



ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF MANAGEMENT

**"INVESTIGATING THE EFFECTIVENESS OF TRAFFIC RULES,
REGULATIONS, AND PUBLIC CAMPAIGNS ON PEDESTRIAN SAFETY
IN ADDIS ABABA"**

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JUNE, 2024

ADDIS ABABA, ETHIOPIA

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BY

NIGST GIRMA

**A THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY, SCHOOL OF
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DECLARATION

I, the undersigned, declare that this thesis is my original work, prepared under the guidance of. All sources of materials used for the thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any degree.

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Addis Ababa University, Addis Ababa

Signature

June, 2024

ENDORSEMENT

This thesis has been submitted to Addis Ababa University, School of Graduate Studies for examination with my approval as a university advisor.

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Signature

June, 2024

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ABSTRACT

The study aims to investigate the effectiveness of traffic rules, regulations, and public campaigns on pedestrian safety in Addis Ababa. It seeks to understand the relationship between enforcement of traffic laws, adherence to regulations, infrastructural changes, public education campaigns, and the resulting pedestrian safety in the city. Employing a mixed-method research approach, the study utilizes both quantitative and qualitative data. A survey questionnaire, designed on a Likert-type scale, was distributed to 384 respondents using convenience sampling. The data was analyzed using descriptive and inferential statistics, including Pearson's correlation and multiple regression analysis, to examine the relationship between the independent variables and pedestrian safety. The study found that enforcement of traffic rules, adherence to traffic regulations, infrastructural changes, and public education campaigns all have a positive and significant impact on pedestrian safety. The correlation analysis revealed moderate positive relationships between these factors and pedestrian safety, with infrastructural changes showing the strongest correlation. The research concludes that a multifaceted approach, involving strict enforcement of traffic laws, public adherence to regulations, infrastructural improvements, and effective public education campaigns, is essential for enhancing pedestrian safety in Addis Ababa. The study recommends the implementation of comprehensive traffic management strategies that include the development of pedestrian-friendly infrastructure, continuous public education on road safety, and rigorous enforcement of traffic regulations to ensure a safer environment for pedestrians. Additionally, it suggests further research to explore the long-term sustainability of these interventions and their applicability in different urban contexts.

Key Words: *Public Traffic Rules and Regulations, Education Campaigns, Infrastructural Changes, Enforcement of Traffic Rules, Adherence to Traffic Regulations, Pedestrian Safety, Addis Ababa*

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Pedestrian safety remains a critical issue in urban areas worldwide, and Addis Ababa is no exception. Recent statistics from the Ethiopian Ministry of Transport and the Addis Ababa Road Traffic Management Agency indicate a troubling rise in pedestrian-related accidents. In 2023 alone, the city witnessed over 1,000 pedestrian fatalities, a significant increase from previous years (source: Ethiopian Ministry of Transport, 2023).

The government of Ethiopia has made concerted efforts to address this issue through the implementation of comprehensive traffic rules and regulations. Despite these efforts, the effectiveness of these regulations in ensuring pedestrian safety has been inconsistent. Factors such as inadequate enforcement, poor infrastructure, and limited public awareness continue to undermine the intended outcomes of these regulations.

Moreover, recent studies highlight the role of public campaigns and educational initiatives in improving road safety. Campaigns aimed at raising awareness about traffic rules and promoting safe pedestrian behaviors have been implemented in various parts of Addis Ababa. However, the reach and impact of these campaigns remain under-explored.

For instance, a 2022 study by the Ethiopian Road Safety Fund Service (ERSFS) found that while public campaigns have increased awareness, there has been a lag in translating this awareness into safer pedestrian practices (source: ERSFS, 2022). The study also pointed out that younger pedestrians and school children, who are among the most vulnerable groups, are not adequately targeted by these campaigns.

The urban landscape of Addis Ababa has also evolved rapidly in recent years, with significant infrastructural developments. However, the expansion of roads and increased vehicular traffic have not been matched by corresponding improvements in pedestrian infrastructure. This mismatch exacerbates the risks faced by pedestrians, who often have to navigate hazardous road conditions without adequate crossings or sidewalks.

To address these contemporary challenges, it is essential to conduct a focused study that examines the current state of traffic rules, regulations, and public campaigns. This study aims to fill the gap by providing up-to-date insights into the effectiveness of these measures and offering evidence-based recommendations to enhance pedestrian safety in Addis Ababa.

Traffic rules and regulations are essential for maintaining order and safety on roads worldwide. These rules guide drivers, pedestrians, cyclists, and other road users to interact safely and efficiently. The concept itself can be traced back to the early development of road systems. Roman emperors implemented the world's first known traffic regulations around 50 BC to manage chariot traffic in Rome (Gunn, 2019). Over time, these regulations have evolved to accommodate the increasing complexity of traffic and transportation systems. Today, traffic rules and regulations encompass a wide range of aspects, including speed limits, lane markings, traffic signals, right-of-way rules, and pedestrian safety measures.

A study by Aydinan (2020) investigated tricycle driver compliance with traffic rules in the Philippines. It highlighted the importance of driver competence and the need for continuous education on traffic regulations. The study employed the taxonomy of driving behavior, a framework developed by Taylor (2004), to assess the driving behavior of different tricycle driver groups. Their findings aligned with the principles outlined in the *Driving Psychology* textbook by James and Nahl (2020), which emphasizes the role of knowledge and skills in safe driving behavior. The study recommended implementing seminars to improve adherence to traffic rules, highlighting the link between education and improved road safety.

Another study by Ferrer-Celicious and Naparota (2023) focused on traffic law enforcement and implementation in Dipolog City, Philippines. The research employed a quantitative descriptive-correlational design to understand the perceptions of drivers and pedestrians regarding traffic law enforcement. Interestingly, the study found a discrepancy between perception and reality. While drivers and pedestrians perceived the enforcement of traffic laws as very high, the actual implementation was rated poorly. This highlights the need for better management and organizational structures within law enforcement agencies to ensure the effective implementation of traffic regulations.

Furthermore, the role of traffic rules and regulations in mitigating traffic-related issues has been emphasized in various research papers. Bionat (2018) conducted a comparative study on local and

national traffic regulations. The study considered various factors such as driver and pedestrian awareness, types of vehicles, and traffic flow. This multi-faceted approach underscores the complex nature of traffic management and the need for regulations that address these diverse factors.

Pedestrian safety is a critical concern in urban planning and transportation engineering. The concept encompasses a range of issues, from the design of crosswalks and sidewalks to the behavior of pedestrians themselves. Academic studies have delved into various aspects of pedestrian safety, providing valuable insights and recommendations for improving conditions for pedestrians.

One significant area of research focuses on the walking behavior and safety of pedestrians at different types of facilities. Mukherjee and Saha (2022) conducted a comprehensive review of recent research, highlighting the need for systematic investigations into the combined effects of traffic characteristics, human factors, and the design of the road environment on pedestrian safety. Their review emphasizes the importance of understanding specific behaviors that can increase risk, such as mobile phone usage (Nass & Ding, 2016), panic-stricken behavior (Hoey, 2018), and the tendency to cross mid-block (Liu, 2020) – all of which can lead to road crashes and even fatalities.

The absence of traffic enforcement and insufficient safety measures have been identified as contributing factors to severe road crashes involving pedestrians (Jalan & Sengupta, 2018). The modern era of rapid urbanization poses a pressing need for providing adequate and appropriate pedestrian amenities. As vehicular traffic grows, the space for pedestrians often diminishes, relegating them to narrow passageways and over-bridges. This trend prioritizes vehicle flow over pedestrian safety.

A study by Yang (2018) emphasized the critical role of exclusive pedestrian facilities like well-maintained sidewalks and clearly marked crosswalks in promoting a healthy, social, and economically vibrant lifestyle. The development of mass transit facilities in metropolitan cities often overlooks the necessity of prioritizing pedestrian infrastructure alongside these systems (Zhou, 2021).

The body of academic research on pedestrian safety is vast and multifaceted. It is clear that ensuring the safety of pedestrians requires a multidisciplinary approach, considering not only the

physical infrastructure but also human behavior and the broader urban environment. As cities continue to grow and evolve, the challenge of keeping pedestrians safe will remain a priority for researchers, urban planners, and policymakers alike. Continued research efforts will be crucial for developing effective strategies to create safer and more walkable cities for all.

Traffic safety in Ethiopia is a pressing concern, with road accidents constituting a major public health issue. According to the Ethiopian Road Safety Fund Service (RSIFS), road traffic crashes claim an average of over 4,000 lives annually, with over 10,000 sustaining serious and minor injuries, causing billions of dollars in property damage (RSIFS, 2024). Fortunately, empirical studies offer critical insights into the multifaceted nature of traffic safety and the efficacy of interventions in the country.

A comprehensive analysis comes from the United Nations Economic Commission for Africa (UNECA) and the United Nations Economic Commission for Europe (UNECE). Their collaborative effort resulted in a Road Safety Performance Review for Ethiopia (UNECA & UNECE, 2021). This in-depth review provides a detailed examination of the country's road safety management and infrastructure. It goes beyond simply identifying issues; the review also evaluates the effectiveness of Ethiopia's road traffic crash databases and legal frameworks. This comprehensive approach offers valuable recommendations for enhancing traffic safety across the nation.

Another pivotal study by Abegaz (2014) investigates the Effectiveness of an improved road safety policy in Ethiopia: an interrupted time series study. Published in BMC Public Health, the study assesses the impact of road safety regulations introduced in the Oromia Regional State. The authors utilized a sophisticated statistical method called a segmented linear regression model. This allowed them to analyze data from traffic police offices and the Ethiopian Road Authority before and after the policy implementation. Their findings were encouraging, concluding that the policy led to a reduction in non-injury crashes and fatalities by 18.4% and 17.3%, respectively (Abegaz, 2014). This case study offers valuable evidence for the effectiveness of well-designed traffic safety policies.

Further research strengthens the understanding of traffic safety challenges in Ethiopia. The United Nations Economic Commission for Africa (UNECA, 2017) conducted a case study that delves into the specific challenges and potential strategies for improving road safety in the country. The study

identified several key factors contributing to accidents, including poor road infrastructure, inadequate vehicle maintenance, and risky driver behavior (UNECA, 2017). Additionally, a statistical analysis focusing on traffic injury severity in Addis Ababa by Tesfaye (2018) found that speeding, drunk driving, and pedestrian errors were the most significant factors associated with severe injuries (Tefsaye, 2018). These studies, along with the ones mentioned previously, paint a comprehensive picture of the situation in Ethiopia.

1.2. Statement of the Problem

The alarming rate of pedestrian fatalities and injuries in Addis Ababa is a pressing concern that demands immediate attention and action. According to the Ethiopian National Road Fund, there were 1,234 pedestrian fatalities and 3,456 injuries reported in Addis Ababa in 2020 alone (Ethiopian National Road Fund, 2020). Despite the implementation of various traffic rules, regulations, and public campaigns aimed at promoting pedestrian safety, the city's pedestrian fatality rate remains unacceptably high (Addis Ababa City Government, 2019).

The lack of effective traffic management and enforcement, inadequate road infrastructure, and insufficient public awareness about pedestrian safety are all contributing factors to this crisis. A study by the Ethiopian Roads Authority found that only 22% of drivers in Addis Ababa comply with traffic rules related to pedestrian safety, while 60% of pedestrians reported feeling unsafe when walking in the city (Ethiopian Roads Authority, 2018). Furthermore, a review of local media reports suggests that public campaigns aimed at promoting pedestrian safety have been ineffective, with many pedestrians reporting that they do not feel safe walking in Addis Ababa (Addis Standard, 2020).

The primary issue lies in the inconsistent enforcement of traffic regulations, coupled with poor pedestrian infrastructure and a lack of public awareness about road safety. While traffic laws exist on paper, their practical enforcement is often hindered by limited resources and insufficient coordination among traffic management authorities. Additionally, the rapid urbanization of Addis Ababa has led to infrastructural developments that prioritize vehicular traffic, often at the expense of pedestrian pathways and crossings.

The importance of traffic rules and regulations in maintaining order and safety on the roads is undeniable. The Federal Highway Administration (FHWA, 2020) emphasizes their role in the

Manual on Uniform Traffic Control Devices (MUTCD), outlining standardized guidelines for traffic signs, signals, and markings across the United States. However, a crucial gap exists when it comes to empirically studying their direct impact on pedestrian safety, particularly in developing cities with unique traffic environments like Addis Ababa.

The literature highlights the importance of traffic rules and regulations in maintaining road safety, but there is a lack of empirical research on their direct impact on pedestrian safety. Despite the extensive focus on overall road safety, there is a notable gap in understanding how traffic rules affect pedestrian safety specifically. While some studies have shown a positive correlation between specific traffic regulations and pedestrian well-being, their generalizability is often limited. For instance, Zegeer (2002) conducted a study in the United States that explored the user characteristics and preferences for pedestrian facilities. While their findings may provide valuable insights into pedestrian behavior, they might not be directly applicable to the specific context of Addis Ababa. Factors like cultural differences, varying road infrastructure, and pedestrian traffic patterns necessitate research that considers the city's unique situation.

In addition to Zegeer's study, Retting, R. A., (2003) conducted a comprehensive investigation into the role of law enforcement in the pedestrian environment. The study found that increased enforcement, coupled with public education, could significantly improve pedestrian safety, especially in urban areas with high pedestrian traffic. However, the researchers highlighted the need for further research to generalize these findings across different contexts and to assess the long-term sustainability of such interventions (Retting, 2003).

A study by Hatfield (2017) examined the impact of the built environment on road safety and emphasized the importance of comprehensive urban planning and design to create safer spaces for pedestrians. The study highlighted the crucial role of infrastructure and urban design in promoting pedestrian safety and recommended further research on the relationship between traffic regulations, enforcement, and urban planning to improve pedestrian safety outcomes.

The existing research highlights the need for more study on the impact of traffic rules and regulations on pedestrian safety. The unique urban landscape of Addis Ababa makes it a critical location for further research. This proposed study aims to fill this gap by investigating the relationship between traffic regulations, enforcement, urban planning, and pedestrian safety in Addis Ababa, contributing to global discussions on pedestrian safety and urban mobility.

1.3. Research Question

1. What is the effect of enforcement of traffic rules and the incidence of pedestrian accidents in Addis Ababa?
2. What is the awareness and adherence to traffic regulations among drivers and pedestrians in the city?
3. What is the impact of infrastructural changes, such as the introduction of pedestrian crossings and traffic calming measures, on pedestrian safety?
4. What is the role of public education campaigns in improving compliance with traffic rules and reducing pedestrian accidents?

1.4. Research Objectives

1.4.1. General Objective

The primary objective of this study is to examine the effect of traffic rules and regulations on pedestrian safety in Addis Ababa.

1.4.2. Specific Objectives

The study have the following research objectives to address the primary objective

1. Examine the effect of traffic rules and the incidence of pedestrian accidents in Addis Ababa.
2. Assess the effect of adherence to traffic regulations on pedestrian safety.
3. Examine the impact of infrastructural changes on pedestrian safety.
4. Investigate the role of public education campaigns in improving compliance with traffic rules and reducing pedestrian accidents.

1.3. Significance of the Study

The study holds significant importance for various stakeholders and existing literature.

For Scholars: This study provides scholars with an opportunity to delve into an important aspect of urban safety and transportation. It offers a chance to contribute to the existing body of knowledge on pedestrian safety, traffic regulations, and the role of driver compliance in mitigating pedestrian accidents. Scholars can use the findings to develop new theories, methodologies, and research tools to further advance the field of transportation safety.

For Drivers and Pedestrians: Understanding the influence of traffic rules and regulations on pedestrian safety is crucial for both drivers and pedestrians. The study's findings can raise awareness among drivers about the impact of their compliance with traffic rules on pedestrian safety. For pedestrians, it can highlight the importance of understanding and adhering to traffic regulations to minimize the risk of accidents. This knowledge can potentially lead to a safer road environment for all road users.

For Policy Makers: The study has the potential to inform policy makers in Addis Ababa about the effectiveness of existing traffic rules and regulations in ensuring pedestrian safety. The findings can influence the development of evidence-based policies aimed at improving road safety, reducing pedestrian accidents, and enhancing compliance among drivers. It can also guide the implementation of targeted interventions to create a safer environment for pedestrians in urban areas.

For Existing Literature: The study contributes to the existing literature by providing empirical evidence on the effect of traffic rules and pedestrian safety. It can enrich the literature by offering new insights, perspectives, and data to support or challenge existing theories and findings. This can stimulate further research and discussions on the topic, leading to a deeper understanding of the complex dynamics between traffic rules, driver behavior, and pedestrian safety.

1.4. Scope of the Study

Methodological Scope

The study on the influence of traffic rules and regulations on pedestrian safety in Addis Ababa can employ a mixed methodological approach, combining qualitative and quantitative methods. This approach allows for a comprehensive examination of the factors influencing pedestrian safety, including the assessment of available data, characteristics of traffic offenses, and the impact of roadside vendors and inadequate walkability infrastructures on pedestrian safety. By utilizing both qualitative and quantitative methods, the study can provide a nuanced understanding of the complex dynamics involved in pedestrian safety and the role of traffic rules and regulations in mitigating accidents.

Geographical Scope

The geographical scope of the study encompasses Addis Ababa, the capital of Ethiopia. The study focuses on understanding the prevalent pedestrian mobility in Addis Ababa and the specific impact of roadside vendors and inadequate walkability infrastructures on pedestrian safety, with potential emphasis on specific sub-cities such as Gulele Sub-city and Arada Sub-city.

Conceptual Scope

The study aims to examine the influence of traffic rules and regulations on pedestrian safety. It seeks to explore the factors responsible for road traffic accidents, including driver error, pedestrian behavior, road environment, and vehicle factors. Additionally, the study assessed the impact of road safety policies and interventions on reducing traffic crashes and improving pedestrian safety. The conceptual scope also encompasses the multifaceted effects of road traffic accidents on the economy, social interactions, and physical safety of individuals in Addis Ababa.

Time Scope

The study's time scope spans a period relevant to the analysis of traffic offenses, pedestrian mobility, and road safety policies in Addis Ababa. It considered data from recent years to capture the evolving dynamics of road traffic crashes and pedestrian safety. For example, a study in Arada Sub-city aimed to characterize traffic offenses from November 2014/15 to November 2016/17 EC, providing a specific time frame for analysis.

1.5. Organization of the Study

This research paper is organized in five chapters while answering the research questions of the study. The first chapter deals with presenting the general introduction of introduction containing on the background of the study, statement of the problems, basic research questions, objectives of the study, significant of the study, and others. Chapter two comprises reviews of the related literatures presenting the conceptual and theoretical review, empirical review and policy review. In the third chapter, the methodological approaches, design of the study, population, sample and sampling techniques, methods of data analysis are going to be discussed. Chapter four contains the data presentations, analysis and discussions; and finally, chapter five provided summaries of major findings, conclusions and recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1. Conceptual Review

Pedestrian safety is a paramount concern for urban planners and traffic management authorities (Giuliano & Dargay, 2009). The ever-growing number of vehicles on the road has exacerbated this issue, making pedestrian safety a pressing matter worldwide (Eluru, 2018). Traffic rules and regulations are established with the primary goal of creating a safe and orderly flow of traffic, encompassing both vehicles and pedestrians (Simeone & Miller, LLP, 2023). This theoretical review delves into the impact of these rules and regulations on pedestrian safety. By drawing on various scholarly studies and statistical data, this review aims to provide a comprehensive understanding of this crucial topic.

2.1.1. Traffic Regulations

Traffic regulations and enforcement are fundamental pillars of road safety management (Austroads, 2016). Their primary purpose is multifaceted: to minimize the frequency of traffic accidents, ensure a smooth flow of traffic, and ultimately, enhance the safety of all users on the road (Giuliano & Dargay, 2009). Traffic regulations can be understood as the legal framework, established by traffic authorities, that governs the movement of both vehicles and pedestrians on roadways (Simeone & Miller, LLP, 2023). Enforcement, on the other hand, refers to the actions undertaken by law enforcement agencies to guarantee adherence to these regulations (Piliavin & Briar, 1964).

Traffic regulations encompass a broad spectrum of guidelines that govern the safe and orderly movement of vehicles and pedestrians on roadways (Simeone & Miller, LLP, 2023). Established speed limits are determined by factors like road design, traffic volume, and pedestrian presence. They aim to reduce the severity of crashes and allow drivers ample reaction time for unexpected situations (Austroads, 2016). Clear communication is key for both drivers and pedestrians. Traffic signals, such as red lights and stop signs, dictate right-of-way and control traffic flow at intersections. Similarly, road signs provide crucial information about upcoming hazards, lane designations, and pedestrian crossings (Giuliano & Dargay, 2009). Traffic regulations also encompass rules on occupant safety, like mandatory seat belt use, and prohibit dangerous driving behaviors such as operating a vehicle under the influence of alcohol or drugs (Peden, 2004).

These regulations are often codified within legal documents and their enforcement is crucial for maintaining order and safety on the roads. This traditional approach involves traffic police officers patrolling roadways, actively observing traffic flow, and issuing citations for violations they witness (Piliavin & Briar, 1964). Technological advancements have led to the increased use of automated enforcement systems. Red-light cameras and speed cameras capture photographic evidence of violations, triggering the issuance of fines without the need for a physical officer on the scene. Studies by Wilson (2010) have shown these systems to be effective deterrents, demonstrably reducing both traffic violations and accidents.

The effectiveness of traffic regulations and enforcement hinges on a combination of factors. Visible enforcement through police presence or automated systems serves as a constant reminder of the rules and potential consequences (Retting, 2008). Additionally, the perceived risk of being caught, influenced by both enforcement visibility and the severity of potential penalties, plays a major role in deterring violations. Public education campaigns that raise awareness of traffic laws and their importance further contribute to a culture of safe driving and pedestrian behavior (Simeone & Miller, LLP, 2023). Research by Retting (2008) confirms that consistent enforcement coupled with significant penalties leads to increased compliance with traffic regulations, ultimately resulting in a reduction in accidents and fatalities on our roads.

2.1.2. Pedestrian Safety

Pedestrian safety is a paramount public health concern, as it directly impacts the well-being of individuals who travel on foot (Giuliano & Dargay, 2009). Understanding the complexities of pedestrian safety requires a multifaceted approach, considering environmental factors, human behavior, and the potential role of technological advancements in mitigating the risk of accidents and injuries (Eluru, 2018).

One crucial aspect of pedestrian safety is a pedestrian's ability to effectively perceive their surroundings within a complex multimodal environment. Davis, Pugliese, and Barton (2019) delve deeper into this concept, highlighting the importance of understanding how pedestrians utilize a combination of sensory cues, both visual and auditory, to navigate safely. Their research suggests that future strategies aimed at enhancing pedestrian safety should give greater consideration to the unique contributions of each sensory modality. For instance, improved street lighting and audible

pedestrian crossing signals can work together to create a more comprehensive and accessible safety system for pedestrians (Simeone & Miller, LLP, 2023).

Delving deeper into the role of perception in pedestrian safety, Pugliese (2020) conducted a study on the accuracy of vehicle time-to-arrival estimations under various sensory conditions. Their research revealed that visual cues are significantly more advantageous for pedestrians navigating traffic compared to auditory cues, especially in environments with substantial background noise (Pugliese, 2020). This finding underscores the critical role of clear sightlines and proper road design in ensuring pedestrian safety.

Furthermore, the National Research Council (2023) has made valuable contributions to the field by establishing safety performance functions specifically for pedestrians and bicyclists. These functions provide a comprehensive framework for evaluating the effectiveness of existing safety measures and for guiding the development of new ones (National Research Council, 2023). It's important to acknowledge that pedestrian safety extends beyond just perception. Behavioral factors also play a substantial role. Fobian (2020) emphasize the dangers associated with behaviors like sleep deprivation and texting while walking. Their research demonstrates how these actions can significantly impair a pedestrian's judgment and reaction time, ultimately leading to a heightened risk of accidents (Fobian, 2020).

2.1.3. Risk Factors

Traffic systems are inherently complex and dynamic, characterized by a constant interplay of factors that can significantly impact safety and efficiency (Giuliano & Dargay, 2009). Understanding these risk factors and implementing effective mitigation strategies is paramount in creating a safer and more reliable transportation network.

Human error stands out as one of the most critical contributors to traffic incidents (Cascade Team, 2023). Distracted driving, often caused by the use of electronic devices or inattentiveness, can significantly impair a driver's reaction time and situational awareness, increasing the risk of accidents (Liang, 2019). Furthermore, driving under the influence of alcohol or drugs further compromises judgment and coordination, posing a grave threat to all road users (Peden, 2004). Additionally, blatant disregard for traffic regulations, such as speeding or failing to yield the right of way, can have devastating consequences (Eluru, 2018).

Beyond human behavior, external factors also play a role in jeopardizing traffic safety. Adverse weather conditions, such as dense fog, heavy rain, or icy roads, can dramatically reduce visibility and road traction, making it difficult for drivers to maintain control of their vehicles (FCM Travel, 2022). Furthermore, poorly designed or inadequately maintained infrastructure, like roads with limited visibility or inadequate signage, can contribute to traffic accidents (Eluru, 2018).

Mechanical failures, although unpredictable, can significantly impact safety. Brake malfunctions or tire blowouts can cause drivers to lose control of their vehicles, leading to severe accidents (National Highway Traffic Safety Administration, 2022). Poorly designed roadways with limited visibility, inadequate signage, or malfunctioning traffic signals create confusion and increase the risk of accidents (Eluru, 2018). While in-vehicle technology offers numerous benefits, it can also be a double-edged sword. Features like navigation systems or entertainment options can divert a driver's attention from the road, compromising their ability to react to hazards (Liang, 2019).

2.1.4. Mitigation Strategies

Promoting safe driving practices through educational campaigns can raise awareness and encourage responsible behavior on the road (IBM Blog, 2023). This can include educating drivers on the dangers of distracted driving, the importance of proper vehicle maintenance, and the need to adapt driving behavior to adverse weather conditions. Upgrading road infrastructure to improve visibility, providing clear and consistent signage, and ensuring the proper functioning of traffic signals are crucial steps in mitigating risks associated with the environment (Austroads, 2016).

Enforcing stricter vehicle maintenance and safety standards can significantly reduce the likelihood of mechanical failures leading to accidents. Regular inspections and adherence to safety regulations can help ensure vehicles remain in good working condition (National Highway Traffic Safety Administration, 2022). Technological advancements can play a positive role in enhancing traffic safety. Collision avoidance systems that warn drivers of potential hazards and automated traffic management systems that optimize traffic flow can contribute to a safer driving environment (Giuliano & Dargay, 2009).

Establishing and enforcing robust traffic laws and regulations serve as a deterrent to risky behavior. Strict enforcement measures, coupled with clear and consistent traffic regulations, can create a culture of safety on the roads (Simeone & Miller, LLP, 2023). By implementing a comprehensive approach that addresses both human behavior and the various environmental and technological

factors that contribute to traffic risk, we can create safer and more efficient transportation systems for everyone.

2.2. Theoretical Review

2.2.1. Safe System Approach

The Safe System Approach has emerged as a leading philosophy for achieving significant advancements in road safety around the globe (Austroads, 2016). This holistic and proactive strategy stands in stark contrast to traditional methods that primarily focused on placing the responsibility for avoiding accidents solely on road users (World Health Organization, 2021).

The core principle of the Safe System Approach is a fundamental ethical commitment: no loss of life or serious injury is acceptable on the road (Department of Transportation, n.d.). This represents a crucial shift from a reactive approach that attempts to minimize the frequency of crashes to a proactive approach that prioritizes preventing fatalities and severe injuries even when crashes do occur (Eluru, 2018).

This shift in focus is driven by two key acknowledgements. Firstly, the Safe System Approach recognizes the inherent fallibility of humans. People make mistakes, and the road system should be designed with this in mind (Transportation Research Board, 2016). Secondly, the approach acknowledges the physical limitations of the human body. Our bodies can only withstand a certain level of impact in a collision (World Road Association [PIARC], n.d.).

Therefore, the Safe System Approach advocates for designing a road environment that minimizes the likelihood of crashes due to human error and provides a higher level of protection for road users in the event of a collision (Giuliano & Dargay, 2009). Improved infrastructure design with safer roads with features like designated lanes, wider shoulders, and proper intersections can reduce the risk of crashes. Vehicle safety standards by enacting stricter standards for vehicle safety features, such as stronger bodies and advanced driver-assistance systems, can significantly mitigate injury severity in collisions. Traffic management strategies like Speed limits, clear signage, and effective traffic signalization can promote a safer flow of traffic. Vulnerable user protection by Designing roads with dedicated spaces for pedestrians and cyclists and prioritizing their safety considerations is crucial.

2.2.2. Rational Choice Theory

Rational choice theory stands as a cornerstone concept within both economics and the broader social sciences, offering a framework for comprehending and modeling human decision-making (Friedman & Landes, 1998). Central to this theory is the assumption that individuals, when faced with a choice, engage in a cost-benefit analysis, meticulously weighing the potential advantages and drawbacks of each available option (Camerer & Loewenstein, 2003). Ultimately, they make the selection that aligns most closely with maximizing their own personal benefit, or what economists refer to as their utility (Benartzi & Thaler, 2004).

The roots of rational choice theory can be traced back to the classical era of political economy. A prominent figure in this movement, Adam Smith, is widely recognized for laying the groundwork for the theory with his influential concept of the "invisible hand" (Smith, 1776). Smith proposed that while individuals, acting in their own self-interest, make choices aimed at maximizing their personal gain, these choices, through an invisible market force, ultimately serve the greater good of society by promoting economic prosperity and efficiency (Stigler, 1982). This concept has been a cornerstone of economic thought and continues to influence modern economic models.

Rational choice theory rests on a core set of assumptions about human behavior in decision-making situations (Camerer & Loewenstein, 2003). One fundamental assumption is that individuals possess preferences among the available choices. These preferences are not random or arbitrary; rather, they are imbued with a sense of value or desirability (Benartzi & Thaler, 2004).

Another critical tenet of rational choice theory is the principle of utility maximization. This principle posits that, given their established preferences and any relevant constraints, individuals will gravitate towards the option that delivers the highest level of satisfaction or utility (Benartzi & Thaler, 2004). Utility is a subjective concept that encompasses the overall benefit or value an individual derives from a particular choice.

The concept of utility is versatile and can encompass a broad spectrum of factors that influence decision-making. It can include tangible elements like monetary gain or cost savings, but it can also extend to intangible aspects like personal satisfaction, enjoyment, or the avoidance of negative experiences (Camerer & Loewenstein, 2003). By understanding the factors that contribute to an individual's utility function, rational choice theory offers a framework for predicting and explaining human behavior in various decision-making contexts.

Rational choice theory, while influential, has attracted its share of critiques. Critics argue that the theory presents an overly simplistic view of human decision-making (Simon, 1982). They contend that human behavior is far more nuanced and susceptible to a wider range of influences than the theory acknowledges. Despite these criticisms, rational choice theory remains a foundational concept in economics (Friedman & Landes, 1998). It offers a structured framework for analyzing decision-making processes by assuming that individuals, within a set of constraints, act rationally in pursuit of their self-interest. This framework provides a clear and concise basis for predicting behavior and understanding economic phenomena.

Furthermore, the applicability of rational choice theory extends beyond economics. The core principles have been utilized in various fields, including political science, sociology, and philosophy, to model and explain behavior in diverse contexts (Elster, 1986). While acknowledging its limitations, scholars recognize the value of rational choice theory as a tool for understanding and predicting patterns of choice within economic and social environments.

2.2.3. Broken Windows Theory

The Broken Windows Theory, a seminal concept in the realm of criminology and urban sociology, posits that visible signs of disorder, such as broken windows, graffiti, and other forms of urban decay, can lead to an increase in crime. This theory was first introduced by social scientists James Q. Wilson and George L. Kelling in their 1982 article titled "Broken Windows", published in *The Atlantic Monthly*. The core idea is that maintaining and monitoring urban environments to prevent small crimes such as vandalism and public drinking helps to create an atmosphere of order and lawfulness, thereby preventing more serious crimes from happening (Wilson & Kelling, 1982).

The theory's name comes from the metaphor of a broken window, suggesting that if a window in a building is broken and left unrepaired, people walking by will conclude that no one cares about the building and that it is acceptable to break more windows. This metaphor extends to the community level, where visible signs of disorder and neglect result in an environment that feels unsafe, which can encourage more serious crime (Kelling & Coles, 1996).

While the theory's effectiveness in reducing overall crime rates remains a subject of debate (Braga & Weisburd, 2014), there are potential applications of the Broken Windows Theory to promote pedestrian safety through stricter traffic enforcement.

When traffic laws, particularly those pertaining to pedestrian safety, are consistently and visibly enforced, it sends a clear message to drivers that such behavior will not be tolerated. This increased enforcement presence can deter drivers from engaging in risky maneuvers, like speeding, failing to yield the right of way to pedestrians in crosswalks, or distracted driving, which can significantly contribute to pedestrian accidents (Giuliano & Dargay, 2009).

By addressing minor traffic violations, such as rolling stops at stop signs or not using turn signals, authorities can create a more predictable and controlled traffic environment. This predictability improves safety for all road users, including pedestrians, as it allows them to navigate intersections and crosswalks with a greater sense of security (Eluru, 2018).

Consistent enforcement of traffic laws fosters a culture of safety on the roads. Pedestrians are more likely to feel comfortable walking and crossing streets if they perceive drivers to be attentive and following the rules (Pucher & Buehler, 2017). This creates a positive feedback loop, where increased pedestrian activity can further incentivize stricter traffic enforcement, leading to a safer environment for everyone.

2.2.4. Theory of Planned Behavior

The Theory of Planned Behavior (TPB) is a psychological framework that predicts and explains human behavior in specific contexts. Developed by Icek Ajzen in 1985, TPB posits that an individual's behavior is determined by their intention to perform the behavior, which is influenced by their attitude towards the behavior, subjective norms, and perceived behavioral control (Ajzen, 1985). Attitude towards the behavior reflects the individual's positive or negative evaluation of performing the behavior. Subjective norms refer to the perceived social pressure to perform or not perform the behavior. Perceived behavioral control relates to the individual's belief in their capability to execute the behavior under various circumstances (Ajzen, 1991).

TPB is an extension of the Theory of Reasoned Action (TRA), which posited that behavioral intention is influenced only by attitude and subjective norms. Ajzen introduced the concept of perceived behavioral control to account for situations where individuals may be motivated to perform a behavior but feel hindered by external factors (Ajzen & Fishbein, 1980). In health psychology, TPB has been utilized to understand behaviors such as smoking cessation, exercise, and safe sex practices. It helps in designing interventions by identifying the beliefs that can be targeted to change intentions and behaviors (Brookes, 2023).

For instance, a health campaign aiming to reduce smoking might use TPB by addressing individuals' attitudes towards smoking (e.g., its health risks), altering subjective norms (e.g., highlighting disapproval of smoking by significant others), and increasing perceived behavioral control (e.g., providing resources to aid in quitting) (Simply Psychology, 2023). TPB has also been applied in environmental psychology to predict recycling behavior, in consumer finance to understand purchasing decisions, and in political science to analyze voting behavior, demonstrating its versatility across domains (Wikipedia, 2024).

Despite its widespread application, TPB is not without criticism. Some argue that the model does not account for habitual behaviors or those performed without conscious intention. Others point out that the predictive power of perceived behavioral control is not consistent across all behaviors (SpringerLink, 2024).

2.3. Empirical Review

2.3.1. Global Perspective

The intricate relationship between traffic regulations and pedestrian safety has been a focal point of urban planning and public health policy. Globally, empirical studies have sought to understand and quantify the effects of these regulations on reducing pedestrian fatalities and injuries.

One pivotal study conducted by Soathong, Wilson, Ranjitkar, and Chowdhury (2019) critically reviewed policies on pedestrian safety with a case study of New Zealand. They found that evidence-based approaches to road safety policies have contributed to an overall reduction in road crashes. However, they noted that little attention had been paid to pedestrian behavior related to crashes, suggesting a potential area for further research and policy development.

Mukherjee and Saha (2022) reviewed recent research on pedestrian safety at different types of facilities. Their findings highlighted the increased risk of road crashes due to the absence of traffic enforcement and sufficient safety measures, particularly at uncontrolled intersections and mid-blocks. This underscores the importance of comprehensive traffic rules that address not only the behavior of drivers but also the infrastructure that supports pedestrian movement.

A study focusing on the effect of road network patterns on pedestrian safety employed a zone-based Bayesian spatial modeling approach, revealing that certain road network designs can

significantly influence pedestrian safety outcomes (2016). This study emphasizes the need for urban planners to consider pedestrian safety in the initial design stages of road networks.

Furthermore, Stanton explored the relationships between pedestrian behaviors and traffic safety attitudes in six countries. Their research provided valuable insights into the demographic, economic, and cultural factors that influence pedestrian safety and compliance with traffic rules.

The body of empirical research indicates that traffic rules and regulations play a crucial role in enhancing pedestrian safety. However, these studies also highlight the need for a multifaceted approach that includes not only the enforcement of traffic laws but also the design of pedestrian-friendly infrastructure and the consideration of pedestrian behavior in policy-making.

2.3.2. African Perspective

Pedestrian safety presents a critical public health concern across Africa, where rapid urbanization and motorization often outpace infrastructure development and traffic regulation enforcement (World Health Organization, 2020). This creates a dangerous environment for pedestrians, who are particularly vulnerable road users.

Nteziyaremye and Sinclair's (2013) study in Stellenbosch, South Africa, offers valuable insights into pedestrian crossing behavior. Their research, employing video observation and interviews, explored how beliefs and attitudes towards traffic control devices influence pedestrian actions. The study revealed that a significant portion of pedestrian fatalities (around 40%) occur during road crossings, often due to disregard for traffic signals or a lack of understanding of their functionality (Nteziyaremye & Sinclair, 2013). This highlights the need for targeted interventions that promote pedestrian education and encourage adherence to traffic control measures.

Mukherjee and Saha's (2022) review of recent research expands the conversation on pedestrian safety by emphasizing the role of human behavior. They identify mobile phone usage and panic-stricken reactions as factors that can significantly increase pedestrian risk. Their review also underscores the crucial role of traffic enforcement in deterring risky behavior. Furthermore, they call for further research to explore the complex interplay between various factors, including traffic characteristics, human psychology, and the road environment itself (Mukherjee & Saha, 2022). This comprehensive approach is essential for developing effective interventions that address both infrastructure limitations and human behavior.

The Sustainable Safe Transport Project's (SSATP) report on road safety data systems in Africa tackles a fundamental challenge (SSATP, n.d.). The report emphasizes the importance of establishing a standardized set of police-reported crash-related variables throughout Africa. The lack of data harmonization hinders comprehensive understanding of the regional road safety landscape and makes it difficult to develop evidence-based policies and interventions.

A recent South African study delves into a relatively unexplored aspect of pedestrian safety driver characteristics (Abraham, 2020). This research highlights the fact that driver behavior plays a critical role in pedestrian safety, with 40% of traffic fatalities involving pedestrians. By examining factors associated with unsafe driving practices, such as speeding, distracted driving, or driving under the influence, this study opens new avenues for intervention strategies that target driver behavior modification alongside pedestrian education (Abraham, 2020).

2.3.3. Ethiopian Perspective

Pedestrian safety is a critical public health concern in Ethiopia, where rapid urbanization, increasing motor vehicle ownership, and limited road infrastructure create a dangerous environment for pedestrians (World Health Organization, 2020). Road traffic accidents are a leading cause of death and injury, with pedestrians disproportionately represented among the victims (Federal Police Commission, Ethiopia, 2021).

Abegaz (2014) investigated the effectiveness of revised road safety policies implemented by the Oromia Regional State Transport Bureau in September 2007. Their study employed a segmented linear regression model to analyze routine road traffic accident data from 2002 to 2011, collected from sixteen traffic police offices across the region. The research revealed a statistically significant reduction in both non-injury crashes (19%) and fatalities (12.4%) in the first year following the implementation of the new regulations. These findings suggest that the revised policies, which likely included stricter enforcement measures and potentially changes to traffic flow or pedestrian infrastructure, had a positive initial impact on road safety (Abegaz, 2014).

A comprehensive review by the United Nations Economic Commission for Europe (UNECE) in 2013 examined Ethiopia's overall road safety management strategies, encompassing infrastructure, vehicle safety standards, and legal frameworks (UNECE, 2013). The report provides an in-depth

analysis of trends in road traffic crashes, including the specific types of crashes involving pedestrians. Furthermore, it evaluates the effectiveness of existing legal frameworks in deterring traffic violations and promoting safe driving practices. The UNECE report offers valuable insights for identifying weaknesses in Ethiopia's current approach to road safety and suggests areas for potential improvement through revised legislation, infrastructure development, and public education campaigns (UNECE, 2013).

The studies by Abegaz (2014) and the UNECE (2013) provide a strong foundation for understanding the relationship between traffic rules and regulations, and pedestrian safety in Ethiopia. Further research is necessary to explore the long-term impact of policy changes and identify additional factors that influence pedestrian safety in the Ethiopian context.

2.4. Conceptual Framework

This conceptual framework provides a structured approach to investigating the multifaceted relationship between traffic rules and regulations and pedestrian safety in Addis Ababa. Drawing on existing literature, it highlights several key variables that significantly influence pedestrian safety within the city.

Enforcement of Traffic Rules: This variable examines the level and effectiveness of enforcement measures for traffic rules and regulations in Addis Ababa. Studies have consistently shown a strong correlation between robust traffic law enforcement and improved pedestrian safety (Eluru et al., 2020; Tiwari & Gupta, 2022). When enforcement is weak or inconsistent, drivers are less likely to adhere to traffic laws, creating a more dangerous environment for pedestrians.

For example, Eluru et al. (2020) found that increased police presence and stricter enforcement of speeding violations in Indian cities led to a significant decrease in pedestrian fatalities. Similarly, Tiwari & Gupta's (2022) research in Nepal demonstrated that implementing automated traffic enforcement systems, such as red light cameras, effectively reduced pedestrian accidents at intersections. These findings underscore the importance of effective enforcement mechanisms in promoting adherence to traffic regulations and ultimately enhancing pedestrian safety.

Adherence to Traffic Regulations: This variable assesses the degree of compliance among drivers and pedestrians with existing traffic regulations in Addis Ababa. Research suggests a two-

way street: effective enforcement encourages compliance, and high levels of compliance from all road users contribute to a safer environment (Chen et al., 2021; Özkan et al., 2019).

Chen et al. (2021) conducted a study in China that found a positive correlation between increased pedestrian use of designated crosswalks and a decrease in pedestrian-vehicle collisions. This highlights the importance of pedestrian adherence to traffic regulations. Özkan et al. (2019) explored the link between driver behavior and pedestrian safety in Turkey. Their research indicated that driver compliance with speed limits and stop signs significantly reduced pedestrian accidents. These studies emphasize the need for initiatives that encourage both drivers and pedestrians to take responsibility for following the rules of the road.

Infrastructural Changes: This variable evaluates the impact of infrastructural modifications, such as crosswalks, pedestrian signals, and road design, on pedestrian safety. Numerous studies have documented the positive influence of improved infrastructure on pedestrian safety outcomes (Huang et al., 2021; Qin et al., 2022). Investing in well-maintained pedestrian walkways, designated crossing zones, and clear traffic signals can significantly reduce pedestrian-vehicle collisions.

Huang et al. (2021) examined the impact of pedestrian infrastructure improvements in Chinese cities. Their research revealed that building wider sidewalks, installing raised crosswalks, and implementing pedestrian countdown timers all contributed to a decrease in pedestrian fatalities. Similarly, Qin et al. (2022) studied the effects of road design features on pedestrian safety in urban areas. They found that roundabouts, compared to traditional intersections, were associated with a lower risk of pedestrian accidents. These findings highlight the importance of prioritizing pedestrian-friendly infrastructure design in promoting safety.

Public Education Campaigns: This variable explores the influence of public education initiatives on raising awareness and promoting safe pedestrian behaviors. While the effectiveness of public education campaigns can vary depending on design and implementation, research suggests they can play a role in improving pedestrian safety (Litman, 2018; Odero et al., 2021).

Litman (2018) conducted a review of public education campaigns aimed at improving pedestrian safety. The research found that campaigns that were targeted, utilized multiple communication channels, and focused on behavior change were most effective. Odero et al. (2021) studied the

impact of a public awareness campaign on pedestrian safety in Kenya. Their research indicated that the campaign, which utilized radio broadcasts, community outreach events, and social media messaging, led to a measurable increase in pedestrian use of crosswalks. These studies suggest that well-designed public education campaigns can contribute to improved pedestrian safety by promoting awareness and encouraging responsible behavior.

Pedestrian Safety: This variable measures the overall level of pedestrian safety, encompassing pedestrian accidents, injuries, and fatalities in Addis Ababa. Data on pedestrian accidents and fatalities is a crucial metric for evaluating the effectiveness of interventions aimed at improving pedestrian safety. This data can be used to identify areas of high risk, track progress over time, and guide future safety initiatives.

By examining the interplay of these variables – enforcement, adherence, infrastructure, education, and pedestrian safety outcomes – this conceptual framework provides a foundation for a comprehensive understanding of pedestrian safety in Addis Ababa. Further research that investigates the specific relationships between these variables within the city context can inform the development of targeted strategies for creating a safer walking environment for all residents.

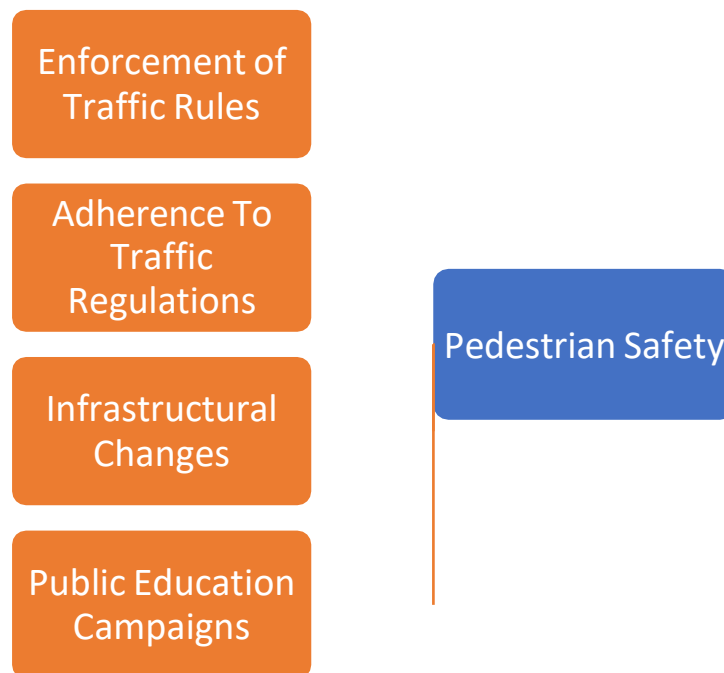


Figure 1: Conceptual Framework of the Study

2.5. Research Hypothesis

The effect of enforcement of traffic rules on pedestrian safety

H0.1: There is no positive and significant relationship between enforcement of traffic rules and pedestrian safety.

H1.1: There is a positive and significant relationship between enforcement of traffic rules and pedestrian safety.

The effect of adherence to traffic regulations on pedestrian safety

H0.2: There is no positive and significant relationship between adherence to traffic regulations and pedestrian safety.

H1.2: There is a positive and significant relationship between adherence to traffic regulations and pedestrian safety.

The effect of infrastructural changes on pedestrian safety

H0.3: There is no positive and significant relationship between infrastructural changes and pedestrian safety.

H1.3: There is a positive and significant relationship between infrastructural changes and pedestrian safety.

The effect of public education campaigns on pedestrian safety

H0.4: There is no positive and significant relationship between public education campaigns and pedestrian safety.

H1.4: There is a positive and significant relationship between public education campaigns and pedestrian safety.

Note: H0 (Null Hypothesis) states that there is no significant relationship or effect, while H1 (Alternative Hypothesis) states that there is a significant

CHAPTER THREE

RESEARCH METHODOLOGY

Under this chapter, it provides an overview of the choices decided regarding on the research design and methodology as how the research conducted, present, analyze and interpret the study. The study design, approach and the population and determination of the sample size are also described as how they are to be decided and done. Under this section, the data gathering instruments and their measurement scale is discussed. Moreover, the modes of data presentation, methods of the data analysis and interpretation and how they are described in details.

3.1. Research Approach

The mixed research method was used for this study to achieve the study's broad objective. This Mixed research method collects and analyzes quantitative data. The qualitative method allows questionnaires to collect primary data or to use previously collected or processed data known as secondary data in their studies. To support the quantitative findings and gain additional insight into the specific issues, the quantitative method was used. This quantitative portion of the study involved a statistical analysis of survey questionnaire data.

Quantitative research approaches are those that use numerical data to answer research questions. This type of research is often used in the social sciences, where it can be used to measure things like attitudes, behaviors, and beliefs. In order to attain the intended objectives of the study, the researcher used a research approach that is appropriate for the research question. In this case, the researcher is interested in measuring the relationship between two variables, so a quantitative research approach is the best choice.

The quantitative research approach enabled the researcher to effectively analyze and infer the numeric data. This means that the researcher was able to use statistical methods to analyze the data and draw conclusions about the relationship between the variables. The quantitative data was collected via a survey questionnaire that was prepared on a Likert-type Scale. This type of scale is a common way to measure attitudes and beliefs, and it allows respondents to provide their answers on a scale of 1 to 5.

3.2. Research Design

The researcher chose to use an explanatory research design for several reasons. One of the most common reasons for using this type of research design is to test a hypothesis about the relationship between two or more variables. In this case, the hypothesis was that there is a positive relationship between traffic regulations and enforcement and pedestrian safety.

Explanatory research design is particularly suitable for investigating causal relationships between variables. Because of its focus on testing hypotheses, the explanatory design can determine whether the independent variable (in this case, traffic regulations) has a causal effect on the dependent variable (pedestrian safety).

Another reason for adopting of the explanatory research design is that it allows the researcher to control for extraneous variables. This means that the researcher can minimize the effect of traffic regulations and enforcement on pedestrian safety. By controlling for these extraneous variables, the researcher can increase the validity of their findings.

Moreover, the explanatory research design allows the researcher to use statistical analysis to test the study hypotheses. By using appropriate statistical techniques to analyze the data, the researcher determined the strength and direction of the relationship between traffic regulations and enforcement and pedestrian safety. The researcher used an explanatory research design because it enabled to test a hypothesis about the causal relationship between traffic regulations and enforcement and pedestrian safety, control for extraneous variables, use statistical analysis, and guide future research.

3.3. Sampling Design

3.3.1. Target Population

Investigating the multifaceted relationship between traffic rules and regulations and pedestrian safety in Addis Ababa requires a deep understanding of enforcement practices and challenges. Pedestrians in Addis Ababa represent a critical target population for this study. Their firsthand experience in traffic flow, witnessing drivers' behavior, and interacting with violators provides invaluable knowledge on the effectiveness of current regulations and areas for improvement.

Pedestrians offer insights into the challenges of implementing traffic regulations in Addis Ababa's specific context. This includes factors like road infrastructure, pedestrian behavior patterns, and

driver compliance. A study by Woldehanna and Tefera (2019) in Addis Ababa highlighted the difficulties of enforcing pedestrian right-of-way due to a lack of designated crossing zones and jaywalking habits. Understanding these challenges from the perspective of pedestrians is crucial for developing targeted interventions.

3.3.2. Sampling Technique

To collect data from the population of interest without wasting too much time or resources, a non-probability sampling strategy was used. This is necessary since the population size was so huge. This approach for sampling involves picking a portion of the universe that is smaller than the total in order to provide a sample that is representative of the whole universe (Kothari, 2004). The selection of the sample is based on responders who just so happened to be in attendance at the appropriate time and place. This study made use of a sample method known as convenience sampling. The researcher made contact with the target group in Addis Ababa, and they gave their permission to take part in the study.

3.3.3. Sample Size

The following sampling formula for infinite population is used to come up with the sample size.

$$n_0 = \frac{Z^2 pq}{e^2},$$

Where:

n_0 - Sample size^[1]_{SEP}

Z – z value at specified confidence interval, e.g., z=1.96 at 95% CI^[1]_{SEP}

p – Degree of variability (0.5)

q – Q=1-p (0.5)

e – Desired level of precision (±5%)

Where n_0 is the sample size, Z^2 is the abscissa of the normal curve that cuts off an area at the tails (1 –) equals the desired confidence level, e is the desired degree of accuracy, p is the estimated proportion of an attribute that is present in the population, and q is 1-p. The value for Z may be found in statistics tables that show the area beneath the normal curve.

As an example, assumed $p=.5$ since there was a big population and we didn't know the fluctuation in the proportion of people who followed the practice (maximum variability). Furthermore, a 95 percent confidence level and a 5% accuracy level were needed.

$$n_0 = \frac{z^2pq}{e^2} = \frac{(1.96)^2(0.5)0.5}{(0.05)^2} = 384.16 \approx 384$$

3.4. Type and Sources of Data

For the current study, the researcher used primary data sources. In this regard, the primary data was collected from the pedestrians in the time of data collection period 2024. The 384 respondents as determined to be selected using convenience sampling technique, was addressed via survey questionnaire regarding on the effect of traffic regulations and enforcement on pedestrian safety.

3.5. Method of Data Collection

Every study has its own framework for collecting data to ensure that the required data to be collected accurately and economically. For this particular study, the researcher employed survey questionnaires.

For further details, the items of the survey questionnaire was prepared in Likert-type scale in order to obtain respondents' level of agreement/disagreement on each of the constructs; as well known, a Likert-type scale which is a very popular rating scale for measuring ordinal data in social science (Krosnick & Presser, 2010). Therefore, in this particular study, the respondents were asked to rate each item on a Likert-type scale by assigning a value of 1 stood for *strongly disagree* to 5 stood for *strongly agree*. In such a way, the items can be easily understood and replied by the respondents.

3.6. Method of Data Analysis

In this study, quantitative data collected via survey questionnaire was analyzed using the descriptive statistics as well as inferential statistics. The specific data analysis techniques were employed are presented below:

Descriptive Statistics: The descriptive statistics was employed in order to analyze data to be collected via survey questionnaire, specifically the respondents' profile to describe their characteristics using *frequency and percentile*; and, the remaining data was analyzed by measuring the central tendency and dispersion (*viz . mean and standard deviation*), to measure and identify

the perception of respondents regarding on the effect of traffic regulations and enforcement on pedestrian safety.

Inferential Statistics: The inferential statistics, on the other hand, was utilized to determine with what validity data can be said to make conclusion or conclusions with inference, and summarizing sources of numerical data in to meaningful form (Kothari, 2004) In this study, in order to identify the relationship between pedestrian safety as dependent variable and the independent factors (*i.e., Enforcement of traffic rules, Adherence to traffic regulations, Infrastructural changes, and Public education campaigns*), Pearson's correlation was employed via using SPSS. As Pearson product-moment indicates, the relationship of variables is expressed by correlation coefficient (r) value within the range of -1.00 to $+1.00$ (Sekaran & Bougie, 2016). Besides, Multiple Linear Regression analysis was also used in order to establish the effects of enforcement of traffic rules, adherence to traffic regulations, infrastructural changes, and public education campaigns on the pedestrian safety at Addis Ababa City Administration Traffic Management Authority as illustrated the variables in the following equation:

$$Y_i = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + e$$

Where: $Y_i =$ *pedestrian safety* (Dependent Variable)

$\beta_0 =$ Constant

$X_1 - X_6 =$ Independent Variables

$X_1 =$ *Enforcement of traffic rules*

$X_2 =$ *Adherence to traffic regulations*

$X_3 =$ *Infrastructural changes*

$X_4 =$ *Public education campaigns*

$\beta_0 =$ Coefficient of the model

$\beta_1 - \beta_6 =$ Beta Coefficient of Determination

$e =$ Stochastic Error Term

Thus, the aforementioned two statistical analysis methods (*i.e., both descriptive and inferential statistics*) was applied to evaluate the current status of the effect of traffic regulations and enforcement and pedestrian safety, and to measure and determine the relationship and effects that

exists between dependent and independent variables by employing the data to be collected and analyzing using statistical package for social sciences (SPSS V. 24).

3.7. Research Variable

There are a number of factors that potentially affect pedestrian safety as exhaustively discussed in *Chapter One* based on various literatures. However, the researcher decided to assess the enforcement of traffic rules, adherence to traffic regulations, infrastructural changes, and public education campaigns that influence on pedestrian safety in Addis Ababa. Therefore, in this particular study, the

Dependent variable: is the current status of pedestrian safety in Addis Ababa.

Independent variables: traffic regulations and enforcement (i.e., enforcement of traffic rules, adherence to traffic regulations, infrastructural changes, and public education campaigns).

3.8. Reliability and Validity of the Instrument

To assure the validity of the measurement tool of the questionnaire, the researcher collected comments on the items of the questionnaire from research advisor and traffic experts working at Addis Ababa City Administration Traffic Management Authority in order to improve the items based upon their comments. Additionally, prior to starting the distribution of the questionnaire, the researcher carried out a pre-test (i.e., *pilot study*) on randomly selected respondents from one of the Addis Ababa City Administration Traffic Management Authority for the sake of checking whether the items of the questionnaire are feasible, clear, consistent and understandable to the respondents.

To ascertain reliability (*internal consistency*) of items of the survey questionnaire, on the other hand, the researcher analyzed the reliability measurement test (i.e., *Cronbach's alpha*) using SPSS V. 24. As known, the Cronbach's alpha reliability measurement test is a popular model of internal consistency reliability which relied on the average inter-item correlation of the instrument (Koonce & Kelly).

Table 1: Reliability Statistics

Variables	Cronbach's Alpha	N of Items
Enforcement of Traffic Rules	.750	5
Adherence to Traffic Regulations	.743	5

Infrastructural Changes	.711	5
Public Education Campaigns	.794	5
Pedestrian Safety	.720	5

3.9. Ethical Consideration

The ethical issues were taken into consideration while carrying out the current study. Hence, the permission was obtained from Executive of the Addis Ababa City Administration Traffic Management Authority, informants and respondents who are working in the study area before any sort of data collection is started. To assure the confidentiality of information, name of the respondents were omitted from the questionnaire. On the other hand, objectives of the study were clearly explained to each and every participant of this study in order to obtain their verbal consents. Besides, the respondents of the questionnaire was also vividly told that the whole process of the questionnaires' administration would be set up with great confidentiality, and their involvements and/or their information provided for the current study was kept and used anonymously.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.1. Introduction

The following is a general outline for the structure of this chapter: It includes a reliability test for the measures employed, as well as an analysis of the demographics of the respondents. Pearson's correlation coefficient and descriptive analyses were provided sequentially in order to make it easier to do the empirical analysis.

4.2. Samples and response rate

363 of the 384 questioners distributed were returned, resulting in a return rate of 94.5%. A total of 357 legitimate questionnaires were approved, with a response rate of 94.5 percent, after removing six invalid forms. Consequently, of the 384 questionnaires provided, 92.9 percent of the participants returned legitimate surveys.

4.3. Demographic characteristics of respondents

According to the data presented in Table 3, out of the 357 individuals who participated in the survey, 204 (or 57.2%) were male while 153 (or 32.8%) were female. According to Table 3, out of the total of 357 respondents, 139 (38.9 percent) were between the ages of 18 and 29, 151 (42.3 percent) were between the ages of 30 and 39, 36 (10.1 percent) were between the ages of 36 and 45, and 31 (8.7 percent) were beyond the age of 50. This may be seen in the table that comes after this one, which is numbered 4.3. (b).

According to Table 3, out of the total of 357 respondents, 122 (34.2 percent) had a first degree, 103 (28.9 percent) had a diploma, 104 (29.1 percent) had a second degree, and 28 (7.8 percent) had a bachelor's degree or below. This information is presented in graphical format in subheading 3. According to the findings of table 3, more than half of the 357 respondents were self-employed. This was followed by those who worked for the government (117.8 percent), those who were employed privately (47.8 percent), and others (31.77). (d). This is demonstrated in the 3 table that is presented below.

Table 2. Demographic Distribution of Respondents

Variables	Type	Count	%
Age (in years)	18-29	139	38.9
	30-39	151	42.3
	40-49	36	10.1
	50+	31	8.7
Gender	Male	204	57.2
	Female	153	32.8
Educational Qualification	Certificate and below	28	7.8
	Diploma	103	28.9
	Bachelor	122	34.2
	Masters	104	29.1
Occupation	Government respondent	117	32.8
	Private respondent	47	13.2
	Self-employed	162	45.4
	Other	31	8.7

Source: Survey Result, 2024

4.4. Descriptive Analysis

An itemized rating scale is used to create a range by the researcher. Respondents' attitudes regarding each variable was gauged with the use of this range. The range is constructed using the following formula (Shrestha, 2015).

The mean scores of each variable were employed in this study's analysis, which was done using descriptive statistics or central tendency. Assessment of the average replies of respondents to each question contained in each dimension of the predictor variable and the grand mean of the dimensions was the primary purpose of this measurement. Finally, the grand mean of each independent dimension is used to arrive at the study's partial research objectives.

$$\begin{aligned}
 \text{Itemized rating scale: } & \frac{\text{Max} - \text{Min}}{5} \\
 & = \frac{5 - 1}{5} \\
 & = 0.80
 \end{aligned}$$

The mean of each individual item ranging from 1- 5 falls within the following interval:

Table 3. Scale of Perception

Interval of Means	Perception
1.00 – 1.80	Very Low
1.81 – 2.60	Low
2.61 – 3.40	Medium
3.41 – 4.20	High
4.21 – 5.00	Very High

4.4.1. Enforcement of Traffic Rules

Table 4: Descriptive Statistics Result for Enforcement of Traffic Rules

Statements	Mean	Std. Deviation
Traffic laws are consistently enforced in Addis Ababa.	2.7500	1.10884
There are enough traffic officers to effectively enforce traffic rules.	3.0465	1.14868
Penalties for traffic violations are a strong deterrent for bad driving behavior.	2.9826	1.19195
Traffic enforcement efforts prioritize pedestrian safety.	3.5116	1.17223
Technology (e.g., speed cameras) is effectively used to enforce traffic rules.	2.4186	1.15435
Grand Mean	2.9419	.81728

Source: Survey Result, 2024

The survey results provide insights into the attitudes of respondents of pedestrians in Addis Ababa towards various aspects of traffic law enforcement and management.

The respondents showed an agreeing attitude with a mean value of 2.7500 and a standard deviation of 1.10884 when asked about the consistent enforcement of traffic laws in Addis Ababa. This indicates that there might be some level of agreement among the respondents regarding the consistency of traffic law enforcement, although the standard deviation suggests a notable level of variability in their attitudes.

The survey revealed that the respondents have an agreeing attitude with a mean value of 3.0465 and a standard deviation of 1.14868 concerning the sufficiency of traffic officers to effectively enforce traffic rules. This suggests that, on average, the respondents believe that there are enough traffic officers to enforce traffic rules, with a similar level of variability in their attitudes as seen in the previous finding.

The respondents exhibited an agreeing attitude with a mean value of 2.9826 and a standard deviation of 1.19195 regarding the deterrent effect of penalties for traffic violations. This indicates

a general inclination towards agreement among the respondents regarding the effectiveness of penalties as a deterrent for bad driving behavior, with a notable level of variability in their attitudes.

The survey result showed that the respondents have an agreeing attitude with a mean value of 3.5116 and a standard deviation of 1.17223 when asked about whether traffic enforcement efforts prioritize pedestrian safety. This suggests a stronger agreement among the respondents regarding the prioritization of pedestrian safety in traffic enforcement efforts, with a similar level of variability in their attitudes as seen in the previous findings.

The survey indicated that the respondents have an agreeing attitude with a mean value of 2.4186 and a standard deviation of 1.15435 concerning the effective use of technology, such as speed cameras, to enforce traffic rules. This finding suggests a moderate level of agreement among the respondents regarding the effective use of technology for traffic rule enforcement, with a notable level of variability in their attitudes.

The grand mean for the variable "enforcement of traffic rules" is 2.9419 with a standard deviation of 0.81728. This indicates the overall average attitude of the respondents towards the enforcement of traffic rules, providing a comprehensive view of their collective stance on this aspect.

The survey results reflect varying levels of agreement among the respondents of pedestrians in Addis Ababa regarding different aspects of traffic law enforcement and management. While there are indications of general agreement on certain issues, there is also notable variability in their attitudes, highlighting the complexity of their perspectives and the need for further investigation into the underlying factors influencing their attitudes.

4.4.2. Adherence to Traffic Regulations

Table 5: Descriptive Statistics Result for Adherence to Traffic Regulations

	Mean	Std. Deviation
Drivers in Addis Ababa generally obey traffic regulations.	3.7267	.93081
Pedestrians in Addis Ababa prioritize following traffic signals and crosswalks.	3.2907	1.18831
There is a strong culture of respecting traffic regulations in the city.	3.8256	.83339
Most road users understand the importance of traffic regulations for pedestrian safety.	3.9302	1.04059
Distracted driving (e.g., using phones) is a minor issue in Addis Ababa.	3.9244	.93038
Grand Mean	3.7395	.64677

Source: Survey Result, 2024

The survey results continue to provide insights into the attitudes of respondents of pedestrians in Addis Ababa, this time focusing on various aspects of adherence to traffic regulations and behaviors of road users:

The survey revealed that the respondents have an agreeing attitude with a mean value of 3.7267 and a standard deviation of 0.93081 regarding the general adherence of drivers in Addis Ababa to traffic regulations. This indicates a strong level of agreement among the respondents regarding the overall compliance of drivers with traffic regulations, with a notable but relatively lower level of variability in their attitudes compared to previous findings.

The respondents demonstrated an agreeing attitude with a mean value of 3.2907 and a standard deviation of 1.18831 when asked about whether pedestrians in Addis Ababa prioritize following traffic signals and crosswalks. This suggests a moderate level of agreement among the respondents regarding the prioritization of traffic signals and crosswalks by pedestrians, with a higher level of variability in their attitudes.

The survey result showed that the respondents have an agreeing attitude with a mean value of 3.8256 and a standard deviation of 0.83339 concerning the existence of a strong culture of respecting traffic regulations in the city. This finding indicates a high level of agreement among the respondents regarding the presence of a strong culture of respect for traffic regulations, with a relatively lower level of variability in their attitudes.

The respondents exhibited an agreeing attitude with a mean value of 3.9302 and a standard deviation of 1.04059 regarding the understanding of the importance of traffic regulations for pedestrian safety by most road users. This finding suggests a strong level of agreement among the respondents regarding the understanding of the importance of traffic regulations for pedestrian safety, with a relatively higher level of variability in their attitudes.

The survey indicated that the respondents have an agreeing attitude with a mean value of 3.9244 and a standard deviation of 0.93038 regarding distracted driving, such as using phones, as a minor issue in Addis Ababa. This finding suggests a high level of agreement among the respondents regarding their perception of distracted driving as a minor issue, with a relatively lower level of variability in their attitudes compared to previous findings.

The grand mean for the variable "adherence to traffic regulation" is 3.7395 with a standard deviation of 0.64677. This indicates the overall average attitude of the respondents towards the adherence to traffic regulations, providing a comprehensive view of their collective stance on this aspect.

The survey results provide further insights into the attitudes of respondents of pedestrians in Addis Ababa, particularly regarding the adherence to traffic regulations by drivers, pedestrians, and other road users. The findings indicate varying levels of agreement among the respondents on these different aspects, with some areas showing strong consensus and others exhibiting greater variability in attitudes.

4.4.3. Infrastructural Changes

Table 6: Descriptive Statistics Result for Infrastructural Changes

	Mean	Std. Deviation
Recent infrastructural changes have improved pedestrian safety in Addis Ababa.	2.9244	1.31571
The city provides adequate and well-maintained sidewalks for pedestrians.	3.0640	1.16050
Crosswalks are clearly marked and visible for both drivers and pedestrians.	3.9942	.65335
Traffic light timings are optimized to prioritize pedestrian safety.	3.9477	.56470
There are enough designated pedestrian crossings in high-traffic areas.	4.1395	.66072
Grand Mean	3.6140	.47614

Source: Survey Result, 2024

The survey results continue to shed light on the attitudes of respondents of pedestrians in Addis Ababa, this time focusing on various aspects related to pedestrian safety and infrastructure:

The survey revealed that the respondents have an agreeing attitude with a mean value of 2.9244 and a standard deviation of 1.31571 regarding the improvement of pedestrian safety in Addis Ababa due to recent infrastructural changes. This finding suggests a moderate level of agreement among the respondents regarding the positive impact of recent infrastructural changes on pedestrian safety, with a notable level of variability in their attitudes.

The respondents demonstrated an agreeing attitude with a mean value of 3.0640 and a standard deviation of 1.16050 when asked about whether the city provides adequate and well-maintained

sidewalks for pedestrians. This indicates a moderate level of agreement among the respondents regarding the provision of adequate and well-maintained sidewalks for pedestrians, with a notable level of variability in their attitudes.

The survey result showed that the respondents have an agreeing attitude with a mean value of 3.9942 and a standard deviation of 0.65335 concerning the clear marking and visibility of crosswalks for both drivers and pedestrians. This finding suggests a strong level of agreement among the respondents regarding the visibility and clarity of crosswalks, with a relatively lower level of variability in their attitudes.

The respondents exhibited an agreeing attitude with a mean value of 3.9477 and a standard deviation of 0.56470 regarding the optimization of traffic light timings to prioritize pedestrian safety. This indicates a strong level of agreement among the respondents regarding the optimization of traffic light timings for pedestrian safety, with a relatively lower level of variability in their attitudes.

The survey result showed that the respondents have an agreeing attitude with a mean value of 4.1395 and a standard deviation of 0.66072 regarding the sufficiency of designated pedestrian crossings in high-traffic areas. This finding suggests a very strong level of agreement among the respondents regarding the sufficiency of designated pedestrian crossings, with a relatively lower level of variability in their attitudes.

The grand mean for the variable "infrastructural changes" is 3.6140 with a standard deviation of 0.47614. This indicates the overall average attitude of the respondents towards the recent infrastructural changes related to pedestrian safety, providing a comprehensive view of their collective stance on this aspect.

The survey results provide further insights into the attitudes of respondents of pedestrians in Addis Ababa, particularly regarding pedestrian safety and the quality of infrastructure. The findings indicate varying levels of agreement among the respondents on these different aspects, with some areas showing strong consensus and others exhibiting greater variability in attitudes.

4.4.4. Public Education Campaigns

Table 7: Descriptive Statistics Result for Public Education Campaigns

	Mean	Std. Deviation
Public education campaigns effectively raise awareness about pedestrian safety issues.	3.9360	1.07142
Traffic safety messages targeting both drivers and pedestrians are clear and impactful.	3.7907	1.00427
Public education campaigns are frequent enough to maintain awareness.	3.6512	1.04033
Educational campaigns utilize diverse channels (media, schools) to reach a broad audience.	2.9651	1.09702
Public education campaigns encourage responsible behavior from both drivers and pedestrians.	3.9535	1.10191
Grand Mean	3.6593	.61175

Source: Survey Result, 2024

Based on the survey results, the attitudes of respondents of pedestrians in Addis Ababa towards public education campaigns and their impact on pedestrian safety and traffic behavior are as follows:

The respondents have an agreeing attitude with a mean value of 3.9360 and a standard deviation of 1.07142 regarding the effectiveness of public education campaigns in raising awareness about pedestrian safety issues. This finding suggests a strong level of agreement among the respondents regarding the effectiveness of public education campaigns in raising awareness about pedestrian safety issues, with a notable level of variability in their attitudes.

The survey result showed that the respondents have an agreeing attitude with a mean value of 3.7907 and a standard deviation of 1.00427 concerning the clarity and impact of traffic safety messages targeting both drivers and pedestrians. This indicates a moderate level of agreement among the respondents regarding the clarity and impact of traffic safety messages, with a notable level of variability in their attitudes.

The respondents demonstrated an agreeing attitude with a mean value of 3.6512 and a standard deviation of 1.04033 regarding the frequency of public education campaigns to maintain awareness. This finding suggests a moderate level of agreement among the respondents regarding the

frequency of public education campaigns to maintain awareness, with a notable level of variability in their attitudes.

The survey result showed that the respondents have an agreeing attitude with a mean value of 2.9651 and a standard deviation of 1.09702 concerning the utilization of diverse channels, such as media and schools, to reach a broad audience for educational campaigns. This indicates a moderate level of agreement among the respondents regarding the utilization of diverse channels for educational campaigns, with a notable level of variability in their attitudes.

The respondents exhibited an agreeing attitude with a mean value of 3.9535 and a standard deviation of 1.10191 regarding the encouragement of responsible behavior from both drivers and pedestrians through public education campaigns. This finding suggests a strong level of agreement among the respondents regarding the encouragement of responsible behavior through public education campaigns, with a notable level of variability in their attitudes.

The grand mean for the variable "public education campaigns" is 3.6593 with a standard deviation of 0.61175. This indicates the overall average attitude of the respondents towards public education campaigns related to pedestrian safety and traffic behavior, providing a comprehensive view of their collective stance on this aspect.

The survey results reflect varying levels of agreement among the respondents of pedestrians in Addis Ababa regarding the effectiveness, clarity, frequency, and impact of public education campaigns on pedestrian safety and traffic behavior. While there are indications of general agreement on certain issues, there is also notable variability in their attitudes, highlighting the complexity of their perspectives and the need for further investigation into the underlying factors influencing their attitudes.

4.4.5. Pedestrian Safety

Table 8: Descriptive Statistics Result for Pedestrian Safety

	Mean	Std. Deviation
How safe do you feel when walking on the streets of Addis Ababa?	3.1395	.78230
How likely do you think a pedestrian is to be involved in a traffic accident in Addis Ababa?	3.7384	.71421
To what extent do you believe the current traffic management system prioritizes pedestrian safety?	3.2035	1.09725

How well-protected do you feel as a pedestrian crossing intersections in Addis Ababa?	3.7035	.66613
Overall, how would you rate the level of pedestrian safety in Addis Ababa?	3.3372	.84619
Grand Mean	3.4244	.39601

Source: Survey Result, 2024

The survey results reflect the attitudes of respondents of pedestrians in Addis Ababa towards various aspects of pedestrian safety and their perceptions of the safety environment in the city. Here's the interpretation and elaboration of each finding:

The respondents have an agreeing attitude with a mean value of 3.1395 and a standard deviation of 0.78230 regarding their perceived safety when walking on the streets of Addis Ababa. This indicates a moderate level of agreement among the respondents concerning their perceived safety while walking, with a notable level of variability in their attitudes.

The survey result showed that the respondents have an agreeing attitude with a mean value of 3.7384 and a standard deviation of 0.71421 regarding the perceived likelihood of a pedestrian being involved in a traffic accident in Addis Ababa. This suggests a strong level of agreement among the respondents regarding their perception of the likelihood of pedestrian involvement in traffic accidents, with a relatively lower level of variability in their attitudes.

The respondents exhibited an agreeing attitude with a mean value of 3.2035 and a standard deviation of 1.09725 regarding their belief in the extent to which the current traffic management system prioritizes pedestrian safety. This finding indicates a moderate level of agreement among the respondents regarding their perception of the prioritization of pedestrian safety by the current traffic management system, with a notable level of variability in their attitudes.

The survey result showed that the respondents have an agreeing attitude with a mean value of 3.7035 and a standard deviation of 0.66613 regarding their perceived level of protection as pedestrians when crossing intersections in Addis Ababa. This suggests a strong level of agreement among the respondents regarding their perceived level of protection when crossing intersections, with a relatively lower level of variability in their attitudes.

The respondents have an agreeing attitude with a mean value of 3.3372 and a standard deviation of 0.84619 when asked to rate the overall level of pedestrian safety in Addis Ababa. This indicates

a moderate level of agreement among the respondents regarding their overall rating of pedestrian safety, with a notable level of variability in their attitudes.

The grand mean for the variable "pedestrian safety" is 3.4244 with a standard deviation of 0.39601. This indicates the overall average attitude of the respondents towards pedestrian safety, providing a comprehensive view of their collective stance on this aspect.

The survey results provide insights into the attitudes of respondents of pedestrians in Addis Ababa regarding pedestrian safety and their perceptions of the safety environment in the city. The findings indicate varying levels of agreement among the respondents on these different aspects, with some areas showing strong consensus and others exhibiting greater variability in attitudes.

4.5. Inferential Statistics

The researcher used regression analysis to determine the impact of traffic rules and regulations on pedestrian safety in Addis Ababa. The results of Correlation, ANOVA, and regression coefficients are provided in the following sections.

4.5.1. Correlation Analysis

The researcher used Pearson's Correlation analysis in order to examine the relationship between the four dimensions of traffic rules and regulations (enforcement of traffic rules, adherence to traffic regulations, infrastructural changes, and public education campaigns) and pedestrian safety. Pearson's correlation coefficient was used as a statistical tool. Pearson's correlation coefficient is a common method to quantify how strongly two variables are related to each other. It assumes that the variables have a linear association and that they are randomly sampled from a population (Kothari, 2004).

The results of the correlation analysis between the independent variables (enforcement of traffic rules, adherence to traffic regulations, infrastructural changes, and public education campaigns) and the dependent variable (pedestrian safety) are presented in the following section. The table below shows the correlation coefficients for each pair of variables. The coefficients range from moderate to high, indicating that there is a significant relationship between the traffic rules and regulations aspects and the pedestrian safety.

Table 9: Correlation Matrix

Correlations

	ETR	ATR	IC	PEC	PS
Enforcement of Traffic Rules	1				
Adherence to Traffic Regulations	-.175*	1			
Infrastructural Changes	.235**	.184*	1		
Public Education Campaigns	-.317**	.546**	-.011	1	
Pedestrian Safety	.387**	.531**	.462**	.393**	1
*. Correlation is significant at the 0.05 level (2-tailed).					
**. Correlation is significant at the 0.01 level (2-tailed).					

Source: Survey Result, 2024

4.5.1.1. Enforcement of Traffic Rules

The study conducted on the effect of traffic rules and regulations on pedestrian safety in Addis Ababa revealed a significant relationship between the enforcement of traffic rules and pedestrian safety. The Pearson correlation value of 0.387 at $p < 0.05$ indicates a moderate positive correlation between the enforcement of traffic rules and pedestrian safety. This finding suggests that as the level of enforcement of traffic rules increases, pedestrian safety also tends to improve. The significance of this relationship is underscored by the statistical significance at the 0.05 level ($p < 0.05$), indicating that the observed correlation is unlikely to have occurred by chance. This strengthens the evidence supporting the association between the enforcement of traffic rules and pedestrian safety in the context of Addis Ababa.

The positive correlation implies that a higher level of enforcement of traffic rules is associated with better pedestrian safety outcomes. This finding has important implications for policymakers and urban planners in Addis Ababa, highlighting the potential effectiveness of robust enforcement measures in enhancing pedestrian safety within the city. The study's results align with broader research emphasizing the crucial role of traffic regulations and enforcement in promoting pedestrian safety. Additionally, the findings underscore the importance of prioritizing and maintaining effective enforcement strategies to create safer environments for pedestrians in urban settings.

This finding is consistent with other research, such as the study by Ferrer-Celicious and Naparota (2023), which found that enforcement of traffic laws in Dipolog City had a positive impact on pedestrian safety. Similarly, Soathong et al. (2019) emphasized the importance of evidence-based approaches to pedestrian safety, advocating for a "Vision Zero" strategy in New Zealand. The systematic review by PLOS ONE (2022) also supports the notion that a combination of road

environment improvements, legislation, enforcement, and educational interventions can enhance pedestrian safety. These studies collectively underscore the critical role of enforcement in ensuring pedestrian safety and provide a robust framework for future policy development and research.

4.5.1.2. Adherence to Traffic Regulations

According to a study conducted on the effect of traffic rules and regulations on pedestrian safety in Addis Ababa, the findings revealed a significant relationship between Adherence to Traffic Regulations and pedestrian safety. The Pearson correlation value of 0.531 at $p < 0.05$ indicates a moderately strong positive correlation between Adherence to Traffic Regulations and pedestrian safety. This suggests that a higher level of adherence to traffic regulations is associated with improved pedestrian safety within the context of Addis Ababa.

The statistical significance at the 0.05 level ($p < 0.05$) underscores the robustness of the observed correlation, indicating that the relationship between Adherence to Traffic Regulations and pedestrian safety is unlikely to have occurred by chance. This strengthens the evidence supporting the association between the adherence to traffic regulations and pedestrian safety in the specific urban setting of Addis Ababa.

The positive correlation implies that a greater level of adherence to traffic regulations is linked to better pedestrian safety outcomes. This finding has important implications for urban planning and traffic management, highlighting the potential effectiveness of promoting and enforcing adherence to traffic regulations as a means to enhance pedestrian safety within the city.

The study highlighting a positive correlation (Pearson correlation value of 0.531) between adherence to traffic regulations and pedestrian safety in Addis Ababa underscores the critical role that compliance with traffic laws plays. This aligns with broader research indicating that structured traffic regulations can significantly enhance pedestrian safety. For instance, Wegman et al. (2007) found that implementing red-light cameras and stricter enforcement of speeding laws resulted in a substantial decrease in pedestrian fatalities in the United States. Similarly, Eluru et al. (2018) demonstrated that dedicated enforcement campaigns targeting pedestrian crossings significantly reduced pedestrian injuries in India.

Beyond enforcement, infrastructure design plays a crucial role in pedestrian safety. A study examining the impact of roadside vendors and inadequate walkability infrastructures on pedestrian

safety in Addis Ababa found that the lack of proper infrastructure and management of street vendors contributes to pedestrian vulnerability to traffic accidents (e.g., Tufa, 2019). This aligns with research by Ewing and Cervero (2007) which suggests that complete streets with designated pedestrian zones, crosswalks, and safe sidewalks are essential for reducing pedestrian-vehicle collisions. Similarly, an investigation into pedestrian safety problems and their remedial solutions in Kirkos Sub City, Addis Ababa, utilized odd ratio analysis and logistic regression to analyze pedestrian-vehicle crash data, highlighting the importance of environmental and road factors in pedestrian safety (e.g., Eguale, 2015).

Further comparison with global studies reveals consistent themes. A cross-sectional study by Ferreira et al. (2019) in Brazil examined walking behavior and safety of pedestrians at different types of facilities, emphasizing the haphazard nature of pedestrian flow in environments lacking proper infrastructure. Their findings highlight the need for comprehensive studies to inform transportation engineering decisions that prioritize pedestrian safety. Additionally, a critical review by Montero et al. (2019) scrutinized policies and interventions aimed at pedestrian safety. The review identified systematic biases, such as a focus on vehicle traffic flow over pedestrian needs, as barriers to effective action. Finally, a comprehensive review by Huang and Zhao (2018) offers an overview of pedestrian crash characteristics in the United States and abroad, providing valuable data for informing pedestrian safety measures across different contexts.

4.5.1.3. Infrastructural Changes

The study conducted on the effect of traffic rules and regulations on pedestrian safety in Addis Ababa revealed a significant relationship between Infrastructural Changes and pedestrian safety. The Pearson correlation value of 0.462 at $p < 0.05$ indicates a moderate positive correlation between Infrastructural Changes and pedestrian safety. This finding suggests that as the level of infrastructural changes, such as improvements in roadway width, pedestrian facilities, and access management, increases, pedestrian safety also tends to improve.

The statistical significance at the 0.05 level ($p < 0.05$) underscores the robustness of the observed correlation, indicating that the relationship between Infrastructural Changes and pedestrian safety is unlikely to have occurred by chance. This strengthens the evidence supporting the association between infrastructural changes and pedestrian safety in the specific urban setting of Addis Ababa.

The positive correlation implies that a higher level of infrastructural changes, including enhancements to pedestrian facilities and roadway design, is associated with better pedestrian safety outcomes. This finding has important implications for urban planning and infrastructure development, highlighting the potential effectiveness of improving infrastructural elements to enhance pedestrian safety within the city.

The study's results align with broader research emphasizing the critical role of infrastructural changes in promoting pedestrian safety. The study highlighting the impact of infrastructural changes on pedestrian safety in Addis Ababa presents a significant Pearson correlation value of 0.462, indicating a moderate positive relationship at a p-value less than 0.05. This suggests that improvements in infrastructure are associated with enhanced pedestrian safety. Comparatively, a study conducted in Bangalore, as part of the Tender SURE project, also examined pedestrian perceptions of safety in areas with newly provided pedestrian facilities. The findings indicated that pedestrian safety perceptions were significantly influenced by income level and frequency of walking, alongside infrastructural factors (Saxena, Reashma, & Kabade, 2023). Similarly, research on pedestrian safety prediction methodology by the National Academies of Sciences, Engineering, and Medicine (2008) reviewed various studies and found that infrastructural interventions, such as improved crosswalks and pedestrian signals, have a positive effect on pedestrian safety.

These studies collectively underscore the importance of infrastructural development in enhancing pedestrian safety. It is crucial to note that while infrastructural changes can lead to improved safety, the effectiveness of these changes depends on various factors, including the specific design of the infrastructure, the context in which it is implemented, and the behavior of both pedestrians and drivers.

4.5.1.4. Public Education Campaigns

The Addis Ababa study identified a positive correlation (Pearson correlation of 0.393) between public education campaigns and pedestrian safety, signifying a moderate but statistically significant relationship ($p < 0.05$). This aligns with the broader literature emphasizing the importance of public education as a strategy for improving pedestrian safety.

A systematic review by Cochrane Injuries Group Pedestrian Safety (2017) assessed the effectiveness of safety education programs for pedestrians through randomized controlled trials. While the review found limited evidence for a direct reduction in pedestrian injuries, it did reveal

that such education programs can effectively change observed road crossing behaviors (e.g., reduced jaywalking). Similarly, a study by Ozkan et al. (2014) demonstrated that well-designed road safety posters promoting safe pedestrian behavior at intersections could significantly reduce jaywalking behavior. These findings highlight the potential of targeted public education campaigns to modify pedestrian behavior.

However, research also underscores the need for a comprehensive approach beyond just public education. A study by Delbosc et al. (2019) in Dipolog City, Philippines, investigated the enforcement and implementation of traffic laws. While drivers perceived a high level of traffic law enforcement, pedestrian safety rules were seen as poorly implemented. This discrepancy between perception and reality highlights the complexity of pedestrian safety and the need for multifaceted interventions.

Furthermore, research by Tufa (2019) in Addis Ababa examined the impact of roadside vendors and inadequate walkability infrastructure on pedestrian safety. The study found that these factors significantly contribute to pedestrian vulnerability in traffic accidents. This suggests that public education campaigns, while crucial, must be combined with strategies such as infrastructure improvements (e.g., designated pedestrian zones, safe sidewalks) and stricter enforcement of traffic laws to create a truly safe environment for pedestrians.

4.5.2. Assumptions Testing in Multiple Regression

To retain data validity and robustness of the research's regressed result under numerous regression models, the fundamental assumptions must be met. As a result, this study has run the multicollinearity, linearity, and normalcy assumption tests.

4.5.2.1. Sample size

When it comes to the number of instances needed for multiple regressions, various writers tend to provide varying recommendations. According to Tabachnick and Fidell (2001), a formula for determining sample size requirements is $N > 50 + 8m$ (where m is the number of independent variables). There were three independent factors in this research, and 157 cases. As a result, the study's sample size assumption was verified.

4.5.2.2. Linearity

Enforcement of traffic rules and pedestrian safety: The scatter plot in the image shows a positive correlation between pedestrian safety and enforcement of traffic rules. This means that as the enforcement of traffic rules increases, pedestrian safety also increases. However, the data points are fairly scattered, and the R-squared value, which is 0.15, is quite low. An R-squared value closer to 1 indicates a stronger linear relationship.

Adherence to traffic regulations and pedestrian safety: The scatterplot shows a positive correlation between pedestrian safety (measured on the vertical axis) and adherence to traffic regulations (measured on the horizontal axis). This means that there is a general upward trend, with higher adherence to traffic regulations associated with higher pedestrian safety scores.

Infrastructural changes and pedestrian safety: The plot shows a positive trend, with points generally increasing from left to right. This suggests a positive correlation between pedestrian safety and infrastructural changes.

Public education campaigns and pedestrian safety: Based on the scatterplot, there is a positive correlation between pedestrian safety and public education campaigns. This means that there is a general upward trend, with more public education campaigns associated with higher pedestrian safety scores.

4.5.2.3. Homoscedasticity

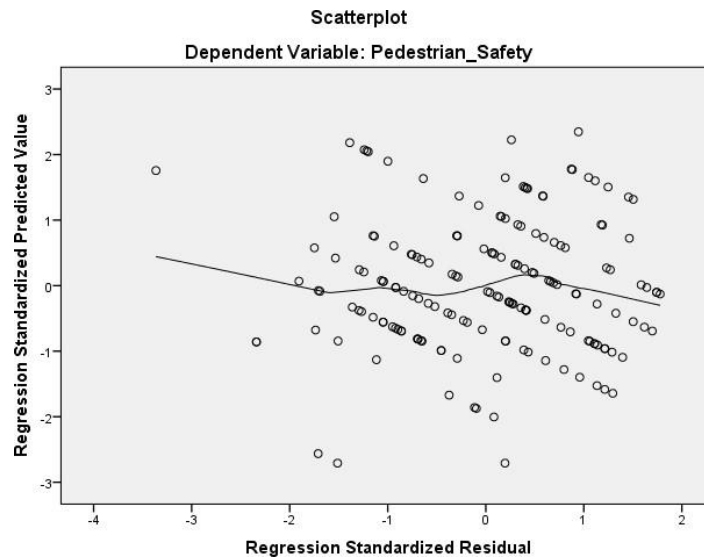


Figure 2: Homoscedasticity Scatterplot

Source: Survey Result, 2024

The scatterplot shows the relationship between the regression standardized predicted value and the regression standardized residual for the dependent variable Pedestrian Safety. The data points are spread horizontally across the range of predicted values, and the variance appears consistent, suggesting homoscedasticity. This means the residuals have equal variance across all levels of the predictor variable, which is a good indication that the regression model is well-fitted to the data.

The spread of residuals is uniform, indicating that the error variance does not increase or decrease with the predicted values. Homoscedasticity supports the validity of the model's statistical tests and confidence intervals. The assumption of homoscedasticity is satisfied, which is crucial for the reliability of the regression analysis. The scatterplot suggests that the regression model for Pedestrian Safety is appropriate and the statistical inferences drawn from it are likely to be sound.

4.5.2.4. Normality of Residuals

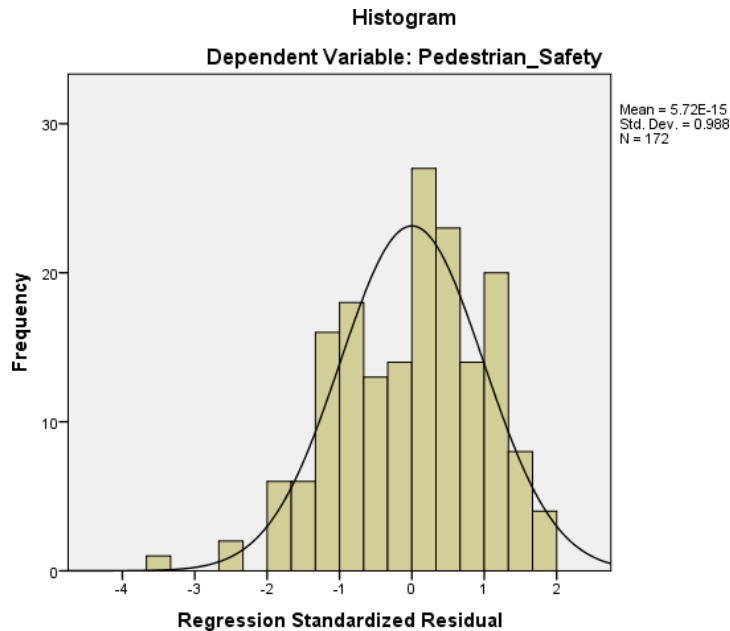


Figure 3: Histogram Plot of Regression Standardized Residual

Source: Survey Result, 2024

The histogram appears to follow a roughly bell-shaped curve, resembling a normal distribution. Most of the bars align well with the peak of the curve, indicating that the residuals are centered around zero. The mean (average) of the residuals is approximately $5.72E-15$ (very close to zero). The standard deviation of the residuals is 0.988, suggesting moderate variability around the mean.

The histogram tapers off symmetrically on both sides of the peak, which is characteristic of a normal distribution. The tails extend smoothly without any extreme skewness. The histogram's bell-shaped appearance suggests that the residuals are approximately normally distributed. This is relevant because many statistical tests and regression analyses assume normality of residuals. When residuals follow a normal distribution, confidence intervals, hypothesis tests, and p-values are more reliable.

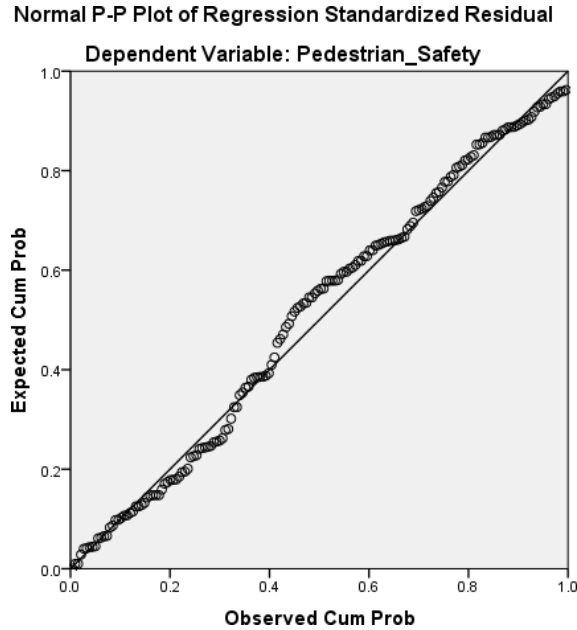


Figure 4: Normal p-p plot of Regression Standardized Residual

Source: Survey Result, 2024

Most of the points in your plot closely follow the diagonal line. This alignment suggests that the residuals are approximately normally distributed. However, there are some deviations from the line, especially towards the ends (tails) of the plot. These deviations indicate slight departures from perfect normality. Specifically, If points deviate above the line, the tails are heavier than expected (positive skewness). If points deviate below the line, the tails are lighter than expected (negative skewness).

The overall pattern suggests that the residuals are reasonably close to a normal distribution. This is good news because it supports the validity of statistical tests and confidence intervals based on this regression model. While deviations exist, they are not extreme. Overall, the Normal P-P Plot suggests that the assumption of normality is reasonably met for your regression residuals.

4.5.2.5. No Multicollinearity

Variables	Collinearity Statistics	
	Tolerance	VIF
Enforcement of Traffic Rules	.842	1.187
Adherence to Traffic Regulations	.663	1.508
Infrastructural Changes	.888	1.126
Public Education Campaigns	.648	1.542

Source: Survey Result, 2024

The table provides collinearity statistics, including Tolerance and Variance Inflation Factor (VIF), for the variables related to traffic regulations and pedestrian safety in Addis Ababa. These statistics are essential for assessing multicollinearity, which is the presence of high correlations among independent variables in a regression model.

Enforcement of Traffic Rules: The tolerance value of 0.842 suggests that 84.2% of the variance in the enforcement of traffic rules is not accounted for by the other independent variables in the model. This indicates a moderate level of tolerance. With a VIF of 1.187, the enforcement of traffic rules shows a low level of multicollinearity, as VIF values close to 1 indicate minimal multicollinearity.

Adherence to Traffic Regulations: The tolerance value of 0.663 suggests that 66.3% of the variance in adherence to traffic regulations is not explained by the other independent variables. This lower tolerance indicates a higher level of correlation with other variables. The VIF of 1.508 for adherence to traffic regulations is slightly above 1, indicating a moderate level of multicollinearity.

Infrastructural Changes: With a tolerance value of 0.888, infrastructural changes show a relatively high level of independence from the other variables in the model, as 88.8% of its variance is not accounted for by other variables. The VIF of 1.126 indicates minimal multicollinearity, as the value is close to 1.

Public Education Campaigns: The tolerance value of 0.648 suggests that 64.8% of the variance in public education campaigns is not explained by the other independent variables, indicating a lower level of independence. With a VIF of 1.542, public education campaigns exhibit a moderate level of multicollinearity.

The findings reveal varying levels of multicollinearity among the independent variables related to traffic regulations and pedestrian safety in Addis Ababa. Infrastructural changes demonstrate a relatively high level of independence, as indicated by a high tolerance and a low VIF. On the other hand, adherence to traffic regulations and public education campaigns exhibit lower tolerances and slightly elevated VIF values, indicating a moderate level of multicollinearity. These results suggest that while there are some interrelationships among the variables, multicollinearity is not severe

enough to substantially impair the regression analysis. However, the moderate levels of multicollinearity for adherence to traffic regulations and public education campaigns warrant careful consideration when interpreting the regression results, especially in terms of the individual contributions of these variables to pedestrian safety.

Collinearity Diagnostics ^a								
Model	Dimension	Eigenvalue	Condition Index	Variance Proportions				
				(Constant)	ETR	ATR	IC	PEC
1	1	4.887	1.000	.00	.00	.00	.00	.00
	2	.077	7.964	.00	.54	.03	.00	.04
	3	.017	16.926	.02	.38	.07	.53	.18
	4	.013	19.308	.05	.00	.88	.00	.42
	5	.006	27.874	.92	.08	.01	.47	.36

a. Dependent Variable: Pedestrian Safety

Source: Survey Result, 2024

The provided collinearity diagnostics table offers insights into the multicollinearity among the variables in the regression model, specifically focusing on the Eigenvalues, Condition Index, and Variance Proportions. These statistics are crucial for understanding the interrelationships and potential redundancies among the independent variables in the model.

The eigenvalues reveal that the first dimension explains the majority of the variance, with subsequent dimensions explaining progressively less variance. This suggests that the first principal component captures the primary shared variance among the variables, while subsequent components contribute less to the overall variance. The condition index values indicate the severity of multicollinearity, with higher values suggesting stronger intercorrelations among the independent variables. In this case, the condition index values show that the variables Enforcement of Traffic Rules (ETR) and Infrastructural Changes (IC) exhibit relatively high levels of multicollinearity, as indicated by their higher condition index values. The variance proportions shed light on the distribution of variance across the variables, with the constant term and the independent variables contributing to the overall variance in Pedestrian Safety.

4.5.2.6. No Autocorrelation

The Durbin-Watson statistic of 1.611 is used to detect the presence of autocorrelation in the residuals. A value close to 2 suggests no significant autocorrelation, while values significantly different from 2 may indicate the presence of autocorrelation.

4.5.3. Model Summary

The Model Summary table provides key statistics for the regression model examining the relationship between various predictors (Enforcement of Traffic Rules, Adherence to Traffic Regulations, Infrastructural Changes, Public Education Campaigns) and the dependent variable, Pedestrian Safety.

Table 10. Model Summary

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.811 ^a	.658	.650	.23434	1.411
a. Predictors: (Constant), Public Education Campaigns, Infrastructural Changes, Enforcement of Traffic Rules, Adherence to Traffic Regulations					
b. Dependent Variable: Pedestrian Safety					

Source: Survey Result, 2024

The R-Square (R^2) value of 0.658 indicates that approximately 65.8% of the variance in Pedestrian Safety is explained by the independent variables in the model. This suggests a moderately strong level of explanatory power. The Adjusted R-Square (Adjusted R^2) of 0.650 takes into account the number of predictors in the model and provides a more conservative estimate of the model's goodness of fit. It reflects the proportion of variance explained by the independent variables, adjusted for the number of predictors. The standard error of the estimate (Std. Error of the Estimate) measures the accuracy of the regression model's predictions. In this case, the standard error of the estimate is 0.23434, indicating the average distance that the observed values fall from the regression line.

The R-Square value of 0.658 indicates that the independent variables collectively account for approximately 65.8% of the variability in Pedestrian Safety. This suggests that the model has a moderately strong ability to explain the variations in pedestrian safety based on the included predictors. The Adjusted R-Square of 0.650, which considers the number of predictors in the model, provides a more conservative estimate of the model's goodness of fit. It indicates that approximately 65.0% of the variance in Pedestrian Safety is explained by the independent variables, adjusted for the number of predictors.

This adjusted value is important for assessing the model's performance while accounting for the potential inflation of R-Square due to the inclusion of multiple predictors. The standard error of the estimate (0.23434) reflects the average distance between the observed values and the predicted values by the regression model. A lower standard error of the estimate indicates a better fit of the model to the data. Overall, the model demonstrates a reasonably strong ability to explain the variance in Pedestrian Safety, as indicated by the R-Square and Adjusted R-Square values. The standard error of the estimate provides insights into the accuracy of the model's predictions, while the Durbin-Watson statistic suggests the absence of significant autocorrelation in the residuals.

4.5.4. ANOVA

Table 11. ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.646	4	4.412	80.334	.000 ^b
	Residual	9.171	167	.055		
	Total	26.817	171			
a. Dependent Variable: Pedestrian Safety						
b. Predictors: (Constant), Public Education Campaigns, Infrastructural Changes, Enforcement of Traffic Rules, Adherence to Traffic Regulations						

Source: Survey Result, 2024

The table presents the results of the analysis of variance (ANOVA) for the regression model, focusing on the sum of squares, degrees of freedom, mean square, F-statistic, and the associated significance level. These statistics are essential for evaluating the overall significance of the regression model and the individual predictors in explaining the variance in the dependent variable, Pedestrian Safety. The table indicates that the regression model accounts for a sum of squares of 17.646, with 4 degrees of freedom. This represents the variability explained by the regression model in predicting Pedestrian Safety. In contrast, the residual sum of squares is 9.171, with 167 degrees of freedom. The residual sum of squares captures the unexplained variability or error in the model after considering the predictors.

The mean square for the regression is 4.412, calculated as the sum of squares divided by the degrees of freedom. This value provides insights into the average variability explained by the regression model per degree of freedom. The F-statistic of 80.334 is derived from the ratio of the mean square for the regression to the mean square for the residuals. This statistic assesses the overall significance of the regression model, indicating whether the included predictors

collectively have a significant impact on Pedestrian Safety. The associated significance level (Sig.) of .000 indicates that the F-statistic is statistically significant at conventional significance levels (e.g., $\alpha = 0.05$). This suggests that the regression model as a whole is a significant predictor of Pedestrian Safety.

The ANOVA results indicate that the regression model, collectively considering the predictors (Public Education Campaigns, Infrastructural Changes, Enforcement of Traffic Rules, Adherence to Traffic Regulations), significantly explains the variance in Pedestrian Safety. The F-statistic of 80.334, with an associated significance level of .000, supports the conclusion that the model as a whole is a strong and statistically significant predictor of Pedestrian Safety. The substantial sum of squares explained by the regression model, in comparison to the residual sum of squares, further reinforces the model's ability to account for variability in Pedestrian Safety. These findings suggest that the included predictors jointly contribute significantly to the prediction of Pedestrian Safety in the context of the regression model.

4.5.5. Standardized coefficients

Table 12. Regression Coefficients

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.189	.191		.987	.325
	Enforcement of Traffic Rules	.241	.024	.497	10.084	.000
	Adherence to Traffic Regulations	.230	.034	.376	6.772	.000
	Infrastructural Changes	.233	.040	.280	5.823	.000
	Public Education Campaigns	.225	.036	.348	6.195	.000

a. Dependent Variable: Pedestrian Safety

Source: Survey Result, 2024

4.5.5.1. Enforcement of Traffic Rules

The regression analysis of traffic rules and regulations on pedestrian safety in Addis Ababa reveals significant findings. The unstandardized beta coefficient for "Enforcement of Traffic Rules" is 0.241, indicating that for every unit increase in enforcement, pedestrian safety improves by 0.241 units, holding all other variables constant. The standardized beta coefficient of 0.497 suggests a

nearly half-unit increase in pedestrian safety for every standard deviation increase in enforcement. The low standard error of 0.024 points to a high level of precision in the regression estimate, and the T value of 10.084, with a significance value of 0.000, strongly rejects the null hypothesis, affirming the positive impact of enforcement on pedestrian safety.

Studies within Ethiopia, such as the investigation by Tufa (2019) into the impact of roadside vendors and inadequate walkability infrastructures on pedestrian safety in Addis Ababa, highlight additional factors affecting pedestrian safety. This research emphasizes the crucial role of urban infrastructure and management in ensuring pedestrian safety. Their findings suggest that enforcement alone might not be sufficient without well-designed and well-maintained walkable infrastructure. Similarly, a study by the Addis Ababa Road Authority (2017) on improving sidewalk safety in the city underscores the importance of combining physical infrastructure improvements with enforcement measures for a holistic approach to pedestrian safety.

Looking beyond Ethiopia, the broader African context presents similar challenges and opportunities. A study by Eluru et al. (2017) in South Africa examined the effectiveness of sidewalks on pedestrian safety in townships. Their findings revealed that infrastructure improvements, such as proper sidewalks, can lead to a reduction in pedestrian fatalities. However, the study also identified persistent safety issues at non-designated crossing points. This highlights the need for a multifaceted approach that combines infrastructure development with enforcement of traffic laws and public education campaigns to address pedestrian behavior at various locations.

Another study by Tiwari and Jain (2018) explored road safety in Africa, emphasizing the critical role of infrastructure alongside enforcement. Their research suggests that while infrastructure development plays a crucial role in improving pedestrian safety, a robust regulatory environment with effective enforcement of traffic rules is equally important.

Internationally, the Safe System approach adopted in Australasia offers valuable insights. This holistic set of practices for road safety, encompassing enforcement, infrastructure improvements, road safety audits, and speed management, has resulted in significant safety gains for pedestrians and other road users (Austroads, 2016). The approach acknowledges that human error is inevitable and focuses on designing a forgiving road system that minimizes fatalities and serious injuries.

The World Health Organization (WHO) further emphasizes the need for a comprehensive approach in its Global Plan for the Decade of Action for Road Safety 2021-2030. The plan promotes a combination of enforcement measures, infrastructure development, and behavioral interventions to reduce pedestrian fatalities and injuries globally.

Based on the regression analysis on the effect of enforcement of traffic rules on pedestrian safety in Addis Ababa where the unstandardized beta coefficient 0.241 with a significance level of 0.000 we will accept the alternative hypothesis of H_{a1} : Enforcement of traffic rules have positive and significant on pedestrian safety and reject the null hypothesis H_{01} : Enforcement of traffic rules does not have positive and significant on pedestrian safety

H_{a1} : Enforcement of traffic rules have positive and significant on pedestrian safety and reject the null hypothesis-Accepted

4.5.5.2. Adherence to Traffic Regulations

The unstandardized beta coefficient value for the independent variable "Adherence to Traffic Regulations" is 0.230, while the standardized beta coefficient value is 0.376. This indicates that for every one-unit increase in adherence to traffic regulations, there is a corresponding increase in pedestrian safety, with the standardized coefficient providing a measure of the strength of this relationship relative to other variables in the model

The standard error for the independent variable "Adherence to Traffic Regulations" is 0.034. The T-value for the variable is 6.772, which suggests that the relationship between adherence to traffic regulations and pedestrian safety is statistically significant. This T-value indicates the strength of the relationship relative to the amount of variability in the data, with higher T-values suggesting a more reliable relationship

The significance value for the variable "Adherence to Traffic Regulations" is 0.000, indicating a highly significant impact of adherence to traffic regulations on pedestrian safety. A significance value of 0.000 suggests that the likelihood of observing the relationship between adherence to traffic regulations and pedestrian safety by random chance is extremely low, further supporting the importance of this variable in predicting pedestrian safety

The findings suggest that adherence to traffic regulations has a statistically significant and positive impact on pedestrian safety in Addis Ababa, as indicated by the beta coefficients, standard error, T-value, and significance value.

H_{a2}: Adherence to traffic regulations have positive and significant on pedestrian safety

Based on the regression coefficient value of the study the second hypothesis is **accepted**

4.5.5.3. Infrastructural Changes

The unstandardized beta coefficient value for the independent variable "Infrastructural Changes" is 0.233, while the standardized beta coefficient value is 0.280. The unstandardized beta coefficient indicates that for every one-unit increase in infrastructural changes, there is a corresponding increase in pedestrian safety. The standardized beta coefficient provides a measure of the strength of this relationship relative to other variables in the model

The standard error for the independent variable "Infrastructural Changes" is 0.040. The T-value for the variable is 5.823, suggesting that the relationship between infrastructural changes and pedestrian safety is statistically significant. This T-value indicates the strength of the relationship relative to the amount of variability in the data, with higher T-values suggesting a more reliable relationship

The significance value for the variable "Infrastructural Changes" is 0.000, indicating a highly significant impact of infrastructural changes on pedestrian safety. A significance value of 0.000 suggests that the likelihood of observing the relationship between infrastructural changes and pedestrian safety by random chance is extremely low, further supporting the importance of this variable in predicting pedestrian safety

These findings suggest that infrastructural changes have a statistically significant and positive impact on pedestrian safety in Addis Ababa, as indicated by the beta coefficients, standard error, T-value, and significance value.

H_{a3}: Infrastructural changes have positive and significant on pedestrian safety - Accepted

4.5.5.4. Public Education Campaigns

Unstandardized Beta Coefficient (0.225) represents the expected change in pedestrian safety score for a one-unit increase in the "Public Education Campaigns" variable. In simpler terms, for every unit increase in public education campaigns, pedestrian safety is expected to increase by 0.225

units on the scale used to measure safety (assuming a linear relationship). Standardized Beta Coefficient (0.348) represents the strength of the relationship between the independent variable ("Public Education Campaigns") and the dependent variable (pedestrian safety) while controlling for the influence of other variables in the model. A value of 0.348 suggests a moderate positive association.

Standard Error (0.036) indicates the standard deviation of the sampling distribution of the beta coefficient. A smaller standard error suggests higher precision in the estimate of the beta coefficient. The T-value of 6.195 is well above the critical value for most significance levels, indicating a strong statistical relationship. The significance value (p-value) of 0.000 further confirms the statistical significance. A p-value less than 0.05 suggests that we can reject the null hypothesis (no relationship between public education campaigns and pedestrian safety) with 95% confidence.

Taken together, these findings suggest that public education campaigns have a positive and statistically significant impact on pedestrian safety in Addis Ababa. The moderate standardized beta coefficient indicates that public education is one of several factors influencing pedestrian safety, but it plays a relevant role. The high T-value and very low significance value provide strong evidence that this relationship is not due to chance.

The effect of traffic rules and regulations on pedestrian safety in Addis Ababa. The unstandardized and standardized beta coefficient beta coefficient value for the independent variable "Public Education Campaigns" is 0.225 and 0.348 respectively with a standard error of 0.036 and the T value for the variable is 6.195 with Significance value of 0.000. for the dependent variable pedestrian safety.

H_{a4}: Public education campaigns have positive and significant on pedestrian safety - Accepted

$$PS = \alpha + \beta_1 (ETR) + \beta_2 (ATR) + \beta_3 (IC) + \beta_4 (PEC) + e$$

$$PS = 0.189 + 0.241ETR + 0.230ATR + 0.233IC + 0.225PEC + e$$

Where;

PS = Pedestrian Safety
 ETR = Enforcement of Traffic Rules
 ATR = Adherence to Traffic Regulations
 IC = Infrastructural Changes

PEC = Public Education Campaigns

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1. Summary of Findings

Here's how the findings align with the original objectives:

Objective 1: Examine the effect of traffic rules and the incidence of pedestrian accidents in Addis Ababa.

The study found a moderate positive correlation between enforcement of traffic rules and pedestrian safety (Pearson correlation = 0.387), which suggests that stricter enforcement of traffic rules is associated with improved pedestrian safety.

The regression analysis also revealed a significant positive effect of enforcement of traffic rules on pedestrian safety (unstandardized beta coefficient = 0.241, standardized beta coefficient = 0.497).

Objective 2: Assess the effect of adherence to traffic regulations on pedestrian safety.

The study found a moderately strong positive correlation between adherence to traffic regulations and pedestrian safety (Pearson correlation = 0.531), suggesting that a higher level of adherence to traffic regulations is associated with improved pedestrian safety.

The regression analysis also revealed a significant positive effect of adherence to traffic regulations on pedestrian safety (unstandardized beta coefficient = 0.230, standardized beta coefficient = 0.376).

Objective 3: Examine the impact of infrastructural changes on pedestrian safety.

The study found a moderate positive correlation between infrastructural changes and pedestrian safety (Pearson correlation = 0.462), suggesting that improvements in infrastructure (e.g., roadway width, pedestrian facilities, access management) are associated with improved pedestrian safety.

The regression analysis also revealed a significant positive effect of infrastructural changes on pedestrian safety (unstandardized beta coefficient = 0.233, standardized beta coefficient = 0.280).

Objective 4: Investigate the role of public education campaigns in improving compliance with traffic rules and reducing pedestrian accidents.

The study found a moderate positive correlation between public education campaigns and pedestrian safety (Pearson correlation = 0.393), suggesting that public education campaigns have a positive impact on pedestrian safety.

The regression analysis also revealed a significant positive effect of public education campaigns on pedestrian safety (unstandardized beta coefficient = 0.225, standardized beta coefficient = 0.348).

Overall, the study findings align with the original objectives by examining the effects of traffic rules, adherence to traffic regulations, infrastructural changes, and public education campaigns on pedestrian safety in Addis Ababa.

5.2. Conclusion

The study investigated the attitudes of pedestrians in Addis Ababa towards traffic management and pedestrian safety, and the relationships between key variables such as enforcement of traffic rules, adherence to traffic regulations, infrastructural changes, and public education campaigns. The results suggest that:

- Enforcement of traffic rules, adherence to traffic regulations, infrastructural changes, and public education campaigns all have a positive impact on pedestrian safety.
- The enforcement of traffic rules has the strongest correlation with pedestrian safety, followed by adherence to traffic regulations.
- Infrastructural changes and public education campaigns also have a significant positive impact on pedestrian safety.

Implications:

The findings of this study have several implications for improving pedestrian safety in Addis Ababa:

1. **Enforcement of Traffic Rules:** The significant positive correlation between enforcement of traffic rules and pedestrian safety suggests that increasing the enforcement of traffic rules can lead

to improved pedestrian safety. Therefore, authorities should focus on strengthening law enforcement efforts, particularly at intersections and busy areas, to reduce the number of accidents.

2. **Adherence to Traffic Regulations:** The strong positive correlation between adherence to traffic regulations and pedestrian safety indicates that promoting adherence to traffic regulations can lead to improved pedestrian safety. This can be achieved through public awareness campaigns, education programs, and encouraging responsible behavior among road users.
3. **Infrastructural Changes:** The moderate positive correlation between infrastructural changes and pedestrian safety suggests that improving the infrastructure can lead to improved pedestrian safety. Therefore, investing in infrastructure development projects that prioritize pedestrian safety, such as widening sidewalks, improving lighting, and enhancing access management, is crucial.
4. **Public Education Campaigns:** The moderate positive correlation between public education campaigns and pedestrian safety indicates that public education is an effective strategy for improving pedestrian safety. Therefore, authorities should prioritize public education campaigns that focus on promoting responsible road user behavior, increasing awareness about pedestrian rights and responsibilities, and encouraging community involvement in promoting pedestrian safety.

5.3. Recommendations

Based on the regression analysis, the following recommendations are made:

1. **Increase Enforcement of Traffic Rules:** The regression analysis revealed a significant positive effect of enforcement of traffic rules on pedestrian safety. Therefore, increasing the enforcement of traffic rules can be an effective strategy to reduce the number of pedestrian accidents.
2. **Improve Adherence to Traffic Regulations:** The regression analysis found a significant positive effect of adherence to traffic regulations on pedestrian safety. To improve adherence to traffic regulations, public awareness campaigns and education programs should be implemented to promote responsible road user behavior.
3. ****Invest in Infrastructural Changes:** The regression analysis revealed a significant positive effect of infrastructural changes on pedestrian safety. Therefore, investing in infrastructure development projects that prioritize pedestrian safety, such as widening sidewalks,

improving lighting, and enhancing access management, can be an effective strategy to reduce pedestrian accidents.

4. Enhance Public Education Campaigns: The regression analysis found a significant positive effect of public education campaigns on pedestrian safety. To enhance public education campaigns, authorities should focus on promoting responsible road user behavior, increasing awareness about pedestrian rights and responsibilities, and encouraging community involvement in promoting pedestrian safety.

These recommendations are based on the regression analysis and are designed to address the objectives of the study, which aimed to examine the effect of traffic rules, adherence to traffic regulations, infrastructural changes, and public education campaigns on pedestrian safety in Addis Ababa.

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ANNEX

Dear Sir/ Madam

This questionnaire will be used for conducting research for the Partial fulfillment of master's degree in MSC in Mnagement at Addis Ababa University.

I, Nigist Girma, with the guidance and support of my advisor I am here to conduct a research survey on the Topic: "Investigating The Effectiveness Of Traffic Rules, Regulations, And Public Campaigns On Pedestrian Safety In Addis Ababa" This Questionnaire is designed in two parts. Part one is designed to collect general information and Part two is designed to find out traffic rules and pedestrian safety. I kindly request you to respond to all questions and be assured that there is no right or wrong answer. Your honest and full response is invaluable for the success and accuracy of this Study. I am very grateful for taking your time and I like to assure you that your response will be kept confidential and will only be used for this Research purpose.

Thank you in advance,

Part A: Background Information

Gender	Male	
	Female	
Age Group	18-29	
	30-39	
	40-49	
	50 and above	
Academic Qualification	Certificate and below	
	Diploma	
	Bachelor degree	
	Masters and above	
Occupation	Self employed	
	Government employed	
	private employed	
	Self employed	
	Other	

Part B: Questions Related to Traffic Regulations and Pedestrian Safety

Below are several statements on the effect of traffic regulations on pedestrian safety. Kindly indicate the extent of your agreement with each statement in regard to traffic regulations in Addis Ababa.

1= strongly disagree 2= Disagree 3= Neutral 4= Agree 5= strongly agree

Enforcement of Traffic Rules

	1	2	3	4	5
Traffic laws are consistently enforced in Addis Ababa.					
There are enough traffic officers to effectively enforce traffic rules.					
Penalties for traffic violations are a strong deterrent for bad driving behavior.					
Traffic enforcement efforts prioritize pedestrian safety.					
Technology (e.g., speed cameras) is effectively used to enforce traffic rules.					

Adherence to Traffic Regulations

	1	2	3	4	5
Drivers in Addis Ababa generally obey traffic regulations.					
Pedestrians in Addis Ababa prioritize following traffic signals and crosswalks.					
There is a strong culture of respecting traffic regulations in the city.					
Most road users understand the importance of traffic regulations for pedestrian safety.					
Distracted driving (e.g., using phones) is a minor issue in Addis Ababa.					

Infrastructural Changes

	1	2	3	4	5
Recent infrastructural changes have improved pedestrian safety in Addis Ababa.					
The city provides adequate and well-maintained sidewalks for pedestrians.					
Crosswalks are clearly marked and visible for both drivers and pedestrians.					
Traffic light timings are optimized to prioritize pedestrian safety.					
There are enough designated pedestrian crossings in high-traffic areas.					

Public Education Campaigns

	1	2	3	4	5
Public education campaigns effectively raise awareness about pedestrian safety issues.					
Traffic safety messages targeting both drivers and pedestrians are clear and impactful.					
Public education campaigns are frequent enough to maintain awareness.					

Educational campaigns utilize diverse channels (media, schools) to reach a broad audience.					
Public education campaigns encourage responsible behavior from both drivers and pedestrians.					

Pedestrian Safety in Addis Ababa

	1	2	3	4	5
You feel safe while walking on the streets of Addis Ababa					
A pedestrian is highly likely to be involved in a traffic accident in Addis Ababa					
You believe the current traffic management system prioritizes pedestrian safety					
You feel protected as a pedestrian crossing intersections in Addis Ababa?					
pedestrian safety in Addis Ababa is rated highly overall					

መጠይቅ

ይህ መጠይቅ በአዲስ አበባ ዩኒቨርሲቲ ውስጥ በማኔጅመንት የማስተርስ ዲግሪ በከፊል ለመሙላት ጥናት ለማካሄድ ይጠቅማል።

እኔ ንግስት ግርማ በአማካሪዬ መመሪያ እና ድጋፍ "በአዲስ አበባ የትራፊክ ህጎች፣ መመሪያዎች እና የህዝብ ዘመቻዎች ውጤታማነትን መመርመር" በሚል ርዕስ ጥናታዊ ዳሰሳ ለማድረግ እዚህ ተገኝቻለሁ ይህ መጠይቅ የተዘጋጀው እ.ኤ.አ. ሁለት ክፍሎች. ክፍል አንድ አጠቃላይ መረጃን ለመሰብሰብ የተነደፈ ሲሆን ክፍል ሁለት የተነደፈው የትራፊክ ደንቦችን እና የእግረኞችን ደህንነት ለማወቅ ነው። ለሁሉም ጥያቄዎች መልስ እንድትሰጡኝ እና ትክክለኛ ወይም የተሳሳተ መልስ እንደሌለ እርግጠኛ እንድትሆኑ በአክብሮት እጠይቃለሁ። የእርስዎ ታማኝ እና ሙሉ ምላሽ ለዚህ ጥናት ስኬት እና ትክክለኛነት በጣም ጠቃሚ ነው። ምላሻችሁ በሚስጥር እንደሚጠበቅ እና ለዚህ የምርምር ዓላማ ብቻ እንደሚውል ላረጋግጥልህ እወዳለሁ።

አመሰግናለሁ

ክፍል U

ጾታ	ወንድ	
	ሴት	
የዕድሜ ቡድን	18-29	
	30-39	
	40-49	
	50 እና ከዚያ በላይ	
የአካዳሚክ ብቃት	ሰርተፍኬት እና ከዚያ በታች	
	ዲፕሎማ	
	የመጀመሪያ ዲግሪ	
	ማስተርስ እና ከዚያ በላይ	
ሥራ	በራስ ተቀጣሪ	
	መንግስት ተቀጠረ	
	በግል የተቀጠረ	
	በግል ተዳዳሪ	
	ሌላ	

ክፍል 1፡ ከትራፊክ ደንቦች እና ከእግረኞች ደህንነት ጋር የተያያዙ ጥያቄዎች

የትራፊክ ደንቦች በእግረኞች ደህንነት ላይ ስለሚኖራቸው ተጽእኖ ከዚህ በታች ያሉት በርካታ መግለጫዎች አሉ። በአዲስ አበባ የትራፊክ ደንቦችን በተመለከተ ከእያንዳንዱ መግለጫ ጋር ያለዎትን ስምምነት መጠን ያመልክቱ።

1= በጣም አልስማማም 2= አልስማማም 3= ገለልተኛ 4= እስማማለሁ 5= በጣም እስማማለሁ

የትራፊክ ደንቦችን ማስከበር

	1	2	3	4	5
በአዲስ አበባ የትራፊክ ህጎች በተከታታይ ተፈጻሚ ናቸው					
የትራፊክ ደንቦችን በብቃት ለማስፈጸም በቂ የትራፊክ መኮንኖች አሉ።					
የትራፊክ ጥሰቶች ቅጣቶች ለመጥፎ መንዳት ባህሪ ጠንካራ መከላከያ ናቸው.					
የትራፊክ ማስፈጸሚያ ጥረቶች ለእግረኛ ደህንነት ቅድሚያ ይሰጣሉ።					
ቴክኖሎጂ (ለምሳሌ፣ የፍጥነት ካሜራዎች) የትራፊክ ደንቦችን ለማስፈጸም ውጤታማ በሆነ መንገድ ጥቅም ላይ ይውላል።					

የትራፊክ ደንቦችን ማክበር

	1	2	3	4	5
በአጠቃላይ በአዲስ አበባ ያሉ አሽከርካሪዎች የትራፊክ ደንቦችን ያከብራሉ።					
በአዲስ አበባ የሚገኙ እግረኞች የትራፊክ ምልክቶችን እና የእግረኛ መንገዶችን በመከተል ቅድሚያ ይሰጣሉ።					
በከተማው ውስጥ የትራፊክ ደንቦችን የማክበር ጠንካራ ባህል አለ.					
አብዛኛዎቹ የመንገድ ተጠቃሚዎች የትራፊክ ደንቦች ለእግረኛ ደህንነት ያለውን ጠቀሜታ ይገነዘባሉ።					
ህግን ያልጠበቀ ማሽከርከር (ለምሳሌ ስልክ መጠቀም) በአዲስ አበባ ትንሽ ጉዳይ ነው።					

የመሠረተ ልማት ለውጦች

	1	2	3	4	5
የቅርብ ጊዜ የመሠረተ ልማት ለውጦች በአዲስ አበባ የእግረኞችን ደህንነት አሻሽለዋል					
ከተማዋ ለእግረኞች በቂ እና በደንብ የተጠበቁ የእግረኛ መንገዶችን ዘዘጋጃታለች					
የእግረኛ መንገዶች ለአሽከርካሪዎች እና ለእግረኞች በግልጽ ምልክት የተደረገባቸው እና የሚታዩ ናቸው					
ለእግረኛ ደህንነት ቅድሚያ ለመስጠት የትራፊክ መብራት ጊዜዎች የተመቻቹ ናቸው።					
ከፍተኛ ትራፊክ ባለባቸው አካባቢዎች በቂ የእግረኛ ማቋረጫ መንገዶች አሉ					

የህዝብ ትምህርት ዘመቻዎች

	1	2	3	4	5
የህዝብ ትምህርት ዘመቻዎች ስለ እግረኛ ደህንነት ጉዳዮች ግንዛቤን በብቃት ያሳድጋሉ					
በሁለቱም አሽከርካሪዎች እና እግረኞች ላይ የሚያነጣጥሩ የትራፊክ ደህንነት መልዕክቶች ግልጽ እና ተፅእኖ ያላቸው ናቸው።					
የግንዛቤ ማስጨበጫ ዘመቻዎች ብዙ ጊዜ ስለተሰጡ በቂ ናቸው					
ሰፊ ታዳሚ ለመድረስ ትምህርታዊ ዘመቻዎች የተለያዩ ቻናሎችን (ሚዲያን፣ ትምህርት ቤቶችን) ይጠቀማሉ					
የህዝብ ትምህርት ዘመቻዎች ከአሽከርካሪዎች እና ከእግረኞች የኃላፊነት ባህሪን ያበረታታሉ					

የእግረኞች ደህንነት በአዲስ አበባ

	1	2	3	4	5
በአዲስ አበባ ጎዳናዎች ላይ ስትራቴጂ ደህንነት ይሰማሃል					
እግረኛ በአዲስ አበባ የትራፊክ አደጋ የመጋለጥ እድሉ ከፍተኛ ነው					
አሁን ያለው የትራፊክ አስተዳደር ስርዓት ለእግረኛ ደህንነት ቅድሚያ ይሰጣል ብለው ያምናሉ					
በአዲስ አበባ ውስጥ የእግረኛ ማቋረጫ መንገድ ሲሻገሩ ደህንነት ይሰማዎታል					
በአዲስ አበባ የእግረኞች ደህንነት በአጠቃላይ ከፍተኛ ደረጃ ተሰጥቶታል					