and vehicle quality. From police

report, even if the recorded Bajaj vehicle accident is less but contribution for accident is more at accidental location.

In Bishoftu city, only in the first three month in 2008, there are 57 (52.3%) accident caused by Bajaj driver lane misuses. This leading to the death of 13 people from total recorded 109 accidents. The policemen argue "High traffic volume along bad road conditions leads to the capacity decrease of the whole traffic system. During the congestion, vehicles, especially Bajaj, always accelerate, using the wrong lane, which is very dangerous and may cause traffic accidents'.

Year	Type of vehicle	Accident	Main crash reasons
	Taxi/Minibus	19	-Drive out of his lane
	Bus	21	- Sight distance
2005	Truck	36	- Speed
	Bajaj	3	- Turning without light
	Motorcycle	2	- Priority (vehicle& pedestrian)
	Taxi/Minibus	16	-Drive out of his lane
	Bus	20	- Sight distance & speed
2006	Truck	34	- Drive with alcohol
	Вајај	6	- Drive with tired
	Motorcycle	1	- Not giving Priority to (vehicle& pedestrian)
	Taxi/Minibus	9	-Drive out of his lane
	Bus	17	- Sight distance & speed
2007	Truck	44	- Priority (vehicle& pedestrian
	Вајај	10	- Aggressive driving
	Motorcycle	1	
	Taxi/Minibus	34	- Drive out of his lane
	Bus	15	- Sight distance
2008	Truck	46	- Speed
	Вајај	13	- inattention

Table.4.2 Accident of Bishoftu city and crash reason for each vehicle type recorded

	Motorcycle	1	- Road user problem
	Taxi/Minibus	16	- Drive out of his lane
	Bus	12	- sight distance
2009	Truck	34	- speed
	Bajaj	21	- inattention
	Motorcycle	2	

As indicated on the graph traffic accident of the Bajaj vehicles from 2005 to 2009 are increasing rapidly. This shows as how much become very series problem. From the police record the reason for this problem (97%) of were driving behavior.

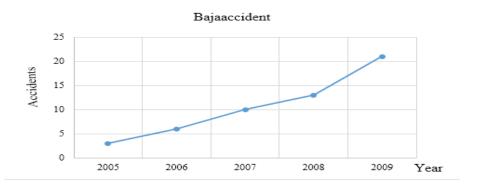


Figure. 4.3 Bajaj traffic accident distribution in each year

4.4 Traffic flow pattern and vehicle composition analysis at segments

4.4.1. Directional Traffic Volume

A directional traffic volume analysis was conducted on a traffic volume data which is counted at 15 min interval and for 12 solid hours of a day starting from the early morning to the late afternoon. The traffic volume analysis is done for both direction and for three segments along the research corridor. The road sections or the segments considered are:

- 1. Hiwot building Teachers road intersection Segment which is the city main road section (segment 1)
- 2. Bishoftu Bus station Tourist intersection (Segment 2) and
- 3. Bishoftu roundabout Mekonenoch club (segment 3).

Sample traffic volume data for the above three segments are summarized for all class of vehicles and reported as hourly volume in the figure 4.4 below.

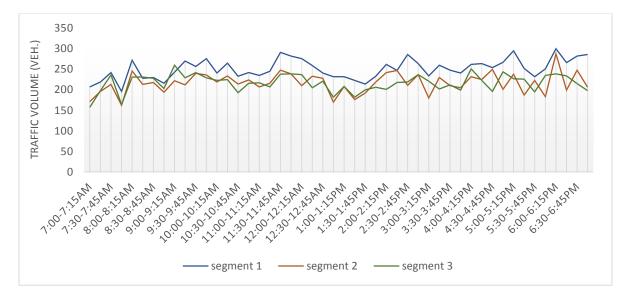


Figure 4.4 Volume of vehicles at the main road of Bishoftu city

In this road section, most of the vehicle share is occupied by the four vehicle classes, Bajaj, private cars, land rovers, mini bus taxi and mid buses. Those road section is a link for the traffic though Addis Ababa to Adama.

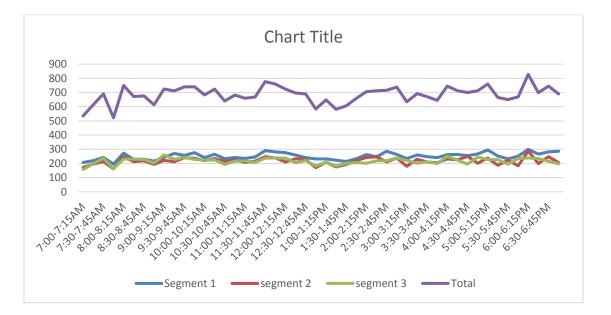


Figure 4.5 Total hourly Volume of vehicles at the main road of Bishoftu city

4.4.2. Traffic Congestion Effect on Accident

The traffic accident trend within the time of a day has been studied by different researchers. Based on the peak trends of both traffic volume and traffic accident during morning and evening time, all the previous researchers conclude that there is a relationship between traffic flow and traffic accident. However, none of the researches showed the relationship between traffic congestion parameters, traffic behavior and traffic accident. It is true that the more vehicles in the road the more likely collision would happen. However, the researcher of this paper doesn't believe that traffic flow or volume is the right parameter to be related with traffic accident. For instance at a freeway we can have the highest traffic flow or volume than other road sections. However, more of traffic accidents can happen at other section of the road.

Driver's error or behavior is highly quoted as the main (93%) cause of traffic accident in Bishoftu accounting more than 93% of the accident. The main mistakes listed under driver's error and causing about 85% of the total accident are; driving on the wrong side, failure to give way, following too close, improper overtaking, speeding, improper turning.

As it can be seen together with other road and environmental factors, behavioral factors contribute a lot for the traffic accident in Bishoftu. Hence, the researcher of this paper believes that having the other road parameters constant, traffic accident would be more related with the behavioral and vehicle to vehicle headway factors than the traffic volume or flow.

One of the factors that affect driver behavior is the stress, over confidence and frustration resulted from delay due to traffic congestion. A questioner result showed that out of 185 drivers interviewed 150 (81%) responded that the traffic congestion make them to stress and frustrate which make them to misbehave and commit wrong driving and most of them think Bajaj vehicles are easy to pass on a small part of road.

Therefore, the link between the traffic accident, driving behavior and the traffic congestion in Bishoftu is so significant and the researcher believes efforts made to mitigate the traffic congestion would also minimize the traffic accident but driver behavior will maximize traffic accident. Conversely, as it is clearly observed on the segments traffic accidents and road side parking are aggravating the incidence and the formation of traffic line up or queuing which in turn results in the probability of traffic congestion lowering the capacity and level of service of the infrastructure.

On the other hand, one can argue congestion can reduce the high speeds on expressways and as a result of that the accident rate is reduced. But in a congested road section vehicles are closely packed and as a result of that rear - end collisions, back-up collisions as well as side collisions can occur. Most results of all this accident can be occurred due to Bajaj drivers driving behavior.

4.4.3. Assessing the Effect of Bajaj Vehicles on the Congested Traffic Stream

An investigation into the effect of Bajaj vehicles on traffic flow during congestion is presented in this section. Several factors that are thought of as determinants of this effect were considered in this investigation. Passenger car equivalency factors applicable in HCM 2000 and HDM were utilized as an indicator of heavy vehicles" effect but regarding this researcher were did on Bajaj vehicles .



Figure: 4.6. Bajaj vehicle movement during congestion time (segment 3)

While study results suggest some similarities between free-flow and congested traffic regimes concerning heavy vehicles" effect, some important differences exist due to the different

mechanisms that govern heavy vehicles" performance in the two regimes. Also, lane-use restriction and the location of bottleneck relative to upgrade were found to have considerable influence on heavy vehicles" effect during congestion. But in case of small vehicle like Bajaj were found that on Bajaj drivers driving believing, this main cause aggressiveness on other vehicles drivers.

4.4.4. Segmental Analysis of Level of Service (LOS)

According to the methodology described above, first, it is necessary to justify that the segments and the road sections to be analyzed are in congested state based on accepted standards and norms. Accordingly, in order to check whether the segments are congested or not, analysis was made using HCM 2000 procedures. In order to analyze the LOS using the procedures, it was made with the options right-hand driving rule and HCM 2000 metric version which represent the driving rule of Ethiopia.

The HCM 2000 metric version was chosen because it is widely accepted Highway capacity manual throughout the world with only minor modifications and calibration. Due to the availability of traffic flow data the level of service (LOS) was made for the three segments specifically where travel volume / time data was collected.

For the analysis purpose of the segmental level of service for the selected corridor a Two Ways – Two Lane Highway analysis procedures are utilized by subdividing the segment into three segments. That is, Hiwot building – Teachers road intersection Segment section, Bishoftu Bus station – Tourist intersection and Bishoftu roundabout – Mekonenoch club Segment section.

Traffic volume for basic design purposes is based on the number of two (or more)-axled motorized vehicles. Consideration of other traffic (motor cycles, motor cycle-based taxis, non-motorized vehicles, pedestrians, etc.) is taken into account by modifying the basic standards. This is done by combining the number of such road users using the PCU (passenger car unit) concept as shown in Table 4.4. Motorcycle taxis (e.g. bajaj) are becoming popular in urban situations and it is only a matter of time before these spread to more rural areas and become adapted for freight as well as for passenger transport.

Assumptions for the Analysis of Class I Two way Two Lane Highways

- > The analysis is based on Operational Level of Service (LoS)
- > The type of Highway is basically classified as Class I HW
- > The terrain type for the semi urban section is categorized as Rolling Terrain
- The input data for the analysis purpose are field measured and counted values and then other adjustment factors are calculated from the existing relations
- Estimated Base Free Flow Speed (BFFS) method along with their adjustment factors are utilized rather than Free Flow Speed from Field Measurement i.e. Field Measured Speed (SFM)

Less than 4 wheel Vehicle PCU value	PCU value			
Pedestrian	0.15			
Bicycle	0.2			
Motor cycle	0.25			
Bicycle with trailer	0.35			
Motor cycle taxi (Bajaj)	0.4			
Motor cycle with trailer	0.45			
Small animal-drawn cart	0.7			
Bullock cart	2.0			
All based on a passenger $car = 1.0$				

Table 4.4: PCU values (source ERA manual 2011)

Almost all the primary input information is gathered from the project road under analysis. These are in general the existing operational geometric feature of the highway, the current two way hourly vehicular volume, the proportions of Bajaj existence, and availability of no-passing zones as well as existing access roads/points to the main corridor.

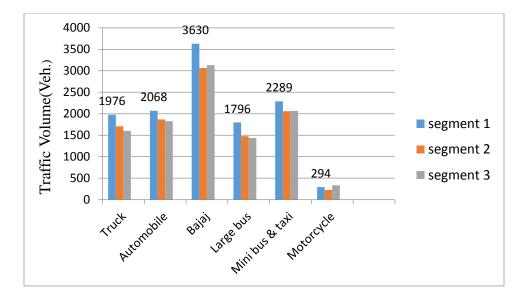


Figure. 4.7. Traffic volume distribution by vehicle type

	segment1		segment2		segment3	
	Volume(total hourly)		Volume(total hourly)		Volume(total hourly)	
Vehicle type	8 - 9 AM	5 – 6 PM	8 - 9 AM	5 – 6 PM	8 - 9 AM	5 – 6 PM
Trunks	621	471	615	378	618	375
Automobile	125	209	118	176	125	168
Bajaj	119	126	104	98	112	107
Bus	888	939	774	735	837	779
M/bus and Taxi	308	260	276	213	261	245
Motorcycle	7	7	6	6	7	9
Total	2067	2011	1892	1606	1960	1701
LOS	F		Е		Е	

Table 4.4 Level of service (LOS) in Bishoftu city

Table 4.4 Total vehicle recorded as road transport authority

The Results A two - lane highway with lane widths of 3.2, a 0.8m median, and a total lateral clearance of 2.4m will meet operation objectives of LOS E during peak hour period with passenger car speed of 64.9km/h, and density of 17.98pc/km/ln, and Bajaj 55.95Km/h. The LOS seen

The analysis between LOS, Accident and driving behavior were described to know the impacts for road safety. However, none of the researches showed the relationship between traffic congestion parameters, traffic behavior and traffic accident. It is true that the more vehicles in the road the more likely collision would happen.

For instance at a freeway we can have the highest traffic flow or volume than other road sections. However, more of traffic accidents can happen at other section of the road. So LOS have not effect on traffic accident, according to research result the highest traffic volume have the less accident. And the area with more accident have less traffic volume (segment 3).

Vehicle code	Number of vehicle
Code 1	4464
Code 2	1044
Code 3	3003
Code 4	464
Code 5	2
Special	8
Total	8985

Table 4.4b. Recorded vehicles under Bishoftu transport agency

4.5 Analysis of interview, questionnaire and field observation

Data were collected from survey questionnaire, where the number distributed questionnaire was 600. The number of returned from respondent was 552, 460 (83.7%) males and 92 (16.7%) females. The study included a sample from road segment area and two private universities (Rift valley and Admas). Statistical data of a participants in the questionnaire are shown in (Table 4.3).

- 1. The first Part of questionnaire represents type of driving behaviors that affect traffic flow andsafty
- 2. The second questionnaire represents driving mistakes and its impact on traffic flow and safety. It depends on the review of literature on Aggressive driving research at road user's safety branch [1]. SPSS (statistical Package for social sciences) version 21 software was used in forming the Regression Models. SPSS is considered one of the

most frequently used program for researchers in many fields such as engineering, science, art and education.

		All	Percent	Male	%	Female	%
			(%)				
Gender	Participant	552	100	460	83.3	92	16.7
Age	<20	2	0.4	2	100	0	0
	20-30`	330	59.8	299	90.6	31	9.4
	31-40	101	18	86	85.1	15	14.9
	41-50	63	11.4	54	85.7	9	14.3
	>50	59	10.6	53	89.8	6	10.2
Vehicle	Bajaj	185	33.5	180	97.3	5	2.7
ownership	Other vehicle	140	25.4	130	92.9	10	7.1
Worker	Public Employee	80	14.5	54	67.5	26	32.5
	Private Employee	67	12.1	44	65.8	23	34.2
	College/university student	75	13.6	48	64	27	36
	Traffic police	5	0.9	3	60	2	40

Table 4.5: Statistical Data about the participants in the questionnaire and interviews

Points list below Show the ranking of driving behavior according to the present of respondents. It contain two parts: the first part is present of respondent which represent the participants' opinion on whether they listed the driving behavior affect traffic flow or not. In the sample the most top cause of Bajaj or other vehicle accidents according to the participants opinion (interviews), and by present of respondents, where as follows:

- 1. Braking suddenly (95%)
- 2. Lane change without lighting (93%)
- 3. Not given priority to other vehicle and pedestrians (90%)
- 4. Driving in and out to pass slow vehicles (87%)
- 5. Turning at any point without care (85%)

Those listed above are the main problems of Bajaj and motorcycles driver driving behavior which listed according to respondent's opinion from interviews.



Figure. 4.8 Turning at any point without care around segment 2

The first part of the table (part 4.2.1) represent the participants' real application for these behaviors for example 96 (43.2%) of the participant said that Bajaj traffic accidents are very serious problem in Bishoftu city in severe traffic conditions, 148 (both agree and strongly agree) of the them said most of Bajaj driver driving habit is not comfortable/safe to pedestrian and other vehicles.

It show that generally of road accident and bad traffic flow is caused by human factors which refer to the behavior of driving. Bajaj vehicle factor has the second percentages for the cause of road traffic accident.

4.5.1 Frequency Tables of Pedestrians response

-		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	59	26.6	26.6	26.6
v and	Agree	96	43.2	43.2	69.8

Table 4.6 Bajaj traffic accidents are very serious problem in Bishoftu city

Neutral	37	16.7	16.7	86.5
Disagree	19	8.6	8.6	95.0
Strongly disagree	11	5.0	5.0	100.0
Total	222	100.0	100.0	

In different ways twelve questions solicited information about driver driving behavior. The first question asked respondents about Bajaj accident problem level in Bishoftu. Analysis of responses to this question was discussed. According to this question 69.8% of the respondent are "Agree" and 13.6% of them "Disagree" (Table 4.6).

Table 4.7 Bajaj traffic accidents Probability in Bishoftu city is greater compare to other vehicle accident

		Frequency	Percent	Valid Percent	Cumulative Percent
	Strongly agree	43	19.4	19.4	19.4
	Agree	74	33.3	33.3	52.7
Valid	Neutral	67	30.2	30.2	82.9
v allu	Disagree	27	12.2	12.2	95.0
	Strongly disagree	11	5.0	5.0	100.0
	Total	222	100.0	100.0	

The Bajaj traffic accidents Probability in Bishoftu city is greater compare to other vehicle accident. About 52.7% of the participant accept the problem and only 17.2% are dis agree. 30.2% of them still did not know whether it have or not. But all of them are agreed Bajaj vehicles direct or indirect involvements for accidents.

Table 4.8 Traffic accidents occurs because of Bajaj drivers do not given a priority to pedestrian

		Frequency	Percent	Valid Percent	Cumulative Percent
	Strongly agree	66	29.7	29.7	29.7
Valid	Agree	85	38.3	38.3	68.0
v anu	Neutral	30	13.5	13.5	81.5
	Disagree	25	11.3	11.3	92.8

Strongly disagree	16	7.2	7.2	100.0	
Total	222	100.0	100.0		

From question traffic accidents occurs because of Bajaj drivers do not given a priority to pedestrian, overwhelming majority (68%) indicated they would at least down for a pedestrian.18.5% indicating they would stop for pedestrian (Table 4.8). SPSS analysis was performed to assess the causes of those analyzing are gender, age and driving experience on drivers' understanding of this issue.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Strongly agree	34	15.3	15.5	15.5
	Agree	32	14.4	14.5	30.0
	Neutral	38	17.1	17.3	47.3
Valid	Disagree	86	38.7	39.1	86.4
	Strongly	30	13.5	13.6	100.0
	disagree				
	Total	220	99.1	100.0	
Missing	Miss	2	.9		
Total		222	100.0		

Table 4.9 There are adequate number of traffic police, traffic regulation, traffic sign and road environment available to reduce traffic accident in Bishoftu city

The other question asked respondents are Bajaj driver driving habit is not comfortable/safe, from this analysis 55.7 percent "Agree" and 19 percent of then is not agree. From summarized result, interview were asked why most of respondents agree. About 90 percent of the respondent are not feel comfort to the Bajaj vehicles. Bajaj vehicle caring capacity is three people, but they not move without caring 5-6 people, especially night time.

Motorist (Bajaj drivers) think that that the road are exclusively for vehicles, and therefore yielding to pedestrian is considered as courtesy. "Pedestrian take long time to cross the road" and "expect pedestrian to yield to motorist" may represent aggressive driving habit. Some studies have reported significant differences between male and female drivers with regard to distraction and aggressive driving behavior [38].

Interview driver reason why they not give priority to pedestrians are given as follow in percent, from 120 driver sample:

- \blacktriangleright Don't see the pedestrian at enough time 73%
- > They think slowing is enough for pedestrian to cross the road 16%
- Pedestrian take a long time to cross the road 8%
- Expect pedestrian to yield (give priority) to motorists 3%

		Frequency	Percent	Valid Percent	Cumulative Percent
	Strongly agree	54	24.3	24.3	24.3
	Agree	94	42.3	42.3	66.7
Valid	Neutral	32	14.4	14.4	81.1
v allu	Disagree	23	10.4	10.4	91.4
	Strongly disagree	19	8.6	8.6	100.0
	Total	222	100.0	100.0	

Table 4.10 Most of Bajaj driver driving habit is not comfortable/safe

To check the respondent's response whether it was true or not they were asked to answer the question 'Bajaj vehicle are easily accessible and safe transportation modes'. But 45% are not agree and 24.8% of then still not sure whether it accessible or not. So it indicated more than half response Bajaj vehicle are not accessible modes.

Table 4.11 Bajaj vehicle are easily accessible and safe transportation modes

		Frequency	Percent	Valid Percent	Cumulative Percent
	Strongly agree	45	20.3	20.3	20.3
	Agree	22	9.9	9.9	30.2
Valid	Neutral 55 24.8 24.8	24.8	55.0		
v allu	Disagree	84	37.8	37.8	92.8
	Strongly disagree	16	7.2	7.2	100.0
	Total	222	100.0	100.0	

Comparing respondent's frequencies in Table 4.12 we see that illegal provisioned license are most dangerous cause of bad driving habit. From punishment record in Bishoftu city police report from 100 drivers ten of them have no license. License giver agencies almost all are private. The respondent think that license regulation is violated if trainer gives money, license can sold without ethics.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Strongly agree	47	21.2	21.2	21.2
	Agree	92	41.4	41.4	62.6
Valid	Neutral	34	15.3	15.3	77.9
v allu	Disagree	27	12.2	12.2	90.1
	Strongly disagree	22	9.9	9.9	100.0
	Total	222	100.0	100.0	

Table 4.12 Most of Bajaj drivers driving license are seems illegally provisioned

As indicated on table 4.13 70.7% of the respondents strongly agree and agree as road type of Bishoftu city are not comfortable for Bajaj vehicle. Half (35.4%) of the respondent rise their reason for this problem are the traffic management system of the city. Their caring capacity also make then

		Frequency	Percent	Valid Percent	Cumulative Percent
	Strongly agree	50	22.5	22.5	22.5
	Agree	107	48.2	48.2	70.7
Valid	Neutral	34	15.3	15.3	86.0
vanu	Disagree	17	7.7	7.7	93.7
	Strongly disagree	14	6.3	6.3	100.0
	Total	222	100.0	100.0	

Table 4.13 Road types of Bishoftu city are not conformable for Bajaj vehicles

4.5.1.1. Unsafe driving Behavior

According to pedestrian response speedy and turning quick while speedy were ranked highest and the most common unsafe driving behavior by the drivers. The respondents has the opinion that the priority-pedestrians crossing at the victory of the school and bus station was not effective as expected. Because Bajaj drivers do not yield to pedestrian on the crossing to principals' satisfaction.

4.2.2 Frequency Tables of Bajaj driver response

Out of 185 drivers 180 male and 5 female are participating on questionnaire. Only 21.1 percent are not drive during angry, but other 78.9 percent drive speedy 28.1%, 45.4%, 4.9% which, rarely, sometimes, and always/often respectively.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	39	21.1	21.2	21.2
	Rarely	52	28.1	28.3	49.5
Valid	Sometimes	84	45.4	45.7	95.1
	Often	9	4.9	4.9	100.0
	Total	184	99.5	100.0	
Missing	Miss	1	.5		
Total		185	100.0		

Table 4.14 I drive speedy when I am angry or upset

Table4.14, represents the participants 'real application for these behaviors, only 21.1% of the participant said that never drive speedy while they are angry, only 8.1% of them never lose their temper during speedy driving. That while, most of accident occur during speedy driving.

Table 4.15 I lose my temper when driving

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1	Never	15	8.1	8.2	8.2

	Rarely	56	30.3	30.4	38.6
	Sometimes	63	34.1	34.2	72.8
	Often	24	13.0	13.0	85.9
	Always	26	14.1	14.1	100.0
	Total	184	99.5	100.0	
Missing	Miss	1	.5		
Total		185	100.0		

A total of 185 Bajaj drivers were observed at 3 road segment and crossings. Table 4.16 indicated that on the overall only 10.8 percent of drivers, not flash headlight while they are angry. But the rest 89.2 percent have the behavior of aggressiveness from level of sometimes to always.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	20	10.8	10.8	10.8
	Rarely	36	19.5	19.5	30.3
Valid	Sometimes	69	37.3	37.3	67.6
v allu	Often	23	12.4	12.4	80.0
	Always	37	20.0	20.0	100.0
	Total	185	100.0	100.0	

Table 4.16 I flash my headlights when I am annoyed by another driver.

The second part of the table, represents the participants' (drivers) real application for these behaviors, 145(78.4%) of the participant said that (rarely-Often) they drive speedy while they are angry, 20-50% of them said that they lose their temper during speedy driving. That while, most of accident occur during speedy driving.

Table 4. 17 particular mode of transportation needs improvement in terms of safety and traffic flow

	Frequency	Percent	Valid Percent	Cumulative Percent
--	-----------	---------	---------------	--------------------

	Motor cycle	48	21.6	21.6	21.6
City t	City taxi	10	4.5	4.5	26.1
N / P 1	Bajaj	114	51.4	51.4	77.5
Valid	Automobile	18	8.1	8.1	85.6
	Trucks	32	14.4	14.4	100.0
	Total	222	100.0	100.0	

Figure 4.6 transportation needs improvement

4.5.2 Frequency Tables of other vehicles driver response.

Table 4.18 which type of vehicles /motor do you think have more chance for an accident comparatively

		Frequency	Percent	Valid Percent	Cumulative
					Percent
	Taxis	32	22.9	22.9	22.9
	Motorcycle	28	20.0	20.0	42.9
Valid	Bajaj	57	40.7	40.7	83.6
	Truck	23	16.4	16.4	100.0
	Total	140	100.0	100.0	

One hundred forty respondent to the question on vehicle/motor type which have more chance for accident comparatively from driver's point of view. Table 4.18 indicate that 40.7 percent given to Bajaj vehicle. Depending on drivers opinion, interview were summarized to know whether Bajaj have chance of accident or not. 85 respondents say that Bajaj vehicles are not the only which have chance for accident, it also the main cause of others vehicles accident causality.

	Frequency	Percent	Valid Percent	Cumulative
				Percent
Valid Lack of experience	75	53.6	53.6	53.6

Low vehicle quality	19	13.6	13.6	67.1
Lack of traffic law	26	18.6	18.6	85.7
unconsidered road type	20	14.3	14.3	100.0
Total	140	100.0	100.0	

Most of Bajaj driver have the habit of lane change time to time and make zigzag in and out to pass front. This habit may have effect on traffic flow and safety and causes road traffic accidents and make to others drivers misbehave (Table 4.19)

Table 4.20 which particular mode of transportation needs improvement in terms of safety and traffic flow?

		Frequency	Percent	Valid Percent	Cumulative
					Percent
	Motorcycle	42	30.0	30.0	30.0
	Taxi	6	4.3	4.3	34.3
Valid	Bajaj	70	50.0	50.0	84.3
	Truck	22	15.7	15.7	100.0
	Total	140	100.0	100.0	

According to Participants questionnaires and interview response the main type of driving behavior are identified as follow:

- Aggressiveness: it is a series of road rage behavior with direct and/or hostile intent to harm others, involves a persistent and consistent to stressors.
- > Inattention while driving, when changing lane and crossing road
- > Drive out of lane to pass or to get free traffic flow
- Angry driving: angry driving can have negatively influence on attitude of driving way, which is affect the traffic flow and further cause road traffic accidents.
- Speeding: It should come as no surprise, speed is a dangerous behavior that many Bajaj drivers are guilty of taking part in. Obviously when they speed or travel faster than the posted speed limit, they are put them self, their passenger and other traveler in danger.
- Distracted driving: There are range of actions that fall in to the "distracted driving" category, of course, texting while driving, using cell phone, they can't fully be paying

attention to the road in front of them. And other type of distracted driving often included, driving while tired, eating/or drinking while driving and messing with the radio.

CHAPTER FIVE

5. Conclusions and recommendations

5.1. Conclusions

The result of the current study have highlighted a number of issues that required attention in order to reduce traffic related accidents among drivers. It is hoped the information from the study will lead to developing a better understanding of issues related to traffic accidents in the region and hopefully lead to change in driving habits and unsafe driving behaviors.

Majority of traffic safety projects and strategies focuses on the prevention car occupants from traffic accidents and only few studies focus on the prevention of vulnerable road users such as pedestrians.

It was identified a types of driving behavior that affect the traffic flow and safety, according to the participants' opinion more than 90% of them decide as Bajaj vehicles impacted the traffic flow and safety, and the second objective part which represent weather the participants conducted this behavior or not. It was found that the highest Bajaj driving impacts are as follows:

- 1. Aggressive driving: this was widely summarized as unwillingness to give yield for pedestrian, to harm others, involves a persistent and consistent to stressors.
- 2. Drive out of lane: violating traffic regulation like, drive on shoulder, in and out to pass and get free flow.
- 3. Inattention: forgetting rule and regulation care and drive with own world.
- 4. Speeding: drive above speed limit at crossing and populated area
- 5. Distracted driving: do other activities included, driving while tired, eating/or drinking while driving and messing with the radio.
- 6. Angry driving: lose mood, temper and disturbing other vehicle fine flows.
- 7. Wrong turning and lane changing

The main causes of bad driving habits related to Bajaj drivers are as follows

A bad driving habit can be defined as any driving practice that is inherently unsafe, illegal or not in line with international best practice that causes

- 1. Experience of the drivers:
- 2. Age of driver (younger drivers): a younger driver those got a license (age 20-30) have revealed that up to 75% believe they are "above average" drivers.
- 3. Low quality of license giver agencies
- 4. Road types (common road) with other vehicles

The impacts of Bajaj driving behaviors for congestion and the main causes of congestion that impacts related to Bajaj driving behavior are:

- 1. Close following and tailgating
- 2. Lane violations and zigzag driving or passing
- 3. Being unfocused and distraction
- 4. Lane change without attention
- 5. Yield violations for other vehicles and pedestrians
- 6. Sudden turning and stopping
- 7. Speeding over the speed limit
- 8. Violation of traffic signs and traffic rule

5.2 Recommendations

The following recommendation are needed to improve traffic flow and traffic safety in Bishoftu: It recommended to improve Bajaj drivers driving behavior impact through the following:

- 1. Increase enforcement: some drivers transporting passenger above Bajaj carrying capacity (>three passenger) and driving above speed limit (>60km/h).so force drivers who repeat this kinds of traffic violations to suspend their driving license and to attend training courses concerning traffic laws and regulations.
- 2. Education and awareness for drivers and pedestrians: education and awareness giving for drivers must be attended at school level, especially at license giver agencies. The agency have the responsibilities to produce responsible driver before licensed.
- 3. Separate the common roads of Bajaj and other vehicles: Bishoftu city have a lot of optional road to manage traffic flow and accident, so it is better to use different road for vehicles and Bajaj vehicles.
- 4. To force drivers who repeat traffic violations to suspend their driving license and to attend training courses concerning traffic laws and regulations.
- 5. To increase the penalties for speeding, close following, drinking, smoking, using cell phones, zigzag driving, and yield violations.
- 6. To encourage drivers to drive defensively and to obey traffic rules and regulations in all circumstances.
- 7. To increase the number of traffic police patrols on the most hazardous and dangerous streets.

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Appendix

Appendix A

Dear respondents:

This questionnaire is designed to gather data on the impacts of Bajaj driving behavior for traffic flow and safety in Bishoftu city, to achieve this purpose and to deeply investigate the case, your response to the questions given below has a crucial value. Therefore, you are kindly requested to read the questions carefully and give accurate and real data which exists on the ground. The response that you reply will not be used for any other purpose other than this research work, so be free and give your honest and genuine response.

Thank you in advance for your

Cooperation!

Instruction: Circle the letter of your choice or fill the blank spaces for the following questions. You may respond more than one answer if it is necessary.

 Sex Age 	A. Male	B. Female	
A. less than 20	C. 31-45		
B. 20-30	D. Above 45		
3. Occupation			
A. Student	C. Unemployment		
B. Employee D. Other (specify)			
4. Marital Status			
A. Married	C. Single E. Other	(Specify)	
B. Divorced	D. Widowed		
5. Educational level			
A. No Schooling (illiterate)	E. above Secondar	y Education	

B. Basic education	F. Diploma
C. Primary education	G. Degree
D. Secondary Education (grade 9-12)	H. Other (specify)
6. Income per month	
A. <500birr	D.2001 – 3000birr
B.500 – 1000birr	E.>3000birr
C.1001 – 2000birr	
 Which transport mode do you usually use A. Walking B. City taxi Why you need to choice the above mode of 	C. Bajaj D. Other
A. Because it has less cost	C. Less travel time
B. It's safe and comfortable	D. Easily available
E Others (specify).	
9. Family size	
A. <4	D.9 – 10
B.4-6	E.>10
C.7 – 8	
10. Which transport mode do your family menA. WalkingB. City taxi	mbers usually use? C. Bajaj D. Other
11. Working hour from to	
A. 1:00 – 8:00	C. 2:30 – 11:00
B.2:00 – 10:00	D. 3:00 – 12:00

12. How much you paid for this trip?

At what time of the day do yo A. 12:00 - 1:00AM	C. 2:00 – 3:00 AM		
A. 12:00 - 1:00AM	$C_{2}:00 = 3:00 \text{ AM}$		
	C. 2.00 = 3.00 AM		
B. 1:00 - 2:00AM	D. 3:00 – 4:00AM		
Which mode of transportation	feel you more comfort in the city?		
A. motor cycle	C. Bajaj		
•	D. Other		
	with accident or near accident possibili	ty the transportation	
A. Yes B. No			
f your answer is yes how did	you think about the causes of that poss	sibility?	
1 4	C. low Road of	quality	
B. Bad driver behavior	D. Other (spec	D. Other (specify)	
-	ansportation needs improvement in ter	rms of safety and tra	
A. motor cycle	C. Bajaj	E. Automobile	
	C. Dujuj		
	 Which mode of transportation A. motor cycle B. City taxi Did you have an experience vised? A. Yes B. No f your answer is yes how did A. Low Vehicle quality B. Bad driver behavior Which particular mode of transportation 	Which mode of transportation feel you more comfort in the city? A. motor cycle C. Bajaj B. City taxi D. Other Did you have an experience with accident or near accident possibilised? A. Yes B. No f your answer is yes how did you think about the causes of that poss A. Low Vehicle quality C. low Road of B. Bad driver behavior D. Other (spe Which particular mode of transportation needs improvement in tertow?	

a =strongly agree	b =agree	$\mathbf{c} = neutral$	$\mathbf{d} = \text{disagree}$	e = strongly disagree
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INTERVIEW FOR INDIVIDUAL PEDESTRIAN.

1.	Do you think Bajaj traffic	cidents are very importan	t problem in Bishoftu city?
----	----------------------------	---------------------------	-----------------------------

no		a	b	c	d	e
1	Bajaj traffic accidents are very serious problem in Bishoftu city					
2	Bajaj traffic accidents in Bishoftu city is greater compare to other					
	vehicle accident					
3	Traffic accidents occurs b/c of Bajaj drivers do not given a					
	priority to a pedestrian					
4	Most of the road have comfortable pedestrian road pavement for					
	normal person and disable person					
5	Most of the road have comfortable and adequate pedestrian road					
	crossing structures and zebra crossing for normal person and					
	disable person					
6	There are adequate number of traffic police ,traffic regulation,					
	traffic sign and road environment available to reduce traffic					
	accident in Bishoftu city					
7	Most of Bajaj driver driving habit is not comfortable/safe for					
	passengers and other vehicles.					
8	Road types of Bishoftu city are not accessible and conformable					
	for Bajaj vehicles					
9	Most of Bajaj drivers driving license are seems illegally					
	provisioned					
10	Since Bajaj vehicle are easily accessible most of people use it as a					
	first choice transportation modes					
	(a) Ves (b) No	1				I

- (a) Yes (b) No
- 2. Do you agree the amount of Bajaj traffic accidents in Bishoftu city is greater compare to other vehicle accident?

a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree

3. Do you agree that you and other pedestrian follow the traffic regulations like crossing road using on zebra crossing to protect from traffic accidents in Bishoftu city?

a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree

4. Do you Agree the traffic accidents occurs b/c of Bajaj drivers do not given a priority to a pedestrian?

a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree

5. Do you agree most necessary traffic safety education and training about traffic accidents is given for drivers and pedestrian is adequate in Bishoftu city?

a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree

- 6. Do you Agree most of the road have comfortable pedestrian road pavement for normal person and disable person?
 - a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree
- 7. Do you Agree most of the road have comfortable and adequate pedestrian road crossing structures and zebra crossing for normal person and disable person?
 - a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree
- 8. Is there adequate number of traffic police, traffic regulation, traffic sign and road environment available to reduce traffic accident in Bishoftu city?
 - a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree
- 9. Are you comfortable waking and crossing zebra without any problems using Bishoftu city pedestrian road pavement than other city pedestrian road pavement.
 - a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree

10. Did you have any Bajaj traffic accident problems happen in your previous life experience?

	(a) Yes	(b) No		
		ault the accident happe		
11				reasing the traffic safety
	in Bishoftu city?	(a) Yes	(b) No	
	If yes, what are your re	ecommendations?		
12	. Are there any problem	ns on implementing traff	fic safety measures in B	ishoftu city?
	(a) Yes	(b) No		
	If yes, what are the pro-	blems?		
13		w should be the most res		
	a) Driver	(b) pedestrian	c) government	d) traffic police

Part-II: Respondent's Perceptions toward Bajaj driver driving impact in Bishoftu City

Use 'X' or ' $\sqrt{}$ ' mark at provided space

1. Do you think there is traffic problem at intersections and crossings in Bishoftu city due to Bajaj vehicles at some level?

Yes____No____

2. If your answer for question number 1 is yes. What do you think the level of driving impact at the intersections and lane segments?

Very High____, High ____ Moderate___ Low___ Very Low____

3. What do you think the cause of Bajaj driver driving behavior impact at the intersection for traffic flow and safety in the city?

	Road qualitydriver experienceRule and regulation Bajaj quality
	Road construction activitiesPoorly Timed Traffic SignalsSpecial Events
	Reduction in road capacityBad Weathervehicle breakdown
	On Parking Street
	Other
4.	What do you suggest to minimize bad driving behavior impact in the city?
	Improve capacity of roadsAdding travel lanes
	Trainee drivers change Baja vehicle road _ Re-examine lenience giver agencies
	Geometric improvements to roads and intersections; improving public transport;

Other____

QUESTIONNAIRE FORM FOR DRIVERS

Please answer each of the following items as honestly as possible. Please read each item carefully and then circle the answer you choose on the form. If none of the choices seem to be your ideal answer, then select the answer that comes closest. THERE ARE NO RIGHT OR WRONG ANSWERS. Select your answers quickly and do not spend too much time analyzing Your onswers. If you change on answer, areas the first one well. No need of write your name on

Your answers. If you change an answer, erase the first one well. No need of write your name on this paper/questioner.

Personal detail

- 1. Age in years
 - (a) Below 18 (b) 18 30 (c) 30 40
 - (d) 40-50 (e) 50 above
- 2. Sex: (a) Male. (b) Female
- 3. Working experience in years

(d) 10 – 20 (e) 20 above

1. I drive when I am angry or upset.

A. Never B. Rarely C. Sometimes D. Often E. Always

2. I lose my temper when driving.

		-					
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
3.	I consider the activ	ons of other drive	ers to be inappropriat	e or "stupid."			
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
4.	I flash my headlig	hts when I am an	noyed by another dri	ver.			
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
5.	I verbally insult d	rivers who annoy	me.				
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
6.	I deliberately use	my Bajaj to blocl	k drivers who tailgate	e me.			
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
7.	I would tailgate a	driver who anno	ys me.				
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
8.	I "drag race" other	r drivers at stop l	ights to get out front.				
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
9.	I will illegally pas	s a car/truck that	is going too slowly.				
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
10. I feel it is my right to strike back in some way, if I feel another driver has been aggressive							
	toward me.						
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
11	. When I get stuck i	in a traffic jam I	get very irritated.				
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
12	. I will weave in an	d out of slower tr	affic.				
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
13	. I will drive if I am	only mildly into	oxicated or buzzed.				
	A. Never	B. Rarely	C. Sometimes	D. Often	E. Always		
14	14. When someone cuts me off. I feel I should punish him/her.						

14. When someone cuts me off, I feel I should punish him/her.

A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
15. I get impat	ient and/or upset when	n I fall behind schedu	ıle when I am driv	ing.
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
16. Passengers	in my Bajaj/car tell n	ne to calm down.		
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
17. I get irritate	ed when a car/Bajaj ir	n front of me slows do	own for no reason.	
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
18. I will cross	double yellow lines t	to see if I can pass a s	low moving car/tr	uck.
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
19. I feel it is r	ny right to get where	I need to go as quickl	y as possible.	
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
20. I feel that p	bassive drivers should	learn how to drive or	r stay home.	
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
21. I will drive	in the shoulder lane of	or median to get arou	nd a traffic jam.	
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
22. When pass	ing a car/truck on a 2-	-lane road, I will bare	ly miss on-coming	g cars.
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
23. I will drive	when I am drunk.			
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
24. I feel that I	may lose my temper	if I have to confront a	another driver.	
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
25. I consider	myself to be a risk-tak	ker.		
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always
26. I feel that r	nost traffic "laws" co	uld be considered as s	suggestions.	
A. Nev	ver B. Rarely	C. Sometimes	D. Often	E. Always

QUESTIONNAIRE FORM FOR TRAFFIC POLICE

Instruction: Circle the letter of your choice or fill the blank spaces for the following questions. You may respond more than one answer if it is necessary.

SECTION ONE Personal details Date----- Rank------

1. Age in years

(a) Below 18	(b) 18 – 30	(c) $30 - 40$
--------------	-------------	---------------

- (d) 40 50 (e) 50 above
- 2. Sex: (a) Male. (b) Female
- 3. Working experience in years
 - (a) Below 1 (b) 1-5 (c) 5-10(d) 10-20 (e) 20 above
- Do you think traffic accidents are very important problem in Bishoftu city?
 (a) Yes
 (b) No
- 2. Do you agree the magnitude of traffic accidents in Bishoftu city is greater compare to other?
 - a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree
- 3. How do you normally get information after the motor accident has occurred?
- a) From driver (b) pedestrian c) eye witness d) condition of vehicles
 - 4. Do you Agree most of the Bajaj traffic accidents occurs in Bishoftu city is b/c of drivers do not given a priority to a pedestrian ?

a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree

- 5. The most necessary traffic safety education and training about traffic accidents is given for drivers and pedestrian is adequate in Bishoftu city?
 - a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree
- 6. Do you Agree most of the traffic accidents occurs in Bishoftu city is at the same location and it must be putting a black spot location is necessary?
 - a) Strongly agree (b) agree c) neutral d) disagree e) strongly disagree
- 7. Is there any problems in getting immediate information after the traffic accident has occurred? (a) Yes (b) No
 - If yes, what are the problems? ------
- 8. How do you transport injured people from the site of accident to hospital?
 - (a) By police vehicle. (b) By ambulance (c) By requesting other motorists to help.
 - (d) Accident victims hire vehicles themselves.
 - (e) Others (specify) ------

No		a	b	c	d	e
1	Bajaj traffic accidents are very serious problem in Bishoftu city					
2	Bajaj traffic accidents in Bishoftu city is greater compare to other					
	vehicle accident					
3	Traffic accidents occurs b/c of Bajaj drivers do not given a					
	priority to a pedestrian					
4	Most of the road have comfortable pedestrian road pavement for					
	normal person and disable person					
5	Most of the road have comfortable and adequate pedestrian road					
	crossing structures and zebra crossing for normal person and					
	disable person					
6	There are adequate number of traffic police ,traffic regulation,					
	traffic sign and road environment available to reduce traffic					
	accident in Bishoftu city					
7	Most of Bajaj driver driving habit is not comfortable/safe					
8	Bajaj vehicle are easily accessible and safe transportation modes					
9	Most of Bajaj drivers driving license are seems illegally					
	provisioned					
10	Road types of Bishoftu city are not conformable for Bajaj					
	vehicles					

Likert scale questionnaires for pedestrian

a =strongly agree **b** =agree **c** = neutral **d** = disagree **e** = strongly disagree

Other vehicles driver questionnaires

1. Sex

2.

	a. Male		b. Female	
Age				
	a. 20-30	b. 31-40	c. 41-50	d. >50

3. Types of vehicle you drive?

a. Mini bus/taxi	b. Automobile c. Bus
d. Truck	e. Other (if)
4. Working experience in years	
(a) Below 1	(b) $1 - 5$ (c) $5 - 10$
(d) $10-20$	(c) 1 c (c) c 1 c (c) c
	lent or near accident possibility during your driving life
time?	tent of notific decident possionity carring your arrying me
	No
6. If your answer is yes how did you think	about the causes of that possibility?
A. Low Vehicle qua	ity C. collision with other vehicles
B. Bad driver behavi	or D. Other if
7. Which type of vehicles /motor do you th	ink have more chance for an accident comparatively
A. Taxi	B. Motor cycles C. Bajaj
D. Trucks/bigger ve	hicles E. Other (if)
8. What are your reason for the answer No	7?
A. Lack of experience	ee B. Vehicle quality C. Lack of traffic law
D. None considered	road type for the vehicle E. Other if
9. Do you think in Bishoftu city there is ve	hicle type which affect the traffic flow and safety?
A. Yes	B. No
10. If answer No 9 is 'Yes' which type of ve	hicle do you think?
A. Buses	B. Motor cycles C. Bajaj
D. Automobile	E. Taxis F. Other if
11. Which particular mode of transportation	needs improvement in terms of safety and traffic flow?
A. Motorcycle	C. Bajaj
B. City taxi	D. Trucks
12. From your answer no 11 why it needs in	provement? please list your idea freely

Appendix B

Participants out put

Frequency Table

Bajaj traffic accidents are very serious problem in Bishoftu city

		Frequency	Percent	Valid Percent	Cumulative
					Percent
	Strongly agree	59	26.6	26.6	26.6
	Agree	96	43.2	43.2	69.8
Valid	Neutral	37	16.7	16.7	86.5
Valid	Disagree	19	8.6	8.6	95.0
	Strongly disagree	11	5.0	5.0	100.0
	Total	222	100.0	100.0	

Bajaj traffic accidents in Bishoftu city is greater compare to other vehicle

accident

		Frequency	Percent	Valid Percent	Cumulative
					Percent
	Strongly agree	43	19.4	19.4	19.4
	Agree	74	33.3	33.3	52.7
Valid	Neutral	67	30.2	30.2	82.9
v allu	Disagree	27	12.2	12.2	95.0
	Strongly disagree	11	5.0	5.0	100.0
	Total	222	100.0	100.0	

Traffic accidents occurs b/c of Bajaj drivers do not given a priority to a

pedestrian

	pedestrian								
-		Frequency	Percent	Valid Percent	Cumulative				
					Percent				
	Strongly agree	66	29.7	29.7	29.7				
	Agree	85	38.3	38.3	68.0				
Valid	Neutral	30	13.5	13.5	81.5				
vanu	Disagree	25	11.3	11.3	92.8				
	Strongly disagree	16	7.2	7.2	100.0				
	Total	222	100.0	100.0					

		person und disaste person						
		Frequency	Percent	Valid Percent	Cumulative			
					Percent			
	Strongly agree	53	23.9	23.9	23.9			
	Agree	94	42.3	42.3	66.2			
Valid	Neutral	27	12.2	12.2	78.4			
vand	Disagree	34	15.3	15.3	93.7			
	Strongly disagree	14	6.3	6.3	100.0			
	Total	222	100.0	100.0				

Most of the road have comfortable pedestrian road pavement for normal person and disable person

Most of the road have comfortable and adequate pedestrian road crossing structures and zebra crossing for normal person and disable person

		Frequency	Percent	Valid Percent	Cumulative
					Percent
	Strongly agree	40	18.0	18.0	18.0
	Agree	76	34.2	34.2	52.3
Valid	Neutral	24	10.8	10.8	63.1
vand	Disagree	68	30.6	30.6	93.7
	Strongly disagree	14	6.3	6.3	100.0
	Total	222	100.0	100.0	

There are adequate number of traffic police ,traffic regulation, traffic sign and road environment available to reduce traffic accident in Bishoftu city

		Frequency	Percent	Valid Percent	Cumulative
					Percent
	Strongly agree	34	15.3	15.5	15.5
	Agree	32	14.4	14.5	30.0
Valid	Neutral	38	17.1	17.3	47.3
vand	Disagree	86	38.7	39.1	86.4
	Strongly disagree	30	13.5	13.6	100.0
	Total	220	99.1	100.0	
Missing	Miss	2	.9		
Total		222	100.0		

Most of Bajaj driver driving habit is not comfortable/safe

		Frequency	Percent	Valid Percent	Cumulative
					Percent
	Strongly agree	54	24.3	24.3	24.3
	Agree	94	42.3	42.3	66.7
Val: 4	Neutral	32	14.4	14.4	81.1
Valid	Disagree	23	10.4	10.4	91.4
	Strongly disagree	19	8.6	8.6	100.0
	Total	222	100.0	100.0	

Bajaj vehicle are easily accessible and safe transportation modes

		Frequency	Percent	Valid Percent	Cumulative
					Percent
	Strongly agree	45	20.3	20.3	20.3
	Agree	22	9.9	9.9	30.2
Valid	Neutral	55	24.8	24.8	55.0
vanu	Disagree	84	37.8	37.8	92.8
	Strongly disagree	16	7.2	7.2	100.0
	Total	222	100.0	100.0	

Most of Bajaj drivers driving license are seems illegally provisioned

		Frequency	Percent	Valid Percent	Cumulative Percent
	Strongly agree	47	21.2	21.2	21.2
	Agree	92	41.4	41.4	62.6
	Neutral	34	15.3	15.3	77.9
Valid	Disagree	27	12.2	12.2	90.1
	Strongly disagree	22	9.9	9.9	100.0
	Total	222	100.0	100.0	
	-	Frequency	Percent	Valid Percent	Cumulative Percent
					rereem
	Strongly agree	50	22.5	22.5	22.5
	Strongly agree Agree	50 107	22.5 48.2	22.5 48.2	
Valid					22.5
Valid	Agree	107	48.2	48.2	22.5 70.7
Valid	Agree Neutral	107 34	48.2 15.3	48.2 15.3	22.5 70.7 86.0

BY TENNA TESFAYE, JIT

Appendix B-1

Bajaj Driver response out put

Frequency Table

I drive when I am angry or upset

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	39	21.1	21.2	21.2
	Rarely	52	28.1	28.3	49.5
Valid	Sometimes	84	45.4	45.7	95.1
	Often	9	4.9	4.9	100.0
	Total	184	99.5	100.0	
Missing	miss	1	.5		
Total		185	100.0		

I lose my temper when driving

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	15	8.1	8.2	8.2
	Rarely	56	30.3	30.4	38.6
X7-1:1	Sometimes	63	34.1	34.2	72.8
Valid	Often	24	13.0	13.0	85.9
	Always	26	14.1	14.1	100.0
	Total	184	99.5	100.0	
Missing	miss	1	.5		
Total		185	100.0		

I consider the actions of other drivers to be inappropriate or "stupid

-		Frequenc	Percent	Valid Percent	Cumulative Percent
		У			
	Never	9	4.9	4.9	4.9
	Rarely	45	24.3	24.3	29.2
	Sometimes	64	34.6	34.6	63.8
Valid	Often	40	21.6	21.6	85.4
	Always	26	14.1	14.1	99.5
	n	1	.5	.5	100.0
	Total	185	100.0	100.0	

I flash my headlights when I am annoyed by another driver.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	20	10.8	10.8	10.8
	Rarely	36	19.5	19.5	30.3
Valid	Sometimes	69	37.3	37.3	67.6
Valid	Often	23	12.4	12.4	80.0
	Always	37	20.0	20.0	100.0
	Total	185	100.0	100.0	

I verbally insult drivers who annoy me.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	56	30.3	30.6	30.6
	Rarely	46	24.9	25.1	55.7
Valid	Sometimes	64	34.6	35.0	90.7
vand	Often	6	3.2	3.3	94.0
	Always	11	5.9	6.0	100.0
	Total	183	98.9	100.0	
Missing	miss	2	1.1		
Total		185	100.0		

I deliberately use my Bajaj to block drivers who tailgate me.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	80	43.2	43.5	43.5
	Rarely	38	20.5	20.7	64.1
Valid	Sometimes	59	31.9	32.1	96.2
vand	Often	2	1.1	1.1	97.3
	Always	5	2.7	2.7	100.0
	Total	184	99.5	100.0	
Missing	miss	1	.5		
Total		185	100.0		

I would tailgate a driver who annoys me.

ſ			Frequency	Percent	Valid Percent	Cumulative Percent
	Valid	Never	102	55.1	55.4	55.4

Rarely	38	20.5	20.7	76.1
Sometimes	42	22.7	22.8	98.9
Always	2	1.1	1.1	100.0
Total	184	99.5	100.0	
Missing miss	1	.5		
Total	185	100.0		

-		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	34	18.4	18.4	18.4
	Rarely	61	33.0	33.0	51.4
	Sometimes	73	39.5	39.5	90.8
Valid	Often	9	4.9	4.9	95.7
	Always	7	3.8	3.8	99.5
					100.0
	Total	185	100.0	100.0	

I "drag race" other drivers at stop lights to get out front.

I feel it is my right to strike back in some way, if I feel another driver has been aggressive toward me.

		Frequency	Percent	Valid Percent	Cumulative Percent
		2	1.1	1.1	1.1
	Never	19	10.3	10.3	11.4
	Rarely	15	8.1	8.1	19.5
Valid	Sometimes	53	28.6	28.6	48.1
	Often	76	41.1	41.1	89.2
	Always	20	10.8	10.8	100.0
	Total	185	100.0	100.0	

When I get stuck in a traffic jam I get very irritated.

-		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	27	14.6	14.6	14.6
	Rarely	27	14.6	14.6	29.2
Val: 4	Sometimes	88	47.6	47.6	76.8
Valid	Often	27	14.6	14.6	91.4
	Always	16	8.6	8.6	100.0
	Total	185	100.0	100.0	

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	28	15.1	15.1	15.1
	Rarely	82	44.3	44.3	59.5
V.1:1	Sometimes	18	9.7	9.7	69.2
Valid	Often	47	25.4	25.4	94.6
	Always	10	5.4	5.4	100.0
	Total	185	100.0	100.0	

I will drive if I am only mildly intoxicated or buzzed.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	93	50.3	50.3	50.3
Valid	Sometimes	92	49.7	49.7	100.0
	Total	185	100.0	100.0	

When someone cuts me off, I feel I should punish him/her

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	92	49.7	52.3	52.3
	Rarely	46	24.9	26.1	78.4
Valid	Sometimes	38	20.5	21.6	100.0
	Total	176	95.1	100.0	
Missing	miss	9	4.9		
Total		185	100.0		

I get impatient and/or upset when I fall behind schedule when I am driving.

_		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	9	4.9	4.9	4.9
	Rarely	18	9.7	9.7	14.6
Valid	Sometimes	121	65.4	65.4	80.0
vand	Often	27	14.6	14.6	94.6
	Always	10	5.4	5.4	100.0
	Total	185	100.0	100.0	

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	46	24.9	24.9	24.9
	Rarely	66	35.7	35.7	60.5
V -1:1	Sometimes	37	20.0	20.0	80.5
Valid	Often	18	9.7	9.7	90.3
	Always	18	9.7	9.7	100.0
	Total	185	100.0	100.0	

Passengers in my Bajaj/car tell me to calm down.

I get irritated when a car/Bajaj in front of me slows down for no reason.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	36	19.5	19.5	19.5
X7 1° 1	Rarely	92	49.7	49.7	69.2
Valid	Sometimes	57	30.8	30.8	100.0
	Total	185	100.0	100.0	

I will cross double yellow lines to see if I can pass a slow moving car/truck.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	75	40.5	40.5	40.5
	Rarely	46	24.9	24.9	65.4
Valid	Sometimes	36	19.5	19.5	84.9
vand	Often	18	9.7	9.7	94.6
	Always	10	5.4	5.4	100.0
	Total	185	100.0	100.0	

I feel it is my right to get where I need to go as quickly as possible.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	18	9.7	9.7	9.7
	Rarely	84	45.4	45.4	55.1
Valid	Sometimes	55	29.7	29.7	84.9
	Often	28	15.1	15.1	100.0
	Total	185	100.0	100.0	

I feel that passive drivers should learn how to drive or stay home.

Frequency Percent Valid Percent Cumulative Percent

	Never	28	15.1	15.1	15.1
	Rarely	18	9.7	9.7	24.9
Valid	Sometimes	129	69.7	69.7	94.6
	Often	10	5.4	5.4	100.0
	Total	185	100.0	100.0	

I will drive in the shoulder lane or median to get around a traffic jam.

-		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	46	24.9	24.9	24.9
	Rarely	20	10.8	10.8	35.7
Valid	Sometimes	92	49.7	49.7	85.4
	Often	27	14.6	14.6	100.0
	Total	185	100.0	100.0	

When passing a car/truck on a 2-lane road, I will barely miss on-coming cars.

-		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	Never 55		29.7	29.7
	Rarely	46	24.9	24.9	54.6
Valid	Sometimes	75	40.5	40.5	95.1
	Always	9	4.9	4.9	100.0
	Total	185	100.0	100.0	

I will drive when I am drunk.

		Frequency	Percent	Valid Percent	Cumulative
					Percent
	Never	30	16.2	16.2	16.2
	Rarely	83	44.9	44.9	61.1
Valid	Sometimes	27	14.6	14.6	75.7
	Often	45	24.3	24.3	100.0
	Total	185	100.0	100.0	

I feel that I may lose my temper if I have to confront another driver.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	18	9.7	9.7	9.7
Valid	Rarely	38	20.5	20.5	30.3
Valid	Sometimes	27	14.6	14.6	44.9
	Often	45	24.3	24.3	69.2

Always	57	30.8	30.8	100.0
Total	185	100.0	100.0	

-		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	19	10.3	10.3	10.3
	Rarely	18	9.7	9.7	20.0
Val: d	Sometimes	38	20.5	20.5	40.5
Valid	Often	54	29.2	29.2	69.7
	Always	56	30.3	30.3	100.0
	Total	185	100.0	100.0	

I consider myself to be a risk-taker.

Appendix B-2

Frequency Table for other drivers

Which type of vehicles /motor do you think have more chance for an accident comparatively

		Frequency	Percent	Valid Percent	Cumulative Percent
	Taxis	32	22.9	22.9	22.9
	Motorcycle	28	20.0	20.0	42.9
Valid	Bajaj	57	40.7	40.7	83.6
	Truck	23	16.4	16.4	100.0
	Total	140	100.0	100.0	

What are your reason for the answer No 7?

		Frequency	Percent	Valid Percent	Cumulative
					Percent
	Lack of experience	75	53.6	53.6	53.6
	Low vehicle quality	19	13.6	13.6	67.1
Valid	Lack of traffic law	26	18.6	18.6	85.7
	unconsidered road type	20	14.3	14.3	100.0
	Total	140	100.0	100.0	

Do you think in Bishoftu city there is vehicle type which affect the traffic flow and safety?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Yes	138	98.6	98.6	98.6
Valid	No	2	1.4	1.4	100.0
	Total	140	100.0	100.0	

		Frequency	Percent	Valid Percent	Cumulative Percent
	Buses	40	28.6	29.0	29.0
	Motorcycle	11	7.9	8.0	37.0
Valid	Bajaj	61	43.6	44.2	81.2
v allu	Automobile	17	12.1	12.3	93.5
	Taxis	9	6.4	6.5	100.0
	Total	138	98.6	100.0	
Missing	miss	2	1.4		
Total		140	100.0		

If answer No 9 is 'Yes' which type of vehicle do you think?

Which particular mode of transportation needs improvement in terms of safety and traffic flow?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Motorcycle	42	30.0	30.0	30.0
	Taxi	6	4.3	4.3	34.3
Valid	Bajaj	70	50.0	50.0	84.3
	Truck	22	15.7	15.7	100.0
	Total	140	100.0	100.0	

Appendix C

Appendix C-1

				-	N ROADS AUT	-				
				ROAD VEH	ICLE COUNT F	ORM		D	M	Y
CATION : _		#		ENUMERATOR	: 1	B/No.				
						Initia				
IRECTION :_				ENUMERATOR	: 2	B./No.			Cycle No.	
						Initia			Day	
									Night	
	Car	L/Rover	S/Bus	L/Bus	S/Truck	M/Truck	H/Truck	Truck & Tra	ailer	
Hour										
				/======						
ginning				·• • • ·						Total
			< <u><</u> 27 Seats	> 27 Seats	< 3.5 Tons	3.5 - 7.5 Tons	7.5 - 12 Tons	<u>></u> 12 Ton	S	_
6-7				_						_
										\square
7-8										_
8-9										
9-10										
10-11										
11-12										
ıb-Total										

AADT and road Hourly volume data form

					ROADS AUTH					
					CLE COUNT F			D	М	Y
OCATION :		#		ENUMERATOR :	1	B/No.				
						Initial				
DIRECTION :_				ENUMERATOR :	2	B./No.			Cycle No.	
						Initial			Day	
									Night	
	Car	L/Rover	S/Bus	L/Bus	S/Truck	M/Truck	H/Truck	Truck & Tra	ailer	
Hour										
				/*******						
eginning										Total
			< <u><</u> 27 Seats	> 27 Seats	< 3.5 Tons	3.5 - 7.5 Tons	7.5 - 12 Tons	<u>>12 Ton</u>	IS	
12-1										
1-2										
2-3										
3-4										_
									┝━━┥╴┡	
4-5										
4-3				╎╶┍╾┰╼┧		1 1 1			┍╼┥┍	_
		╉┈┝╌╃┈		┞──┞──┦		╉╴┞┥		┞───┡───┙	┡━┥╴┞	
= 6										_
5-6				╏──┟──┧					┝─┥┍	_
									┡━╋╇┻╋	
ub-Total										
TOTAL										

Appendix D

Traffic volume Data

Hourly volume of the vehicles

Segme	ent 1								
	Truc	:k			Autom	obile		E	ajaj
	Right	Left L	L	Right	Left	L Turn	Right	Left	L
	L		Turn	L	L		L	L	Turn
Time									
7:00-7:15AM	15	16	5	13	10	6	26	21	14
7:15-7:30AM	10	17	6	13	15	6	28	34	10
7:30-7:45AM	13	19	7	15	14	7	29	35	12
7:45-8:00AM	20	19	7	7	12	3	24	32	15
8:00-8:15AM	30	28	10	11	15	5	29	31	14
8:15-8:30AM	22	20	7	9	16	4	32	29	17
8:30-8:45AM	30	13	8	12	17	5	27	34	12
8:45-9:00AM	12	20	7	9	18	4	29	27	15
9:00-9:15AM	11	14	8	15	14	15	22	19	18
9:15-9:30AM	21	20	8	27	12	12	28	28	15
9:30-9:45AM	20	16	9	15	21	17	22	19	20
9:45-10:00AM	14	22	8	22	22	15	27	19	21
10:00-10:15AM	17	19	7	19	12	8	19	19	21
10:15-10:30AM	18	26	9	22	20	10	18	36	12
10:30-10:45AM	10	21	8	19	24	9	20	35	12
10:45-11:00AM	14	22	8	18	27	9	14	37	13
11:00-11:15AM	12	20	6	18	18	7	33	29	14
11:15-11:30AM	9	16	6	15	19	6	26	34	25
11:30-11:45AM	20	26	9	21	16	9	32	35	21
11:45-12:00AM	21	23	8	15	28	6	36	36	14
12:00-12:15AM	24	27	9	14	27	7	29	34	17
12:15-12:30AM	23	21	8	15	29	3	26	31	19
12:30-12:45AM	18	19	6	13	21	6	29	32	12
12:45-1:00AM	25	16	5	13	14	7	26	29	14
1:00-1:15PM	14	20	7	16	10	8	22	29	11
1:15-1:30PM	26	17	4	14	12	7	15	27	11
1:30-1:45PM	12	12	7	15	11	4	21	28	12
1:45-2:00PM	14	21	3	18	12	8	25	25	12
2:00-2:15PM	15	16	8	14	15	5	67	29	14
2:15-2:30PM	12	14	9	17	14	6	51	23	17
2:30-2:45PM	17	13	9	18	17	7	64	29	19
2:45-3:00PM	11	12	8	18	12	7	58	26	13
3:00-3:15PM	10	12	7	19	12	8	23	39	17
3:15-3:30PM	14	12	10	22	14	10	31	34	19
3:30-3:45PM	12	12	12	21	13	9	27	36	14
3:45-4:00PM	10	9	14	21	13	9	34	31	12
4:00-4:15PM	17	12	11	26	16	10	33	24	19
4:15-4:30PM	19	14	11	19	24	9	38	25	12
4:30-4:45PM	9	12	12	19	26	9	32	12	14

1976 2068								3	630
1439									
	75	58	809	409	843	859	366	1480	711
6:45-7:00PM	11	11	12	28	16	7	30	45	24
6:30-6:45PM	14	11	11	24	20	5	27	41	11
6:15-6:30PM	12	9	10	26	18	2	29	39	12
6:00-6:15PM	15	12	14	25	20	4	34	37	14
5:45-6:00PM	14	15	12	19	11	11	28	39	17
5:30-5:45PM	12	16	9	13	31	7	26	36	10
5:15-5:30PM	13	17	10	16	29	7	32	37	9
5:00-5:15PM	12	18	9	25	28	12	30	39	10
4:45-5:00PM	14	12	11	20	24	9	31	35	11

	Large bus		М	inibus&ta	ki	М	otorcycle	
Right L	Left L	L Turn	Right L	Left L	L Turn	Right L	Left L	L Turn
13	9	6	11	22	10	5	3	2
13	8	6	12	16	9	8	5	3
15	10	7	25	11	12	6	3	2
7	4	3	12	12	11	4	2	2
11	7	5	28	17	21	5	3	2
9	6	4	21	15	10	5	2	0
12	7	5	15	14	14	4	1	0
9	6	4	19	16	15	4	1	1
19	28	5	17	15	17	3	2	1
17	18	9	19	12	18	3	2	1
22	15	6	15	17	15	4	2	2
22	21	7	17	19	14	3	2	1
19	12	8	18	17	21	3	2	0
22	14	9	19	14	12	1	3	0
19	12	5	14	12	10	1	1	1
18	13	7	12	10	14	3	3	0
18	11	6	16	12	12	1	2	0
15	11	10	18	17	14	2	2	0
21	12	14	19	19	12	3	1	1
15	11	8	24	17	15	2	2	1
14	9	9	21	15	17	2	1	0
15	9	8	20	17	13	1	1	0
13	8	7	14	24	12	5	1	1
13	8	9	12	23	14	2	2	0
16	10	8	23	17	18	1	2	0
14	6	9	25	18	12	4	2	0

15	7	8		28		16	14	1		3	0
	, 11	7		27	-	10	12	3		3	0
	9	9		12		15	14	3		3	0
	11	9		13		14	15	3		2	0
	12	10		18		±.	21		-	2	0
	12	7		19		17	14	4		8	0
	12	9		17		14	12	2		2	0
	14	10		19		12	12	Э		2	0
	13	10		13		21	10	1		3	0
	13	9		17		13	9	3	}	3	0
26	16	10		19		12	8	2		1	0
F	12	12		13		15	14	5		3	0
19	12	11		28		19	15	3	}	2	0
	12	7		21		17	12	6		4	1
25	16	12		21		18	13	5	5	2	0
16	10	8		10		15	14	5	5	3	1
13	8	6		12		14	12	5	5	1	1
19	12	5		13		10	21	2	2	2	1
25	20	9		31		12	21	4	ŀ	3	0
26	18	10		21		14	12	6	5	2	0
24	20	10		19		25	15	2	2	2	1
28	16	9		17		14	12	4	Ļ	2	0
844	571	381		874		760	655	1	59	109	26
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								L	.OS facto	ors	
Total	RL		LL		LT	ר	Pedestrian	1	Car & '	Гахі	1
207	70		72		37		104		4-WD		1
219	71		87		34		125		Mini B	us	1.5
	88		82		40		200		Mediur		1.5
	67		77		38		98		Std. Bu		3
	103		94		52		89			n Trucks	3
	89		82		38		100		Large		3
	88		79		39		122		Bajaj 0		0.4
	73		82		42		147		Motorc		0.25
	68		64		59		100		Pedestr	lans	0.15
	98 76		74 75		54 63		93 97				
	83		75 84		63 59		97				
	76		69		59		88				
	78		99		43		117				
	64		93		40		117				
1233					. · ·						1
	61		99		44	ŀ	121				

2457029195282982769025985241792327823276	5 8 0 5 9 8 6	88 97 106 104 99 97 84	51 52 44 50 43 37	2 1: 1: 1: 1:	39 11 55 22	
282 98 276 90 259 85 241 79 232 78 232 76	8 0 0 5 9 8 6 6	106 104 99 97 84	44 50 43	1: 1: 1:	55 22	
2769025985241792327823276	0 5 9 8 6	104 99 97 84	50 43	12	22	
25985241792327823276	5 9 8 6	99 97 84	43	1.		
241792327823276	9 8 6	97 84			22	
2327823276	8 6	84	37		33	
232 76	6			1	11	
			40	12	22	
		78	44	9'	7	
223 84	4	76	34	9	8	
214 77	7	70	37	9	9	
233 87	7	75	35	1	10	
262 11	11	78	41	1	88	
247 96	6	67	47	1	66	
286 11	19	80	47	1'	74	
264 11	10	75	42	12	25	
234 71	1	79	44	19	98	
260 89	9	74	51	12	25	
248 74	4	85	45	1.	31	
241 85	5	69	44	12	25	
262 97	7	65	48	12	24	
264 94	4	81	46	1:	58	
254 91	1	71	50	12	24	
267 92	2	92	44	1.	32	
295 93	3	105	44	12	24	
252 76	6	101	41	10	00	
232 68		98	39	98		
251 76	6	77	62	121		
300 10	09	84	53	93		
266 94	4	82	36	97		
282 86	6	99	43	244		
286 90	0	88	55	145		
12053 40	073	4017	2167	6161	1	

Time											
Truck				Automo	bile		Bajaj	Bajaj			
	Right	Left L	L Turn	Right L	Left L	L	Right L	Left	L Turn		
	L					Turn		L			
7:00-7:15AM	45	48	15	13	10	6	10.4	8.4	5.6		
7:15-7:30AM	30	51	18	13	15	6	11.2	13.6	4		
7:30-7:45AM	39	57	21	15	14	7	11.6	14	4.8		
7:45-8:00AM	60	57	21	7	12	3	9.6	12.8	6		
8:00-8:15AM	90	84	30	11	15	5	11.6	12.4	5.6		

8:15-8:30AM	66	60	21	9	16	4	12.8	11.6	6.8
8:30-8:45AM	90	39	24	12	17	5	12.8	13.6	4.8
8:45-9:00AM	36	60	24	9	18	4	11.6	10.8	6
9:00-9:15AM	33	42	24	15	14	15	8.8	7.6	7.2
9:15-9:30AM	63	60	24	27	12	12	11.2	11.2	6
9:30-9:45AM	60	48	27	15	21	17	8.8	7.6	8
9:45-10:00AM	42	66	27	22	21	15	10.8	7.6	8.4
		57				8			
10:00-10:15AM	51		21	19	12		7.6	7.6	8.4
10:15-10:30AM	54	78	27	22	20	10	7.2	14.4	4.8
10:30-10:45AM	30	63	24	19	24	9	8	14	4.8
10:45-11:00AM	42	66	24	18	27	9	5.6	14.8	5.2
11:00-11:15AM	36	60	18	18	18	7	13.2	11.6	5.6
11:15-11:30AM	27	48	18	15	19	6	10.4	13.6	10
11:30-11:45AM	60	78	27	21	16	9	12.8	14	8.4
11:45-12:00AM	63	69	24	15	28	6	14.4	14.4	5.6
12:00-12:15AM	72	81	27	14	27	7	11.6	13.6	6.8
12:15-12:30AM	69	63	24	15	29	3	10.4	12.4	7.6
12:30-12:45AM	54	57	18	13	21	6	11.6	12.8	4.8
12:45-1:00AM	75	48	15	13	14	7	10.4	11.6	5.6
1:00-1:15PM	42	60	21	16	10	8	8.8	11.6	4.4
1:15-1:30PM	78	51	12	14	12	7	6	10.8	4.4
1:30-1:45PM	36	36	21	15	11	4	8.4	11.2	4.8
1:45-2:00PM	42	63	9	18	12	8	10	10	4.8
2:00-2:15PM	45	48	24	14	15	5	26.8	11.6	5.6
2:15-2:30PM	36	42	27	17	14	6	20.4	9.2	6.8
2:30-2:45PM	51	39	27	18	17	7	25.6	11.6	7.6
2:45-3:00PM	33	36	24	18	12	7	23.2	10.4	5.2
3:00-3:15PM	30	36	21	19	12	8	9.2	15.6	6.8
3:15-3:30PM	42	36	30	22	14	10	12.4	13.6	7.6
3:30-3:45PM	36	36	36	21	13	9	10.8	14.4	5.6
3:45-4:00PM	30	27	42	21	13	9	13.6	12.4	4.8
4:00-4:15PM	51	36	33	26	16	10	13.2	9.6	7.6
4:15-4:30PM	57	42	33	19	24	9	15.2	10	4.8
4:30-4:45PM	27	36	36	19	26	9	12.8	4.8	5.6
4:45-5:00PM	42	36	33	20	24	9	12.4	14	4.4
5:00-5:15PM	36	54	27	25	28	12	12	15.6	4
5:15-5:30PM	39	51	30	16	29	7	12.8	14.8	3.6
5:30-5:45PM	36	48	27	13	31	7	10.4	14.4	4
5:45-6:00PM	42	45	36	19	11	11	11.2	15.6	6.8
6:00-6:15PM	45	36	42	25	20	4	13.6	14.8	5.6
6:15-6:30PM	36	27	30	26	18	2	11.6	15.6	4.8
6:30-6:45PM	42	33	33	24	20	5	10.8	16.4	4.4
6:45-7:00PM	33	33	36	28	16	7	12	18	9.6

2274	2427	1227 843	859	366	592	284.4
			575.6			

Large bus		Minibus	&taxi		Motorcycle			
Right L	Left L	L Turn	Right L	Left L	L Turn	Right L	Left L	L Turn
78	63	42	16.5	33	15	1.25	0.75	0.5
84	102	30	18	24	13.5	2	1.25	0.75
87	105	36	37.5	16.5	18	1.5	0.75	0.5
72	96	45	18	18	16.5	1	0.5	0.5
87	93	42	42	25.5	31.5	1.25	0.75	0.5
96	87	51	31.5	22.5	15	1.25	0.5	0
81	102	36	22.5	21	21	1	0.25	0
87	81	45	28.5	24	22.5	1	0.25	0.25
66	57	54	25.5	22.5	25.5	0.75	0.5	0.25
84	84	45	28.5	18	27	0.75	0.5	0.25
66	57	60	22.5	25.5	22.5	1	0.5	0.5
81	57	63	25.5	28.5	21	0.75	0.5	0.25
57	57	63	27	25.5	31.5	0.75	0.5	0
54	108	36	28.5	21	18	0.25	0.75	0
60	105	36	21	18	15	0.25	0.25	0.25
42	111	39	18	15	21	0.75	0.75	0
99	87	42	24	18	18	0.25	0.5	0
78	102	75	27	25.5	21	0.5	0.5	0
96	105	63	28.5	28.5	18	0.75	0.25	0.25
108	108	42	36	25.5	22.5	0.5	0.5	0.25
87	102	51	31.5	22.5	25.5	0.5	0.25	0
78	93	57	30	25.5	19.5	0.25	0.25	0
87	96	36	21	36	18	1.25	0.25	0.25
78	87	42	18	34.5	21	0.5	0.5	0
66	87	33	34.5	25.5	27	0.25	0.5	0
45	81	33	37.5	27	18	1	0.5	0
63	84	36	42	24	21	0.25	0.75	0
75	75	36	40.5	21	18	0.75	0.75	0
201	87	42	18	22.5	21	0.75	0.75	0
153	69	51	19.5	21	22.5	0.75	0.5	0
192	87	57	27	31.5	18	0.5	0	0
174	78	39	28.5	25.5	21	1	2	0
69	117	51	25.5	21	18	0.5	0.5	0
93	102	57	28.5	18	18	0.75	0.5	0
81	108	42	19.5	31.5	15	0.25	0.75	0
102	93	36	25.5	19.5	13.5	0.75	0.75	0

	1							
99	72	57	28.5	18	12	0.5	0.25	0
114	75	36	19.5	22.5	21	1.25	0.75	0
96	36	42	42	28.5	22.5	0.75	0.5	0
93	105	33	31.5	25.5	18	1.5	1	0.25
90	117	30	31.5	27	19.5	1.25	0.5	0
96	111	27	15	22.5	21	1.25	0.75	0.25
78	108	30	18	21	18	1.25	0.25	0.25
84	117	51	19.5	15	31.5	0.5	0.5	0.25
102	111	42	46.5	18	31.5	1	0.75	0
87	117	36	31.5	21	18	1.5	0.5	0
81	123	33	28.5	37.5	22.5	0.5	0.5	0.25
90	135	72	25.5	21	18	1	0.5	0
4317	4440	2133	1311	1140	982.5	39.75	27.25	6.5

						Vo	lume/ł	nr		PHF		Pedestrian
Total	RL	LL	LT	Pedestrian	total	RL	LL	LT	RL	LL	LT	Volume PHF
411.4	86.15	100.15	42.1	104	1791	360.6	407.6	183	0.862	0.97		
437.3	74.2	104.85	42.3	125								
486.15	104.6	102.25	51.3	200				7:00 -	8:00 AN	1		
455.9	95.6	100.3	47	98								
588.1	155.9	137.65	72.6	89	2067	498.8	452.2	228	0.8	0.82	0.78	458 0.7789
511.95	120.6	110.6	46.8	100								
500.95	136.3	90.85	54.8	122				8:00 -	9:00 AN	1		
465.9	86.1	113.05	53.8	147								
418.6	83.05	86.6	72	100	1896	421.9	415.5	285	0.808	0.83	0.95	389 0.9725
514.4	130.5	101.7	69.3	93								
467.9	107.3	102.6	75	97				9:00 -	10:00 A	М		
495.3	101.1	124.6	68.7	99								
453.85	105.4	102.6	68.9	88	1868	379.9	479.6	241	0.848	0.89	0.87	440 0.9091
503.9	112	134.15	59.8	117								
451.55	78.25	119.25	53.1	114				10:00	- 11:00	AM		
459.1	84.35	123.55	59.2	121								
476.15	91.45	108.1	48.6	158	2142	423.3	488.9	225	0.821	0.89	0.9	663 0.7855
496.5	79.9	106.6	55	139								
586.45	123.1	136.75	62.7	211				11:00	- 12:00	AM		
582.65	128.9	137.4	58.4	155								
580.25	129.6	144.35	66.3	122	2092	472	510.2	216	0.91	0.88	0.81	488 0.9173
536.9	124.7	130.15	54.1	133								
493.95	100.9	127.05	47.1	111				12:00	AM - 1:0	00 PM		
481.1	116.9	108.6	48.6	122								
455.55	101.6	107.6	60.4	97	1756	451	398.6	192	0.826	0.93	0.8	404 0.9182
438.2	136.5	101.3	41.4	98								
418.4	101.7	82.95	50.8	99				1:00 -	2:00			
443.8	111.3	106.75	39.8	110								
588	104.6	97.85	55.6	188	2258	424	369.6	235	0.868	0.93	0.94	653 0.8684
515.65 616.8	93.65 122.1	86.7 99.1	62.3 59.6	166 174				2.00	3:00 PN			
010.8	122.1	99.1	59.0	1/4				2.00-	5.00 PN			
	400 5	05.0										
537.8	103.7	85.9	57.2	125	1000	202.2	005.5		0.071	0.00	0.00	F70 0 7044
460.1 505.35	84.2 105.7	85.1 82.1	53.8	198	1909	368.3	535.5	254	0.8/1	0.88	0.92	579 0.7311
			65.6	125				2.00 4	-00 PM4			
479.8	87.55 90.85	95.65 72.65	65.6	131				5.00 - 4	:00 PM			
463.8 489.65	119.2	79.85	69.3 62.6	125 124	1042	440.1	375 /	268	0 023	0.03	0.92	538 0.8513
504	119.2	99.25	67.8	124	1342	440.1	373.4	200	0.523	0.95	0.32	336 0.6513
444.45	101.6	95.8	73.1	138				4.00 - 2	:00 PM			
503.55	107.4	100.5	64.7	132								
530.35	107.4	125.1	62.5	132	2011	360.7	444.9	266	0.853	0.89	0.78	443 0.8931
497.95	84.05	118.05	61.9	100	2011	000.7		200	5.555	0.00	0.70	710 0.0001
	005	110.00	01.0	100								

465.55	78.65	114.65	56.3	98	5:00 - 6:00 PM								
516.85	92.2	87.1	85.6	121									
558.75	131.1	89.55	83.1	93	2113	443	367.6	274	0.845	0.86	0.82	579	0.5932
483.5	106.6	82.1	54.8	97									
515.35	105.8	107.4	65.2	244				6:00 - 3	7:00 PM				
555.6	99.5	88.5	70.6	145									
23845	5043	5045.3	2866	6161	2258	498.8	510.2	285	0.923	0.97	0.95	663	0.9725

	PHF	Volum	Pedest	rian
RL	0.923	499	Volum	PHF
LL	0.972	510	663	0.97
LT	0.95	285		

Segment 2									
Time									
	Tr	uck		Automobile			Bajaj		
	Right L	Left	L	Right L	Left	L	Right L	Left	L Turn
		L	Turn		L	Turn		L	
7:00-7:15AM	11	9	5	11	10	6	26	21	14
7:15-7:30AM	10	17	6	13	15	6	28	22	10
7:30-7:45AM	13	19	2	15	14	7	29	21	12
7:45-8:00AM	9	8	7	7	11	3	24	32	15
8:00-8:15AM	25	28	10	11	15	5	29	25	14
8:15-8:30AM	30	20	7	9	16	4	32	12	17
8:30-8:45AM	22	21	8	12	17	5	27	24	12
8:45-9:00AM	12	20	2	9	11	4	29	22	15
9:00-9:15AM	11	21	8	12	19	15	20	21	18
9:15-9:30AM	21	8	8	15	12	12	16	19	12
9:30-9:45AM	24	12	9	23	21	17	15	22	15
9:45-10:00AM	11	22	8	11	12	15	27	29	21
10:00-10:15AM	9	19	2	19	11	8	19	29	21
10:15-10:30AM	18	9	9	22	20	10	18	22	12
10:30-10:45AM	10	21	8	19	24	9	20	20	12
10:45-11:00AM	14	22	8	18	27	9	14	37	13
11:00-11:15AM	12	9	6	18	11	7	33	22	14
11:15-11:30AM	9	16	6	15	19	6	26	12	25
11:30-11:45AM	11	26	2	11	16	9	32	21	21
11:45-12:00AM	21	23	8	15	11	6	36	22	14
12:00-12:15AM	11	8	9	14	27	7	29	14	17

12:15-12:30AM	23								
12.13 12.30/ 101	25	21	8	15	29	3	26	11	19
12:30-12:45AM	18	19	6	13	11	6	29	32	12
12:45-1:00AM	11	16	2	13	14	7	26	11	14
1:00-1:15PM	14	20	7	11	10	8	22	11	11
1:15-1:30PM	11	9	4	14	12	7	15	12	11
1:30-1:45PM	12	12	7	15	11	4	21	12	12
1:45-2:00PM	14	21	3	18	12	8	25	22	12
2:00-2:15PM	15	16	8	11	15	5	67	12	14
2:15-2:30PM	12	14	9	17	14	6	51	23	17
2:30-2:45PM	10	9	9	11	11	7	64	10	19
2:45-3:00PM	11	12	8	18	12	7	58	10	13
3:00-3:15PM	10	12	2	11	12	8	23	12	17
3:15-3:30PM	14	12	10	22	11	10	31	22	19
3:30-3:45PM	12	8	12	11	13	9	27	12	14
3:45-4:00PM	10	9	14	11	13	9	34	21	12
4:00-4:15PM	17	12	2	26	16	10	33	10	19
4:15-4:30PM	11	14	11	11	24	9	38	12	12
4:30-4:45PM	9	12	12	19	26	9	32	12	14
4:45-5:00PM	11	12	11	11	24	9	31	21	11
5:00-5:15PM	12	8	2	25	11	12	30	21	10
5:15-5:30PM	13	17	10	11	29	7	32	12	9

5:30-5:45PM	12	16	2	11	31	7	26	36	10
5:45-6:00PM	14	8	12	11	10	11	28	14	17
6:00-6:15PM	15	12	14	25	20	4	34	37	14
6:15-6:30PM	12	9	2	26	18	2	29	22	12
6:30-6:45PM	14	8	11	12	20	5	27	22	11
6:45-7:00PM	11	11	2	28	10	7	30	22	24
	662	707	338	726	778	366	141	943	703
							8		
	1707			1870			3064		

	Large bus			taxi		Motorcycle			
Right L	Left L	L Turn	Right L	Left L	L Turn	Right L	Left L	L Turn	
13	9	2	8	11	9	1	3	2	
13	8	6	12	11	9	2	5	3	
9	10	7	25	11	12	2	3	2	
7	4	3	12	1	11	4	2	2	
11	7	5	28	17	9	2	3	2	

BY TENNA TESFAYE, JIT

9	6	2	21	11	10	5	2	0	
12	7	5	15	14	14	2	1	0	
9	6	4	19	11	15	4	1	1	
9	8	5	17	15	17	3	2	1	
16	18	9	19	12	9	3	2	1	
20	14	2	15	11	15	2	1	2	
9	8	7	17	19	14	3	2	1	
19	12	8	18	11	9	3	2	0	
22	14	9	19	14	12	1	3	0	
19	8	5	14	12	10	1	1	1	
9	13	2	12	10	14	1	1	0	
18	11	6	16	12	9	1	2	0	
15	11	10	18	11	14	1	2	0	
21	9	10	19	19	12	3	1	1	
15	11	3	24	11	15	2	1	1	
9	9	9	24	15	9	1	1	0	
15	9	8	20	11	13	1	1	0	
13	8	7	14	24	12	2	1	1	
9	8	3	14	11	9	2	2	0	
9 16	10	8	23	11	18	1	1	0	
		9			9	2	2	0	
14	9 7	8	25	11			3		
9			28	16	14	1		0	
18	9	3	27	14	9	3	1	0	
14	9	9	12	15	14	3	3	0	
17	11	9	13	14	15	3	2	0	
9	9	2	18	11	9	2	1	0	
18	9	7	19	17	14	3	1	0	
9	12	9	17	11	12	1	2	0	
22	9	3	19	12	9	3	2	0	
21	13	10	13	21	10	1	3	0	
9	9	9	17	13	9	3	3	0	
26	16	2	19	12	9	2	1	0	
9	12	12	13	15	14	5	3	0	
19	9	11	28	19	15	3	1	0	
9	12	3	21	1	9	3	1	1	
25	16	12	21	18	13	1	1	0	
9	9	2	10	1	9	5	1	1	
13	8	6	12	14	12	5	1	1	
9 25	9 20	3 9	13 31	10	9 21	2 3	2 3	1 0	
25 9	<u> </u>	3	21	1 14	9	<u> </u>	<u> </u>	0	
24	20	10	19	25	15	2	2	1	
9	9	3	17	11	9	2	1	0	

683	493	303	871	618	568	112	87	26
1479			205	57			225	

Total	RL	LL	LT	Pedestrian	Car & Taxi	1
171	57	54	36	104	4-WD	1
196	65	70	34	125	Mini Bus	1.5
213	84	68	35	200	Mediun bus	1.5
162	56	54	38	98	Std. Bus	3
246	95	88	40	89	Medium Trucks	3
213	97	61	38	100	Large Trucks	3
218	78	77	39	122	Bajaj 0.4	0.4
194	73	65	37	147	Motorcycle	0.25
222	63	78	59	100		
212	74	53	42	93		
240	79	67	58	97		
236	69	84	59	99		
219	68	72	40	88		
234	78	68	43	117		
214	64	78	40	114		
224	59	97	44	121		
207	80	56	36	158		
216	69	60	51	139		
248	76	83	45	211		
239	98	68	44	155		
210	76	65	42	122		
233	85	73	43	133		
228	76	87	37	111		
170	64	54	32	122		
208	71	59	44	97		
176	67	46	31	98		
192	77	54	37	99		
219	87	70	32	110		
242	108	61	41	188		
247	96	67	47	166		
211	105	42	44	174		
237	109	52	42	125		
180	62	49	39	198		
230	89	59	48	125		
210	64	57	45	131		
205	75	59	44	125		
232	97	51	40	124		

225	78	68	46	158	
250	91	70	50	124	
201	77	59	41	132	
238	89	59	37	124	
187	71	60	36	100	
223	66	98	32	98	
183	68	44	50	121	
288	108	73	53	93	
199	89	64	25	97	
248	74	77	43	244	
206	88	55	42	145	
10402	3789	3133	2001	6161	

Time	Vehicle Types					
	Tru	ck		Automol	oile	
	Right L	Left L	L Turn	Right L	Left	L Turn
					L	
7:00-7:15AM	33	27	15	11	10	6
7:15-7:30AM	30	51	18	13	15	6
7:30-7:45AM	39	57	6	15	14	7
7:45-8:00AM	27	24	21	7	11	3
8:00-8:15AM	75	84	30	11	15	5
8:15-8:30AM	90	60	21	9	16	4
8:30-8:45AM	66	63	24	12	17	5
8:45-9:00AM	36	60	6	9	11	4
9:00-9:15AM	33	63	24	12	19	15
9:15-9:30AM	63	24	24	15	12	12
9:30-9:45AM	72	36	27	23	21	17
9:45-10:00AM	33	66	24	11	12	15
10:00-10:15AM	27	57	6	19	11	8
10:15-10:30AM	54	27	27	22	20	10
10:30-10:45AM	30	63	24	19	24	9
10:45-11:00AM	42	66	24	18	27	9
11:00-11:15AM	36	27	18	18	11	7
11:15-11:30AM	27	48	18	15	19	6
11:30-11:45AM	33	78	6	11	16	9
11:45-12:00AM	63	69	24	15	11	6
12:00-12:15AM	33	24	27	14	27	7
12:15-12:30AM	69	63	24	15	29	3
12:30-12:45AM	54	57	18	13	11	6
12:45-1:00AM	33	48	6	13	14	7

1:00-1:15PM	42	60	21	11	10	8
1:15-1:30PM	33	27	12	14	12	7
1:30-1:45PM	36	36	21	15	11	4
1:45-2:00PM	42	63	9	18	12	8
2:00-2:15PM	45	48	24	11	15	5
2:15-2:30PM	36	42	27	17	14	6
2:30-2:45PM	30	27	27	11	11	7
2:45-3:00PM	33	36	24	18	12	7
3:00-3:15PM	30	36	6	11	12	8
3:15-3:30PM	42	36	30	22	11	10
3:30-3:45PM	36	24	36	11	13	9
3:45-4:00PM	30	27	42	11	13	9
4:00-4:15PM	51	36	6	26	16	10
4:15-4:30PM	33	42	33	11	24	9
4:30-4:45PM	27	36	36	19	26	9
4:45-5:00PM	33	36	33	11	24	9
5:00-5:15PM	36	24	6	25	11	12
5:15-5:30PM	39	51	30	11	29	7
5:30-5:45PM	36	48	6	11	31	7
5:45-6:00PM	42	24	36	11	10	11
6:00-6:15PM	45	36	42	25	20	4
6:15-6:30PM	36	27	6	26	18	2
:30-6:45PM 42		24	33	12	20	5
6:45-7:00PM	33	33	6	28	10	7
1986 2121	1014 72	6	778	36	6	

Large bus	S		Minibus8	ktaxi		Bajaj		
Right L	Left L	L Turn	Right L	Left L	L Turn	Right L	Left L	L Turn
10.4	8.4	5.6	78	63	42	12	16.5	13.5
11.2	8.8	4	84	66	30	18	16.5	13.5
11.6	8.4	4.8	87	63	36	37.5	16.5	18
9.6	12.8	6	72	96	45	18	1.5	16.5
11.6	10	5.6	87	75	42	42	25.5	13.5
12.8	4.8	6.8	96	36	51	31.5	16.5	15
10.8	9.6	4.8	81	72	36	22.5	21	21
11.6	8.8	6	87	66	45	28.5	16.5	22.5
8	8.4	7.2	60	63	54	25.5	22.5	25.5
6.4	7.6	4.8	48	57	36	28.5	18	13.5
6	8.8	6	45	66	45	22.5	16.5	22.5
10.8	11.6	8.4	81	87	63	25.5	28.5	21
7.6	11.6	8.4	57	87	63	27	16.5	13.5

7.2	8.8	4.8	54	66	36	28.5	21	18
8	8	4.8	60	60	36	28.5	18	10
-			1					
5.6	14.8	5.2	42	111	39	18	15	21
13.2	8.8	5.6	99	66	42	24	18	13.5
10.4	4.8	10	78	36	75	27	16.5	21
12.8	8.4	8.4	96	63	63	28.5	28.5	18
14.4	8.8	5.6	108	66	42	36	16.5	22.5
11.6	5.6	6.8	87	42	51	31.5	22.5	13.5
10.4	4.4	7.6	78	33	57	30	16.5	19.5
11.6	12.8	4.8	87	96	36	21	36	18
10.4	4.4	5.6	78	33	42	18	16.5	13.5
8.8	4.4	4.4	66	33	33	34.5	25.5	27
6	4.8	4.4	45	36	33	37.5	16.5	13.5
8.4	4.8	4.8	63	36	36	42	24	21
10	8.8	4.8	75	66	36	40.5	21	13.5
26.8	4.8	5.6	201	36	42	18	22.5	21
20.4	9.2	6.8	153	69	51	19.5	21	22.5
25.6	4	7.6	192	30	57	27	16.5	13.5
23.2	4	5.2	174	30	39	28.5	25.5	21
9.2	4.8	6.8	69	36	51	25.5	16.5	18
12.4	8.8	7.6	93	66	57	28.5	18	13.5
10.8	4.8	5.6	81	36	42	19.5	31.5	15
13.6	8.4	4.8	102	63	36	25.5	19.5	13.5
13.2	4	7.6	99	30	57	28.5	18	13.5
15.2	4.8	4.8	114	36	36	19.5	22.5	21
12.8	4.8	5.6	96	36	42	42	28.5	22.5
12.4	8.4	4.4	93	63	33	31.5	1.5	13.5
12	8.4	4	90	63	30	31.5	27	19.5
12.8	4.8	3.6	96	36	27	15	1.5	13.5
10.4	14.4	4	78	108	30	18	21	18
11.2	5.6	6.8	84	42	51	19.5	15	13.5
13.6	14.8	5.6	102	111	42	46.5	1.5	31.5
11.6	8.8	4.8	87	66	36	31.5	21	13.5
10.8	8.8	4.4	81	66	33	28.5	37.5	22.5
12	8.8	9.6	90	66	72	25.5	16.5	13.5
567.2	377.2	281.2	4254	2829	2109	1306.5	927	852

Motorcycle							
Right L	Left L	L Turn	Total	RL	LL	LT	Pedestria
							n

0.25	0.75	0.5	352.9	66.65	62.65	40.6	99
0.25	1.25	0.75	387.5	72.7	92.55	42.25	122
0.5	0.75	0.75	422.55	103.6	96.65	36.3	111
1	0.5	0.5	372.4	62.6	49.8	47	98
0.5	0.75	0.5	533.95	140.1	135.25	54.6	89
1.25	0.5	0	472.15	144.55	97.8	46.8	100
0.5	0.25	0	466.45	111.8	110.85	54.8	97
1	0.25	0.25	419.4	86.1	96.55	38.75	111
0.75	0.5	0.25	441.6	79.25	113.4	71.95	100
0.75	0.5	0.25	371.3	113.65	62.1	54.55	93
0.5	0.25	0.5	435.55	124	82.55	73	97
0.75	0.5	0.25	499.3	81.05	118.6	68.65	99
0.75	0.5	0	420.85	81.35	96.6	35.9	88
0.25	0.75	0	405.3	111.95	77.55	59.8	117
0.25	0.25	0.25	400.55	78.25	113.25	53.05	114
0.25	0.25	0	458.1	83.85	123.05	59.2	98
0.25	0.5	0	407.85	91.45	65.3	44.1	125
0.25	0.5	0	412.45	79.65	88.8	55	139
0.75	0.25	0.25	480.85	86.05	131.15	41.65	99
0.5	0.25	0.25	508.8	128.9	105.55	58.35	155
0.25	0.25	0	404	90.35	79.35	54.3	122
0.25	0.25	0	459.9	124.65	113.15	54.1	98
0.5	0.25	0.25	483.2	100.1	117.05	47.05	97
0.5	0.5	0	343.4	74.9	83.4	32.1	122
0.25	0.25	0	389.1	96.55	100.15	60.4	97
0.5	0.5	0	302.7	91	60.8	36.9	98
0.25	0.75	0	364	101.65	76.55	50.8	99
0.75	0.25	0	428.6	111.25	105.05	35.3	110
0.75	0.75	0	527.2	101.55	91.05	55.6	112
0.75	0.5	0	515.65	93.65	86.7	62.3	97
0.5	0.25	0	486.95	94.1	58.75	55.1	120
0.75	0.25	0	481.4	103.45	77.75	57.2	125
0.25	0.5	0	340.55	75.95	69.8	38.8	124
0.75	0.5	0	457.05	105.65	74.3	61.1	99
0.25	0.75	0	376.2	77.55	74.05	65.6	98
0.75	0.75	0	419.8	80.85	68.65	69.3	125
0.5	0.25	0	416.55	119.2	74.25	37.1	124
1.25	0.75	0	427.8	79.95	94.05	67.8	111
0.75	0.25	0	444.2	101.55	95.55	73.1	96
0.75	0.25	0.25	407.95	88.65	70.15	60.15	132
0.25	0.25	0	399.9	104.75	70.65	41.5	124
1.25	0.25	0.25	378.95	79.05	86.55	54.35	100

1.25	0.25	0.25	442.55	76.65	114.65	35.25	98
0.5	0.5	0.25	383.85	84.2	55.1	67.55	121
0.75	0.75	0	542	130.85	73.05	83.1	93
0.25	0.25	0	395.7	105.35	75.05	26.3	97
0.5	0.5	0.25	429.75	93.8	90.8	65.15	121
0.5	0.25	0	431.65	99	68.55	36.1	100
28	21.75	6.5	20550.4	4613.7	4224.95	2519.7	5211

PHF			Volume	/hr		Pedestrian		
total	RL	LL	LT	RL	LL	LT	Volume	PHF
1535.35	305.5	301.65	166.15	0.73733	0.78026	0.883777	430	0.881148
	5			1	4			
1891.95	482.5	440.45	194.95	0.83457	0.81414	0.88937	397	0.894144
	5			3				
1747.75	397.9	376.65	268.15	0.80231	0.79395	0.918322	389	0.9725
	5			9				
1684.8	355.4	410.45	207.95	0.79365	0.83390	0.869356	417	0.891026
				8	9			
1809.95	386.0	390.8	199.1	0.74873	0.74494	0.853042	518	0.835484
	5			9	9			
1690.5	390	392.95	187.55	0.78219	0.83927	0.86349	439	0.89959
					8			
1484.4	400.4	342.55	183.4	0.89988	0.81520	0.759106	404	0.918182
	5			8	7			
2011.2	392.7	314.25	230.2	0.94913	0.86285	0.923756	454	0.908
	5							
1593.6	340	286.8	234.8	0.80454	0.96500	0.847042	446	0.892
				3	7			
1696.5	389.3	334	238.15	0.81659	0.87388	0.814466	463	0.876894
	5				8			
1605.25	344.6	326.95	198.65	0.82255	0.71293	0.735196	443	0.893145
	5			4	1			
1799.1	429	307.45	210.65	0.81964	0.84650	0.633724	411	0.849174
				1	3			
2011.2	482.5	440.45	268.15	0.94913	0.96500	0.923756	518	0.9725
	5				7			

PHF		Volume		Peo	destrian	
0.94913	482.55		Volume		PHF	
0.965007	440.45		518		0.9725	

0.923756

268.15

Segment 3										
Time				T			1			
		Truck		Autom	1	1	Bajaj			
	Right L	Left L	L Turn	Right L	Left L	L Turn	Right L	Left L	L Turn	
7:00-7:15AM	11	11	1	11	10	6	11	21	9	
7:15-7:30AM	9	9	6	13	15	6	28	22	10	
7:30-7:45AM	13	19	7	15	14	7	25	35	12	
7:45-8:00AM	20	9	1	7	12	3	24	22	9	
8:00-8:15AM	25	18	10	11	15	5	29	21	14	
8:15-8:30AM	22	30	7	9	16	4	32	22	17	
8:30-8:45AM	22	35	1	12	17	5	35	34	9	
8:45-9:00AM	9	20	7	9	18	4	29	22	15	
9:00-9:15AM	11	9	8	11	19	3	30	29	18	
9:15-9:30AM	21	20	1	27	12	12	28	28	9	
9:30-9:45AM	9	25	9	11	21	3	12	27	28	
9:45-10:00AM	14	9	1	11	32	15	27	29	21	
10:00-10:15AM	17	19	7	19	31	3	19	22	9	
10:15-10:30AM	9	26	1	11	20	10	12	36	12	
10:30-10:45AM	10	9	8	19	24	9	20	22	12	
10:45-11:00AM	11	22	1	11	27	3	14	37	9	
11:00-11:15AM	12	9	6	18	18	7	33	22	14	
11:15-11:30AM	11	16	6	11	19	6	12	34	25	
11:30-11:45AM	20	9	2	21	16	2	32	35	9	
11:45-12:00AM	11	23	8	11	28	6	36	22	14	
12:00-12:15AM	24	9	9	14	27	2	29	34	9	
12:15-12:30AM	11	21	3	11	29	2	12	31	19	
12:30-12:45AM	18	9	6	13	21	6	29	22	12	
12:45-1:00AM	12	16	3	11	14	2	26	29	9	
1:00-1:15PM	14	9	7	16	10	8	12	29	11	
1:15-1:30PM	12	17	4	11	12	2	15	27	11	
1:30-1:45PM	12	9	3	15	11	4	21	22	9	
1:45-2:00PM	12	21	3	18	12	8	12	22	12	
2:00-2:15PM	15	16	3	11	15	5	12	29	14	
2:15-2:30PM	12	9	9	17	14	6	51	22	9	
2:30-2:45PM	17	13	3	18	17	7	12	29	19	
2:45-3:00PM	12	12	8	11	12	7	58	22	13	
3:00-3:15PM	10	12	3	19	12	2	23	39	17	

								-	
3:15-3:30PM	14	9	10	22	14	10	20	22	9
3:30-3:45PM	12	12	3	11	13	2	27	36	14
3:45-4:00PM	10	9	14	21	12	9	20	22	12
4:00-4:15PM	12	12	3	26	16	10	33	24	19
4:15-4:30PM	12	9	11	19	24	2	38	25	12
4:30-4:45PM	9	12	3	11	12	9	20	22	9
4:45-5:00PM	11	12	11	20	24	9	31	35	9
5:00-5:15PM	12	9	3	25	28	2	20	22	10
5:15-5:30PM	11	17	10	16	11	7	32	37	9
5:30-5:45PM	12	16	3	13	31	2	20	22	10
5:45-6:00PM	11	9	12	11	11	11	28	39	17
6:00-6:15PM	15	9	3	25	11	2	20	37	14
6:15-6:30PM	11	9	10	26	18	2	29	22	9
6:30-6:45PM	14	11	3	11	11		2 27	41	11
6:45-7:00PM	11	9	12	11	16		7 12	22	24
	6	684	273	721	842		2 1177	1327	627
	5						6		
							6		
		160)2		1829)	3131		

Large bu	S		Motorcyc	le		Minibus8	taxi	
Right L	Left L	L Turn	Right L	Left L	L Turn	Right L	Left L	L Turn
9	9	3	11	15	9	5	3	2
13	8	6	12	16	9	8	5	3
15	10	5	25	11	12	6	3	2
9	4	3	12	12	9	4	2	2
11	7	5	18	11	21	5	3	2
8	6	5	21	15	10	5	2	0
8	7	5	15	9	9	4	1	0
9	6	4	19	11	15	4	1	1
34	28	5	17	15	17	3	2	1
8	9	9	19	11	9	3	2	1
12	24	6	15	17	15	4	2	2
8	9	5	17	11	14	3	2	1
8	12	8	18	17	9	3	2	0
22	14	9	19	11	9	1	3	0
8	9	5	14	12	9	1	1	1
18	13	7	12	11	14	3	3	0
18	11	6	16	12	12	1	2	0
8	9	5	18	9	14	2	2	0
21	12	7	19	19	9	3	1	1
8	11	8	24	9	15	2	2	1

14	9	5	21	11	17	2	1	0
8	9	7	20	11	9	1	1	0
13	8	7	14	24	12	5	1	1
7	8	9	12	11	9	2	2	0
16	10	5	23	17	18	1	2	0
9	6	5	25	11	9	4	2	0
15	7	8	28	16	14	1	3	2
9	11	5	27	14	9	3	3	5
14	9	9	12	15	14	3	3	2
9	11	5	13	14	9	3	2	3
18	12	7	18	11	12	2	4	0
9	9	7	19	17	9	4	8	0
19	12	5	17	14	12	2	2	1
9	9	7	19	12	9	3	2	2
21	13	10	13	11	10	1	3	0
9	9	5	17	13	9	3	3	2
26	16	10	19	12	8	2	1	2
9	7	7	13	11	14	5	3	2
9	12	5	28	19	9	3	2	2
11	8	7	21	11	12	6	4	2
11	16	12	21	18	9	5	2	2
16	8	7	10	11	14	5	3	2
11	8	5	12	14	9	5	1	1
19	8	5	13	11	21	2	2	5
12	20	9	31	12	9	4	3	3
26	9	7	21	11	12	6	2	4
11	9	6	19	25	9	2	2	1
11	8	9	17	11	12	4	2	0
626	499	311	864	642	559	159	109	68
1436			2065			336		

Total	RL	LL	LT	Pedestrian	Car & Taxi	1
157	49	60	27	104	4-WD	1
198	70	67	34	125	Mini Bus	1.5
236	84	82	40	200	Mediun	1.5
					bus	
164	67	57	24	98	Std. Bus	3
231	88	68	52	89	Medium	3
					Trucks	
231	89	85	38	100	Large	3
					Trucks	
228	88	96	24	122	Bajaj 0.4	0.4

BY TENNA TESFAYE, JIT

203	70	72	42	147	Motorcycle	0.25
260	72	74	47	100		
229	98	73	32	93	-	
242	51	92	57	97	-	
229	72	83	52	99	-	
223	76	91	28	88	-	
225	52	96	32	117	-	
193	64	68	39	114	-	
216	51	100	27	121	-	
217	80	63	39	158	-	
207	54	80	51	139	-	
238	95	80	23	211	-	
239	84	84	44	155	-	
237	90	82	37	122		
205	55	93	33	133		
221	79	77	37	111		
182	63	72	23	122		
208	66	67	44	97		
182	67	69	26	98		
200	77	61	32	99	-	
206	72	72	37	110		
201	53	78	38	188	-	
218	96	61	36	166	-	
219	67	70	45	174		
237	104	71	37	125		
221	71	79	35	198		
202	78	59	40	125		
212	64	75	29	131		
199	71	59	46	125		
251	92	65	42	124		
223	87	72	41	158		
196	71	67	32	124		
244	89	86	43	132		
227	83	79	26	124		
226	74	79	42	100		
195	62	84	25	98		
235	65	72	66	121	_	
239 234	95 93	72 62	31 37	93 97		
234 215	73	<u>62</u> 90	26	244		
198	55	60	55	145		
10399	3566	3604	1793	6161	7	

Time							
		Bajaj		Truck			
		Automo	bile				-
	Right	Left L	L Turn	Right L	Left L	L	Right L
	L					Turn	
7:00-7:15AM	33	33	3	11	10	6	4.4
7:15-7:30AM	27	27	18	13	15	6	11.2
7:30-7:45AM	39	57	21	15	14	7	10
7:45-8:00AM	60	27	3	7	12	3	9.6
8:00-8:15AM	75	54	30	11	15	5	11.6
8:15-8:30AM	66	90	21	9	16	4	12.8
8:30-8:45AM	66	105	3	12	17	5	14
8:45-9:00AM	27	60	21	9	18	4	11.6
9:00-9:15AM	33	27	24	11	19	3	12
9:15-9:30AM	63	60	3	27	12	12	11.2
9:30-9:45AM	27	75	27	11	21	3	4.8
9:45-10:00AM	42	27	3	11	32	15	10.8
10:00-10:15AM	51	57	21	19	31	3	7.6
10:15-10:30AM	27	78	3	11	20	10	4.8
10:30-10:45AM	30	27	24	19	24	9	8
10:45-11:00AM	33	66	3	11	27	3	5.6
11:00-11:15AM	36	27	18	18	18	7	13.2
11:15-11:30AM	33	48	18	11	19	6	4.8
11:30-11:45AM	60	27	6	21	16	2	12.8
11:45-12:00AM	33	69	24	11	28	6	14.4
12:00-12:15AM	72	27	27	14	27	2	11.6
12:15-12:30AM	33	63	9	11	29	2	4.8
12:30-12:45AM	54	27	18	13	21	6	11.6
12:45-1:00AM	36	48	9	11	14	2	10.4
1:00-1:15PM	42	27	21	16	10	8	4.8
1:15-1:30PM	36	51	12	11	12	2	6
1:30-1:45PM	36	27	9	15	11	4	8.4
1:45-2:00PM	36	63	9	18	12	8	4.8
2:00-2:15PM	45	48	9	11	15	5	4.8
2:15-2:30PM	36	27	27	17	14	6	20.4
2:30-2:45PM	51	39	9	18	17	7	4.8
2:45-3:00PM	36	36	24	11	12	7	23.2
3:00-3:15PM	30	36	9	19	12	2	9.2
3:15-3:30PM	42	27	30	22	14	10	8
3:30-3:45PM	36	36	9	11	13	2	10.8

					0	1	
3:45-4:00PM	30	27	42	21	12	9	8
4:00-4:15PM	36	36	9	26	16	10	13.2
4:15-4:30PM	36	27	33	19	24	2	15.2
4:30-4:45PM	27	36	9	11	12	9	8
4:45-5:00PM	33	36	33	20	24	9	12.4
5:00-5:15PM	36	27	9	25	28	2	8
5:15-5:30PM	33	51	30	16	11	7	12.8
5:30-5:45PM	36	48	9	13	31	2	8
5:45-6:00PM	33	27	36	11	11	11	11.2
6:00-6:15PM	45	27	9	25	11	2	8
6:15-6:30PM	33	27	30	26	18	2	11.6
6:30-6:45PM	42	33	9	11	11	2	10.8
6:45-7:00PM	33	27	36	11	16	7	4.8
		2052	819	721	842	266	470.8
1935							

		L	arge bus	Minibus&taxi				
Left L	L Turn	Right L	Left L	L Turn	Right L	Left L	L Turn	
8.4	3.6	33	63	27	16.5	22.5	13.5	
8.8	4	84	66	30	18	24	13.5	
14	4.8	75	105	36	37.5	16.5	18	
8.8	3.6	72	66	27	18	18	13.5	
8.4	5.6	87	63	42	27	16.5	31.5	
8.8	6.8	96	66	51	31.5	22.5	15	
13.6	3.6	105	102	27	22.5	13.5	13.5	
8.8	6	87	66	45	28.5	16.5	22.5	
11.6	7.2	90	87	54	25.5	22.5	25.5	
11.2	3.6	84	84	27	28.5	16.5	13.5	
10.8	11.2	36	81	84	22.5	25.5	22.5	
11.6	8.4	81	87	63	25.5	16.5	21	
8.8	3.6	57	66	27	27	25.5	13.5	
14.4	4.8	36	108	36	28.5	16.5	13.5	
8.8	4.8	60	66	36	21	18	13.5	
14.8	3.6	42	111	27	18	16.5	21	
8.8	5.6	99	66	42	24	18	18	
13.6	10	36	102	75	27	13.5	21	
14	3.6	96	105	27	28.5	28.5	13.5	
8.8	5.6	108	66	42	36	13.5	22.5	
13.6	3.6	87	102	27	31.5	16.5	25.5	
12.4	7.6	36	93	57	30	16.5	13.5	
8.8	4.8	87	66	36	21	36	18	

11.6	3.6	78	87	27		18		16.5		13.5	
11.6	4.4	36	87	33		34.5		25.5		27	
10.8	4.4	45	81	33		37.5		16.5		13.5	
8.8	3.6	63	66	27		42		24		21	
8.8	4.8	36	66	36		40.5		21		13.5	
11.6	5.6	36	87	42		18		22.5		21	
8.8	3.6	153	66	27		19.5		21		13.5	
11.6	7.6	36	87	57		27		16.5		18	
8.8	5.2	174	66	39		28.5		25.5		13.5	
15.6	6.8	69	117	51		25.5		21		18	
8.8	3.6	60	66	27		28.5		18		13.5	
14.4	5.6	81	108	42		19.5		16.5		15	
8.8	4.8	60	66	36		25.5		19.5		13.5	
9.6	7.6	99	72	57		28.5		18		12	
10	4.8	114	75	36		19.5		16.5		21	
8.8	3.6	60	66	27		42		28.5		13.5	
14	3.6	93	105	27		31.5		16.5		18	
8.8	4	60	66	30		31.5		27		13.5	
14.8	3.6	96	111	27		15		16.5		21	
8.8	4	60	66	30		18		21		13.5	
15.6	6.8	84	117	51		19.5		16.5		31.5	
14.8	5.6	60	111	42		46.5		18		13.5	
8.8	3.6	87	66	27		31.5		16.5		18	
16.4	4.4	81	123	33		28.5		37.5		13.5	
8.8	9.6	36	66	72		25.5		16.5		18	
530.8	250.8	3531	3981	1881		1296		963		838.5	
Motorcycle		1	1	1	-		T		T		
Right L	Left L	L Turn	Total	RL	LL		LT		Ped	lestri	
									an		
1.25	0.75	0.5	290.4	66.15	-	.65	26		104		
2	1.25	0.75	369.5	71.2	-	5.05		.25	125		
1.5	0.75	0.5	472.55	103	-	2.25	51		200)	
1	0.5	0.5	350.5	95.6	-	5.3	23		98		
1.25	0.75	0.5	485.1	125.85	-	.65	72		89		
1.25	0.5	0	518.15	120.55	_	7.8	46		100		
1	0.25	0	523.95	115.5	-	9.35	25		122		
1	0.25	0.25	432.4	77.1		3.55		.75	147		
0.75	0.5	0.25	453.8	82.25		0.6		.95	100)	
0.75	0.5	0.25	458	130.45	_	0.2		.35	93		
1	0.5	0.5	464.3	66.3	-	2.8	64		97		
0.75	0.5	0.25	456.3	90.05	-	2.6		.65	99		
0.75	0.5	0	419.25	105.35	12	2.8	41	.1	88		

0.25	0.75	0	412.5	71.55	129.65	31.3	117
0.25	0.25	0.25	369.85	78.25	78.05	51.55	114
0.75	0.75	0	404	68.35	125.05	30.6	121
0.25	0.5	0	419.35	91.45	72.3	48.6	158
0.5	0.5	0	438.9	76.3	94.6	55	139
0.75	0.25	0.25	462.15	123.05	85.75	25.35	211
0.5	0.5	0.25	489.05	94.9	119.8	58.35	155
0.5	0.25	0	488.05	129.6	84.35	58.1	122
0.25	0.25	0	418.3	79.05	121.15	32.1	133
1.25	0.25	0.25	429.95	100.85	93.05	47.05	111
0.5	0.5	0	386.6	75.9	90.6	28.1	122
0.25	0.5	0	388.55	97.55	74.6	60.4	97
1	0.5	0	373.2	91.5	90.8	31.9	98
0.25	0.75	0.5	367.3	101.65	71.55	38.1	99
0.75	0.75	1.25	380.15	100.05	105.55	36.55	110
0.75	0.75	0.5	383.5	79.55	97.85	41.1	188
0.75	0.5	0.75	461.8	93.65	71.3	50.85	166
0.5	0	1	408	101.3	84.1	42.6	174
1	2	0	512.7	99.7	84.3	49.7	125
0.5	0.5	0.25	442.35	84.2	85.1	36.05	198
0.75	0.5	0.5	380.15	101.25	68.3	57.6	125
0.25	0.75	0	420.8	77.55	80.65	31.6	131
0.75	0.75	0.5	385.1	85.25	68.05	69.8	125
0.5	0.25	0.5	451.15	104.2	79.85	39.1	124
1.25	0.75	0.5	455.5	90.95	78.25	61.3	158
0.75	0.5	0.5	363.15	88.75	85.8	35.6	124
1.5	1	0.5	479	98.4	91.5	64.1	132
1.25	0.5	0.5	378.05	101.75	91.3	29	124
1.25	0.75	0.5	468.2	78.05	94.05	62.1	100
1.25	0.25	0.25	370.05	76.25	109.05	28.75	98
0.5	0.5	1.25	484.35	75.2	70.6	86.55	121
1	0.75	0.75	440.9	125.5	71.55	30.85	93
1.5	0.5	1	409	103.6	70.8	54.6	97
0.5	0.5	0.25	457.35	92.8	98.4	29.15	244
1	0.5	0	388.7	75.3	68.8	70.6	145
39.75	27.25	17	20461.9	4462.55	4415.05	2191.3	6161

Pedestrian		Volume/hr			PHF			
total	RL	LL	LT	RL	LL	LT	Volume	PHF

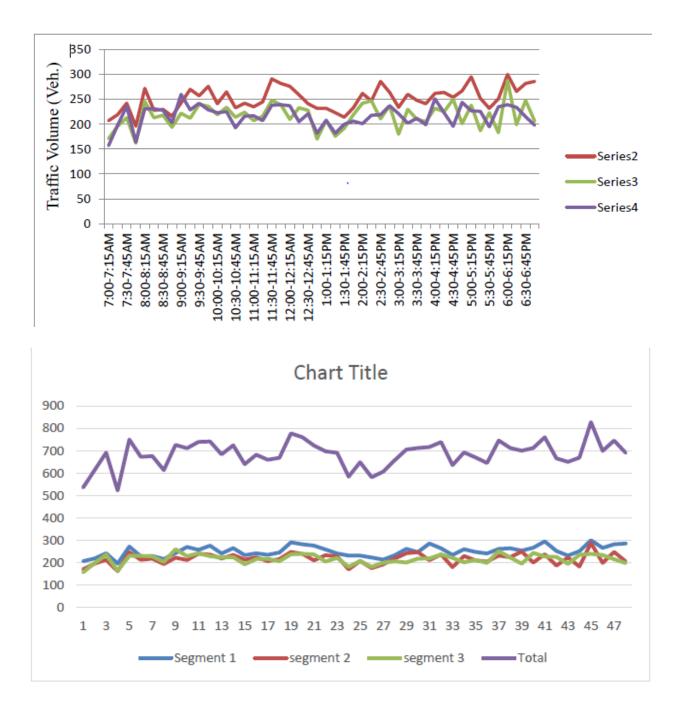
1482.9	335.95	319.25	143.75	0.81541	0.78056	0.70053	527	0.65875
5				3	2	6		
1959.6	439	485.35	198.25	0.87207	0.81243	0.68267	458	0.778912
					7	9		
1832.4	369.05	401.2	204.15	0.70726	0.75527	0.79497	389	0.9725
				3	1	7		
1605.6	323.5	455.55	154.55	0.76767	0.87842	0.74951	440	0.909091
				9	3	5		
1809.4	385.7	372.45	187.3	0.78362	0.77723	0.80248	663	0.785545
5				5	3	5		
1722.9	385.4	389.15	165.35	0.74344	0.80303	0.71148	488	0.917293
				1	3	9		
1509.2	390.75	342.5	166.95	0.96101	0.81122	0.69101	404	0.918182
				8	7	8		
1766	374.2	337.55	184.25	0.92349	0.86241	0.90585	653	0.868351
				5	7	1		
1628.4	348.25	302.1	195.05	0.85987	0.88748	0.69860	579	0.731061
				7	5	3		
1748.8	382.3	335.4	200.1	0.91722	0.91639	0.78042	538	0.851266
				6	3	1		
1700.6	331.25	365	206.4	0.81388	0.83677	0.59618	443	0.893145
5				2	2	7		
1695.9	397.2	309.55	185.2	0.79123	0.78645	0.65580	579	0.593238
5				5	8	7		
1959.6	439	485.35	206.4	0.96101	0.91639	0.90585	663	0.9725
				8	3	1		

PHF		Volume		Peo	destrian
0.961018	439	Ð	Volume		PHF
0.916393	485	5.35	663		0.9725
0.905851			206.4		

Total traffic volume									
		segment 2	segment 3	Total					
Segment 1									
7:00-7:15AM	207	171	157	535					
7:15-7:30AM	219	196	198	613					

		I		
7:30-7:45AM	242	213	236	691
7:45-8:00AM	196	162	164	522
8:00-8:15AM	272	246	231	749
8:15-8:30AM	228	213	231	672
8:30-8:45AM	230	218	228	676
8:45-9:00AM	216	194	203	613
9:00-9:15AM	243	222	260	725
9:15-9:30AM	270	212	229	711
9:30-9:45AM	257	240	242	739
9:45-10:00AM	276	236	229	741
10:00-10:15AM	241	219	223	683
10:15-10:30AM	265	234	225	724
10:30-10:45AM	233	214	193	640
10:45-11:00AM	242	224	216	682
11:00-11:15AM	235	207	217	659
11:15-11:30AM	245	216	207	668
11:30-11:45AM	291	248	238	777
11:45-12:00AM	282	239	239	760
12:00-12:15AM	276	210	237	723
12:15-12:30AM	259	233	205	697
12:30-12:45AM	241	228	221	690
12:45-1:00AM	232	170	182	584
1:00-1:15PM	232	208	208	648
1:15-1:30PM	223	176	182	581
1:30-1:45PM	214	192	200	606
1:45-2:00PM	233	219	206	658
2:00-2:15PM	262	242	201	705
2:15-2:30PM	247	247	218	712
2:30-2:45PM	286	211	219	716
2:45-3:00PM	264	237	237	738
3:00-3:15PM	234	180	221	635
3:15-3:30PM	260	230	202	692
3:30-3:45PM	248	210	212	670
3:45-4:00PM	241	205	199	645
4:00-4:15PM	262	232	251	745
4:15-4:30PM	264	225	223	712
4:30-4:45PM	254	250	196	700
4:45-5:00PM	267	201	244	712
5:00-5:15PM	295	238	227	760
5:15-5:30PM	252	187	226	665
5:30-5:45PM	232	223	195	650
5:45-6:00PM	251	183	235	669

6:00-6:15PM	300	288	239	827
6:15-6:30PM	266	199	234	699
6:30-6:45PM	282	248	215	745
6:45-7:00PM	286	206	198	690
12053		10402	10399	
Total				



Traffic volume Distribution						
	segment	segment 2	segment 3			
1						
Truck	1976	1707	1602			
Automobile	2068	1870	1829			
Bajaj	3630	3064	3131			
Large bus	1796	1479	1436			
Mini bus & taxi	2289	2057	2065			
Motorcycle	294	225	336			

