

IMPACT OF TRAFFIC CONGESTION ON THE COMMERCIAL CENTER: THE CASE
OF NEKEMTE TOWN, OROMIA, ETHIOPIA



Shumi Belay Amenu

A Thesis Submitted to the Department of Architecture
School of Civil Engineering and Architecture

Presented in Partial Fulfillment of the Requirement for the Degree of Master's in Urban
Planning and Design

Office of Graduate Studies
Adama Science and Technology University

February, 2024
Adama, Ethiopia

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Declaration

I hereby declare that this Master thesis entitled “Impact of Traffic Congestion on the Commercial Center: The Case of Nekemte Town, Oromia, Ethiopia” is my own work. It has not been submitted to any university for a similar purpose. The references and sources that are used for this thesis have been properly recognized by proper citation.

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Recommendation of Advisors /Supervisors

I, the major advisor of this thesis, hereby certify that I have advised the revised version of thesis entitled “Impact of Traffic Congestion on the Commercial Center: The Case of Nekemte Town, Oromia, Ethiopia” prepared under my guidance by Shumi Belay Amenu, submitted in partial fulfillment of the requirements for the degree of Masters of Science in Urban Planning and Design.

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LIST OF ACRONYMS AND ABBREVIATION

Av	Average
CAD	Computer Aid Drawing
CBD	Central Business District
CS	Collector Street
E	East
GDP	Growth Domestic Product
GIS	Geographic Information System
LOS	Level of Service
N	North
OUPiWB	Oromia Urban Planning Institute of Western Brunch
PAS	Principal Arterial Street
SAS	Sub Arterial Street
S	South
SW	Southwest
TA	Traffic Accident
TC	Traffic Congestion
TTC	Teacher's Training Collage of Nekemte
W	West
WURH	Wollega University Referral Hospital

Abstract

Today, the problem of traffic congestion in cities, which is frequently seen following economic, social, and political development, is one of the biggest problems in the world. While this is common in both developed and developing countries, it is a difficult and serious problem in developing countries due to lack of proactivity, lack of capital and un-adaptive use of advanced technology. The impact of traffic congestion on commercial activities and daily life in cities is a problem that appears to be quite realistic. Nekemte is one of the largest cities in western Oromia and is suffering from traffic congestion. In particular, its being a commercial center and a transportation crossing has made it even more vulnerable to traffic congestion. This paper aims to investigate the impact of traffic congestion on the commercial center of the city. Descriptive and explanatory research design was employed in the study aims to identify the current condition of traffic congestion, a major cause and its impacts on commercial centers. On site observation strategy was adopted to collect data on the selected road with high congestion, and organized questionnaire and interview was also conducted to traders, pedestrians and experts. Both qualitative and quantitative approach methods were used, and 158 samples were selected both in probability and non-probability sampling techniques. For probability portion a simple random sampling method was used on traders, and a convenience sampling method was used in non-probability sampling methods on pedestrians, drivers and experts. Traffic accidents are the major element that measures the current condition of traffic congestion. Internally the fast development of infrastructure in the city, externally highly entrance of vehicles daily to the city, and illegally on street parking of trucks that takes the existing space of internal activity are a major causecauses for the occurrence of traffic congestion in the city. The on-street parking affect the permeability of pedestrians, ability to see and understand the environment (visual permeability) and it also affect ability to access functionally (functional permeability) where they intend and what they want to do regarding the commercial activity. And the researcher recommended that the city administration could reduce the impact of traffic congestion on the commercial center by creating a poly centric city and revising policies to allow trucks not to pass through the city center, but through the outskirts.

Key words: Commercial activity, congestion, traffic accident, and traffic congestion

CHAPTER ONE

1. INTRODUCTION

Currently, the cause of traffic congestion has become the focus of research, especially in developed countries. However, it lacking attention in the lower-level countries due to lack of financial expenditure, loss of synergy, lack of experience and understanding of the benefits of technology and lack of adaptation to change. In this regard, the researcher feels the need to contribute information and knowledge-based study evidence and further strengthen the understanding of the community awareness regarding the impact of traffic congestion and its management. Hence, the risk in terms of traffic congestion is high at the national level, so being able to understand causes and consequences and wanting to find a solution in any way possible is the task of this paper.

1.1 Background

Just as the basis of life for all living things is the function of the circulatory and respiratory systems, commercial and transportation systems are also crucial for the growth and development of a city. One of the jobs in a city that attracts people is commercial activity and the phases of urban transportation. According to (Godsk, Jensen et al. (2012)urban growth in the central west of the country has accelerated due to the country's strong commercial business and transportation linkages. As the history of the founding of many cities shows, commercial activity significantly connects the city and people, and cities and towns, with transportation acting as a bridge. Different scholars and researchers have different perceptions and considerations for it, and commerce and transportation are considered and processed by the transformation and growth of the urban district and its suburbs (Gospodini 2006)in the form of effective transportation and communication (Snir, Smith et al. 2003)) and strengthening service relationships close to the home (Davlouros, Arseniou et al. 2009) in densely populated areas.

However, if the movement and relationship between commercial activity and transportation in the city on the roads are not in a scientific, coordinated, and balanced manner, it will put the city under serious pressure and cause serious problems. One of the problems it can cause is traffic congestion. So far, one of the worst problems facing cities in the world is traffic congestion. Traffic congestion is a constantly changing phenomenon that limits the

movement of people, vehicles, and goods from place to place, wasting time and money. (Anas and Lindsey 2011) this characteristic is reflected in the actual situation of the city, for example, the increasing economic growth and increasing demand of the city's residents, the expansion of urban development infrastructure, the landscape of the city, and the rapid expansion of the city. They appear in such circumstances, however, in an environment of activity and warmth: on the main road in the city center, at intersection points, landmarks, nodes, and in transition areas, the traffic hotspots become a highly experienced phenomenon. Therefore, congestion leads to high costs due to the lack of timely availability of the urban road transport system for the desired services (Scully, Friedrichs et al. 2002).

In the city human life is based on transportation and pedestrian movement, their needs cause collisions which are caused by a mismatch between the size of the road and the needs of the users. This is affecting their daily lives by preventing them from reaching where they intend to go when and as they intend to. Urban growth without harmony and coordination of planning and a lack of living and working space in urban areas in a manner equal to the population are mentioned as the first problems. Especially the lack of comfortable conditions for pedestrians, which causes injuries and impacts commercial activities. According to (Tu, Nisan et al. 2001) pedestrianization has further enhanced commercial activities, but a lack of capacity leading to inconvenient streets and collisions causing congestion is another problem. In the study and teaching of urban planning and design, there must be access to streets and permeability (physical permeability and visual permeability) for people to walk and transport in a city. This helps them to understand their surroundings, avoid collisions and crowds, and get to the desired situation perfectly.

According to reality, the pace and spread of traffic congestion are increasing and causing economic losses and social and environmental problems in the country. According to (Lamy-Giner 2011) and (Greicius and Menon 2004) when the number of vehicles flowing in the city starts moving simultaneously, it causes traffic congestion and economic decline. There are many countries affected by the problem of traffic congestion; among the worst traffic congestion at the world level are: Bengaluru in Indian country, and Manila in the Philippines country scored 71% level of congestion, Colombia in Bogota with 68% level of congestion, Mumbai and Pune in Indian city are scored 65% and 59% level of congestion respectively, Moscow in Russia scored 59%, Istanbul in Turkey scored 55%, Kyiv in Ukraine 53%, Bucharest in Romania scored 52% level of congestion. Los Angeles, New York, and San

Francisco in the USA score 42%, 39%, and 36% levels of congestion, respectively, and etc. As the statistics of 2018 and 2019 describe, the world's congestion level increased beyond unexpected situations because of the high growth of their economies.

In developing countries like African's countries, the congestion level is very high and is becoming a huge project and input challenge for the government's work. According to (Lee, A. & Lin, W., 2018), the former and challenging countries in Africa by traffic congestion are Cairo in Egypt at 40%; Cape Town in South Africa; Johannesburg in South Africa; Pretoria in South Africa; East London in South Africa; and Durban in South Africa at 32%, 30%, 29%, 25%, 22%, and 19% levels of congestion, respectively. Nairobi, Kenya, is another African country affected by traffic congestion currently. Due to this traffic congestion, she lost \$1 billion (about \$3 per person in the US) (about \$3 per person in the US) in productivity in a year. The main problems and root causes of traffic congestion in this developing country are industrializations, unemployment, a low budget for new development, low accessibility of technology, etc. (TomTom, (2020)) due to the challenges, they faced and fell under.

Traffic congestion has an impact on the market and economy of the city by affecting the interaction that the people have with business performance or commercial activity. Since commercial activity is mainly expanded with street centrality and complex road networks (Wang et al., 2005; Wang et al., 2015)) it is easily exposed for traffic impact. In all major cities the traffic congestion impact is a wider spread phenomenon causing waste time, inaccessibility to commerce area and blocking the movement of customers and their perception to commerce's center. According to (Colak, Lima and Gonzalez, (2016)) traffic congestion affects the convenience performance of commercial activity, (De Sarkar, (2019)) it is the cost of urban externality that affects the quality of urban life, their walk, work and the economic viability of the city.

In developed country traffic congestion causes impact on commercial activity in various ways. These are creating too much of journey time, over collusion of road, loss of time to work, energy consumption and environmental pollution like noise pollution, and segregation from socio-economic activity and thoroughly pace an impact on the commercial activity of the city (Fattah, Morshed et al., 2022)) and losses of safety of users or customers through their access to commercial activity. In contrast to the developed country in developing country traffic congestion also causing various impact on the commercial activity center. Although

the impact of traffic congestion is similar in both countries, developing countries lack the power to solve because most of the solutions are technological based.

In Ethiopia the condition of traffic congestion is becoming a common problem, especially due to the un stabilized level of urbanization and the low economic level of Ethiopia's ability to solve this problem. Today, more than ever, Nakamte is also a city that is suffering from traffic congestion. Nakamte is the capital of the commercial and communication center of the Western Oromia Region, the Eastern Wallaga Zone, and the commercial capital of Western Ethiopia. Nakamte is the center of the city in all directions and has a comfortable climate, which has made it expand rapidly. Due to the expansion of the city, the demand of the people on the roads and the amount of road service cannot be matched, which has exposed it to the problem of traffic congestion. In addition, the speed of traffic and its impact on the community have increased due to the city's geographical location and its relationship with other cities and regions.

1.2 Problem statement

Many cities in Ethiopia including Addis Ababa are increasing in overpopulation and economy however, their level of expansion and economic level are not matched and that causes them currently under the pressure of traffic congestion. Even various studies and research conducted in the city to reduce the accidents and problems caused by traffic congestion to pedestrians, passengers and drivers have not been able to come up with a convincing and decisive solution.

The city of Nekemte is one of the cities that is under pressure and traffic problems. In the current reality, accidents of death, property and injury are part of the problems caused by traffic congestion in the city today. Lack of access to transportation opportunities, and if available, lack of access to transportation and waste of time, money, and lack of workplaces when they need them and inability to provide adequate security are also problems. The installation and expansion of various development infrastructures in the city, as well as the increase in the expansion of the city has made it appear to have such problems.

The researcher in his study investigates the causes of traffic congestion and the negative impact it faces on the commercial center of Nekemte city. The outcome of traffic congestion has all ways the negative impact on commercial activity by various factors and daily

contributions of human life in the city. So, the researcher gone to investigate the issues raised regarding the cause and effects of the traffic congestion, suffering of commercial activity, blocking of road accessibility and daily loss of time and energy in the hotspot area of the city. However, related to this research, although various researchers have previously studied in different places, the researcher's approach to his research is unique. Let us first consider the opinions of past researchers as follows:

Author, Amit Vashisth (2017) was researched on Traffic Congestion in Samalkha Town, India. In this research he investigated the impact of congestion on the economic cost associated with accidents by measuring economic lost due to accidents and considering pedestrians as a focused group. This being the case, as a shortcoming of this researcher and what I found is that the source of traffic congestion has not been thoroughly investigated depending on the major features of city elements. Author Yared Haregewoin (2010) was researched on the Impact of Vehicle Traffic Congestion in Addis Ababa, Ethiopia. His investigation was based on economic loss due to long time consuming of passengers in peak hour and his deficiency is like that of the researcher who first mentioned. Author Hayu Alemgena (2018) was another researcher who investigated his research on the pedestrian safety problems and its counter measurement in the case of Nekemte city. His issue is focusing on developing strategic measurements to improve pedestrian safety problems and improving the health service delivery of pedestrians through LOS method analyses.

The researchers described above and those like them conduct a critical study process. This means that they do not consider the cause and effect of traffic congestion with critical variables that describe the characteristics of a city, especially those related to road characteristics like permeability (physical and visual permeability), and accessibility and they also not considered the internal pull factors and the external push factors of creating traffic congestion. Also, the cause and effect of urban congestion have different characteristics from place to place, and this has not been specifically explained or done in the research of previous researchers, for example location. It is good to know not only the economic growth, rapid urban expansion, road congestion, and lack of traffic management but also the actual situation in and around the city.

One of the shortcomings that the researcher is going to get in this study is to find ways to measure the causes of traffic congestion and their potential impact. So, in this paper, the researcher considers the location of the study as a case to investigate the traffic congestion

and examined the behavior of vehicles and pedestrian accessibility or permeability to commercial activities, the internal and the external factors that play a part in creating traffic congestion to occur impacts on commercial activity.

1.3 Research Objective

1.3.1 General Objectives

The general objective of this research is to investigate the impact of traffic congestion on the commercial center of Nekemte town and suggest alternative strategic approaches and design solutions that overcome the current problem.

1.3.2 Specific objectives

1. To examine the current congestion of traffic condition in Nekemte town.
2. To identify the root cause of traffic congestion in the study area.
3. To study the challenges that the traffic congestion has on the commercial center of the study area.
4. To develop set of recommendation and design solutions for reducing traffic congestion in the commercial center of study area.

1.4 Research question

1. What is the current traffic congestion situation in Nekemte?
2. What are the root causes of traffic congestion in the study area?
3. What are the major challenges that traffic congestion facing commercial on commercial center in the study area?
4. What are the recommended strategies and design solutions for reducing traffic congestion in the commercial center of the study area?

1.5 Significance of the study

The outcome of the study perceived regarding the following constructive works on the study area. It will help to analyze and deeply study the issues of traffic congestion, its causes and effect on the life of the citizens of the city and surrounding areas, especially on commercial activity. And that is to determine whether street crowd reduced and safe for work, walk and life in the study area without or with low pressure gets congestion on the area (study area).

The study is designed to address the gaps in studies and research conducted in different places and times. It also identifies the problems and sources of traffic congestion problems and provides awareness to the community to help the community to be vigilant and take necessary precautions and cooperation. In addition to advancing knowledge, it will be the main input consideration of town planning development and implementation policy approval.

It is also intended to provide the concepts in the study as a crucial framework for further study and research. Still in unique, there is no pull enforcement policy and strategic development that traffic congestion pressures in land use development implementation while it is seated in default regarding the norms of urban planning and design in academic and working ministers. This issue will be considered and gets alternative mechanism of solution in this research conduction.

1.6 Scope of the study

The spatial scope of this study is limited to Oromia Regional State, Nekemte town Administration. And focusing on Nekemte -Asosa and Nekemte Addis Ababa highways from the Bordi to the 2nd roundabout including the street access to Kumsa, Tourist and Bake Jama starting from roundabout. The reason that these streets were selected was that the streets are the cross-section street to various cities, regions and states. Due to that the mass volume of the vehicles are moving every in a time on it and exposes the street for the congestion.

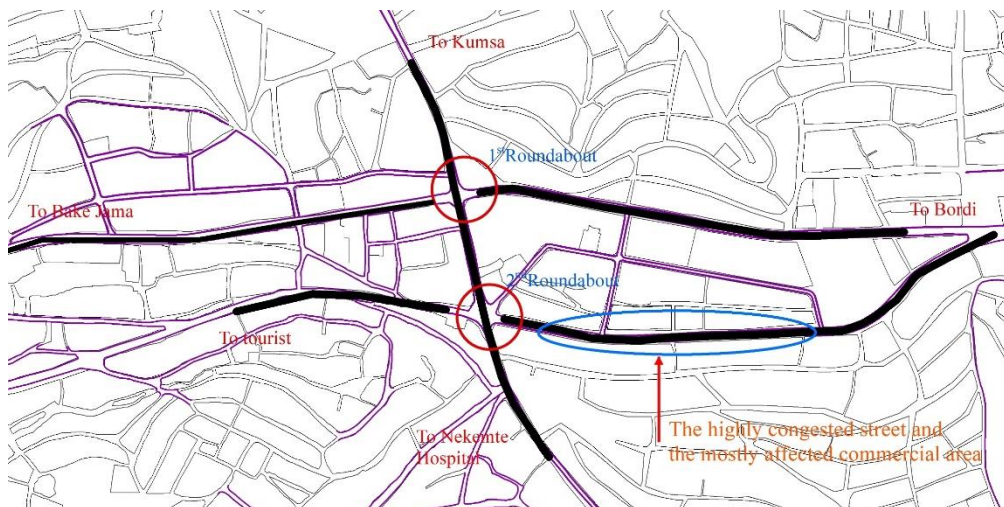


Figure 1.1: the spatial location of the study area

Whereas the thematic scope of the study allows the researcher to focus on what and why traffic congestion is happening on this specified area, spatial scope of the study. And embracing the cognitive and required information in the current issues of traffic congestion on the safety and quality of work, walk and life in commercial centers with the proposed solution. The improvement and reduction methodology of traffic congestion in the commercial center may provide an awareness of city officials and policy maker and helps to improve and manage problems by fostering accessibility and safety on the pedestrian walkways in the city. Generally, the main scope of this study is to understand why congestion is visible and what challenges it has on the commercial center of the study area.

1.7 Operational definition

Definition of some terms in this research are set out below.

Commercial center: Area of a town where most of the commercial activities are found. This area is dominated by shops, hotels, and local government offices with tall buildings (Samuel, 2012).

Traffic: It can be the passage/mobility of people, goods and vehicles along routes of transportation (vehicles or pedestrians in transit).

Traffic accidents: Dangers to limb, property and life caused by road congestion, traffic accidents and uncontrolled movement of people and vehicles.

Permeability: It is the ability of people to perceive or see, control and easily access and maneuver their surroundings during street activities, making them easily adaptable to their needs or wants

Data survey: A process during study and research in which relevant and satisfactory information can be collected by conventional and unconventional methods by the methods of primary and secondary data methods.

1.8 Limitation of the study

In this study there are varies challenges and limitations which affect the system of the researchers conduct during the data collection. These are: the security of the city was the main and big reason for limiting the necessarily data like photo capturing, and video recording for the reality description of the events on the field about the traffic congestion especially regarding the cause of traffic congestion which needs observation on the field. In

addition, some office staff have shortcomings in responding to requests for comments and providing available data based on fears related to security issues. This requires convincing time and mysterious methods, so the researcher spent a lot of time getting this evidence.

On the other hand, many government sectors were not aware of the linkages and relationships between sectors which had an impact on what the researcher asked them, and it was burns time and money to convince them again and again in the possible way.

1.9 Organization of thesis

The contents of this thesis are briefly described below.

Chapter one: It contains and includes the introduction or the background of the research title, statement problems, research objective, and the significance of the research, scope and the limitation of the study in general.

Chapter two: It contains the literature review of the study regarding the cause and effect of traffic congestion in the urban area. And it is crucial for the study to understand the gap and fill it.

Chapter three: It is the part of methodology and materials in the study area for the study purpose sets in it's about the population or targeted group in the study, sample size and techniques, methods of data collection and tools of data collection including the analyses of the data.

Chapter four: It focuses on the result and discussion. And it realizes, measures and discusses the outcome of chapter three regarding the problem statement and research objective stated in the 1st chapter by the qualitative and quantitative approaches.

Chapter five: This is the end chapter of this thesis and contains the conclusion and recommendation of the thesis overall.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Traffic Congestion

According to (de Jong, Van De Voorde et al. 2009) states that congestion can be perceived as unavoidable consequences of scarce transport facilities such as road space, parking area, road signals and effective traffic management. They argue that urban congestion mainly concerns two domains of circulation, passengers and freight, which share the same infrastructure. Thus, traffic congestion conditions on road networks occurs because of excessive use of road infrastructure beyond capacity, and it is characterized by slower speeds, longer trip hours and increased vehicular queuing. (Chan, Van Zwieten et al. 2008)also opines that traffic congestion occurs when the volume of vehicular traffic is greater than the available road capacity, a point commonly referred to as saturation. He describes several specific circumstances which cause or aggravate congestion. Most of such circumstances are concerned with reduction in the capacity of road at a given point or over a certain length or increase in the number of vehicles required for the movement of people and goods.

(Chan, Van Zwieten et al. 2008)further argues that economic surge in various economies has resulted in a massive increase in the number of vehicles that overwhelms transport infrastructure, thus causing congestion on roads in cities. (Harriet, Poku et al. 2013)note that congestion in urban areas is dominantly caused by commuting patterns and little by truck movement. They further attributed the causes of congestion to rise in population densities, road incidents and broken vehicles on the roads which restrict capacity of roads and impair smooth traffic flows. Another contributing factor to congestion as suggested by (Herman 2001) cited (Chan, Van Zwieten et al. 2008)is parking. He is of the view that road parking, which consumes large amount of space has become a land issue that greatly inflates the demand for urban land, causing congestion in cities. He adds that high urban mobility rate also contributes to the congestion menace. The massive use of cars does not only have an impact on traffic congestion but also leads to decline in public transit efficiency, thereby creating commuting difficulties in cities.

Indeed the over dependence on cars has tremendously increased the demand for transport infrastructure. Unfortunately the supply of transport infrastructure has never been commensurate with the growth of mobility needs. Consequently, several vehicles spend most of the time in traffic as a result of traffic space limitation (Whelan, Julian et al. 2019) Furthermore, (Peden, Scurfield et al. 2004) that traffic congestion in Kumasi is attributable to limited road capacity, parking space, dysfunctional road signals, drivers' behavior, vehicle breakdown on roads and too many cars within the city. (Harriet, Poku et al. 2013) outline some measures that could help deal with the congestion menace. They mention traffic signal synchronization, incident management, congestion pricing and the use of public transit as possible effective strategies available in dealing with congestion situation, although not without their associated challenges.

2.1.2 Urban Traffic condition

In our world, road traffic dominates other modes of transportation. The most common means of urban transport is public transport. public buses, taxis that either scheduled or non-scheduled or based on demand, individual motorized passengers (automobiles) and freight transport (trucks), and non-motorized "slow modes" of transport, principally walking and cycling, sometimes animals, like donkey and horse riding are also included (Aubin, Garbe et al. 2011).

Non-motorized travel, such as walking and cycling movements has a positive impact for reducing automobile trips in most urban areas. However, in developing cities, infrastructures for non-motorized transport are inadequate and because of these passengers forced to use cars even for short trip (Litman 2003). Developing cities also experience heavy traffic congestion during large peak hours "Tourists are concentrated because the activities will start in the first half of the year. "So many trips take the same amount of time every day. A similar pattern was revealed in ... the afternoon when the business activity ends" and travel by commuters in single-seat vehicles (Litman 2003).

2.1.3 Causes of traffic congestion

There are two main factors that cause traffic congestion. The number of people traveling at the same time, a large number of vehicles exist in a limited amount of road space. Macro-level factors such as land use patterns, vehicle ownership trends, and geographic economic

development. Congestion is caused at the micro level and controlled at the macro level ((Kunder, Avinash et al. 2016)).

2.1.3.1 Vehicle congestion

Most authors agreed that there are two main types of traffic congestion: it can be recurrent: when it occurs regularly or daily base, making it easier to manage and non-recurrent which occur due to accidents, special events or road closures (Ungemah and Dusza 2009). There are variables that can measure the main causes of vehicle traffic congestion. Like, imbalance between the vehicles volume and road capacity (LOS), illegal on-street parking (double parking, and park for long time specially during peak hours), inflexible work schedule that start and end at the same time, poor vehicle condition (too old and technical inefficient), traffic accident, and un-integrated land use.

Congestion can be measured in various ways, including roadway level-of-service (LOS), and average congestion delay compared with free-flowing traffic ((Litman 2005, Fitzgerald 2009). The capacity of a road depends on various design factors, such as lane widths and intersection configurations among others. As indicated in various literatures, it is possible to conclude that capacity of a given road can be determined by actual traffic volume or level-of service of the roads (Godefrooij, de Jong et al. 2009).

2.1.4 Pedestrian side walk

Pedestrian walk ways are lane of street that everyone has the right to use except motorized and are legally protected and respected (Ye, Jianhong, et al, 2008). This means that just as carriageways are legally protected and respected, people's roads are well protected and respected and have carriageway connections and can provide timely services. It also a place provided for kids to walk, run, skate, ride bikes and play. We need to know how much standard is needed for a person on pedestrian to control congestion on a pavement. We determine this in detail, and it is 1220mm for a person. Based on this, the pedestrian LOS can be known. It is shown in following Table 2. 1.

Table 2. 1: Minimum pedestrian clear area

Pedestrian Flow rate (pedestrian/hour)	LOS A	LOS B	LOS C	LOS D	LOS E
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< 600	1.5 m	1.2 m	1.2 m	1.2 m	1.2 m
600-1200	3.1 m	1.2 m	1.2 m	1.2 m	1.2 m
1200-2400	6.1m	1.8 m	1.5 m	1.2 m	1.2 m
2400-3600		2.8 m	1.8 m	1.5 m	1.2 m
3600-4800		3.7 m	2.5 m	1.8 m	1.2 m
4800-6000		4.6 m	3.1 m	2.1 m	1.2 m
6000-7200	Not	5.5 m	3.7 m	2.5 m	1.5 m
7200-8400	Recommended	6.1 m	4.3 m	3.1 m	1.8 m
8400-9600		7.1 m	4.9 m	3.4 m	2.1 m
9600-10800		8.1 m	5.5 m	3.7 m	2.5 m
10800-12000		8.9 m	6.1 m	4.3 m	2.5 m

Source:

2.1.5 Pedestrian Walkway LOS

LOS A

Pedestrian Space > 5.6 m²/p Flow Rate ≤ 16 p/min/m. At a walkway LOS A, pedestrians move in desired paths without altering their movements in response to other pedestrians. Walking speeds are freely selected, and conflicts between pedestrians are unlikely (Bosina, Ernst, 2018). It is shown in Figure 2. 1.

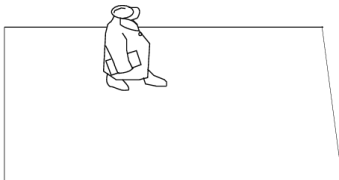


Figure 2. 1: LOS A

LOS B

Pedestrian Space > 3.7 - 5.6 m²/p Flow Rate > 16 - 23 p/min/m. At LOS B, there is sufficient area for pedestrians to select walking speeds freely, to bypass other pedestrians, and to avoid crossing conflicts. At this level, pedestrians begin to be aware of other pedestrians, and to respond to their presence when selecting a walking path (Bosina, Ernst, 2018). It is shown in Figure 2.2.

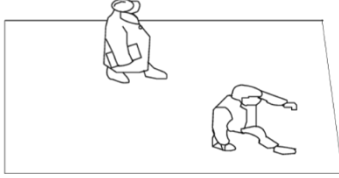


Figure 2.2: LOS B

LOS C

Pedestrian Space $> 2.2 - 3.7 \text{ m}^2/\text{p}$ Flow Rate $> 23 - 33 \text{ p/min/m}$. At LOS C, space is sufficient for normal walking speeds, and for bypassing other pedestrians in primarily unidirectional streams. Reverse-direction or crossing movements can cause minor conflicts, and speeds and flow rate are somewhat lower (Bosina, Ernst, 2018). It is shown in Figure 2.3.

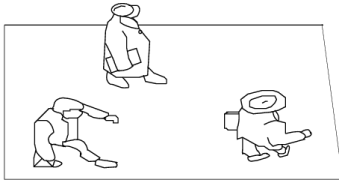


Figure 2.3: LOS C

LOS D

Pedestrian Space $> 1.4 - 2.2 \text{ m}^2/\text{p}$ Flow Rate $> 33 - 49 \text{ p/min/m}$. At LOS D, freedom to select individual walking speed and to bypass other pedestrians is restricted. Crossing or reverse flow movements face a high probability of conflict, requiring frequent changes in speed and position. The LOS provides reasonably fluid flow, but friction and interaction between pedestrians is likely (Bosina, Ernst, 2018). It is shown in Figure 2.4.

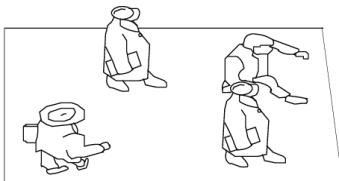


Figure 2.4: LOS D

LOS E

Pedestrian Space $> 0.75 - 1.4 \text{ m}^2/\text{p}$ Flow Rate $> 49 - 75 \text{ p/min/m}$. At LOS E, virtually all pedestrians restrict their normal walking speed, frequently adjusting their gait. At the lower range, forward movement is possible only by shuffling. Space is not sufficient for passing slower pedestrians. Cross- or reverse-flow movements are possible only with extreme

difficulties. Design volumes approach the limit of walkway capacity, with stoppages and interruptions to flow (Bosina, Ernst, 2018). It is shown in Figure 2.5.

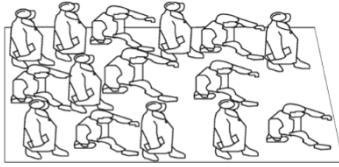


Figure 2.5: LOS E

LOS F

Pedestrian Space $\leq 0.75 \text{ m}^2/\text{p}$ Flow Rate varies p/min/m. At LOS F, all walking speeds are severely restricted, and forward progress is made only by shuffling. There is frequent, unavoidable contact with other pedestrians. Cross- and reverse flow movements are virtually impossible. Flow is sporadic and unstable. Space is more characteristic of queued pedestrians than of moving pedestrian streams (Bosina, Ernst, 2018). It is shown in Figure 2.6.

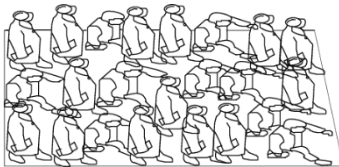


Figure 2.6: LOS F

2.1.6 Impacts of traffic congestion

2.1.6.1 Road Networks as a Determinant of Commercial development

Road network consists of large number of interwoven roads exhibiting many patterns ranging from star-like to grid-like with irregular patterns becoming recognized (Zang, Zuccollo et al. 2004). It consists of large amounts of roads that interweave with each other to exhibit a pattern. Patterns are defined as characteristics and properties found in repeated and regular manner within one object, or between a number of objects with such repetition in the form of shape, density, distribution, linkages, connection or orientation. These occur among the same kind of objects or different kinds of objects or within an object, or between objects repeated with sufficient regularity. Such repeated properties may be shape, orientation, connectedness, density or distribution. The frequency of such patterns enables development of prototypical views of geographical processes (Mackanness and Edwards 2002).

There is no doubt to the fact that road network has a great impact on the rental value of commercial properties. Many studies indicated road network as a determinant of commercial property rental value, for example, according to (Aderamo 2003) road network constitutes an important element in urban development as roads provide accessibility required by different land uses and the proper functioning of such urban areas depends on efficient transport network, which is a backbone to their very existence. The analysis of the road network involves recognition of the patterns and qualities of the roads, which can be emphasized through process of abstraction and symbolization (Oni, Ajibola et al. 2020).

2.1.6.2 Functional classification of road

Most authors argued that there are four main road types in urban area based on their functions. (Eppell, McClurg et al. 2001), (De Langen and Tembele 2001) and (Malenkovska Todorova, Donceva et al. 2009) have common arguments on road functional classification in urban areas.

Principal Arterial Street (PAS)

Arterials have high mobility level in connecting major trip generators, which demand long trip length and high traffic volumes, and speeds than on local and collector Streets. Urban PAS system are streets and highways significant to the correspondingly area, assigned to serve the major activities, highest traffic volume corridors and longest trip desires that provide access to various land uses, such as houses, shops, small business, and workshops. Except expressways, sidewalk is important on all streets, and particularly necessary on collector and arterial roads. This functional type of street which has high access activity contains 60m, 50m, 40m and 30m width and its planned and designed at space distance of every 2km as (Addis Ababa Structural Plan, (2017-2027)).

Sub Arterial Street (SAS)

Urban SAS system offer lower mobility level; put the accent on land access, and carry through traffic between multiple specific areas (collector streets) and the arterial roads. And it used as an access to public transport, through movement of public transport, regional – local cycle movements (off road) and pedestrian movement. This functional type of street has 30m and 25m width as (Addis Ababa Structural Plan, (2017-2027)) and it's planned and designed at space distance of every 1km.

Collector Street (CS)

Urban CS system has two significant features: land access service and connection of the urban areas. It links the local and arterial highways and serves subordinate traffic generators and more provide for direct access to the properties, pedestrian movement and local cycle movement. The width of this functional street type is less than the former two street types and contains 20m and 15m and its planned and designed at space distance of every 0.5km ((Addis Ababa Structural Plan, (2017-2027))).

Local Streets (LS)

Local Street means those streets whose sole function is to provide access to immediately adjacent land. They make up a large percentage of the total street mileage of the county, but carry a small portion of the vehicle-miles of travel and provides more pedestrian movement, access to properties and local cycle movement ((Addis Ababa Structural Plan, (2017-2027))). Since its width varies every space there is no standardized with this functional street type, but it is below the standard width of Collector Street and it is better if it would be more than 5m width.

2.1.6.3 Congestion impact on travel time and capital lose

The simple method in measuring the variables of the impact of traffic congestion is how many litters lost due to congestion. Average vehicle's fuel consumption that is the difference between kilometers running per litter at a normal daytime and a congested traffic flow condition (low speed) along with amount of fuel consumption with in these environments ((Chakraborty, S. , 2010)). Average delay per vehicle and per passenger can be also measured via using queue length. For instance, estimated number of vehicles and passengers stopped in and leaved the queue with in a specific time interval are the main variables that able to measure delaines.

According to (Godefrooij, de Jong et al. 2009)locating commercial activities in the CBD is all determined by traffic of that very area and because of traffic customers can come to the CBD's for various reasons such as shopping, entertainment among others. (Fornal, Zhu et al. 2005)recognizes that location of premises is attained by use of methods like estimating scale volume in a location, the qualitative and quantitative analysis of pedestrians" traffic often supplemented by estimates of the volume of competition in the vicinity of the site. The

obvious objective of traffic analysis is to determine the number of potential customers who pass the site of who are in the vicinity and might be attracted to the store located there.

2.1.7 Socio-economic impacts of road development

(Reynolds, Todaro et al. 1981)), view development as a multi-dimensional process involving change in structure, habit attitude and institution as well as acceleration of economic growth. They illustrate a significant relationship between transportation and development process. However, the nature of interaction is still a subject of debate between scholars who say development depends on many factors such as availability of resources and level of technology. In all, transportation is of great significance to development in any society. An efficient transportation system is in many ways, the bedrock of any social and economic system in terms of improving the quality of life for the common person.

Therefore, the transport sector can be viewed an important component of the economy impacting on development and the welfare of populations (Weisbrod 1997) When transport systems are efficient, they provide economic and social opportunities and benefits that impact throughout the economy. When transport systems are deficient, they can have an economic cost in terms of reduced or missed opportunities. Transport also carries an important social and environmental load, which cannot be neglected. From a general standpoint, the economic impacts of transportation can be direct and indirect: Direct impacts related to accessibility change where transport enables larger markets and enables to save time and costs.

2.1.8 On-street parking management

There are many factors or variable that influences the road capacity, such as on-street parking. The supply, price and regulation of on-street parking should aim to enhance the smooth traffic flow of a given area. As a result, it should supply sufficient space, variable price rate and duration, and prohibition of parking on specific place during peak hours. Regularly occurred on the transportation system, such as daily commuting or weekend trips, traffic is vulnerable to sudden breakdowns as demand approaches the maximum throughput capacity on a link or in the network. Roads are operated near to their maximum capacity saturated intersections can quickly give rise to queues whose upstream propagation can swamp local roads and intersections ((Talukdar 2013)).

2.1.9 Road capacity

The extent of traffic congestion is differing from one level-of-service to other level-of service. Road become more congested and incapable if the volume of vehicles increases from “A” level- of- service to “F” level- of- service. Many conceptual frameworks explain the causes and the impact of vehicle traffic congestion in different way. However, for the aim of this study, the above conceptual framework is adopted. In literatures, most writers argued that traffic congestion has an impact on travel time and fuel consumption, among them (Zatelli, Luchin et al. 2007) illustrates that “traffic congestion can causes more fuel to be used” European Conference of Ministers of (Lemmon, Huber et al. 2007).

2.2 The Empirical Literatures

2.2.1 Urban traffic congestion impacts and strategic mitigation the case various cities

a) Lagos –Nigeria

According (Joshua, et al., 2009) the study on this city, the factors contribute to the cause and effect and possible road of the congestion measurements are discussed as the following.

- i) **Accident factors:** Improper management of traffic congestion causes accident on disabled vehicles and overcrowded movements of vehicles on narrow and improper street due to lack of access to circulation able to occupy vehicles move on the road and massive mode of transportation blocking the opportunity of the walkers to a possible way and exposing them to unconducive path of alley.
- ii) **Vehicle factors:** The vehicles being as factor of traffic congestion due to the lack geographic standard road width stated by law to unexpected increment of vehicles in length, width and height they occupy and resulting the shifting of adaptive origin of activity and creating over volume over space.
- iii) **Social and economic factors:** According to the standard the land use of Lagos city was very poor, and most of the government and non-government institutions and offices are concentrated at its center and affects the traveler’s direction on their possible opportunity and in the same time or direction at peak hour an inadequate public transport exposes social and economic disruption and being as the congestion factors in this city of Lagos.

- iv) Lack of road design and control management:** Since many of roads in Lagos city are too narrow and unable to occupy the opposite movement of number of vehicles or condition of the road and unrelated element of activity heading in the city. Many of the road in this Lagos city are ever overcrowded and high traffic congestion are visible to the city center and blocking of both passengers and pedestrian due to the sudden occupancy of pedestrian side walk by the vehicles and over dominance of traffic movement. So the free movement on carriage way and pedestrian side walk is hindered and it is more aggravated due to unregulated on street parking on the too narrow street and over all narrow characteristics of street in the city.

To sum up the study conducted that the factors causes of traffic congestion, these are poor condition of street, inadequate public transport and improper capacity of road occupying the mass transit of vehicles activity with high economic development of the city.

b) Hanoi –Vietnam

As the study conducted by ((Thuy , 2003)) Hanoi-Vietnam welcoming the problems of traffic congestion due to different factors visible in the city. These factors are: number vehicles increment due to high development of economy especially motor cycle which needs extra road side development and expansion of demand every time on every side or alley path. This is exposing the city for the development of new construction of road due to more reveal of traffic congestion starting from year 1990-1999. During this period of road construction the high traffic congestion was highly existing at the intersection of road hindering of mobility due to the reason of some part of the roads are embraced under construction and was out of service giving. And due to the new development of land use following the construction of road like shops, residents, industrials and other services built on unexpected increment of traffic congestion was existed.

For this dilemma of traffic congestion on the life of this city the study prolonged strategic development to alleviate the problems in the following form. These are:

- i) Development of public transportation system:** This was the first priority to mitigate the problem like mass and rapid transit this means metro and light transit development to the city would alleviate the problem.

- ii) **Focusing on integrated land use and transport planning:** For urban sustainable development improved public transportation should be deployed by the city government and should formulate and implement the responsive policy through the enabling the entire community involvement for more effective application
- iii) **On the demand and supply side:** The road network should be developed and expanded as fast as capacity of transportation development. And the travel demand or independency of vehicle transportation needs to reduces the number of vehicles and motorcycles 15%-20% increasing in a year. Allowing one vehicles per family is another mitigation strategy deployed in the study of this city. Also high parking fee, on street parking prohibition and time staggering of offices should be implemented.

c) **Chicago- America**

The impact of traffic congestion in actual economy can differ from one area to one another due to different of economic profile and location existence. The economic impact of traffic congestion in Chicago and Philadelphia vary as researched by (Treyz , 2003) and conducted how various producer of economic goods and services are sensitive to the active development of traffic congestion, through its impact on the business cost, productivity and level of productivity. Due to that it recognizes different factors of traffic congestion costs. These are depicted as the following.

- i) **Travel Cost:** The main causes of the inefficiency of the transport system include congestion, which affects travelers by adding time to their journey and raising the costs of gasoline and replacement parts for car owners.
- ii) **Operating Costs for Businesses:** Businesses that supply goods and services may incur additional expenses as a result of traffic congestion. For example, delays in time-sensitive freight delivery may result in higher inventory costs and increased logistical expenses for receiving and distributing the goods, both of which have a direct effect on end users.

Under this study it outlines various solutions for congestion reduction, however it does not go into great detail. Business organizations should combine technology with labor and capital input, shrink delivery areas, alter delivery times or pricing strategies, and cater to more specialized or smaller worker, supplier, and consumer markets. The production function model is an additional tactic that combines a variety of inputs, materials utilized in the creation or delivery of goods and services.

d) Kyoto – India

As (Uddin, A. , 2009) study growth of economy or the highly development of GDP via the region or the city of the country through direct foreign investment, trade of goods and services-linking of the city to the world economy fosters the highly increment of traffic congestion and accident through the year in the city. The population increment- known as the world second next to china, the massive occupancy of private vehicles are another factors contributing to the traffic congestion in the city. So different mitigation strategies are taken by this study as the following in brief way.

i) Build better transport system

This is the first and very recommendable strategy to solve the problems of traffic congestion in the city by the cooperated work of the city municipality and public organization agenda issuers. The transportation community can accelerate the solution to congestion by being more aggressive in championing the need for transportation systems management and operations. So India is the second largest producer of buses, accounting for 16 percent of world's total bus production has a bus penetration ratio anywhere between 0.4 to six buses per 1000 people. However, initiation and providing of an efficient public transport system can effectively reduce the traffic congestion on city roads. There's considerable evidence to suggest vehicle owners will use a mass transit system, if a good one is available. Regarding this many cities in India are already taking steps in this direction and this study embraced under implacable work.

ii) Reduce traffic congestion through congestion charging schemes, Car-pooling

The idea was to ensure that those using the road infrastructure made a financial contribution towards it, discourage vehicle owners from making unnecessary journeys and encourage the use of public transport systems. Additionally congestion charging brings with it a dual advantage: it reduces traffic on the roads and generates funds that can go towards improving alternative systems of transport. In the absence of traffic restraint schemes in India, including the controversial Bus Rapid Transit which has run the gauntlet of motorists' ire in Delhi but is adopted in 83 of the world's cities, public transport is suffering. From 1994 to 2007, the share of public transport has declined from 69 % to just 38 % in cities with more than 4 million people.

iii) Using technology to solve traffic congestion problem

What was unique about the project was that there were no toll gates or barriers to collect charges from vehicle owners. Instead, a network of cameras records the number plates of vehicles entering the city center. Hence it shows how the congestion charges could be collected without slowing down traffic in any way. In the recent past, traffic police has introduced a number of technological innovations like online prosecution system, the area traffic control system, and other facility for information dissemination and GIS based accident information system - to mention just a few. The most satisfying aspect of these changes is that they have proved to be very relevant to the needs of the people of India (Dahlia) and using of such pilot project demonstrated the potential to create a city-wide real-time traffic information system, and this was shown to city officials are an important for traffic management system.

But, to sum up this study lack implementation challenge, it does not address the potential challenges or barriers to implementing these strategies in the context of Kyoto, India, stockholder engagement, involvement of key stakeholders such as local communities, businesses, and government agencies in the development and implementation of the mitigation strategies, which is crucial for their success, and sustainability, it does not consider the long-term sustainability of the proposed mitigation strategies and their impact on the environment and overall quality of life of the city.

2.3 Methodological Reviews on Traffic Congestion Study

As economy and demand of cities increases the congestion also increases and become the dilemma of cities life. However different researcher studies the causal and factors of traffic congestion in different context with different methodology, metric measurement and remedies as mentioned on the following Table 4. 2 - shows the methodological reviews of previous researcher relating to the research studies.

Table 2. 2: The analyses of previous research developers regarding the traffic congestion researcher

No	Authors	Methodology	Tools of data used	Title and context	Findings
1.	Fattah, M. A., Morshed, S. R., & Kafy, A. A. (2022)	Level of service index, on site survey strategy	Questionnaire, and observation: measuring speed of vehicles, travel time and delay time	Insights into the socio-economic impacts of traffic congestion in the port and industrial areas of Chittagong city, Bangladesh	Assessed the social impact of traffic congestion, assessed the economic impact of traffic congestion
2.	Abubakar M. Ndayako, Muhammed E. Ohida (2020)	Experimental and survey methods	Observation (traffic count), and questionnaire survey	Assessment of the Causes and effect of traffic congestion on road users in major road intersection in Minna metropolis	The effects of traffic congestion on time, energy and fuel consumption
3.	Muneera CP and Krishnamurthy Karuppanagounder (2018)	By method of Estimation cost of economy	Primary data (observation, questionnaire s, and observational checklist)	Economic impact of traffic congestion-estimation and challenges in European city	Quantifying the monetary impact of the traffic congestion
4.	Raheem, S. B., Olawoore,	Traffic counting	Primary data like observation (	The Cause, Effect and Possible Solution to Traffic	The effect of traffic congestion on

	W. A., Olagunju, D. P., & Adeokun, E. M. (2015)	and delay survey	traffic counting and traffic delay survey), questionnaire , and interview	Congestion on Nigeria Road (A Case Study of Basorun-Akobo Road, Oyo State)	fuel consumption, movement delay, accident, inability to forecast travel time and environmental pollution
5.	Nilesh R. Mate (2022)	Understandi ng categoricall y affected group of peoples	Observation and interview (primary data) with both qualitative & quantitative methods	Indian Road Traffic Congestion Problems, its reasons with focus on Road width	Improving the improper utilization of road infrastructure, and the impacts of population and vehicles size
6.	Manoj Kumar, and Pritikana Das (2021)	By focusing on road traffic congestion	Observation (measuring LOS, travel time and speed at peak hour) with both qualitative & quantitative data methods	Study on Road Traffic Congestion in Delhi, India	improved traffic management and control, better public transport services, use of modern technology
7.	Harriet, T., Poku, K., & Emmanuel, A. K. (2013)	Deductive approach with descriptive statistics	Survey data, interview and questionnaire with linked road	Traffic Congestion and Its Effect on Productivity in Urban Ghana	Traffic congestion effect on daily hour productivity

8.	Retallack, A. E., & Ostendorf, B. (2019	Statistical or quantitative measurement method and Systematic review of existing literature	Statistical analysis, literature review, and real-time traffic data	Current Understanding of the Effects of Congestion on Traffic Accidents	The alleviation of traffic accident prone condition
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Source: Own computation

Based on the methodological summaries or reviews provided for each research article, the following potential gaps in the studies can be identified:

1. Fattah, M. A., Morshed, S. R., & Kafy, A. A. (2022): While the study focuses on the socio-economic impacts of traffic congestion in Chittagong city, Bangladesh, it may not have explored potential solutions or interventions to mitigate these impacts.
2. Abubakar M. Ndayako, Muhammed E. Ohida (2020): The study assesses the causes and effects of traffic congestion on road users in Minna metropolis but may lack a comprehensive analysis of the broader societal implications beyond individual road users.
3. Muneera CP and Krishnamurthy Karuppanagounder (2018): The study estimates the economic impact of traffic congestion in European cities but may not have delved into the specific challenges faced by different cities or proposed tailored solutions for each context.
4. Raheem, S. B., Olawoore, W. A., Olagunju, D. P., & Adeokun, E. M. (2015): The research focuses on traffic congestion on a specific road in Nigeria but may not have compared the findings with other similar case studies to provide a broader perspective on the issue.
5. Nilesh R. Mate (2022): While the study examines Indian road traffic congestion problems, it may lack a comparative analysis with other countries facing similar challenges to identify common trends or unique factors influencing congestion.
6. Manoj Kumar, and Pritikana Das (2021): The study on road traffic congestion in Delhi highlights potential solutions such as improved traffic management and public transport services, but it may not address the feasibility or implementation challenges of these recommendations.

7. Harriet, T., Poku, K., & Emmanuel, A. K. (2013): The research focuses on the effect of traffic congestion on productivity in urban Ghana, but it may not explore the specific mechanisms through which congestion impacts different sectors or industries within the urban environment.

8. Retallack, A. E., & Ostendorf, B. (2019): The systematic review on the effects of congestion on traffic accidents provides valuable insights, but it may not have investigated emerging trends or technologies that could help prevent or reduce traffic accidents in congested areas.

Research Gap

Theoretically, according to various researchers and studies regarding traffic congestion in cities is a complex issue caused by various factors such as inadequate infrastructure, poor road design, and high travel demand. Previous studies have highlighted the impact of congestion on consumer performance and business profits. However, these studies have not fully explored critical variables like permeability and accessibility of roads, as well as internal and external factors contributing to congestion. Because each city has unique characteristics influencing congestion, such as location and urban expansion. Therefore, it is crucial to consider these factors when studying congestion. This research aims to analyze how street characteristics affect pedestrians and traders, particularly in commercial areas, and identify internal and external factors contributing to congestion, with a focus on location. By examining these aspects, a more comprehensive understanding of urban congestion can be achieved.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

This section discusses the study area, methodology, sampling strategy, tools used to obtain the information, and data analysis processed to produce expected outcomes.

3.2 Description of the Study Area

3.2.1 Background of the Nekemte city

Nekemte City is located in the western part of Oromia National Regional state. Nekemte is the administrative capital of Eastern Wollega Zone which is located at about 328 kilometers of distance from Addis Ababa to the west. Nekemte is one of the old towns in the country, established in the mid-19th century which is situated on a flat, hilly landscape. Nekemte was founded in 1840's during administration of King Bakare Godana which was a ruler of the area (Endalkachewu & Nekemte City Administration, 2018). The high way asphalt that connects Addis Ababa with Asosa, Gambella, Ilu Ababor, Dambi Dollo, Jimma and Bure Bahirdar pass through the city. Thus, Nekemte is one of the major urban centers in western Ethiopia that serves as a linkage for south west Bedelle-Jimma, to west Gimbi- Assosa, to north Bure-Bahirdar and to the east Ambo- Addis Ababa.

The growth and development of Nekemte is closely linked with the development of trade and transportation facilities acted through the access of street crossing the city to pass to various region and towns. The expansion of infrastructures, development of commercial activity and emergence of traffic congestion are pursuing that street access crossing the city as an opportunity.

3.2.2 The physical setting of the Nekemte City

The location and the area of the study

Nekemte city is the capital center of East Wollega Zone, in the west part of Oromia Region in Ethiopia. Demographically, it has a total population of around 102345, with a census conducted in 2012. It is located at an earth distance of 331 km southwest of Addis Ababa (Finfinne), the capital city of Ethiopia. It linearly stretches over 3,192 ha. Nekemte City was

selected as a study area because, geographically, it exists at the center, connecting the state's central city with neighboring states, making it a commercial and market city with rapid economic growth. This is because it increased consumer demand for roads and businesses and caused a serious problem called traffic congestion in the study area.

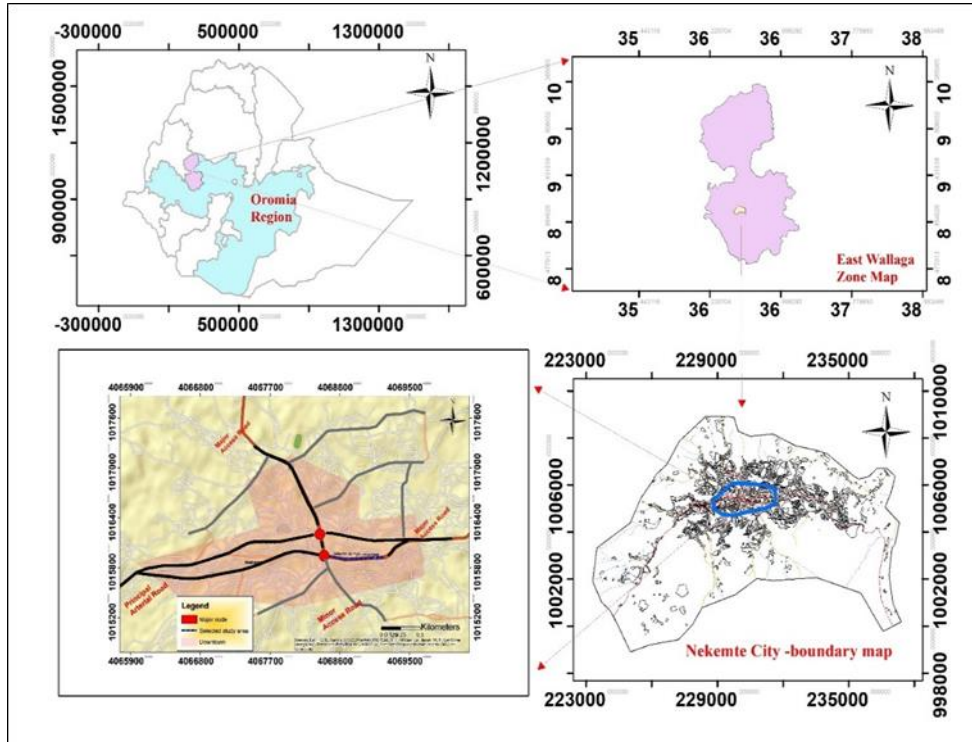


Figure 3. 1: Location Map of the Study Area

3.2.3 The socio and economic activities of the Nekemte city

The demography size of the Nekemte city

Currently Nekemte city has eight sub city administration and two woredas. The eight city administrations are Chalalaki, Kase, Makanisa Kase, Burka Jato, Haro Sarga, Bake Jama, Dalo, and Darge. And these sub cities are further classified in to 56 zones, and the zones are also further classified in to 420 development group or teams. As the National census held in 2007, the population of Nekemte city were been 75219, among them 38385 were male, and 36834 were been female. As obviously known that it includes only those who live permanently and has house in the city, but the population of Nekemte city is greater than mentioned during that time.

According to the current assessment or data survey by house to household conducted during 2020 the population of the Nekemte city is grew to 138, 127, out of these 50.24% were male and 49.76% were female. But now a day it is approximately near to 150,000 in nuber.

Religious composition in the Nekemte city

Table 3.1: The distribution and composition of religious in Nekemte city

Description		Religious						
		Orthodox	Protestant	Catholic	Muslim	Waqefat	Other	Total
Municipal survey (2020)	No	35126	80841	3298	16813	1216	813	138127
	%	25.43%	58.53%	2.40%	12.17	0.88%	0.60%	100%
CSA, 2007	No	29586	36471	510	8184	-	468	75219
	%	39.33%	48.48%	0.68%	10.88%	-	0.62%	100

Source: The compiled census of 2007 and survey data in 2020

Economic activity of the Nekemte city

Nekemte city is well known by the trade in the middle of the west of the region. And also, it is the transition center of production exchange and supply thoroughly. Due to the rate of growth of economic level in the city many infrastructures are developed, population density increased, and city is widely expanded. The more economic activity in the city is, commerce, urban agriculture (crop production, dairy farms, fattening, poultry farming, and beekeeping), investment and construction.

3.3 Research Design

The researcher used a descriptive research type in the study. The reason that the researcher used the descriptive research type is because, further exploration about phenomenon was

needed in the research. This was due to the research aims to describe and analyze the current situation or phenomenon regarding the impacts of traffic congestion on the commercial center, the extent of traffic congestion in commercial centers, and its impact. And also the reason that the descriptive research types needed in this research was to ensure a complete description of the existing situation, manage bias during the data collection, and developing constrictive ideas during interpretation. This type of research design can be used in both qualitative and quantitative research types.

In a qualitative research type, the descriptive research design can help the researcher to identify and describe the various factors that contribute to traffic congestion in the commercial center, such as road infrastructure, driver behavior, the experiences and perceptions of different stakeholders, such as business owners or traders, pedestrians, and other experts of the city on the study. In a quantitative research type, the descriptive research design can help the researcher to measure the extent of traffic congestion in the commercial center, such as the volume of vehicles the case of patterns and trends over time, such as peak hours and days of congestion.

The explanatory research design was also used in the study to identify the cause-and-effect of traffic congestion on the study area. The reason that the researcher used the explanatory research design type in addition to descriptive research design was to have an understanding about the case of the impact of traffic congestion on the commercial center, explanatory research can help the researcher to identify the underlying causes of traffic congestion and its impact on businesses or traders, customers, and the community. This type of research design can help answer questions such as why traffic congestion occurs in commercial centers, how it affects businesses and customers, and what measures can be taken to mitigate its impact.

Generally, the research design was involve collecting data through surveys, interviews, and observations to gain a better understanding of the problem and its effects. The data collected was then be analyzed and summarized to provide a clear picture of the situation. The results of the study would be useful for policymakers, urban planners, and business owners in developing strategies to mitigate the impact of traffic congestion on commercial centers.

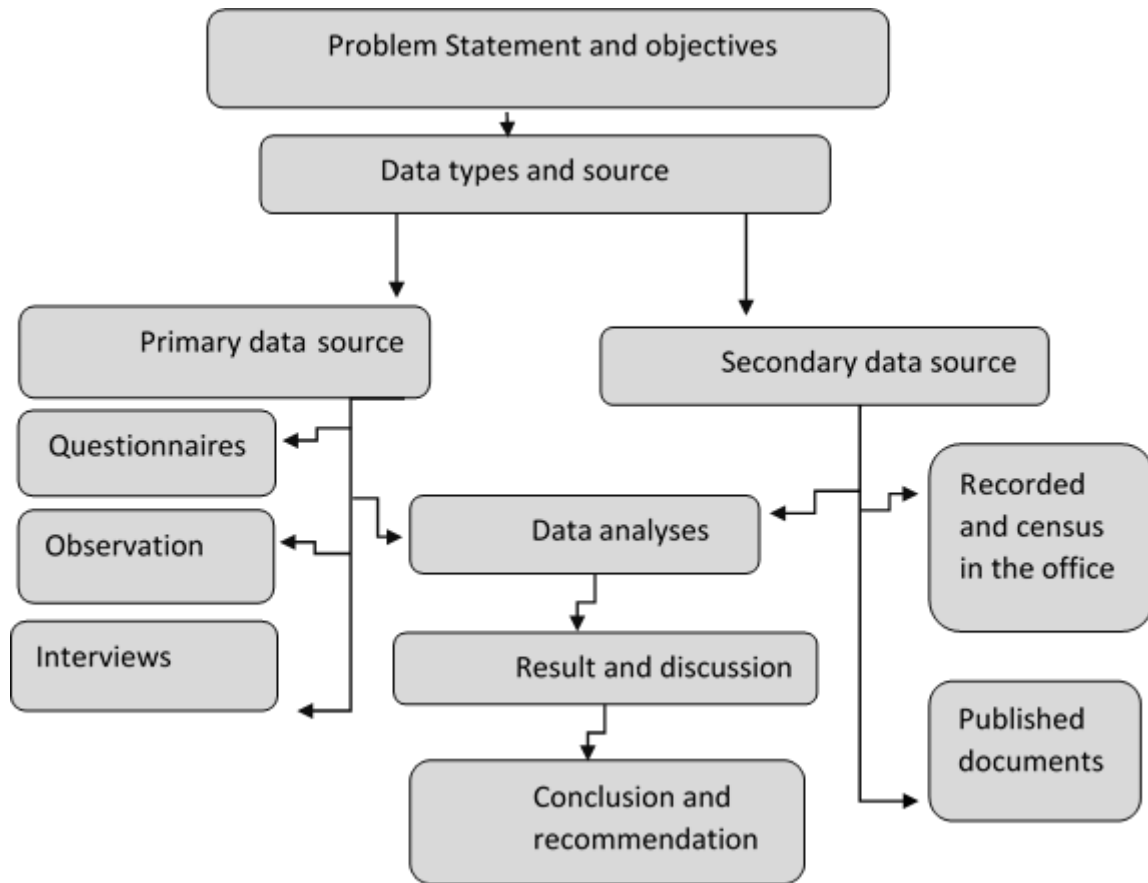


Figure 3.2: The research design and methodological frame work the study

3.4 Research Approach

The researcher used mixed approaches (qualitative and quantitative), which enabled the researcher to interpret the data adequately and accurately. The quantitative type of data that researcher helped was used to describe the numeric values scored at the dependent and independent variable features mostly used in the first objectives, on the examining of current congestion of traffic condition. The approach of this research is deductive, which is used to measure, reveals, and realizing the existing views regarding the research content. For this the inputs was the result of questionnaires from primary data and the secondary data types which described in details under data collection tools and techniques.

The qualitative approach was also used to assess and identify the existing condition of traffic congestion, and cause and effects of traffic congestion posed in the city. The second and third objective of the researcher, the root causes of traffic congestion and the impacts of traffic congestion on the commercial activity respectively were achieved by the methods of inductive approach, which used to explore and generalize the research through the tools of

observation and interview methods of data collection. This was realized through closed ended and open ended interview and questionnaires to the targeted groups (passengers, pedestrians, and traders).

3.5 Data Types and Sources

The researcher used both primary and secondary data sources. The sources of primary and secondary data, how and where they were collected are described by the researcher as follows.

Primary data source: The primary data that could be used to explore the impact of traffic congestion on the commercial center would include various types of information related to traffic congestion, and business performance.

Some of the primary data sources that could be used to investigate this research include: Traffic volume and flow data: This data would help to determine the causes of traffic congestion, the level of congestion in the commercial center and how it affects the movement of vehicles, pedestrians and traders. Travel and car parking time data: This data would also help to understand the causes of traffic congestion and how traffic congestion affects the travel time of customers and traders or the commercial centers. Business performance or interaction data: This data would help to determine how traffic congestion affects the performance of businesses in the commercial center, how it reduces the flow of customers and traders or businesses interaction and the impacts on the commerce's. Environmental data: This data would help to understand the impact of traffic congestion on the environment in terms of pollution like nuisance, and unsafe pedestrian walkways for pedestrians and customers on the side of intending to reach the commercial center or businesses center.

The primary data for this research was collected through the methods of observation, interviews, and questionnaires. The researcher used primary data collection to answer all objectives in this research, but more it focused on the second and third objectives, for the first objective used secondary data in detail. For more details look the following

Table 3.2.

Table 3.2: The methods used to collect data in the primary data form

Methods	Description	Whom and what it concern
1. Observation	Field observing and taking note, take photo to realize the data again and again, count traffic volume at peak hour and identifying the more entering and outing direction of the vehicles in the city. This is focused more on the external causes of traffic congestion.	Researcher, and field or area to be considered
2. Interview	It is a human-to-human process in which information is collected orally or in the structured question form. These was focused on the cause and effect of the traffic congestion in the Nekemte city. That means it ask the question about how, when and where the condition of traffic congestion happening, especially regarding to the traffic congestion vs. traffic accident	Experts, offices of transportation, office of trade and market of Nekemte city
3. Questionnaire	It is an organized and structured question on the situation of traffic congestion and its impact on the commercial activity in the city of Nekemte and it was asked on the way to get reliable data regarding to identifying the varies causes of traffic congestion, characteristics of traffic congestion on the life of the citizens of the city, and the impacts of the congestion on daily work activity of the traders of the city.	Traders, pedestrians, derives

Source: Own composition

Secondary data source: The secondary data for this research was collected from documentaries, reviews of published and unpublished materials, internet documents, journals, and research reports. The offices of trade and marketing, offices of transportation of the city and municipality were the place where these data was collected.

3.6 Study Population

The target population was started from Kumsa Moroda palace to the second round street of Nekemte town. The reason for the researcher choosing this location was that when the researcher conducted the field observation first, this location is one of the main roads adjacent to the commercial center in the city where heavy traffic congestion is frequently observed. It was also because this place can represent all the practical walking, working and living characteristics of the city and confirm the results of the researcher's research.

Therefore, the researcher conducted a house-to-house survey and identified the number of targeted or focused groups. The survey data were taken from house to house by the researcher for the consecutives of ten days. The total households were 205, and the total population was 1026. And the populations were selected on the idea of the researcher by means of affected groups of people in the study area. Hence, the number of household is only occupying commercial house, and the number of member worker were taken as 5 in average. The criteria on which the targeted groups were focused were based on the involvement or experience with which they had on the commercial center and traffic congestion, their location within the city or proximity to the commercial center and based on the hot spot of traffic congestion around there. For example, the target group are business owners or traders, employees or experts, and customers or residents' proximity to the commercial center who frequently visit the commercial center and have firsthand experience with traffic congestion.

As an alternative option, two hotspot areas were selected with inclusive and exclusive property criteria. These are the formerly targeted groups' areas (Kumsa Moroda Palace to Second Round Street), and the second one is the first round street of Nekemte city to the bus station (the former bus station). The inclusive criteria for the selected or targeted groups are the existence of high traffic jam, the daily existence of on-street parking there, and the variety of transportation modes that are accommodated there. The exclusion over there is that there are a few residences. The inclusive criteria for the second option (first round street of Nekemte city to bus station) is street venders and many of the shops. And the exclusion criteria are low traffic congestion, on-street parking and transportation modes in the case of vehicle types are low. This reality enables the researcher to focus on the first target group while the research is conducted and to get a choice for a proffer.

3.7 Sample size

The researcher selected the central business of Nekemte city which is more congested and closest to the congestion flow to obtain sample size to approve the results of his research paper. This includes PAS and adjacent SAS that can provide mixed transport services. This follows the main national crossing road that divides the capital (the road to Asosa and Addis Ababa, as well as Bure-Bahirdar). Even though these are considered for more providing of analyses the access road from Kumsa Place to the second round about was selected. But for slight analyses the other street with more activity and congestion was selected. This means as the thought of the researcher, the data collection and analyses was not only held and fixed on that former single street, but for it is unique characters among others. For example, more car are parking here, more mobility is here compared to the others access road. So to determine the minimum sample size for finite populations, and the proportion of the population is estimated. The formula for determine of sample size can be used by Krejcie and Morgan (1970) used for surveyed and finite population - sample size calculation formula.

Therefore, population size 1026 obtained, if 205 households were surveyed separately, and each household may have a different number of members, we would need to know the average number of individuals per household to calculate the total population surveyed. Then 205 households * 5 members per household = 1026. Hence, 2026 is the population size found by surveyed population finitely.

Test sensitivity: ~100%

Test specify: 99%

Z = 1.96 (two-tailed 95%)

P = 0.5 (expected prevalence)

d = precision

To calculate sample size

N = population

$$n = N \cdot Z^2 \cdot P (1-P) / d^2 (N-1) + Z^2 \cdot P (1-P)$$

With N = population = 1026

n = sample size

$$Z = 1.96$$

P = expected prevalence

And d = precision = P/5,

$$n = 88$$

So that the researcher has need to collected data primary from these 88 number of peoples randomly from the total population (1026), which was assigned as the targeted groups. In addition to that the researcher used the convenience methods of non-probability data to strength the clarity and quality of data availability on his research. Those respondents clearly included under convenience methods of sampling size are: passengers, pedestrians, drivers and experts. The researcher decides their numbers in the following ways.

Derivers = 20,

Passengers = 23,

Pedestrians = 22, and

Experts = 5, the reasons the researcher decided on those focused group was because he believed they would provide accurate information. Then sample respondents chosen by the researcher include 20 drivers, 23 passengers, 22 pedestrians, and 5 experts, totaling 70 respondents. The population group of sample respondents are discussed as the following briefly.

Drivers: Population group, individuals who hold a valid driver's license and actively drive vehicles. And potential sources, driver databases and vehicle registration records.

Passengers: Population group, individuals who use public transportation or ride in vehicles as passengers. And potential sources, public transportation hubs.

Pedestrians: Population group, individuals who walk or use non-motorized modes of transportation- individuals who have witnessed or experienced pedestrian accidents, have opinions on pedestrian infrastructure and safety and potential sources pedestrian-heavy areas such as sidewalks and shopping districts.

Experts: Population group, individuals with specialized knowledge and expertise related to the research topic (urban planner-2, from office of transportation 1, traffic office 1, and from office of trade and market 1). And potential sources professional networks and industry associations.

Why the researcher needs to use additional purposive sample respondents was to find convincing response corresponding to simple random respondents. So, from both sample method (simple random sample and purposive sample) 158 sample respondents were chosen.

3.8 Sampling Techniques

The probability sample methods held on legalized traders who are working at the high traffic congestion area, so the random sample techniques were used for 88 sample respondents. Nonprobability sample methods held on drivers, passengers, pedestrians, and experts, so the purposive sampling techniques for 70 sample respondents was used.

3.9 Data Collection Methods and Tools

3.9.1 Primary data collection methods and tools

The researcher used different techniques of data collection tools under primary data collection for the achievement its research objectives. These are:

Observation/field survey

The researcher used observation regarding the necessary data in the delineated spaces of study. The researcher recorded the action, behavior, and nature of the studied area by using field notes and camera photos. The main observation that researcher held were: peak hour (morning, mid-day, and evening), and counting traffic. It was used to realize the exact situations and actions of the study area during the analysis part.

Questionnaires

The researcher used structured questionnaires to collect the data from individuals or groups by the approach of close ended questions in this research study. These were conducted through face-to-face interviews. The participants were traders- those whom researcher was asked information to be filled. Some question raised and asked here are the mode of transportation and formation of traffic congestion and its level of impact on the commercial center, the impacts of traffic congestion on commercial center or on traders, their experience with the causes of traffic congestion, which of the sources of traffic congestion problems can affect them, and the condition of their daily income. This tool of the data collection methods were used to cover all the necessary information used to achieve the objective of the researcher that are raised in chapter one.

Interview

The researcher conducted the interview in structured and unstructured form by contacting people and using phones on some of the field studies. The participants were experts (urban planners, traffic police, transportation offices: for knowing the root challenges of traffic congestion and on control management and solution), pedestrians: for understanding what they were saying about the challenge and impact of traffic congestion on their daily lives and activities through their walks, and drivers: for understanding what they preferred and ruled as rule and regulations of transportation declared and agreed as national and international laws.

3.9.2 Secondary data collection

The researcher used different techniques for the achievement research objectives by the secondary data tools while the research data collection was held on the study areas. These are: recorded data from the offices (the Offices of Transportation, Offices of Trade and market of the Nekemte town, offices of traffic police, and Offices of Urban Planning Institute of Oromia State-Western Region), literature reviews, published documents and unpublished documents.

Table 3.3: Methods of data collected time and condition to collected

Methods	When to use	How to collected
1. Primary data		
Observation	Peak hour, rash hour,	Field note, photo take, counting the pedestrians/minute on vehicles lane and vehicles per minute, per hour on intended place and time.
Questionnaire	When it is necessary to recognize differences between conflicting or interrelated variables, and when faced with complex situations that are difficult to distinguish by subjective understanding.	By distributing or giving out questionnaires, by paving the way for them to answer or by giving them awareness.

Interview	When things cannot be quantified, when a general understanding of the subject in question is sought.	By being physically present and conducting inquiries in structured and, when necessary, in structured and unstructured manner.
2. Secondary data method	When standard measurements are needed and in recognizing the trends of things (for cause and effect). When the source of historical and actual event information required.	From government offices such as the marketing and trade office, the transportation office, municipal city office, and the traffic accident prevention office. From searching and reading published and unpublished documents (using the internet).

Source: Own composition

Based on the necessary methods to acquired data as depicted on the Table 3.3, for each required research objectives answering and analyzing methods is described below.

The methods used to gather data and analyses for 1st objectives (assessing the current condition of congestion in the Nekemte city)

This objective was detected and measured by identifying 1st, the pull factors being for the flow of traffic flow in city (internally and externally) and aware the direction of the more entering and outing vehicles of the city. It was realized by counting the vehicles on each direction of access linkage to the city at the peak hour, rash hour and sometimes in suddenly for avoiding the bias and miss understanding. Second, traffic accident due to traffic congestion and the condition of street and vehicles including pedestrians was identified. Both primary and secondary data was used for acquiring of data for this objectives, qualitative and quantitative data approach was also applied.

For the primary data gathering field observation was held. This is the good mechanism in which the 1st objective was answered. It includes, observing and understanding of external causes of traffic congestion, and quantifying and detecting of the direction of traffic congestion entering city. Furthermore, regarding the distribution of urban development infrastructure as a pull factor for the flow of traffic congestion, questionnaires were prepared

and distributed randomly regarding the field condition and field observations and analysis were conducted. Especially the condition of street, the street with high traffic congestion (from 1st roundabout to Kumsa, Bake Jama, and Bordi, from 2nd roundabout to Bordi, Tourist, and Darge and Nekemte hospital) was detected and measured by field observation, questionnaire and interview (regarding where and when the traffic accident happened due to more traffic congestion with the street).

In addition secondary data was also be a powerful answers for this objectives, in spite of how, where, and when accident was happened by traffic congestion. This data was collected from the offices of transportation in the city and office of criminal investigation administration.

Generally, the current traffic condition in the city the internal and external factor for the flow of traffic congestion is not focused on the rout causes of traffic congestion, but it is the physical movement and accidents of traffic congestion on the study area regarding this objective.

The root causes of traffic congestion

For this object both quantitative and qualitative approach was used, and the primary data methods was also the only way to answer for it. This has used both observation, questionnaire and interview and the details are depicted on the Table 3.4.

Table 3.4: The methods and analyses data for the second objectives (the root causes of traffic congestion)

The measured variables	Methods	General ideas and understanding	Data approach
1. On street parking	Observing	Kinds of vehicles mostly parked on the street, hour of the trucks that cross the city parked on the street, the most area and street with illegal parking	Quantitative
	Interview	hour of the trucks that cross the city parked on the street	Quantitative, qualitative

2. Street vendors	Observing (by check list)	Pedestrian level of services in congestion condition, the width of pedestrian services on the selected street	Quantitative
	Questionnaire	The perception of pedestrians on the condition of vendors and congestion	Quantitative
3. Centralization of government offices	Observing	Distributions of government administration, their closeness, their connection to the street with high mobility and the distribution of urban infrastructure which contribute to traffic congestion were selected and identified	Qualitative (mapping)
4. Unseparated mode of transportation	Observing	The flow of mode of transportation on a single street access at the peak hour, rash hour and for consecutive of seven days	Quantitative
	Interview	Understanding the drivers' perceptions of on-street conditions regarding service delivery and operations like safety, accessibility and availability. And the street from the 2 nd roundabout to Bordi was selected	Quantitative
5. Unemployment	Interview	The perception of unemployed pedestrians on the condition of staying place in Nekemte city, and also the trends of unemployment rate in the city by secondary data usage	Quantitative, Qualitative

Source: Own composition

The impact of the traffic congestion on the commercial center

For this objective the primary data method was used with both qualitative and quantitative approach, but the qualitative data approach was the more dominant for its analyses. The measurement taken in the objective are more explained on the Table 3.5 below.

Table 3.5: The methods and analyses data for the third objective of the research (the impact of traffic congestion on the commercial activity)

The measured variables	Methods	The general ideas and understandings	Data approach
1. Visibility	Questionnaire	Understanding the trader's perception on how the congestion reduces the visibility of their location to the users, identifying the vehicles type which stops on the street a long hour and reduces the trader's location visibility	Quantitative and Qualitative
2. Reduce Permeability	Observing	Understanding the purpose of the street and its permeability to users (functional permeability, physical permeability, and visual permeability) with the help of photo capturing on the field and field notes or records about the event	Qualitative
3. Crime	Observing	It is about an understanding gained by going out in the field about how traffic congestion can be a cover for crime and affects the user's safety, life and walk	Qualitative
4. Pollution	Observing	How traffic congestion can be a cause of pollution is an understanding gained by going out in the field at various	Qualitative

		times, this for the perceiving of number of users on the commercial activity and how it reduces their interest	
5. Reduced productivity	Questionnaire	Regarding the impact of traffic congestion, the perception of the traders on their daily income and on the user's comfort to reach to their location work has been processed. The growth rate annual income from the office of trade and market, and revenue and tax has been processed	Quantitative

Source: Own composition

3.10 Data Analyses and Interpretation

For the clarity and reliability of this research the researcher used both quantitative and qualitative approaches to study and analyses the data gathered from the respondents through data collection techniques. In qualitative data analyses the following software were used. These includes SPSS, Excel software, and Microsoft word. These were outputted in the form of maps, diagrams, charts or pie chart, graphs, text, tables, and figures. In the context of this research study quantitative data analyze describes the measurement, and statics analyzed through survey, questionnaires, and census by using of SPSS, Microsoft word, and Excel software to analyze. Additionally the engineering software like, AutoCAD, GIS software used in the context of this form of data analyses in the research performance.

3.11 Ethical Consideration

Research ethics refers to the accepted norms, conduct as well as moral standards that are widely accepted in conducting research (Resnik 2011). Ethics is the basic of standard used to guide and manage the things gone to be doing with measurable methods and techniques for performing of good research at the end. It uses as the proactivity for the future biased while research will be processed in complex and heterogeneous society. The ethical work in

this research was seen as the study of how researcher guides himself with good knowledge and ability of capturing new information with new ideas for the seek of complete focused area of the study. The researcher was kept the security of society and kept his respect of all focused groups at where the research was conducted. This was kept the researchers effort and the background knowledge of the conducted area of the study from seldom and unconditional risks. The overall frame work of this researchers is explained on the Figure 3.2.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Introduction

This chapter contains about the result and discussions regarding the traffic impact on the nature of commercial and productive business centers. It is discussed in relation to the objectives and methodology of the research based.

The research findings are discussed in different forms since they are quantitative-based; these are in the form of charts, tabular data, and graphics. After their form of description, the general description or reports were given regarding the parameters and measurements of the objectives and methodological analyses. These are the current condition of traffic congestion in the city, commercial impacts due to traffic congestion, root causes of traffic congestion, centralization of government employee work, street vending and on street parking, and unmanageable modes of transportation that are accommodated on a particular and specified street with the help of data organized regarding the discussed part.

4.2 The Background of the Respondents

According to Figure 4. 1 the majority of the respondents participated in the study of researcher were male, this is 57% of the total number of 158 respondents and the rest are women and 43%. shows the age of the study participants, most of whom are between the ages of 25-45 with in the 35% and a small percentage of participants are over 60 years of age with the 15%.

a) Gender respondents

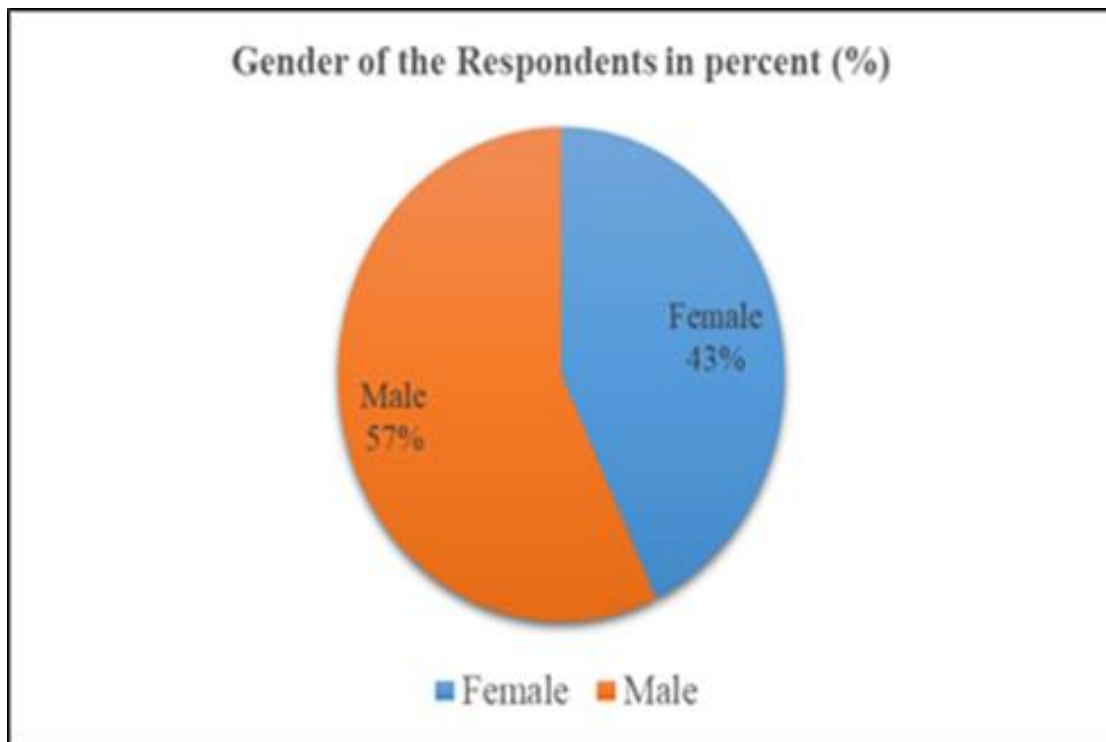


Figure 4. 1: The gender of the respondents

b) Age respondents

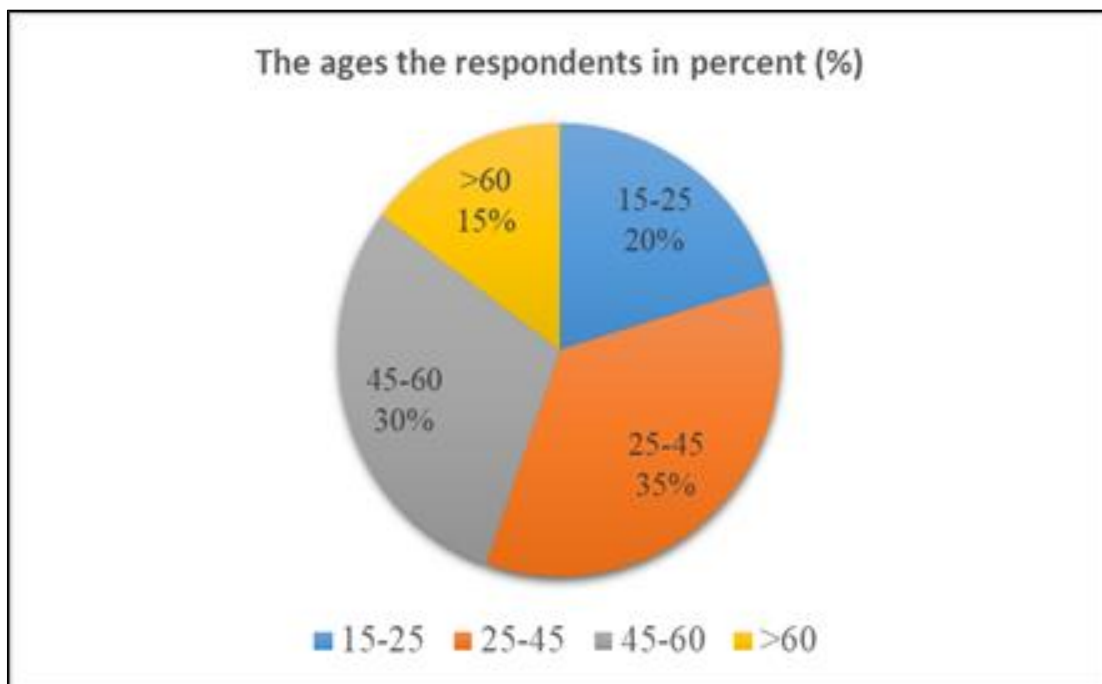


Figure 4. 2 The age of the respondents

4.3 The current traffic congestion situation in Nekemte town

The current situations of the Nekemte town was investigated mostly based on field observation and secondary data avails with a descriptive form of data. Additionally the questionnaire data was also used. It also focuses on the underlying pull of traffic congestion flow and the damage it has caused to explain the current traffic congestion situation in the city. The major internal and external factors occurring traffic congestion, the behavior of road infrastructure and their influence in occurrence of traffic congestion, the traffic congestion and the accidents it caused, where, when and to whom it affected were also explained under this part.

4.3.1 Internal pull factors and congestion flow in Nekemte town

4.3.1.1 Infrastructure development

The expansion and development of urban infrastructure plays a major role in the rate of impact of traffic congestion. According to the study, the nature and impact of traffic congestion has increased since the establishment of higher education like colleges and university, health institutions such as hospitals and sports fields such as stadiums. As their development trends explained on Table 4. 1 regarding infrastructure development of the study area, the expansion of the colleges is the main attraction of the occurrence of the traffic congestion. As is well known, social service institutions are places of meeting or gathering of people and the needs of people can be easily communicated and can be a major reason for road closures or congestion, according to the data found in this study.

Table 4. 1: The trends of the infrastructure developments in the Nekemte city

Years	Major distribution and development of infrastructures							
	Collages		University		Hospitals		Community centers	
	G	G1	G	G1	G	G1	St	Rc
1990-1995	1	1	-	-	1	-	-	-
1995-2000	1	2	1	1	1	1	-	1

2000-2005	1	2	1	1	1	1	-	2
2005-2010	1	4	1	1	2	1	1	-
2010-2015	1	6	1	1	2	1	-	3

Source: Data from the municipal offices of the Nekemte town (2015), where, G = governmentally organized, G1 = Non-governmental or privately organized, St = Stadium, Rc= Well known Recreations in the city of study area.

As depicted on the Figure 4.3, the development of the infrastructure and their location creating and being a reason for the traffic congestion as deeply analyzed in this study. For this, the field observation was held on each location of the institutions (education center, healthy center and to some religious centers-those linked more to the high access street) at different hours and days.

The location of high institutions linking with Access Street like Wollega University, Rift Valley University, the Hospitals (Nekemte Hospital, WURH), TTC of Nekemte and other private institutions creates more flow of traffic congestion on the center of the street the city parallel and overlap to the city administration, and business center of the city. When each demanders come to gather on the right time on the right place for there is no other street access opportunity, the congestion created easily on the specified and study area held.

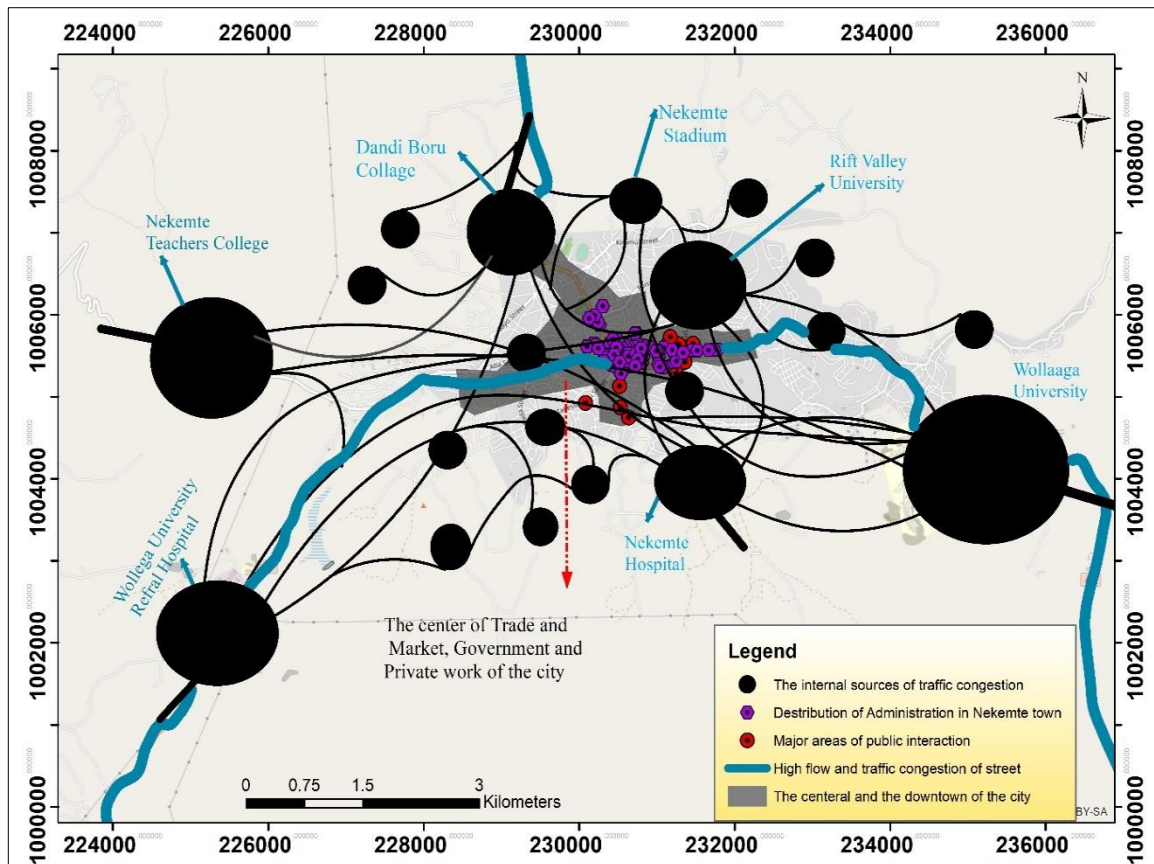


Figure 4.3: The condition of the traffic congestion and the distribution of the infrastructures in the Nekemte city

4.3.2 The external push factors and congestion flow in Nekemte town

4.3.2.1 Nekemte as the cross-section center of the region

The location of a city plays a major role in the rapid increase in traffic congestion. Nekemte is the capital of the market and commercial center of western Oromia in western Ethiopia and the hub of many regions and zones. Therefore, the bridge for the means of communication is transportation and the number of vehicles entering, crossing and staying in the city in different directions is increasing, has been revealed in this research. According to the research, especially the abundance of minerals, fodder and food grains in the four Wallaga regions has facilitated the city to have strong connectivity with the major cities of the country on the Finfinee, Asosa, Jimma and Bure-Bahirdar roads.

The study found that the city's roads are exposed to traffic congestion as the transportation activities are carried out on the main road that passes through the middle of the city (Nekemte). The Table 4. 2, below shows the percentage of vehicles entering the city from different directions during the same and different periods. This is based on field data, which

is obtained daily by standing at the entrance to the city to determine how many vehicles enter the city per hour and leave the city per hour, has conducted on each entrance. The number of vehicles entering the city exceeded the number of vehicles leaving the city as can be seen from the Table 4. 2 below.

It is also possible to understand at which direction most vehicles enter and leave the city, at which direction least vehicles enter and leave the city. For example, the most vehicle enters the city through the west by 34%, and the least vehicles enter the city through the north by 8%. On similar way, the most vehicles leaves the city through east by 38%, and the least vehicles leaves the city through the north by 4%.

Table 4. 2: The number of vehicles and the direction in which they entered and leaves the Nekemte city

Entering vehicles	Vehicles/hour-in to the city			Vehicle/hour-leave the city		
	Morning 4:00- 5:00	Afternoon 10:30	%	Morning 4:00- 5:00	Afternoon 10:30	%
Through North	150	113	8%	57	23	4%
Through South	461	398	27%	341	150	26%
Through East	523	479	31%	399	321	38%
Through West	587	498	34%	370	243	32%
Total	1721	1488	100%	1167	737	100%

Source: Field Survey

The understanding of the types of the vehicles entering the city was used the researcher to determine how many vehicles stayed at the night and at the day for along hour. This was explained more in Table 4. 3, of this paper regarding on parking as the root causes of congestion it needs to know which types of vehicles to stay for along hour. But on this Table 4. 3, only the percentages of vehicles type entering the city through different direction of traffic flow was explained. As described in the Table 4. 2, the researcher used counting and typing the vehicles at the entrance of each to the Nekemte city to determine in percentages of vehicles type entering to the city as displayed on Table 4. 3.

In other words, the researcher was decided to identify not only the types of vehicles listed in this table, but to identify those that facilitate traffic congestion by entering the city directly and parking on the road, stayed for along. Regarding so that by more percentage, by 29% the vehicles entering the city were public buses, and trucks through the west entrance and the least vehicles was entering through north by 21%. In this case, the researcher has identified as a drawback that it is difficult to study the characteristics and activities of the vehicles in the desired time and conditions due to safety problems. According to the data of this study, the main reason why vehicles entering the city can cause traffic congestion is that when their entrance and the occupation of the inner road coincide, it causes unexpected traffic congestion. This is because the width of the road cannot contain or include as many cars entering, cars leaving and staying inside the city.

Table 4. 3: Types of vehicles and directions in which they entered Nekemte city

Entering vehicles	Types of Entering Vehicles	Percentage (%)
Through- N	Public Bus, Trucks	11%
Through –S	Public Bus, Trucks, Minibus	25%
Through –E	Public Bus, Trucks, Minibus	31%
Through -W and SW	Public Bus, Trucks, Minibus	33%
Total		100%

Source: Field Survey

4.3.3 Traffic Congestion and Accident Formation

4.3.3.1 Accidents caused by traffic congestion in Nekemte town

The problem of traffic accidents describes the harmful nature and difficulties of traffic congestion. The analysis process was conducted based on the factual and reliable data available to the traffic accident office of Nekemte city. This is based on a series of data recorded for 5 years and changes from time to time. This used secondary source data and was also used as a primary source of information for deeper understanding interviews and more mature analysis. Hence, the actual scenario of traffic accidents related to traffic congestion is described in the Table 4.4, below. As shown here also in Figure 4. 4, the problems of traffic accidents in congested traffic conditions have caused accidents such as death, serious and minor injuries, and property damage, according to the data of the Nekemte Traffic Accident Investigation and Prevention Office records annually.



Figure 4. 4: Traffic congestion and traffic congestion accidents in Nekemte for years

Table 4.4, describes the traffic accidents in traffic congestion and the percentage of injuries (death and physical accident) is shown in the table by year. Of the injury years (2010-2015), 29 % of the fatalities occurred in 2012 year mostly on pedestrians. Similarly, the physical accidents occurred with a high percentage, 40% in 2011 which is mostly happened on

pedestrians. It is also stated that the risk of death decreased to 17% in 2011, but the overall reality is that the percentage of fatalities is increasing significantly in the years.

Especially the accidents, injuries and fatalities on the pedestrians are explained by the lack of suitable pedestrian conditions due to the lack of suitable street in the vicinity of their work, walk and life with the increasing traffic congestion from time to time as the study quoted intellectuals and targeted communities.

Table 4.4: Traffic accident and congestion condition in Nekemte town

Year of Accidents	Types of accident's	Accident bodies in quantity				Total	in %
		Passengers	Pedestrians	Drivers	Others		
2010	Death	2	6	8	5	21	21%
	Physical accident	1	3	6	9	19	19%
2011	Death	3	4	5	5	17	17%
	Physical accident	7	14	11	8	40	40%
2012	Death	1	12	3	11	29	29%
	Physical accident	8	5	9	7	29	29%
2013	Death	3	9	6	8	26	26%
	Physical accident	11	3	11	9	34	34%
2014	Death	4	12	2	9	27	27%
	Physical accident	9	11	3	4	27	27%
2015	Death	2	9	7	9	27	27%
	Physical accident	14	6	3	12	35	35%

Source: Nekemte Traffic Police Office (2015)

According to Figure 4. 5 shows, the most affected by traffic congestion are pedestrians and in 2015 it has decreased significantly compared to previous years. Similarly, it can be seen by comparing Figure 4. 5, and Table 4.4, that passengers are more affected this year than in previous years. This explains how worrying and difficult the traffic congestion situation in the city is when measured and understood by traffic accidents.

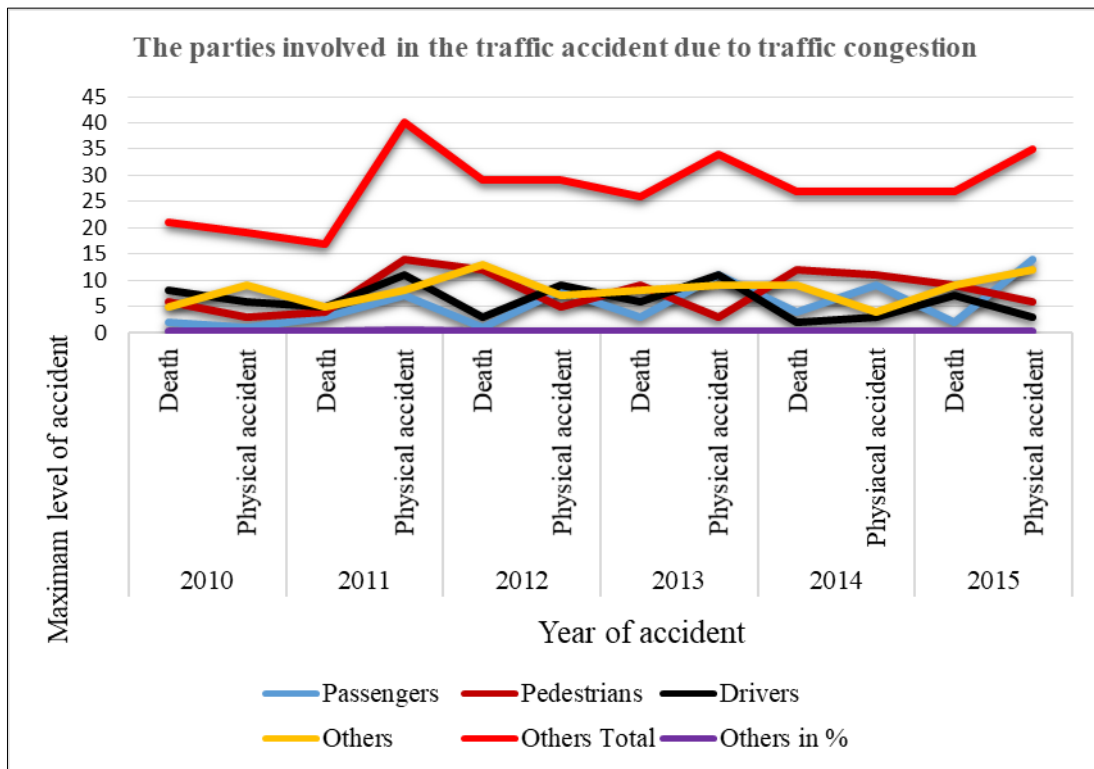


Figure 4. 5: The trends parties involved in the traffic accident due to traffic congestion

As can be seen from the Figure 4.6, there is various evidence that traffic congestion is the cause of traffic accidents such as fatalities, injuries, and property accidents. The fact that the accident of property damage by vehicles due to traffic congestion is not taken lightly as seen from the Figure 4.6. In addition to the recorded sources of information, information and understanding from the interviews of the target audience confirmed that there is a high percentage of physical injuries (mild injuries, severe injuries) following property damage. The Table 4. 5, and Figure 4.6, provides an estimate of the annual loss of property due to traffic congestion with its percentage, based on the source of referenced data in the office of traffic police in Nekemte town. As Figure 4.6, clearly shows that the change in property damage caused by traffic congestion varies from year to year and has ups and downs.

Among these years, the largest percentage of property destroyed in 2010 was 32.72 %, while from this year to 2014 it decreased by 17.62 % and in 2015 it doubled to 15.10%, the Table 4. 5 below will fully explain which years there are declines and increases in property estimates in cash terms along with their percentages.

Table 4. 5: Estimate of property damage caused by traffic congestion accidents in money

Year of accident	Estimated property in cash (EB)	Percent (%)
2010	532396	32.72%
2011	251200	15.44%
2012	236520	14.54%
2013	215500	13.25%
2014	145700	8.96%
2015	245600	15.10%
Total	1,626916	100%

Source: Nekemte Traffic Police Office (2015)

Additionally the following figure 4.6 also shows the linear and up down increment of property damage due to traffic congestion impact.

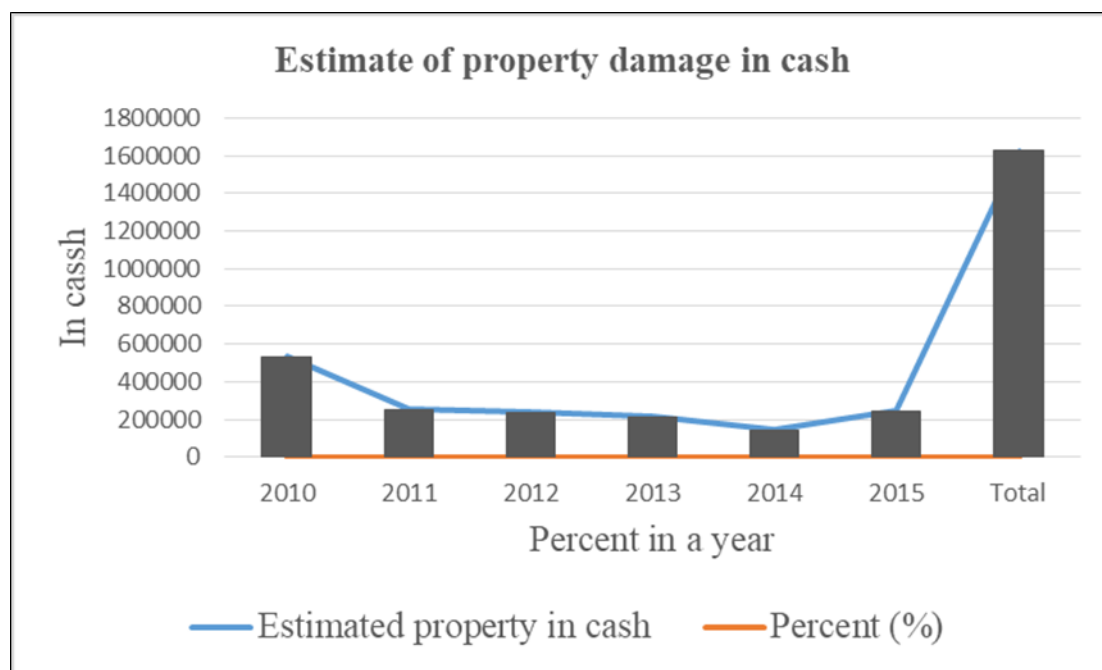


Figure 4.6 : The estimated property damaged annually in cash

As evidenced in the figure below, the traffic congestion-related accidents also vary by age. Most of the children are vulnerable to this risk and the most fatalities was recorded in 2010 and the total accident in this year was 27% in record related to the listed years. The least recorded fatalities was occurred in 2012 which was 12% and the Table 4.6, shows that young people are the second most affected after children and this is based on data recorded over the years. This is due to the lack of roads specifically reserved for children, disabled and aged, the roads are crowded and the demand of people using the roads is increasing from time to time, according to the concerned office and the community focused in the study.

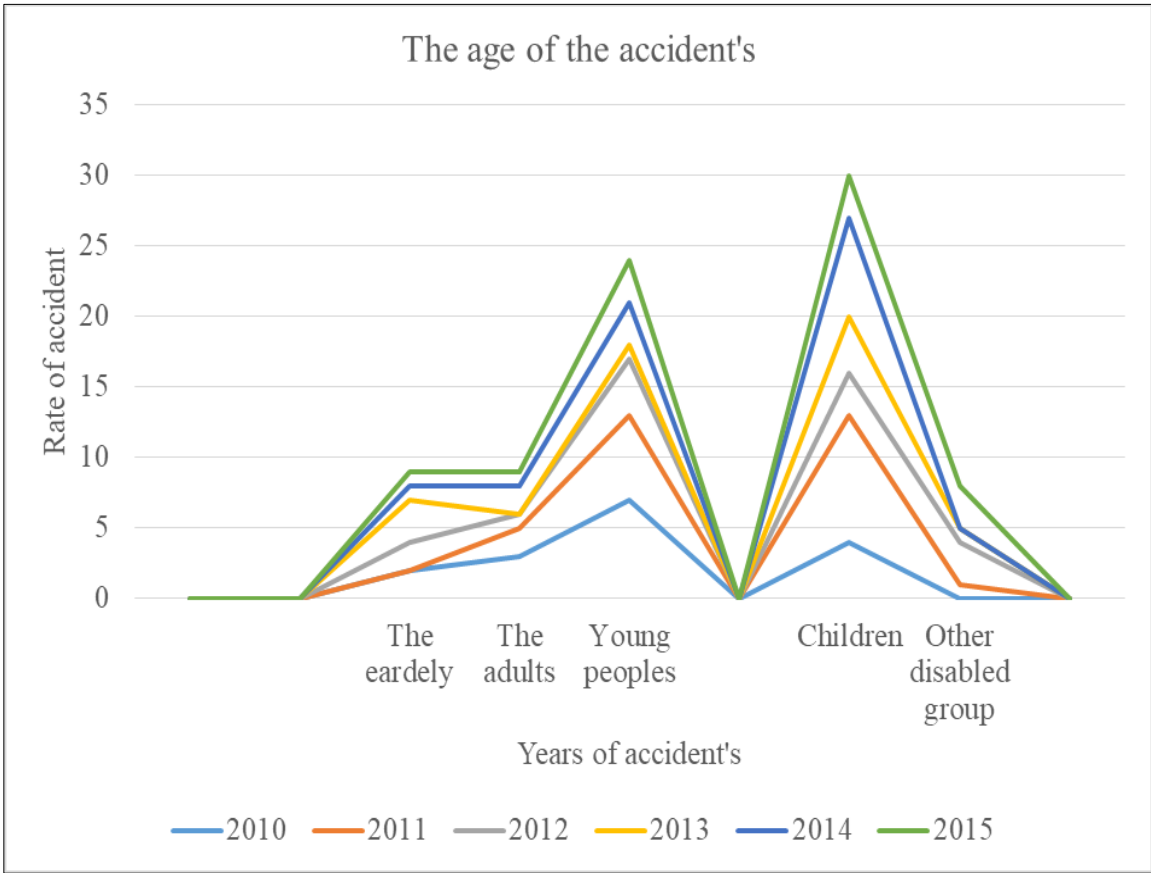


Figure 4.7: The ages of the accidents and the condition of the traffic congestion

As depicted on the Table 4.6, the trends on the year 2010-2015 shows in which year the age of accident was high in number and in what percent it was existing. As the study revealed the in 2010 the number of accident was high. Except in 2010 the number of accident in number was reduced but, yet it is the major challenge and frustration condition on the life of the city.

Table 4.6: The ages of the accidents and the condition of the traffic congestion

Year of accident	The age of the accident's					Total accident's	Total accident's in percent (%)
	The elderly	The adults	Young peoples	Children	Other disabled group		
2010	5	8	7	15	4	39	27%
2011	1	5	9	12	2	29	20%
2012	2	1	4	7	3	17	12%
2013	3	7	6	5	1	22	15%
2014	2	5	4	7	0	18	13%
2015	1	6	3	5	3	18	13%
Total						143	100%

Source: (The Collaboration of Nekemte Transport Office and the Traffic Police Office)

As is well known in everyday life, it is clearly understood that the place of residence of human beings, their work and their commute time in the city creates a shortage with the capacity of the street to hold the problem of traffic congestion. The Figure 4.8, indicates how a citizens of a city suffer in the process of traffic conjection in relation to their lives and work. It also reveals that private workers and unemployed are the most affected by traffic accidents due to traffic congestion in Nekemte town. This is due to the lack of proper recreational facilities that welcome the unemployed and provide them with a place to rest and refresh their lives, was confirmed in this study.

Similarly, private working people who move in the city and surrounding here and there to earn a living lack suitable roads to accommodate their needs are seen to suffer similar injuries for they only have the choice to use motorways as sidewalks. It verifies that it can cause collisions and traffic congestion which is causing accidents.

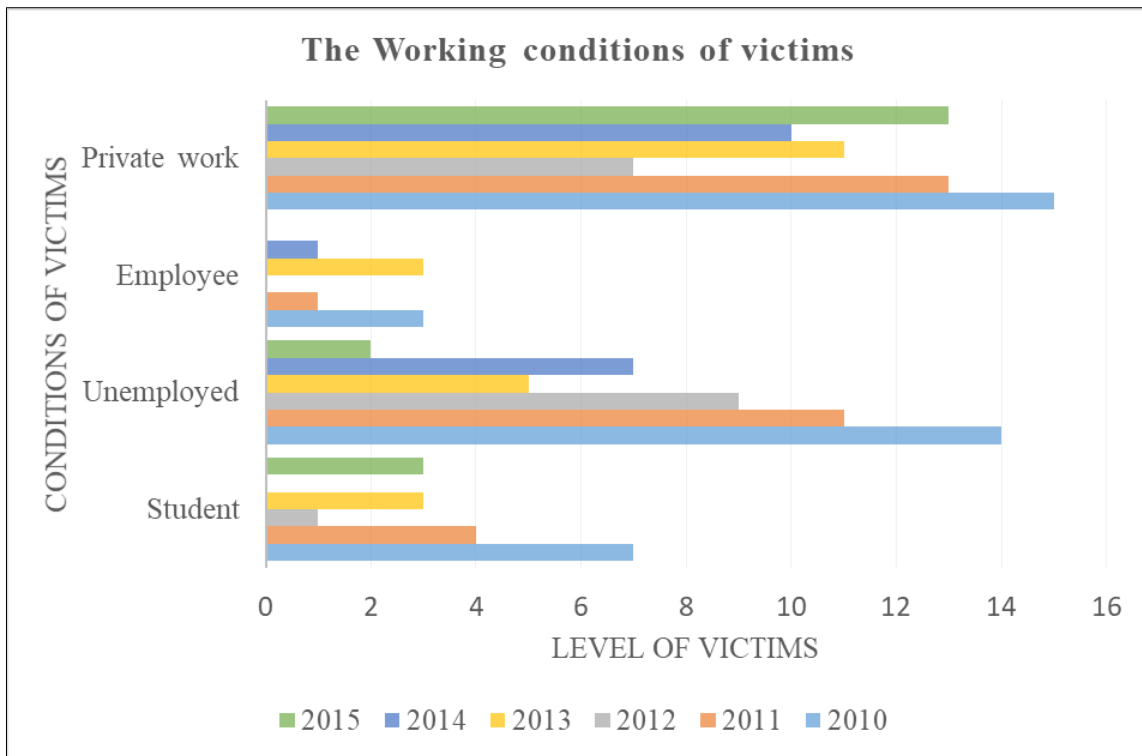


Figure 4.8: The working conditions of Victims

The Table 4. 7, shows the percentage of people affected by traffic accident in the congestion condition with their occupation. On average the majority of private workers and the unemployed were repeatedly injured during the periods mentioned. Subsequently, students were also affected by the accident as witnessed in the Table 4. 7. This is because the school attendance and student movement are the main road, all modes of transportation are used on it and excessive traffic congestion has exposed it to this problem.

Table 4. 7 The percentages of the working condition of victims in each consecutive years

Year Of Accident	The Work Of The Victims				Total in Each Year	In %
	Student	Unemployed	Employee	Private Work		
2010	7	14	3	15	39	27%
2011	4	11	1	13	29	20%
2012	1	9	0	7	17	12%
2013	3	5	3	11	22	15%
2014	0	7	1	10	18	13%
2015	3	2	0	13	18	13%

Total		143	100%
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Source: (The Collaboration of Nekemte Transport Office and the Traffic Police Office)

With regard to traffic accidents and traffic congestion, it is important to know the days and times when accidents occur frequently. For example, it is important to understand peak hour, supermarket time, when children go to school, when people go to religious center, the time of holidays, the time of weddings, and etc. This helps to significantly control and reduce the traffic congestion process caused by accidents. Accordingly, the Figure 4. 9, below compares the days of traffic accidents in traffic congestion with the data described by years. According to the data explained on the Figure 4. 9, Thursday is the most frequent day of accident in the week in the condition of congestion.

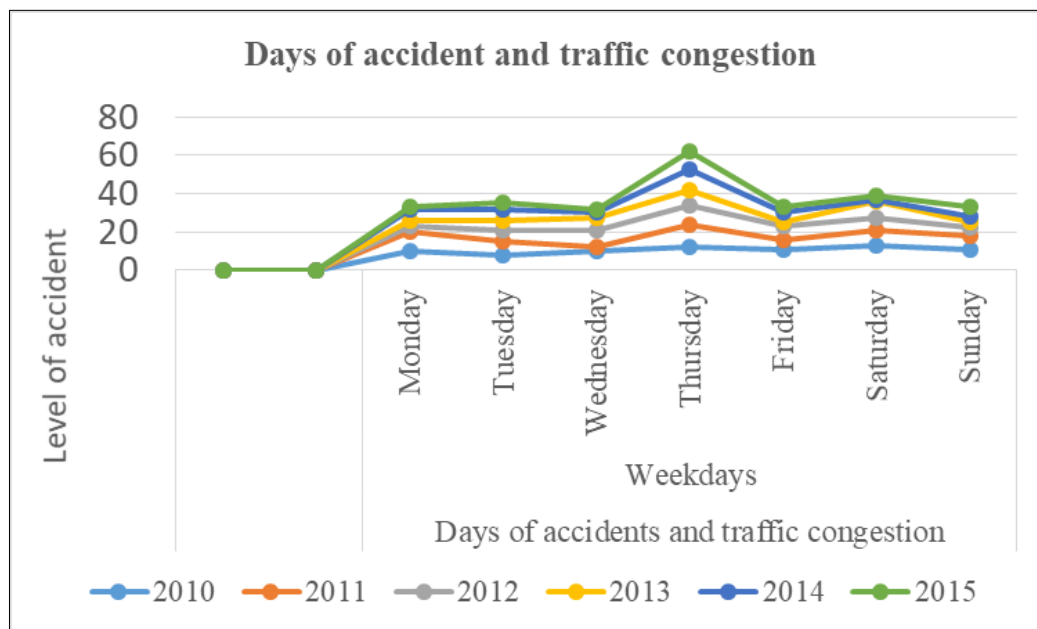


Figure 4. 9: Traffic congestion and accident days during the week

As shown in Table 4. 8 a similarly large percentage of traffic accidents occurred on Thursdays, which is 23%, and similar patterns occurred on Sunday, Wednesday, Friday, and Saturday which is considered as a small percentage compared to the rest of the week in which the traffic accident occurred with the 12%. According to the researcher, the main reason for the worst traffic accidents on Thursdays is the big market day when people from nearby cities and the whole city gather, which facilitates traffic congestion and causes traffic accidents. This was confirmed by insiders and collaboration based on traffic accident prevention and the transportation office, according to the results of the study. And this data

description contains the totals of accident bodies like, the physical accident, death and property accident.

Table 4. 8 Percentage of city traffic accidents in the condition of traffic congestion on weekdays

Year of accident	Days of accidents and traffic congestion							Grand Total
	Weekdays							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	
2010	10	8	10	12	11	13	11	
2011	10	7	2	12	5	8	7	
2012	3	6	9	10	7	6	4	
2013	3	5	6	8	2	9	3	
2014	6	6	3	11	5	1	3	
2015	1	3	2	9	3	2	5	
Total in quantity and %	33	35	32	62	33	39	33	267
	12%	13%	12%	23%	12%	15%	12%	100%

Source: (The Collaboration of Nekemte Transport Office and the Traffic Police Office)

Another important thing to understand about accidents and traffic congestion is to know and understand what time they occurred. Accordingly, the researcher divided the occurrence of traffic accidents and traffic congestion into morning, day and evening depending on the respondents and observation conducted on the field. This is explained in the Table 4. 9 below and the Figure 4. 10 below, for better understanding.

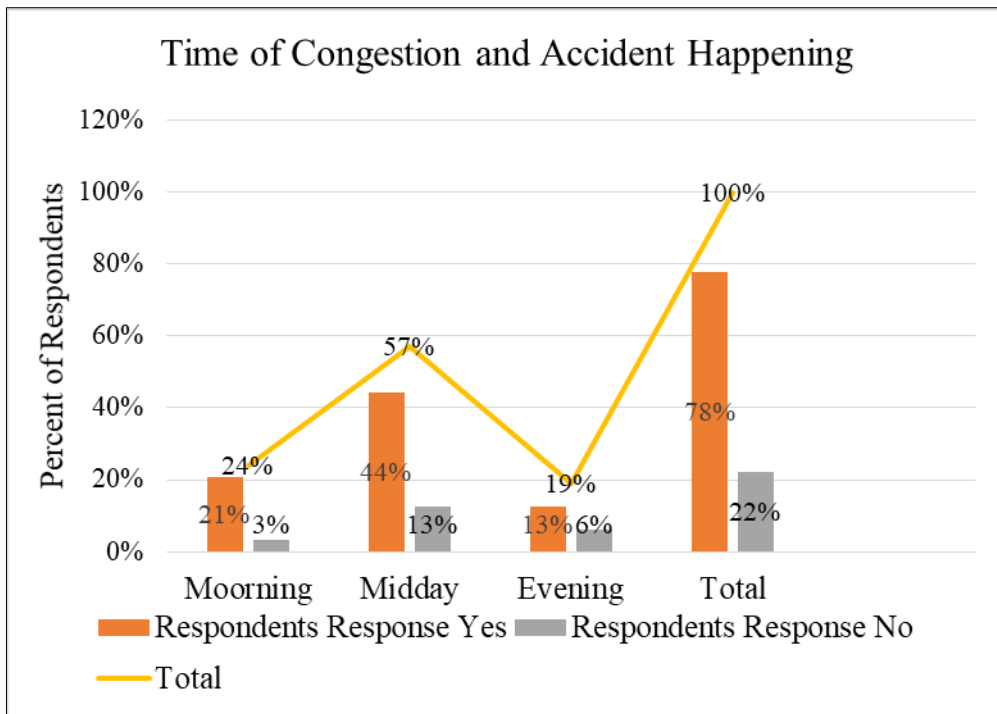


Figure 4. 10: The happening time of the congestion and accident in the Nekemte city

Based on the respondents' response regarding the traffic congestion situation, the researcher found that a large percentage agreed with his description. The methodology used by the researcher to explain in this way helps to gain insight into the problems in terms of traffic accidents and how to reduce traffic congestion in the way it occur frequently. Accordingly, to understand the nature of traffic congestion in the city, the evidence and understanding obtained from the respondents and survey field on morning, midday and evening times is described in the table Table 4. 9. Overall, 78 % of respondents in the researcher's survey agreed, while the remaining 22 % indicated that it occurs at different times. However, in most 44% occur at midday, according to the study. This means that there is more movement and communication of people at midday than in the morning and evening and communication between residents outside the city is also more frequent at this time.

Table 4. 9: The percentage of respondents on the happening time of congestion and accident

Time of accident happening	Respondents Response		Total
	Yes	No	
Morning	21%	3%	24%
Midday	44%	13%	57%
Evening	13%	6%	19%

Total	78%	22%	100%
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Source: Data survey (2015)

On the other hand, the researcher of this study described the location of the traffic congestion based on the actual situation in the area where the traffic accident occurred and the survey of respondents as well as experts familiar with the activities and lifestyle of the city of Nekemte. According to the results of this respondent survey, the highest percentage occurs in the city center and it was agreed by 64 %, as shown in the Figure 4. 11 below. The 9% of the respondents were opposing on the occurrence of traffic accident and traffic congestion on the center of the city, 3% of the respondents are agreed on that the traffic congestion and accident are occurred on the outskirts of the city. This describe us the high percentage of the traffic condition (accident and congestion) is occurring on the center of the city and it reminds us that caution is needed by the government and the community in the area where that condition was happening frequently.

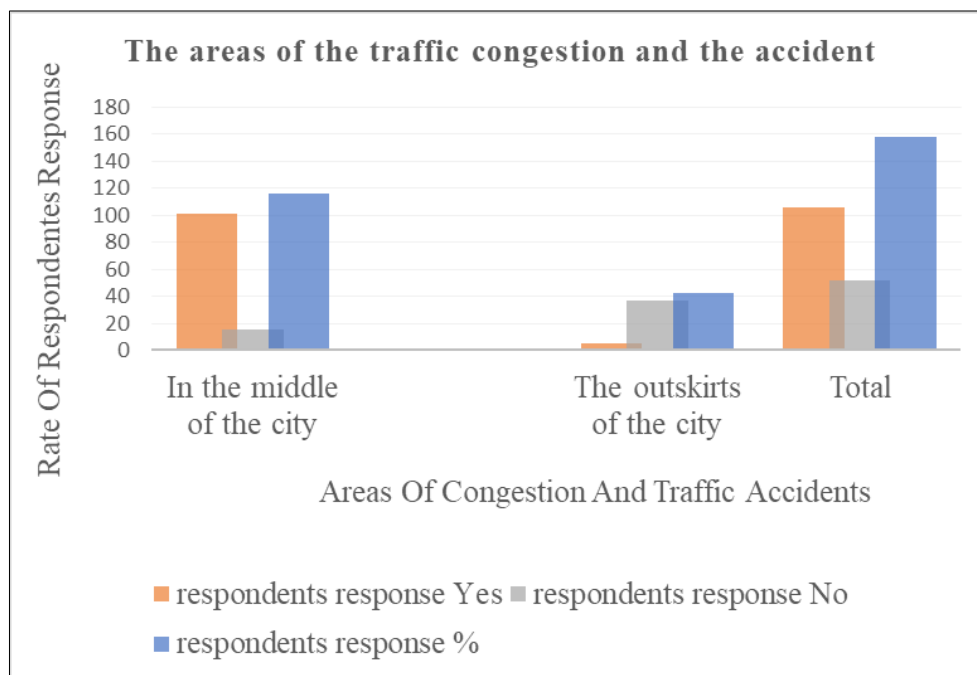


Figure 4. 11: The areas of traffic congestion and the accident happening in the Nekemte city

More traffic congestion is happening at the center of the city, where commercial activity exists, high percentage of public interaction interact each other, flow of the vehicles to the city and out of the city to other using it as cross-section. As it is depicted on Table 4. 10, the creation and formation of traffic congestion by peoples and vehicles causes the traffic

accident is happened more in the center of the city which scored with 64% in contrast happening at the periphery of the city with 3%.

Table 4. 10: The percentages of the respondents on the areas of the traffic congestion and accidents

Area of accidents	Respondents response in percentage		Total
	Yes	No	
In the middle of the city	64%	9%	73%
At the outskirt of the city	3%	23%	27%
Total	67%	33%	100%

Source: Data survey and understanding of office evidence records (2015)

This description of traffic accidents and how traffic-related accidents occur explains how to happen for speed, under what circumstances and in what places, as well as the problems and damage that congestion can cause in the city of Nekemte. In general, the researcher wrote in 4.3.4 that the main cause of traffic accidents in this city is traffic congestion and the characteristics of this traffic congestion are related to the road conditions has been explained.

4.3.4 The Characteristics of the Road Congestion

The characteristics of road congestion include the congestion and width of the road, the activity around the road, the carrying capacity of the road and the length of service the road has in the city. Accordingly, the road from the second roundabout to Ghimbi-Asosa is up to 1km, from the second roundabout to the hospital is 450m, and from the second roundabout to the Board (Ambo- Addis Ababa) direction is up to 1km, and also 1km from the first roundabout to the Bake Jama, from this first turn to Kumsa (Bure_Bahirdar road) 878m and the roads from the first roundabout to the Board are areas with significant traffic congestion characteristics. Especially from the second roundabout to the Board is the most famous and highest traffic jam.

The reason for this is that as a city, vehicles entering the city from all directions stop there and use it as a place to stay. The location is the center of the city and convenient to find places of interest and with the movement of vehicles and people there, the chances of traffic congestion have been found to be the greatest. The Table 4. 11 below visualizes the number

of vehicles that each of the following road widths can carry per minute. As the high way capacity manuals in the 2010, the LOS indicated in the level of service A the minimum numbers of the vehicles occupying the street per min or traveling on the street per min is 48, and the minimum number of vehicles per min for the other services are 80, 120, 168, 268, and greater than 268 for the LOS of B, C, D, E and F respectively. Regarding the Table 4. 11 below, 1st round about to Kumsa, 1st round about to Bake Jama, and 2nd round to Board are the areas of Congestion Street when compared with the other street areas.

Table 4. 11: Congestion and distance of road congestion on peak hour in Nekemte city

Congested road	Distance of the road congestion	Within minutes traffic movement off the road Vehicle/min		
		Forward	Opposite	Total Sum
1 st Round about-Board	1km	78	56	134
1 st Round about-Kumsa	0.878km	91	101	192
1 st Round about to Bake Jama	1.3km	103	93	196
2 nd Round about to Nekemte hospital	0.45km	39	40	79
2 nd Round about to Board	1km	77	81	158
2 nd Round about to Manjallo Garadge	1.23km	69	74	143

Source: Field survey (2015)

To determine the congestion of a road, it is first necessary to know the services provided by the road, so the Table 4. 12 below describes the services provided by the roads. Among the roads mentioned in the Table 4. 12 below, all the roads except the road from second roundabout leading to Nekemte town hospital provide complex services. First round about to Kumsa and to Bake Jama are the more congested of street in character including the second round about to Board Street. This means that they accommodate all modes of transportation and provide complex services and exposed for the more occurrence of traffic congestion with the risk behind. Only the street from the second round about to the Nekemte city hospital can provide the single types of services. On that street the public transport is

doing through the Bajaj, and sometimes by taxis and the street is the dead end, not continuous and provides only to the location of the hospital (Nekemte city hospital).

Table 4. 12 The users and the services that the street provide

Street Name	Service it provides		Rate of congestion (%)
	Mixed services	Single service	
1 st Roundabout-Board	✓	✗	15%
1 st Roundabout-Kumsa	✓	✗	21%
1 st Round about to Bake Jama	✓	✗	22%
2 nd Round about to Nekemte hospital	✗	✓	9%
2 nd Roundabout to Board	✓	✗	18%
2 nd Round about to Manjallo Garage	✓	✗	16%
Total in %			100%

Source: Field survey (2015)

In the other case the way in which we can measure and understand the characteristics of the street congestion is about the hierarchy of the street. The hierarchy of the street in the Nekemte town arranged according to the level of their congestion with respect to the distance and width to which the congestion flow. Since the width level of the roads in this city is below the standard, look Table 4.13 below, it means that the traffic congestion will accelerate frequently in high speed.

Table 4.13: The Hierarchy of road that are congested in the city of Nekemte

Street Name	Hierarchy	Width	Unit	Remark
1 st Round about-Board	PAS	16m	Standard	It doesn't meet the standards
1 st Round about-Kumsa	PAS	12m	Standard	It doesn't meet the standards
1 st Round about to Bake Jama	PAS	16m	Standard	It doesn't meet the standards

2 nd Round about to Nekemte hospital	SAS	10m	Function	It doesn't meet the standards
2 nd Round about to Board	PAS	12m	Function	It doesn't meet the standards
2 nd Round about to Manjallo Garadge	PAS	10m	Function	It doesn't meet the standards

Source: Field Survey (2015)

One of the characteristics we use to identify traffic congestion is the events that the road hosts. For example theft, dumping things on the street, slowing down, noise and pollution of the area. Vehicles parked continuously on the road can especially expose road users to theft, and also as a shelter for dumping objects. It reduce the quality of the road and can be harmful to road users and limit their interest from the street. This is based on the researcher's understanding of the field evidence and the respondent's response. This was divided into recurrent and occasional events as shown on the Table 4. 14 below.

Table 4. 14: On-road incidents and patterns of road congestion

Streets name	On-road incidents	Remark
1 st Round about-Board	Theft, noise pollution, conflict of interest	Frequently
1 st Round about-Kumsa	Time wasting, pollution	Seldom
1 st Round about to Bake Jama	Time wasting, theft, noise pollution	Seldom
2 nd Round about to Nekemte hospital	Time wasting, noise	seldom
2 nd Round about to Board	dumping of objects that pollute the environment, theft, and etc.	Frequently
2 nd Round about to Manjallo Garadge	conflict of interest, theft, time wasting	Frequently

Source: Field Survey (2015)

On the other hand, surface material plays a major role in creating road congestion. Which when the road is wet and unsuitable for vehicle movement and pedestrians, reduces the speed of walking, wastes time and causes traffic congestion. In addition, cracked roads, poor cleanliness, and lack of understanding of drivers at intersections can cause harm to pedestrians, passengers, properties and others. In general, the surface material problems of

a road, the properties it exhibits, the damage it can cause when it is out of standard and the percentage of their occurrence are described in the Table 4.15 below. This is also based on field evidence obtained by the researcher and information analyzed by insiders over time.

Table 4.15: The surface materials of the street and traffic congestion, traffic accident

Surface of the street and quality of the road	The movement characteristics of the road	Percent of happening (%)
Gravel –asphalt	Slow speed, Falls and accidents	17%
Wet roads-asphalt	Slow speed, Falls and collision	15%
Muddy roads-asphalt	Slow speed, Falls and accidents	19%
Quality of the street		
Straight street	It is comfortable for speed and visible frontally	11%
Cracked straight street	slows down, burns time	22%
Crooked street	Collision and conflict, slows down	16%
Total percentage		100%

Source: Field Survey (2015)

In addition to the quality of the road, width and events on the road, the time or hours spent by the users of the road itself will play a role in causing the impact of road congestion. This was conducted during the peak hour, but since they are similar all over the peak hour time the researcher used a single description to display how many hour and min the user of the road could burn the time due to the congestion and other cases, slow speed, losing the vehicles due to the congestion and demand exceeds the supply on the particular time. The result of this was organized from the survey that the researcher count the peak hour and the respondent's response. The

Table 4.16 and Figure 4.12, below show the things that can waste the time of road users on the road and their percentage.

Table 4.16: The condition of time use on the street

	Time waste for congestion
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Time waste and condition on the street	<15min	15-30min	>30min	Total	Total Percent (100%)
Wait for car	28	31	19	78	49%
To cross the street	51	0	0	51	32%
Long distance to cross	29	0	0	29	18%
Total	108	31	19	158	100%

Source: Field Survey (2015)

As started to be showed on the Table 4.14 the Figure 4.11 would also be explains about the maximum and the minimum flow rate of the users' condition on the street, how much time is waste for joining their interest through their life here in the Nekemte city. Users of the street include, pedestrians and transportation, and the results were obtained through extensive analysis with respondents about the actual situation in the community. According to information and insights gained by the researcher from road users or the community, the reason for wasting time on the road is that people's needs occur at the same time, for example when going to school, offices, institutions such as churches and centers. In general, the characteristics of a road and events that occur on the road at the same time or at different times are factors that limit road user demand cause collisions and cause traffic congestion according to the researcher based on the data formed from the respondents and offices.



Figure 4.12: The condition of the street and the time wasting of street users

4.4 The root causes of the traffic congestion in the Nekemte town

While there are many plausible reasons for traffic congestion, they have been identified in this study based on the level of agreement between respondents and city experts. These are on street parking, street vendors, and centralized employment working places, unemployment and unseparated mode of transportation on the single street.

4.4.1 On street parking vehicles

The vehicles are parking on the road for the seek of different things and reason and causes the congestion by creating the collision and overlap, parallel and crossing interest on a particular area of the street in the city.



Figure (a)



Figure (b)

Figure 4.13: On street parking vehicles and traffic congestion

Table 4.17: The reasons for why a car is an illegally parked on the road for a long time and causing traffic congestion.

Reason of illegal parking	Respondents response in %
Lack of legal parking	68%
For community service	9%
For personal interest	16%
For other reason	7%
Total in %	100%

Source: Field survey (2015)

In other case the number and types of vehicles moved and arrived parallelly and oppositely on the particular place at a particular time creates congestion and stages the mobility of both peoples and goods to, and from the city. This may consume the time, energy and hindering the destine reaching on time due to street occupied by congestion. As the observation was held on the field, on-street parking is the main factors and being for this challenge and creating of traffic congestion. As depicted on the Table 4.18, the lorry trucks parking on street when they are going to passing and crossing through the Nekemte city to varies cities and regions are high in percentage which is 77% when compared to other types of vehicles.

In contrast private cars are low in percent, which is 1% it is not in number of existing but in number of parking on the street and closing the street mobility. For reveals of this data the field survey was held including the respondent's perception and the expert's ideas.

Table 4.18: Kinds of cars mostly parked on the street for an hours and days

Kinds of cars	Respondents response %
Trucks going across the street	77%
Public transport	15%
Private cars	1%
Trucks carrying the supplies for the city	7%
Total in %	100%

Source: Field survey (2015)



Figure 4. 14: the most frequently vehicles parking on street

As depicted on the Table 4.19, the over continuous on street parking of the trucks has consume the time of pedestrians when they wait and finding alley to cross the street. As this study reveals it may affect the pedestrians in many directions, one it hides the ally they pass on or cross on to the next terminals, it hides where they want to intend like of shopping, drinking and eating places, and secondly it affects the positive interactions of pedestrians

with their suppliers at exact time and right place. In this data, the stakeholders were pedestrian, especially regarding to how many hours and minute they are burning on the street to reach where they want to be intended when they are starting the journey and hinderers of walking are narrated here on the Table 4.19 below.

Frequently for 37% the trucks are stopping and closing the street from 1:00 hr-6:00 hrs. in a day, and 22% of them are using 1:00 hr-12:00 hrs to stopping on the street, and closing the street and creating the congestion because between this times many interests of the users are over lapped.

Table 4.19: The hours that the trucks crossing the city parked on the street

Time of staying on street	Respondents' response in percent (%)
1:00-6:00 hours	37%
6:00-12:00 hours	22%
24:00 hours	26%
A day or more	15%
Total in %	100%

Source: Data survey (2015)

Table 4.20, shows the types of roads subjected to congestion due to illegal vehicles parked for long hours and the percentage of congestion caused by them. Among the access streets in the Nekemte city the street accessed from the 2nd roundabout to the Bordi is the most and well known by the illegally parked vehicles and characterized of congestion and it is 69% comparing with the other street access and service giving in the Nekemte city like the street from the 2nd roundabout to the tourist (Ghimbi direction), to Nekemte Hospital, and the street from 1st roundabout to the Kumsa, Ghimbi direction and Bordi (Addis Ababa direction). In contrast the street accessed from the 2nd roundabout to the Nekemte Hospital score the percent of illegal on street parking with 0.5% and the mode of transport and vehicle types mostly parking on are explained on the Table 4.20.

Table 4.20: Area with a large number of Vehicles illegally parked on the street

The street types	Percent of car parking in a duration	Mostly Parked cars
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1st Round about-Board	13%	Trucks, Bajaj's and Taxis
1st Round about-Kumsa	5%	Slight trucks, Bajaj's
1st Round about to Bake Jama	4%	Taxis, Bajaj's, Slight trucks
2nd Round about to Nekemte hospital	0.5%	Bajaj's, Seldom slight trucks
2nd Round about to Board	69%	Trucks, and Taxis in a particular place
2nd Round about to Manjallo Garadge	8.5%	Trucks, Slight trucks, and Bajaj's
Total in %	100%	

Source: Field survey (2015)

4.4.2 Street vendors

4.4.2.1 The pedestrian conditions and street congestion

In the city, at any given time people whether low-income or otherwise, have a job that is connected to the street through their lives. This includes people trading on the or at the edge of publicly approved or constructed walkways and shows their significant impact in traffic congestion. This is created when pedestrians deviate from their allotted lane and occupy the vehicles lane, which is due to unsuitable pedestrians for it reduces their speed. In this study, the researcher analyzed the level of service for pedestrians, examined how much it can reduce walking speed, and explained how it can cause collisions and overall road congestion. First the types of street vendors which is more congested and active was selected by the observing the field, and that street vendor is the one that exist between the 2nd roundabouts to the Bordi with 1km distance. Hence the speed of pedestrian in congestion condition was counted square/person. Likewise the speed of pedestrians in free congestion was counted square/person of the pedestrian street (free of street vendors).

Only C-F service levels were considered because pedestrian congestion was chosen to determine pedestrian conditions and congestion seeking to directly define the highest level of traffic congestion on the selected road as shown in the Table 4.21 below. This condition of congestion was not only measured by number of pedestrians per min but with the width of pedestrian walkway. Here the level of service researcher used C-F is because he wanted to show only the level where there is a lot of traffic congestion pressure, according to the

results of the study there is no problem with pedestrians due to traffic congestion among those as level of service A-C. As depicted on the Table 4.21 the width of the pedestrian path has fallen below the standard of the sidewalk and has caused congestion on the sidewalk.

Table 4.21: Pedestrian level of services in congestion condition

Level of service	Sq. ft. /person	Peak hour			Person per min	Congested street	Width (m)
		2:30-300	6:00-6:30	11:00-11:30			
C	2.7m ²	✓	✗	✓	27	1 st roundabout-Kumsa	Not assigned
D	1.8m ²	✓	✓	✓	45	2 nd roundabout-Tourist	1m
E	1m ²	✓	✓	✗	60	1 st roundabout-Bake Jama	1.5m
F	0.5m ²	✓	✓	✓	70	2 nd roundabout-Bordi	1m

Source: field survey (2015)

The Table 4.22 the perception of pedestrians on the services and congestion condition regarding the selected pedestrian street, which means the street mostly characterized by traffic congestion due to illegally parking on street. The data was organized explained depending on the respondent's perception on the practice of traffic congestion in the Nekemte city.

Table 4.22: The perception of pedestrians on the services and the condition of pedestrian street congestion on the selected street

Something to be understood	Its characteristics	Respondents' response in (%)	
		Yes	No
1. Street vendors	Occupy the pedestrian lane and move the pedestrian lane to the carriageway	23.5%	-
	Reduce the speed of pedestrians, and it change people's needs and directions	26%	
	Total	49.5%	

2. Pedestrians	Voluntarily leaving the streets without any congestion	21%	17.5%
	The occurrence of road congestion and the lack of travel alternative routes		14%
	Not having the experience of walking on the pedestrian walk ways		
	Total	21%	31.5%
	Ground total	100%	

Source: The field survey (2015)

In addition, as depicted on the Table 4.23, the pedestrians have varies perception and experience on the idea that the street vendors creating the traffic congestion and causing an impact on the safety, healthy and comfort of the users or the pedestrians in their lifetime in the Nekemte city. And it is related with occurrence time of the congestion due to the street vending, and among the respondents 49% of them are agreed that it is created every day of the week in contrast 3% of them are disagreed and finally their whole idea is explained on the Table 4.23 below.

Table 4.23: The perceptions of the pedestrian on the condition of street vendors and its occurrence congestion

When it occurs	The respondents' perception in (%)		Total in (%)
	Yes	No	
Special day of the week (Tuesday, Thursday and Sunday market)	17%	-	100%
Every day of the week	49%	3%	
Occasionally	-	31%	
Total percent	66%	34%	

Source: The field survey (2015)

As this study reveals a street near and close to the business centers, the street being cross-section to many movements of purposes due to lack of fixed layouts and fixed locations collide with demand and other suppliers, causing the impact of human-to-human, human-to-car traffic congestion

4.4.3 Centralization of government offices (centralized employment working place)

4.4.3.1 The dispersion of government offices and traffic congestion

The location and distribution of the government work has a cause on the creation of the traffic congestion on the direction to which the peoples are going to it and served. Especially the existences of each office and sectors on a particular place increases the number of flow and movement there and affects the capacity of the street that exist before. As shown in the Figure 4.15, most of the government offices in Nekemte are located in the city center particularly on the same areas, which is connected to the roads leading to business, education, and various religions in creating traffic congestion.

As revealed on this study it embeds the capacity of the existing street by the parallel, overlap and cross interest of the peoples to the offices and from the offices to where they intend including those uses that street as opportunity to pass for varies purposes.

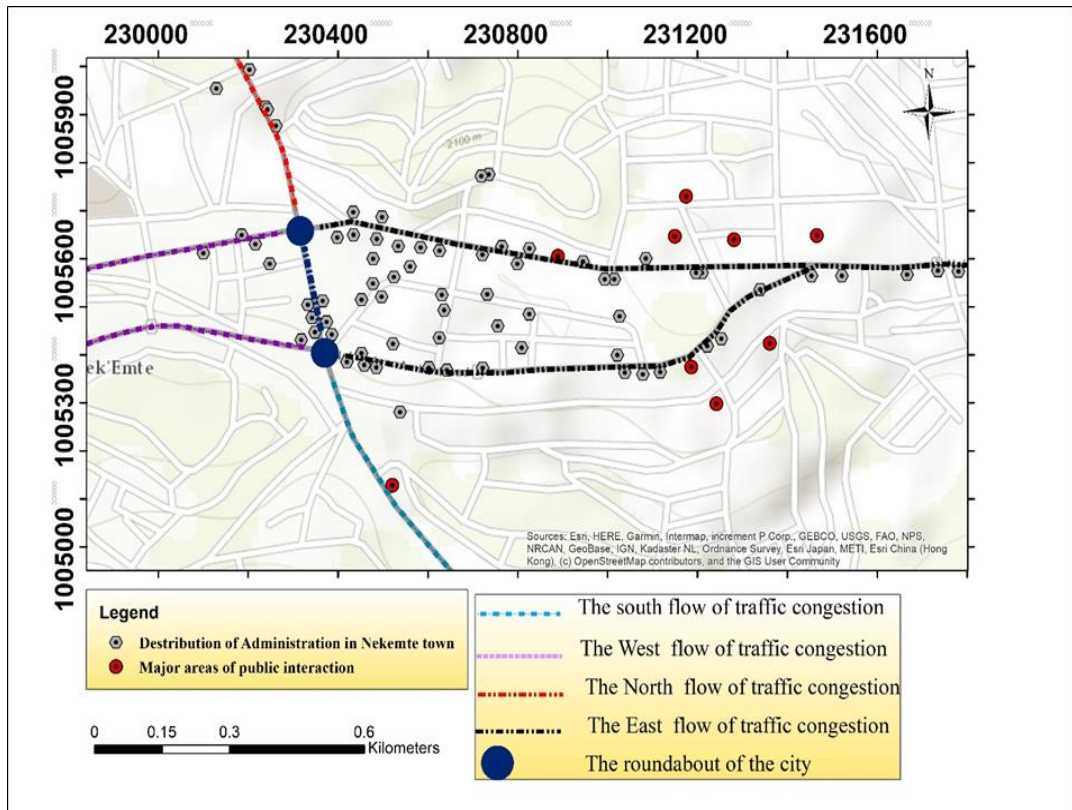


Figure 4.15: The centralization of the government work in the center of the city and congestion flow

Furthermore, the major institutions and services of the city such as University, College and Hospital are directly connected to the city center road, which makes the movement in the city center even more intense and creates a lack of roads. As revealed on the Figure 4.16, the location and functioning of the city's major institutions shows that road congestion and traffic movement are even worse as the roads are linked to the centralized provision of services in the city in addition to the city administration distribution in the center of the city. This can lead to traffic congestion by creating similar demands on limited roads at the same time, as proven in the study.

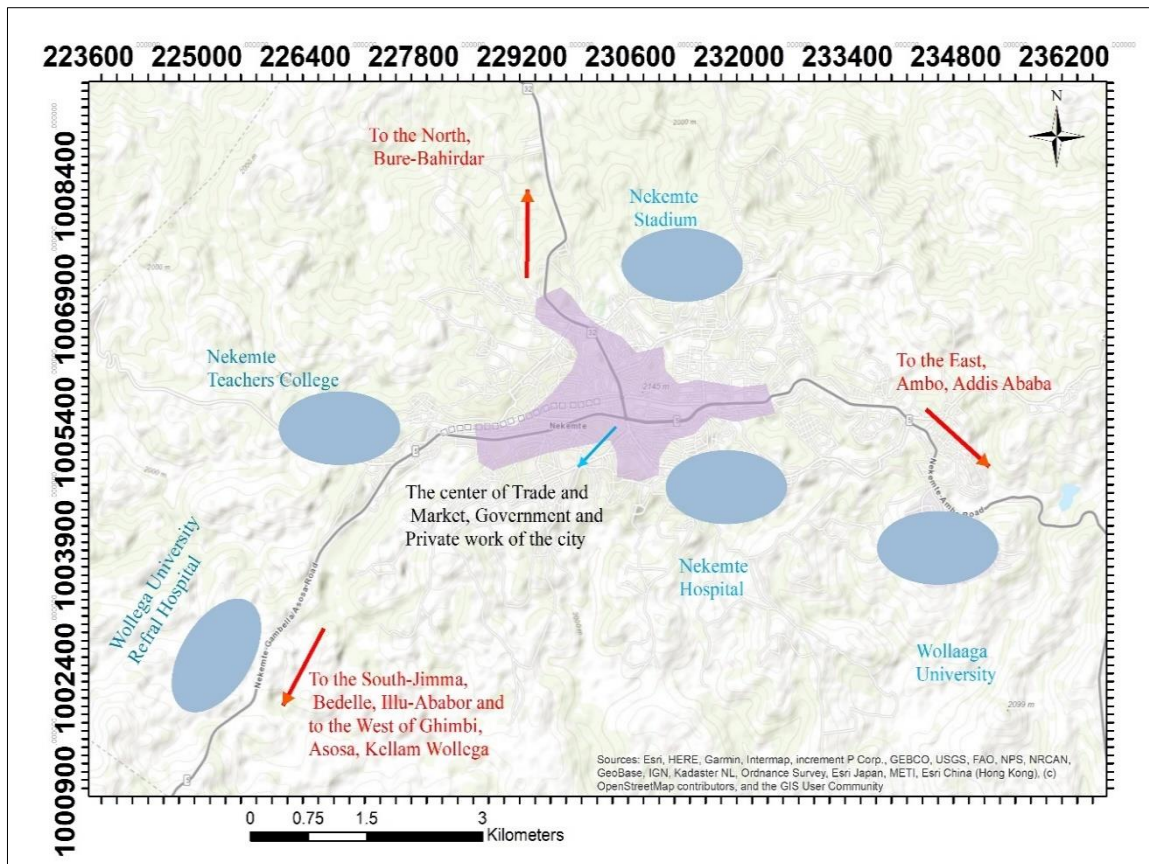


Figure 4.16: Physical distribution of government institution and the flow direction of traffic congestion

4.4.4 Unseparated modes of transportation on the same road

Every mode of transportation which is on a single street in the city creates traffic congestion as it narrows the street and limits the demand of passengers or drivers that each intends to reach where they want to intend in a given period of time. This selected the routes that accommodated all transport modes and created traffic congestion in the study as described on the Table 4.24 below. Therefore the street which start and exist from 2nd roundabout to the Bordi was selected and the types of the modes of transportation which were held on a particular time was identified and quantified at the peak hour for an hour for a week but the average was taken and depicted on Table 4.24.

Table 4.24: The mode of transportation held on the single street in a particular time, creating the traffic congestion

	The flow of Mode of transportation
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The flow on peak hour		Motorized mode of transportation (vehicle/hour)							Flow in percent (%)	Non-motorized mode of transportation/15mi		Flow in percent (%)
		Trucks	Light trucks	Bus	Bicycle,	Mini bus	Bajaj	Motor cycle		By foot	Horseback	
Street from 2 nd roundabout to Bordi	Morning 1:30-2:30	113	197	29	34	304	406	29	31 %	830	23	30 %
	Midday 6:30-7:30	211	233	36	21	335	469	20	37 %	1009	44	38 %
	Evening 11:00-12:00	179	201	23	19	303	419	16	32 %	899	31	32 %

Source: Field survey (2015)

In other case the lack of available, safe and accessible road for the accommodating the service of transport causing the traffic congestion and regarding that the respondents (the derivers) were responded here as on the table below, the data was organized by the check list.

Table 4.25: Drivers' perceptions of on-street conditions regarding service delivery and operations

Elements to be understood	Its character and context	Response		
		Yes	No	Total Score
Availability of street	There is a street availability but no width except, because all modes of transport use it	✓	✓	

	The drawback is the lack of classification and separation of transport according to their comparability	✓		
	Total	13	7	20
Safety of street	The pavement of the street which are purposely used as the alternative option is not good and it does not linked to the main access road for user to intend	✓		
	It has good pavement and linkage		✓	
	Total	13	7	20
Accessibility of street	It is difficult to access easily where is intended because of unalternative services and function that not street give	✓		
	There is prevail of alternative street to accommodate each and separate mode of transportation regarding where they intend		✓	
	Total	11	9	20

Source: Field survey (2015)

4.5 The Impacts of Traffic Congestion on the commercial nature-of the city

The impact of traffic congestion can cause many problems including economic, social and environmental problems, but in the path of this research it is focused on the problems it can cause to the commercial centers or traders of the city and is explained below.

4.5.1 Congestion reducing the visibility of commercial location

The street congestion may affect the visibility of commercial location within their types, affect the visibility of graffiti, and it may the loss the time, and interest of the users and the economic feasibility of the traders. This is mostly affected by the on-street parking vehicles, when the scale of their parking is above where users intend to reach, where they want to arrive. As the pedestrian, respondent the continuous on-street parking can affect the angle of the visual position of commercial activities like what type of activity is existing. Because the banner which shows the specific purpose of the building that the function it gives (is shopping place, clothing and shoes, drinking and eating, drug stores, etc.) are not easily

identified and the respondents responded that they loss their time and interest to get their what they want to intend.

The traders them self also responded that especially the large trucks which are parking on the street for a long hour (more than six hour) affects the visual location of place where we are and serving the customers. During this time both of us (traders and customers, or the suppliers and demanders) become affected for we loss the exact time and the exact place we meet. The traders may loss the time, and their interest, and the traders may also loss their income per day, as the general respondent of the researcher during the field data. Regarding this as the thought of the traders the condition of the traffic congestion and normal condition their income per day was described on the table below, but it is not the only element to affect the daily income of the traders in their daily work activities. But in some extent to what level and context the impact was happened, depending on the context of their daily life, the field data was held in each day of a week for a week.

Table 4.26: The thought of the traders on their working and per income day during the normal traffic

Condition of congestion	The traders perception on the stay of trading day							The time vehicles stay per hr. and congesting			
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	2:00-4:00 hr.	4:00-8:00 hr.	Half day hr.	A day
Normal or free of congestion	1	2	1	3	1	2	1	✓			
Congestion time	2	5	3	5	4	5	4	✓	✓	✓	✓

Source: Field survey (2015)

Where, 5=very marketable, 4= marketable, 3=medium marketable, 2=low marketable, 1=very low marketable, and the right tick shows the time that the congestion formed and stayed.

According to pedestrians, when vehicles create road congestion by narrowing the road or stopping on the road, there is no movement of the road where pedestrians can freely pass or cross at any place and time as depicted on the Table 4.27. In addition, pedestrians expressed fear and lack of guarantee of responsibility for their safety when traffic congestion occurs in this form, and also, they explained places of business or purchase and supply of goods are not easily accessible by their permeability. To ensure this, a check list was prepared and presented, and the respondents were able to fill and explain the questionnaire, accordingly, and it was based on the actual situation and commutes of the road users. So as the study revealed the more percent of respondents were agreed on the effect and situations of happening congestion by on street parking.

Table 4.27: The opinions of the pedestrians on their customers (pedestrians and other users), when the large trucks stoping on the streest and blocking the street

Element	The features	The traders response		Grand total
		Yes	No	
When the trucks closes the street and stopping on for a long hr.	User, pedestrians, passengers could not pass or cross the street from left to right or right to left easily	23%	-	
	The visibility of the trading place(their specific function) couldn't flexible to all users in exact time and place	41%	11%	
When pedestrians walk on his or her side way	Shaking to the environment and lost hope to will be come again	11%	-	
	Pollution like noising, and over lapping interest	9%	4%	

Total %		84%	16%	100%
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Source: Data survey on the Field (2015)

4.5.1.1 Reducing the permeability of the environments

People walking on the road in all the necessary directions, will be exposed to various dangers if they do not recognize the objects they see. One of the obstacles to people's attitude and orientation is the way the cars park on the road, especially in the downtown or center of business centers, transformation areas or nodes and other areas of human interaction are frequent. This affects the visual permeability of pedestrian, or other users of pedestrians on the street where they were going to use what they are intending to use like shopping, drinking and eating, vacating, crossing and etc. for all the permeability, safety and attractive to the place or the street should be important. Here the phases of the permeability are explained in different way, these are perceptual or visual permeability, functional permeability, and physical permeability, which are explained as the following separately.

Physical permeability

The physical permeability was happened when the vast and large peoples are walking on the particular time and spaces for the overlap and variety of interests. According to this research the physical permeability is affected by overflow and standing of vehicles and peoples at the same time and on the same place particularly on the same areas. The transition street, which exists from the 2nd roundabout to the Bordi and from the 2nd round about to the Nekomte Hospital, and tourist direction street is the most welcoming congestion movement and affecting the physical permeability of the that street at all. That street is serving the community or the city as the cross-section and sprit or rest place. The way to goes the schools, market or business centers and crossing to the other district, town and surrounding environment is mostly through by it. So due to the lack of pedestrian width proportion to the pedestrians or the users of the street, on street parking of the vehicles and lack the opportunity to pass or cross timely to where intend and creation of demand overlap are the major factors for the unsafe physical permeability for the service provided from the street. Generally it frustrates the pedestrians or users while they walk to the commercial areas for it is highly linked transportation or congested network activity.

Table 4.28: The purpose and the issues of the street, the low permeability street that peoples have flowing through on.

The purpose of the pedestrians and others	The movement of the peoples in percent (%)
To school	25%
To the office	13%
To commercial center	27%%
It is a passing way	30%
Other	5%
Grand Total %	100%

Source: Field survey (2015)



Figure 4.17: The physical permeability affected by the on street parking vehicles

Visual permeability

The traffic congestion affects the visual permeability by reducing the ability to seeing and understanding of things side by side and distantly. As the researcher conducted observation on the field and get of data, the visual permeability of the pedestrian, and user of the street would be affected by the on street parking which is continuous at a long distance especially

by the large trucks. The street from the 2nd roundabout to the Bordi is the one that serving as the main arterial access and more pedestrians are using when the side is filled of pedestrians. On the walking or the flow of traffic when the visual permeability affected or staged by something like of on street parking, and over condensation and movement of peoples, then the place of trading or business location become invisible to same scale. It reduces the attraction in between the supply and demand or between the users and traders, it may affect or reduces their daily income, from their daily working.

For the visual permeability enhances the attractivity, belongingness and relaxing of the environment during walkway, and it also enhances the linkage of buildings function and user's street the economics of the street side worker or traders may increase and increase. The image, table below shows how the level of on street parking affects the visual permeability of the user's street on their daily life and on the contrast how it reduces the interaction between the users and the traders or the business man which is on their daily income.



Figure 4.18: The visual permeability affected by the on street parking of vehicles (more of trucks)

Functional permeability

Over lapping function is a factors that affects the functional permeability of the users on the street and side by the street, on the same thing to the traders. This may happen on the street and users as this study, when a trip length is centered and to a particular space or the street

and the views many users becoming overlap, parallel, and conflict or cross to each other. This may has an impact on the daily life of the street life and side by it. It is difficult to measure such types of event and activities unless we understand and differentiate on observation and determine who on whom effect happens. As the research reveals, the functional permeability of the users are affected by different factors, like, incompatible use of land uses, impermeability of the street, pedestrian congestion, inaccessibility of the street, low and lack of the street signage which reduces what users expect in time and place are some and major factors which are affecting the permeability (functional permeability) of the users, changing and obstructing their interest and function they deserved.

The image below shows the factors that are affecting the functional permeability of the street and the users of the street due to the traffic congestion in the Nekemte town. Overcrowding of vehicles and on street parking can affect the functional permeability of the peoples, pedestrians or users lost opportunity of double function through their mobility.



Figure 4.19: The functional permeability affected by the on street parking and modes of congestion

4.5.1.2 Congestion and the crime formation

One of worries that the people's movement and commercial activity have in the center of this study is crime created by the shed of congestion. As the research revealed, some features of the crime condition which are visible to the life of the business center and between the users are thief, beating and physical injuries or the fatal injuries. This is held mostly around

the place where many of trucks and other vehicles are parking and stayed at the night. These actors are also used on street parking as shadow and hidden themselves from the judgment of the law. And this types of activity and work affects the safety, convenience, comfortably, healthy, property and the interaction of peoples between themselves and their surroundings. For example when there is no safety and health; when people's lacks guarantee to its life on the particular place and time the interaction that it has on the it's environment (buying, or exchanging goods and services, working, walking, vacating, meeting and etc.) may be broked off.

And in other case the social interaction, economic and the environmental activity of the entire of the city may exposed for different problems, which is due to the lack of guarantees to peoples right and security to work, walk and lives. The image, below shows the place where many of crimes are formed, and affecting the life's of the citizens of the city and the business workers, reduces the working time and feels fearing about the users walking in a particular time and place. As it was explained on the early of this paragraph, the most congestion street, the street from the 2nd roundabout to the Bordi well known and experiencing and well coming of these problems reveals thoroughly, as this study depicts. In this study, as data was collected from experts and traders' perception, the condition in which crime formed has bringing economic crises on business workers through their daily income is high even though not statically scored or presented separately as due to traffic congestion. This directly affects the safety of customers and suffers the daily income of the commerce's.

4.5.2 Congestion and the pollution

In this research, the traffic congestion was revealed as the creation of pollution like the pollution of noises which loses the safety of the peoples who are walking, crossing and using the areas. Since it affects the safety, healthy and comfort of the users, it reduces the interrelation between the traders and users to and from the side of the traders or businessman's opportunity to sell and meet their customers. The environmental safety and health have its own impact on both life of demander and suppliers in the city. The researcher was used different methods for airing an organized data, like observing both at evening time especially 1:00-3:00 pm, day when the peoples were more congested and interrupted and when the vehicles were closing the street, for consecutive days in a week, asked the experts and traders that they have an experience before. As this research was revealing, the traffic

congestion increase and increase and then there will be the increase of pollution un safety of belongingness and exciting to the where to intend, to serviced commercial.

4.5.3 Congestion and the reduced productivity

The daily change of productivity is depending on the true time – the planed time work in the given day minus burnt time with unconditional way, the health, safety, comfort and convenience of the users while interacting to their supplier place or business center. The Table 4.29, below depicts the condition of traffic and level of the traffic congestion's impact on the daily income of the commercial activity.

Table 4.29: Perception of traders on their daily income in the condition of normal and traffic congestion

Condition of traffic	Income per day					Grand total in 100%
	5	4	3	2	1	
Normal	✓	✓	✓	✓	✓	100%
Score	26%	15%	7%	5%	3%	
Congested	-	-	✓	✓	✓	
Score	-	-	7%	13%	24%	
Total in %	26%	15%	14%	18%	27%	

Source: Field survey (2015)

Where, 5= Excellent, 4= Very good, 3 = Good, 2 = Low, and 1 = Very low

As the depicted on the Table 4.30 the perceptions of the traders on the pedestrians or the users of the pedestrian walkway who crosses through the trades is explained regarding the problem facing them when they want to buy, interact and joy with the environments. These are the feeling of the users, the doubt of the users for their safety and the security, and etc. cross ponding to the percent of the effect it has on their daily life. For the reveals of this study, the data was gathered and organized frequently at different time evening, day, and night for identifying how much the perception or experience of the traders is to the honest true regarding the users lack ability to interact with them.

Table 4.30: The perception of the traders on the users (passengers and pedestrians) when the traffic congestion happened and sided by their working (trading) place.

Effect of street congestion	Perception of the traders in percent	
	Yes	No
People or users fleeing the road	33%	7%
Users lose interest due to their doubts about their safety and security	26%	4.5%
The interaction and relation of the users with in the area become erected	19.5%	9%
Total	78.5%	19.5%
Total score in percent (%)	100%	

Source: Field survey (2015)

As depicted on the Table 4.31, the annually growth rate of the commercial productivity was explained based on the consecutive of the five years, it shows that in what percent the productivity of the commercial activity reduced from varies factors in congestion form

Table 4.31: The growth rate of traders' annual income in the city revenue and reducing productivity

Business types	Annual income rate in percent (%)					Growth rate in percent (Reducing and increasing rate in percent)	
	2011	2012	2013	2014	2015	Reducing rate	Increasing rate
Shoe and clothing stores	23%	25%	25.5%	25%	27.5%	-	0.5%
Restaurants and bars	26.7%	29%	30%	29%	29%	1%	-
Electronics stores	20%	22.3%	23%	25%	26%	-	3%
Pharmacies or drug stores	7%	7.5%	8%	8%	7%	1%	-
Hairdressers	3.5%	4%	4.3%	5%	4.4%	1%	-
Publishing and printing	7.5%	8%	11%	11.5%	11%	0.5%	-

Source: Nekemte municipal office (2015)

In the other case most of the business man who are located and sided by the traffic congestion were let and leave the area by withdrawing the permission receipt work to the traders office, as the researcher get the confirmation from the offices of the trading and marketing of Nekemte town. The table below shows the percent of those business man and shows how much it has an effect on the productivity (their daily and annual income).

Table 4.32: Perceptions of retailers leaving their primary retail outlets due to stress and complaints about unsuitable locations in percentage terms

Business type	Reasons of location and job release			Total grand in%
	Invisible	Pollution	Low interaction	
Restaurant and Bars	✓	✓	✓	
Drug stores	✓	✓	✓	
Hairdressers	✓	-	-	
Total percent (%)	47%	17%	36%	100%

Source: Field survey (2015)

Various factors affect the daily income of the traders or the business man in the center of city. But in unique way the traffic congestion alone influences in many directions: one reduces environmental attractivity by forming accident redundantly on the area, exposing the area for other crime like theft, pollution and reducing the visual and environmental permeability on the ways of the users. According to a 5-year trend on certain types of businesses, the annual percentage of revenue decreased by 3.5 percent in this study, in which the impact of traffic congestion was significant in the context of spatial research.

5 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The main scope of this study was assessing the impact of traffic congestion on the commercial areas and central markets of the city, which was confirmed by pull factor of traffic congestion analyses, accident of traffic congestion analyses, pedestrians and permeability analyses and includes income per day analyzes of traders in and out of traffic congestion situations. Data survey such as counting traffic at peak hour both for pedestrians and vehicles, LOS for pedestrians, and the record of secondary data source of information regarding the traffic accident vs. congestion was conducted thoroughly.

The current traffic congestion situation was influenced internally by high expansion of infrastructure, but lack of attention to the expansion and service of street is the most serious problem. Externally as the city is the cross-section of center for many regions and urban the number of vehicles entering and exit the city per hour significantly influenced traffic congestion. For this, field observation was held, counting the number of vehicles entering and exit the city was conducted on each direction of city access linkage during the peak hour. The percent of vehicles entering the city per hour in a day through the east and west-southwest was 31% and 34% respectively. Among them the type of vehicles mostly enter the city was trucks with 38% which crosses the city and goes to where they intend and public bus including minibuses.

Similarly, traffic accident was another measure of the current traffic congestion in the city. Due to the collusion and overlap interest of street users with heavy traffic congestion, with heavy movement of vehicles and heavy movement of pedestrians faced major problems such as fatalities, injuries and property with 24.5%, 32% and 16% respectively in average. This was revealed by the trends of data analyzed, recorded from 2010-2015 EC.

The characteristics of road such as types, distance, width, and service provision of road were analyzed to assess the traffic congestion condition. The street from first roundabout to Bordi with 1km distance and 12m in width is PAS in type and high attraction of traffic congestion with 142 vehicles/minute and the street from first roundabout to Bake Jama attracts 146 vehicles/minute with 16m width.

The root causes of traffic congestion was analyzed based on the features and impact of on street parking, centralization of government employment, street vendors, unemployment and unseparated modes of transportation as a whole. Additionally the internal and external factors of congestion facilitators were identified, the centralization of government working are one of the factors highly influence traffic congestion is one of internal factor.

On street parking was analyzed regarding the place and hours that the vehicles take to stay on illegally above the time given. The reason of on street parking was due to lack of legalized and formalized car parking, which was confirmed by 68 %, this was based on the data provided by the drivers. The most vehicles accommodated in on street parking were trucks with 77%, it is especially common on the road from the first turn to the Bordi and it is considered under external factor of causing congestion. With the same condition with 26% they were stayed on street for 6:00hr-12:00hr and 15% were styed for a day. The trucks were the dominantly accommodated vehicles on the street exist through first roundabout to Bordi. And they were the crossing types of vehicles, but they once left the space another occupied the space every day making the road too exposed to traffic congestion.

On street parking affect the permeability of pedestrians, ability to see and understand the environment (visual permeability) and it also affect ability to access functionally (functional permeability) where they intend and what they want to do. And this is the reason why traders are affected by the impact of the traffic congestion; their location is not visible to the users or pedestrians when the street occupied and full of vehicles on street. To find the location of business center and function, time and money was lost, and the daily income of traders become decreasing while they were not interacting with their users at the right time and place. For this description data survey was held on the traders regarding their work in both normal and congestion situations. This is one of the ways in which the impact of traffic congestion on the shopping center was identified and evaluated.

To sum up the data survey was held with traders, drivers, pedestrians and experts and additionally the secondary data regarding the understanding of the current congestion condition in trend form was processed. From the root causes of traffic congestion on street parking was the serious problem on the traders' daily life as the result indicated. As the condition of traders measured in normal and high congestion condition regarding the pedestrians and vendors, during the high congestion the days like Tuesday, Thursday and

Saturday are the time not to meet with their customers or users in good way. The others are also the most need of consideration and measurement to be managed.

5.2 Recommendation

This is the direction that the researcher guided the concerned party in a solvable manner and proposed solutions regarding the results and the problems observed in the discussion. So the recommendations are set out as follows.

Regarding accident formed with traffic congestion,

- I. Determine methods of preventing traffic accidents such as technology-enabled traffic signs in the city center and areas with high traffic congestion, and traffic movement; especially on the road starting from the second winding road leading to Bordi and Tourist or direction to Ghimbi where this attention is needed.
- II. Resolving the width of the pedestrian path to the standards set for city streets is to deflect their movement and walking from the carriageway. Because the pedestrian walkway is very narrow and uncomfortable, and the carriageway is occupied by human traffic.
- III. Feasible ways and means of developing and smoothing alternative roads, which have nothing to do with the high traffic congestion roads, can protect the lives of pedestrians and avoid the dangers of traffic congestion.

Regarding traffic congestion caused,

On street parking is the top source of traffic congestion and has an impact on retailers and is classified as an external impact, especially most noticeable on the streets from the second roundabout to the Board. In this the more visible was trucks that comes in four directions as they enter the city and are about to cross. So, what needs to recommend is,

- I. Traffic congestion in the city center can be avoided by laying new roads on the outskirts of the city for trucks that do not benefit the city but cross the city.
- II. Vehicles that are allowed to park on the road for various reasons can be charged if they exceed their allotted hours to prevent them from using the road again and again illegally. According to traffic law guidelines and regulations, those vehicles accidentally broken or damaged can stay on the road for a day, while those in service are only allowed up to six hours, which means they can be fined and charged of price

if they used above the allotted time. It is possible to reduce and control the risk behind them through these methods.

- III. Distributing public buses in the city reduces minibuses and banning Bajaj's from the central road can reduce traffic congestion in this regard. Further increase in the number and services of Bajaj's in the city has led to congestion, and distribution of public buses can easily reduce congestion by transporting more people in less space. This is especially concern the three main cross-town roads such as the roads leading from the 1st and 2nd roundabouts to Bake Jama (Ghimbi Asosa direction), to Bordi (Ambo Addis Ababa direction) and to Kumsa (Bure-Bahirdar direction). Additionally using the public buses in towns near to the Nekemte city such as Gute, Uke, Gatama, and Diga reduces traffic congestion, vehicles (minibus) are always deployed to those town for they are near to the city.
- IV. Creating, developing the public center, and creating job opportunity making it attractive to those who have no job and move here and there without any issue. Most pedestrians who go for minutes, and for hours are those who do not know what to do, who not know where to go, and those who want pass time. So, when they come together with people who matter, conflict or collisions can occur on the road and cause congestion (of pedestrians).
- V. Relocation of government offices associated with congested roads, as customers travel there using transport. The first roundabout and the second roundabout are especially close to the government offices in the area and therefore the number of passengers and pedestrians will be too high there.
- VI. Committing or forcing any houses built for commerce to have underground car parking (private and sometimes minibus) can avoid the number of vehicles parked on the road that reduce the demand for road users.
- VII. By having the concepts of the Multiple nuclei model improving the concentration and movement of the peoples to the single CBD of the city, avoiding the over concentration of the users and services on the particular area and single space. It is obvious that the city is an extremely expanding city and people's needs are increasing too much. However, by creating another CBD to a place with dense population and suitable land, their demands can be met without transportation. By this way it is possible to control and reduce the traffic congestion and its problems on daily life of the city.

VIII. Additionally as a choice promoting compact city development is important for the city for all issue concerning traffic congestion and its impact visible currently in the city.

The researcher more focused on the solution on the root causes of traffic congestion for it covers the solution for other objectives.

Design recommendation regarding pedestrian walkways

Resolving sidewalks is one of the processes to reduce traffic congestion and users can safely interact with businesses and personal matters.

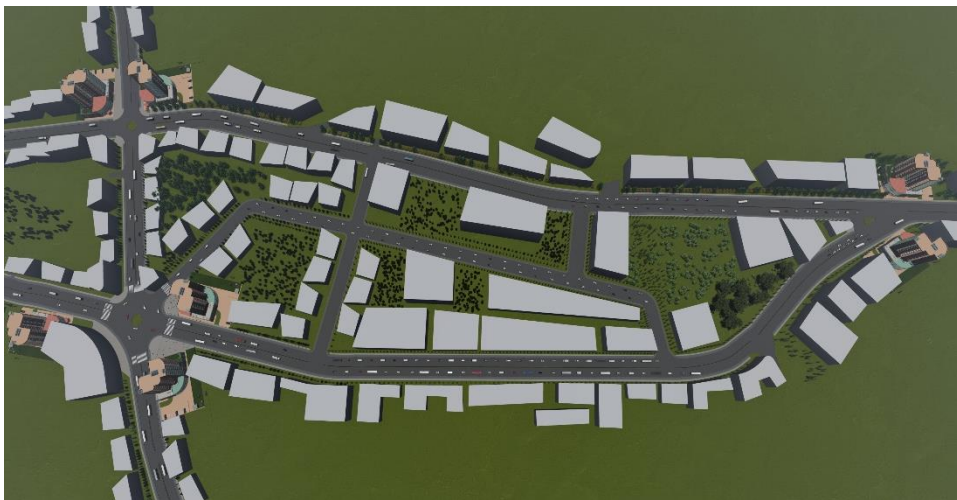


Figure 5. 1: proposed physical design in congested area



Figure 5. 2: Proposed pedestrian safety and walkway in the area of commercial center



Figure 5. 3: the choice of pedestrian users to where they intend to safely



Figure 5. 4: the movement of pedestrians with free level of service and good visual permeability



Figure 5. 5: The movement of vehicles with free level of service



Figure 5. 6: the street walkway with good functional permeability

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APPENDICES

Appendices I

The questionnaire and Interviews

Adama Science and Technology University

School of Civil Engineering and Architecture

Department of Architecture

The purpose of this questionnaires and interviews are to investigate and assess the impacts of traffic congestion on the commerce by inviting the participants like, passengers, pedestrians, drivers, traders and experts especially focusing on the street that exist between 1st roundabouts to the Bordi and fulfills the requirement for award of Master's degree in Urban Planning and Design.

I hope you will fill or give the necessary information regarding requested that is pleasant for the work. Please be confident and have a constructive idea before giving the acquired information. Don't worry it is an academic purpose. Thank you for your voluntary response.

Background of the respondents

Profiles Of The Interviewee
Sex: Male ☐ Female ☐
Age: 15-25 Years Old ☐ 26- 35 Years Old ☐ 36- 45 Years Old ☐
46-60 Years Old ☐ Greater Than 60 Years Old ☐
Interviewers: Name_____
Sign_____
Date_____

Questionnaires and interview

Part I: Questionnaires and interview regarding drivers

- 1) How many hours a day do cross-country trucks stop in the city?
 - a) 1:00-6:00 hours
 - b) 1:00-12:00 hours

- c) 24:00 hours
- d) A day or more

Part II: Questionnaires and interview regarding pedestrians

- 2) At the time of congestion due to car parking, when people go to cross the road, how do they cross?
 - a) they cross fast
 - b) they have a lot of trouble
 - c) they spend long mints
 - d) they don't have trouble
- 3) How do you feel when you walk on the sidewalk?
 - a) Afraid
 - b) very scared
 - c) Good
 - d) Happy
- 4) What have you ever experienced while walking this path? Or what doubts do you have?
 - a) the danger of death
 - b) the danger of property
 - c) the conflict of interests, and the movements of people
- 5) What do you think of the condition and location when you go to buy or use something at the Commerce?
 - a) Time-consuming
 - b) money-wasting
 - c) convenient
- 6) What can slow you down when you hold your lane and walk along the side of the road?
 - a. road congestion
 - b. excessive number of people using the walkways
 - c. speeding of vehicles and lack of traffic accident prevention
 - d. lack of convenient road opportunities

Part III: Questionnaires and interview regarding traders

- 7) Which of the vehicles will have the strongest impact on your working activity?
- a) Truck
 - b) Private
 - c) Public
 - d) Government
 - e) Other
- 8) What problems do you face because of traffic congestion in front of your workplace?
- a) people lose interest
 - b) they have a full need
 - c) we don't know
- 9) What do you think happens when large trucks stop and blocking the road?
- a) our direction is not visible to the service
 - b) exposes the area to pollution
 - c) shaking /disturbing the service
 - d) Not well known
- 10) When there is no traffic congestion, what is your daily income?
- a) very high
 - b) High
 - c) Medium
 - d) Low
 - e) Unknown
- 11) What do you think your daily income will be like when traffic congestion gets worse?
- a) High
 - b) Medium
 - c) Low
 - d) very low
- 12) What impact congestion has on the passengers/ users?
- a) decrease reliability
 - b) decrease safety
 - c) decrease quality
 - d) accessibility

Appendices II

Field Survey Check List

Elements of checks	The characteristics of element to be checked	Yes	No	Unit	Remark
Street vendors	Occupy the pedestrian lane and move the pedestrian lane to the carriageway				
	Reduce the speed of pedestrians, and it change people's needs and directions				
	Other				
Pedestrians	Voluntarily leaving the streets without any congestion				
	The occurrence of road congestion and the lack of travel alternative routes				
	Not having the experience of walking on the pedestrian walk ways				
	Other				
Availability of street	There is a street availability but no width except, because all modes of transport use it				
	The drawback is the lack of classification and separation of transport according to their comparability				
	Other				
Safety of street	The pavement of the street which are purposely used as the alternative option is not good and it does not linked to the main access road for user to intend				
	It has good pavement and linkage				
	Other				

Accessibility of street	It is difficult to access easily where is intended because of unalternative services and function that not street give				
	There is prevail of alternative street to accommodate each and separate mode of transportation regarding where they intend				
	Other				
Public libraries	Has no enough and attractive public libraries which accommodate the entire of interested in a particular time				
	There is an enough community centered library				
	Lack of cultural reading and experience in society				
	Other				
	Has no attractive recreation too pull the youth and other groups those move here and there with no busy work				
	Other				
	The walkway is not wide enough, and people cannot walk on it as they please				
	Has no street furniture				
	Other				
Recreation areas(swimming, playing and training)					
Pedestrian safety					

When the trucks closes the street and	User, pedestrians, passengers could not pass or cross the street from left to right or right to left easily				
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stopping on for a long hr.	The visibility of the trading place(their specific function) couldn't flexible to all users in exact time and place				
When pedestrians	Shaking to the environment and lost hope to will be come again				
walk on his or her side way	Pollution like noising, and over lapping interest				

Where the unit indicates Excellent, Very well, Good, Bad, and Awful for it represents 5,4,3,2, and 1 respectively.