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**THE MAJOR CAUSES OF VEHICLE TRAFFIC CONGESTION ON ADISUGEBEYA
ROUNDBOUT TO MINILIK II SQUARE CORRIDOR IN ADDIS ABABA**

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September, 2025**

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ATHESIS SUBMITTED TO THE DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL
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This is to certify that the thesis is prepared by Biruk Getasetegn, entitled: *The major causes of vehicle traffic congestion on Addisu Gebeya Roundabout to MinilikII Square Corridor* and submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Geography and Environmental Studies (Population, Resources and Development) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Abstract

This thesis is the analysis of traffic congestion in Addis Ababa with a particular emphasis on Addisu Gebeya Roundabout to Menelik II Square Corridor. Traffic congestion is one of many serious global problems of cities of both developed and developing countries. In most cities, especially in developing regions it results in massive delays, monetary losses, fuel wastage, and accidents. Due to poorly planned road networks and land use, and poor traffic management, it results into elongated traffic congestion. Due to the growth in population in Addis Ababa and the movement of people into urban areas coupled with an increase in car ownership and usage exacerbates the demand for road space and impact mobility. To achieve the goal of the study both qualitative and quantitative research methodologies have been used to analyze traffic flow problem. For a thorough and precise understanding of the problem data of traffic counting and traffic delay surveys were made. The findings of the study showed the worst time congestion in Addisu Gebeya Roundabout to Minilik II Square corridor is between 8 and 9 a.m. The main causes of traffic congestion on Addisu Gebeya Roundabout to Minilik II Square corridor are on street and illegal parking, poorly designed bus and taxi loading and unloading stops, Less public transport use and Rigid working hours of the employees and an inability to manage traffic flow. The corridor between Semen Mazegaja traffic light and Addisu Gebeya roundabout is very congested. The study area is affected by traffic congestion in terms of time waste, delayed mobility, psychological stress, inability to predict travel time, and fuel usage. The primary solutions to address traffic congestion in the Addisu Gebeya Roundabout to Minilik II Square corridor are control On-street and illegal parking, improving the standard of the bus and taxi stops, increased public transportation usage, and flexible working hours scheduling

Keywords: *Traffic congestion, urban mobility, Addis Ababa, parking management, public transport, traffic flow*

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Acronyms /Abbreviations

A.A:	Addis Ababa.
AACRA:	Addis Ababa City Road Authority.
ADP:	Average Delay per passenger
Adv:	Average Delay per Vehicle
BRT:	Bus Rapid Transit
CBD:	Central Business District.
CSA	Central Statistical Agency,
ECMT:	European Conference of Ministers of Transport
GDP:	Gross Domestic Product
GRP:	Gross Regional Product
HEI:	Health Effects Institute
HCH:	Highway Capacity Handbook
HOV:	High-Occupancy Vehicle
Km/L:	Kilometers per One litter
LOS:	Level of Service
LUM:	Land Use Management
MOE:	Measure of Effectiveness.
PV/v/hr:	Passengers Volume or carried per Vehicle Traveled per hour.
SPSS:	Statistical Package for the Social Sciences
SSATP:	Sub-Saharan Africa Transport Policy Program
TDM:	Transport Demand Management
TIM:	Traffic Incident Management
TSM:	Transport System Management

1. INTRODUCTION

1. 1. Background of the Study

The transportation system of a city is a crucial element, and the capacity of the city to ensure mobility might even be an indication of its overall administration. When describing how their city is a world-class city, every mayor in the world employs transportation. (Dawit,2018).

One key component of human society is transportation. A nation's social and economic progress is heavily influenced by its transportation network. Transportation is crucial to urban development because it provides people with access to markets, employment, healthcare, education, and other necessary services. In transportation systems, demand, the locations they serve, and the networks that facilitate movement are all closely connected. (Rodrigue,2016).

Transportation is essential for moving goods from one place to another in the majority of the world's cities, but particularly in developing countries traffic congestion remains a major problem that results in significant delays, financial losses, mental stress fuel waste, and accidents that occasionally end in fatalities. In addition to this the major sources of this problem are Badly planned road networks, land use, and traffic management result in extended traffic congestion, which has a negative impact on the economy, the environment, and commuters (McGroarty, 2009).

According to the European Conference of Transport Ministers, traffic congestion results in extended travel times, slower speeds, and lengthy queues. These difficulties result in financial costs for the economy and have a variety of impacts on cities and their population. (ECTM, 2007)

Traffic congestion is a major issue in developing countries. The rapid increase in population, the inadequacy and low quality of the road network, the layout of cities, the rapid rise in the number of vehicles, and the lack of a physical development plan to regulate urban growth are just a few of the causes of this problem (Robert, 2013).

The majority of intercity freight and passenger transportation in Ethiopia is done via road, which is a vital part of the country's infrastructure and development. The nation's inadequate road infrastructure, however, has presented infrastructure problems that have made it difficult for Ethiopia to advance in socioeconomic development and reduce poverty (ERA, 2008).

In Ethiopia, traffic congestion is generally recognized as a major problem for both business and recreational tourism. There are two types of congestion recurring and nonrecurring. Recurring congestion is brought on by a large number of cars and pedestrians traveling at the same time in the same places (such as at crowded intersections) at the same time (such as during holidays or rush hour) is connected to expected delays. Nonrecurring congestion is related to unforeseen delays caused by sporadic traffic events such as accidents (Mulugeta, 2014).

According to the United Nations World Population Prospects (2024), Addis Ababa's overall population is expected to reach 5.9 million, and the city's surface area is 540 square kilometers. The City Government is composed of both urban and sub-urban districts, and it is split into 11 subcities: Addis Ketema, Akakikality, Arada, Bole, Gulele, Kirkos, KolfeKeranio, Lideta, NifasilkLafto, LemiKura, and Yeka.

In recent years, the capital city of Addis Ababa has experienced significant traffic congestion, particularly in the suburban areas, which is impeding the country's growth. Thus, there is no doubt that traffic congestion significantly affects city residents. Due to traffic congestion concerns such as urban mobility difficulties, traffic collisions, environmental pollution, and extended trip lengths, fuel consumption and operating expenses are rising at a frightening pace. The problem will get worse and go out of hand if a solution is not implemented right away (Sokido, 2024).

Traffic flows into the inner city in large quantities in the morning and out of the city during the evening rush hour. This consistent traffic pattern results in severe traffic bottlenecks at the main entrance to the city. The major traffic flow zones might be one potential cause of traffic congestion in suburban locations. When thinking of blocked roads, the delay is frequently the first thing that comes to mind. Traffic delays can make people late for work, which increases the stress of their daily commute. Fuel is burned more rapidly when stopping and starting in traffic jams than when traveling smoothly on an open road. The increase in fuel usage not only costs

commuters more money for fuel, but it also raises the amount of emissions produced by automobiles. These pollutants cause air pollution and global warming. Traffic congestion prevents emergency vehicles, such as fire trucks or ambulances, from responding quickly. (Fekremariam, 2023)

As a result, determining the main reasons for congestion is essential to finding a solution. Therefore, this study sought to identify the primary causes and effects of traffic congestion in the study corridor and propose strategies to mitigate its consequences.

1. 2. Statement of the problem

For both public and private institutions, as well as city people generally, traffic congestion is a major problem. Increased traffic congestion and difficult access to places of employment and residence, particularly in the morning and evening, are linked to the city's congestion (Abel D, 2013).

Poorly maintained streets, a lack of sidewalks, together with the utilization of sidewalks by human and street trade are characteristics of Addis Ababa's transportation system. Pedestrians therefore utilize vehicle lanes for walking, mounting buses, and taxis. In general, there are numerous shortcomings in the city's transportation system. Two east-wests and north-south axial roads, constructed "ring road," and many smaller roads make up the city's main roads (Mulu, 2015).

It is evident that individuals in Addis Ababa spend more time waiting in traffic queues than they do engaging in other activities. The transportation system in Addis Ababa is often dangerous, chaotic, and inefficient. It has a detrimental effect on society, especially on the urban poor, because it inhibits human development, lowers quality of life, and decreases productivity. The majority of workers and members of the public experience these issues and annoyances to different extents and in different circumstances, but they are all thought to be directly related to the current traffic congestion. In this specific location, there is still a lot of traffic, even though the city has recently grown, as seen by the construction of roads, parking lots, pedestrian walkways, traffic signals, and signals, as well as the introduction of light rail nearby. Haregewoin (2010).

According to studies, traffic congestion is caused by a number of factors, the main ones being an imbalance between the volume of traffic and the capacity of the roads, inflexible work schedules, inadequate public transit, and bad urban land use planning. A 2013 study found that traffic congestion has a social and economic impact on people in both wealthy and emerging nations (Abel, 2013).

Its connection to job performance and other socioeconomic aspects of daily life was clearly shown. In terms of both work and non-work trips, traffic congestion is now understood to be a significant issue in Ethiopia. Traffic congestion is significant and worsening, especially in major cities, intercity corridors, and popular tourist routes, which is impacting people's comfort and business expenses. There is also a growing awareness that, for economic, social, and environmental reasons, the construction of new highways has only a limited role in addressing current and future transportation challenges, especially in urban locations. Additionally, there is an increasing worry about road accidents, climate change, environmental pollution, and the depletion of fossil fuels. (Dawit,2018)

The challenges and future of the Addis Ababa city administration's traffic control procedures were examined by Yilma (2014). The main objective of this research is to assess the city's traffic management methods and the impediments to the successful application of best practices, considering the present traffic situation in the city. In Addis Ababa there are several researches have been conducted which is related to traffic congestion. The previous several researches attempted to address the traffic congestion issue. For example DawitDessalegn (2018) studied the impacts of traffic congestion in Lideta sub-city; Fekremariam (2023) studied the socio-economic impact of traffic congestion in Addis ketema sub-city. They both ignored the analysis of the underlying causes of the congestion problem and failed to identify particular times of traffic congestion at peak hours (morning and evening peak hours). This study attempts to fill the gap in the literature by including the factor of causes and temporal aspects of congestion in the study corridor. As a result, this study focuses on the major causes and of traffic congestion during workers peak hour in Addisu Gebeya Roundabout to Minilik II Square corridor in Addis Ababa.

1.3. Research Objectives

1.3.1. General Objectives

The general objective of this study is to identify the major causes of vehicle traffic congestion that is hampering road traffic flow from Addisu Gebeya Roundabout to Minilik II Square in Addis Ababa.

1.3.2. The Specific Objectives

- ✚ To explain the major causes which contribute for road traffic congestion on the study area?
- ✚ To discuss the major effects of traffic congestion in the study area.
- ✚ To suggest some possible solutions and counter measures that will contribute to reducing the problems of road traffic congestion.

1.4. Research Questions

1. What are the major reasons for traffic congestion in the study area?
2. What are the major effects of the traffic congestion in the study area?
3. What are the possible solutions to mitigate traffic congestion in the study area?

1.5 Significance of the study

This study focuses on to investigate the main causes of vehicle traffic congestion in the study area. And the study's importance lies in its ability to identify the main factors that contribute to traffic congestion and to provide information and knowledge about how the area's road traffic flow is managed. And this thesis is conducted it is based on the street survey for five days, rush hours morning and afternoon in 2025GC. And to gather relevant data from the respondent the researcher used mixed research approach. The information and knowledge from the research used for to develop countermeasures that could lessen the severity and effects of traffic congestion. It also inspires other researchers to conduct additional research in the field.

1.6. Scope of the Study

Geographically, the research is carried out in Addis Ababa, Gulele and Arada sub-city on particular area of Addisu Gebeya Roundabout to Minilik II square corridor. This area is among the major route of traffic flow in Addis Ababa (Northern door of the city). In this area there are a significant number of people who are victims of road traffic congestion. Conceptually, the scope of this research is limited to finding the major causes of vehicle traffic congestion in the study area. Temporally it is based on the street survey made in 2025 GC.

1.7. Organization of the Study

This thesis paper has five chapters. The first chapter includes the study's background, research problems, objectives, research questions, significance, and scope, definitions of important terms, limitations, and research organization. The review of relevant literature on traffic congestion will be covered in Chapter 2. The study field will be described in detail in Chapter 3, which also covers research design and methods. The display and interpretation of data will be the main topics of chapter four. Chapter 5 includes the conclusion and recommendations. Lastly, the paper work is concluded with appendixes and references.

1.8 Limitation of the study

As stated on the objective this study focuses on the major causes those responsible for road traffic congestion on Addisu Gebeya roundabout to MinilikII square street corridor. Doing such kind of research, one is obviously need to collect primary data through long periods of field observation, needs different techniques and adequate time. Due to different reasons it was challenging to collect traffic data for more days to get accurate traffic volume, however the researcher overcame the problem by taking traffic volume that he himself collected for five consecutive days it is from Monday to Friday (June 9-13),2025GC.

1. 9 Definitions and Terms

Traffic congestion: is a condition on road network occurs as use increases, and is characterized by slower speeds, longer trip time, and increase vehicles queuing.

Traffic jam: when vehicles are fully stopped for periods, this is colloquially known as traffic jam

Recurring congestion: occur when the volume of traffic exceeds the roadway capacity

Nonrecurring congestion: occur mostly by crashes and incident, vehicle breakdown, road construction activities, special events etc

Congestion: is a situation in which demand for road space exceeds supply

Level of Service: The most used way of measuring congestion is the level of service. The traffic volume of a certain area is measured qualitatively using the LOS measure, which divides it into six levels (LOS A, B, C, D, E, and F), with LOSA representing the optimum state and LOS F representing the bad. Many agencies define congestion in relation to the LOS value, either LOSE or F.

Traffic density: The number of vehicles in a particular road segment at any given moment. It is calculated in cars per kilometer.

Traffic flow: is the volume of vehicles in a given area as measured over a period of time.

Speed: was measured by taking a sample of vehicles and recording their travel time on a set length of road along the case route using a stopwatch.

Traffic incidents: According to the 2000 TIM Handbook, an "incident" is defined as "any nonrecurring event that causes a reduction of roadway capacity or an abnormal increase in demand." Special nonemergency events, traffic incidents, broken vehicles, spilled cargo, highway maintenance, and reconstruction projects are examples of such occurrences.

2. LITERATURE REVIEW

2.1 Introduction

An increasing number of researchers in both developed and developing nations are now concentrating on traffic congestion as their research priority. People can be affected in a variety of ways by a direct or indirect relationship to vehicle ownership, population increase, insufficient road width, poor vehicle maintenance, poor planning, poor traffic management, driver misconduct, road way characters or capacity, inadequate parking space, and inappropriate parking in the city center: extended travel time and excessive fuel use. As a result, the emphasis of this chapter is on these aspects and various authors' perspectives on strategies for easing traffic.

2.2 Theoretical literature Review

2.2.1 Definitions and Concepts of Traffic Congestion

The word traffic originated from French Traffique, Spanish Trafico, or Italian traffic in the early 19th century, which means the movement of vehicles on a road or public highway (oxford online dictionary 2017). All segments of society, including academics, the media, politicians, and the general public, frequently use the term congestion. Nevertheless, there is no widely agreed upon definition of traffic congestion.

It is easier to recognize traffic since streets are packed with cars, trucks, buses, and sidewalks are full of pedestrians. Overcrowding, obstruction, and obstruction are just a few of the words used to describe congestion. Anyone who has ever been caught in heavy traffic should be able to relate to it. Transportation congestion is mostly caused by too many automobiles on a road at any given moment, which results in slower speeds, which can be quite noticeable at times. Traffic congestion is defined by a slower-than-normal or free-running speed, which often signals stop-and-start traffic (US Department of Transportation, 2020).

The growing problem of traffic delays on city streets and highways is referred to as traffic congestion. They are caused by a large number of vehicles and may be avoided by using prudent traffic control measures that utilize data transfer and vehicle communications (Vehicular Communications, Elsevier, 2015).

The larger framework of urban dynamics and the advantages of agglomeration must be used to comprehend urban traffic congestion. Successful urban economic development, employment, housing, and cultural policies that entice people to live and work in close proximity to one another and entice enterprises to profit from the productivity increases produced frequently result in traffic congestion in the urban region. Despite the fact that they may not be enthusiastic about the idea, urban road users are willing to tolerate congested streets as long as they gain other advantages from living and working in the cities, as evidenced by a number of indicators. (ECMT, 2007)

Longer queues, slower speeds, and extended travel times are the hallmarks of traffic congestion as a transportation situation. Since the 1950s, when traffic demand is high, urban road networks have seen a noticeable rise in traffic congestion. An overabundance of cars causes traffic to move more slowly, resulting in congestion. (DL Sokido,2024).

According to the United States Department of Transportation (2017), congestion has seven major causes, many of which are related to one another. These seven sources may be broken down into three main groups, as shown below:

Category 1 deals with the effects of traffic on weather, work zones, and traffic events.

Category 2 covers variations in traffic demand during normal traffic and special occasions, while Category 3 covers physical roadway components such as bottlenecks and traffic control systems.

2.2.2 Common types of Traffic Congestion

-  **Traffic-affecting events that cause congestion:** Construction, accidents, or weather conditions like rain or snow can limit the capacity of roads and intersections.
-  **Traffic Jam:** When all roads leading to a major intersection are blocked, traffic cannot move through that location.
-  **A bottleneck:** occurs when the volume of traffic is too high for a particular portion of the road, forcing some drivers to slow down or come to a complete stop.
-  **Shockwave:** This occurs when a vehicle abruptly decelerates, causing the vehicles behind it to slow down or halt.

🚦 **Special event traffic congestion:** Sporting events or concerts are examples of events that can drastically raise traffic volume as crowds gather in that area.

2.2.3 Major Causes of Traffic congestion

Traffic Congestion has become a significant topic of investigation for an expanding group of scholars in both wealthy and less wealthy nations. These congestion may linked to various factors, including the number of vehicles owned, rising populations, narrow roadways, neglect in vehicle upkeep, ineffective planning, inadequate traffic control, improper driver behavior, characteristics or limits of the roads, insufficient parking capacity, and inappropriate parking in city centers. All of these can impact people in several ways, such as extended travel time and increased fuel expenses.

The European Conference of Ministers of Transport (2007) states that traffic congestion arises from multiple elements, like poor road conditions, an overwhelming number of vehicles and motorcycles, land development patterns, employment trends, income levels, vehicle ownership patterns, investment in infrastructure, regional economic conditions, tourism, and the poor integration of land use. Congestion can be categorized into two types: micro and macro, which include recurrent and non-recurrent factors. Micro factors are connected to traffic flow on specific roads, while macro factors refer to the overall demand for road access. Recurrent factors emerge when demand surpasses the network's technical capacity, whereas non-recurrent factors are unexpected occurrences, such as road construction, special events, or accidents that arise unpredictably. (ECMT, 2007)

According to Rodrigue (2016), the primary cause of congestion in cities is related to commuting habits, with truck movements contributing less to the problem. He identified several reasons contributing to congestion, such as increases in population density, road accidents, and broken vehicles, which limit road capacity and disrupt smooth traffic flow.

Downie (2008) explained that traffic congestion happens when the amount of vehicle traffic exceeds the road's capacity, a situation often known as saturation. He outlined specific situations that can cause or worsen traffic jams. Different scholar suggest about factors of traffic congestion as follows:-

2.2.3.1 Population Increase

The rapid increase in population and the growth of urban areas are leading to a higher demand for transportation. Transportation plays a crucial role in the economic and social progress of cities and regions. The fast-paced urbanization taking place globally results in more trips within cities. Traditionally, cities have addressed the rise in transportation needs by improving their transport systems, such as constructing new highways and transit lines (Rodrigue, 2009).

One significant factor contributing to traffic congestion worldwide is population growth. This phenomenon causes households and economic activities to cluster together within a connected market network in a confined space. Urban population growth is driven by various push and pull factors (Kyessi, 2012).

Over 50 percent of the global population resides in urban areas. Globally, the annual average growth rate of urban populations stands at 2 percent, and the number of megacities—defined as those with populations exceeding 10 million has increased fourfold in the last twenty years (Davis, 2007).

The expansion of vehicle ownership is occurring at a rate that far exceeds the available road capacity, resulting in traffic congestion. As the population continues to rise and the city expands, more individuals both reside and work in the urban area, leading to an increase in trips within the cities, often covering considerable distances. As a result, the current transport infrastructure is under immense pressure, creating difficulties in meeting the public's travel needs. (Mohamed, 2019)

2.2.3.2 Limited Parking Capacities

The location, intended purpose, building style, and management style are all factors that may be used to classify parking spots. Parking can be divided into on-street and off-street depending on where it is located. Parking vehicles within the designated lines on the roads is known as on-road parking, which can be further categorized as general road parking and roadside parking. Outside of these boundaries, off-street parking consists of designated spaces such as parking lots, garages, or buildings. Off-street parking can also be divided into indoor facilities and outdoor areas. Parking may be classified by service type as public, auxiliary, or private. The building

options include underground infrastructure, aboveground lots, and structured parking. (Wang Yanling et al. 2016)

2.2.3.3 Poor Vehicle Maintenance

When routine maintenance is ignored, frequent vehicle breakdowns are typical. These disruptions can impede traffic flow and prevent other cars from moving freely. With adequate vehicle maintenance, these scenarios may be avoided, but instead they cause increased congestion during those times, resulting in lengthy vehicle queues, traveler delays, and disruption to other services. This problem is particularly common in developing nations. As a result, traffic delays are caused by poor automobile maintenance. Additionally, inadequately maintained cars might cause accidents. The Texas Transportation Institute (TTI) and other experts contend that traffic collisions involving vehicles are a major contributor to traffic congestion. (Abel, 2013).

2.2.3.4 Poor Planning

Due to insufficient planning restrictions, people are compelled to move to metropolitan regions, which results in an unequal growth in cities as road capacity increases. In addition to wealthy countries like the UK, several cities, including those in developing economies, exhibit this trend. Inadequate planning is to blame for the high population density and high frequency of people's needs and activities in the city center. The city's transportation infrastructure is severely strained by the demand for travel, which is caused by the unequal distribution of public and private facilities (SSATP, 2005).

This suggests that the major emphasis of employment and market opportunities is in the city center. Most of the time vital urban infrastructure, including the port, the main hospital, the biggest market, and the commercial area located in the center of the city. Due to these circumstances, residents are compelled to travel in order to take advantage of these chances. In addition, it emphasizes the scarcity of services since schools and healthcare facilities are concentrated in residential neighborhoods, which require commuting. Additionally, the majority of government offices, ministries, and embassies are located in the city center. As a result, people commute to these places for employment in the morning. As they head back to their

houses outside the city in the evenings, the situation changes, leading to more traffic flow.(Olvera et al,2003)

2.2.3.5 Building Roads

Because road building is so common in every country, detours and alternative routes must be established to ensure that people can reach their destination. It might result in traffic delays if not done correctly. The biggest challenge is controlling or preventing traffic congestion during construction. As a result, drivers frequently experience delays and irritation. Sometimes, construction workers make matters worse by closing off portions of roadways for long periods of time, even when they are not really working.(Abel, 2013).

2.2.3.6 Traffic incidents

The 2000 TIM Handbook defined an “incident” as ...any non-recurring event that causes a reduction of roadway capacity or an abnormal increase in demand. Such events include traffic crashes, disabled vehicles, spilled cargo, highway maintenance and reconstruction projects, and special non-emergency events. These do not occur on daily basis but when they do they cause even more severe congestion.

2.2.4. Effects of Traffic Congestion

Traffic congestion is a condition of transportation in which queues get longer, travel times get longer, and speeds get slower. Due to increased demand, urban road systems have experienced a significant increase in traffic congestion since the 1950s. The flow of traffic is hampered when the number of automobiles raises, which results in more fuel use and longer travel times. Addis Ababa's transportation system is distinguished by poorly maintained roadways and sidewalks, and sidewalks are frequently utilized for both business and social purposes. As a result, pedestrians utilize public transportation such as buses and taxis, and share roads with cars as they walk. In general, the city's transportation infrastructure has a lot of flaws. (Mulu, 2015)

The first thing that comes to most people's minds when they picture traffic congestion is usually delays. As such delays may cause individuals to be late for work, the tension increases during the morning hours. Traffic conditions that stop and start also use more gasoline than continuous highway driving. In addition to raising costs for commuters, this increased fuel consumption also

adds to the emissions produced by vehicles. As a result, air pollution is brought on by this circumstance, which is also associated with climate change. When the roadways are crowded, it may be difficult for emergency vehicles like fire trucks and ambulances to reach their destinations.(Dawit,2012)

As this unproductive time can have a detrimental impact on the economic health of the region, the time wasted in traffic constitutes an opportunity cost for drivers and passengers. Due to potential tardy attendance at work, meetings, or courses, individuals may experience financial, disciplinary, or personal consequences. Drivers waste time on needless excursions due to the uncertainty of travel durations, which lessens their opportunity to participate in productive pursuits. Fuel is wasted as a result of excessive idling, acceleration, and braking, which raises carbon emissions and air pollution. Furthermore, lengthy traffic delays and frequent speed fluctuations can contribute to vehicle wear and tear, necessitating more repairs and replacements. Drivers who are irritated and under stress may experience road rage, detrimental impact on their health. In addition, heavy traffic may prevent emergency vehicles from arriving to locations where they are urgently needed. The side streets, which impact local services and property values, are frequently overwhelmed by traffic attempts to seek alternative routes.(Taddese, 2011)

Traffic congestion has become a major issue for residents of Addis Ababa, particularly along the main routes. This congestion causes problems such longer commute times and fewer work hours, which hurt the city's economic development. The actual expenses of traffic congestion are borne by all travelers, including local and long-distance truck drivers, service providers such as plumbers and computer technicians, as well as police and ambulance personnel. Commuters, tourists, and shoppers are also impacted by personal travel. Increased emissions and fuel usage are caused by traffic congestion.(Mohamed,2019)

Vehicle emissions have surpassed other sources of air contaminants in many places, such as nitrogen oxides (NO_x), particulate matter (PM), carbon monoxide (CO), carbon dioxide (CO₂), volatile organic compounds (VOCs), or hydrocarbons (HCs) (Transportation Research Board (TRB), 2002). Traffic congestion is getting worse and lasting longer, which might lead to a significant rise in pollutant emissions and a decline in air quality, especially in the vicinity of busy highways. According to epidemiological research, assessments of suggested vehicle emission regulations, and environmental impact analyses for particular road projects, these

emissions raise the risk of morbidity and mortality for drivers, commuters, and those who reside close to highways (World Health Organization (WHO), 2005; Health Effects Institute (HEI), 2010).

Service providers can attend to fewer calls each day because of the time wasted in traffic, which increases expenses for customers. Because it can delay the arrival of vital emergency services like medical and fire response teams to urgent situations, this problem is a major one. Companies that rely on timely deliveries of components for assembly lines are compelled to make arrangements for early arrivals, which consumes storage capacity and resources that could be used for more productive endeavors. Congestion steals valuable time from travelers that may have been used for work or leisure activities (Cambridge Systematic, Inc, 2004).

Increasing traffic congestion leads to travel costs, impacts overall business operations, increases vehicle operating expenses, raises environmental costs, and decreases productivity. But it has been difficult to accurately assess these economic costs (Weisbrodet al.2003). Some scholars have estimated the cost of congestion based on their hypotheses and conclusions, even though it can be difficult to calculate.

By choosing eight cities as examples, conducting thorough modeling, and analyzing each city, Hartgen looked into the effect of congestion on the gross regional product (GRP) in 2009. They discovered that in these cities, the gross regional product per employee varied from \$81,700 in Salt Lake City to \$125,400 in San Francisco. Surprisingly, in areas with high traffic, improving traffic flow and congestion may boost worker productivity by as much as 30%.

2.2.5. Measurement of Traffic Congestion

2.2.5.1 Level of Service (LOS)

Service volume, which is frequently mistaken for capacity, is a closely related notion. While capacity provides a quantitative indication of traffic, the level of service (LOS) attempts to provide a qualitative one. The maximum number of automobiles, passengers, or other similar items that a specific system or facility can handle at a particular level of service under certain circumstances is known as its service volume. The capacity of a particular road or facility may remain the same. However, the true flow will vary depending on the day and the hour of the day. The purpose of LOS is to link the quality of traffic service to a particular traffic flow rate. The

word refers to a variety of operational circumstances on a specific sort of infrastructure. The transportation research board of the United States produced the highway capacity handbook (HCM), which includes some methods for assessing the degree of service. The traffic quality is divided into six categories, ranging from A to F. The best traffic quality is represented by level A, where the driver is free to drive at a free flow speed. Level F represents the lowest traffic quality. The measure of effectiveness, or MOE, is used to determine the level of service. This approach usually employs three variables: speed and travel time, density, and delay. The amount of time spent traveling is one of the key indicators of service quality. As a result, speed and travel time are seen to be better indicators of a facility's LOS. Density reflects how near other vehicles are in the flow. It is also employed to define LOS (Richard Iles 2005), as it has an impact on the driver's capacity to navigate the traffic flow.

Typical Highway Level of Service (LOS) rating (HCM 2000)

LOS	Description	Speed (mile/hr)	Flow (Veh/hr/ln)	Density (Veh/mile)
A	Traffic flows at or above posted speed limit. Motorists have complete mobility between lanes.	Over 60	Under 700	Under 12
B	Slightly congested, with some impingement of Maneuver ability .Two motorists might be forced to drive side by side, limiting lane changes	57-60	700-1100	12-20
C	Ability to pass or change lanes is not assured. Most experienced drivers are comfortable and posted speed maintained but roads are close to capacity. This is the target LOS for most urban highways	54-57	1100-1550	20-30
D	Speeds are somewhat reduced, motorists are hemmed in by other vehicles. Typical urban peak-period high way conditions.	46-54	1550-1850	30-42
E	Flow becomes irregular; speeds vary and rarely reach the posted limit. This is considered a system failure.	30-46	1850-2000	42-67
F	Flow is forced; with frequent drops in speed to nearly zero mph. Travel time is unpredictable.	Under 30	Unstable	67- max

Table 2.1Level of Service (LOS) rating (HCM 2000)

Excessive or unanticipated time spent traveling is referred to as delay. The highway capacity manual defines and utilizes a number of particular delay measures as MOE's.

SPEED

The speed of the trip is prioritized over the traffic's design features, making it a quality indicator of travel. It is defined as the speed of movement in distance over time. Mathematically, velocity or speed v is defined as follows:

$$V = d/t$$

In this case, d is the distance traveled in meters over the course of t seconds, and V is the vehicle's velocity in meters per second. The velocity of different vehicles will vary in time and space.

FLOW

The number of vehicles on a road can be counted in nearly two ways. Flow or volume is the number of automobiles that travel across a certain spot on a highway or in a particular lane or direction of a highway throughout a specified time period. The measurement is made by counting the number of cars, nt , that travel in a certain lane past a certain point during a specified time t . The flow q expressed in vehicles/hour is then determined by

$$q = \Sigma nt/t$$

DENSITY

The number of vehicles in a certain stretch of road or lane is called density, which is usually measured in vehicles per km. It is possible to determine the density k by taking a picture of a stretch of road x , counting the number of cars, nt in one lane of the road at that specific moment, and using the formula (O'Flaherty et. al. 2003).

TRAVEL TIME:

The time it takes to finish a trip is known as travel time. Travel time necessary to get at the destination decreases as the speed increases, and vice versa. Therefore, travel time is inversely proportional to speed (Tom 2006).

2.2.6 Traffic Management System

The state of the current traffic management system at any given moment has a significant impact on the effectiveness of any transportation system. The traffic management system for a highway comprises the following elements: traffic signals; pedestrian facilities (crossing levels, sidewalks, overpasses); bicycle lanes; curbs and road markings; acceleration and deceleration lanes; and bus stops. Traffic police officers' inclination to manually control traffic is another reason why they are included in the traffic management system. Because of their ability to efficiently regulate traffic at intersections, roundabouts may be included in the management system as well (Njoroge , 2009).

Congestion management strategies are divided into demand-side measures and supply-side measures. Based on this categorization, typical congestion relief management strategies are outlined below.

2.2.6.1 Strategy for Managing the Supply Side

The engineering theory of traffic congestion focuses on boosting the traffic capacity of road links, junctions, and entire urban networks through restrictions on parking, pedestrians, access, and even public transportation, as well as through the construction of new roads (Thomson, 1998, p. 94). The European Conference of Ministers of Transport (ECMT) suggests some supply side congestion management measures, such as improving traffic operations, enhancing public transport, implementing mobility management, modifying existing infrastructure, etc. (2007, pp. 2529).

2.2.6.2 Strategies for Managing Demand Side

Demand-side congestion management strategies are also crucial in addressing the congestion issue since they lower the demand for car use. The ECMT (2007, pp. 2123) recommended three interconnected demand-side management strategies: pricing policies, parking management, and access management. The ECMT (2007, p. 20) also advised ensuring that land use planning and the community objectives it reflects are in line with congestion management policies. Pricing regulations are economic measures, while access management and parking management are regulatory measures. As a result, ECMT really covers three areas of demand side congestion management: economics, law, and land use. According to Hon (2005, p. 28), these three areas are also successful strategies for reducing demand side congestion.

2.2.7 Traffic Congestion Mitigation Strategies

New Realism basically asserts that the optimal way to address traffic congestion issues is via a comprehensive package strategy that offers the framework and method for integrating Transport Demand Management (TDM), Transport System Management (TSM), and Land Use Management (LUM). The logic behind this prescription is that, in accordance with a supply-side paradigm, traffic problems can no longer be solved by simply increasing network capacity, as this causes congestion to move to other locations, raising traffic pressures there (Werner 2015).

There is different body of stakeholders suggest different mitigation strategies as follows:-

2.2.7.1 Improving Public Transport

One essential supply management technique of the transportation system for reducing congestion is enhancing public transportation, since it can carry more passengers than private vehicles for a given amount of road space (ECMT 2007).

Cities can build more mass transit networks in a variety of ways. In order to give public transport users more time, some road lanes are designated for public transit usage, such as bus lanes (Hon 2005). By encouraging public transportation, it can lessen traffic issues by removing lone drivers from private vehicles and utilizing road space more efficiently (Hon 2005).

However, literature (Downs 1992; Black 2003; Hon 2005; ECMT 2007) suggests several methods for enhancing public transit, including: developing mass transit, bus lanes/high occupancy vehicle (HOV) lanes, better public transport services, more peak and ride facilities, expanding services, adopting fee structures, improving operations, providing public transport information, etc. However, these initiatives are not without expense, and they are probably insufficient on their own to address congestion (ECMT 2007).

2.2.7.2 Parking Control

Effective traffic management also includes parking control, which, if implemented correctly, can be quite beneficial in easing congestion on congested highways. Parking that is not regulated is a major issue in many developing nations since it can impede traffic movement and consequence in congestion. On street parking restrictions can improve the usable road width; in areas where

On street parking is allowed, restricting on street parking near bus stops is advantageous to all traffic because buses can stop at the on the street rather than blocking other traffic. Parking is generally prohibited at busy bus stops or at all bus stops on busy streets, but the restrictions are not always enforced consistently (Richard Iles 2005).

2.3 Empirical Literature Review

The capital city of Addis Ababa has experienced significant traffic congestion, particularly in the suburban areas, which is impeding the country's growth. Thus, there is no doubt that traffic congestion significantly affects city residents. Due to traffic congestion concerns such as urban mobility difficulties, traffic collisions, environmental pollution, and extended trip lengths, fuel consumption and operating expenses are rising at a frightening pace. The problem will get worse and go out of hand if a solution is not implemented right away (Sokido, 2024).

Traffic flows into the inner city in large quantities in the morning and out of the city during the evening rush hour. This consistent traffic pattern results in severe traffic bottlenecks at the main entrance to the city. The major traffic flow zones might be one potential cause of traffic congestion in suburban locations. When thinking of blocked roads, the delay is frequently the first thing that comes to mind. Traffic delays can make people late for work, which increases the stress of their daily commute. Fuel is burned more rapidly when stopping and starting in traffic jams than when traveling smoothly on an open road. The increase in fuel usage not only costs commuters more money for fuel, but it also raises the amount of emissions produced by automobiles. These pollutants cause air pollution and global warming. Traffic congestion prevents emergency vehicles, such as fire trucks or ambulances, from responding quickly. (Fekremariam, 2023)

Its connection to job performance and other socioeconomic aspects of daily life was clearly shown. In terms of both work and non-work trips, traffic congestion is now understood to be a significant issue in Ethiopia. Traffic congestion is significant and worsening, especially in major cities, intercity corridors, and popular tourist routes, which is impacting people's comfort and business expenses. There is also a growing awareness that, for economic, social, and environmental reasons, the construction of new highways has only a limited role in addressing current and future transportation challenges, especially in urban locations. Additionally, there is

an increasing worry about road accidents, climate change, environmental pollution, and the depletion of fossil fuels. (Dawit,2018)

One of the most common transportation issues in major metropolitan centers, often with a population of over a million, is congestion. is closely related to motorization and the spread of the automobile, which has raised the need for transportation infrastructure. However, the availability of infrastructure has Motorization has grown as a result of the fact that automobiles are often parked for most of their time.This has made it difficult to keep up with the development of mobility. the need for parking spots, which has led to space use issues, notably in metropolitan regions(Habtamu,2016)

2.4 Research Gaps

Several writers wrote about traffic congestion across the world at different level and period of time. But there is no research conducted directly in this study area cause and effect of traffic congestion. That is why the researcher intended to made critical analyses on the cause, and effect to traffic congestion in the case of Addisu Gebeya roundabout to MinilikII Second Square corridor.

In order explain the above facts, Mohamed (2014) The main objective of this research is to assess the city's traffic management methods and the impediments to the successful application of best practices, considering the present traffic situation in the city. This thesis focus on management or strategies to improve of traffic movements of the city, but it does provide more emphasis on the main factors for traffic congestion of the city.

Fekremariam (2023) studied the socio-economic impact of traffic congestion in Addis ketema sub-city.The researcher provides emphasis on socio-economic impacts of traffic congestion and ignore the main causes of traffic congestion in Addis Ababa city.

Dawit,(2017) causes and Impact of Vehicle Traffic Congestion in Addis Ababa: The case of Lideta, Addis Ababa, Ethiopia. In this thesis the researcher tries to focus on cause and effects of traffic congestion of Addis Ababa city with ignoring specific time of the congestion.

As it is discussed in the above the researchers do not consider the analysis of the underlying causes of the congestion problem and failed to identify particular times of traffic congestion at

workers peak hour. This study attempts to fill the gap in the literature by including the causes and temporal aspects of congestion in the study corridor. As a result, this study focuses on the major causes and of traffic congestion during workers peak hour in Addisu Gebeya Roundabout to Minilik II Square corridor in Addis Ababa.

2.5 Conceptual Framework of major causes and effects of vehicle traffic Congestion

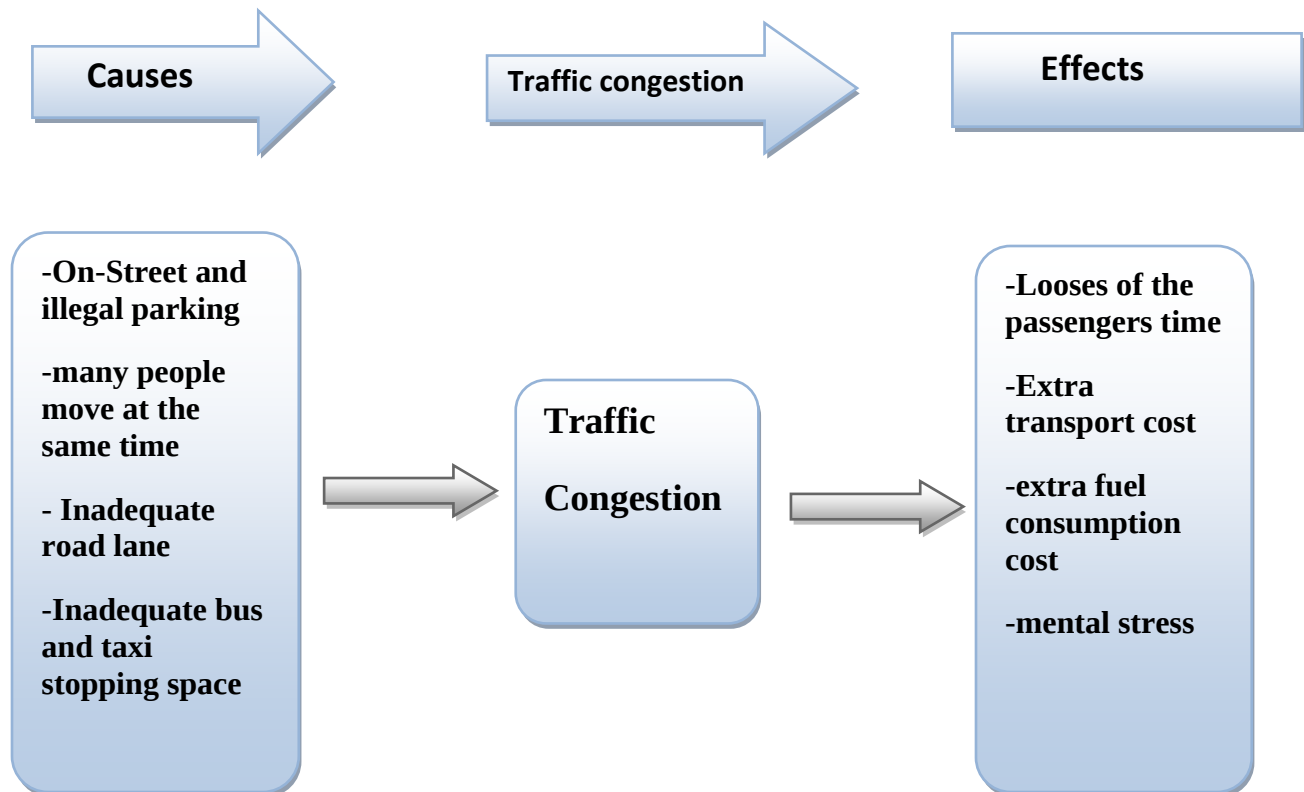


Fig2.1: Conceptual frame work of major causes and effects of vehicle traffic Congestion

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1 Research Design

The framework of a study that is systematically planned to address research questions is referred to as the research design (Kothari 2004). The researcher employs some particular research methodology to collect, analyzes, and arrange the data pertaining to the movement of traffic in the study region. The researcher uses of both qualitative and quantitative approaches to begin with, data is gathered from both primary and secondary sources. Structured questionnaires and interviews are administered to participants in the case study area in order to gather primary data. In addition, field survey also conducted to count traffic flow, speed and density of vehicle flow on the street. After the data is collected from both primary and secondary data source, and it is coded, input into a computer system, and analyzed using SPSS and Excel sheet. Finally the analyzed data is presented in the form of table and bar graphs.

3.2 The Study Area

Addis Ababa, the economic and political center of Ethiopia, is the focus of the study. The population of Addis Ababa accounts is estimated 5.9 million people (UN world urbanization prospects, 2025)

Addis Ababa serves as the capital of the Federal Democratic Republic of Ethiopia and is home to several international bodies, including the African Union and numerous diplomatic posts. Addis Ababa has a population of 3.3 million people living in a 540 km² area. The city is located at 38°44'24"E longitude and 9°1'48"N latitude. It is located in the middle of the nation and also serves as the hub of the United Nations Economic Commission for Africa and the African Union. The city is referred to by some as Africa's political capital. Addis Ababa, however, is the economic center of the nation rather than just the political hub (Socio-Economic Profile of Addis Ababa 2013).

The research Conducted in Addis Ababa, Gulele and Arada sub-city in a particular corridor of Addisu Gebeya roundabout to Minilik II square corridor. The northern portion of Addis Ababa city is where you may find Gulele sub-city.

On the surface of the planet, Gulele and Arada Sub-cities geographic coordinates are 9°3' 46"N latitude and 38°43' 96"E longitude for Gulele and 9°00' 0"N latitude and 38°45'00"E longitude for Arada. Gulele sub-city has a total area of 30.18 km² and 12,493 residents per km². There are 377,032 inhabitants in the entire, when we came to Arada sub-city, It has 298,044 population and the area is 30,075/km² (Ethiopian Statistical Service,2022)

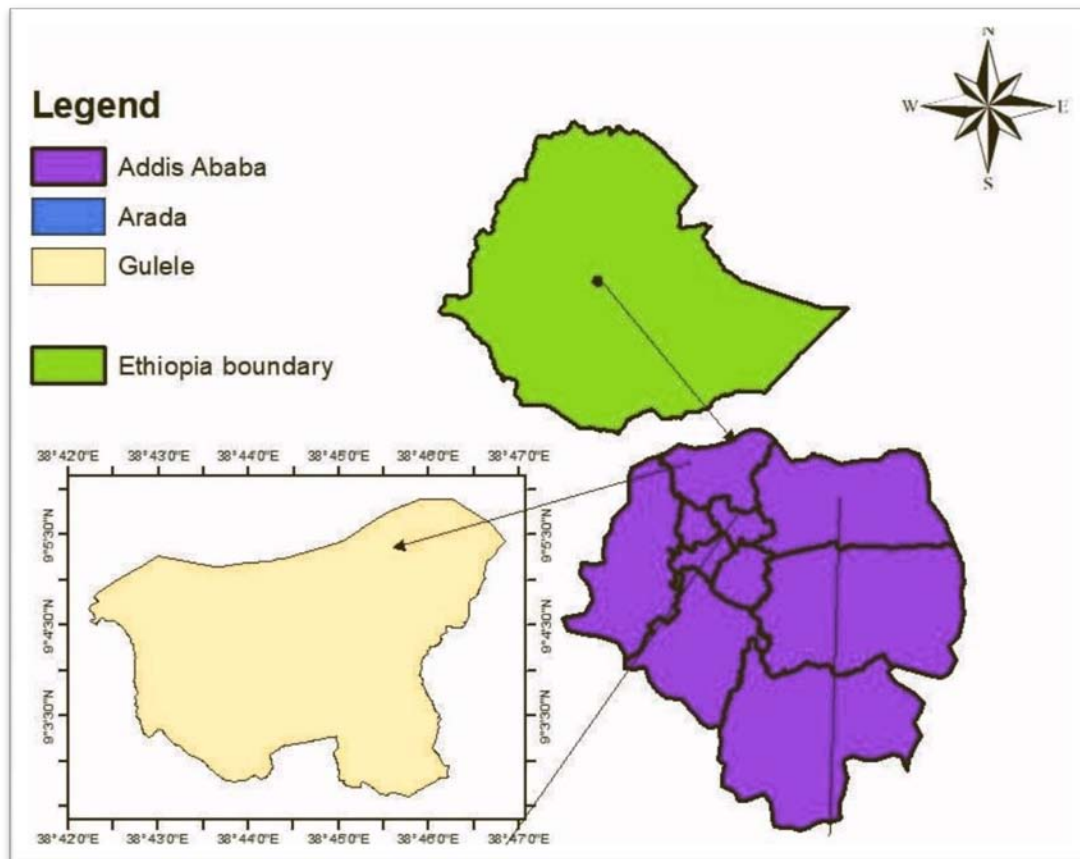


Fig 3.1 Map of the study area

3. 3. Research Approaches

For data collection, this research used both quantitative and qualitative methods. The qualitative approach will produce thorough data based on site observations, in-depth interviews, and questionnaires with both open and close ended questions. The numerical data is processed using mathematical and statistical methods, presented in tables, and graphs, which enables the researcher to understand the results in a clear and precise way.

3. 4. Data Sources

3. 4. 1. Primary data sources

Information is collected from both primary and secondary sources. Direct observation, questionnaire surveys, interviews, and traffic volume counts are examples of primary sources. Data is gathered from a variety of stakeholders, including drivers, passengers, traffic officers, and professionals engaged in traffic management, with a focus on their opinions about the issues and potential remedies, in order to provide complete information.

Interview

The interview was conducted deliberately. Intentional sampling is a widely used technique in qualitative research for identifying and choosing information-rich cases in order to make the most use of scarce resources (Patton, 2002). This entails finding and choosing individuals or groups of people who have exceptional expertise or experience with a topic of interest (Cresswell& Plano Clark, 2011). From the Addis Ababa Transport Bureau, Gulele sub-city traffic control, Arada sub-city traffic management officer, the Addis Ababa road authority, and the Addis Ababa traffic police staff, sixteen (16) concerned stakeholders were chosen for the data collection target.

Questionnaire

The questionnaire is intended to collect data regarding the causes and effects of vehicular traffic congestion, as well as the extent to which the issue of congestion is impacting their daily lives and the development of their city, in accordance with the study's goals. Therefore, the researcher chooses the respondents from the entire sample of 306 people who uses from Addisu Gebeya roundabout to MinilikII Square route and identified locations for on-street parking, services

(business centers), and stations at the origin and destination. As a result, a total of 208 individuals were chosen from among motorists. Additionally, passengers traveling from Addisu Gebeya roundabout to Minilik II Square corridor and vice versa purposefully choose and utilized a total of 98 sample respondents, including 33 passengers who used taxis, 33 who used buses, and 32 who drove their own vehicles.

Observation

A remark made to gauge the total number of travelers using the road every hour before defining the sample frame. As a result, the carrying capacity of various types of motor vehicles is evaluated during the two trip times, morning and evening. Consequently, the public buses are operating at or close to capacity during the morning and evening rush hours, while private cars are only using 25% of their capacity during these times. As a result, the researcher opted to distribute based on what had been seen. The average number of vehicles traveling along the street in both directions during the morning peak hours from 8:00-9:00 am 2284 and evening peak hours was from 5:00 pm to 6:00 pm 2040 (according to the spot count, with an estimated average of 26850 passengers being transported during this traffic congested time.

3. 4. 2. Secondary data sources

Data from secondary sources comes from concerned organizations, such as the Addis Ababa transport Authority, Gulele Sub-city traffic controls Authority, Arada Sub-city Traffic Controls Authority, Addis Ababa city Traffic management Agency, the Addis Ababa City Road Authority.

3. 5. Sampling technique

The researcher employed a deliberate, non-probability sampling strategy to choose the sample in the sub-city. Traffic police officers and transport management control officer in Gulele sub-city provided initial data showing a high volume of traffic. Consequently, the research exclusively concentrated on the Addisu Gebeya roundabout to Minilik II square corridor. The study considered all registered motor vehicles in Ethiopia but those traversed the study corridor on the days of the count.

The study's sampling unit was determined by employing purposive, non-probability sampling methodology, which allowed us to choose those groups of people who utilized the street for

travel, including businesspeople, students, government and private employees, and all types of motorized vehicle drivers. The researcher decided to allocate according to what have been observed. Spot count indicated that, on average 2040 vehicles are passing along the street per hour in both directions with estimated carrying total passengers of 13732 on average to achieve a stated objective with resource on hand; the research has adequate sample size depending on the size of the sample frame mentioned above. As the sample frame is greater than 10,000 per day, from estimated number of population sample size will determine using sampling distribution of proportion method formula (Kothari 2004).

$$n = Z^2 * p * q / e^2$$

Z= standard variation at a given confidence level, z = 1.75 at confidence level 92%

P = probability of success at each event p = 0.5

q = probability of failure q = 0.5

e = acceptance error e = 0.05

n=sample size from sample frame

There for:- $n = Z^2 * p * q / e^2$

$$n = 1.75^2 * 0.5 * 0.5 / 0.05^2$$

$$n = 306$$

Therefore 306 representative sample elements were selected from each of the four segments of the corridor, with 98 (32.03%) sample population coming from all passengers: government and non-government employees, business people, and others, and 208 (67.97%) samples coming from drivers of various motor vehicles (Anbesa bus, Sheger bus, Velocity bus, mini bus, and private car).

3. 6. Data Analysis and Presentation

The first step is to assess the data collected from the field to determine whether it is appropriate and relevant to the study's goals. The data is categorized and entered into a computer, where it is analyzed and organized using SPSS, a statistical analysis program, as well as Microsoft Excel to

present the results. The results are displayed using graphs, frequency distribution tables, diagrams, and figures, along with appropriate explanations.

Table 3.1 Matrix of the Research

No	Specific objectives	Variables	Sources of data	Data collection instrument	Method of data analysis
1	To analyze factors that responsible for traffic congestion in the study area.	.Insufficient road lane, .Inflexible working schedule .Inadequate parking space.	Primary and secondary	Questionnaire, interview And observation	Descriptive analysis
2	To identify the effects of traffic congestion in the study area.	Loses of time , Health problem like stress. .Increase Fuel and transport cost	Primary and secondary	Questionnaire and interview	Descriptive analysis

CHAPTER FOUR

DATA ANALYSIS AND RESULT

4. 1. Introduction

The primary result of data gathered using various approaches, as mentioned in the methodology, is examined and discussed in this chapter. The primary components of this section document analysis are Questionnaires, field surveys and in-depth interviews, which are used to answer the study questions.

4.2 Response Rate

Table 4.1 Response Rate of the Respondents

Sample Size		Frequency	Percent
306	Collected	280	91.5%
	Uncollected	26	8.5%
		306	100%

According to table 4.1, The total sample size for the study was 306 respondents. Out of this sample, 280 responses were collected, representing a response rate of 91.5%. The number of uncollected responses was 26, which accounts for 8.5% of the total sample. Thus, the total sample size of 306 corresponds to 100% of the respondents.

4.3 Demographic data

This research has two categories of participants who use the road for various reasons. In this way, we choose the segment of society that travels the route at least twice daily all passengers (government and private workers, business people) and drivers of all motor vehicles. From them, 90 representative sample items were chosen at random, meaning 90(32.14%) were taken from all passengers: government and non-government workers, business people, and others, while 190 (67.86%) were selected from various car drivers.

Table 4.2 Respondents by Sex

	Passenger		Driver		Total
Male	54		158		202
Female	36		32		68
Total	90	(32.14%)	190	(67.86%)	280(100%)

According to table 4.2, The respondents were categorized by sex and role as passengers or drivers. Among the passengers, there were 54 males and 36 females, making a total of 90 passengers which accounted for 32.14% of the total sample. Among the drivers, there were 158 males and 32 females, totaling 190 drivers, which represented 67.86% of the respondents. Overall, the total number of respondents was 280, with 202 males and 68 females, making up 100% of the sample.

Table 4.3 Driving experience of the driver

	How Long You Have Been Driving?					Total
	<5	5-10	10-15	15-20	>20	
Total	63	37	39	28	23	190
Percent	33.15	19.47	20.5	14.7	12.1	100

Among the 190 respondents who were drivers, the duration of their driving experience varied. A total of 63 drivers, representing 33.15% of the group, had been driving for less than 5 years. Those with 5 to 10 years of driving experience amounted to 37 respondents, making up 19.47%. Drivers with 10 to 15 years of experience numbered 39, accounting for 20.5%. There were 28 drivers with 15 to 20 years of experience, representing 14.7%, and 23 drivers had been driving for more than 20 years, comprising 12.1% of the total. Overall, these groups sum to the total of 190 drivers surveyed.

4.4 Traffic condition of the study area

4.4.1 Traffic growth in Addis Ababa

According to several data, that the number of vehicles, bus, mini bus, freight, private cars, and motorcycles growth rapidly in Addis Ababa in the past several years. In Ethiopia Vehicles' number **grew** from 118,348 in 2005 to 539,658 in 2010 which match up to almost 355%. For example the company like Sheger transport company, Alliance transport company, Public bus enterprise and Anbesa bus enterprise increased by number and types so on. But Mini bus decrease by 3775(26%) because the Government focus public mass transport. The number of private car increase from 176,174 to 302,526 almost 71%. The number of Freight and Motor bicycle grew above 100% (Federal Transport Authority, 2018). And In Addis Ababa 8264 vehicle in (2005), 596,084 vehicle in (2020), and 620,440 vehicle in (2022), (AAUATF, 2022)

Table 4.4 Traffic Growth in Addis Ababa

Traffic Growth in Addis Ababa				
Year	2015 G.C	2019 G.C	2020 G.C	2024 G.C
Vehicle Population	426,500	596,084	620,440	645,000

Source:-AAUATF, 2024

According to table 4.4, the traffic in Addis Ababa has shown consistent growth over the years. In the year 2015 Western Calendar (G.C.), the number of vehicles registered was 426,500. This number increased significantly to 596,084 vehicles by 2019 G.C. The growth continued in 2020 G.C. with 620,440 vehicles registered in the city. The most recent figure, for 2024 G.C., indicates that the vehicle population in Addis Ababa reached 645,000. This steady increase in vehicle numbers reflects the rapid expansion of traffic volume in Addis Ababa over the past decade. (AAUATF, 2024 G.C.).

4.4.2 Population growth in Addis Ababa

The population growth of Addis Ababa city has shown a steady increase over recent years. In 2019 G.C, the population was approximately 4,592,000. This number rose to 4,794,000 in 2020 G.C. By 2023 G.C, the population had grown significantly to 5,461,000, followed by an increase to 5,704,000 in 2024 G.C. The latest estimate for 2025 E.C indicates that the population has reached around 5,957,000, (UN World Urbanization Prospects, 2025G.C).

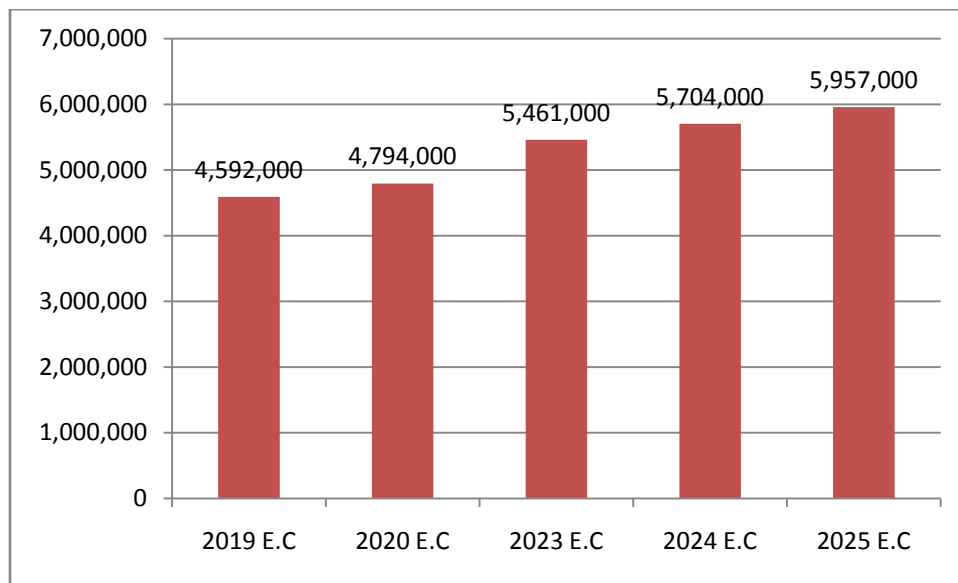


Fig 4.1 Population growth of the city

Source: UN World Urbanization Prospects, 2025

4.4.3 Congested Corridor of the study area

Table 4.5 Congesting situation of the corridor from 8:00-9:00 am

Point	Frequency	Percent
A)From MinilikII Roundabout to <i>Semen Hotel</i> Traffic light	61	32.1
B)From Semen Hotel Traffic light to Shola Traffic Light	33	17.3
C)From Shola Traffic lightto Semen Mazegaja Traffic light	31	16.3
D)From Semen Mazgaja Traffic light to Addisu Gebeya Roundabout	65	34.2

Source:- Feld Survey,2025

From the above table show that 34.2% passenger's respondents were agreed that from Semen Mazegaja Traffic light to Addisu Gebeya roundabout highly congestion corridor segment. 32.1% passengers respondents were determined next the most congested corridor from MinilikII Roundabout roundabout to Semen Hotel Traffic light. Almost 17% passengers respondents were agreed that congested corridor from MinilikII roundabout to Addisu Gebeya roundabout corridor. Finally 16.3% passengers respondents congested corridor were from Shoal Gebeya traffic light to Semen Hotel roundabout.



Fig 4.2: From Semen Mazegaja traffic light to Addisu Gebeya roundabout Congested corridors

Source: field survey 2025

4.4.4 Measuring Traffic Congestion

Speed in each LOS for Addisu Gebeya to MinilikII Square Street Level- of- Service is one and the most generally measure that used to assess the position of traffic. LOS measures a business volume of a given area qualitatively (Mathew and Krishna 2007). Six different situations are defined (LOS A, B, C, D, E, and F) with LOS- A representing the stylish condition and LOS- F representing the worst condition). Numerous agencies defining traffic in relation with LOS value, either LOS- E or F (Corpus Christi Metropolitan Planning Organization 2009)

4.4.4.1 Speed in each LOS for Addisu Gebeya to Minilik Square Corridor

Table 4.6 Speed in each LOS for Addisu Gebeya to MinilikII square Corridor

Segments	Average Time (in minute)	Average speed from 8:00-9:00 am peak hour(Km/h)	LOS	Average Time	Average Speed from 5:00-6:00pmpeak hr	LOS	Average Time
Addisu Gebeya to Semen Mazegaja	15	3.8	F	14	4.2	F	14.5
Semen Mazegaja to Semen hotel	12	9.5	F	12	10.36	F	9.84
Semen Hotel to Minilik Square	13	6.5	F	14	10.	E	13.5

Source: Field survey, 2025

Among the three streets, the average speed on Addisu Gebeya round about to Semen Mazegaja traffic light is the lowest, and remains at around 3.8 km/h at 8:00-9:00am peak hour, 4.2 km/h at 5:00-6:00pm peak hour and off peak hour 25km/h, the LOS in this road is F in all peak hour. Such an average speed is considered quite low; the next with the worst road traffic congestion, average journey speed at am peak hour close to 6.5 km/h has been recorded from Semen Mazegaja to Semen Hotel traffic light 12km/hr pm peak hour for both LOS is F at off peak hour LOS E. In Semen Hotel to Minilik square, the average speed is slightly better, the average speeds are 10 km/h, the general LOS is E. The above table suggest that road traffic congestion is serious on Semen Mazegaja to Addisu Gebeya.

4.4.4.2 Traffic Flow in each LOS for Addisu Gebeya to Minilik Square Corridor

Table 4.7: Traffic Flow in each LOS for Addisu Gebeya to MinilikII Square Street

	No of lanes	Peak Hourly Volume	LOS (Peak hours)
Addisu Gebeya around about to Semen Mazegaja traffic light	2	2354	F
Semen Mazegaja to Semen hotel	2	1920	E
Semen Hotel to Minilik Square	2	2032	F

Source:-Field survey, 2025

According to the above table traffic flow from Addisu Gebeya to Semen Mazegaja and Semen hotel to Minilik level of service is F but in Semen Mazegaja to Semen Hotel is E.

4.3.4.3 Density in each LOS Addisu Gebeya to Minilik Square Coridoor

Table 4.8: Density in each LOS for Addisu Gebeya to Minilik Square Street

Time	Lane Description	No. Of passenger car per mile (1.6km) per	lane Level of Service
At peak hour	to Semen Mazegaja	96	F
	Semen Mazegaja to Semen hotel	65	E
	Semen Hotel to Minilik Square	112	F

Source:-Field survey, 2019

Traffic flow from Addisu Gebeya Roundabout to Semen Mazegaja and from Semen Hotel to Minilik level of service is F but on Semen Mazegaja to Semen Hotel traffic light is E.

4.5. Major Causes of traffic congestion

Table 4.9: Causes of vehicle traffic congestion on the study area

	Very Agree		Agree		Neutral		Disagree		Very disagree	
a)Weak management of traffic movement	37	19%	48	25.2%	52	27%	42	22%	11	5.7%
b) On street and illegal parking	128	67.3%	46	29.4%	6	3.1%	6	3.1	4	2.1%
c)Inadequate road lane	77	40.5%	54	28.4%	44	23.1%	12	6.3%	3	1.5%
d)Population pressure	62	32.6%	53	27.8%	53	27.8%	17	8.9%	5	2.6%
e)Insufficient public transport services	46	25%	46	28%	39	15%	36	22%	19	11%
f)Too many private car vehicles	40	21%	38	20%	33	17.3%	45	23.6%	34	17.9
g)Illegal trade activity	43	22.6%	24	12.6%	43	22.6%	37	19.4%	43	22.6%
h)Rigid working time of the organization	68	15%	60	18%	41	38%	14	22%	7	8%
i) Inadequate road network	51	26.8%	46	24.2%	37	19.4%	11	5.7%	8	4.2
j)Traffic incident	38	20%	36	18.9%	37	19.4%	52	27.3%	27	1.4%

Source:-Field survey, 2025

According to the drivers respondent,128(67.3%) of the drivers respondents that the major reasons for traffic congestion in Addisu Gebeya to MinilikII Roundabout corridor is on-street and illegal parking. And 77(51%)of the respondents of the field survey show that inadequate road lane are the second major causes of vehicle traffic congestion in Addisu Gebeya to MinilikII Roundabout corridor. The 3rd most reasons for traffic congestion in Addisu Gebeya to MinilikII Roundabout corridor is rigid working time of the organization said 68(40.7%) of the

drivers respondents of the field survey responded. 62(46%)drivers respondents show that population pressure causes for the vehicles traffic congestion problem on Addisu Gebeya Roundabout to Minilik Roundabout corridor.51(26.8%) of the respondents believe that the major causes for traffic congestion of the study area is inadequate road network. 22.6%and 21% of the respondents of the field survey show that influence of illegal trade activity and to many private car respectively were causes for traffic congestion problem in Addisu Gebeya Roundabout to MinilikII Roundabout corridor.And 38(20%) of the respondents show that traffic incident serious causes for the vehicles traffic congestion on the study area.

4.6 Effect of Traffic Congestion

The study identified several effect of traffic congestion along the study area that which included loosing man-hours, increased cost of commuting, extra transportation cost, increased travel time, pedestrian-motorist conflicts, mental stress as well as air and noise pollution.

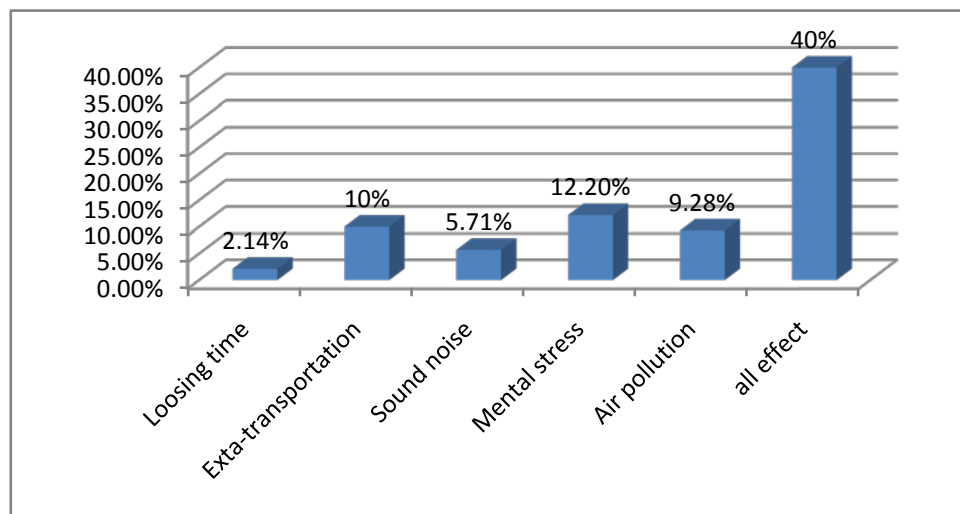


Fig 4.3 the effects of vehicle traffic congestion

Source: Field Survey, 2025

According to fig 4.3, The effects of vehicle traffic congestion are observed in several areas with varying frequencies and percentages. The most significant impact is the loss of man-hours, which accounts for 23.14% of the total effects, affecting 65 individuals. Extra transportation needs are reported by 28 people, making up 10% of the cases. Sound noise is experienced by 16

individuals, representing 5.71%. Mental stress affects 34 people, corresponding to 12.2%, while air pollution impacts 26 people, or 9.28%. Overall, 40% of the cases, totaling 112 individuals, experience all these effects combined. The total number of respondents is 280, accounting for 100% of the data.

4.7. Possible strategies to solve traffic congestion

Table 4.10: Possible strategies that can solve traffic congestion

	Very-agree		Agree		Neutral		Disagree		Very disagree	
Increasing public transport	55	28 %	45	23.6 %	44	23.25 %	36	19%	10s	5.2%
Control On street and illegal parking	77	40.5%	52	27.3 %	33	17.3 %	22	11.5 %	6	3.15
Flexible Work Hours/ Office/School time scheduling,	62	32.6%	50	26.3 %	46	24.2 %	16	8.42 %	16	8.4%
Improve the road lane	58	30.5%	37	19.4 %	38	20%	31	16.3 %	26	16.6

Source: Field Survey, 2025

In table 4.8,129(67.8%) of the drivers respondents of the field survey response the 1strank were control on street and illegal parking are the major possible strategies that can solve traffic congestion in Addisu Gebeya Roundabout to Minilik Roundabout corridor. And 114(59.9%) of the respondents of the field survey show that Improving new bus and taxi Stops are the second possible strategies that can solve traffic congestion on Addisu Gebeya to Minilik Roundabout corridor.Flexible work hours/office/school is the 3rd possible strategies that can solve traffic congestion in the study area corridor. And 112(58.9%) of the drivers respondents of the field survey responded that improving the size of the road lane, 95(49.9%)drivers respondents that increasing public transport are the possible strategies that can solve traffic congestion in Addisu Gebeya to Minilik Roundabout corridor.

4.8 Interpretation

4.8.1 On-street parking

Direct observation check conducted generally in Addisu Gebeya Round about to Minilik Square corridor. And it is discussed as follows: The researcher observed on- road parking in this corridor numerous heavy freight auto and machine on the road at peak hour especially around Addisu Gebeya. The other is from Shola Gebeya Traffic light to Semen Mazegaja Traffic light there

were heavy freight truck for long time without any engagement. I got the information from traffic police officer and as I observe small freight, Lada (small taxi) and heavy liquid auto in this congested corridor parked on lane made the road capacity to drop. Also the researcher observed that from Semen Mazegaja traffic light to Addisu Gebeya Roundabout, this area is congested part of corridor and one lane taken by small and heavy trucks.

4.8.2. Unwell designed taxi and bus Stops

From the researcher observation and interviewed from traffic control and traffic police officer that from Addisu Gebeya Roundabout to MinilikII Roundabout street is do not has well designed bus and taxi stops. Most of the stations are not properly designed because the stations create obstacles for other vehicles which travel on the main road. For example as we see in the figure 4.4 It is around Addisu Gebeya Roundabout and It Shows that because of the taxi stops on the main road of one lane how this makes the street to be congested.



Fig4.4 on-street taxi stops around Addisu Gebeya

Source: Field survey 2025

4.8.3 Rigid working time

According to the researcher frequent observation and the most the stockholder replies ideas, the passengers use the corridor area specific morning and evening time for trip and this increases the traffic flow of the corridor. Flexible work hours mean that the organization allows for workers some inflexibility in their diurnal work schedules. For illustration, rather than all workers start working 8:30 am, some might start work 7:00 am, and others may start 9:30 extending spin time. This spreads the appearance and departure time of workers and directly contributes to reducing peak business intensity and enables workers to choose indispensable modes of public transport.

4.8.4 Less Usage of Public Transport

According to the researcher interview with transport and traffic management officer the public (mass) transport like different vehicle like Sheger bus, Anbesa bus and New city bus (Velocity) are not sufficiently on Addisu Gebeya roundabout to Minilik II Roundabout corridor. And also as the researcher gets information from traffic control officer that further passengers traveled mixed with other lower engaged transport like small taxi and Mini bus. And some passengers choose the private vehicle. And this is one of the responsible factors for traffic congestion on the study area corridor.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATION

5.1 Conclusions

Traffic congestion is the impedance of vehicles imposed on each other due to speed-flow relationship in conditions where the use of counting and delay survey. One of the major socio-economic problems in Ethiopia and its capital city is traffic congestion. Because of human population and vehicle population growth rapidly are responsible for transportation problem in Ethiopia. In order to carry out effective paper work on the case study the method adopted were interview, traffic counting, and traffic delay survey. Congestion is occurred regularly and the major factor for congestion problem along the route of Addisu Gebeya roundabout to MinilikII square are on street and illegal parking, unwell design of bus and taxi stops, less usage of public transport and rigid/fixed working time of the organization. According to Federal Transport Authority,2018, the number of Freight and Motor vehicle grew above 100%.And In Addis Ababa number of vehicle increased rapidly as follow 8264 vehicle in (2005), 596,084 vehicle in (2020), and 620,440 vehicle in (2022), (AAUATF,2022).Like the vehicle the population number of the city also increase rapidly, the number population of Addis Ababa city is estimated 5.9 million(UN world urbanization prospects,2025).The effects of traffic congestion on the study area are waste of time, mental stress, and extra transportation coast, inability to forecast travel time, fuel consumption and environmental pollution.The worst time congestion in Addisu Gebeya roundbout to MinilikII Square from 8a.m to 9a.m. From Semen Mazegaja traffic light to Addisu Gebeya roundabout highly congestion corridor.And control on street and illegal parking, improving the standard of bus and taxi stops, improving the road lane and increasing and using mass transport are the major possible strategies that can solve traffic congestion in Addisu Gebeya roundabout to MinilikII Square corridor.

5.2 Recommendations

Based on the findings generally the researcher recommended three options, improving the standard of the bus and taxi stops. It should be built separately from the main road especially at the source around Addisu Gebeya because the bus and other public bus using the main road as a station. And this option is concerned for Addis Ababa Road Authority. The second one increasing usage of mass (public transport), It plays the most essential role in order to minimize the traffic congestion. Because large area of the street which is taken by small automobiles saved by high occupancy vehicle or public bus transport. And this option is for Addis Ababa Transport Authority. The last option is increasing or adjusting supply of road space to meet demand of traffic flow, or managing demand to fit within the available supply by increasing mass transport. This the last option concerned for Addis Ababa Road Authority.

5.2.1. Improving the standard of bus and taxi stops

So many heavy freight car, taxis and different private car are parked on the street at peak hours around the study area corridor. And as we observed the above picture (Fig 4.4) the taxis and buses are uses the main road as a station this means one lane of the road is taken by parking and station. And this makes the traffic to be more congested. Therefore improving or constructing the taxi and bus stops and this is expected to make the traffic smooth flow.

5.2.2 Priority to Public Transport

Public transport has potential to transport as many, if not more people, than private cars while at the same time consuming significantly less road space. As from different countries experiences, efficient public transport is one and most important than others in solving traffic congestion by shifting traffic from automobile to a mass transit. Introducing high occupancy vehicles should be coupled with better management of the existing road network and traffic management will have essential role in improving the high movement demand of the city.

5.2.3 Adjusting the road lane

From Addisu Gebeya roundabout to MinilikII square corridor is one of the essential transport lane because of the corridor is northern door of the city, the road provided transport service for different types of vehicles and the Vehicles population of the city in increasing rapidly therefore the need for extra road lane. So the administration of the city should consider and included construction of new lane and pedestrian walk way” on its long-term plan or part of corridor project program.

5.2.4 Flexible Work Hours

Flexible work hours mean that organizations allow employees some flexibility in their daily work schedules. For example, rather than all employees start working 8:30am, some might start work 7:00a.m, and others may start 9:30 extending outing time. This spreads the arrival and departure time of employees and directly contributes to reducing peak traffic intensity and enables employees to choose alternative modes of public transport.

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- a) 5 min to 20min
b) 21min to 35 min
c) 36min to 50min
d) 51min to 1hour

5. Which street in Addisu Gebeyarounds about to Minilik II square road corridor do you feel have the worst congestion problems?

- a) From Minilik roundabout to Semen Hotel traffic light
- b) From Semen Hotel to Shola Gebeya traffic light
- c) From Shola traffic light to Semen Mazegaja traffic light
- d) From Semen Mazgaja traffic light to Addisu Gebeya roundabout

6. How big effect traffic congestion from Addisu Gebeya roundabout to Minilik II square in your life?

- a) No problem at all
- b) To some extent
- c) Highly affect

7. What are the effect coming by cause of Vehicle Traffic Congestion on Addisu Gebeya Roundabout to Minilik II square corridor?

- a) Loosing man-hours
- b) Extra transportation cost
- c) Sound pollution
- d) mental stress
- e) Air pollution
- g) All
- h) Any other, specify-----

Appendix-2: Questioner and Interview

Addis Ababa University Department of Geography and Environmental Science

Questioner for drivers along Addisu Gebeya Roundabout to Minilik II square corridor

The aim of this question is to identify the causes of road traffic congestion and to investigate the major effect to contributing to road traffic flow. Based on the analyses, some possible measures for road traffic congestion and other related urban transport problems will be suggested in order to promote smooth mobility and safety and fulfill the requirement for award of Master's degree in Geography.

I hope that you will give true information that a precious input for this work. Please, be informed that your information will kept secretly. Thank you for your all cooperativeness and kindness in advance.

1. Personal Information putting an “X” mark

Sex: male ☐ female ☐

2. How Long You Have Been Driving?

- a) <5 b) 5-10
c) 10-15 d) 15-20 e) >20

3. For what purpose most frequently you traveled along Addisu Gebeya roundabout to MinilikII Square corridor?

- a) For job b) For education
c) For recreation d) for shopping
e) Any other, specify-----

4. Do you think there is traffic congestion on Addisu Gebeya Roundabout to MinilikII Square corridor?

- a) Yes b) No

5. If yes, what do you think the level of traffic congestion on the street?

- a) Very high Congested

- b) Congested
- c) Medium Congested
- d) Low Congestion
- e) No Congestion

6. If your answer to the above is "a" or "b", Putting an “X” mark the following causes of vehicle traffic congestion on Addisu Gebeya to Minilik Square corridor.

The Major causes of traffic congestion	Very agree	agree	Neutral	disagree	Very disagree
a) Population pressure					
b)On street and Illegal Parking					
c) Inadequate road network					
d)inadequate road lanes					
e)Insufficient public transport services					
f)Too many private car vehicles					
g) Illegal trade activity					
h)rigid working time of the organization					
j)Traffic incident					
k)Any other, specify-----					

7. What are the effects coming by cause of Vehicle Traffic Congestion on Addisu Gebeya roundabout to MinilikII Square road?

- a) Loosing man-hours
- c) Extra fuel consumptions
- e) Sound pollution
- g) Any other, specify-----
- B) Mental stress
- d) Vulnerable for accident
- f) Air pollution

8. What are the possible strategies that can solve traffic congestion? Please, Rank them according to their significances.1,2,3,...

A) Flexible Working Hours/ Office/School time scheduling,	
B) Priority to Public Transport & HOVs	
C) building new Bus and taxi terminals	
D) Constructing extra road lane	
E) Increase the number of public transport	
F) Discourage private cars	
G) Control illegal parking and on-street parking	
H) Any other, specify-----	

Appendix-3, Interview

Addis Ababa University Department of Geography and Environmental Science

Interview for traffic Police and Experts (worked on traffic management agency) along Addisu Gebeya roundabout to Minilik II square corridor

The aim of this interview is to identify the causes of road traffic congestion and to investigate the major factors contributing to road traffic flow. Based on the analyses, some possible remedial measures for road traffic congestion and other related urban transport problems will be suggested in order to promote smooth mobility and safety and fulfill the requirement for award of Master's degree in Geography.

I hope that you will give true information that a precious input for this work. Please, be informed that your information will kept secretly. Thank you for your all cooperativeness and kindness in advance.

1. How do you see the current vehicle traffic flow in Addisu Gebeya Roundabout to MinilikII Square corridor?
2. How do you evaluate the general Vehicle Traffic Congestion conditions on this street corridor?
3. From your experience, what are the major causes for vehicle Traffic congestion along this route?
4. How do you evaluate the existing road width or design in respect to the vehicle Traffic congestion in Addisu Gebeya Roundabout to MinilikII Square corridor?
5. How do you evaluate the current on-street parking management regarding its relation to the congestion?
6. Which Specific time is vulnerable for the traffic congestion?

7. How do you evaluate the effect coming by cause of Vehicle Traffic Congestion on Addisu Gebeya roundabout to MinilikII Square road?

8. Would you state some possible measurement that can be solution strategy to minimize the impacts?

9. Any other information you want to add/ give?

Thank you