



ADDIS ABABA UNIVERSITY

ADDIS ABABA INSTITUTE OF TECHNOLOGY

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

POST-GRADUATE PROGRAM

ROAD AND TRANSPORT ENGINEERING STREAM

**EVALUATION OF THE EFFECT OF TRAFFIC
OFFENSES ON ROAD TRAFFIC CRASHES IN
BAHIR DAR CITY, ETHIOPIA**

By

Getinet Abrham

Advisor: - Dr. Getu Segni

March, 2019

Addis Ababa, Ethiopia

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A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in the partial fulfillment of the Degree of Master of Science in Civil Engineering (Road and Transport Engineering)

By

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Declaration

I the undersigned, declare that this thesis is my original work performed under the supervision of my research advisor Dr. Getu Segni and has not been presented as a thesis for a degree in any other university. All sources of materials used for this thesis have been greatly acknowledged.

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POST GRADUATE PROGRAM

This is to certify that the thesis prepared by Getinet Abrham, entitled, **Evaluation of the Effect of Traffic Offenses on Road Traffic Crashes in Bahir Dar City, Ethiopia** and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Civil Engineering (Road and Transport Engineering) complies with the regulation of the university and meets the accepted standards with respect to its originality and quality.

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Acknowledgment

First and foremost I would like to thank the Almighty God for making everything possible and for giving the knowledge and wisdom and leading always to the right way. I am very grateful to express my deepest gratitude to my advisor Dr. Getu Segni for his valuable support and clarifications with all doubts. I have encountered during the title selection and thesis work. Without him, the work would not have been possible.

Next my appreciation goes to Amhara National Regional State Traffic Police Commission Staffs, especially Bahir Dar City Administration Police Commission staffs for their full support by giving any necessary documents and information for the study.

Finally, I would like to thank my family, friends, and classmates for their respect, support, assistance, and good wish which inspire me to further my knowledge. And to everyone who helped me. I may not mention you all but deep within my hearths, I am so thankful that you became part of this success. God will bless us all!!!

Abstract

Road traffic crashes are a major public health problem worldwide, the number of annual road traffic deaths has reached 1.35 million per year (WHO, 2018). Road traffic injuries are now the leading killer of people aged 5-29 years. The main objective of this study is to investigate the effect of traffic offenses on road traffic crashes in Bahir Dar city and also analysis scio-demography factors on the traffic offenses. The quantitative methods are uses in secondary data that is the traffic offence penalties from Bahir Dar city traffic police commission and questionnaires distributed to the driver and uses as primary data.

About 70.14% of drivers aged between 24-29 years and 20.63% of drivers aged between 30-35 years and 99.8% of the sampled drivers were males and almost all of the traffic violation was caused by male and youth drivers. Illegal parking, loading passengers above the capacity of the vehicle, driving the vehicle without schedule and permission and violation traffic signs are the major traffic offences types in Bahir Dar city. From Chi-square test there is an association between the occurrences of road traffic offences and age, gender, education level, driving experience, license level and day of the week. Finally, young age driver, high school education level, (Truck 1, Public 1, Taxi1-Public 1, and Level 3) license level, and male driver shows higher connection with the number of traffic offences and crashes.

Key Words: - Traffic Offences, Traffic Crashes, Police Enforcement & Traffic Law Enforcement.

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List of Abbreviation

ANOVA	Analysis of Variances
ANRS	Amhara National Regional State
ANRSPC	Amhara National Regional State Police Commission
BAC	Blood Alcohol Concentration
E.C	Ethiopian Calendar
ETB	Ethiopian Birr
G.C	Gregorian Calendar
GDP	Gross Domestic Product
GPS	Global Position System
RBT	Random Breath Test
SPSS	Statistical Package for the Social Sciences
TLE	Traffic Law Enforcement
WHO	World Health Organization
α	Level of Confidence
ρ	Significance Value

1 INTRODUCTION

1.1 Background

Road traffic crashes are a major public health problem worldwide, the number of annual road traffic deaths has reached 1.35 million per year. Road traffic injuries are now the leading killer of people aged 5-29 years and unlike the high income countries which have road traffic crashes related death rates of 8.7 per 100,000 population middle and low income countries have a higher rate 20.1 and 18.3 respectively. Among these all deaths fifty percent of all road traffic crashes related deaths are among pedestrians 22%, cyclists 5% and motor cyclist 23% and in Ethiopia, a road traffic death rate is 25.3 per 100,000 of populations (WHO, 2018; WHO, 2013a). Road traffic law is one of the main tools available to society to reduce the number and severity of road crashes and traffic offenses. Traffic laws attempt to improve driving standards by defining as illegal those types of behavior which are held to be unduly risky, such as drink-driving or driving too fast.

Police enforcement is an effective measure to ensure better compliance with road traffic law. The chief benefit of more effective police enforcement will be a reduction in the number of traffic offenses and road crashes fatalities and injuries (Rune Elvik, 2001).

Traffic Police have a great number of tools available for enforcing road traffic rules. They concern gathering evidence against offenders and the tools for their sanctioning. Traffic offenders can be penalized in various ways. Those are penalties, temporary driving license suspensions, confiscation of their vehicles, and mandatory participation in rehabilitation programs, prison sentences or community service. Penalties are meant to sanction offenders, protect society and influence the behavior of offenders and all citizens (ETSC, 2011).

Evaluation the effectiveness of road policing are designed to monitor the police activity on the project roads, to estimate changes in road users apprehension and behavior and to assess changes in traffic crashes that might be attributable to the project performance.

Effectiveness of police enforcement is measured in terms of the impact on fatal, serious and slight injury crashes (Biecheler-fretel, 2000).

The effect of road policing on more conventional behaviors, which are associated with less severe (non-fatal) crashes, varies significantly among regions, and appears to be more dependent on the regional presence of the police on the road network. In fact, the regional police departments often have different enforcement practices (different enforcement distribution in space and time), in terms of frequency, density and duration of controls (Yannis, Papadimitriou and Antoniou, 2008).

1.2 Statement of the Problem

Traffic crashes are a major problem all over the world. This problem has taken millions of lives and caused huge economic losses worldwide. Bahir Dar city is the capital city of the Amhara national regional state and its role as a cross-flight junction point to Gondar, Lalibela and Axum.

Bahir Dar city is one of the tourist sites of monasteries have all contributed to growth of the city and vehicle population due to the this facts the traffic activity, road traffic offenses and crashes in study area have increase over the year in disturbing rate in term of both the direct economic loses and the social lives.

Bahir Dar city recorded the maximum number of deaths and the working age group between 15 and 50 years accounted for more than two-thirds of all road traffic deaths. This has a great impact on the family and on the national level because the loss of such active working group may lead to foregone Gross Domestic Product due to diminished workforce and economic shock to families that have lost a breadwinner (H, Fesseha and Sileshi, 2008).

Bahir Dar City has road rules and regulations which should be applied for all drivers in the city. But the drivers are not performing according to the rules and regulations of the city in every day of their driving activities. Disrespect of road traffic rules and regulations occur in the study area and this is one of the reasons to increase the number of traffic offense and crashes. Road traffic offences and crashes are common problem in the study area and requires detail assessment to take proper measure that help to minimize the consequences of the problem. And in the study area there has been no assessment made on the traffic offences and there no research has been conducted to identify the causes of traffic offenses.

Therefore, this study to evaluate the effect of police enforcement on the traffic offenses; analyze the traffic offences that has been charge or penalty for ignoring traffic signals or stop signs, for excessive speeding, for drunk driving, for not wearing seatbelt, for illegal parking and others; focuses on identifying the types of traffic offenses, day of the week, socio demographic of the offenders; and finally try to fill the research gap which proposes possible measures that help to minimize the traffic offense on the study area.

1.3 Research Questions

The main questions to be answer through the research process are the following.

- What is the relationship between police enforcement and traffic offenses?
- What are the major types and cause of the traffic offenses and crashes?
- How driver's socio-demographic characteristics and vehicles characteristics effects on the traffic law violations?
- Which police enforcement mechanisms are effective in reducing traffic offenses?

1.4 Objectives of the Study

1.4.1 General Objectives

The general objective of the study is to investigate the effect of traffic offenses on the road traffic crashes in Bahir Dar city.

1.4.2 Specific Objectives

- To investigate the association between police enforcement activity and traffic offenses.
- To identify the major causes of traffic offenses and traffic crashes in the study area and identifying the associated factors.
- To analysis socio-demographic and socio-economic characteristics factors on traffic offense.
- To suggest effective police enforcement mechanisms on traffic offenses.

1.5 Significance of the Study

Bahir Dar city, the road traffic crashes and offenses are serious that many people lost their life and injuries a large number of people and damage of properties which has the highest collision record in the regional level. Bahir Dar city road and transport authority to make decision to do a road in safety manner, traffic police office to concentrate causes and possible measures for crashes to be taken, driver to learn from different mistakes that has done and those who are doing on similar topic as possible. In short the significance of the study can be stated as follows:-

- The study is carried out for academic purposes and, it could be helpful to have a deeper knowledge about the effectiveness of road policing and traffic offenses.
- The findings obtained from the study would be helpful to gain information and knowledge about the patterns of traffic offense, road crashes, which in turn, could help to develop countermeasures that could reduce the number offenses and severity of traffic crashes.
- It is important for the traffic police for law enforcement and distribution of man power for investigation.
- It also helps to carry out further research to refine the conceptual and methodology of the present study.

Generally, this study is help to give insight in to road traffic offenses, crashes and casualty rates, evaluate the effectiveness of road policing, identify as major contributory factors in crashes and traffic offenses, and develop possible countermeasures for road policing mechanism in the study area that can reduce the numbers and severities of crashes.

1.6 Scope of the Study

The study is to one of the major ANRS, in Bahir Dar city, roadway which has a recorded of high causality rank in the regional level and also the study covers on the traffic crashes for a period of five years (2012/13- 2016/17 G.C) and on traffic offenses for only one year (2016/17 G.C), based on this time frame, the data is considered as adequate for a reasonable historical analysis, especially as they are generated on a monthly, quarterly and annual basis along the different traffic police office, covering different police enforcement, weather, environmental and land use conditions for the purpose of observing how they affect road traffic offenses in the study area.

The traffic offenses and crashes records generated and documented by the traffic police in Bahir Dar city police commission and Amhara National Regional State police commission were used. The records of road traffic crashes are fatal, serious, slight injuries, property damage and traffic offenses punishments covering all categories of vehicle makes and road policing, using the study area during the period under study were obtained and used for analysis. Therefore in order to complete the study with in a given time and budget the thesis focuses on the evaluation of the effectiveness of road policing on traffic offenses and crashes in Bahir Dar city.

1.7 Thesis structure

The construction and flow of this thesis is presented in Figure 1 followed by a brief description of how the thesis is formatted.

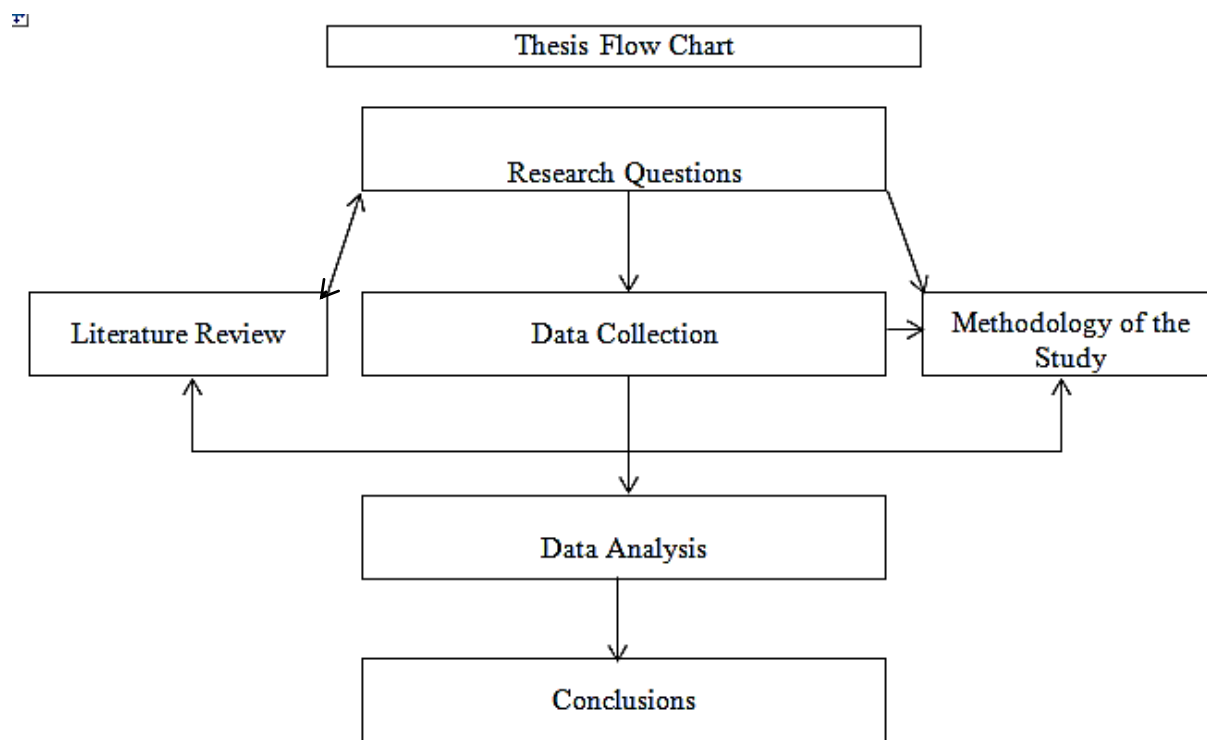


Figure 1: Thesis Flow Chart

1.8 Research Outline

This research will have the following general categories. Part one describes the research introduction, problems of the statement. It also indicates the research objectives, how the research process is conducted and the contents of the research. Part two deals with the literature review part of the thesis; the literature review will include general information about traffic offenses and traffic crashes. Part three covers the analysis of traffic crashes in the study area. Part four covers background of the study area, source of data, target population, method of data collection and method of analysis. Part five contains the analysis and discussion part. In this study both primary and secondary data has been analyzed. Part six provided the conclusions and recommendations of the thesis.

2 LITERATURE REVIEW

2.1 Introduction

The effect of road policing on road traffic crashes is currently the subject of much debate and investigation. The general belief resulting from recent studies is that increasing the level of police enforcement, both manual and automated, leads to a reduction in both road traffic crashes and traffic violations. There are many methods available to enforcement agencies in trying to reduce rates of road traffic crashes and violations. The main aim of enforcement is to target irresponsible, dangerous and unlawful behavior, and if necessary apply the proper enforcement strategy and related sanctions.

Drink-driving, speeding, non-use of safety devices, behavior of young drivers, dangerous or aggressive behavior in traffic and handling repeat offenders are the compliance problems that traffic law enforcement officials are concerned (Zaidel, 2002).

According to Zaidel, (2002) Traffic Law Enforcement (TLE) operates under two mechanisms which can help to prevent crashes and reduce their severity. The first of these is system management. By maintaining a safe road system, through system management, there are fewer hazards presented to the road user, which results in less risk and fewer crashes. The second mechanism is based on the assumption that a large proportion of crashes are caused by road users failing to comply with traffic laws and regulations. While it is clear that TLE can lead to changes in both driver and traffic behavior it is also very clear that non-compliance is still a major problem. The theoretical estimates for reducing crashes can be as high as 50%. This is based on achieving full compliance, through police enforcement, with existing laws. It also takes into account the roll of non-compliance by road users.

Police enforcement of traffic laws can only be effective if it operates in a supportive environment of laws, regulations, and a sensitive penal system. These combined forces act to create the deterrence effect of police enforcement, both on the individual level and on society at large (SafetyNet, 2009).

The legal system of traffic laws of a country forms a complex system of interrelating components. First, traffic laws are heterogeneous in the sense that they may refer to different behavioral domains. The most common understanding of traffic laws is that they define the legal limits for road users' behavior. One source of complexity is that there are different traffic laws for different groups of road users. Moreover, there are also laws and regulations relating to the competences and responsibilities of parties involved in detecting, prosecuting and sentencing offenders. When the administrative legal systems support the action of traffic law enforcement, the responsibility for the whole enforcement process rests on the shoulders of the police bodies even when the police do not receive the fine payment, and while an appeal in court is possible (Scott, 2010).

The whole punishment process is condensed to the time of detection, with the subsequent time reduction in the process duration, the automatic application of sanction under the restriction of police discretion or losses at the stage of fine payment.

2.2 Traffic Crashes in Amhara National Regional State

According to WHO, (2015) road traffic injuries disproportionately affect a young working population and the cost to individuals, families and governments is enormous. Injuries and their associated healthcare costs are a common cause of poverty and bankruptcy, and the overall cost is as high as 5% of GDP in some low- and middle-income countries. Road safety laws improve road user behavior and reduce road traffic crashes, injuries and deaths especially laws relating to the five key risk factors for road safety speeding, drink-driving, the use of motorcycle helmets, seat-belts and child restraints.

The majority of the crashes occur during daytime hours, involve males, and involve persons in the 18-50 age group Ethiopia's active workforce (Tulu, Washington and King, 2013).

The magnitude of road traffic crashes in ANRS between 2007 and 2011 about 10,162 road traffic crashes were reported, claiming the lives of 2,761 people, injuring 3,890 people and caused property damage worth 128,398,879 ETB (Fesseha and Sileshi, 2008).

Enforcement is a routine aspect of police responsibilities in the high-income nations. This activity consumes the majority of police resources directed to reducing crashes and saving lives but not in the low-income nations including our country Ethiopia. Good practice enforcement includes intercepting offending vehicles for the commission of offences such as speeding, drink-driving and careless and dangerous driving (Shuey, 2013).

2.3 Traffic Crashes and Road Policing in Bahir Dar City

In Bahir Dar city, 48 (42.1%) of the crashes were caused by three wheelers rather than other vehicles while in North Gondar and Oromia zones, the leading causes for the crashes were crashes of Taxis and Minibuses, However, in the other zones most of the crashes were accounted for by Cargo vehicles (Fenta and Workie, 2017).

Enforcement, crash investigation and reporting are done by local police station. In Bahir Dar city administration there are nine traffic police stations and each police station have five and more traffic police men.

Those traffic police men is recorded road traffic crashes and traffic offences data in their station and reported monthly and yearly aggregated traffic crash data to the next higher police station following the hierarchy to the Police Commission Office.

2.4 Traffic Law Enforcement

Traffic law enforcement is one of the instruments to secure or improve traffic law compliance. In the literature the concepts of ‘traffic law enforcement’ and ‘police enforcement’ are often used interchangeably. However, the concepts differ in width. Traffic law enforcement is wider and covers the entire enforcement chain, from detection of a violation through to the penalty. Police enforcement refers to the actual work of detecting a traffic law violation, apprehending the offender, and securing the evidence needed for his prosecution. Police enforcement can only be effective if it operates in a supportive environment of laws, regulations, and a sensitive penal system. Consequently, the effectiveness of police enforcement cannot be seen in isolation from how the police collaborate with the other parties in the traffic law enforcement chain (SafetyNet, 2009).

The standard behavioral countermeasures of laws, enforcement, and sanctions, which are used successfully for alcohol impairment, seat belt use, aggressive driving, and speeding, are unlikely to be effective for distracted or drowsy drivers (NHTAS, 2009).

Within the area of police enforcement focuses on speed enforcement. There are two reasons for this. First, the relationship between excess speed and unsafely is well-established and speed control is one of the major spearheads of road safety programs world-wide. Second, speed enforcement merits special attention in view of the variety of policing methods used to prevent speeding violations and the continuing (technological) developments in this area. It should be kept in mind, however, that police traffic enforcement involves much more than just speed enforcement (SafetyNet, 2009).

2.5 Traffic Police

The traffic police in Ethiopia play a twofold role in traffic safety. They primarily take the responsibility of improving safety by enforcing the traffic regulations. They secondly carry out crash investigation and reporting mainly for own use to document evidences required for court ruling, and as well as to identify priorities and plan enforcement strategies. Similar to the government bodies concerned with transport and road infrastructure, police is also organized at the federal and regional levels with hierarchical links. At the federal level, there is a Federal Police Commission accountable to the Ministry of the Federal Affairs (Federal police commission, 2009).

Enforcement, crash investigation and reporting are done by local police station. The monthly and yearly aggregated traffic crash data is reported to the next higher police station following the hierarchy to the police commission office. The police commission sends the sub-city aggregate traffic crash data to the federal police commission office which forms the national aggregate traffic crash statistics.

The main function of police control is to demonstrate that the law is being enforced and to detect high consumption groups. Because car drivers have to be stopped in order to detect non-compliance, random and evidential breath testing are important elements as road users' perception of the risk of apprehension depends on the objective risk of detection. New regulations for the traffic police must also clearly define the rights and obligations of the patrol officer, aspects of their relations with civilians and drivers, the correct procedures for stopping and checking drivers violating the rules, as well as administrative measures for handling violations. Activities that may damage the image of the police must be strictly forbidden for example, ambushing vehicles, officers communicating with civilians without getting out of their police cars and sleeping on the job (Broughton, J ; Elliott, 2004).

The creation of a monitoring service within the traffic police is necessary for preventing disciplinary and other types of violations by policemen. This service should conduct continuous reviews of the work of traffic police personnel, reveal any violators, and investigate violations and present recommendations for disciplinary penalties. It should also analyze the work of the traffic police, maintain statistics and help to plan the future activities of the traffic police (Biecheler-fretel, 2000).

Generally, Traffic Police have a great number of tools available for enforcing road traffic rules. They concern gathering evidence against offenders and the tools for their sanctioning. Traffic offenders can be penalized in various ways. Those are fines, (temporary) driving license suspensions, confiscation of their vehicles, and mandatory participation in rehabilitation programs, prison sentences or community service (ETSC, 2011).

2.6 Road Policing

Road policing of traffic laws is intended to influence the behavior of road users in such a way that their risk of becoming involved in a crashes or causing a crashes decreases. It is generally accepted that traffic law enforcement influences driving behavior through two processes: general deterrence and specific deterrence. General deterrence can be described as the impact of the threat of legal punishment on the public at large, while specific deterrence can be seen as the impact of actual legal punishment on those who have been apprehended. Thus, general deterrence results from a perception of the public that traffic laws are enforced and that a risk of detection and punishment exists when traffic laws are violated. Specific deterrence arises from actual experiences with detection, prosecution and punishment of convicted offenders (Goldenbeld, 1995).

In short, road policing is aimed at the behavior modification of road users and deterrence is seen as the central influence process. In all six methods of road policing are random breath testing (RBT), sobriety checkpoints, where the BAC of suspected drunk drivers was tested, speed cameras and driver and number plate photography, red light cameras, random road watch.

A selective traffic enforcement program approach where police patrols operate as usual but never in the same place at the same time on consecutive days 13 and varied programs of activity including enforcement and educational publicity (Scott, 2010).

The strategies of enforcement are described with respect to four spearheads of national road safety policy: drinking and driving, speeding, seat belt use and young moped riders. Each strategy constitutes a set of recommendations that describes an exemplary type of enforcement operation. These practical barriers and the keys to successful police enforcement are discussed in the closing section (Goldenbeld, 1995).

Police patrolling is when Police officers record traffic offences in road traffic from the roadside and stop the offenders immediately for sanction. Depending on the seriousness of the offence, different forms of sanction follow, as described earlier. Road traffic offences can also be recorded from Police vehicle, helicopter, or dedicated planes. In such cases, various modern technologies, that enable to record the offence, are used (ETSC, 2011).

2.6.1 Speed Enforcement

The term speeding is used as a label to describe the behavior of drivers going at speeds considered too fast for the prevailing conditions (inappropriate speed) or driving at speeds higher than specified by the posted speed limits (excess speed). However, as the context here is law enforcement, the term speeding is confined to excess speed. Speeding is by far the most frequent road traffic offence. Speed is one of the few forms of driver behavior for which a clear and consistent relation between behavior, in terms of average speed, and the number of crashes has been established (ETSC, 1999).

The adjudication process for speeding violations is fairly similar in the various countries. The nature of possible sanctions is similar, the size of the fine is in a common range, the majority of people pay the fine without appeal, and well over 50% of the public support speed limits and their enforcement (Zaidel, 2002).

Automatic speed enforcement implies by static cameras whereas the conventional one uses a vehicle mounted camera or a speed-gun. However, there is also a third case where a mobile camera is applied. In the latter case, if a) the camera works for a long time period, i.e. several successive hours, at least; b) the policeman is not involved in making a picture, i.e. the violation is memorized without human intervention; and c) in principle, all the violations performed during this time-interval can be apprehended, then the project is treated as an automatic enforcement study (Biecheler-fretel, 2000).

The effects of police enforcement on behavior, crashes and injuries have often failed to give precise descriptions of the enforcement methods used. In addition, many studies consider experiments involving the use of more than one method which make it impossible to attribute the effects to any specific enforcement method.

While static speed cameras can have an important role to play in road safety enforcement used in the wrong places they have only a limited impact in reducing speeding. Research shows they create a 'wave effect,' causing drivers to cut their speed only when they are near the camera. They also can reduce public support for speed enforcement, as they are often seen as purely a means of revenue-raising. They are really recommended only near places where the risk from speeding is particularly high e.g., near school crossings (Patron, 2010).

Speed devices measuring time over distance are much more effective at controlling speed, but are significantly more expensive and technically challenging to install. They require a suitable and reliable back-up data facility to cross-check vehicle registration and licensing, along with a secure system and coordination through the legal system to process offences (Patron, 2010).

Speed reduction is not confined to the site of speed enforcement. Drivers generalize speed reduction in time as well as in space that is, at times where there is no longer enforcement activity and/or at certain distances upstream or downstream from the enforcement site. Speed enforcement is most effective when it is unpredictable and difficult to avoid, when there is a mix of highly visible and less visible activities, and when it is continued over a longer period of time.

Furthermore, it is advisable to focus speed enforcement on roads, situations, and times where speeding is considered to affect the road safety (SafetyNet, 2009).

Speeding becomes aggressive driving when a vehicle's speed is too high for conditions or substantially exceeds the prevailing travel speeds of other vehicles. Speeding is a more clearly defined problem than aggressive driving, and strategies to reduce speeding (and other serious traffic law violations) may provide a means to address the problem of aggressive driving (NHTAS, 2009).

I. Red-Light Camera

The enforcement activity indicators mentioned in this area are the number of cameras in operation, the number of cameras to be introduced soon, the number of monitoring points per camera; and the amount of police activity, i.e. number of proceedings in court, caution letters sent, total number of drivers contacted, per year (Biecheler-fretel, 2000).

II. Speed Camera

Speed camera enforcement is most appropriate if the crashes are clearly concentrated on specific road sections and are related to excess speed, and when the volume of traffic makes physical policing a time-consuming, less effective approach.

In order to reduce violations by those with a disregard for speed limits and no fear of overt cameras it may be necessary to increase the use of more covert methods in the case of those regarded as manipulators. Depriving them of their knowledge of camera sites will allow for less manipulative driving and may lead to a more safety oriented style of driving. They must be made aware that their behavior is not tolerable and that any violation will be met with the appropriate penalty (Scott, 2010).

2.6.2 Drinking and Driving Enforcement

Effective enforcement of drink driving laws needs to be targeted primarily at optimizing the road users' perception of the risk of apprehension when driving with a BAC above the legal limit. Accompanying measures are required to reduce social acceptance of drunk driving and change public attitudes. In northern European countries this has already been achieved to a large extent and enforcement activities in those countries should primarily aim to maintain this situation. In several southern European countries, alcohol usage is very much a part of daily social life. As a consequence in these countries a process of social change has to be initiated resulting in public awareness that alcohol usage and driving need to be strictly separated (Scott, 2010).

Most studies in the literature that have evaluated policing methods used to enforce drink driving laws have studied the effects of random breath testing on crashes rates. This involves providing enforcement in a random manner i.e. there is no requirement to suspect drink driving before stopping a driver to apply a breath test.

In this way a police force can provide for the needs of simple, deterrent drink-driving screening, and the needs of prosecuting drink-driving, which can be more demanding than other violations. In several countries police officers are not routinely equipped with personal drink-driving screening devices and in some there is still a reluctance to dispense with mandatory blood tests, which require cumbersome involvement of medical staff in the testing (Zaidel, 2002).

High-BAC sanctions are based on the observation that many high-BAC drivers are habitual impaired driving offenders, even though they may not have a record of previous arrests and convictions. Enhanced sanctions for high-BAC drivers vary by State, and may include mandatory assessment and treatment for alcohol problems, close monitoring or home confinement, installation of an ignition interlock, and vehicle or license plate sanctions (NHTAS, 2009).

Enforcement of drinking and driving comprises more than just the pure enforcement on the road. The enforcement of drinking and driving is sometimes seen as one component among several others, which in some may constitute the total package of enforcement efforts, designed to reduce drinking and driving (Rune Elvik, 2001).

Over speeding and drink driving are the main contributing factors of road traffic offenses and crashes. Traffic offenses are involve use of alcohol and driving (14%), reckless driving (11%), speeding in excess of 15 mph over the speed limit (73%) and involve non-driving drug offenses (2%) of all traffic offenses (Waller *et al.*, 2001).

Enforcement of alcohol service laws is key, but largely lacking. Alcohol enforcement by police is almost exclusively directed toward drivers. As a result, action against licensed establishments has historically been limited to case law action involving serious crashes (NHTAS, 2009).

The enforcement of drink driving sanctions resulted in an overall reduction of all crashes of 3.7%, with fatal crashes being reduced by 9%. Crashes involving injury were reduced by 7.1%. It is also reported that revoking the driving license of offenders resulted in an 18% reduction in all crashes and this appears to be the most effective measure in reducing alcohol related crashes (Scott, 2010).

2.6.3 Seat Belt Enforcement

The enforcement of seat belt laws, especially when run in tandem with other strategies, results in an increase in compliance with seat belt laws and a resulting reduction in fatal and serious injuries. The key to reaching maximum achievable compliance levels would appear to be the use of highly visible and well publicized, by means of sustained mass media campaigns, police enforcement. However there seems to be a hardcore of violators, approximately 10% in most Western countries, who are immune to current enforcement strategies. In order to bring this hardcore element into line it may be necessary to take the decision of compliance or non-compliance out of their hands. This can be done by introducing automatic in-car safety devices such as intelligent warning systems or compulsory interlock devices in every car (Scott, 2010).

Though few studies have investigated the effects of seat belt enforcement on crashes, a number of studies have found that increased enforcement of seatbelt laws can result in increased wearing rates, which is likely to reduce the numbers of road crashes casualties.

The most common high-visibility belt law enforcement method consists of short (typically lasting for two weeks), intense, highly publicized periods of increased belt law enforcement, frequently using checkpoints (in States where checkpoints are permitted), saturation patrols, or enforcement zones (NHTAS, 2009).

Seat belts are not intended to prevent crashes, only to reduce the likelihood and severity of personal injuries when a crash has occurred. The effects of increased wearing rates for seat belts may nevertheless manifest themselves in the form, of a reduced number of crashes at a given level of severity (Rune Elvik, 2001).

2.7 Penalty Type and Level

Penalty types and levels for speeding and the various traffic offenses included under aggressive driving are part of each State's overall driver control system. Penalties typically are low for first offenses that do not produce serious crashes and casualties and include small fines and perhaps a few demerit points assessed against the driver's license. When violations cause a crash producing serious injury or death, the offense may carry criminal charges and sanctions may be more severe (NHTAS, 2009).

States use the demerit point system in an attempt to prevent drivers from committing repeated traffic offenses. As drivers accumulate demerit points, States use various actions and penalties such as warning letters, educational brochures, group counseling meetings, individual counseling, administrative hearings, and driver's license suspension or revocation. Penalty levels and types for speeding and aggressive driving offenses should be considered within the context of a State's overall driver control and problem driver remediation system (NHTAS, 2009).

2.8 The Relationship between Enforcement Levels and Crashes Rates

The relationship between levels of policing, on the one hand, and crashes or casualty rates, on the other, is not easy to establish. At zero enforcement level, crashes and casualties are expected to be at their highest levels. An increase in enforcement would have no noticeable effect at first. However, drivers will become aware of the police presence at a certain level of enforcement and can be expected to modify their behavior (i.e. reduce their violations), so the number of crashes and casualties would start to drop. As enforcement increases, the numbers of crashes and casualties can be expected to decrease, but only up to a certain point after which increased enforcement would have little or no effect because of a saturation effect (Broughton, J; Elliott, 2004).

A similar relationship is with respect to policing levels and violations, except that it is likely that violation rates can be reduced to a greater extent than can crashes or casualty rates. Enforcement could be increased so far that every violation of the traffic laws would be detected; the violation rate would probably fall to almost zero (it is likely that some drivers would still occasionally violate). However, crashes and casualties would not fall so far since crashes are caused by a multitude of factors both related and unrelated to violations of traffic laws.

The relationship indicates that more enforcement improves safety up to a certain point, but reduces safety beyond that point. There is a very clear relationship between the relative change in the amount of enforcement and the change in the number of injury crashes. It is seen that a reduction in the amount of enforcement was associated with an increase in the number of crashes, whereas increasing enforcement was associated with a reduction in the number of crashes (Rune Elvik, 2001).

The relationship between levels of policing and crashes/casualty rates is non-linear. At zero enforcement level, crashes and casualties are expected to be at their highest levels.

Increases in enforcement will have no noticeable effect at first but at a certain level, when drivers become aware of the increased police presence, crashes and casualties can be expected to drop

up until a saturation point is reached, after which further increases in enforcement levels can be expected to have little or no effect (Broughton, J ; Elliott, 2004).

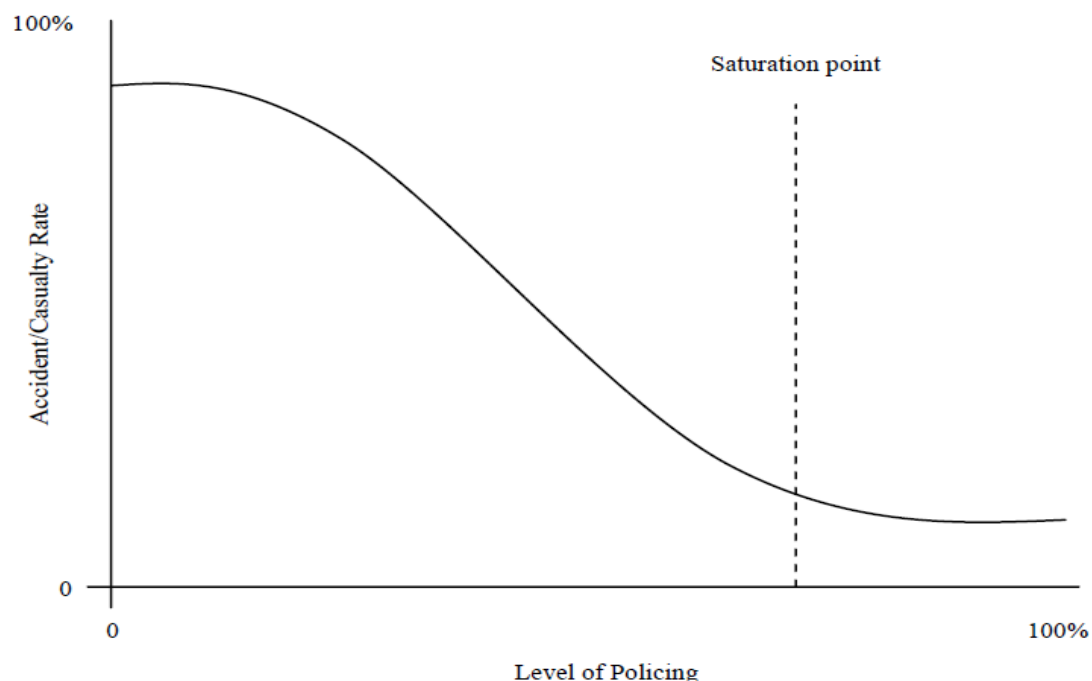


Figure 2 Theoretical Relationships Between Levels of Policing and Crashes

(Source: Broughton, J ; Elliott, 2004)

The challenge for road safety researchers is to establish the levels of policing that are required to bring about the initial decrease in the curve and to reach the saturation point. It is also important to establish the violation, crashes and casualty reductions that can be achieved with these levels of policing. Different studies have defined enforcement in different ways. For example, some reports provide information about enforcement levels in terms of police hours devoted to traffic policing, whereas others provide information in terms of the numbers of citations or arrests made during the enforcement period, or details about the numbers of drivers' prosecuted for offending. It is not possible to compare between these groups of studies (Broughton, J ; Elliott, 2004).

The intensification of police enforcement may or may not have the same on the number of crashes as on the number of related casualties, and each effect may or may not have the same in

regional variation. In particular, an improved road environment or an increase in traffic may be the causes of fewer casualties within the number of crashes (Yannis, Papadimitriou and Antoniou, 2008).

Generally, the majority of studies in the literature have found that increased levels of traffic policing have reduced road crashes and traffic violations. However, it is difficult in practice to establish the relationship between levels of police enforcement and violation, crashes or casualty rates. Unfortunately, it is not possible to establish the relationship by generalizing across the studies in the literature because appropriate information about enforcement levels is not given consistently across the different studies. Some studies do provide limited information about the levels of enforcement required to have an effect on safety.

2.9 Research Gap

Bahir Dar city one of the highest number of road traffic crashes and traffic offences in the region but there is no scientific literatures to identifying the most commonly occurring traffic offences types and characteristics which including the factors influencing traffic offences and the differences in traffic offence types exists by socio-demographic characteristics of traffic offenders, socio-economic characteristics of traffic offenders, travel history of traffic offenders and other driver and vehicle related variables. Finally to identify the most common traffic offences, the relationship between police enforcement and traffic offences, identifying the influencing factors and differences in traffic offence types by different socio-demographic, socio-economic characteristics and other variables related to driver and vehicle helps in making interventions towards reducing number of traffic offences. So, this study analyzes traffic offences, identifies the common traffic offences, and explores potential predictors of traffic offences and differences in traffic offences by different categories of socio-demographics of drivers, socio-economic characteristics, travel history and other driver and vehicle related variables.

3 METHODOLOGY OF THE STUDY

3.1 General

In this study the methodology used during the research i.e.it presents the types of data required for the research, source of data, sample size, data collection, data preparation and analysis. It will present the different options available to carry out the study and gives the reasons why a particular method is selected at different stage of the study. The primary data for the study is obtained through distribution of questionnaires from professionals involved in road user and driver of Bahir Dar city. In order to enrich the questionnaire for the research, a review of conferences and journals were used to identify the various efforts that have been made in the past to evaluate and examine the effects of variation orders on road policing enforcement.

3.2 Study Area

The historical foundation of Bahir Dar City is associated with the establishment of Kidane Miheret Church in the present site of St. Giorgis Church around the 14th century. Beginning from that time as a rural village on wards it has developed into one of the current largest city of the country. Its fast development and transformation into a modern town ship was made during the Italian occupation period of 1928 - 1933 since it was used as a major military base for their expeditions in the region. The naming of the city called as Bahir Dar has a connection with its near proximity to the two water bodies of the surrounding (Lake Tana and River Abay). It means periphery of a water body, which may be a periphery to one of them or both of them. As far as the reasons for its foundation are concerned, the availability of these two water bodies and the foundation of Kidane Mehiret Church in the area were the major responsible reasons among others (Federal Urban Planning Institution, 2006).

Bahir Dar, one of the main cities of Ethiopia and is the capital city of the Amhara National Regional State and the city is classified in to 9 sub cities and 27 kebeles which is located approximately at the geographic co-ordinates of 11°38' north latitudes and 37°15' east longitudes.

Bahir Dar City is located at the distances of 567 km along Addis Ababa - Dejen - Debre Markos - Bure road and 465 km along Addis Ababa - Dejen - Motta road (EMA, 2008). However, there are also some domes and ridges with relatively higher elevations that stand out in the area, particularly to the west and south of the town. Elevation variation in the area ranges from 1,786 m above sea levels near the Lakeshore to 1,886 m above sea levels at Bezawit. The average daily temperature is 19°C and the daily rain fall is variable extending from 3mm in the month of February to 438mm in the month of July (NMA, 2014).

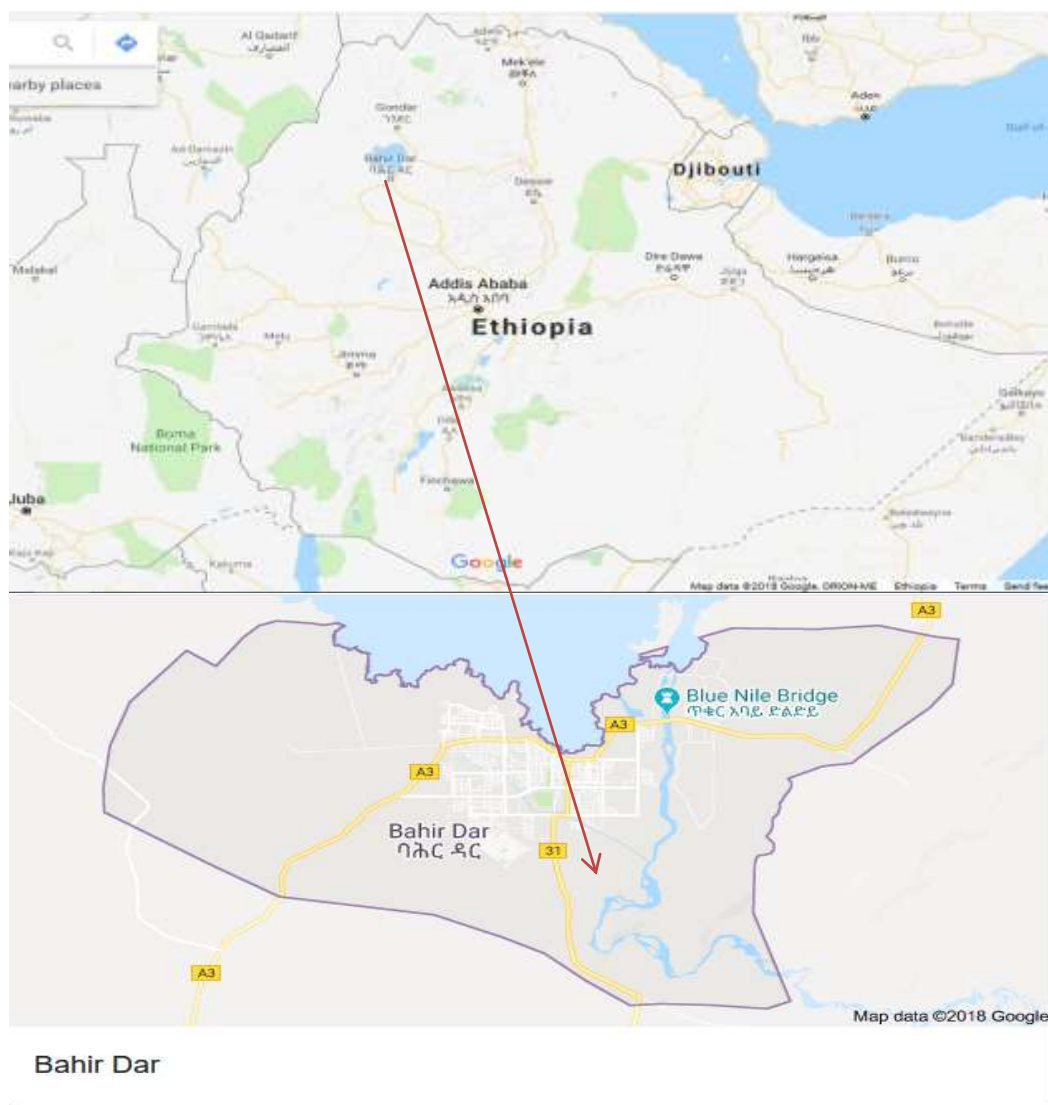


Figure 3 Map of study area

Source of Google Map

According to Bahir Dar city road and transport office report the total road network in Bahir Dar city are 971.3 km is paved road, 106.5 km is unpaved road and 273.2 km is cobblestone. Bahir Dar city which is interconnected to other cities of the country through very long main asphalt roads which runs people's socio-economic activities using different vehicles such as taxis, privately owned cars, governmental cars, bus (city and intercity), Bajaj, and cycling (both motor and bicycle); have already evolved into a very important center for commerce, administration, social services and recreation, and also for manufacturing.

According to the 2006-2007 population and housing census result, the population of the city has 167,261 of this 86,355 are males and 80,906 are females. Fifty eight percent of this population is in the age group of 15-64 years and this similar population is active labor force. 42% of the total population is below 15 years and above 64 years, which is unproductive labor force (CSA, 2006).

3.3 Research Design

The effects of police enforcement activity were investigated on two police stations in Bahir Dar city with in the number of offenses occurring over study period. Research methodology is a key instrument to solve the problem identified to carry out research. For this study a descriptive and inferential analysis method types were used. The method used when collecting, processing and analyzing the gathered information. This study helped the researcher to analysis and describes the respondent response and the number of traffic offenses in this research structured questionnaires and documentary analysis was used to meet the research objectives and research questions.

3.4 Sources of Data

Road traffic offenses and crashes are recorded by the traffic police on daily basis. The main types of data used in this thesis are primary and secondary sources of data.

I. Sources of Primary Data

Primary data sources were the best sources for the study. In this research questionnaire was the major instruments used to gather basic inputs for the study. The questionnaires were designed with the aim of sourcing primary data for the study. The questionnaires were series of structured questions which were related to the research work and directed to respondents of driver (civil servant, students and the merchant) who are the major participants of the city to drive the vehicle. The questionnaire is close-ended questions. Thus, in some cases, respondents were to choose the option that best reflected their options. Respondents were required to respond to a number of questions. The respondents were asked to respond more than fifty questions.

II. Source of Secondary Data

The secondary data sources were considered the traffic offenses and road policing enforcement to collect from Bahir Dar city administration police commissions, and Bahir Dar city road and transport bureau and also to collect the recorded data from Amhara National Regional State Traffic Police Commission.

3.5 Target Population of the Study

To make the study substantive, reliable and easier, a finite population was used which included commercial minibus drivers, mechanics, travellers and road users, transport owners, road safety campaign crusaders as well as road traffic enforcement agencies.

The study has a great input to the effectiveness of the road policing on traffic offenses. The major crash and traffic offences contributing factors are the pedestrians, drivers, and roadway and environmental conditions. So, in order to identify the most traffic offense factors along the study area the target population are resident of Bahir Dar city administration communities and drivers.

3.6 Sampling Method

The study area covers Bahir Dar city administration, and it is not possible to take all the whole populations as a sample. Due to this reason the representative sample from the target population should be selected. With this population, a minimum statistical sample that could be a representative for analysis, i.e. simple random sampling was used to select both drivers and passengers. Therefore, in this research simple random sampling technique is applied.

3.7 Sample Size Determination

Sample size determination is the foremost task prior to conducting a research work based on a sample of the parent population. In order to have an optimum sample size, objective of the study, significance of the study, cost or budget consideration, appropriate use of statistical analysis, degree of precision required for justifications and level of confidence use for conclusion has to be taken into consideration.

I. Primary Data

To collect the primary data the techniques was the questionnaires. The questionnaires have designed to identify the most reflective difficulties and traffic offenses problem that road users face while driving the vehicles.

To collect the primary data the number of sample size would be estimated based on (Israel 1992) developed equations which yield a representative sample for proportions.

$$n = \frac{z^2 * p(1-p)}{d^2}$$
 To determine the sample size in which samples are drawn from the sampling

frame. Where:-

n=Sample size required for the study

z=Critical value (=1.96) for the 95 percent confidence level, the amount of uncertainty that one can tolerate. Most researchers recommend 95 percent confidence level.

p=Proportion of people expected to have the basic knowledge about the problem (road policing enforcement on road traffic crashes in this case). Assume there is a large population but that do not know the variability in the proportion that will adopt the practice; therefore, assume $p = 0.5$ (maximum variability).

d=Margin of error that can be tolerated: it is the discrepancy between the sample size and the population. The recommended value is 5 percent ($=0.05$).

Therefore, substituting all these values to the above Cochran formula produced a total sample size (n) of $n = \frac{z^2 * p(1-p)}{d^2} \Leftrightarrow n = \frac{1.96^2 * 0.5(1-0.5)}{0.05^2} = 385$ vehicle drivers. The researcher has selected the place which all vehicles was accommodated in the study area and then distribute the questionnaires' to the vehicles drivers. So, a random sample of 385 vehicle drivers in the city in our target population should be required to give the confidence levels the study needs.

II. Secondary Data

The secondary data such as road traffic offences and crashes data have been collected from the Amhara police commission crashes data and Bahir Dar city police commission. Bahir Dar city police commission commissioner recommends that police station two (around Gambi Hospital) and police station five around (Abay mado) have the best recorder secondary data were selected for the purpose of this study. Due to the fact that the populations are quite large and considering the resources and constraints to collect five thousand two hundred thirty four (5234) secondary data in 2016/17 about road traffic offenses in Bahir Dar city.

3.8 Data Collection Method

Depending on the research perspective and strategy chosen, it must be choose methods for collecting data. The data collected can be either primary or secondary. In this thesis, both primary and secondary data are used and the time of data collected both primary and secondary data from April to June 2018 G.C in the study area.

I. Primary Data collection Method

Several techniques were employed to collect primary data. In this study, questionnaires have been prepared. The questionnaires for drivers were distributed to the target populations were 385 that is based on the number of sample sizes estimated depending on the confidence level (level of certainty), that the characteristics of the data collected will represent the characteristics of the total populations (95%) and margin of error that is the accuracy required for any estimates made from the sample (5%).

II. Secondary Data Collection Method

The secondary dataset contained details of roads policing enforcement and traffic offenses data in the period of 2016/17 G.C from the Bahir Dar city police commission and road traffic crashes data in between 2012/13-2016/17 G.C from Amhara region police commission are collected. The data collected from questionnaire and traffic offense which analysis to meet the specific objectives.

3.9 Data Preparation

Traffic offenses and crashes are recorded by the traffic police on yearly basis. This study is based on a primary and secondary data obtained from Bahir Dar city traffic police commission investigation division.

The first step in preparing the data was to extract, from the dataset, crashes records relating to road traffic crashes, and road policing as these were to be the main focus of the study. The total number of crashes and different measurement of police enforcement are also recorded to enable a calculation of crashes severity rates. In order to simplify the data and reduce it to a state ready for analysis it was entered in to an access database from where it would be easier to extract the required data. All queries used police station as a grouping variable which allowed for the selection of any combination of dependent and independent variables relating to any number.

The methodologies employed to analyze the data were both descriptive and inferential statistics. The data obtained will be checked and edited manually, then coded and entered into the computer using the Statistical Package for the Social Sciences (SPSS) software.

3.10 Variable of the Study

For this research a number of independent variables were used initially. These were socio-demographic characteristics of vehicle driver like age, gender, job, marital status, education level, driving experience, license level, licensing body, salary, and vehicle characteristics like vehicle service year and typical week kilometer travelled. The numbers of dependent variable of this research were over speeding, drinking driving, violation of traffic signs, illegal parking, and others traffic offences of the respondent involved in the past 12 months. Generally variables are related to offense and crashes events such as demography of the offender, offense type, and time of day, month of the year, weather conditions, the crash types and environmental roadway conditions.

3.11 Method of Data Analysis

Analysis of the data, now contained in the access database, was done in progressive steps. Before using the data for any analysis the data was checked for missing values, outliers and any other extraneous values. These are necessary steps to ensure the reliability and validity of the data.

Having ensured the data was suitable for analysis an initial investigation was carried out to identify any apparent or hidden trends in the data. This was important in the sense that it helped to further develop ideas for more complex analysis used to identify any relationships between offenses rates and measures of road policing activity as well as the various socio-demographic variables. After collecting the necessary information, data processing and interpretations were done using Statistical Package for Social Sciences (SPSS) version 24.0 software and descriptive methods in the form of table, charts, cross tabulation and graph. p -value below 0.05 (95% confidence interval) was considered as statistically significant and was undertaken to suggest possible engineering measures and to identify section road policing measurements and enforcement influence on the road traffic offenses.

3.11.1 Descriptive Method

Descriptive analysis is done prior to the analysis and used to analyze, present and interpret data. Frequency tables, percentages and cross tabulations were widely used in the analysis to generate values of dependent and independent variables.

3.11.2 Chi-Square Test Method

Chi-square Test of independence determines the associations between two categorical variables. Hence, it is used in this study to obtain associations of socio-demographic, travel history, vehicle characteristics and traffic offenses because these variables are categorical in nature.

It tests the following Hypotheses:-

Null Hypotheses: - There is no association between driver Socio-demography characteristics, vehicle characteristics and traffic offenses;

Alternative Hypotheses: - There is an association between driver Socio-demography characteristics, vehicle characteristics and traffic offenses. The driver Socio-demography characteristics are driver age, gender, job, driving experience, marital status, license level, education level and monthly salary. And vehicle characteristics are vehicle code, vehicle owner, vehicle service years, weekly travelled distance in kilometer.

3.11.3 ANOVA Test Method

Analysis of variances (ANOVA) was used to explore differences in mean number of traffic offences, across socio-demographic, socio-economic and travel history of traffic offenders. Because, the independent variables are categorical (more than two levels), this inferential statistics is selected. This differs from the other available methods in that it uses analysis of variance (ANOVA) to determine the distances between group by attempting to minimize the sum of squares between any two group that are formed at each step of the procedure.

4 ANALYSIS AND DISCUSSION

4.1 Introduction

This study investigated the evaluation of the effectiveness of road policing on road traffic offenses and crashes in Bahir Dar city. The analysis and discussion part are presents the analysis and interpretation of the traffic offences characteristics, characteristics of socio demography for the respondents, association of socio demography and traffic offenses, to evaluate the road policing enforcement activity on level of traffic offenses and to identify the causes of the traffic offenses by the method of descriptive and inferential analysis. The presentation and analysis of this study is therefore done in two parts. The first part will focus on secondary data and the second part will provided primary data.

4.2 Characteristics of Road Traffic Offences in Bahir Dar City

4.2.1 Evaluation of Traffic Offenses

Police enforcement is one of the preventative activities to reduce traffic offenses and road crashes. Police enforcement must be intelligence led using all the available information, statistics, attitude surveys and other data available so that operations can be planned to achieve maximum success. This means that police enforcement actions are focused and based on good evidence and can be strategic and efficient. The collected information is used to identify the real causes of collisions in the target area: when and where crashes and offences mostly take place, who are the key offenders and then to develop and implement a strategy to ensure effectiveness in enforcement of road law. Meaningful and practical enforcement solutions to the road safety problem need to be applied only after thorough interrogation of the offences, road crashes, deaths and serious injuries that take place.

A main role of traffic enforcement is seen as deterring road users from committing offences, which can be related to road crashes and injuries. In the study area there are nine police station and 46 policemen, and in the last year (2016/17) 29000 number of offence has recorded in the

police station. From this traffic offense the researcher has selected two police stations and has taken 5234 traffic offense and analysis as below.

Table 1 Number of traffic offenses in Bahir Dar City with in Five Year

Year	Number of Traffic Offenses	Percent (%)
2016/17	29000	21.1
2015/16.	28000	20.3
2014/15	27000	19.6
2013/14	26785	19.5
2012/13	26500	19.3
Total	137285	100

Source: Bahir Dar city police commission

I. Traffic Offence by Driver Education Level

A larger percentage of the respondents have secondary education or high school level that is basically important in the understanding of road traffic signs, highway codes and defensive driving principles. About 2.2% of drivers have primary and below primary educational level and the majority (52.2%) of them have secondary school.

Table 2 Driver Education Level on Traffic Offense

Academic Rank	No. of Offenders	Percent (%)
Elementary	115	2.2
High school	2758	52.7
Preparatory	111	2.1
Diploma	194	3.7
Degree	39	0.7
Other	2017	38.5
Total	5234	100.0

Source: Bahir Dar city police commission

II. Traffic Offense By Gender of Driver

From the table below about 99.8% of the sampled drivers were males and almost all of the traffic violation was caused by male drivers. The analysis of road traffic offences by sex and age group showed a uniform predominance of males over females in all age categories. This finding supported by Waller *et al.*, (2001) reported that men have more offenses and crashes than women and incur their first offenses and crashes rather than women.

Table 3 Gender of Drivers on Traffic Offense

Gender	Number of Offenders	Percent
Male	5225	99.83
Female	3	0.06
Total	5234	100.00

Source: Bahir Dar city police commission

Note that: other is missing data

III. Traffic Offense by License Certification Place

About 81.3% of the license certification institution is from Bahir Dar and 5.7% of the total from Gondar. This is good chances for Bahir Dar police commissssion due to manage and control the traffic offenses and crashes by giving additional training and courses about traffic law enforcement and regulation with another concern body during the traning time.

Table 4 Place of License Certification by Traffic offenses

License Certification Place	Number of Traffic offenses	Percent (%)
Bahir Dar	4256	81.3
Addis Ababa	134	2.6
Gondar	300	5.7
Debre Markos	102	1.9
Dessie	119	2.3

Mekelle	83	1.6
Oromia	236	4.5
Other	4	0.1
Total	5234	100.0

Source: Bahir Dar city police commission

IV. Traffic Offense by Day of the Week

Saturday has recorded about 17.7% of the total traffic offenses. These days are the market days in the study area, and there were a lot of movements for vehicles, pedestrians and animals. In addition, drivers or businessmen were importing products to the study area, coming from surrounding the rural woreda and kebeles.

Saturday is a market day. So the city population (consumers and sellers) constantly or mostly visit these markets every weekend using different numbers and types of vehicle. As this market serves the local, the nearby woreda, the region and the people of other cities in the nation and different types of vehicles are becoming congested (Federal Urban Planning Institution, 2006).

Table 5 Day of the Week in Traffic Offences

Day of Week	Number of Offenses	Percent
Monday	721	13.8
Tuesday	781	14.9
Wednesday	680	13.0
Thursday	792	15.1
Friday	829	15.8
Saturday	926	17.7
Sunday	489	9.3
Others	16	0.3
Total	5234	100.0

Source: Bahir Dar city police commission

V. Traffic Offense by Month of the Year

About 10.85%, 10.36% of the road traffic offences occurred during the months of August and December. August is the rainy season in the city, and drivers may commit more traffic violation due to the problem of visibility and unfavorable weather condition. December is the time at which farmer products are being transported to market areas. Due to this, there are a high number of traffic movements. October is the month with the lowest traffic offences about 5.73% of the total number of traffic offenses.

Table 6 Month of the Year on Traffic Offence

Month of Year	Number of Offenses	Percent
September	359	6.86
October	300	5.73
November	498	9.51
December	542	10.36
January	433	8.27
February	506	9.67
March	329	6.29
April	305	5.83
May	389	7.43
June	527	10.07
July	449	8.58
August	568	10.85
Pagume	11	0.21
Others	18	0.34
Total	5234	100.00

Source: Bahir Dar city police commission; Note that: other is missing data

VI. Traffic Offense by Age Group

About 70.14% of drivers aged between 24-29 years and 20.63% of drivers aged between 30-35 years. The majority (90.77 %) of the traffic offence was also due to those age group drivers, while 9.23% of them were aged above 36 and below 23 years. The working age group between 24 and 35 years accounted for more than 90% of all road traffic offences.

From NHTAS, (2009) showed that young drivers, especially males were had high crashed and almost crashed after falling asleep at the wheel or had friends who had crashed. But neither their knowledge nor their crash experience changed their sleep habits. They sacrificed sleep for the demands of their work, families, and social lives. Campaigns directed to young drivers also must overcome the higher risk-taking behavior and overall immaturity of young drivers.

Table 7 Age Group in Traffic Offense

Age Group	Number of Offenders	Percent
<17	9	0.17
18-23	134	2.56
24-29	3671	70.14
30-35	1080	20.63
36-45	276	5.27
46-55	48	0.92
>56	13	0.25
Others	3	0.06
Total	5234	100.00

Source: Bahir Dar city police commission

Note that: other is missing data

VII. Traffic Offence by Driver License Level

Among the sampled drivers about 3.67%, 36.11%, 43.54%, 7.18%, and 8.56% had motors, (auto, taxi one and two), (Truck one, Public one and Level three), (Truck two, Public two and Level four), and Truck three, Public three, and Level five driving license levels respectively. Furthermore, most of the traffic offences were due to drivers who had Truck one, Public one and Level three license levels. According to Blondiau and Rousseau, (2013) reported that drivers can take several actions to improve road safety and reduce crashes and offenses risks. These actions were defensive driving, avoiding drinking and driving, wearing seat belts and not driving while fatigued. This action taken depends on the driver experience and license level.

Table 8 Driver License level in Traffic offense

License level	Number of Offenders	Percent (%)
Motor	192	3.67
Auto, Taxi 1, and Taxi 2	1890	36.11
Truck 1,Public 1,Taxi1-Public 1,Level 3	2279	43.54
Truck 2,Public 2, and Level 4	376	7.18
Truck 3, Public 3, Trailer and Level 5.	448	8.56
Others	49	0.94
Total	5234	100.00

Source: Bahir Dar city police commission

Note that: other is missing data

VIII. Types of Traffic Offence in the City

From the below table 9 illegal parking, loading passengers above the capacity of the vehicle, driving other road segment without schedule and permission and violation traffic signs are the major traffic offences types in Bahir Dar city with a total of 1401 cases, 1257 cases, 500 cases and 332 cases respectively.

The study conducted by Young and Regan, (2007) showed that illegal parking violations are a major detected and enforced either through visual observation while patrolling or via complaints from the public. The typically only enforce illegal parking or stopping violations if they pose a safety risk to other road users (e.g., stopped on a curve in the road) or if they are in a disabled zone.

Table 9 Types of Traffic Offense in Bahir Dar city

No	Types of Traffic Offenses	Number of offenses	Percent (%)
1	Car washing in the main road	15	0.29
2	Chat chew while driving	9	0.17
3	Driving vehicle above driving license level	23	0.44
4	Driving against traffic direction	127	2.43
5	Driving on another road segment without permission and schedule	500	9.55
6	Driving without license	70	1.34
7	Incomplete license plate	41	0.78
8	Light problem	7	0.13
9	Loading and unloading improper place	176	3.36
10	Making wrong turn and blocking the road	33	0.63
11	Loading passengers above the capacity of the vehicle	1257	24.02
12	Not have Identification card	13	0.25
13	Not giving ticket for the passenger and tariff	82	1.57
14	Not use seatbelt while driving	175	3.34
15	Not wearing helmet	171	3.27
16	Over speeding	13	0.25
17	Illegal Parking	1401	26.77
18	Running away from the traffic policemen	73	1.39
19	Driving by fraudulent document	16	0.31

20	Driving by incomplete document	17	0.32
21	Not accomplish his charge within the given time	80	1.53
22	Not attach bolo	72	1.38
23	Not giving priority to pedestrian	54	1.03
24	Not attach tapela	14	0.27
25	Not wearing uniform	7	0.13
26	Unlicensed driving	14	0.27
27	Using mobile while driving	71	1.36
28	Violation of traffic policemen commands	156	2.98
29	Violation of traffic sign	332	6.34
30	Driving without withdraw	191	3.65
31	Others	24	0.46
32	Total	5234	100.00

Source: Bahir Dar city police commission

Note that: other is missing data

4.2.2 Characteristics of Socio-Demographic for Respondent

I. Demography Profile of the Respondent

Socio-demographic characteristic of the respondents about 0.3% of drivers aged are less than 17 years, 13% of drivers aged are 18-23 years, 46.8% are between 24-29, 24.4% are 30-35 years and 13.2% aged are more than 36 years. About 93.2% of the sampled drivers are males and 6.8% of the drivers are females. About 53% of the drivers are married, with 47% of the total respondents is single. About 6.8% of drivers have elementary and below elementary educational level, 33% of drivers have secondary or high school, 11.7% driver have preparatory school level, 30.4% of driver have diploma level and the 15.6 % of driver have degree education level.

Table 10 Demographic Profile of Driver

Socio-demographic Characteristics		Frequency	Percent (%)
Age	< 17	1	0.3
	18-23	50	13
	24-29	180	46.8
	30-35	94	24.4
	36-45	44	11.4
	> 46	7	1.8
	Unknown	9	2.3
Gender	Male	359	93.2
	Female	26	6.8
Marital Status	Single	181	47
	Married	204	53
Education Level	Elementary	26	6.8
	High school	127	33
	Preparatory	45	11.7
	Diploma	117	30.4
	Degree	60	15.6
	Unknown	10	2.6
	Total	385	100

Note that: unknown is not filled by respondents.

Source: own survey

II. Driver Experience and License Level

The driving experience of the respondents along highway as presented as below shows that about 55.3% of the respondents have been driving on the road between 2 – 5 years and 37.1% of the respondents have been driving on the road between 5 – 10 years. This indicates that 92.4% of the drivers have a driving experience that is adequate for them to provide necessary information that can be relied on for the purpose of the study.

Among the sampled drivers about 1%, 9.1%, 64.4%, 20.8 and 2.1% had motor, level two (Auto, Taxi 1 and Taxi 2), level three (Truck 1 and Public 1), and level four (Truck 2 and Public 2) and level five (public 3, truck 3, trailer and liquid) driving license levels respectively. Furthermore, most of the traffic law violations were due to drivers who had license level three i.e. Truck one, Public one and Level three. And the majority (51.2%) of sampled vehicles gave service years less than 5 years, vehicle service 6-15years is 26% of the total sampled, vehicle service 16-25 years is 4.2% of the total sampled and the rest 2.6% of the sampled gave service years greater than 26 years.

Table 11 Driver Experience and License Level for Respondent

Driving characteristics		Frequency	Percent
Driving Experience	0-2	7	1.8
	2-5	213	55.3
	5-10	143	37.1
	Above 10 years	19	4.9
	Unknown	3	0.8
License Level	Motor	4	1
	Auto, Taxi 1 and Taxi 2,	35	9.1
	Truck 1, Public 1, Level 3	248	64.4
	Truck 2, Public 2, Level 4	80	20.8
	Public 3 , Liquid, Trailer, Truck 3 and Level 5	8	2.1
	Unknown	10	2.6
Vehicle Service	<5	197	51.2
	6-15	100	26
	16-25	16	4.2
	> 26	10	2.6
	Unknown	62	15.8

Total	385	100
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Note that: unknown is not filled by respondents.

Source: own survey

III. Respondent View on Road Type and Day of the Week

Road traffic offences and crashes are occurs at a particular period of the day ranging from the morning, lunch time, afternoon and night time. The most traffic violation or offences on highway occur in the night time of the day about 50.9% of the total of traffic offences. This might be as a result of drivers less enforcement, light problem, speeding, fatigue and tiredness because most traffic on the road is on a long distance trip. This result supported by Tulu *et al.*, (2013) reported that the pedestrian crashes higher at night time due to reduced visibility and poor perception and reaction of drivers or pedestrians.

The perception of crashes occurrence along on highway by the respondents revealed that majority of the traffic offences on the road occurs on Saturday, Sunday and Monday. This characteristic nature of road traffic offence on the road could be associated with an unusual increased traffic flow on the road during this time and the low level of road traffic enforcement by the law enforcement agents. Saturdays, Sunday and Mondays the occurrence of traffic offences were relatively higher than it is on other days. To have a clear picture of traffic offences within a day, the following table may help for contrasting the situation within a week. About 40.3% and 41% respondents say that the traffic crashes occur on curve and intersection road geometric types respectively.

Table 12 Rpondent View on Road Type and Day of the Week

	Occurrence of traffic offence	Frequency	Percent
Insurance	Vehicle Insurance	80	20.8
	Third Party Insurance	230	59.7
	Workman Insurance	35	9.1
	Not Insurance	40	10.4
Road Geometric Types	Straight road	26	6.8
	Intersection	158	41
	Curve	155	40.3
	Residential	41	10.6
	Unknown	5	1.3
Time of the day	Morning (6:01 AM – 11:00 AM)	98	25.5
	Lunch Time (11:01 AM – 2:00 PM)	58	15.1
	Afternoon (2:01 PM – 6:00 PM)	24	6.2
	Night Time (6:01 PM – 6:00AM)	196	50.9
	Unknown	9	2.3
Day of the week	Monday	62	16.1
	Tuesday	8	2.1
	Wednesday	10	2.6
	Thursday	8	2.1
	Friday	10	2.6
	Saturday	163	42.3
	Sunday	111	28.8
	Unknown	13	3.4
	Total	385	100

Note that: unknown is not filled by respondents.

Source: own survey

IV. The Relationship Between Police Enforcement and Traffic Offence

The enforcement of comprehensive and clear legislation with appropriate penalties and accompanied is a critical factor in reducing road traffic crashes and deaths (WHO, 2009).

The relationship between police enforcement and traffic offence are about 67.5% of the sampled drivers have by increase road policing to minimize the traffic crashes and offenses, 18.2% of the sampled have not agree that by increasing road policing to minimize the traffic offences and crashes and 10.6% of the sampled have not relationship between road policing and traffic offence. The age groups between 24-29 drivers strongly agree that by increasing road policing to decreasing traffic offence and traffic crashes.

Broughton, J ; Elliott, (2004) showed that as enforcement increases, the numbers of crashes and traffic offense are can be expected to decrease, but only up to a certain point after which increased enforcement would have little or no effect because of a saturation effect. And also Factor, (2018) reported that more effective prevention and enforcement programs to reduce the offenses and crashes.

Table 13 Respondent View on Police Enforcement and Traffic Offences

	Respondents Answer	Frequency	Percent (%)
By increasing police enforcement to decrease traffic offences and traffic crashes.	Yes	260	67.5
	No	70	18.2
	No Relation	41	10.6
	unknown	14	3.6
	Total	385	100

Note that: unknown is not filled by respondents.

Source: own survey

V. Types of Traffic Offence and Driver Distracting

The majority (44.4%) of the sampled drivers talk on phone while reduce speed and driving the vehicle, 17.1% of driver talk on phone without reduce the speed of vehicle, 17.9% of them stopped when they used phone and only 16.4% never talk on phone while driving the vehicles. As table below revealed that 79.4% sampled of the traffic violation were caused by drivers using phone while driving vehicles.

About 62.3% of the sampled drivers' that conversation with passengers is very distracting while driving the vehicle, 15.8% of sampled drivers conversation with passenger is somewhat distracting, 16.1% of the sampled driver not all distracting conversation with passenger while driving the vehicle and only 3.9% have never been in that situation while driving the vehicles.

About 27.8% of the sampled drivers' that using GPS while driving the vehicle is very distracting, 58.7% of sampled drivers using GPS is somewhat distracting, 8.8% of the sampled driver not all distracting using GPS while driving the vehicle and only 2.6% have never been in that situation while driving the vehicles.

About 4.9% of the sampled drivers' that listen radio and music playing is very distracting while driving the vehicle, 72.5% of sampled drivers listen radio and music playing is somewhat distracting, 14.3% of the sampled driver not all distracting listen radio and music playing while driving the vehicle and only 3.4% have never been in that situation while driving the vehicles and the sampled drivers used seat belt while driving vehicles were about 59.5%, 26.2%, 14.3% of that used seat belt always, some times and never respectively. About 13.8%, 40.8%, 7% of the drivers are drive after drinking alcohol always, sometimes and never drive after drinking respectively.

According to Rolison *et al.*, (2018) reported that a driver's attention is diverted from the activity of driving by a competing activity (e.g., using a mobile phone, playing music), whereas inattention refers to a failure to allocate attention to the activity of driving.

Table 14 Respondent View on some of the Traffic Offence Types and Distracting

Respondent's Characteristics		Frequency	Percent (%)
If your cell phone ring while you are driving what would you do to answer the calls?	Reduce speed and Answer	171	44.4
	Answer without changing speeding	66	17.1
	Stop and Answer	69	17.9
	Reject the call	63	16.4
	Unknown	16	4.2
Conversation with passenger while driving	Very Distracting	240	62.3
	Somewhat Distracting	61	15.8
	Not all Distracting	62	16.1
	Have never been in that situation	15	3.9
	Unknown	7	1.8
Using GPS while driving	Very Distracting	107	27.8
	Somewhat Distracting	226	58.7
	Not all Distracting	34	8.8
	Have never been in that situation	10	2.6
	Unknown	8	2.1
Listen Radio Music Playing While driving	Very Distracting	19	4.9
	Somewhat Distracting	279	72.5
	Not all Distracting	55	14.3
	Have never been in that situation	13	3.4
	Unknown	19	4.9
Using seatbelt while driving	Yes	334	86.8
	No	39	10.1
	Unknown	12	3.1
If yes, How often use seatbelt?	Always	229	59.5
	Sometimes	101	26.2
	Never	55	14.3

Drink Driving	Yes	210	54.5
	No	27	7
	Unknown	148	38.4
If yes how often Drink Alcohol	Always	53	13.8
	Sometimes	157	40.8
	Never	27	7
	Unknown	148	38.4
	Total	385	100

Note that: unknown is not filled by respondents.

Source: own survey

4.2.3 Association of Socio-Demographics Characteristics and Traffic Offences

The association between traffic offence and different variables were analyzed by non-parametric correlation i.e. chi-square test. It was hypothesized that there is no associations between driver socio-demographic, socio-economics, vehicle characteristics and violation of traffic rule and regulation. Chi-square test showed a statistically significant association in all the variables and road traffic offences.

Table 15 The Association between socio-demographic factors and traffic offences (Chi-square test results).

Have you committed traffic offences in the past twelve months?				Chi-Square Value	Sig.
Variables		Yes	No		
Age	< 17	0(0%)	1(0.92%)	19.954	0.001
	18-23	36(13.79%)	13(11.92%)		
	24-29	128(49.11%)	51(46.79%)		
	30-35	66(25.3%)	27(24.77%)		

	36-45	31(11.88%)	10(9.17%)		
	> 46	0(0%)	7(6.42%)		
Gender	Male	257(95.89%)	96(86.48%)	10.875	0.001
	Female	11(4.11%)	15(13.51%)		
Job	Civil Servant	49(18.42%)	22(20%)	13.785	0.008
	Driver	168(63.16%)	53(48.18%)		
	Merchant	29(10.9%)	16(14.54%)		
	Student	19(7.14%)	15(13.64%)		
	Unemployed	1(0.37%)	4(3.64%)		
Education level	Elementary	10(3.83%)	16(14.68%)	20.752	0.000
	High school	90(34.48%)	37(33.94%)		
	Preparatory	37(14.18%)	7(6.42%)		
	Diploma	88(33.72)	27(24.77%)		
	Degree	36(13.8%)	22(20.18%)		

Source: own survey

Table 16 Association of driving and vehicle characteristics, day of the week and traffic offense (Chi-square test results).

Have you committed traffic offences in the past twelve months?				Chi-Square Value	Sig.
Variables		Yes	No		
Driver Experience	0-2	7(2.6%)	0(0%)	10.782	0.013
	2 – 5	147(54%)	63(60%)		
	5 – 10	99(36.4%)	42(40%)		
	Above 10 Years	19(7%)	0(0%)		
License Level	Motor	3(1.14%)	1(0.93%)	20.086	0.000
	Auto, Taxi 1 and Taxi 2,	25(9.54%)	10(9.34%)		
	Truck 1, Public 1,Level 3	176(67.17%)	67(62.62%)		
	Truck 2, Public 2, Level 4	58(22.14%)	21(19.63%)		
	Public 3, Liquid, Trailer, Truck 3 and Level 5	0(0%)	8(7.47%)		
Day of the Week	Monday	48(18.53%)	12(11.21%)	20.988	0.002
	Tuesday	2(0.77%)	5(4.67%)		
	Wednesday	4(1.54%)	6(5.60%)		
	Thursday	8(3.10%)	0(0%)		
	Friday	4(1.54%)	6(5.60%)		
	Saturday	115(59.85%)	46(42.99%)		
	Sunday	78(30.11%)	32(29.91%)		

Source: own survey

Based on the assumption the ρ -values for the variables: such as age (0.001), gender (0.001), job (0.008), education level (0.000), driving experience (0.013), license level (0.000), and day of the week (0.002) are less than the α -value as a result, the null hypothesis is rejected and concluded that there is an association between the occurrences of road traffic offences and each of the above stated independent variables. This finding supported that Misker *et al.*, (2017) found that males were much more likely to suffer from injuries than females. This is likely due to the nature of work exposing, majority of males on urban streets or the increased level of participation in high risk activities among male individuals. And also sex, age, job, day of the week and whether conditions were significantly associated with road traffic crashes.

4.2.4 Differences in Traffic Offences by Socio-demographics Characteristics

I. Differences in Traffic Offences and Driver Age

Table 17 shows differences in driver age groups by different traffic offence types. Driver age group among different traffic offences were found and there is statistically significant differences in variances between groups in cases of over speeding ($\rho=0.002$), red light running ($\rho=0.008$), drink-driving ($\rho=0.01$), illegal parking ($\rho=0.01$), over loading ($\rho=0.007$), not giving priority to vehicle ($\rho=0.021$), not giving priority to pedestrian ($\rho=0.008$), violation of traffic signs ($\rho=0.001$) and chew chat while driving ($\rho=0.020$). This finding supported by Yismaw, (2015) showed that the drivers approximate average driving speed, drivers giving priorities to pedestrians, driver giving priorities to vehicles, being stopped for violating traffic rules & regulations are an association among the occurrences of road traffic crashes and offense.

Table 17 Differences in Traffic Offences among Driver Age (one-way ANOVA Output)

No.	Types of offence	Sum of Squares	df	Mean Square	F	Sig.
1	Over speeding	2.971	5	.594	3.918	.002
2	Red light running	2.496	5	.499	3.176	.008
3	Drinking-Driving	1.544	5	.309	3.105	.010
4	Illegal parking	2.437	5	.487	3.086	.010

5	Over loading	2.552	5	.510	3.257	.007
6	Not giving priority to vehicle	2.176	5	.435	2.706	.021
7	Not giving priority to pedestrian	2.332	5	.466	3.182	.008
8	Violation of traffic signs	3.048	5	.610	4.131	.001
9	Chew chat while driving	1.611	5	.322	2.723	.020

Source: own survey

II. Differences in traffic offences and Gender

Table 18 below shows the gender traffic offenders for different measures of traffic offences. Gender is statistical significance difference in the case of over speeding ($\rho=0.000$), red light running ($\rho=0.002$), illegal parking ($\rho=0.002$), overloading ($\rho=0.035$), not giving priority to vehicle ($\rho=0.001$), not giving priority to pedestrians ($\rho=0.002$) and violation of traffic signs ($\rho=0.005$).

Table 18 Differences in Traffic Offences among Gender (one-way ANOVA Output)

No	Types of Traffic offence	Sum of Squares	df	Mean Square	F	Sig.
1	Over speeding	2.167	1	2.167	14.114	.000
2	Red light running	1.491	1	1.491	9.448	.002
3	Illegal parking	1.482	1	1.482	9.359	.002
4	Over loading	.720	1	.720	4.492	.035
5	Not giving priority to vehicle	1.653	1	1.653	10.370	.001
6	Not giving priority to pedestrian	1.471	1	1.471	10.004	.002
7	Violation of traffic signs	1.229	1	1.229	8.091	.005

Source: own survey

III. Differences in Traffic Offences and Job

The differences in traffic offences by job of traffic offenders were shown in the table 19 by using one way ANOVA. Statistically significant differences were found in cases of over speeding ($\rho=0.010$), red light running ($\rho=0.010$), illegal parking ($\rho=0.009$), over loading ($\rho=0.002$), not giving priority to vehicle ($\rho=0.014$), not giving priority to pedestrian ($\rho=0.037$), and violation of traffic signs ($\rho=0.013$).

Table 19 Differences in Traffic Offences among Job (one-way ANOVA Output)

No	Types of traffic offence	Sum of Squares	df	Mean Square	F	Sig.
1	Over speeding	2.112	4	.528	3.417	.010
2	Red light running	2.130	4	.533	3.409	.010
3	Illegal parking	2.154	4	.539	3.438	.009
4	Over loading	2.613	4	.653	4.236	.002
5	Not giving priority to vehicle	2.026	4	.506	3.187	.014
6	Not giving priority to pedestrian	1.534	4	.383	2.601	.037
7	Violation of traffic signs	1.944	4	.486	3.246	.013
8	Drive while conversation with passenger	6.370	4	1.593	1.990	.095

Source: own survey

IV. Differences in Traffic Offences and Education Level

Table 20 below shows differences in traffic offences by education level of traffic offenders. Statistically significant differences were found in cases of over speeding ($\rho=0.049$) and not giving priority to vehicle ($\rho=0.009$).

Table 20 Differences in Traffic Offences among Education Level (one-way ANOVA Output)

No.	Types of traffic offence	Sum of Squares	df	Mean Square	F	Sig.
1	Over speeding	1.517	4	.379	2.419	.049
2	Red light running	1.308	4	.327	2.052	.088
3	Not giving priority to vehicle	2.201	4	.550	3.479	.009
4	Not giving priority to pedestrian	1.176	4	.294	1.978	.099
5	Violation of traffic signs	1.234	4	.309	2.024	.092

Source: own survey

V. Differences in Traffic Offences and Driver Experience

The differences in traffic offences by driver experience of the traffic offenders were shown in the table 21 by using one way ANOVA. Statistically significant differences were found in cases of over speeding ($\rho=0.006$), red light running ($\rho=0.001$), drive after drink ($\rho=0.000$), illegal parking ($\rho=0.004$), over loading ($\rho=0.007$), not giving priority to vehicle ($\rho=0.009$), not giving priority to pedestrian ($\rho=0.003$), violation of traffic signs ($\rho=0.004$), using cellphone while driving ($\rho=0.034$) and chew chat while driving ($\rho=0.013$). This finding supported by ETSC, (1999) reported that to identifying effective strategies for road law enforcement for a range of road law offences. Since these vary for different offences over speeding, drinking and driving, red light offences, insufficient headways and failure to give way at pedestrian crossings are identified as major contributory factors in crashes.

Table 21 Differences in Traffic Offences among Driver Experience (one-way ANOVA Output)

No	Traffic offence	Sum of Squares	df	Mean Square	F	Sig.
1	Over speeding	1.942	3	.647	4.199	.006
2	Red light running	2.598	3	.866	5.580	.001
3	Drive after drinking	2.496	3	.832	9.013	.000
4	Illegal parking	2.178	3	.726	4.615	.004

5	Over loading	1.934	3	.645	4.094	.007
6	Not giving priority to vehicle	1.901	3	.634	3.957	.009
7	Not giving priority to pedestrian	2.098	3	.699	4.784	.003
8	Violation of traffic signs	2.038	3	.679	4.507	.004
9	Drive and using cellphone	11.484	3	3.828	2.912	.034
10	Chew chat while driving	1.278	3	.426	3.627	.013

Source: own survey

VI. Difference Traffic Offences Type and License Level

The differences in traffic offences by license level of the traffic offenders were shown in the table 22 by using one way ANOVA. Statistically significant differences were found in cases of over speeding ($\rho=0.000$), red light running ($\rho=0.002$), illegal parking ($\rho=0.001$), not giving priority to vehicle ($\rho=0.002$), not giving priority to pedestrian ($\rho=0.001$), and violation of traffic signs ($\rho=0.001$). According to (Mahdi *et al.*, 2017) result that speeding had the highest numbers of violations. The effects of speeding on the severity of the crash and the risk of being involved in a traffic offense was very high, but no study looked at the importance of speeding on reducing the numbers of traffic crashes.

Table 22 Correlation in Traffic Offences among Licence Level (one-way ANOVA Output)

No.	Traffic offence	Sum of Squares	df	Mean Square	F	Sig.
1	Over speeding	3.316	4	.829	5.626	.000
2	Red light running	2.773	4	.693	4.526	.002
3	Illegal parking	2.860	4	.715	4.662	.001
4	Over loading	2.995	4	.749	4.977	.001
5	Not giving priority to vehicle	2.637	4	.659	4.230	.002
6	Not giving priority to pedestrian	2.812	4	.703	4.974	.001
7	Violation of traffic signs	2.889	4	.722	4.964	.001

Source: own survey

VII. Differences in Traffic Offences and Vehicle Service Year

The differences in traffic offences by vehicle service year of the traffic offenders were shown in the table 23 by using one way ANOVA. Statistically significant differences were found in cases of illegal parking ($\rho=0.032$) and not giving priority to vehicle ($\rho=0.017$). Most the time old vehicles have a mechanical problem and parking in the main road due to different problem.

Table 23 Differences in Traffic Offences among Vehicle Service Year (one-way ANOVA)

No	Types of traffic offence	Sum of Squares	df	Mean Square	F	Sig.
1	Illegal parking	1.514	3	.505	2.993	.032
2	Over loading	1.160	3	.387	2.318	.076
3	Not giving priority to vehicle	1.751	3	.584	3.474	.017
4	Not giving priority to pedestrian	1.062	3	.354	2.233	.086
5	Violation of traffic signs	1.090	3	.363	2.269	.082

Source: own survey

VIII. Differences in Traffic Offences and Monthly Income

The differences in traffic offences by monthly incomes of the traffic offenders were shown in the table 24 by using one way ANOVA. Statistically significant differences were found in cases of conversation with passenger while driving ($\rho=0.010$) and using cell phone while driving ($\rho=0.024$).

Table 24 Differences in Traffic Offences among Monthly Income (one-way ANOVA Output)

No	Types of traffic offence	Sum of Squares	df	Mean Square	F	Sig.
1	Red light running	1.532	5	.306	1.892	.096
2	Wear a helmet while driving	2.587	5	.517	2.212	.053
3	Conversation with passenger	12.048	5	2.410	3.043	.010
4	Use cellphone while driving	9.300	5	1.860	2.616	.024

4.3 Characteristics of Road Traffic Crashes

4.3.1 Amhara Region Crashes Statistics

Road traffic crashes are essentially caused by improper interactions between vehicles, between vehicles and other road users and or roadway features. The situation that leads to improper interactions could be the result of the complex interplay of a number of factors (Goel and Sachdeva, 2016).

Based on ANRS police commission traffic police recorded data in Amhara region, the type and number of crash severity that is human injuries and property damaged was described below figure and table. As shown below each type of human injuries and property damage with respect to all zones per each analysis year has been provided from the secondary data of Amhara national regional state of road traffic safety police commission.

Table 25 Reported Traffic Crashes in ANRS Trends for Five Years

No.	Zone/City Administration	2012/13	2013/14	2014/15	2015/16	2016/17	Total	Percent (%)
1	Bahir Dar City	281	360	315	293	326	1575	10.99
2	Gondar City	295	407	232	161	154	1249	8.72
3	North Gondar	242	204	150	134	130	860	6.00
4	South Gondar	179	187	190	140	161	857	5.98
5	Awi	130	111	118	111	110	580	4.05
6	West Gojjam	269	258	247	276	258	1308	9.13
7	East Gojjam	204	193	168	189	230	984	6.87
8	North Shiwa	297	278	322	371	463	1731	12.08
9	South Wollo	207	254	231	203	212	1107	7.73
10	Dessie City	156	189	235	282	316	1178	8.22
11	North Wollo	277	346	341	334	354	1652	11.53

12	Oromia	210	199	184	193	254	1040	7.26
13	Waghmira	32	33	28	50	62	205	1.43
14	Total	2779	3019	2761	2737	3030	14326	100.00
	Percent	19.40	21.07	19.27	19.11	21.15	100.0	

Source: Amhara police commission

Based on ANRS police commission traffic police recorded data showed that a total of 14326 numbers of road traffic crashes in Amhara region of each zones and cities administration. As a result, from the analysis North Shewa, North Wollo and Bahir Dar cities have recorded the first highest zones in road traffic crashes from Amhara region for the analysis periods of 2012/13-2016/17 G.C.

As shown table 26 below, the types of severity per the analysis period of time is depicted. As it is clearly shown below on death 3217 (22.42%) crashes, serious injury 2207 (15.38%) crashes, slight injuries 3126 (21.79%) crashes , and damaged vehicle 5796 (40.40%) crashes were recorded from traffic police station of each zone from 2005 - 2009 E.C. Generally, a total of 14346 traffic crashes severities were recorded in Amhara Regions from 2012/13-2016/17 G.C.

Table 26 Traffic Crashes Severity in ANRS for Five Years

Crashes Severity Types	2012/13	2013/14	2014/15	2015/16	2016/17	Total	Percent (%)
Fatal	558	542	610	711	796	3217	22.42
Serious Injuries	392	429	437	447	502	2207	15.38
Slight Injuries	648	768	628	517	565	3126	21.79
Property Damage	1182	1289	1096	1062	1167	5796	40.40
Total	2780	3028	2771	2737	3030	14346	100.00

Source: Amhara police commission

As ANRS police commission traffic police crashes reported data showed on table 27 below, traffic police estimated cost on the property damage of Amhara region road traffic crashes is 366,190,450 (ETB) in 2016/17 G.C and 734,006,692 (ETB) in the period of five year until 2012/13- 2016/17 G.C.

Table 27 Estimated Cost on the Property Damage in each Zone with in Five Years

No.	Zone	2012/13	2013/14	2014/15	2015/16	2016/17	Total	Percent (%)
1	S/Gondar	4984008	5473485	5038354	4572000	3047700	23115547	3.15
2	N/Gondar	6232686	6348562	5079653	11998098	6577300	36236299	4.94
3	Gondar City	1886183	3707185	2015846	1415700	1394539	10419453	1.42
4	Bahir Dar City	3393300	2293157	3021828	1719376	4398076	14825737	2.02
5	W/Gojjam	8353850	30461110	6331431	5035550	6418655	56600596	7.71
6	Awi	3883658	5256700	5316103	9003700	7699950	31160111	4.25
7	E/Gojjam	335651	3909969	3899782	6410200	5052178	19607780	2.67
8	N/Shiwa	10133533	9036787	11781244	18215015	26150189	75316768	10.26
9	Oromia	5462960	3622302	6287090	6918450	268253991	290544793	39.58
10	S/Wollo	8537574	6258986	3743900	19226770	6352400	44119630	6.01
11	Dessie City	3099150	3527413	2827371	6252854	6683290	22390078	3.05
12	North Wollo	22986208	20550206	29299926	2687140	20731182	96254662	13.11
13	Waghimira	2034496	3334439	1899300	2716000	3431000	13415235	1.83
Total		81323257	103780302	86541828	96170853	366190450	734006692	100.00

Source: Amhara police commission

4.3.2 Bahir Dar City Crashes Statistics

Bahir Dar city is a capital city of Amhara national regional state and one of a city administration or a special zonal part of Amhara national regions state and the most rural area peoples come close to this regional center city. However, a great care should be exercised regarding on traffic rule awareness on each zone and woreda.

For the purpose of evaluating the crashes trends on Bahir Dar city the road traffic crash data has been collected from Bahir Dar city administration police commission as shown on table 28 below. The type of crash severity has been depicted relative with the year in which crashes happening on five year. From the table it is clearly shown that 56.38% of crashes belong to property damage, 11.75% of were Fatal, 9.65% of were serious injuries, and 22.22% of were slight injuries.

Table 28 Crashes Severity in Bahir Dar City for the Five Year

Types of crashes severity	2012/13	2013/14	2014/15	2015/16	2016/17	Total	Percent (%)
Fatal	32	16	36	45	56	185	11.75
Serious Injuries	29	30	34	30	29	152	9.65
Slight Injuries	51	122	62	65	50	350	22.22
Property Damage	169	192	183	153	191	888	56.38
Total	281	360	315	293	326	1575	100.00

Source: Bahir Dar city police commission

Based on table 29 below the driver age on the traffic crashes have been investigated. From the table 29 (18 - 30) years age categories of drivers highly susceptible for crashes (52.17%), 31- 50 years age categories also the second highly vulnerable groups on road traffic crashes (31.48%), age older than 51 years also at risk (11.81%).

According to (Rolison *et al.*, 2018) finding that to identified the factors that were typically associated with actual collisions of young drivers. Drugs or alcohol and excessive speed were frequently generated for the young driver crashes scenarios.

Inexperience and driver distraction were also generated frequently for young driver actual collisions and the most characteristic factors that contribute to road traffic collisions of young drivers. This finding supported by (Al-Khateeb, 2010) stated that both the age group and road user type were considered, it was observed that 71.6 percent of the total number of low-severity driver injuries and 71.1 percent of the total number of high-severity driver injuries were in fact from the age group 18-42 years.

Table 29 Traffic Crashes Occurrence in Driver Age

Age Group	2012/13	2013/14	2014/15	2015/16	2016/17	Total	Percent (%)
Below 18	11	1	14	3	1	30	1.92
18-30	159	192	56	193	217	817	52.17
31-50	49	122	150	81	91	493	31.48
above 51	52	30	90	8	5	185	11.81
Others	10	6	5	8	12	41	2.62

Source: Bahir Dar city police commission

Note that: Others is missing data

Based on the table 30 below Bahir Dar city road traffic crashes for two year analysis period of 2015/16 – 2016/17 G.C indicated that 42.81% of crashes were committed by a driver experienced within 2-5 year, 24.88% of the crashes were involved by driver these experienced within 1 -2 years, 14.05% of crashes were 5-10 year experience holder drivers, and drivers holding above 10 years' experience the crashes decreases.

Table 30 License Experience in Bahir Dar City in Two Years

License Experience	2015/16	2016/17	Total	Percent (%)
No license	5	4	9	1.45
Below 1 year	32	12	44	7.11
1-2 year	98	56	154	24.88

2-5 year	109	156	265	42.81
5-10 year	33	54	87	14.05
Above 10 year	7	22	29	4.68
Others	9	22	31	5.01

Source: Bahir Dar city police commission

Based on table 31 below the data from Bahir Dar city traffic police records the major causes of road traffic crashes were identified as not giving priorities for pedestrians (21.93%), not keeping the gap distance (19.55%), over speeding (19.41%), not giving priorities for vehicles (14.85%), overtaking and suddenly turning (6.54%), unacceptable overtaking (5.93%), illegal or wrong turning (3.13%), and not keeping the right lane (2.25%).

This finding supported by H, Fesseha ; Sileshi, (2008) conducted that the five major crashes factors, in order were: failure to give priority to pedestrians, speeding, driving on the wrong side of the road, failure to maintain distance between vehicles and failure to give priority for other vehicles.

Together these five causes accounted for 82.28% of all road traffic crashes. Chala, Quezon and Kumela, (2017) showed that the major causes of crashes were speeding composed of 36.75%, driving without attention of 16.51% and failure to give way to pedestrians of 12.29%.

Table 31 Cause of Traffic Crashes in Bahir Dar City

No.	Cause of Traffic Crashes	2012	2013	2014	2015	2016	Total	Percent (%)
		/	/	/	/	/		
		13	14	15	16	17		
1	Drink driving	1	3	1	2	0	7	0.48
2	Chat chewing	1	0	0	0	0	1	0.07
3	Not keeping the right lane	5	14	3	6	5	33	2.25
4	Not giving priority for vehicle	27	48	42	39	62	218	14.85
5	Not giving priority for pedestrian	62	94	50	60	56	322	21.93
6	Not keeping the gap distance	44	49	45	70	79	287	19.55

7	overtaking in sharp curves	14	3	1	4	1	23	1.57
8	Stopping in curves	2	1	1	2	0	6	0.41
9	Sudden overtaking and turning	1	24	39	32	0	96	6.54
10	Over speeding	47	44	90	32	72	285	19.41
11	Unacceptable over taking	13	28	10	16	20	87	5.93
12	Wrong turning	14	19	7	3	3	46	3.13
13	Violate traffic police command	0	0	0	2	0	2	0.14
14	Violation signal light	0	0	0	0	0	0	0.00
15	Violation stop sign	0	0	0	1	0	1	0.07
16	Violate priority sign	7	4	6	0	0	17	1.16
17	Incidental starting of drivers	8	3	1	1	0	13	0.89
18	Illegal parking	5	4	2	0	1	12	0.82
19	Over loading	5	0	3	0	1	9	0.61
20	Illegal lighting	2	0	0	0	0	2	0.14
21	Loading and unloading	0	0	0	0	1	1	0.07
Total		258	338	301	270	301	1468	100.00

Source: Bahir Dar city police commission

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

According to findings revealed about evaluation of the effect of road traffic offenses in Bahir Dar city, the following conclusions are drawn.

- By increase over speeding, drink driving, illegal parking enforcement, and other police enforcement to minimize the number of traffic offense and crashes in the study area.
- Illegal parking, loading passengers above the capacity of the vehicle, driving other road segment without schedule and permission and violation of traffic signs are the most common traffic offences and not giving priorities for pedestrians, not keeping the gap distance, over speeding, not giving priorities for vehicles, overtaking and suddenly turning, unacceptable overtaking, wrong turning and not keeping the right lane are the most factor of traffic crashes.
- Age (24-29 years), gender (male), education level (high school), driving experience (2-5 years), license level (Truck one, Public one, Taxi one-Public one, Level three), month (August and December) and travelled distance more than (250 km per week) were potential predictors of traffic offences. Male drivers are overrepresented in the overall traffic offences in the city with 99.87% in (secondary data) and 93.2% in (primary data) of study. And traffic offence is significantly associated with driver age, gender, education level, driver experience, license level, and day of the week.
- Using cameras or radar and speed reduction signs which reduce speeding and red light running violation and also parking enforcement must apply in the city.

5.2 Recommendations

Based on the findings of the study the following are the main recommendations, which will benefit the improvements of the road policing and traffic Safety;

- Traffic management agencies in the city should enhance the enforcement of traffic rules and regulations and ensure that the road is fixed with speed limiting devices, Blood alcohol test at every check points, Breath analyzers at different road sections of the city. The road traffic management agencies should increase the enforcement levels for the risk factors of traffic crashes like driving over speed limit, illegal parking, drink driving, driving without seatbelt and helmet, red light running and driving while using mobile phone.
- More attention should be done on road safety through educational campaigns to make road users know and understand the road traffic laws and regulations and develop road traffic infrastructures like traffic signals, parking areas and increasing public transportations.
- Drivers should be responsible for the life of passengers and pedestrians, obeying traffic rule, and reduce their speeding.
- To educating all stakeholders especially drivers, pedestrians or the people as a whole about road safety using Medias (TVs, Radios, Newspapers, Magazines etc.) or in formal organizations in schools and other governmental and non-governmental organizations, in religious institutions.
- To increased police enforcement using random breath testing, speeding, and red light camera and parking enforcement to reduce the traffic offenses and crashes.

In general road traffic offences are predictable and therefore preventable, it is hoped that this study will encourage and facilitate increased cooperation, commitment and innovation towards preventing traffic offences in the city through close coordination and collaboration using holistic and an integrated approach, across many sectors and many disciplines.

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Appendixes

Questionnaire

HELLO, my name is Getinet Abraham. I am from Addis Ababa University and I am gathering information about traffic offense and safety in Bahir Dar City. You have been chosen randomly, and I would like to ask some questions about driving practices, offences, crashes and other traffic safety related questions.

Consent

I will not ask your name, address, or other personal information that can identify you. You do not have to answer any question you do not want to, and you can stop the interview at any time. For most people the interview takes about 15 minutes, but it can vary from person to person. There are no direct benefits to you and any risks of participating are similar to those typically encountered in your day to day life. Your individual answers are grouped with those of others to maintain your confidentiality. If you have any questions about the study, you can ask me now and if required I will provide a telephone number for you to call to get more information.

1. What is your age?.....years
2. Are you Male..... Female.....
3. What is your Job?.....
4. Are you married? Yes..... No
5. What is your Education level?.....
6. What is your Driving Experience?.....years
7. What is your Driving License Level?.....
8. Have you had first aid training? Yes..... No.....
9. What type of life insurance do you have?

A/Own damage (vehicle) insurance B/ Third party (passenger, pedestrian, property) insurance
C/Work man (driver and assistance driver) insurance D/ Not Insurance

10. Do you use a seat belt when driving the vehicle?

A/ Yes

B/No

11. If yes, to “10”, how often do you use seat belt?
A/Always B/ Sometimes C/Never
12. If “No” to Number 10 above, why do not you use a seat belt?
A/ It annoys me B/ it is not functional C/ it doesn’t benefit me
13. Do you drink alcohol?
A/ Yes B/ No
14. If “Yes” to Number 13 above how often?
A/ Always B/ Sometimes C/ Never
15. Do you drive after drinking alcohol?
A/ Yes B/No
16. How serious a threat is to traffic safety you think excessive speeding is?
A/ Very serious B/Slightly serious C/ Not at all serious
17. Do you agree or disagree that there is not much chance of crash if I am careful when speeding.
A/Strongly Agree B/ Agree C/Disagree D/Strongly disagree
18. Do you chew chat while driving?
A/ Yes B/ No
19. If “Yes” to Number 18 above, what benefits do you get from chewing chat while driving?
A/It energizes me B/ it gives me pleasure C/It makes me free D/It is not benefit
20. If your cell phone rang while you are driving, what would you do to answer the calls?
A/reduce speed and answer B/ answer without changing speed C/stop and answer
D/reject the call/turn the phone off/ignore the call
21. In the past 12 months have you committed traffic offences and been fined?
A/Yes B/No
22. If “Yes” to Number 21 above what type and how many times you made offences?
Speeding.....How many.....
Red Light Running.....How many.....
Drink DrivingHow many.....
Illegal Parking..... How many.....
OverloadingHow many.....

- Not giving priority to vehicle.....How many.....
- Not giving priority to pedestrian.....How many.....
- Not Obeying Traffic signs..... How many.....
- Not wearing Seat beltHow many.....
- Not wearing HelmetHow many.....
- Use cell phoneHow many.....
23. Have you ever had a crash while breaking a traffic law?
A/Yes B/No C/I do not know D/refused
24. If ‘yes’ to number 23 above what type of traffic crashes?
A/Fatal B/Serious C/Slight D/property damages only E/
others
25. On which of these road environments are you most likely to commit traffic Offences?
A/ Straight road B/Intersections C/ Curves D/residential areas E/Others specify
26. What time of day are you most likely to commit traffic Offences?
A/ Morning B/Lunch time C/Afternoon D/Night time
27. On what days of the week do you most often violate traffic laws?
A/Monday B/Tuesday C/Wednesday D/Thursday E/Friday F/Saturday G/Sunday
28. What is the service Year of your vehicle?.....years
29. What is the Type of Vehicle you drive?.....
30. What is the Code of your vehicle?.....
31. Who is the Owner of the vehicle you drive?.....
32. Does the vehicle have a mechanical problem?
A/Yes B/ No
33. If “Yes” to No “32” above what type of problem?
A/ Brake B/light C/Tire D/Other
34. How serious a threat to traffic safety do you think it is, if drivers and passengers do not wear seat belts?
A/Very serious threat B/ Slightly serious C/ Not at all serious
35. What do you think about the cost of fines for traffic violations?
A/ Expensive B/No Expensive C/ don’t know/Not sure

36. During the last year, in a typical 7-day week, about how many Km did you drive?
A/Less than 50 Km B/50-99 Km C/100-149 km D/150-199 km E/ 200-249 km
F/250km or more G/ don't know/Not sure H/Refused
37. Overall, do you think driving in Bahir Dar City feels safer, less safe, or about the same as it did three years ago?
A/Safer B/Less safe C/about the same D/don't know/Not sure E/ Refused
38. Have you made a specific effort to improve or maintain your driving skills in the last three years, such as reading about safe driving, looking at the official Bahir Dar City driver's manual, or taking a refresher class?
A/Yes B/No C/haven't driven in the last 5 years D/don't know/Not sure E/ Refused
39. The Bahir Dar City road bureau provides information on road conditions and road regulations.
A/Yes B/No C/don't know/Not sure
40. Did you listen any media programs on road safety and road traffic regulations to make your trip faster or to make your trip safer?
A/ Yes B/ No C/ don't know/Not sure
41. Thinking of response times and quality of care, how satisfied are you with the emergency medical services in your area? Would you say....?
A/Very satisfied, B/ somewhat satisfied, C/ Not very satisfied D/don't know/Not sure
42. Do you support or oppose Bahir Dar City to Increase the dollar amount of fines for speeding
A/Support B/Oppose C/ don't know/Not sure D/ Refused
43. Is it legal or illegal to read, write, or send a text message while driving in Bahir Dar City?
A/Legal B/Illegal C/don't know/Not sure D/ Refused
44. Does the uses of Radar and red light cameras increasing in Bahir Dar City?
A/Yes B/ No C/ don't know/Not sure
45. Would drivers be more careful if they knew that speed and red light cameras were in place?
A/Yes B/No C/ don't know/Not sure
46. What do you think the speed limit is on Urban roads, day times?

A/Less than 30 KPH B/30-40 C/Greater than 40 KPH D/ don't know E/ refused

47. What do you think the speed limit is on Urban roads, night times?

A/Less than 30KPH B/30-40 C/Greater than 40KPH D/ don't know E/ refused

48. Please tell me whether you find it very distracting, somewhat distracting, or not at all distracting to from the listed activities while driving,

- a. To have the radio on or music playing.
- b. To have passengers in your car having conversations or interacting.
- c. To drive through an area with a lot of commercial signage such as billboards.
- d. To use a GPS device while driving.
- e. To make or receive cell phone calls.

A/Very distracting, B/ Somewhat distracting, C/ Not at all distracting

D/I have never been in that situation E/don't know/Not sure F/ Refused //

49. What is your monthly household income from all sources? Is it.....?

A/Less than 500ETB B/500-1000ETB C/1001-1500ETB D/1501-2000ETB
E/Greater than 2000ETB F/don't know/Not sure G/ Refused

50. Do you think novice drivers are most common violators of traffic laws in Bahir Dar City?

A/Yes B/No C/I do not know D/refused

51. If yes to number "50" above what is your reason?

A/less training B/new to driving C/give no attention or less attention to the laws
D/ do not understand the risk E/Unable to control/guide the vehicle F/others

52. When you ride a motorcycle, do you usually wear a helmet?

A/Yes B/No C/ don't know/Not sure E/ Refused

53. If yes to number "52" above, do you think helmet protects you?

A/ Yes B/ No C/ Sometimes D/ I do not know E/refused

54. If no to number "52" above why don't you wear helmet

A/it reduces my hearing B/ has no comfort C/has no use D/others E/refused

55. By increase road policing to minimize the road traffic crashes and offences?

A) Yes B) No C) no relationship