UNIVERSITY OF NAIROBI

FACULTY OF ENGINEERING

EMISSIONS OF VEHICULAR TRAFFIC ALONG UHURU HIGHWAY CORRIDOR IN NAIROBI

BY

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F56/6897/2017

"A thesis submitted in partial fulfillment for the Degree of

Master of Science in Civil Engineering (Transportation Engineering) in the

Department of Civil and Construction Engineering in the

University of Nairobi

2022

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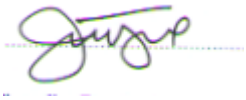
Signature:  **Date:** 15th November, 2022.

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DEDICATION

This thesis is dedicated to the memory of my late sister Josephine, my late sister in law and her daughter Millicent and Cheryl respectively, my wife Kate, my mother Esther, my sister Bella, my brother Cyprian, my daughters Ella and Keren and finally to my sons Joseph and Ethan for their unwavering support.

ACKNOWLEDGEMENT

God has been good to me and to this far I say thank you Jehovah. My sincere gratitude to my supervisors Prof. Sixtus. K. Mwea, Dr. Simeon O. Dulo and Eng. George Matheri of the Department of Civil and Construction Engineering University of Nairobi.

I would also like to appreciate the support of my lecturers Prof. Oyuko. O Mbeche and Prof. Francis .J. Gichaga and to the entire staff of the Department of Civil and Construction Engineering University of Nairobi.

My appreciation also gladly extended to Prof. Mwaura Francis of Department of Geography Population and Environmental Studies University of Nairobi, my classmates in Transportation Engineering Class of 2017- Eng. Onesmus Kituku, Eng. Gakuhah Nyamu, Eng. Caroline Indakwa, Eng. Zachariah Wahome, Eng. Cyprian Kisimbo and Eng. Caesar Kinyanjui for their academic and professional pieces of advice during my course and research work. Their assistance during data collection, thesis proposal and thesis report presentations giving criticism, comments and questions helped me build my report , I will be forever grateful.

Finally to my family members for their unwavering support during my studies, I say thank you.

JIMBO KAUNDA KENNETH.

ABSTRACT

Uhuru Highway Corridor is a road segment of the northern corridor (A8) in Nairobi city. It is one of the busiest and congestion-prone highways in Nairobi covering approximately 3.7 kilometers spanning between Lusaka roundabout and the museum hill interchange. The study investigated the urban ambient air pollutants levels correlation with vehicular emissions which included Carbon monoxide, (CO), Nitrogen dioxide (NOx), Sulphur dioxide (SOx), Total volatile organic compounds (TVOC), Hydrocarbons (HCHO) and Particulate matter of diameter 2.5 microns (PM2.5).

A systematic study which measured CO, NOx, SOx, PM2.5, HCHO and TVOC in ambient air at two different stations, near Railway Underpass (NRU 01) and University of Nairobi Pedestrian Tunnel (UNPT 02) was done having variations in traffic flows and meteorology. Traffic flow was assessed with prevailing levels of emissions and the association of these air pollutants among each other. PM2.5. HCHO, SOx, CO and TVOC, all decreased with decrease in vehicle Volume. However, NOx which increased with decrease in vehicle.

The ambient vehicular pollutions for the corridor were within the limits of World health organization (WHO) standards of ($10mg/m^3$) with an exception on PM2.5 which was found to be $18.39mg/m^3$ and $18.56mg/m^3$ for stations NRU 01 and UNPT 02 respectively, CO values were 3.72ppm for NRU 01 and 3.76ppm for UNPT 02, SOx for the two stations NRU 01 and UNPT 02 were 0.37ppm. Volatile Organic Compounds (TVOC) for the stations were highest at NRU 01 at 0.36ppm and least at UNPT 02 at 0.32ppm. Nitrogen dioxide (NO_2) was least at UNPT 02 at 0.32ppm and highest at NRU 01 at 0.50ppm. Sulphur dioxide (SO_2) was 0.37ppm for the two stations NRU 01 and UNPT 02. To control this, an awareness campaign should be done by the Government to set up strict emission control standards to govern vehicle emissions and pollution.

Key words: Traffic emissions, particulate matter, hydrocarbons, carbon monoxide, sulphur dioxide, total volatile organic compounds.

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LIST OF ABBREVIATIONS

AADT	-Annual Average Daily Traffic
AAWT	-Annual Average Weekly Traffic
ADT	-Average Daily Traffic
AWT	-Average Weekly Traffic
CBD	-Central Business District
CSE	-Centre for Science and Environment
CO	-Carbon monoxide
CH_4	-Methane
COHb	-Carboxyhaemoglobin
Hb	-Hemoglobin
CNG	-Compressed Natural Gas
EPA	-United States Environmental Protection Agency
EU	-European Union
EVs	-Electric Vehicles
ExternE	-External Cost of Energy
GHG	-Greenhouse Gas Emission
GDP	-Gross Domestic Programme
HCM	-Highway capacity manual
HCHO	-Hydrocarbon
HFC_5	-Hydrofluorocarbons
ICCT	-International Council on Clean Transportation
IEA	-International Energy Agency
ICCT	-International Council on Clean Transportation
IQs	-Intelligence Quotients
JICA	-Japan International Cooperation Agency
KS	- Kenya Shillings
LOS	-Level of service

LRS	-Lower Respiratory Symptoms
NRU	-Nairobi Railways Underpass-Station NRU 01
US	-United States
UNPT	-University of Nairobi pedestrian Tunnel-Station UNPT 02
NCCG	-Nairobi City County Government
NO_2	-Nitrogen dioxide
NO_X	-Nitrogen oxides
PM	-Particulate matter
PM10	-Coarse particulate matter (particles measuring 10 µm or less)
PHF	-Peak hour factor
PHC_5	-Perfluorocarbons
PM2.5	-Fine particulate matter (particles measuring 2.5 µm or less)
RRTS	-Regional Rapid Transit System
SF_6	-Sulphur hexafluoride
SO_4	-Sulfates
SMMT	-Society of Motor Manufacturers and Traders
TVOC	-Total Volatile Organic Compounds
TPE	-Tail Pipe Emissions
UON	-University of Nairobi
UNEP	-United Nations Environment Programme
UNECE	-United Nations Economic Commission for Europe
ULS	-University of Nairobi Law School
VOC	-Volatile organic compounds
O_3	-Ozone
H_2O	-Water vapour

CHAPTER ONE: INTRODUCTION

1.1 Background

Uhuru Highway Corridor is a road segment of the - northern corridor (A8) in Nairobi city. It is one of the most highly travelled and congestion-prone covering approximately 3.7 kilometers spanning between Lusaka Roundabout and the Museum Hill Interchange. It is the main access road to central business district of Nairobi County from the west and also links Central Business District (CBD) to the city's industrial area, "The daily total traffic volume on the road can exceed 70,000 vehicles per day over most of its length", - (COWI, 2012 a,), with the major junctions along the road except for the recently constructed Museum Hill interchange operating most of the time at Level Of Service F (LOS F), (COWI, 2012 b).

The levels of urban air pollution correlate with vehicular emissions with the air pollutants from on-road vehicles (Carbon monoxide, Nitrogen dioxide, Sulphur dioxide, Total volatile organic compounds hydrocarbons and Particulate matter diameter 2.5microns). Nairobi's capital city has traffic congestions during peak hours of travel, the concerns surrounding emissions from automobiles have been primarily focused on air pollutants due to their effects on human health.

1.2 Study area

The study focused on Uhuru Highway Corridor, a road segment of the northern corridor, one of the most highly travelled and congestion-prone roadway in Nairobi County the capital city of Kenya situated 140 kilometers south of equator and 500 kilometers west of the Indian Ocean at 1°17′S 36°49′E and UTM Northing 9857083.2891357.

Nairobi City occupies 696 km^2 at an altitude of 1,661 meters above sea level (Nairobi county website, 2016 www.nairobi.go.ke/home/about-the-county). Plates 1.1 and 1.2 shows the location of Nairobi County and the study area (Google map 2020).

Plate 1.1: Map of Kenya showing Location of Nairobi County

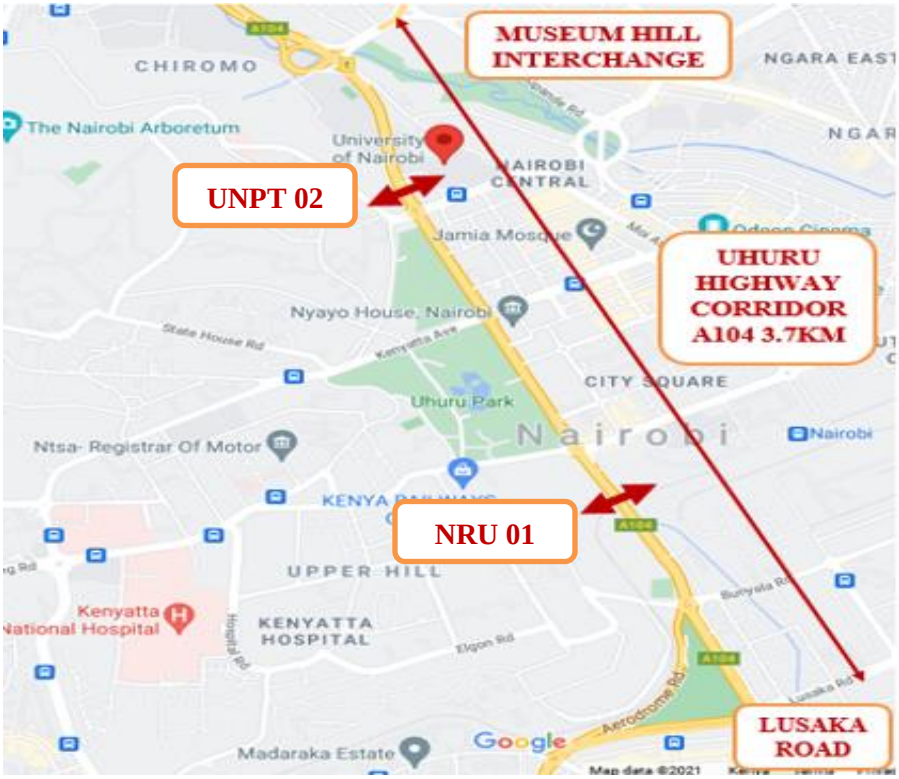


Plate 1.2: Map of Uhuru Highway corridor the study area

1.2.1 Description of the Study Area

The study focused on Uhuru Highway corridor, this road section traverses the CBD of Nairobi County from the west and also links CBD to the city's Industrial Area. Traffic is attracted from all parts of the city via arterial roads which include Haile Selassie Avenue, Kenyatta Avenue, University Way and Museum Hill road and local distributors like State House road, City Hall Way, Harambee Avenue and Bunyala road. Land use features attracting traffic onto Uhuru highway include Nyayo National Stadium located on the west of Lusaka Roundabout for local and international sports activities, The University of Nairobi located along University Way, Nairobi County assembly offices along City Hall Way and government offices along Harambee Avenue among business premises within the CBD.

1.2.2 Characteristics of Uhuru Highway Corridor

Uhuru Highway is a primary road which provides communication links to sectors of the economy and; its efficiency as an infrastructure is a requisite for economic and social development.

Roundabouts and Road Junctions along Uhuru Highway Corridor

A total of six roundabouts exist along Uhuru Highway corridor at which secondary distributor roads intersect the highway. The roundabouts are located at an interval distance of approximately 0.5 Km. Roundabouts are important tools for distributing traffic at major junctions of the city but they become inefficient with very heavy traffic, especially when this is a mix of 'through' and 'city' traffic. The closeness of the roundabouts does not favor 'through' traffic due to the frequent stops required at each of the roundabouts (peak time).The highway has three more junctions namely: Uhuru Highway/City Hall Way Junction; Uhuru Highway/Harambee Avenue Junction and; Uhuru Highway/Slip Road junction. The slip road provides a quicker route for motorists accessing University of Nairobi.

1.2.3 Climatic Conditions

Nairobi has a moderate warm and temperate climate with a bimodal distribution of rainfall. The city experiences the long rainy season around April and the short rains around November. The annual average rainfall received is about 875mm with variation range of 500mm-1500mm. The average temperature variation ranges between 10˚Celsius to 28˚Celsius.

The monthly mean relative humidity varies between 36% and 55%. The daily mean sunshine hours vary between 3.4 and 9.5 hours.

1.2.4 Population

The city's population is projected to be about 5,119,000 inhabitants in 2022, with a population growth rate of 4.00 per cent per annum, 2021 of population of 4,922,000 with a population growth rate of 3.95 per cent per annum. Nairobi's population is projected to reach about 5.8 million inhabitants by 2025 and its population density has then increased to 4850 residents per square kilometer in 2022.

1.2.5 Socio-Economic Situation

Positive economic growth and development generally experienced in Kenya and Nairobi in particular has contributed to high rates of urbanization in the city. The city's gross domestic product was estimated to be €14.1 Billion in 2015. The Gross Domestic Product (GDP) of Nairobi contributes over 60% of Kenya's GDP. The poverty line of Nairobi City is Kenya Shillings, KS 2,913 per person per month for urban households. The gross regional GDP per capita of Nairobi County is estimated to be three times of Kenya's GDP. Unemployment levels in Nairobi City County Government (NCCG) average at 14.70 per cent. (*NCCG, 2014 Integrated Urban Development Master Plan for the City of Nairobi).*

1.2.6 Transport

Public transport and walking are the main means of transport in Nairobi City with Railway transport limited to use during peak hours. Apart from the limited urban railways, public transport in Nairobi is mainly by minibuses (Matatus) operated by private investors with traffic congestion during peak hours as a major challenge. Nairobi is estimated to have sufficient space of 30% of Kenya's total national vehicle population. As of August 2018, Kenya had 3,135,573 registered vehicles, rising from 2,011,967 in 2013. This translates to a national vehicle population growth rate of about 11 per cent per annum in the last 5 years. Based on the estimates, Nairobi City alone was home to approximately 940,672 motor vehicle units as of August 2018. Public transport accounts for more than 50 per cent of all the trips in Nairobi, private cars 15 per cent while the remaining percentage is mainly by walking and/or bicycles and motorcycles. (*NCCG, 2014 Integrated Urban Development Master Plan for the City of Nairobi).*

1.2.7 Land use distribution

Land use along Uhuru Highway Corridor influenced traffic movement, levels of emissions were on the increase; the land use included industries, recreational areas (Uhuru Park and Lunar Park) and commercial buildings.

Table 1.1 represents the different land uses in Nairobi City County over the years due to urban development, Nairobi City County Air quality Action Plan (2019-2023).

Table 1.1: Land uses in Nairobi City County

Land Uses	**Area km^2**	**Percentage**
Residential area	175.6	25.22
Industrial/Commercial/Service centers	31.8	4.57
Infrastructure	15.9	2.28
Recreation	12	1.72
Water bodies and riverine areas	11.8	1.69
Urban agriculture	96.8	13.9
Open lands	198.8	28.55
Others (including protected areas)	153.6	22.06
Total	696.3	100

1.3 Problem Statement

The policy response to urban transportation has not been fully addressed to reduce emissions and pollution over the years, traffic congestion on Uhuru Highway Corridor would consequently increase emissions and pollutions. Figure 1.1 presents the six Levels of service (A, B, C, D, E, and F) conditions defined within the corridor.

Level of Service

Level-of-Service (LOS) of a traffic facility is a concept introduced to relate the quality of traffic service to a given flow rate. Level-of-Service is introduced by (HCM 2000) to denote the level of quality one can derive from a local under different operation characteristics and traffic volume. HCM denotes LOS by letters that designate a range of operating conditions on a particular type of facility. Six LOS conditions are defined in the HCM, namely A, B, C, D, E, and F, where A denote the best quality of service and F denote the worst (Figure 1.1 shows a graph of LOS on vertical axis and Volume/Capacity Ratio on the horizontal axis). These definitions are based on Measures of Effectiveness (MoE) of that facility. Typical measures of effectiveness include speed, travel-time, density, delay etc. There will be an associated service volume for each of the LOS levels. A service volume or service flow rate is the maximum number of vehicles, passengers, or the like, which can be accommodated by a given facility or system under given conditions at a given LOS. The same can be shown in the form of Table 1.2. Plate 1.3 shows a photos of breakdown flow LOS F.

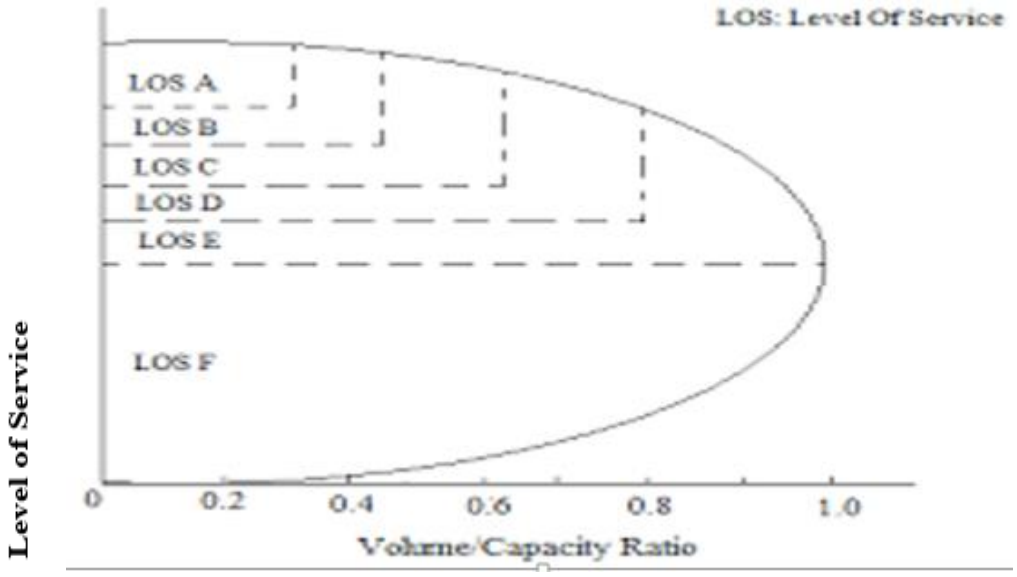


Figure 1.1: The LOS of a Mid-Block Section

Table 1.2: The LOS of a Mid-Block Section

LOS	Quality	Speed (Kph)	V/C	Description
A	Free-flow	80	0.6	High level of physical and psychological comfort
B	Reasonable free-flow	70	0.7	Reasonable level of physical and psychological comfort
C	Near free-flow	60	0.8	Local deterioration possible with blockages
D	Medium flow	50	0.85	Non-recoverable local disruptions
E	Congested flow	40	0.9	Minor disturbances resulting breakdown
F	Forced or breakdown flow	15	1.0	Break down of flow capacity drops

Plate 1.3: Traffic Congestion at the University way and Uhuru Highway Roundabout Junction

1.4 Research Questions

The study had the following research questions:

- Are the traffic emissions and pollutions due to vehicular traffic volume?
- Are the ambient vehicle pollutions within the minimum tolerable levels?
- What is the government policy on vehicle emissions and pollution mitigation?

1.5 Objective and Scope of the Study

The study aims at determining the level and variation of pollution caused by vehicle traffic along Uhuru Highway corridor.

1.5.1 Specific Objectives

The study has the following research objectives:

- To determine the ambient vehicular emissions and pollutions.
- To compare the relationship between traffic volume and prevailing air pollution levels.
- To compare the pollutions measured to the World Health Organization's (WHO) specifications and suggests measures to reduce vehicular emissions.

1.5.2 Scope of the Study

The study was aimed to determine the level and variation of emissions and pollutions caused by vehicular traffic along Uhuru Highway Corridor with emphasis on the ambient emissions and pollution. The relationship between traffic volumes and prevailing levels of air pollutants and the government possible policy to eventually set up emission control standards.

1.6 Limitations of the Study

Mobilization of resources for manual classified traffic counts was costly due to the number of people involved, Bosean and Dienmaern equipment used in recording emissions and particulate data had also limited 6 to 8 hours of batteries life and therefore required backup battery and charging system. The heavy rains experienced occasionally interfered with data collection process.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviews and compares urban road transportation and emissions within Nairobi and globally. It highlights the theories used by various authors to establish ambient emissions of vehicles and flow characteristics on roads, providing an overview of the various factors that influence emissions based on vehicles volume.

2.1.1 Definitions of Terms

Air Pollution

Air pollution refers to an atmospheric condition indicating concentration in excess of foreign matter in the air that negatively affect people and damage to property, animals feeding on particulate coated plants get affected with arsenic and lead poisoning leading to bronchitis.

Plants get damaged on leaves causing premature fall, discoloration and curling of sepals by NO_2. Ozone on dead areas of the leaves (Necrosis) and SO_2 causes bleaching due to lack of chlorophyll (Hurley et al., 2005).

Primary Pollutants

These are emitted directly from the source and are found in the atmosphere in the form in which they were emitted they include; Sulphur Oxides, Nitrogen Oxides, Hydrocarbons, Ash, Smoke, Dust, Fumes, Sprays and; Radioactive compounds (Hurley et al., 2005).

Secondary Pollutants

Chemical interactions between primary pollutants and constituents of atmosphere form secondary pollutants according to WHO (2018) “Ambient Outdoor Air quality and Health Facts".

Ozone

Sulfur trioxide

Aldehydes

Ozone (O_3)

Ground level ozone (O_3) is not emitted directly through vehicle exhaust, it is a secondary pollutant formed when NO_x and volatile organic compounds (VOC) react with sunlight. O_3 causes adverse health effects, such as acute mortality and morbidity (Bickel and Friedrich, 2005; Hurley, et. al., 2005).

The health effects associated with O_3 are respiratory hospital admission, minor restricted activity days, increased need of respiratory medication used by people with respiratory diseases and cough and lower respiratory symptoms (LRS) among children in the general population (Hurley et al., 2005).

Sulphur Oxides

Sulfates (SO_4) are secondary particles formed by oxidation of SO_2. SO_4 is assumed in external cost of energy to have the same health impact as PM10. For SO_4 there are few studies indicating health association (Bickel and Friedrich, 2005). According to the newer study by Sehlstedt et al. (2007) SO_4 is associated with less health endpoints than PM2.5. However, there are only few studies on SO_4 and these are showing inconsistent results. SO_4 is also correlated with metals from combustion processes (Sehlstedt, et. al., 2007) revised by Nairobi City County Air quality action plan (2019-2023).

Nitrogen Oxide (NOx) Pollution

At high concentrations, nitrogen dioxide causes airways inflammation. During combustion process, nitrogen released combines with oxygen atoms to create nitric oxide.

Particulate Matter (PM)

Particulate matter normally is measured as PM2.5 and PM10. The numbers indicate the size of the particles, for example, less than 2.5 micrometer (µm) and less than 10 µm in diameter (Sehlstedt et al., 2007). Generally, smaller particles can cause cardiovascular effects while larger particles are more likely to cause respiratory diseases (Sehlstedt et al., 2007; American Heart Association, 2010). The reason is that particles above 10 µm are filtered out in the upper airways while smaller particles are not. PM from combustion processes are PM2.5 while PM from road wear is in the coarse (PM10-2.5) range (American Heart Association, 2010). Hence, when measuring PM10 the

estimate will be influenced both by emissions from combustion sources and from road wear. External source of energy classified emissions from power plants as equally toxic as PM10 and vehicle (exhaust) emissions as PM2.5 (Bickel and Friedrich, 2005, p. 84). In the update in 2005 these assumptions were revised and presented in the Plate 2.1.

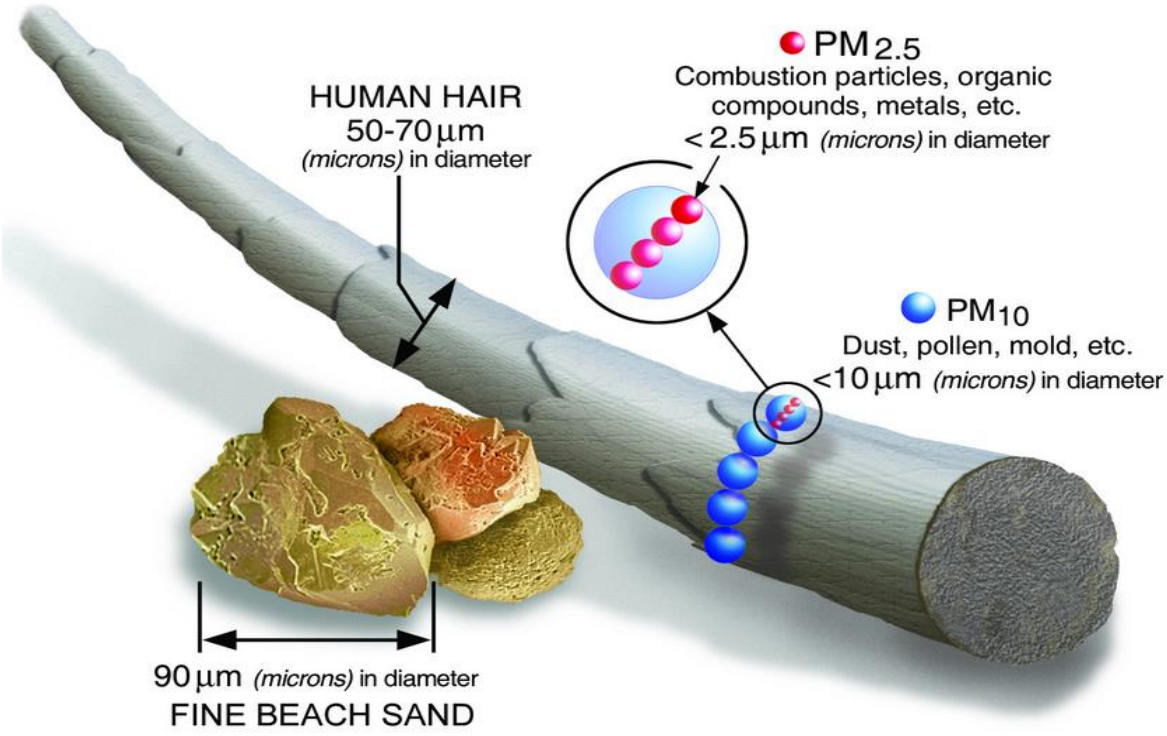


Plate 2.1: United States Environmental Protection Agency

Particulate matter is a combination of solid particles and liquid droplets in air, vehicle exhaust particles are usually grouped into PM2.5, which embraces several different particles with a diameter less than 2.5 µm as indicated above. Most of the exhaust particles are however mainly equal to or smaller than PM0.1 (Nerhagen et al., 2005). PM2.5 has been proved to cause mortality and morbidity, both acute (short-term) and chronic (long-term). Associated health effects are both respiratory and cardiovascular (Bickel and Friedrich, 2005).

The smallest particles, nanoparticles or ultrafine particles (< 0.1 µm), seem to be very toxic in large numbers due to their sizes. When particles are inhaled, it is primarily the surfaces of the particles that interact with cells. This makes the surface area critical for toxic effects (Sehlstedt et al., 2007). The report from the American Heart Association (2010) concludes that it appears traffic related pollution increase cardiovascular risk but it is unclear if this is due to the ultrafine particles. The

main sources for wear particles are wear of vehicle components which include brakes, studded tires and suspension of road dust by traffic. The wear particles are coarser than exhaust particles and are usually grouped under the definition PM10-2.5.

Particulate matter consists of:

- Soot due to incomplete combustion
- Oxides of Sulphur and Phosphorus
- Soluble organic fractions arising from the thermo-cracking of fuels (10-30%) and lubricants (70-90%)

Lead Oxide from the Combustion of Leaded Gasoline

The vehicular pollution has significantly contributed to environmental degradation in Nairobi, diseases related to vehicular pollution and evidence of degenerating biodiversity along the roads are just but a few impacts. Effects of increase in cardiovascular diseases due to esposure to carbon monoxide cannot be overlooked. The general idea in the Traffic Act Revised Cap, 403, 2012 Laws of Kenya is that if the amount of visible emission is reduced, the invisible pollutants will also be reduced considerably.

2.2 Previous Global Studies on Vehicle Emissions

2.2.1 Emissions Health Effects Considered in External cost of Energy

An overview of the different emissions associated with adverse health effects in external cost of energy is shown in Table 2.1. One example is black smoke or soot which was discussed in Friedrich and Bickel (2001) to be used as an alternative to particulate matter. The same was for diesel particles which were also discussed in Friedrich and Bickel (2001) but not in the Bickel and Friedrich (2005). The classic pollutants PM10, SO_2, NO_2, and O_3 were considered in external cost of energy but SO_2, NO_2 only contributed to secondary particulate matter (Bickel and Friedrich, 2005; Hurley et al., 2005). For quantifications of relative risks and dose-response functions for the different pollutants reference was made to Bickel and Friedrich (2005).

Table 2.1: Traffic Emissions Health Effects Considered in External Cost of Energy Source: (Friedrich and Bickel, 2001; Bickel and Friedrich, 2005)

Impact category	Receptor	Pollutant	Morbidity/Mortality
Respiratory	Asthmatics, Adults, and Children	PM10 and O_3	Morbidity/Mortality
Cardiovascular	Elderly 65+	PM10 and CO	Morbidity/Mortality Morbidity
	All	PM10, PM2.5, NO_3, and SO_4	Morbidity/Mortality
Cancer	All	Benzene, Benzo(a)Pyrene 1,3 butadiece Dioxins, Formaldehyde, As, Cd, Cr-VI, and Ni	Morbidity/Mortality
Neurotoxic	All	Pb	-

2.2.2 Why air pollution is a major concern

Air pollution is currently considered as the greatest environmental health risk globally with many parts of the world recording dangerously high levels of air pollution. World Health Organization (WHO) estimations show that 90 per cent of people worldwide breathe air containing high levels of pollutants. Air pollution causes 1 in every 9 deaths globally. The WHO estimations reveal an alarming death toll of 7 million people every year caused by exposure to fine particles in polluted air that penetrate deep into the lungs and cardiovascular system, causing diseases including stroke, heart disease, lung cancer, chronic obstructive pulmonary diseases and respiratory infections, including pneumonia. Of the total annual air pollution related deaths, 4.2 million result from exposure to ambient (outdoor) air pollution and 3.8 million from exposure to household air pollution in smoke from dirty cook stoves and fuels according to WHO (2018) "Ambient Outdoor Air quality and Health Facts".

Table 2.2 outlines a summary of the air pollutants of great impact on health and environment.

Table 2.2: Air Pollutants of Great Impact on Health and Environment

Emission	Description	Sources	Harmful Effects
Carbon monoxide (CO)	CO is a colourless, odourless toxic gas produced by incomplete or inefficient combustion of carbon-based fuels and by biological and industrial processes.	Anthropogenic Sources Fossil fuel combustion for power generation or transport, agricultural burning, wood burning for heat and cooking fuel Natural sources Forest fires, emissions from plants and oceans and oxidation of methane and non-methane hydrocarbons	Health impacts Can cause dizziness, confusion, unconsciousness and death
Nitrogen oxides (NO_X)	Nitrogen Oxides (NO_X) is a collective term for nitric oxide (NO) and nitrogen dioxide (NO_2). NO is a colourless and tasteless gas while NO_2 is a yellowish-orange to reddish-brown gas with a pungent, irritating odour and is a strong oxidant.	Anthropogenic Sources combustion of fossil fuels in vehicles (predominantly road traffic) and power generation units Natural Sources wildfires, lightning, and microbial activity in soils	Health Impacts • Eye and lung irritation • May contribute to the susceptibility/ aggravation of respiratory diseases Environmental impacts • Accelerates eutrophication • Makes soils and freshwater ecosystems more acidic • Affects visibility due to formation of haze in the air
Ozone (O3)	Major urban air pollutant caused by NOx and VOCs combined In sunlight and is usually at Earth's surface (Tropospheric Ozone)	Secondary pollutant of VOCs and NOx	Health Impacts Respiratory and cardiovascular problems Environmental problems Affects sensitive vegetation and ecosystems
Sulphur dioxide (SO_2)	SO_2 is a colourless, non-flammable gas, with an unpleasant, pungent odour.	Anthropogenic Sources Fossil fuel combustion for power generation, industry, shipping and road transport Natural Sources Volcanoes	Health effects Affects the respiratory system and irritation of the eyes, nose, throat and airways Environmental impacts • Reduces growth in plants • Accelerates loss of foliage, aging and premature death of

Emission	Description	Sources	Harmful Effects
			vegetation • Causes stain and damage stone and other materials, including culturally important objects such as statues and monuments. • Can reduce visibility due to formation of haze in the air.
Particulate matter (PM10, PM2.5)	Particulate matter (PM) refers to a mixture of solid particles and liquid droplets found in the air such as dust, dirt, soot, or smoke that are large or dark enough to be seen with the naked eye and can be primary or secondary. PM10 refers to particles with diameter less than 10μm and cannot be inhaled PM2.5 refers to fine inhalable particles with diameter less than 2.5μm	Anthropogenic Sources Combustion from vehicle engines, power plants, domestic heating and cooking, mining, quarrying and fugitive dust emissions from construction activities Natural Sources Erosion of natural materials, wind suspension of soils and constituents of sea spray	Health impacts Respiratory and cardiovascular problems (mainly associated with PM2.5) Environmental impacts • Nitrogen and Sulphur containing particles can lead to acidification of soils and water course • High levels of dust deposition onto vegetation can affect plant health and reduce growth • PM2.5 particles can reduce visibility in cities

2.2.3 Urban Transportation

Urbanization has led to growth of global population living in towns; consequently, environmental deterioration has become a major issue. The street noise and the surrounding areas have been growing up to intolerable levels. The exhaust from the vehicles pollutes the atmosphere with fumes and smell. Vibration of buildings and adjacent structures and visual intrusion are some of the other ill-effects. Vehicular pollution has become a significant environmental problem over the years. Table 2.3 outlines the main vehicular pollutants namely lead and by-products of fuel combustion which include both the visible (smoke) and invisible emissions as outlined by the Traffic Act Revised Cap, 403, 2012 Laws of Kenya.

Table 2.3: Main Vehicular Pollutants, Green House Gases and Fluorinated Industrial gases

Main Vehicular Pollutants	Green House Gases	Fluorinated Industrial Gases
Carbon Monoxide (CO) Nitrogen Oxide (NO) Hydrocarbons (HCHO) Particulate matter (PM2.5)	Carbon dioxide (CO_2) Methane (CH_4) Nitrous Oxide (N_2O)	Hydrofluorocarbons (HFC_5) Perfluorocarbons (PHC_5) Sulphur hexafluoride (SF_6) Ozone (O_3) Water vapour (H_2O) Halocarbons

Effects of Air Pollutions

Carbon monoxide (CO), is colourles, odourles gas chemically inert under normal conditions of temperature and pressure. It has no effect at normal concentrations (0.1mg/l), but at higher concentrations it seriously affects the human metabolism. The effects manifest as itemized below:

- Irritation of eyes, nose and throat
- Irritation of respiratory track
- Lead particles cause lead poisoning leading to convulsions even death/ coma
- Cadmium particles through smokes cause cardiovascular diseases, kidney and liver damage and even death
- Nickel particles in smokes causes respiratory damages
- Mercury results in nerve, brain and kidney damage

Effects of Vehicle Emissions

Oxygen carrying capacity in blood is reduced by selectively combining with haemoglobin (Hb) forming carboxyhaemoglobin (COHb). This causes laziness and exhaustion, it reduces vision and causes cardiovascular disorders, carbon monoxide is very dangerous asphyxiate and its high levels fatal to human lives, these effects could be controlled by developing efficient internal combustion engines and substitute fuel. Haneen K., Mark N., Zietsman J., Ramani T., (2020) "Traffic-Related Air Pollution".

The presence of SO_X and NOx gas in the atmosphere lower the pH of rainwater to as lower as pH 2.4 due to the formation of H_2SO_4 and HNO_3 respectively. The presence of hydrocarbon and oxides of nitrogen steps up the rate of oxidations in reactions in water droplets ion, Mn^{2+}, Fe^{2+}, Ni^{2+}, Cu^{2+}

catalyze the oxidation reaction. When HNO_3 and H_2SO_4 combine with HCL they generate acidic precipitation known as acid rain. (Gurjaret, al., 2010; USEPA; MassDEP.2014).

Acid rains cause damages to buildings, sculptural materials (marble, limestone, slate and mortar) and retard growth of forests. Besides damaging flora and fauna, acid rain also affect aquatic mortality, lower pH of rain water, change the metabolism rate of organisms, cause irritation to the eyes and mucus membrane and accelerates the rate of corrosion.

Driving Style and Emissions

A JICA (2006) projections study estimated that the average speed in Nairobi considering no changes in transportation management would reduce from 35km/h in 2004 to 11km/h in 2025 due to increment in vehicle number which would worsen the Air quality.

In assessing the impact of congestion on pollution, driving style is critically considered, frequent start-stops, deceleration and accelerations increase exhausted emissions.

Congestion

Traffic congestion is seen in terms of average speed, excess travel time and characteristics. Table 2.4 indicates causes of road congestion leading to emissions and pollutions.

Table2.4: Causes of Congestion Source: (JICA (2006)

Supply	**Demand**
Space allocation for Road	Vehicle numbers
Constructions and repairs works	Vehicle type
Emergency activities	Pattern and driving conditions

Effects of Vehicle Congestion on Air quality

When average speed is reduced, congestion of vehicles leading to prolonged time of travel and increased vehicle pollutant exposure is experienced, conditions of the weather namely wind direction, humidity, rainfall sunlight and, temperature affects vehicle-derived pollutants dispersal. Dispersion of pollutants depends on the traffic speeds and street width; high speeds create higher

turbulence causing greater dispersion and efficient intermodal connectivity would improve air quality by reducing congestions.

2.2.4 Sustainable Urban Transportation

"Sustainable urban transportation is transportation that meets the needs of the present without compromising the ability of future generations to meet their own needs". Strategies for a sustainable transportation must fight poverty, create a new economic growth, develop new life styles and enforce limits determined by the biosphere, the technology and the human being.

The component of sustainability implies that human activities should not deplete" the plenary capital" which include:

- The renewable resources (natural capacities)
- The infinite stock of non-renewable resources (fossil fuels; mineral)
- The natural systems 'capacity to absorb emissions without any danger (ozone layer, greenhouse gases).

Atlanta Area Sustainability Concerns

Atlanta is the capital and most populous city of the U.S. state of Georgia. With an estimated 2019 population of 506,811 it is also the 37th most populous city in the United States. The city serves as the cultural and economic center of the Atlanta metropolitan area, home to more than 6 million people and the ninth-largest metropolitan area in the nation. Atlanta is the seat of Fulton County, the most populous county in Georgia. Portions of the city extend eastward into neighboring DeKalb County. The city is situated among the foothills of the Appalachian Mountains and has the highest elevation among major cities east of the Mississippi River.

Atlanta was originally founded as the terminus of a major state-sponsored railroad. With rapid expansion, however, it soon became the convergence point among multiple railroads, spurring its rapid growth. The city's name derives from that of the Western and Atlantic Railroad's local depot, signifying the town's growing reputation as a transportation hub.

Of a wide range of regional sustainability issues is Metro Atlanta area, it is considered as part of public policy. A high dependency on automotive transportation is linked to limited transit options. Congestion and traffic delay are major concerns linked to air quality, respiratory health issues and stress, each of which emphasizes the need to conserve and have effective systems. Limited transit

options also lead to social equity issues in the region and have been the subject of environmental justice complaints against the transportation agencies. Public and private vehicles fuel efficiency is an important consideration both in energy and transport policies, the use of clean fuels are measures in to achieve sustainable transportation to minimize pollution, according to Jeon as cited by Vollmer. D. (2011).

Electric Vehicle Technologies

Used commonly means of powering vehicles are batteries (Chapman, 2007).They are also in private cars and experimentally for public transport. Electric motors are much more efficient as compared to internal combustion engines in which about 75% of the fuel's energy are wasted in vibration, heat and noise, instead electric motors lose only 5-10%. (Khare & Sharam, 2003). Consequently, current electric vehicles (EVs) regenerate during braking', this change the kinetic energy of the vehicle in the battery's chemical energy. Electric vehicles may be still on when the car is at rest in stop-start driving conditions this is because no energy is consumed (Khare & Sharam, 2003).

Best ways in Emissions Reduction

Controlled urban development reduce urban sprawl and traffic growth. Cities should have a well-planned, easily-navigable, efficient, and environmentally-responsible transportation system. Purchasing tickets before and avoiding frustrating boarding processes are great navigation graphics.

Pan Chan's rating

University of Waterloo master's thesis by Peter Cheuk Pan Chan demonstrated emissions performance rating system for roads. He concentrated on, management, design and pavement materials, but among others land use planning, public transit, walkways and cycle ways, and alignment as shown on the Figure 2.1.

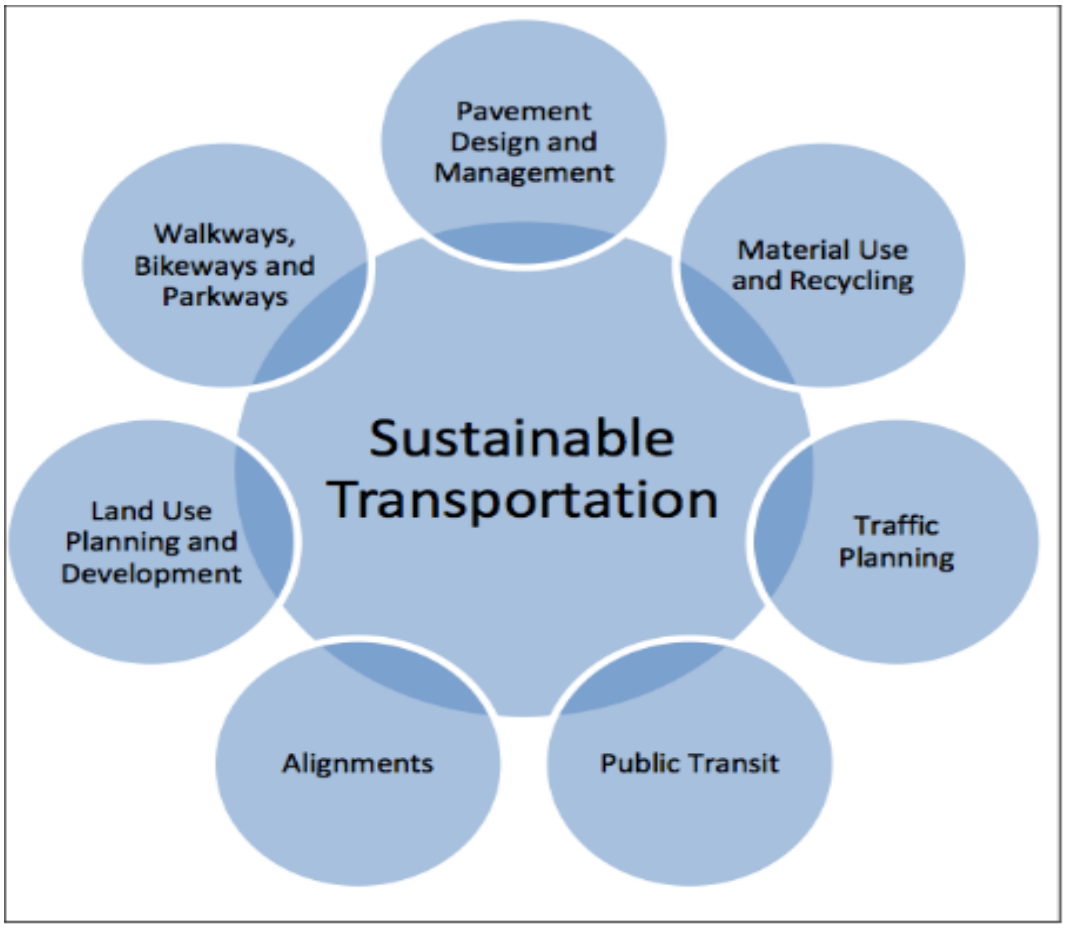


Figure 2.1: Pan Chan's Rating System

Transportation was found to be a major source of carbon emissions and support services that encouraged healthy and sustainable forms of traveling to class and to work which included pilots of new micro-mobility solutions such as bike-sharing and e-scooters, car-sharing, secure bike storage, and working with local government on expanding transit infrastructure were suggested to reduce the transportation emission trends.

Delhi Ranks Worst in Vehicular Pollution

The Centre for Science and Environment (CSE) a Delhi-based research organization assessed transport-related emissions from urban commuters. Plate 2.2 illustrates levels of air pollutions in Delhi.

Plate 2.2: Delhi ranks worst in vehicular pollution

Delhi's contribution to India's pollution was approximated to 9% of the PM10 load and 20% of the PM2.5 load according to the 2016 study by IIT-Kanpur and secondary particles, vehicular emissions could rise to 30%.Public transport contributed in reducing levels of two important vehicular pollutants - carbon monoxide (CO) and nitrogen dioxide (NO_2).

Regional Rapid Transit System (RRTS) rail with an average speed of 100kph implementation in India was expected to lift the public transport share from the then 37 percent to around 63 percent. This estimated to significantly reduce pollutants namely PM 2.5 particle by 60,000 tones, nitrogen oxide by 475,000 tones, hydrocarbons by 800,000 tones and carbon monoxide by 800,000 tons each year. Plate 2.3 shows Traffic congestion in Delhi.

Plate 2.3: Traffic Congestion in Delhi

Delhi Pollution Fight of Outdoor Air

Attempts to bring down air pollution in the capital after record levels in 2016 were considered. The winter season in Delhi steadily worsened pollution. Helicopters were used to shower water to the city to fix the problem with not much success. Additionally aircraft could not fly in the smog. The flying water spraying tests reduced air pollution by about one-third in Delhi, but only in the 20 meters surrounding.

2.2.5 European Union Cities Nitrogen Oxides Emissions

Parameters influencing emissions and energy consumption from urban travel included travel demand based on population, different modes, average daily travel distance and quality of vehicle used, Walsh M. P (2001).

Euro Emissions Standards

The EU air pollutant emissions from transport were significant contribution to the overall state of air quality in Europe", with industry and power generation being the other major sources.

The Euro emissions standards were aimed to reduce the levels of harmful exhaust emissions, which included chiefly:

- Nitrogen oxides (NOx)

- Carbon monoxide (CO)
- Hydrocarbons (HC)
- Particulate matter (PM)

These standards had a positive effect, with the SMMT (Society of Motor Manufacturers and Traders), claiming: “It would take 50 new cars today to produce the same amount of pollutant emissions as one vehicle built in the 1970.”In 2017, the SMMT quoted the Figures in support:

- Carbon monoxide (CO): petrol down 63%, diesel down 82% since 1993
- Hydrocarbons (HC): petrol down 50% since 2001
- Nitrogen oxide (NOx): down 84% since 2001
- Particulate matter (PM): diesel down 96% since 1993

Because petrol and diesel engines produced different types of emissions they were subjected to different standards. Diesel, for example, produced more particulate matter and soot which led to air pollution implicated in human cancer, heart and lung damage.

European Union Nitrogen Oxides Emissions by Sector Group

The Figure 2.2 shows road transport energy produced the highest Nitrogen oxides emissions of 40%, other sources of Nitrogen oxide were energy production and distribution of 21%, commercial institutions and house holds 14%, energy use in industries 13%, non-road transport 7%, industrial process 3%, agriculture 2% and solvent and product use and waste with 0%. World Health Organization, (2021).

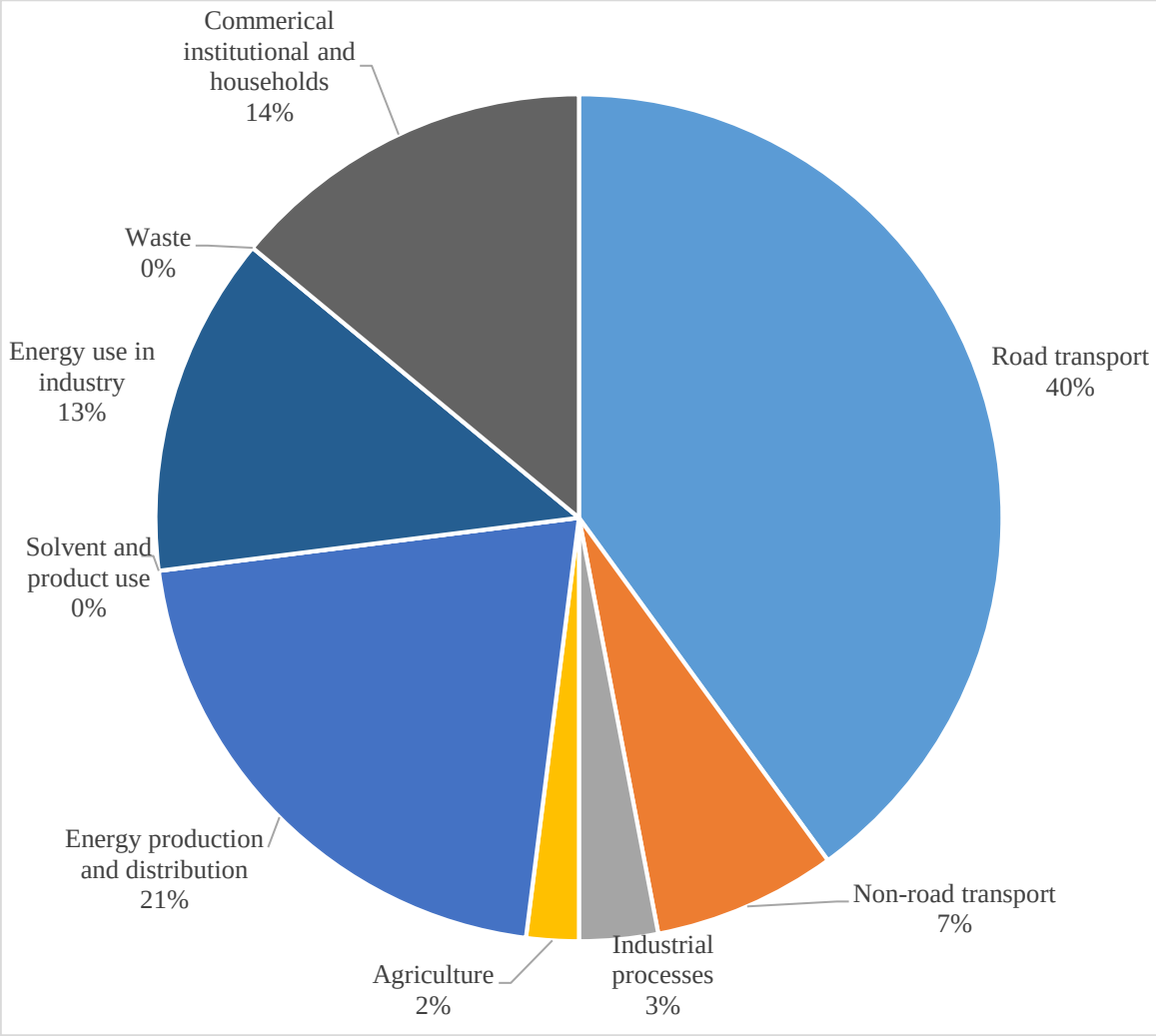


Figure 2.2: Emission Inventory report under the UNECE Convention on Air Pollution (LRTAP) Long -range Trans-boundary

London City Nitrogen Oxides Emission

Figure 2.3 illustrates the city of London sources of NOx emissions, similar prediction for 2015. The highest NOx emissions was from major roads at 65%, other NOx emissions were from commercial gas at 26%, domestic gas at 5%, minor gas at 3% and other at 1%.

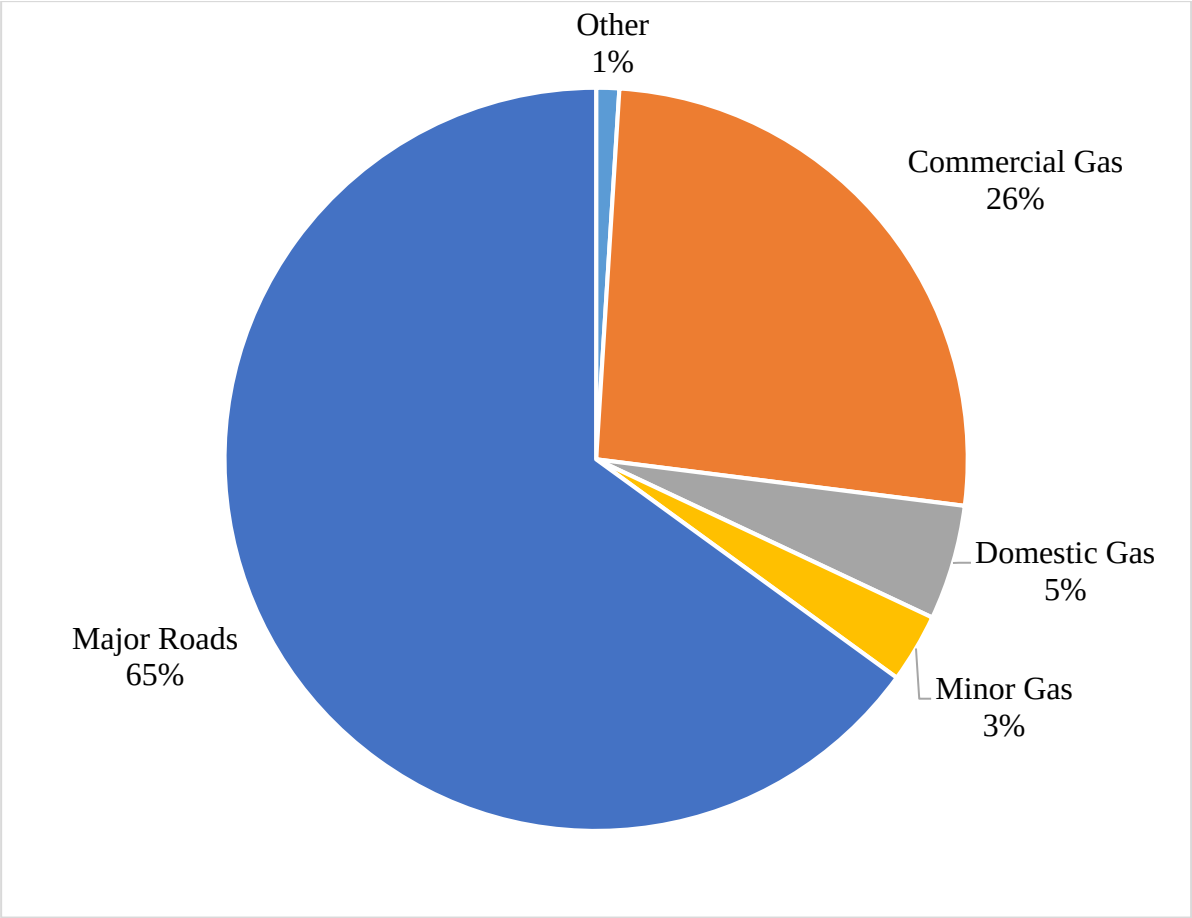


Figure 2.3: City of London on Air Quality Strategy

European Union and United Kingdom NOx Level

Most cities in England and Wales did not meet the annual average air quality of European limit value for dioxide and nitrogen .Two health based objectives were set for nitrogen dioxide, first was making sure hourly concentrations did not exceed 200 µg/m^3 for more than 18 hours in any year. The second was to ensure that the annual average was no greater than 40 µg/m^3. In the Environment Act 1995, levels of pollution above the objectives set by the Government are declared an Air Quality Management Area with levels of pollution to be reduced.

EU NOx Emission Standards not met by new Diesel cars in 2017

According to The International Council on Clean Transportation (ICCT), based on emissions tests it conducted on more than 700,000 cars and 4,850 vehicle models across Europe, even new diesel-engine vehicles could not meet EU standards conditions. Automobile manufacturers argued that new diesel engine vehicles had less emissions but the research indicated otherwise, Peter Mock,

managing director of the ICCT in Europe revealed that Euro 6 diesels on the market were not clean. Peter Mock et al (2017). *The International Council on Clean Transportation (ICCT).*

The nitrogen oxide (NOx) pollution data received from the tests classified cars into three-colour rating system indicating their real-world driving NOx emissions. Mortier R. Y., Fox M. F., Orszulik S. T., (2011).

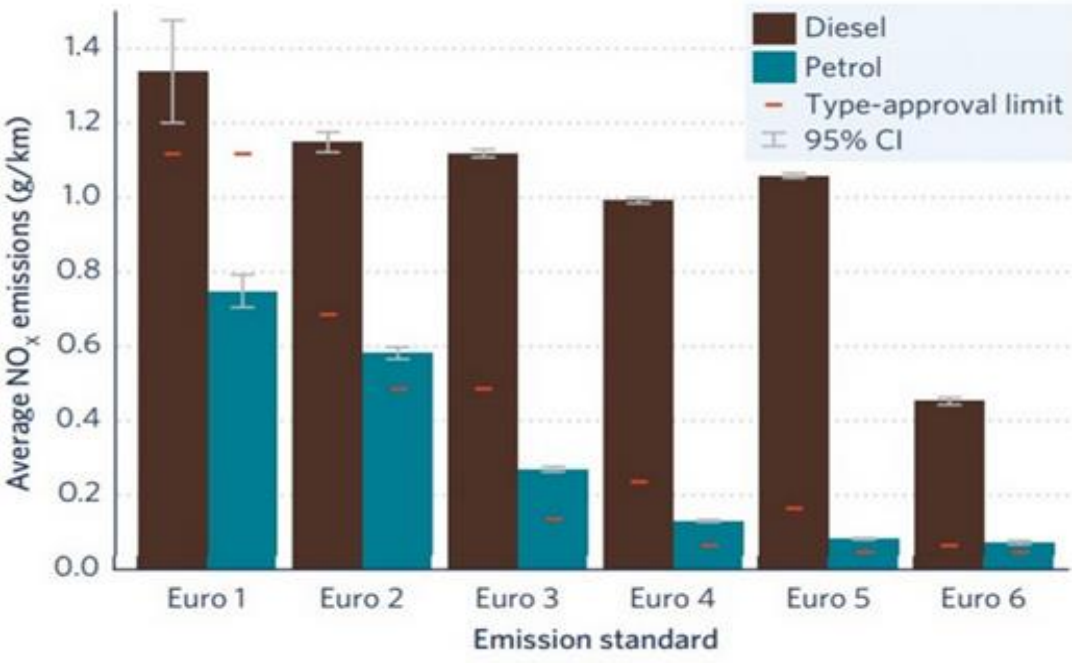
Green: less than 90 milligrams of NOx emitted per kilometer of driving

Yellow: between 90 and 180 milligrams of NOx emitted per kilometer of driving

Red: more than 180 milligrams of NOx emitted per kilometer of driving

No Euro 6 standard diesel engine received a green rating with an exception of BMW top-selling brand which achieved a yellow rating for its diesel cars. Figure 2.4 shows emission tests conducted on Vehicle models across Europe.

Euro 1 to Euro 6 NOx Emissions, Diesel and Petrol Vehicles



Overview of NOx emissions (g/km) of the on-road fleet, from Euro 1 to Euro 6, from Petrol and Diesel Passenger Vehicles.

Figure 2.4: Emission tests conducted on vehicle models across Europe in 2018

Going by the results, it was evident that NOx emissions from petrol vehicles decreased significantly, while real-world diesel NOx emissions remained almost unchanged from Euro 1 through Euro 5. The study showed that Euro 3 petrol vehicles produced between 2000 and 2005 perform much better than Euro 6 diesel vehicles produced from 2014 onward. Diesel vehicles had higher NOx average emissions than petrol vehicles, emissions standards reduced from Euro 1 to Euro 6 vehicles.

Euro 5 more Polluting than Euro 2

What is also alarming is the fact that almost no Euro 3 through Euro 6 diesel vehicles had NOx emission below their respective type-approval standards. All of them had NOx emissions at least twice that of the limit, and the worst vehicles had emissions 18 times the limit. In fact, Euro 5 diesel vehicles performed poorly.

On the contrary, despite an average vehicle age of 16.4 years at the time of the remote sensing measurements, Euro 2 vehicles performed better, with 25 per cent of them still emitting less NOx than the Euro 2 limit meeting the type-approval limit.

The Table 2.5 shows NO_2 to NOx ratio per fuel type and Euro standard for diesel vehicles, ratios calculated from the data where a constant average value was assumed for petrol vehicles.

Table 2.5: NO_2 to NO_X ratio per fuel type and Euro Standard

NO_2 to NOx Ratio (%)	Diesel	Petrol
Euro 1	22%	5%
Euro 2	16%	5%
Euro 3	22%	5%
Euro 4	32%	5%
Euro 5	30%	5%
Euro 6	35%	5%

Global Movement against Emission Pollution

Motor vehicle idling burns fuel, releasing gas pollution and hastening engine's deterioration. The "No Idling" campaigns in 13 US states produced car idling laws. Switzerland has laws that require

motorists to turn off their engines waiting for the red traffic light to turn green. England and Scotland likewise impose fines for engine idling violations while different countries like Canada, Italy, France, Germany, Holland, Hong Kong, Japan and Singapore, regulates different idling time limits. The latter three Asian countries allow three seconds idling time per hour while Holland allows as much as 60 seconds for engines to idle. Taiwan also has banned car idling for more than three minutes at a time. Most people think of the “No Idling" campaign as merely a call for people to reduce fuel consumption and promote energy efficiency while all the rest are general technicalities about gas emissions and air pollutions (U.S federal law on Clean Air Act of 1970).

Vehicular Emission Models HDM-4

The Highway Development and Management-4 HDM-4 *(Manual Volume -4 HDM Global Publications)* tool has been widely used for the pavement management activities across the world. Exhaust emissions are one of the important outputs of vehicular performance models that are helpful in assessing viability of investment options and environment impact assessment activities. There are seven exhaust emission models (for different components like hydro carbon, carbon monoxide and particulate emissions) available within HDM-4. Operating weight, pavement gradient and vehicle life were very sensitive inputs into HDM-4 emission models.

Emissions Modeling Approaches

Several approaches have been developed for modeling of vehicle emissions. Each of the following approaches has advantages as well as disadvantages and is used for specific types of applications. Mensink C., Kallos G., (2018).

a) Average speed
b) Single emission factors
c) Fuel consumption
d) Detailed traffic flow/ engine power calculations

Average Speed

This approach utilizes the empirical relationship between emissions level (in gram/vehicle-kilometers) and average speed for the emission component and vehicle type. Total level of emissions is then obtained by multiplying total vehicle-kilometers travelled at that speed. The advantage of this approach is that the only independent variable average speed is used to calculate

emission levels. Moreover, average speed represents a combination of driving pattern, so partially the effect of acceleration and deceleration is taken into account.

Single Emission Factors

This approach applies a separate emission factor for each combination of vehicle type and pollutant. In this approach, driving activity conditions have no effect over the level of emissions. Total number of kilometers travelled by each vehicle type is the only factor to calculate total emissions. Its advantage is that it is simple to calculate emissions and disadvantage is that altering road conditions has no direct impact on emission levels.

Fuel Consumption

Fuel consumption approach links emissions with fuel consumption. This is the approach which has been applied for modeling of current HDM-4 emission models. Its main advantage is that where fuel consumption is calculated in a detailed way, for example modeling the effect of road condition, gradient, engine function, changes in fuel consumption are related directly to changes in road condition. Levels of pollutant emissions can therefore also be related directly to changes in road condition, as well as traffic and vehicle technology.

Detailed Traffic Flow/ Engine Power Calculations

In this approach, information on real driving cycles is used to simulate vehicle engine condition over time. This approach is accurate and data intensive and lack of relevant data makes this approach difficult to apply.

HDM-4 Emissions Model Form

The engine out emissions are predicted based on fuel consumptions rates acted upon by catalytic converter (a vehicle emission control device), if present, to yield tailpipe emissions observed by the environment. TPE are tailpipe emissions absorbed by the environment, consequently EOE are engine out emissions which are produced during combustion process and then treated by catalytic converter. CPF are catalyst pass fraction of catalytic converters in reducing emissions, Australian Road Research Board (2002).

$$TPE = EOE * CPF$$ Equation 2.1

Engine out Emission Models

These models give engine emissions by component for standard motorized vehicle types. The following are some of the components of vehicle exhaust emissions modeled in HDM-4: Carbon monoxide, Sulphur dioxide, Nitrous oxide, Hydrocarbons, Particulates, Lead and Carbon dioxide.

Carbon monoxide

A direct relationship exists between engine out emissions and fuel consumption which is evident from the model.

$$EOEco = aco * FC$$ Equation 2.2

Where:

EOEco is the engine out CO emissions in gram/km

aco is a model coefficient, defined as grams of CO emitted per gram of fuel consumed (gramco/gramfuel) and

FC is the Fuel Consumption in gram/km.

Sulphur Dioxide

The amount of SO_2 emitted is related directly to the quantity of Sulphur present in the fuel. Model coefficient is estimated by assuming all the Sulphur present in the fuel is converted to SO_2. The following relationship is used to predict engine out emissions:

$$EOESO2 = 2\ aSO2\ FC$$ Equation 2.3

$EOESO_2$ is the engine out SO_2 emissions in gram/km. A SO_2 is defined as grams of SO_2 emitted per gram of fuel consumed (gso2/gfuel).

Nitrous Oxide

This component of exhaust emissions is least related directly to fuel consumption. That is why the model presented below is a bit complex.

$$EOE_{NOx} = max\ [\ a_{NOx}\left(FC - \frac{FR_{NOx}}{V}\ 1000\right), 0]$$

Equation 2.4

EOE_{NOx} is the engine out NOx emissions in gram/km.

NOx is defined as grams of NOx emitted per gram of fuel consumed (a_{NOx}/gfuel) FR_{NOx} is a fuel threshold parameter below which NOx emissions are very low in g/s.

Hydrocarbons

It is believed that hydrocarbons are generated from two sources within a combustion engine. First source is burning of fuel and second is from incomplete combustion. So, the model which predicts engine out emissions takes the following form:

$$EOE_{HC} = a_{HC}\ FC + \frac{r_{HC}}{V} 1000$$

Equation 2.5

EOE_{HC} is the engine out HC emissions in gram/km. AHC is defined as grams of HC emitted per gram of fuel consumed (a_{HC}/gfuel). HC is a constant to account for incomplete combustion in gram/sec.

Particulates

These emissions are modelled in a same way as hydrocarbons. So, the model form is as follows:

$$EOE_{PM} = a_{PM}\ FC + \frac{r_{PM}}{V} 1000$$

Equation 2.6

EOE_{PM} is the engine out PM emissions in gram/km, a_{PM} is defined as grams of PM emitted per gram of fuel consumed (a_{PM}/gfuel) ^{r}PM is a constant to account for incomplete combustion in gram/sec Lead. The amount of lead emitted is related directly to the quantity of lead present in the fuel. Model coefficient is estimated by assuming a proportion of the lead present in the fuel is converted to lead emissions. The following relationship is used to predict engine out emissions.

$$EOEPb = Prop\_Pb * aPb * FC$$ Equation 2.7

EOEPb is the engine out Pb emissions in gram/km, Prop_Pb is the proportion of lead emitted. aPb defined as grams of Pb emitted per gram of fuel consumed (aPb/gfuel).

Carbon Dioxide

For understanding of carbon dioxide emission model, first we need to understand about functioning of Catalytic Converters. Catalytic converters convert certain harmful emissions to less harmful chemical compounds. They convert, if present, any carbon in carbon monoxide, hydrocarbon, and particulate matter into carbon dioxide. The effectiveness of catalytic converters in reducing emissions is modeled through the term Catalyst Pass Fraction (CPF). The prediction of CO_2 is modeled through carbon balance equation. This model directly gives tailpipe emissions, as the catalytic converter increases the output of CO_2 by converting CO and HC and PM into CO_2. The model takes the form of equation:

$$TPE_{CO2} = 44.011\left[\frac{FC}{12.011 + 1.008\ aCO2} - \frac{TPE_{CO}}{28.011} - \frac{TPE_{HC}}{13.018} - \frac{TPE_{PM}}{12.011}\right]$$ Equation 2.8

TPE_{CO2} is tailpipe CO_2 emissions in gram/km. A CO_2 is a fuel dependent model parameter representing the ratio of hydrogen to carbon atoms in the fuel. TPEx is the tail pipe emissions for component x. Here x is CO, HC and PM.

Steps in Calibration of HDM-4

Prior to using HDM-4 for the first time in any country, the system should be configured and calibrated for local use. Since HDM-4 has been used design in a wide range of environments, calibration of HDM-4 provides the facility to customize system operation to reflect the norms that are customary in the environment under study. HDM-4 models are mainly classified into two parts: Road Deterioration &Works Effects (RDWE) models and Road User Effects (RUE) models. For Road Deterioration &Works Effects models, pavement distress models are included. For Road User Effects models, they consist of travel time, vehicle operation, accidents and emission effects models. (A Guide to Calibration and Adaptation. HDM-MM 4 Manual, Voulme-5. HDM Global publications).

The Highway Development and Management (HDM-4) model can predict the vehicle emissions during an analysis, the degree of local calibration appropriate would be a choice depending on application and resources available having vital impact on transport emissions. HDM-4 assesses the changes in emissions as a result of changes in road characteristics and vehicle technology. (4th International Conference on Sustainable Energy and Environmental Engineering (ICSEEE 2015).

Urban Roads and Streets Design and Emissions

In any urban setting, roads and streets play a critical role in enabling residents to move from one part of the city to the next, meet, conduct business, socialize, and relax. The design of roads and streets, therefore, has a large impact on emissions and quality of life. Most African cities have experienced a surge in motor vehicle owner-ship over recent years. This has resulted in traffic congestion, air pollution, and a deteriorating urban environment. Urban Roads and Streets design emphasized on sustainable development promoting walking, cycling and public transport reducing use of cars.

Efficient use of energy and land reduces greenhouse gas emissions; transportation policy set included five key goals:

- Minimization of travel demand
- Maximization of efficient transport network,
- Minimization of fossil fuels reliance,
- Transport emissions reduction and
- Improvement on public transport accessibility.

To make non-motorized transportation appealing, measures which included, reprioritization of traffic signals for pedestrians than for vehicles, minimization of crossing distances and waiting times at junctions, footpaths widening at high pedestrian flows especially the nodes, removal of unnecessary street furniture erected on footpaths, provision of quality user friendly surface to people living with disabilities and a continuous direct and well-lit pedestrian walkways were considered. Ministry of transport, infrastructure, housing, urban development, and public works April 2019.

2.3 Previous Regional/Local Studies on Vehicle Emissions

Health Impact of Vehicle Emissions on Traffic Police in Nairobi

Table 2.6 shows vehicle fuel relationship at selected road junctions within the Nairobi CBD, high pollution levels were at railways and Kamkunji which had high concentration of buses which uses mostly diesel while low pollution were recorded at University way and Uhuru highway where vehicles used fuels that had substantial volumes of nitrogen oxides, carbon monoxide, and other pollution. *Journal of Environment Pollution and Human Health*, 2017, Vol 5, No3, 104-110.

Table 2.6: Association between Type of Vehicle Fuel Type and Category of Road Junction intersections on CBD Nairobi City Kenya

Road Junctions	**Pollution Levels (Percentages)**			
	High Pollution (Type of vehicle/ fuel type)	Percentage (Number of vehicles of high pollution levels)	Low Pollution (Type of vehicle/ fuel type)	Percentage (Number of vehicles of low pollution levels)
Kamkunji	49.7	100	51.7	100
Railways	48.3	100	50.3	100
Uhuru highway	36.5	100	63.5	100
University way	27.9	100	72	100

Table 2.7 shows the particulate matter concentration of air quality and tolerable levels sampled in different location in Nairobi County, Mukaria, et al (2017).

Table 2.7: Air Quality Particulate Matter Levels

Sampling Location	**Dust Concentration Levels (Mg/m^3)**	**Tolerable Levels (Mg/m^3)**	**Remarks**
Outer-ring- Thika Road Junction	3.25	10	Within the Limit
Allsopps - GSU Area	4.32	10	Within the Limit
Kariobangi-Kiamakio Area	6.15	10	Within the Limit
Juja Road - Outer- Ring Roundabout	7.59	10	Within the Limit
Kariobangi South- Mumias Road Junction	5.45	10	Within the Limit
Umoja- Buruburu Road Junction	6.48	10	Within the Limit
Pipeline Estate Area	4.56	10	Within the Limit
Outer-ring- Thika Road- Eastern Bypass Area	5.60	10	Within the Limit

The Table 2.8 shows a summary of Air Quality Emission levels of CO, SOx, CO_2, VOC and NOx levels.

Table 2.8: Air Quality (Emission Level)

	Location	**Carbon Monoxide (CO)**	**Sulphur Dioxide (SO_2) ppm**	**Carbon Dioxide (CO_2)%**	**Volatile Organic Compounds (VOC)**	**Nitrogen Dioxide (NOx)ppm**	**Comments**
1.	Outer-Ring Road/Thika Road Junction (Top of the Bridge)	ND	<0.01	0.01%	ND	<0.05	Within the limit
2.	Kariobangi - Kiamakio Area	ND	<0.01	0.03%	ND	ND	Within the limit
3.	Juja Road - Outer-Ring Junction	ND	0.12	0.05%	ND	ND	Within the limit
4.	Kariobangi South-Mumias Road Junction	ND	0.02	0.05%	ND	ND	Within the limit
5.	Umoja-Buruburu Road Junction	ND	0.01	0.06%	ND	ND	Within the limit
6.	Pipeline Estate Area	ND	0.01	0.05%	ND	ND	Within the limit
7.	Outer-ring-Road /Bypass-Under the Bridge	ND	0.04	0.06%	ND	ND	Within the limit
	TLV	10ppm	0.125mg/m^3	0.5%	70ppm	0.150mg/m^3	Within the limit

ND: Not Detected

The Tables 2.7 and 2.8 show particulate matter and emissions measurements, higher emissions due to economic activities and high population were expected but most of the corridor sections had high dispersal levels effectively displaying low concentrations. Areas with high emissions (including SOx and CO_2) included Juja Road junction, Eastern Bypass junction and Kariobangi/Kiamaiko with between 0.01-0.4ppm SOx and 0.03-0.05% CO_2. Particulate matters were reported as between 4-7ppm with high levels at Juja Road junction and Kariobangi/Kiamaiko.

The Tables 2.9 and 2.10 show some of the pollution levels in Nairobi by *Odhiambo, Kinyua, Gatebe, Awange, (2010) and AzifFaiz et al (1990).*

Table 2.9: Data Collection and Analysis Air Pollution in Nairobi

	Mean concentrations	**WHO Guidelines**
PM 10	66.66-444.45 (Mean 239 ± 126µg/m^3	50µg/m^3
NO_2	0.011-0.976ppm	200µg/m^3 (0.10ppm)
O_3	LLD*-0.1258ppm	100µg/m^3 (0.056ppm)
PM 2.5	10.7- 98.1µg/m^3	25µg/m^3

Table 2.10: Estimations of Pollutant Emissions by Passenger Cars and Buses in Nairobi in (tones per day)

Year	**CO**	**HC**	**NO_X**	**SO_2**	**PM**
1980	77	7	4	0.6	0.5
2000	381	38	20	3.0	2.7

The emissions show the World Bank estimates of pollutant emissions by some sources in the city which are very critical. The predicted increase would be due to vehicle increase and their deterioration condition.

Traffic Volume and Rate of Flow in Emission Measurements

Traffic volume is the number of vehicles that pass a point on a highway, or a given lane or direction of a highway, during a specific time interval. Volume and flow rate are two measures that quantify the number of pedestrians passing a point on a lane or roadway during a given time interval. Flow rate is the equivalent hourly rate at which vehicles pass over a given point or section of a lane or roadway during a given time interval of less than 1 hour, usually 15 minutes. TRB. (2010), *Highway Capacity Manual*.

Demand and Capacity

Demand is the number of vehicles (persons) that desire to travel past a point during a specified period also usually one hour while Capacity refers to the maximum rate at which vehicles can traverse a point or short segment during a specified time period, actual volume can never be observed theoretically at levels higher than the true capacity of the section. TRB. (2010), *Highway Capacity Manual*.

Daily Volumes

Daily volumes are used to establish trends over time for planning purposes, they are not differentiated by directional or lane but totals for an entire facility at the specified location. Volume and flow are variables that quantify demand, that is, the number of motorists who desire to use a road way facility during a specific time period. Congestion can influence demand, and observed volumes sometimes reflect capacity constraints rather than true demand. The distinction between volume and flow rate is important. On the one hand, volume represents the number of vehicles observed or predicted to pass a point during a time interval, while the flow rate represents the number of vehicles passing a point during a time interval less than 1 hour, but expressed as an equivalent hourly rate. TRB. (2010), *Highway Capacity Manual*.

AADT-Annual Average Daily Traffic is the average 24-hour traffic volume at a given location over a full 365-day year that is the total number of vehicles passing the site in a year divided by 365.

AAWT-Annual average weekly traffic is the average 24-hour traffic volume occurring on weekdays over a full year. AAWT is computed by dividing the total weekly traffic volume for the year by 260. This volume is of considerable interest where weekend traffic is light, so that average higher weekday volumes over 365 days would mask the impact of weekday's traffic.

ADT-Average Daily Traffic is an average 24-hour traffic volume at a given location for some period of time less than a year. While an AADT is for full year, an ADT may be measured for six months, a season, a month a week, or as little as two days. An ADT is a valid number only for the period over which it was measured.

AWT-Average Weekly Traffic is an average 24- hour traffic volume occurring on weekdays for some period of time less than one year, such as for a month or a season. The relationship between AAWT and AWT is analogous to that of AADT and ADT.

AADT and AAWT are used for several transportation analyses:

- Computation of accident rates in terms of 100 million
- Establishment of volume trends
- Evaluation of the economic feasibility of highway projects
- Development of freeway and major arterial street systems
- Development of improvement and maintenance programs
- ADT and AWT are used for several transportation analyses:
- Measurement of current demand and
- Evaluation of existing traffic flow.

Peak flow rates and hourly volumes produce the peak-hour factor (PHF), the ratio of total hourly volume to the peak flow rate within the hour. TRB. (2010), *Highway Capacity Manual*.
For standard 15- minute analysis period, this becomes:

$$PHF = \frac{Hourly\ volume}{Peak\ flow\ rate\ (within\ the\ hour)}$$ Equation 2.9

$$PHF = \frac{V}{4 \times V_{15}}$$ Equation 2.10

Where PHF = peak-hour factor

V = hourly volume (vehicle/hour)

V_{15} = volume during the peak 15 minutes of the peak hour (vehicles/15 minutes).

When the PHF is known, it can convert a peak-hour volume to a peak flow rate, as in Equation 2-11: TRB. (2010), *Highway Capacity Manual*.

$$v = \frac{V}{PHF}$$ Equation 2.11

Where v = flow rate for a peak 15-minutes period (vehicles/hour)

V = peak-hour volume (vehicles/hour)

PHF = peak-hour factor.

Equation 2.11 does not need to be used to estimate peak flow rates if vehicle counts are known; however, the chosen count interval must identify the maximum 15-minutes flow period. The rate then can be computed directly as 4 times the maximum 15-minutes count TRB. (2010), *Highway Capacity Manual*.

Speed

Although pedestrian traffic volumes provide a method of quantifying capacity values, speed (or its reciprocal of travel time) is an important measure of the quality of the traffic service provided to the pedestrian. It is an important measure of effectiveness defining levels of service for many types of facilities, walkways and urban streets.

Speed is defined as a rate of motion expressed as distance per unit of time, generally as meters per second (m/s). In characterizing the speed of a traffic stream, a representative value must be used, because a broad distribution of individual speeds is observable in the traffic stream. In this study, average travel speed is used as the speed measure because it is easily computed from observation of individual vehicles within the traffic stream and is the most statistically relevant measure in relationships with other variables. Average travel speed is computed by dividing the length of the highway, street section, walkway or segment under consideration by the average travel time of the vehicles traversing it. If travel times t_1, t_2, t_3, t_n (in hours) are measured for n vehicles traversing a segment of length L, the average travel speed is computed using Equation 2.12, TRB. (2010), *Highway Capacity Manual*.

$$S = \frac{nL}{\sum_{i=1}^{n} t_i} = \frac{L}{\frac{1}{n}\sum_{i=1}^{n} t_i} = \frac{L}{t_a}$$ Equation 2.12

Where:

S = average travel speed (m/s)

L = length of the highway segment (m)

ti = travel time for the i^{th} vehicle to traverse the section (s)

n = number of travel times observed

$t_a = \frac{1}{n}\sum_{i=1}^{n} t_i$ = average travel time over L (s)

Density

Density is the number of vehicles occupying a given length of a lane or roadway at a particular instant; it is averaged over time and is usually expressed as vehicles per kilometer (vehicles/kilometer).

Density computation can however be, from the average travel speed and flow rate, which are measured more easily. Equation 2.13 is used for under saturated traffic conditions.

TRB. (2010), *Highway Capacity Manual*.

D = V/S Equation 2.13

Where:

D = Density (vehicles/kilometer)

V = Flow rate (vehicles/hour)

S = Average travel speed (meters/second)

Figure 2.5 shows the fundamental Speed, Flow, Density, Relationships. TRB. (2010), *Highway Capacity Manual*.

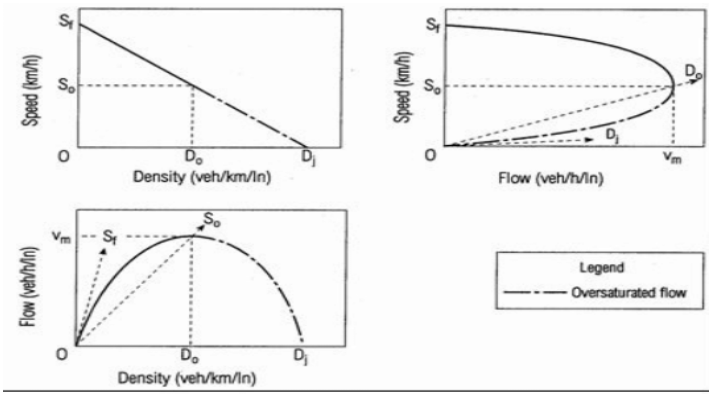


Figure 2.5: Fundamental Speed, Flow, Density, Relationships

Traffic Flow Speed and Density

Equation 2.13 cites the basic relationship among the three parameters, describing an uninterrupted traffic stream.

Although the equation $v = S \times D$ algebraically allows for a given flow rate to occur in an infinite number of combinations of speed and density, there are additional relationships restricting the variety of flow conditions at a location. Figure 2.5 shows a generalized representation of these relationships, which are the basis for the capacity analysis of uninterrupted-flow facilities. The flow-density function is placed directly below the speed-density relationship because of their common horizontal scales, and the speed-flow function is placed next to the speed-density relationship because of their common vertical scales. Speed is space mean speed.

Traffic Volume Count

Traffic Data Collection is basic requirements for transport planning. Traffic Data forms an integral part of national economics and such knowledge is essential in drawing up a rational transport policy for movement of passengers and goods by both government and the private sectors. Traffic Volume Count is counting of number of vehicles passing through a road over a period of time. It is usually expressed in terms of Passenger Car Unit (PCU) and measured to calculate Level of Service of the road and related attributes like congestion, carrying capacity, V/C Ratio, identification of peak hour or extended peak hour. Traffic volume count (TVC) is usually done as a part of transportation surveys; TVC can be classified or unclassified.

Need of Traffic Volume Count Survey

Traffic Volume Survey is an essential part of Town Planning, especially for a town planner. It includes counting the number of vehicles passing through a survey station. The study of Classified Traffic Volume Count is to understand factors that form the basis of:

- Checking the efficiency/saturation of the road network by comparing current traffic volume with the calculated capacity or by identifying level of service
- Establishing the use of the road network by vehicles of different categories, traffic distribution, PCU/vehicle value
- Need of median shifting or road widening

Purpose of Traffic Volume Count

The purpose of classified traffic volume count is to draw inferences on the basis of data collected and to provide possible solutions, improvement on suggestion for the problem identified. The objectives covered in it include identifying the hourly distribution of vehicles and peak hour, identify level of service and compare modal composition on different hierarchy of roads.

Methods of Implementing Traffic Volume Count

Traffic Volume Count can be done by various methods depending upon various factors like manpower available, budget, technology/instrument available, magnitude of traffic data required or to be collected which will then determine quality and type of vehicle classification to be adopted. Traffic counting falls in two main categories, namely: manual count and automatic count. Traffic data collection forms the integral part of traffic volume study as it provides the raw data and includes primary survey. The various types and methods used to collect traffic data not only provide a good and valuable coverage of the required traffic information. Different methods of traffic volume count are as mentioned below:

Durational and Interval of Traffic Counts

In order to predict traffic flow volumes that can be expected on the road network during specific periods, knowledge of the fact is required that traffic volumes changes considerably at each point in time. There are three important cyclical variations:

Hourly Pattern: the way traffic flow characteristic varies throughout the day and night;

Daily Pattern: The day-to-day variation throughout the week

Monthly and Yearly Pattern: The season-to-season variation throughout the year.

When analyzing the traffic one must also be aware of the directional distribution of traffic and the manner in which its composition varies as it is important to deal with tidal flow.

Hourly Patterns - Typical hourly patterns of traffic flow, particularly in urban areas, generally show a number of distinguishable peaks. Peak in the morning followed by a lean flow until another peak in the middle of the afternoon, after which there may be a new peak in the late evening. The peak in the morning is often more sharp by reaching the peak over a short duration and immediately

dropping to its lowest point. The afternoon peak on the other hand is characterized by a generally wider peak. The peak is reached and dispersed over a longer period than the morning peak.

Daily Patterns-The traffic volume generally varies throughout the week. The traffic during the working days (Monday to Friday) may not vary substantially, but the traffic volume during the weekend is likely to differ from the working days on different type of roads and in different directions.

Manual Count

The most common method of collecting traffic volume data is the manual method of traffic volume count, which involves a group of people recording number of vehicles passing, on a pre-determined location, using tally marks in inventories. Raw data from those inventories is then organized for compilation and analysis. This method of data collection can be expensive in terms of manpower, but it is nonetheless necessary in most cases where vehicles are to be classified with a number of movements recorded separately, such as at intersections also in case where automatic methods cannot be used due to lack of infrastructure, necessary authorization.

Automatic Count

This method is employed in cases where manual count method is not feasible. Various instruments are available for automatic count, which have their own merits and demerits. Some of the widely used instruments are pneumatic tubes, inductive loops, weigh-in-motion sensor, micro-millimeter wave, radar detectors and video camera. Both types of counts can be classified or unclassified. Classified traffic volume count gives a better understanding of the types of vehicles which uses the road and can be used for number of other purposes apart from the transportation surveys. It can also be used for calculating the modal split of vehicles on the road. Unclassified traffic volume count is done where sufficient manpower is not available or the budget for the survey is low. This type of volume count does not give a good information about the road.

Some of the widely used instruments are:

i) Pneumatic Tubes - These are tubes placed on the top of road surfaces at locations where traffic counting is required. As vehicles pass over the tube, the resulting compression sends a burst of air to an air switch.

ii) Inductive Loops - Inductive loop detector consists of embedded turned wire. It includes an oscillator, and a cable, which allows signals to pass from the loop to the traffic counting device. Inductive loops are cheap, almost maintenance-free and are currently the most widely used equipment for vehicle counting and detection.

Factors to be considered while doing a Traffic Volume Survey on mid-block

i. Surveyor should not affect the flow of traffic.
ii. Survey station should be located at position where queuing does not take place.
iii. Vehicles should be classified if possible as it saves time for Classified Traffic Volume Survey. Also classified results have much other application.
iv. Safety of surveyor should be kept in mind and safe location should be selected. This becomes more important in rural area where carriageway is not well-defined.
v. Equipment used while automatic count should be placed such that they do not draw attention of driver.
vi. Traffic Volume Survey can be done manually or by use of automatic methods depending upon various factors like manpower available, budget, technology/instrument available, magnitude of traffic data required.

Table 2.11 show a summary of literature review on vehicular air pollutions, these clearly indicates the need to critically analyze the traffic emissions in urban areas due to the negative health and environmental effects as a result on traffic congestion and therefore the study of emissions along Uhuru highways corridor in Nairobi.

Table 2.11: Gaps in literature review on Vehicle Traffic Emissions

	Author	Study	Strengths	Weaknesses
1.	EU Environment Act 1995.	Levels of pollution above the objectives set by the EU.	Pollution above the objectives set by the Government were declared an Air Quality Management	Environmental law depended on implementation at Member State, regional and local levels.
2.	Sehlstedt et al., 2007; American Heart Association, 2010).	Health effects of particulate matter.	Smaller particles caused cardiovascular effects and larger particles respiratory diseases. SO_4 was associated with less health endpoints than PM2.5.	It was unclear if this was due to the ultrafine particles. Inconsistency on results of SO_4 studies.
3.	DTE Staff 2018 IIT-Kanpur, 2016.	Traffic congestion in Delhi.	Delhi overall toxic emissions 9% of the PM10 load and around 20% of the PM2.5 load secondary particles, vehicular emissions could rise to 30%.	Helicopters showered water to fix the problem with not much good results.
4.	Adapted from: Faiz et al 1990, Table 26.	Estimations of vehicle Pollutant Emissions.	Estimations of Pollutant Emissions by Passenger Cars and Buses in Nairobi in (tones per day).	No clear framework on predictions on vehicle increase and deterioration condition.
5.	APEC Consortium in association with CE 2013.	Air Quality Emission Level.	Emissions due to economic activities and high population, along the outer-ring corridor.	Emissions study was not specifically related to traffic emissions.
6.	Friedrich and Bickel, 2001; Bickel and Friedrich, 2005.	Emissions health effects.	Gave impact category, receptor, pollutant and morbidity/mortality caused by traffic emissions.	Did not give clear measures to reduce traffic emissions.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

Existing information on data collection techniques and sample size were reviewed. Traffic data survey was conducted at the two identified sites within the study area, the first station was identified as NRU 01 road side near Nairobi railways underpass and second station as UNPT 02 near the University of Nairobi pedestrian tunnel. The peak (6:00am to 10:00am and 4:00pm to 8:00pm) and off-peak (10:00am to 4:00pm) hours of motorized traffic counts were considered from 11th to 16th, November 2019. Further to enable development of trends on vehicular traffic and emissions over time during the days of the week, a fifteen-minute time interval throughout the survey period (6:00 am to 6:00 am) was adopted. This would give a variability representation across small time interval as the recommended best practice.

Preliminary Site Visit

A preliminary site visit was conducted along Uhuru Highway corridor and designated stations for data collection identified as NRU 01 and UNPT 02 on 10th November 2019. Safety measures and police authorization letters were also affirmed with manual traffic count as preferred means of traffic data collection. A map of the study area showing layout of the data collection points is given in plate 1.2.

Traffic Volume Survey at mid-block

Various factors were considered in conducting traffic volume survey at mid-block, stations were located where queuing would be minimal, safety of the surveyors and equipment taken in to consideration and attention of motorists less drawn.

3.2 Research Design

Quantitative research design emphasized objective measurements and statistical analysis of data collected through surveys, gathered numerical data were generalized across vehicular traffic which explained the emissions phenomenon and answered research questions more effectively. Figure 3.1 shows in summary the strategy and plan used for data collection.

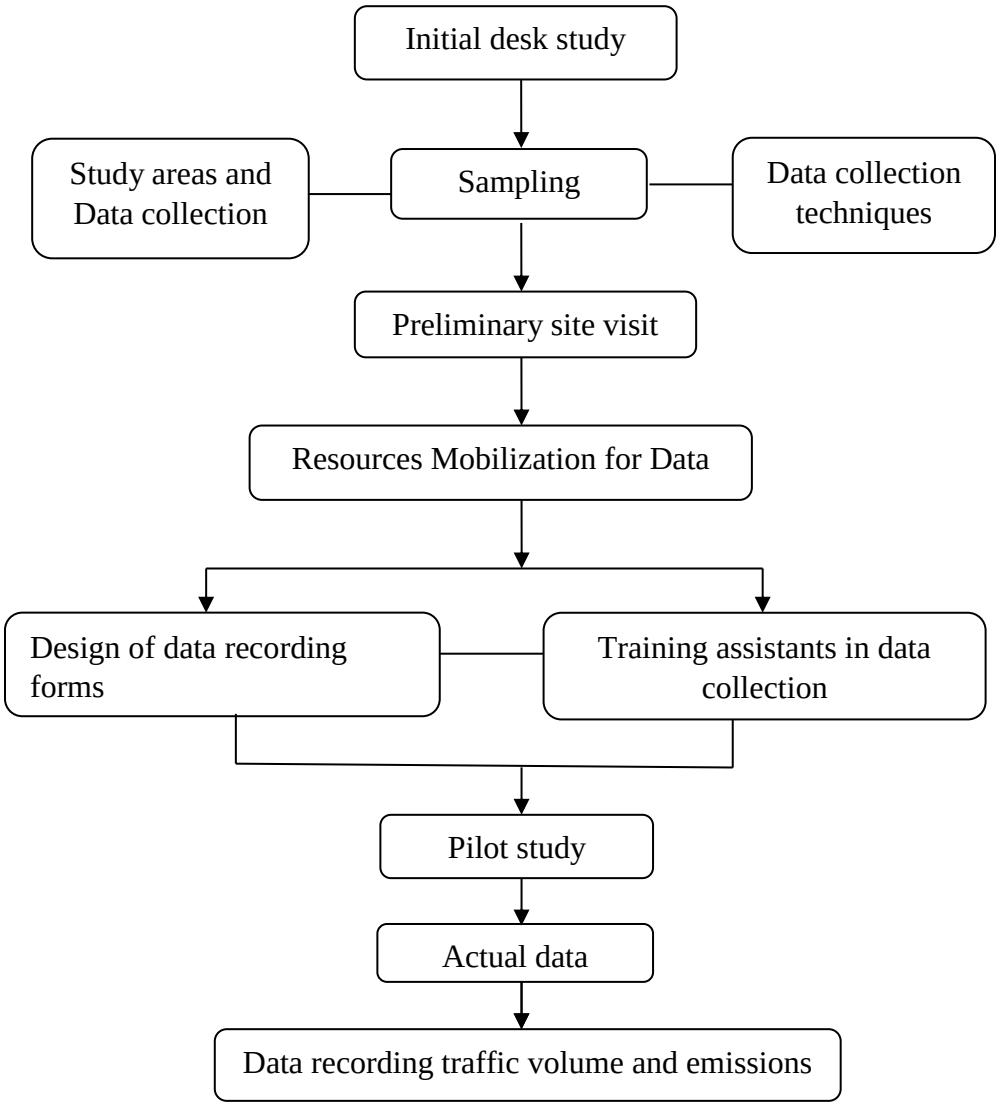


Figure 3.1: Strategy and Plan for Data collection

3.3 Research Sampling

The study was based on a random sample calculated using the following statistical formulae:

$$n = \frac{N}{1+Ne^2}$$ Equation 3.1

Richardson A. J., Ampt E. S. and Meyburg A. H. (1995), Survey Methods for Transport Planning.

Where:

n- Sample size

N- Pedestrian/vehicle population using the facility

e- Margin of error, based on 95% Confidence level, example 5%.

The average daily traffic at stations NRU 01 and station UNPT 02 were 69783 and 60479 taken over a period of 24 hours for six days with a daily sample size of 398.

The sample size was computed as:

Station NRU 01 ADT 69783

Station UNPT 02 ADT 60479

Average ADT 65131

$n = (65131) / (1+65131 \times 0.05^2) = 397.56$ say 398

From the results, there were 398 vehicles for the study per day at 95% Confidence level.

3.3.1 Secondary Data Collection

This step in research involved collection and review of existing data related to the vehicle traffic and emissions in order to understand the concepts and ascertain any pre-existing relevant information.

3.3.2 Primary Data Collection

This involved mobilization of resources for data collection. Manual classified count forms, cameras and stop watches were used to record traffic data while Bosean and Dienmaern machines to record emissions data. Transportation and mobile phones for communication during the process were also put in place.

Sampling Procedure

The stages involved in data collection included:

- Review of existing information
- Site assessment
- Volume data collection
- Emissions data collection

The activities were done as explained:

Site Assessment for Data Collection

A specific location for data collection (temporary) was determined on site taking cognizance of the potential use of data collected. The following were kept in mind before deciding on the sites which included uniform geometric characteristics along the road length and away from junctions, a horizontal (flat) and geometrically straight road section, uninterrupted traffic flow, little pedestrian traffic interruption and finally a section which met safety requirements (A typical straight road).

Wind Speed and Wind Direction during Data Collection

Effects of wind speed and direction were considered during the study, the Figures 3.2 to 3.6 show data from weather station taken from the months of January to December of the year 2021, giving climate information on average wind speed, temperature, sunshine hours, precipitation and humidity throughout the year, the distance between the area of study and the Kenya Metereological Department in Nairobi is 7 km.

The wind experienced at any given location was highly dependent on local topography and other factors, and instantaneous wind speed and direction varied more widely than hourly averages. The average hourly wind speed in Nairobi was essentially constant during November, remaining within 3m/s. On average, higher and lower wind speeds were recorded in the month of January and July respectively.

The mean monthly wind speed over the year in Nairobi, Kenya (meters per second)

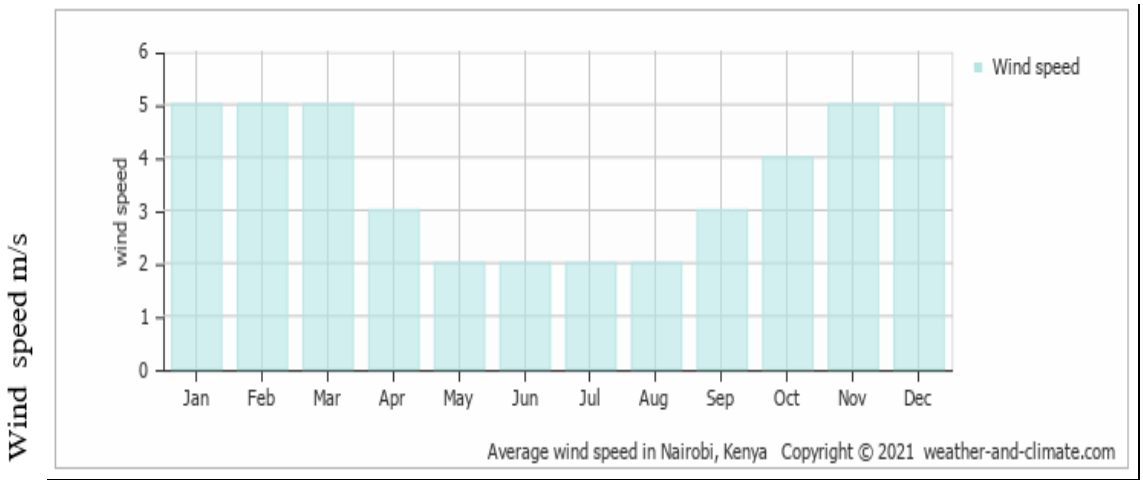


Figure 3.2: Average Wind Speed from January to December 2021

Average day and night temperature

The mean minimum and maximum temperatures over the year show in Fahreheit were changed into degree Celsius in (Figure 3.3). The average temperature was 68ºF converted to 20º C.

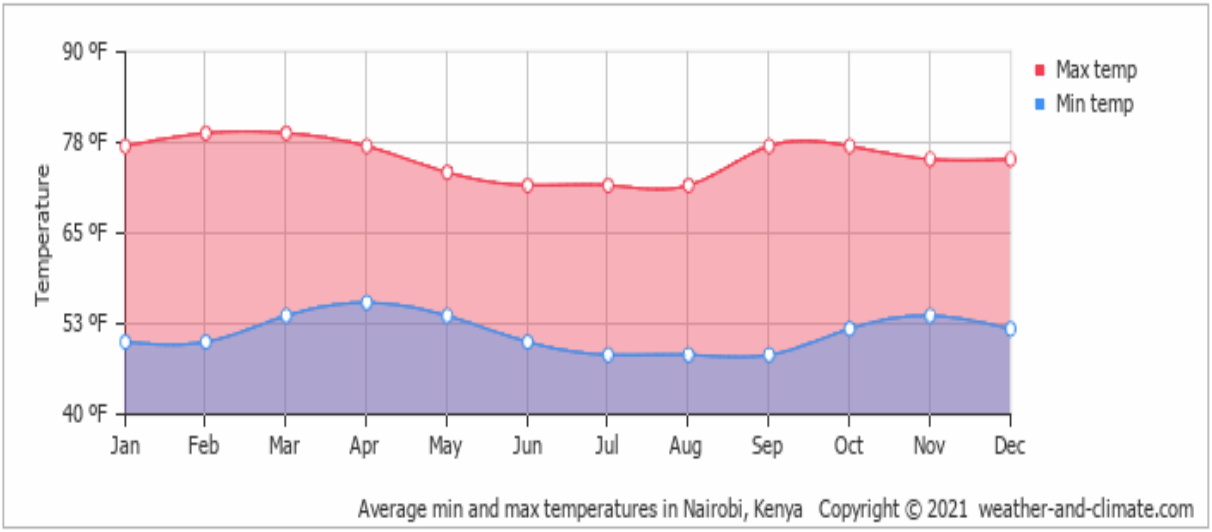


Figure 3.3: Average monthly hours of Temperature from January to December 2021

The monthly sun hours over the year in Nairobi, Kenya shown in (Figure 3.4)

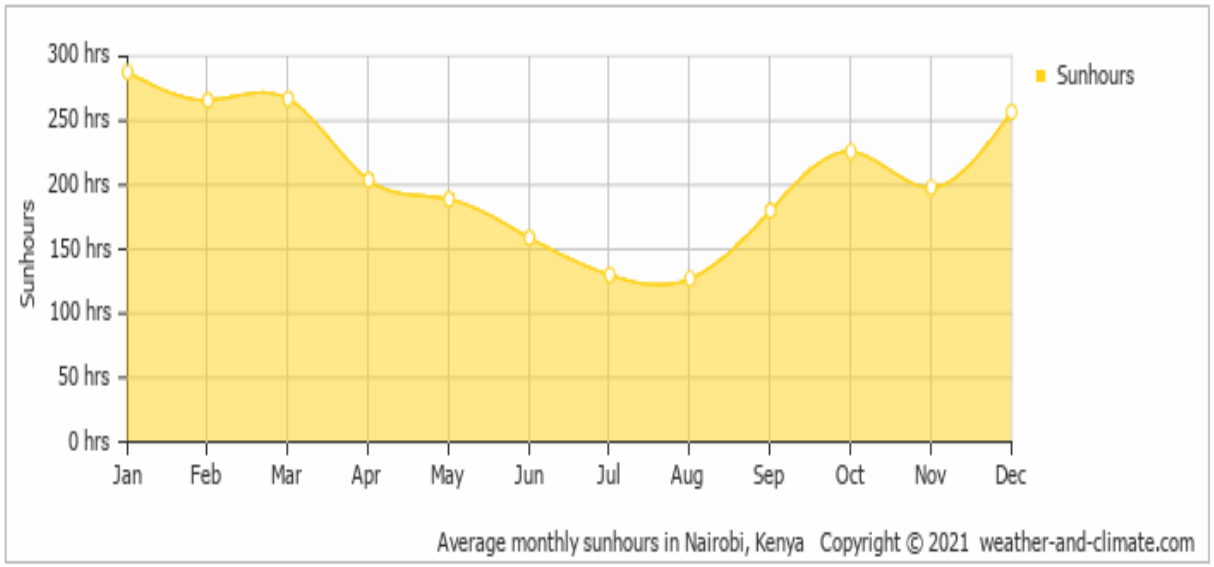


Figure 3.4: Average monthly sunshine from January to December 2021

On average, January had the highest and August the lowest sun hours with an average of 2492.0 sun hours.

Monthly Precipitation

The mean monthly precipitation over the year, (rain/snow) is illustrated in (Figure 3.5).

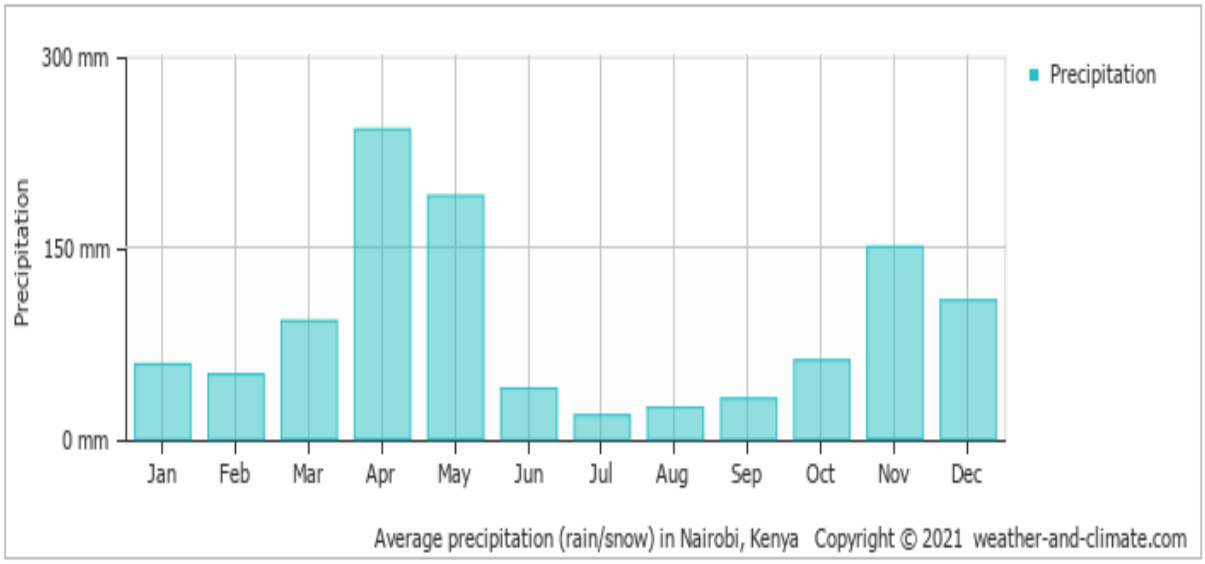


Figure 3.5: Average precipitation (rain/snow) from January to December 2021

Rainy season falls in the months of April, May, November and December. Nairobi has dry periods in the months of July and August. On average, July is the driest month. The average amount of annual precipitation is: 1062.0 mm.

Average Humidity

The mean monthly relative humidity over the year is illustrated in (Figure 3.6).

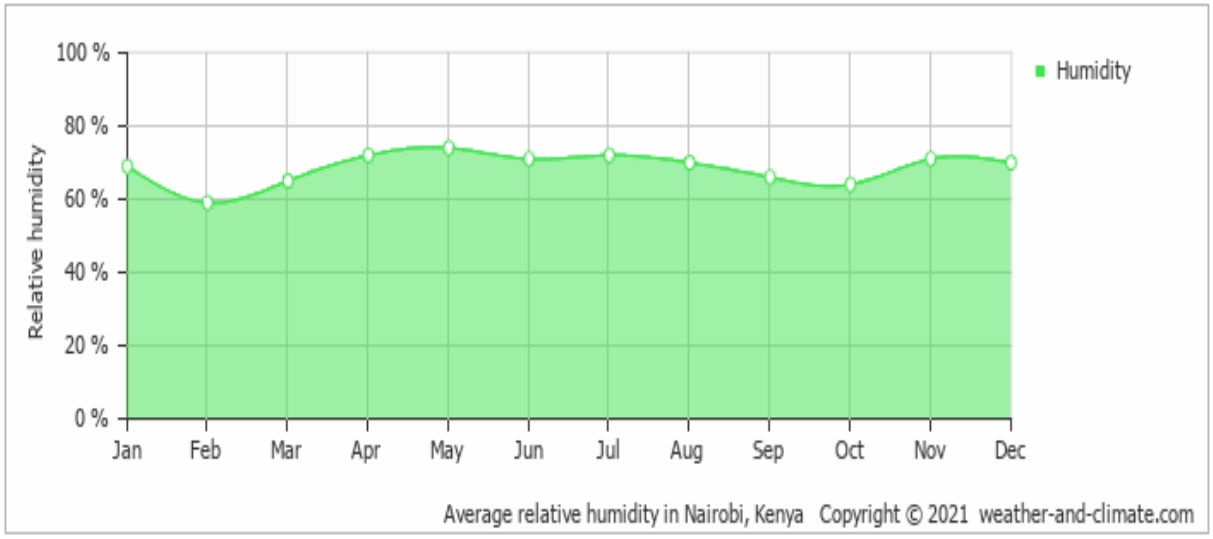


Figure 3.6: Average relative humidity from January to December 2021

On average the month of May was the most humid and February least humid with the average annual percentage of humidity as 69.0%.

3.4 Wind Measurement during the Study

Wind has both speed and direction. Anemometer measured wind speed and wind vanes measured wind direction. A typical wind vane had a pointer in front and fins at the back. When the wind blew, the wind vane pointed into the wind. For example, in a north wind, the wind vane pointed northward.

A cup anemometer was used to measure wind speed. The cups caught the wind and produced pressure difference inside and outside the cup. The pressure difference, along with the force of the wind, caused the cups to rotate. Electric switches measured the speed of the rotation, which was proportional to the wind speed.

Propellers also could measure wind speed. The propeller blades rotated at a rate proportional to the wind speed.

In summary, the 24-hour mean weather condition during data collection was as shown:

- The mean temperature was 20 degrees centigrade
- Monthly relative humidity was 55%
- Wind direction was predominantly from east to west
- Daily mean sunshine hours were 3 to 10 hours
- Low rainfall ranging from 116mm to 965mm and
- Wind speed was averagely 3m/s.

3.4.1 Emissions and Particulate Matter

Control measurement monitoring station away from Uhuru Highway Corridor

"Monitoring" involved the collection and use of measured data and other information to control the process assuring compliance with applicable requirements. Ambient air quality monitoring involved collection and measurements of samples of ambient air pollutants to evaluate the status of the atmosphere as compared to clean air standards and historical information.

3.5 Data and Methodology

3.5.1 Measurement of Emissions

The data was collected averagely every 15 minutes' using various gas analyzers with meteorological parameters measured by an automated weather observing stations. Three measuring equipment were used at a height of 2 meters away from the road at approximately 2 meters height. They included: Bosean for determination of NOx, SO_2, CO and Dienmaern for determination of PM2.5, HCHO and TVOC.

Wind speed and wind direction were of great importance during the emissions determination taking the readings at every station averaging readings after 15 minutes period. The ambient air emissions were determined for a period of 6 days (from 11th to 16th of November 2019) for 24 hours' period from 6:00 am to 6:00 am alongside vehicle traffic volumes by types at the two sites of the study area.

3.5.2 Parameters Measured using the Equipment

The PM2.5 was measured by DM 201PM2.5 Air Quality Detector. The machine had 2.8" FTF LCD Display, support 320 × 240 Pixel, high speed ARM Control Program, easy to operate with testing holes designed to provide cross ventilation and handheld design making it convenient to detect air within a short test time. The PM2.5 Particle valid range was: 0-500µg/m^3 with a charging voltage of 5V/1A, it also measured HCHO and TVOC. The TVOC test had a range:0.000-9.999mg/m^3, semiconductor sensor sample type, a diffusion concentration unit: mg/m^3 test time of 5 minutes with a test range of: 0-999µg/m^3.

The BOSEAN equipment was used to measure, Nitrogen oxide, Sulphur dioxide and Carbon monoxide. It had an adjustable calibrating level, self-adjustment function, visual and audible alarm with vibration, advanced self-examination and self-renovation function. The sampling method was diffusion type with environmental condition of humidity 5% to 95% relative humidity non-condensing. The detecting range of CO was 0.1000ppm, accuracy of 3%, response time 10 seconds, repeatability 1% with 1% zero drift. Plates 3.1 and 3.2 presents the equipment used for field data collection.

Plate 3.1: Equipment for measurement of particulate matter, HCHO and TVOC

Plate 3.2: Equipment for measurement of Nitrogen oxide Sulphur dioxide, and Carbon Monoxide

3.5.3 Data Collection Procedure

Measurements of CO, NOx, HCHO, PM2.5, TVOC and SOx

In this study, field equipment were installed at a distance of 2.0 meters away from the road carriageway on both sides at the two measurement sites to monitor on-road minute-by-minute ambient concentrations. Reflector jackets were worn for clear visibility by the motorists for safety. Air pollutants were measured at approximately 2.0 meters height above the ground level. Local meteorology (wind speed/direction, temperature, humidity, were received from meteorological data from google search. To achieve the objectives of the study, field measurements were carried out at two different stations:

Road side near Nairobi railways underpass between Nyayo stadium roundabout at Bunyala road and Haile Selassie Avenue - NRU 01.

The second station was near the University of Nairobi pedestrian tunnel between University way and Museum hill interchange - UNPT 02 .These measurement sites were selected on the basis of intensity of traffic flow. The parameters measured included (CO, NO_2, HCHO, TVOC, PM2.5 and SO_2), meteorology (wind speed and wind direction).

Table 3.1 presents the details of the field measurements and information of the monitoring sites.

Table 3.1: Monitoring Sites and Details of the Measurement Program

Measurement site	**Site code**	**Sites Characteristics**	**Details of field measurement**			
			Air quality	**Meteorology**	**Traffic survey**	**Duration of study**
Near Nairobi railways underpass	NRU 01	Higher traffic volume	CO, NO_2, HC, TVOC, PM 2.5, SO_2	Wind speed, wind direction	Car, bus, taxi, bike.	11-16 November, 2019
Near the University of Nairobi pedestrian Tunnel	UNPT 02	Higher traffic volume	CO, NO_2, HC, TVOC, PM 2.5, SO_2	Wind speed, wind direction	Car, bus, taxi, bike.	11-16 November, 2019

Measurements were conducted NRU 01 and UNPT 02 were conducted for a period of 6 days, automated equipment were maintained in an open air environment. A video camera was used to capture the traffic flows and to characterize the composition of the vehicles traveling at each measurement sites. The wind speed and wind direction were measured with wind vane and anemometer, respectively. Geometric Characteristics of Road (A8) - Uhuru Highway Corridor had a lot to influence the emissions contributions, the Table 3.2 presents in summary the Geometric Characteristics of the study area.

Table 3.2: Geometric Characteristics of the Uhuru Highway Corridor

ID	Road section	Road type	Number of lanes	Section length Approximation (m)	Average lane width (m)	Average side walk width (m)
1	Grade separated interchange at the Museum Hill intersection to University Way	Arterial	6	500	3.50	2.0
2	University Way to Kenyatta Avenue	Arterial	6	500	3.50	2.0
3	Kenyatta Avenue to Haile Selassie Avenue	Arterial	6	500	3.50	2.0
4	Haile Selassie Avenue to Bunyala road	Arterial	6	500	3.50	2.0

Data collections at the two designated sites (NRU 01 and UNPT 02) along Uhuru Highway Corridor were as shown on The Plates 3.3 and 3.4.

Plate 3.3: Section between Haile Salassie Avenue and Bunyala road, Station NRU 01 at 6:00pm

Plate 3.4: Emission data Collection University of Nairobi Pedestrian Tunnel, Station UNPT 02 at 6:00am

3.5.4 Traffic Data Survey

Traffic Volume Surveys Program

At a safe distance of 2.0 meters away from the road carriageway at the stations (NRU 01 and UNPT 02) vehicle traffic volumes counts by types were recorded after every 15 minutes for a period of 6 days (from 11th to 16th of November 2019) for 24 hours' period from 6:00am to 6:00am.

Traffic Classification-Motorized

Motorized Traffic (MT) count was manually done for the study classifying them into Motorcyle Private Cars, Jeeps / 4WD's/utility vehicle, pickup/vans, Matatus (9 - 25 seats), Small buses, Large Bus (>27 passengers), Light Trucks 2 axles (single rear wheel), Medium Trucks (2 axles, Double rear wheels), Heavy Trucks (3, 4 axle), Artics/Draw - bar Trucks (>4 axles), Other (Agricultural tractors, grader).

Volume of Traffic Recorded by Vehicle Classification

Traffic was first categorized into eleven types for convenience of the study according to their respective Passenger car units (PCU) factor. Traffic counting was done using the tally sheets which was the simplest and least expensive data collection tool. For easy analysis, data was collected for the desired 15 minutes time intervals for 24 hours and converted into PCU, a method in which various vehicle characteristics and types in equivalent standard unit where one car was considered one unit, multiplying the traffic data with respective PCU factor for the individual vehicle type. Table 3.3 was used for the PCU factor conversion for different vehicles recorded during the survey.

Table 3.3: Vehicle type and PCU conversion factors

	Type of Vehicle	**PCU Factor**
1	Motorcyle	0.5
2	Private Cars	1
3	Jeeps / 4WD's/utility vehicle	1
4	Pickup/vans	2
5	Matatus (9 - 25 seats)	2
6	Small buses	3
7	Large Bus (>27 passengers)	3
8	Light Trucks 2 axles (single rear wheel)	3
9	Medium Trucks (2 axles, Double rear wheels)	3
10	Heavy Trucks (3, 4 axle),	4.5
11	Artics / Draw - bar Trucks (>4 axles), Other (Agricultural tractors, grader).	4.5

Traffic Speed Survey Methodology

Average travel speed was used as the speed measure computed from observation of individual vehicles within the traffic stream conducted on 11th November 2019 and was the most statistically relevant measure in relation to other variables. Average travel speed was computed by dividing 100

meters length of the highway section near (NRU 01 and UNPT 02) sites segment under consideration by the average vehicular travel time traversing. If travel times t_1, t_2, t_3, t_n (in hours) were measured for n vehicles traversing the segment of length (100 meters) L, the average travel speed was computed, (Refers to Equation 2.12).

Method of Converting Traffic Counts data into ADT Values

Average Daily Traffic (ADT) values were determined by dividing the total Traffic Volumes converted in to passenger car units for 24 hours a day for the 6 days' Traffic survey period.

CHAPTER FOUR: RESULTS, ANALYSIS AND DISCUSSION

4.1 Introduction

Traffic characterization (volume by time) and traffic emissions level (significant parameters and variation by time) relationship are illustrated in this chapter.

4.1.1 Traffic Composition

Traffic composition along Uhuru Highway Corridor at Station NRU 01 was presented in Figure 4.1. Typically, cars, pick-ups and vans comprise the largest type of vehicles with an average of 57%, matatus at 15%, small and large buses at 17%, trucks at 4% and motorcycle 7%. The Table 4.1 also gives in summary the data of traffic composition.

Table 4.1: Traffic Compositions on Uhuru Highway Corridor Station NRU 01

NRU 01	Motor-cyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/ vans	Matatus (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	TOTALS
DAY 1 Westbound	1,323	12,069	4,818	2,742	9,489	4,697	3,441	229	182	212	11	3	39216
DAY 1 Eastbound	836	11053	6982	2282	4940	3935	3553	468	223	74	10	3	34361
DAY 2 Westbound	2561	8465	6310	1216	2110	1146	816	210	157	23	0	0	23016
DAY 2 Eastbound	2015	9066	4386	1678	4101	2907	3065	204	93	17	4	2	27538
DAY 3 Westbound	882	8046	3212	1828	6326	3131	2294	152	122	141	7	2	26144
DAY 3 Eastbound	557	7369	4655	1522	3293	2624	2369	312	149	50	7	2	22907
DAY 4 Westbound	2097	7824	4907	1465	2104	1407	911	172	197	85	19	0	21186
DAY 4 Eastbound	2968	8744	3939	833	3047	1910	1580	216	179	238	4	0	23658
DAY 5 Eastbound	2134	7055	5258	1013	1759	955	680	175	131	20	0	0	19180
DAY 5 Westbound	1679	7555	3655	1398	3418	2422	2554	170	78	14	3	2	22948
DAY 6 Eastbound	1613	6019	3775	1127	1618	1082	701	132	151	65	15	0	16297
DAY 6 Westbound	2283	6726	3030	641	2344	1469	1215	167	137	183	3	0	18198
DAYTIME TRAFFIC	20,949	99,991	54,925	17,743	44,549	27,684	23,180	2,609	1,798	1,124	82	14	294,648
NIGHT TIME TRAFFIC	8,380	39,996	21,970	7,097	17,820	11,074	9,272	3,913	2,697	1,686	124	20	124,049
TOTALS	29,329	139,897	76,896	24,840	62,369	38,757	32,452	6,521	4,496	2,810	206	34	418,697
ADT	4888	31948	13200	2278	3652	1041	885	1303	1238	376	59	3	69,783

The value of ADT at station NRU 01 on Table 4.1 was 69783, determined by dividing the total traffic volumes by 6 days' traffic survey period.

Figure 4.1 Shows the Traffic Composition on Uhuru Highway Corridor Station NRU 01

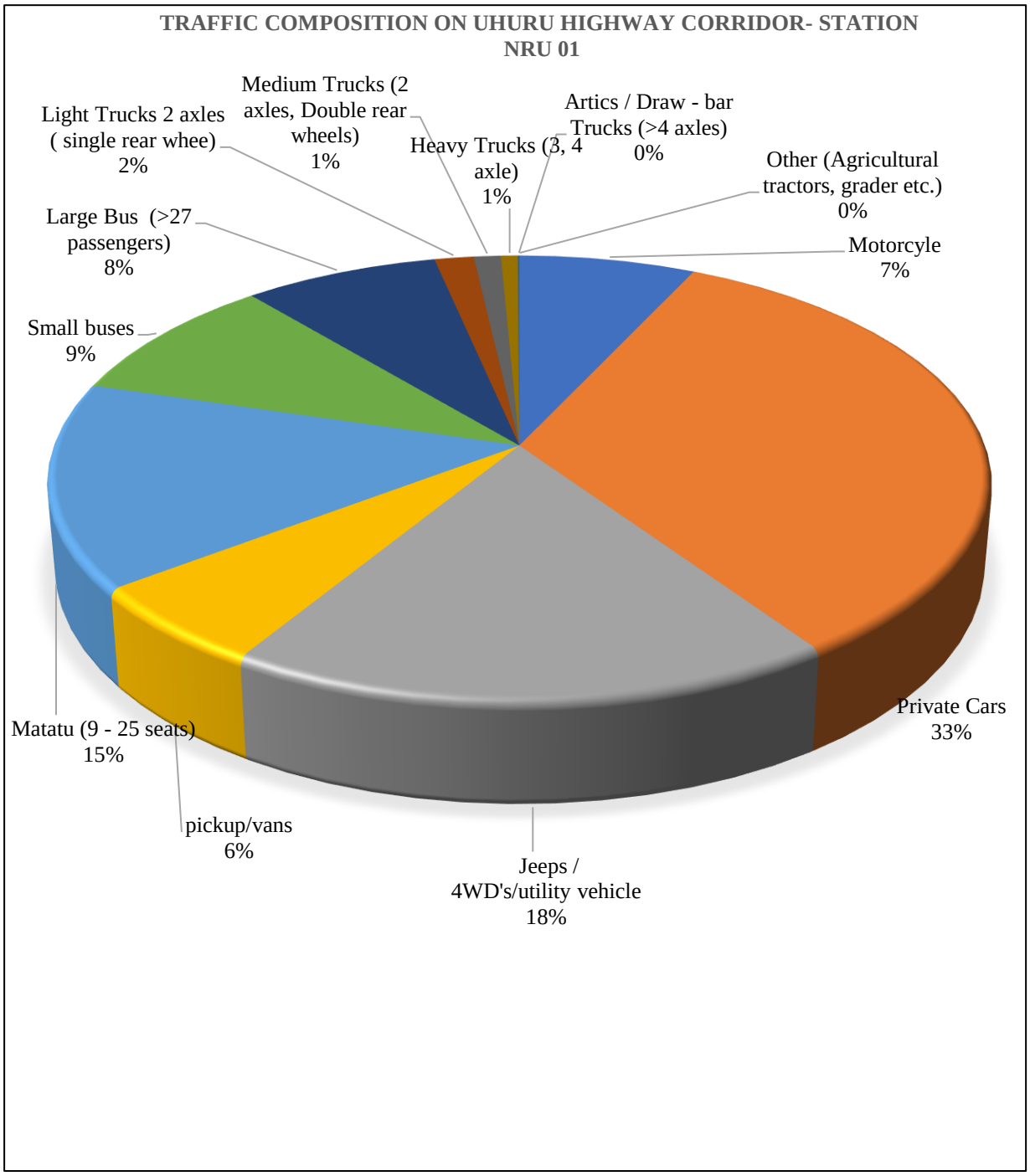


Figure 4.1: Traffic Composition on Uhuru Highway Corridor Station NRU 01

Traffic composition along Uhuru Highway Corridor at station UNPT 02 was also presented in **Figure 4.2.** Cars had 48%, pick-ups and vans comprised 20%, motorcycle 15%, matatus, trucks small and large buses at 17%. The Table 4.2 also gives in summary the data of traffic composition.

Table 4.2: Traffic Compositions on Uhuru Highway Corridor Station UNPT 02

UNPT 02	Motor-cyle	Private Cars	Jeeps / 4WD's/u tility vehicle	pickup/ vans	Matatus (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricult ural tractors, grader etc.)	TOTALS
DAY 1 Westbound	5,910	16,061	6,991	1,634	1,050	66	147	371	398	164	16	0	32806
DAY 1 Eastbound	4148	8987	3647	366	1983	1893	442	153	203	0	0	0	21821
DAY 2 Westbound	2955	8030	3495	817	525	33	74	186	199	82	8	0	16403
DAY 2 Eastbound	2502	13121	5369	1008	1166	156	380	389	315	114	7	2	19215
DAY 3 Westbound	3940	10707	4661	1089	700	44	98	247	265	109	11	0	21870
DAY 3 Eastbound	2765	5991	2431	244	1322	1262	295	102	135	0	0	0	14547
DAY 4 Westbound	2478	13121	5369	1008	1166	156	380	389	315	114	0	2	2765
DAY 4 Eastbound	3580	13551	5034	616	1788	166	460	210	214	53	38	0	25709
DAY 5 Eastbound	4552	12365	5597	894	846	100	173	265	264	70	17	0	25143
DAY 5 Westbound	3482	8314	3574	462	2153	264	503	215	134	32	0	0	19134
DAY 6 Eastbound	2478	13121	5369	1008	1166	156	380	389	315	114	7	2	19215
DAY 6 Westbound	3580	13551	5034	616	1788	166	460	210	214	53	38	0	25709
DAYTIME TRAFFIC	42,368	136,919	56,570	9,763	15,652	4,462	3,794	3,127	2,972	903	142	6	244,338
NIGHT TIME TRAFFIC	16,947	54,768	22,628	3,905	6,261	1,785	1,518	4,690	4,458	1,354	213	9	118,536
TOTALS	59,315	191,687	79,199	13,668	21,913	6,247	5,312	7,817	7,430	2,257	355	15	362,874
ADT	9886	31948	13200	2278	3652	1041	885	1303	1238	376	59	3	60479

The value of ADT at station UNPT 02 on Table 4.2 was 60479, determined by dividing the total traffic volumes by 6 days' traffic survey period.

Figure 4.2 Shows the Traffic Composition on Uhuru Highway Corridor Station UNPT 02

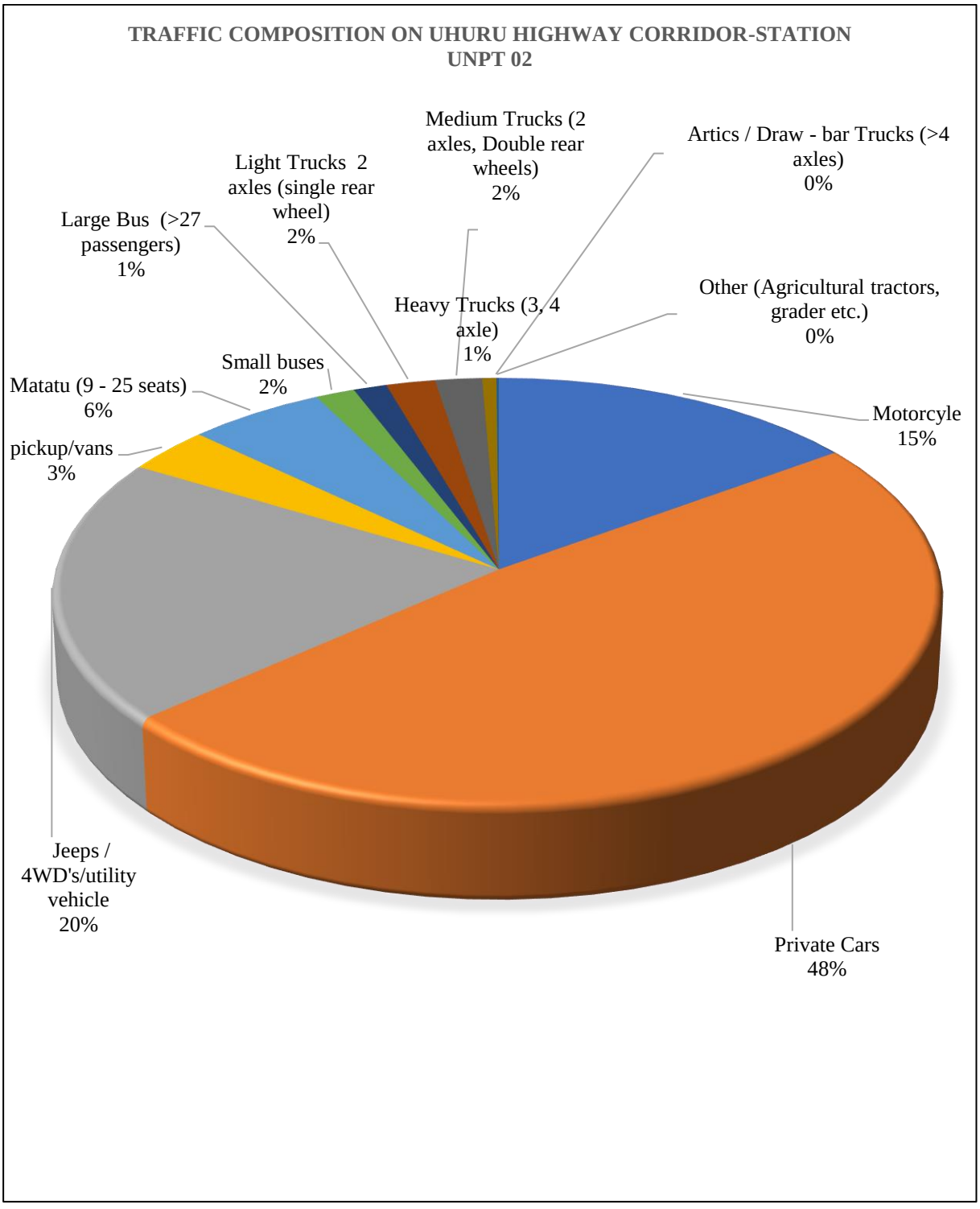


Figure 4.2: Traffic Composition on Uhuru Highway Corridor Station UNPT 02

The Figures 4.3 to 4.14 show the 24 hours' Traffic Volumes Variations while Figures 4.15 and 4.16 show the one-week traffic volume variations for the two stations NRU 01 and UNPT 02 respectively and are derived from Manual Classified Traffic data and Emissions data attached in Appendix 1.

The 24 Hours' Traffic Volume Variations sampled are presented in Figures 4.3 to Figure 4.14

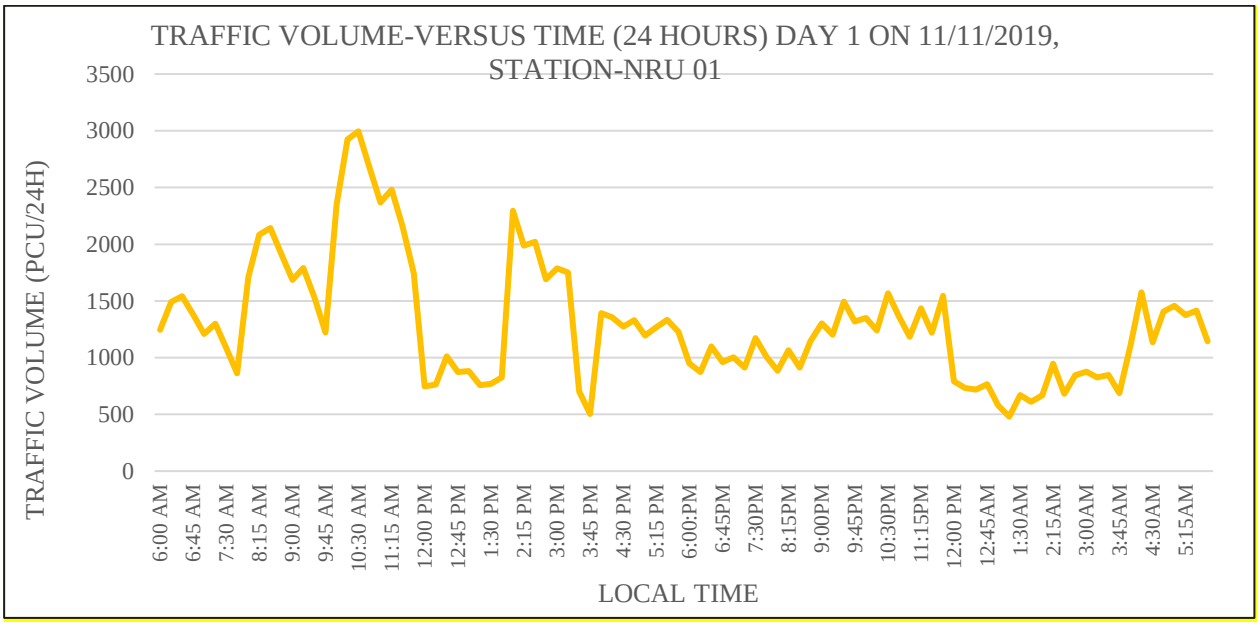


Figure 4.3: Day 1 - 24 Hours' Traffic Volume Variations Station NRU 01

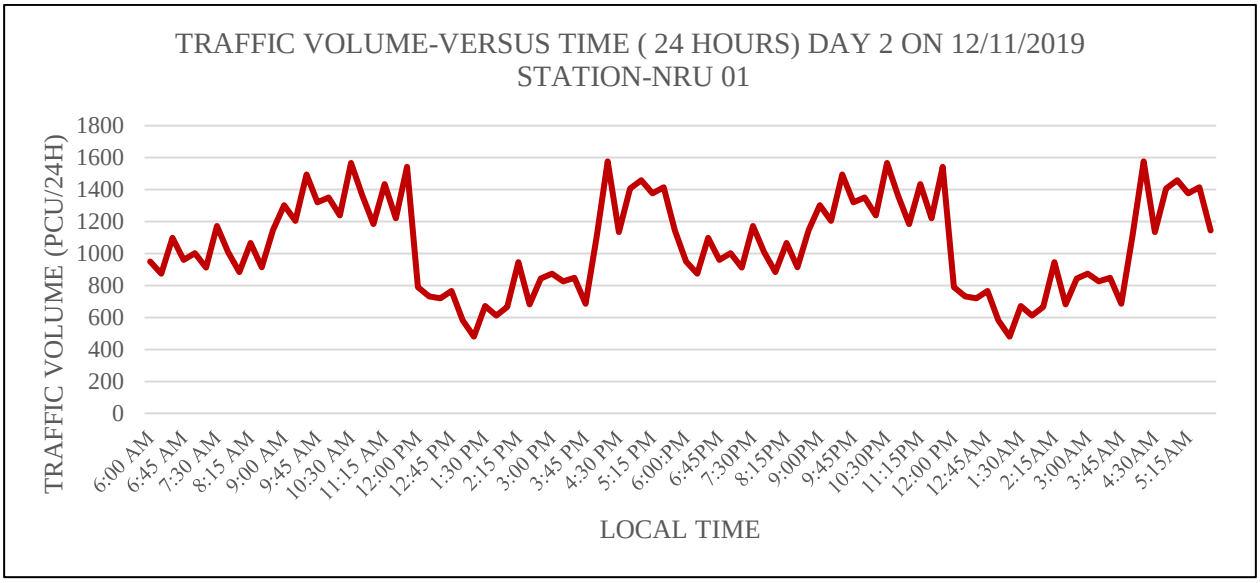


Figure 4.4: Day 2 - 24 Hours' Traffic Volume Variations Station NRU 01

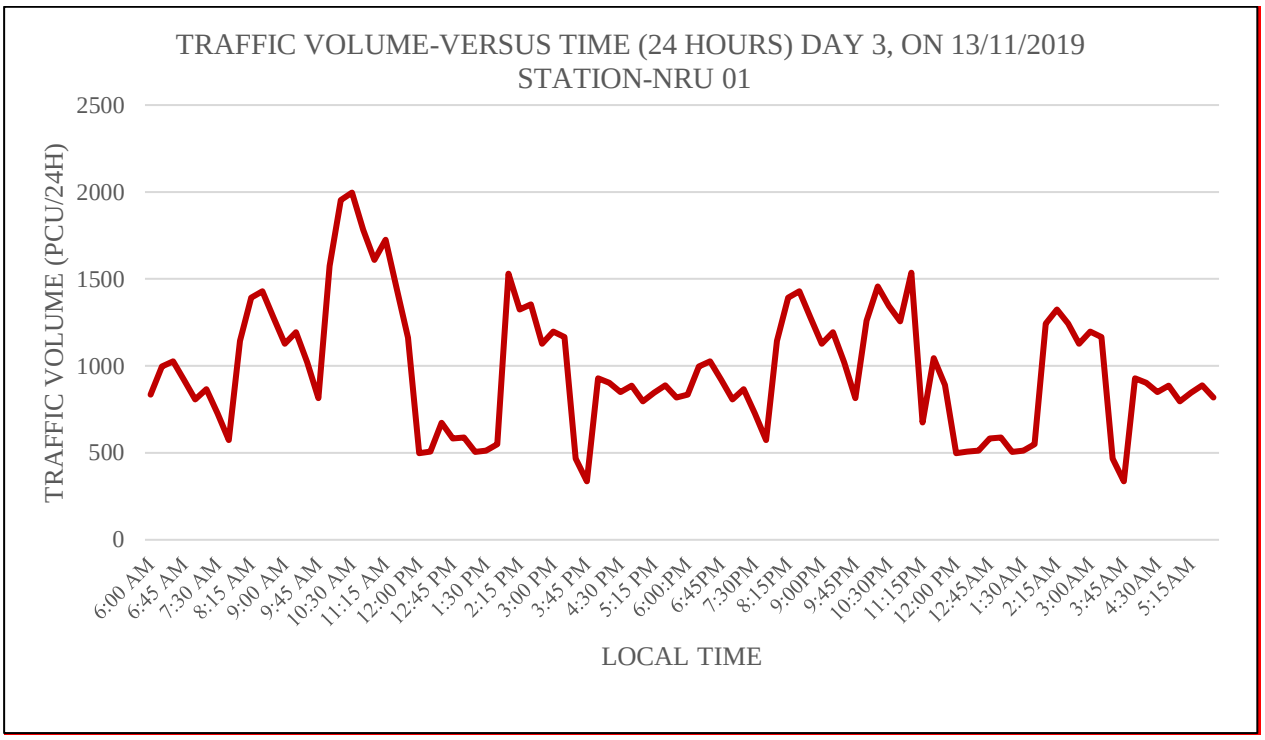


Figure 4.5: Day 3 - 24 Hours' Traffic Volume Variations Station NRU 01

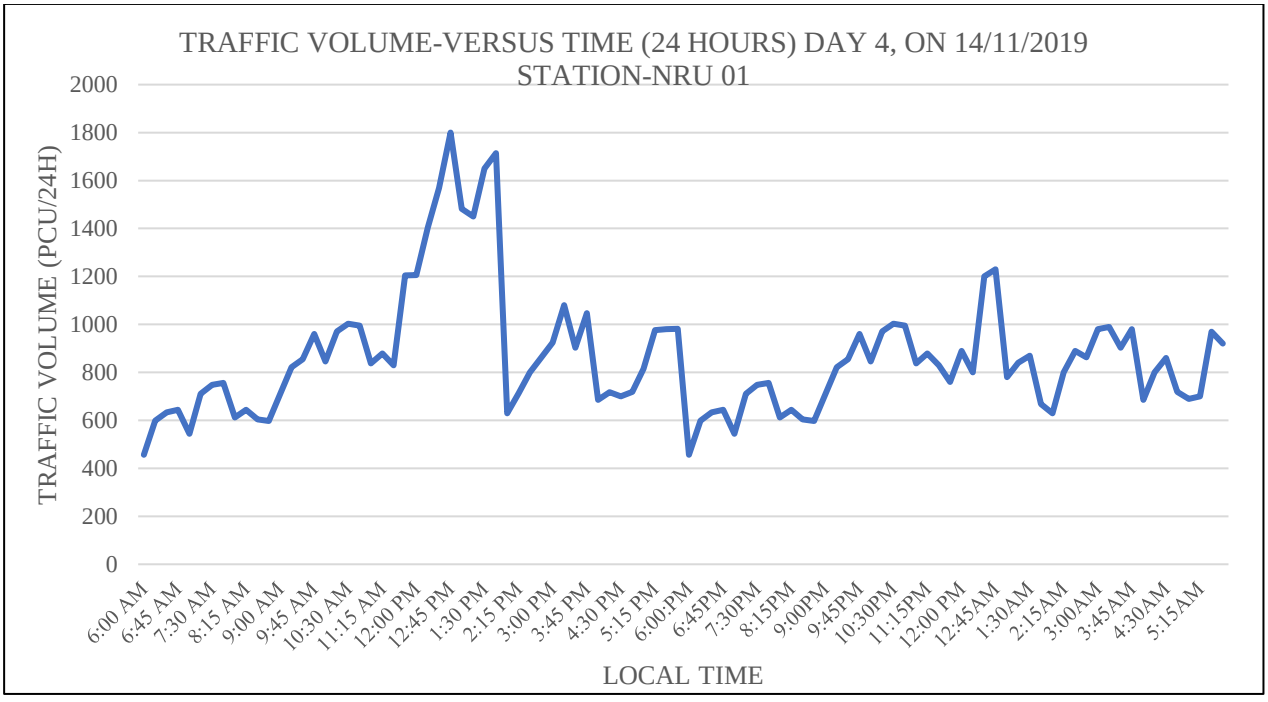


Figure 4.6: Day 4 - 24 Hours' Traffic Volume Variations Station NRU 01

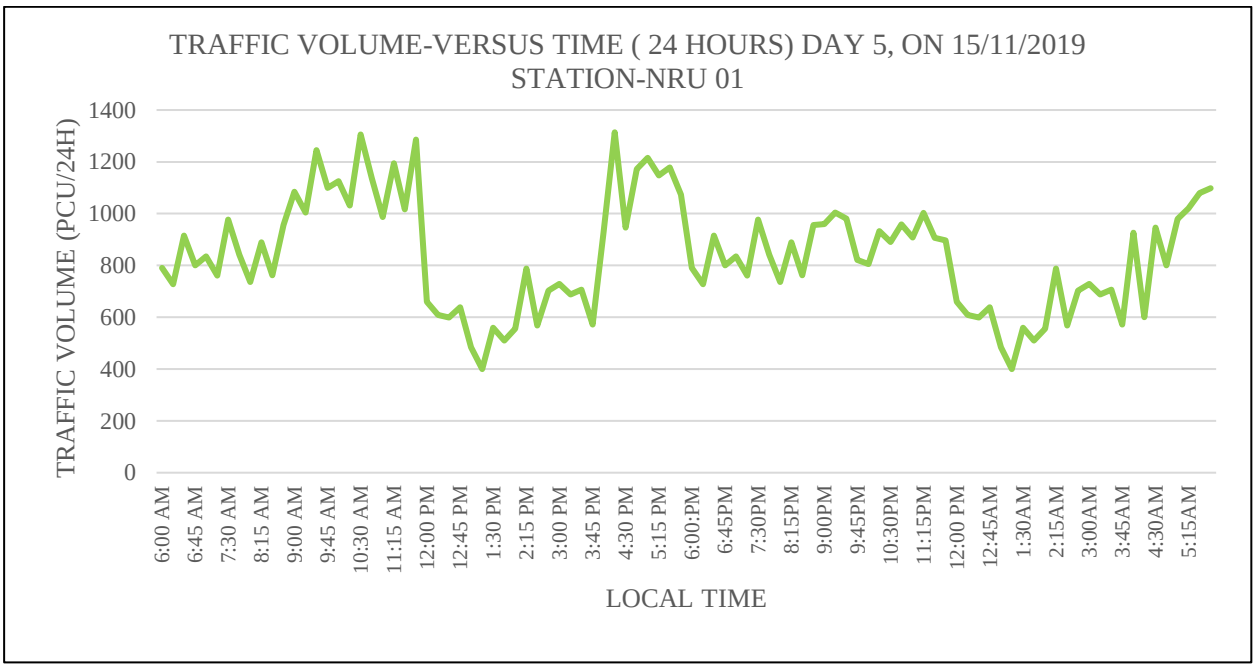


Figure 4.7: Day 5 - 24 Hours' Traffic Volume Variations Station NRU 01

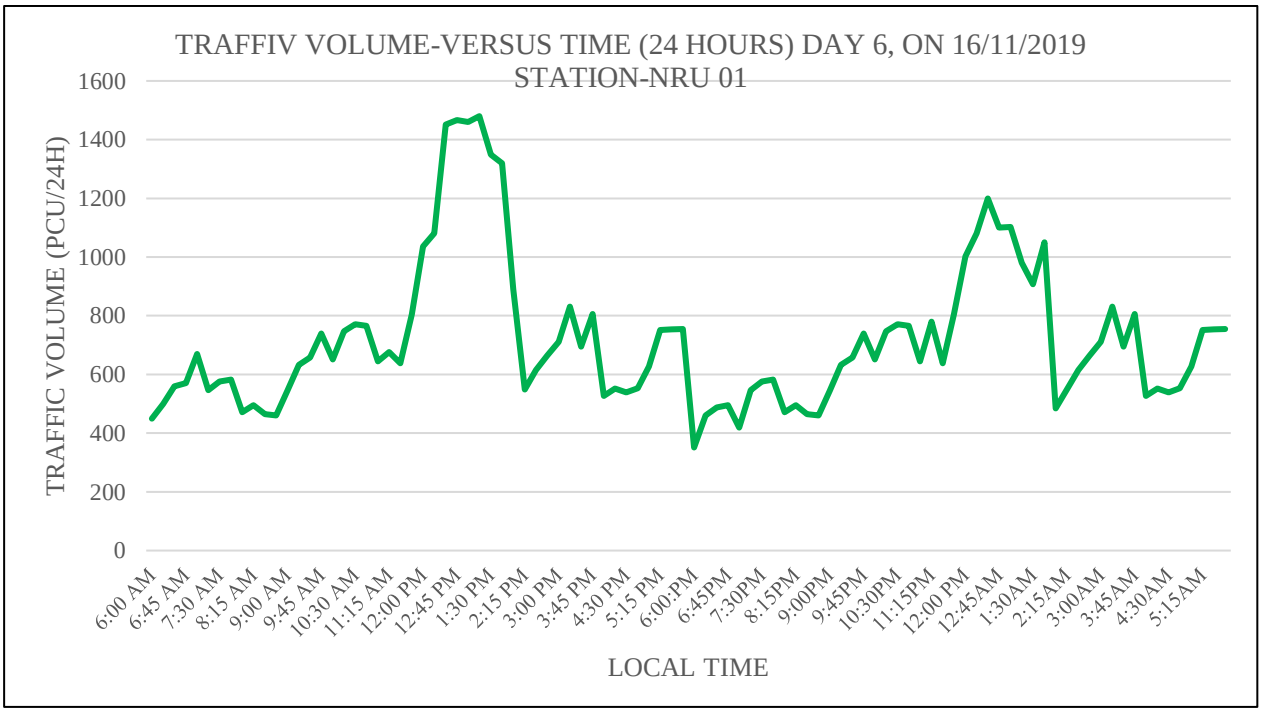


Figure 4.8: Day 6 - 24 Hours' Traffic Volume Variations Station NRU 01

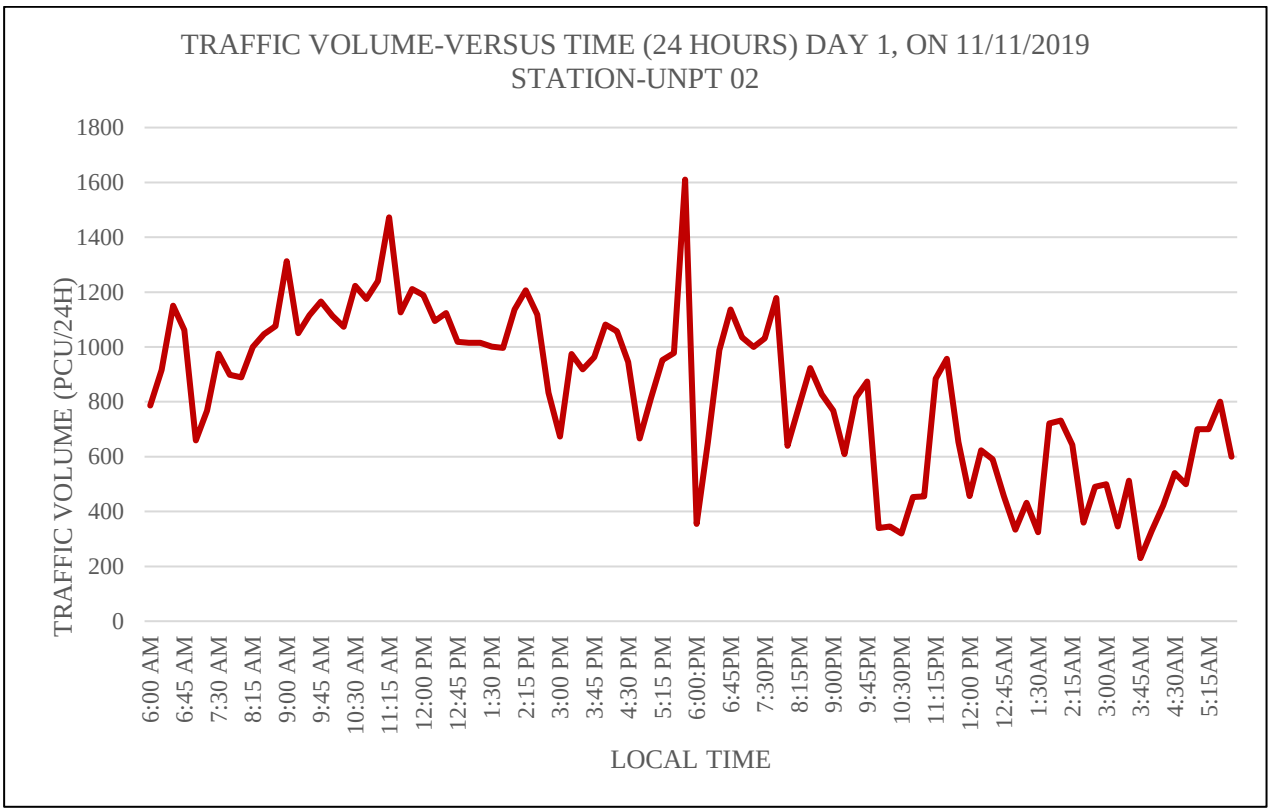


Figure 4.9: Day 1 - 24 Hours' Traffic Volume Variations Station UNPT 02

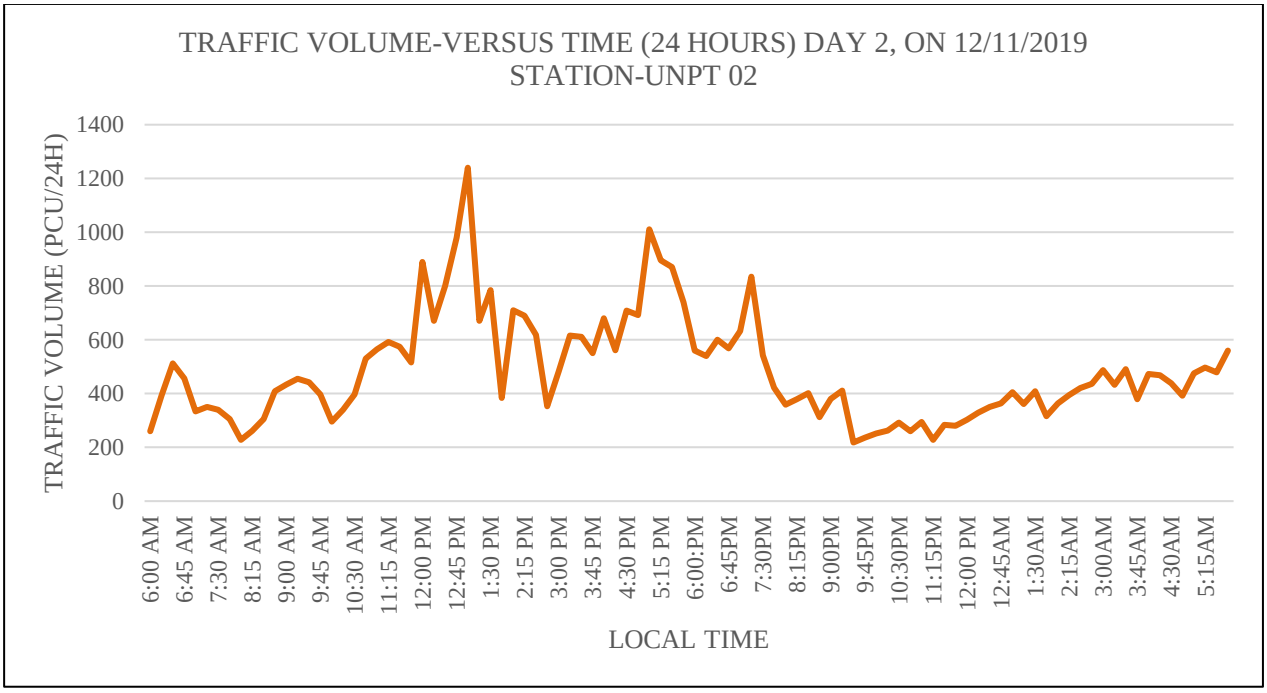


Figure 4.10: Day 2 - 24 Hours' Traffic Volume Variations Station UNPT 02

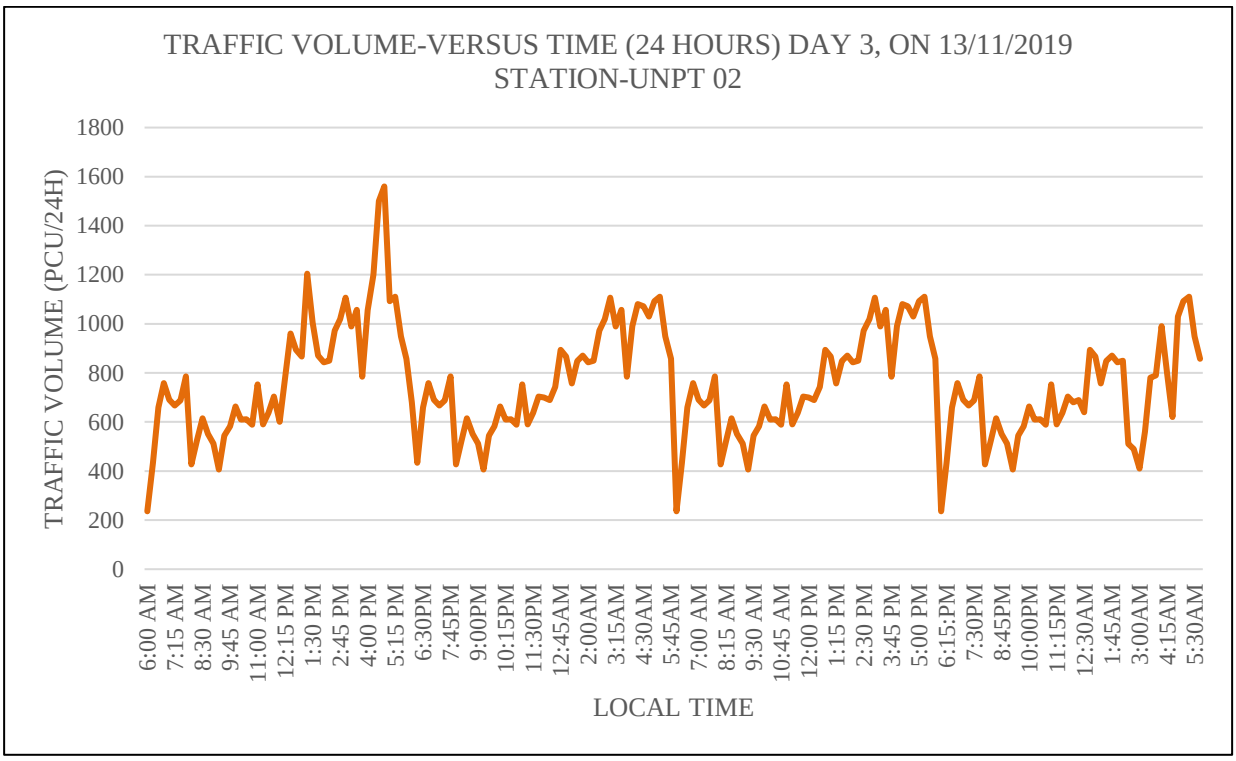


Figure 4.11: Day 3 - 24 Hours' Traffic Volume Variations Station UNPT 02

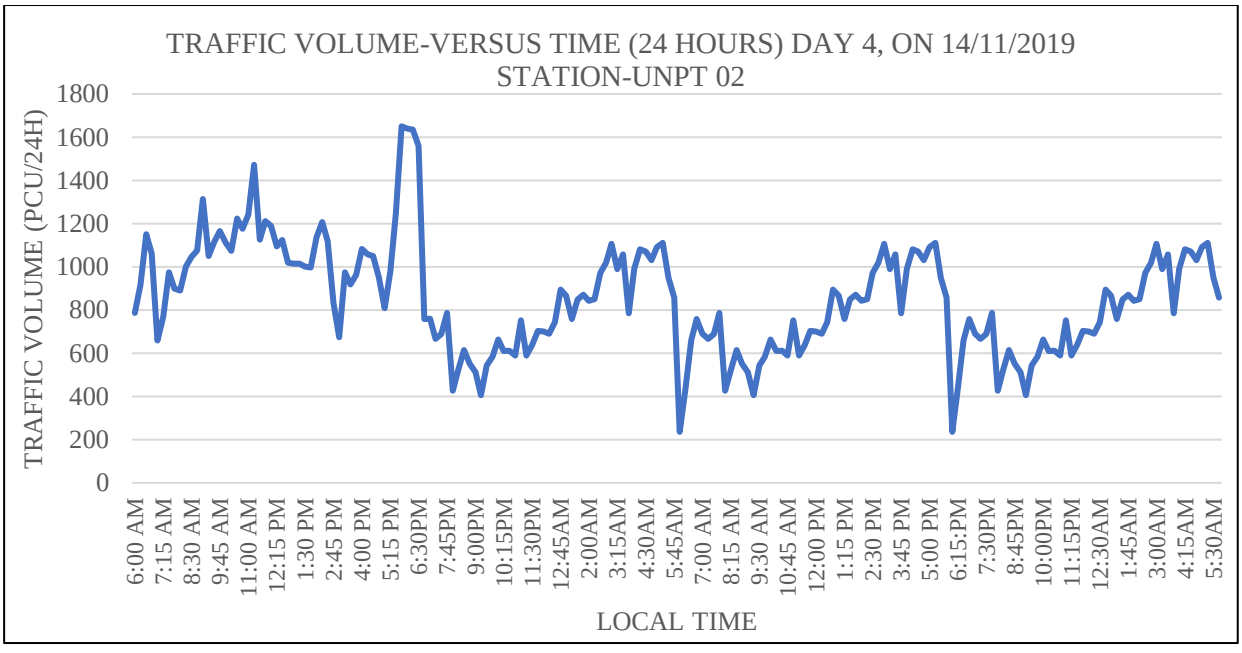


Figure 4.12: Day 4 - 24 Hours' Traffic Volume Variations Station UNPT 02

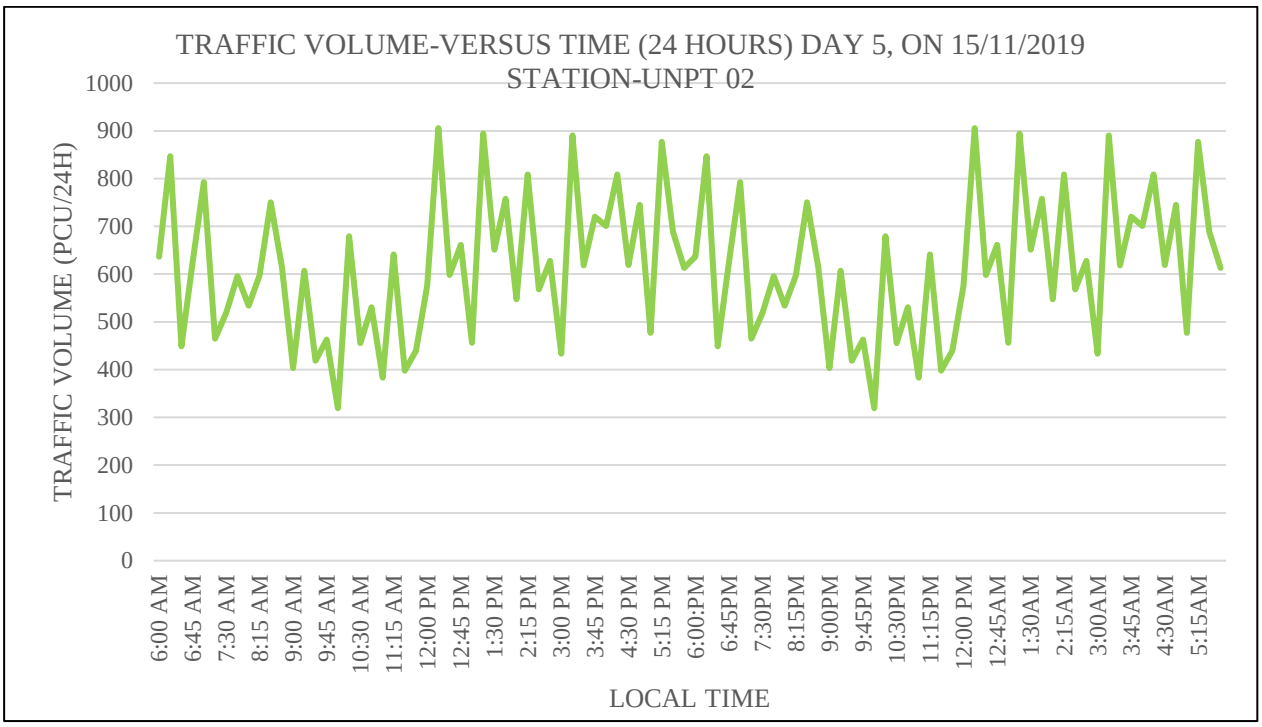


Figure 4.13: Day 5 - 24 Hours' Traffic Volume Variations Station UNPT 02

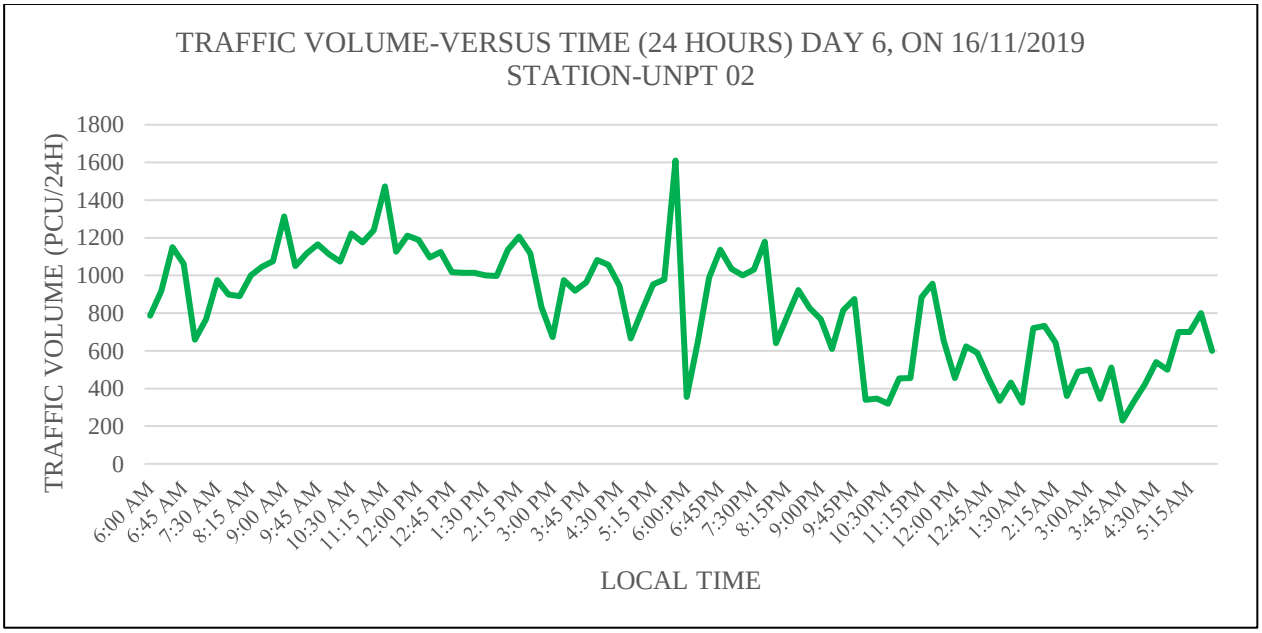


Figure 4.14: Day 6 - 24 Hours' Traffic Volume Variations Station UNPT 02

The Figures 4.15 and 4.16 show Traffic Daily Volumes for stations NRU 01 and UNPT 02 in each directions for the six days. Data used to derive the Figures are attached on Tables 4.3 and 4.4. There was a decrease trend of traffic volume throughout the week at Station NRU 01 while station UNTP 02 had traffic volume fluctuating throughout the week.

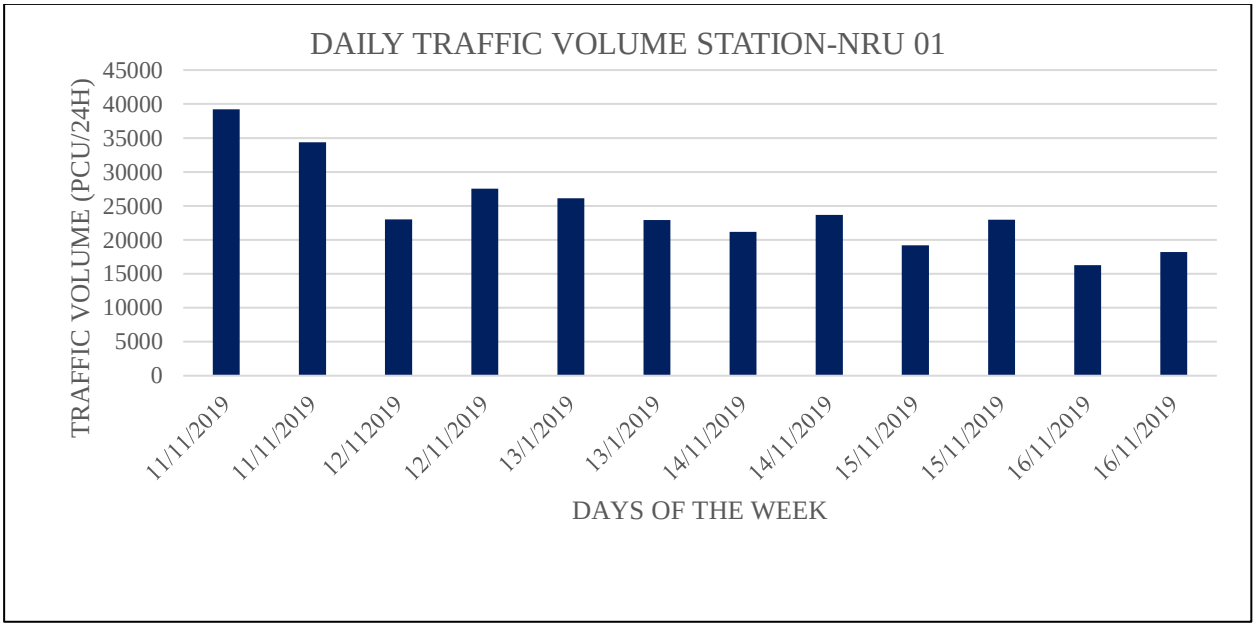


Figure 4.15: One Week Traffic Volume Variations Station NRU 01

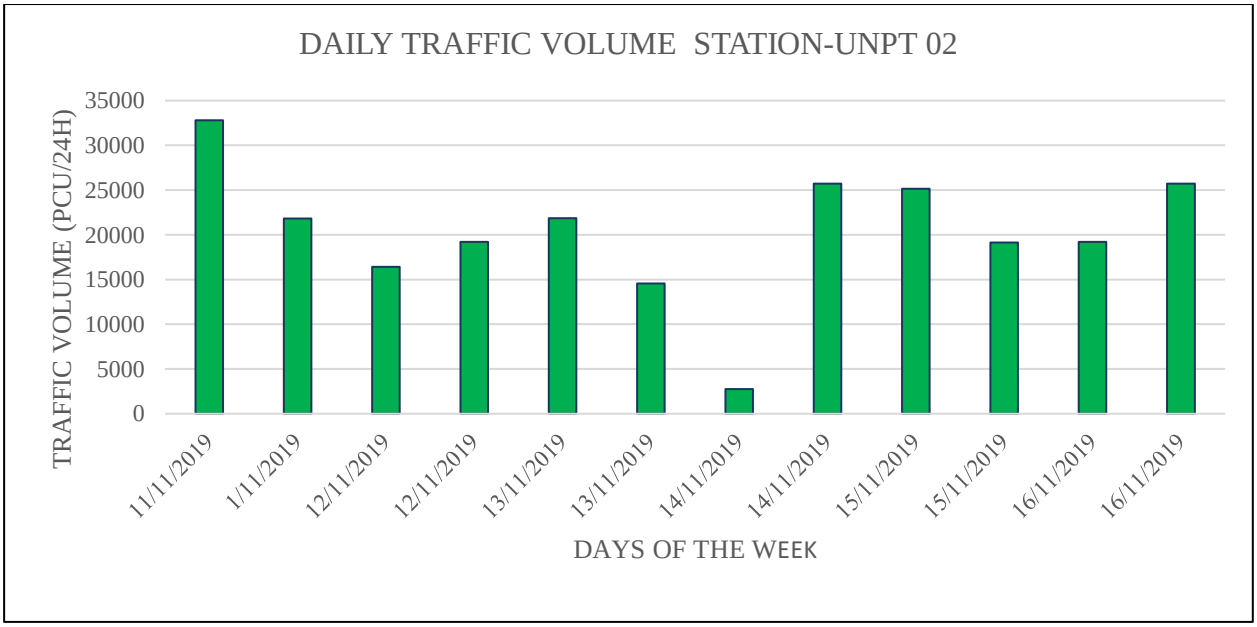


Figure 4.16: One Week Traffic Volume Variations Station UNPT 02

4.2 Traffic Analysis

Traffic mean speed was considered for the each 100 meters stretches near the two sampling points- arithmetic mean (average speed of all observed vehicle).

$$\bar{X} = \frac{\sum fv}{n}$$ Equation 4-1

Where:

f = Frequency of observation in the particular group

v = Mean speed of each group

n = Number of observations

From the analysis:

Volume Q, in vehicles per hour, Q max was 1450 vph.

Average speed in kilometers per hour (Kph) was 26 Kph with maximum speed of 52Kph.

The average daily traffic (ADT) for the two stations NRU 01 and UNPT 02 were 69783 and 60479 respectively.

Validation of Traffic Data Collected for Emissions

The sizes of the traffic samples for emissions analysis were checked against the sample size in Equation 3.1 for a 95% Confidence level ±10% error level.

The Figures 4.17 to 4.32 show the 24 hours' diurnal variations of emissions and particulate matter PM2.5 for the two Stations NRU 01 and UNPT 02 respectively, the data represented is attached in Appendix 1.

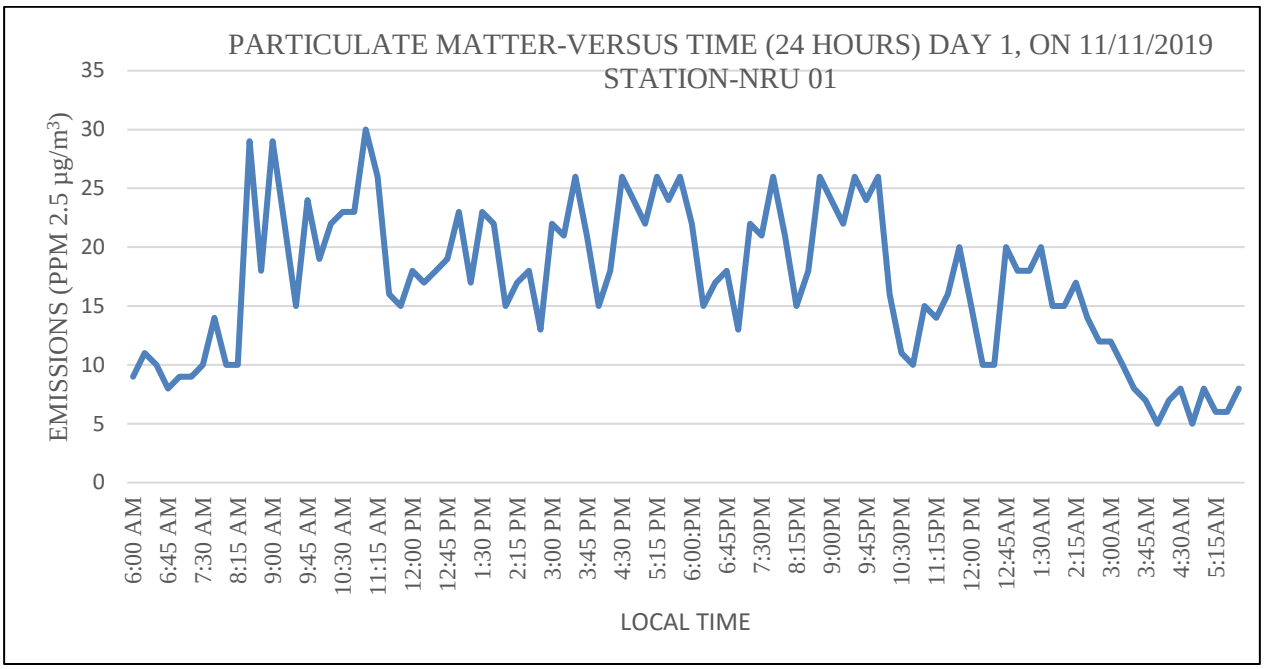


Figure 4.17: Day 1 Hourly Traffic Emission Variations Station NRU 01

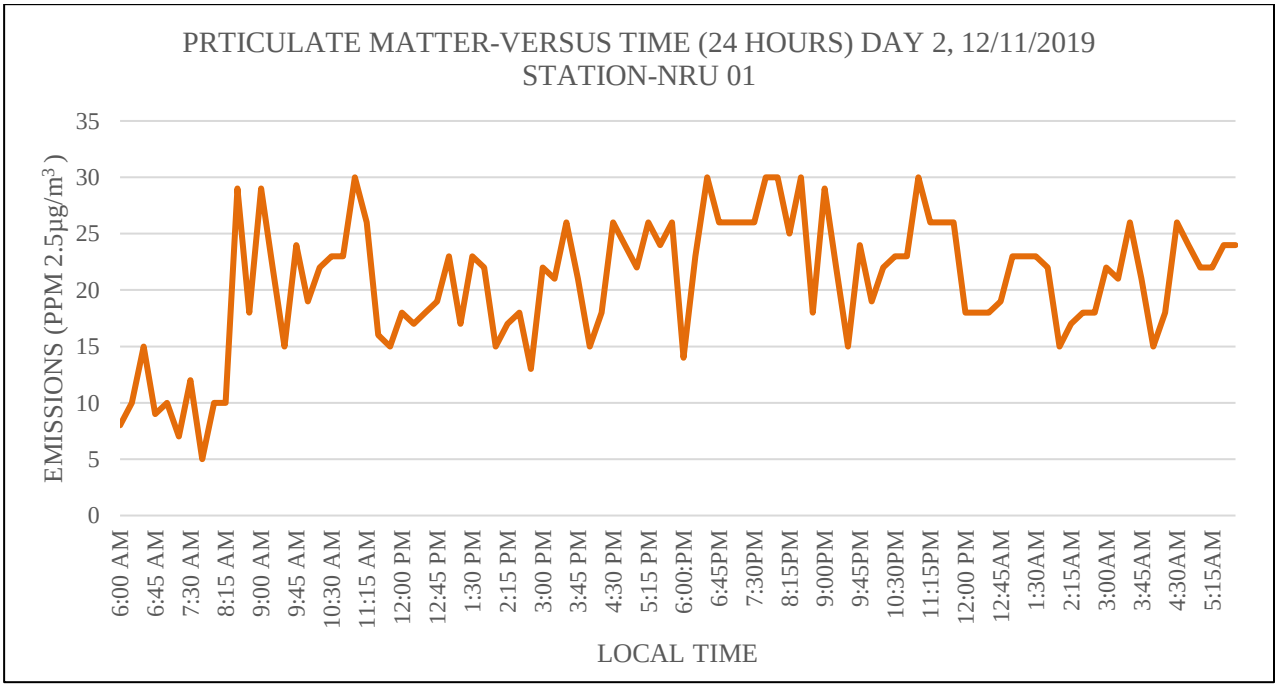


Figure 4.18: Day 2 Hourly Traffic Emission Variations Station NRU 01

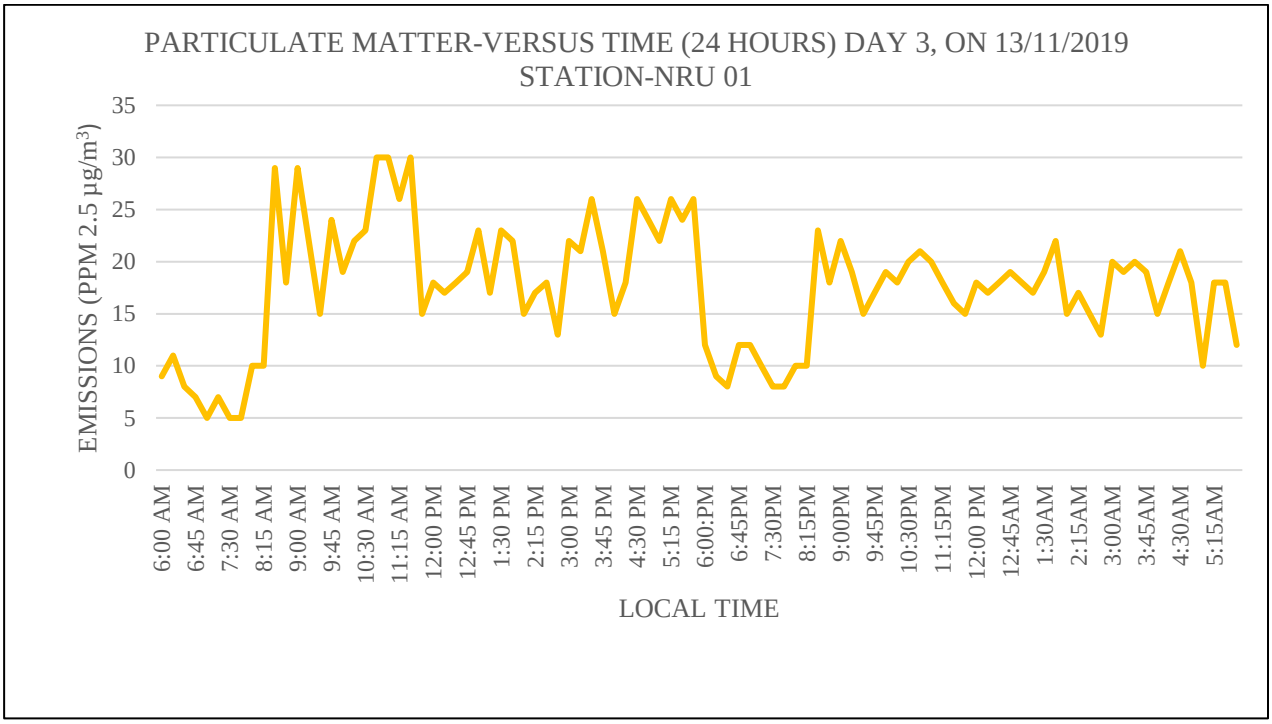


Figure 4.19: Day 3 Hourly Traffic Emission Variations Station NRU 01

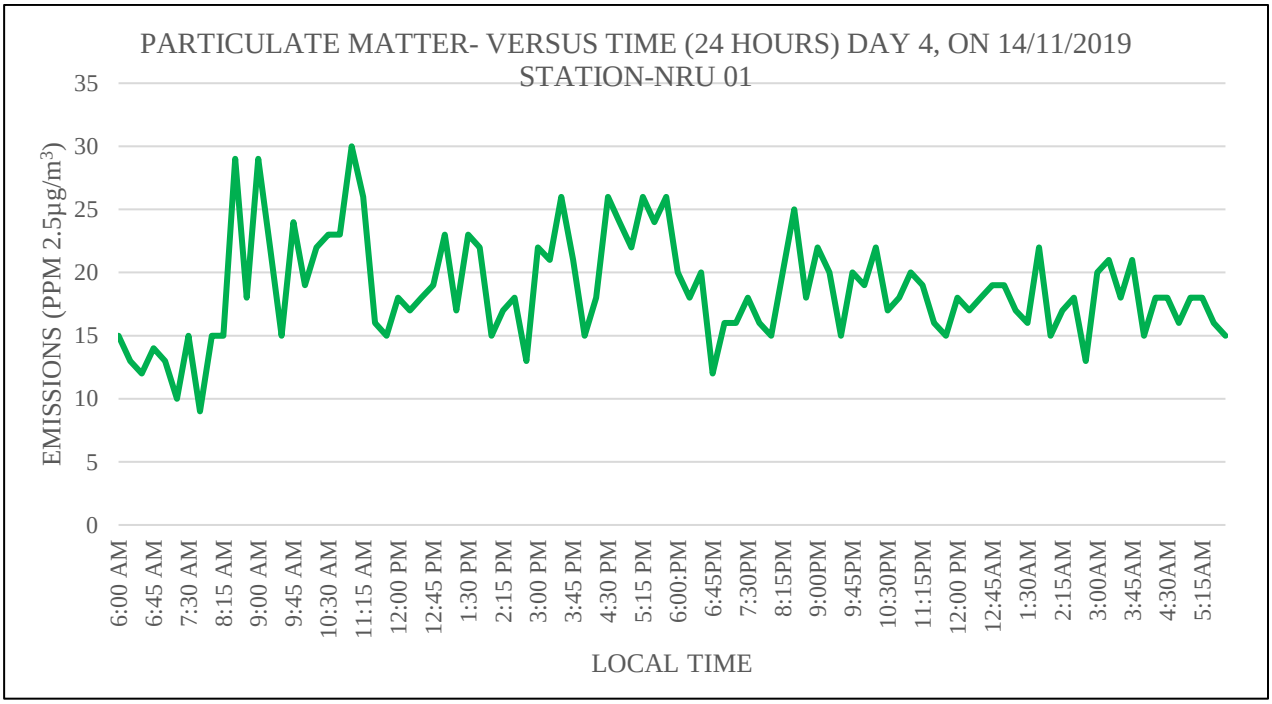


Figure 4.20: Day 4 Hourly Traffic Emission Variations Station NRU 01

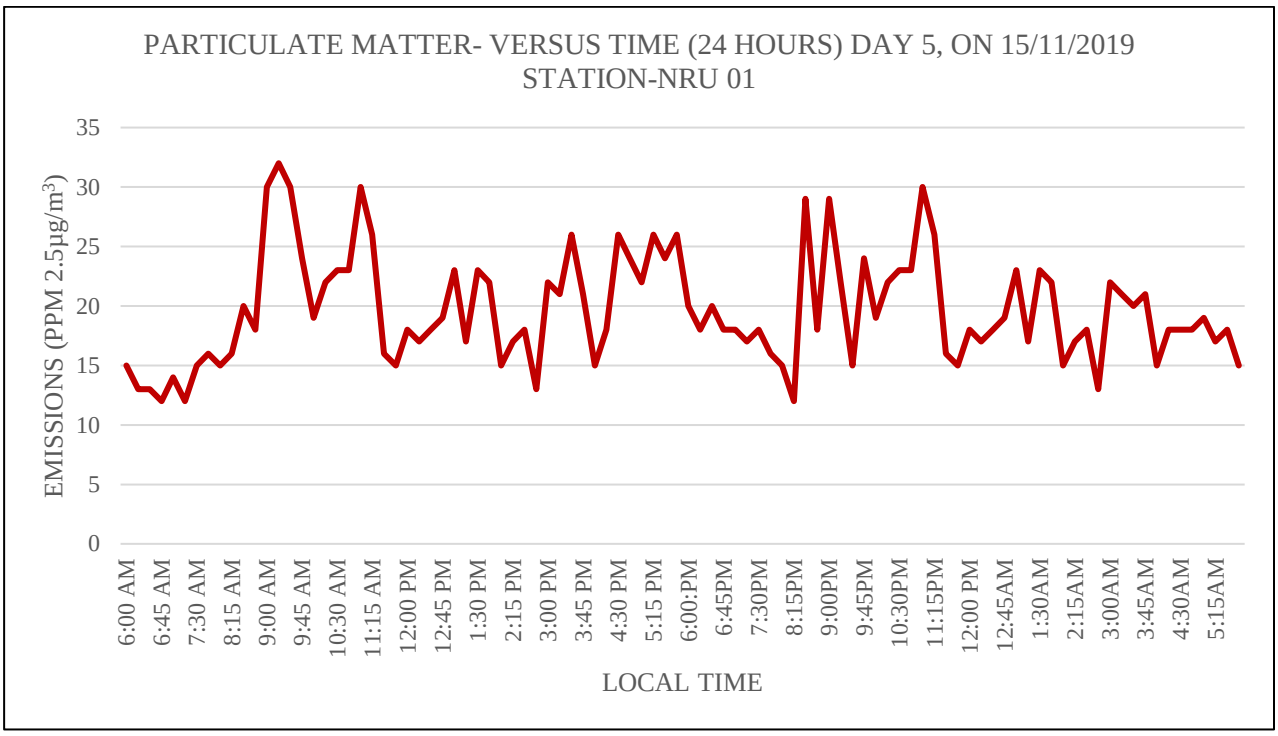


Figure 4.21: Day 5 Hourly Traffic Emission Variations Station NRU 01

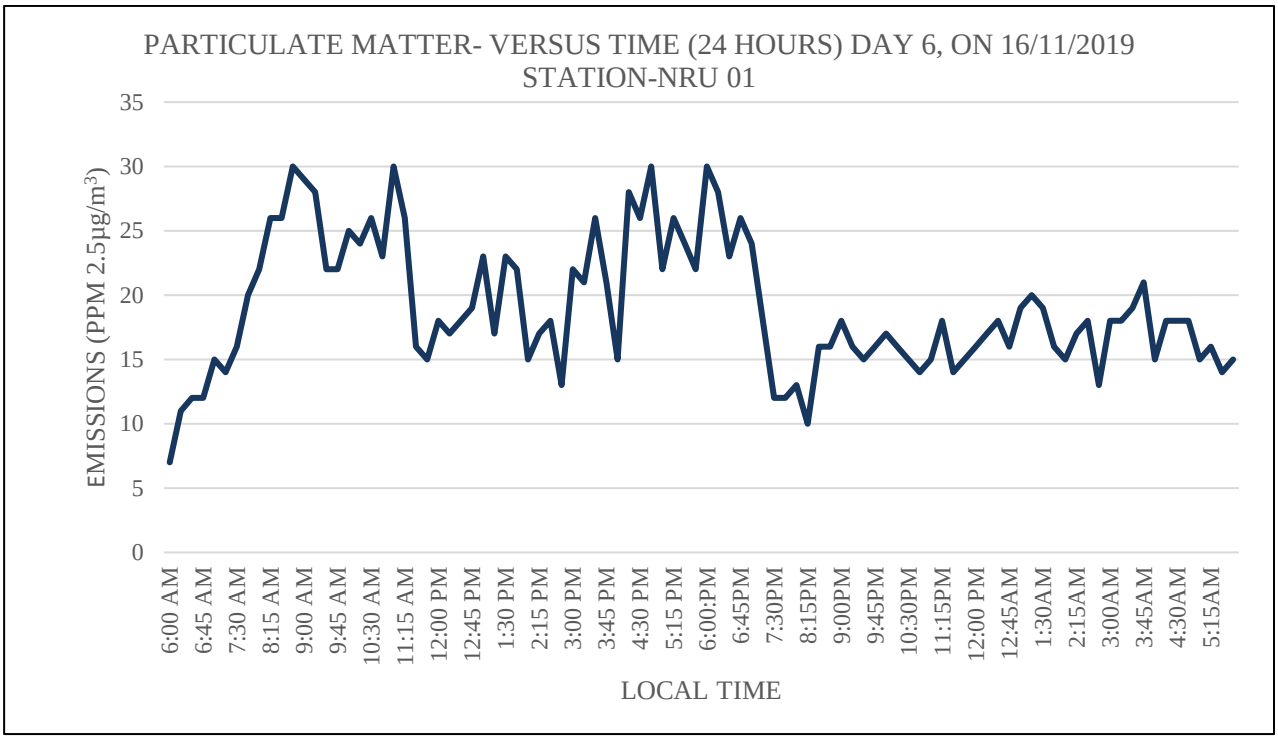


Figure 4.22: Day 6 Hourly Traffic Emission Variations Station NRU 01

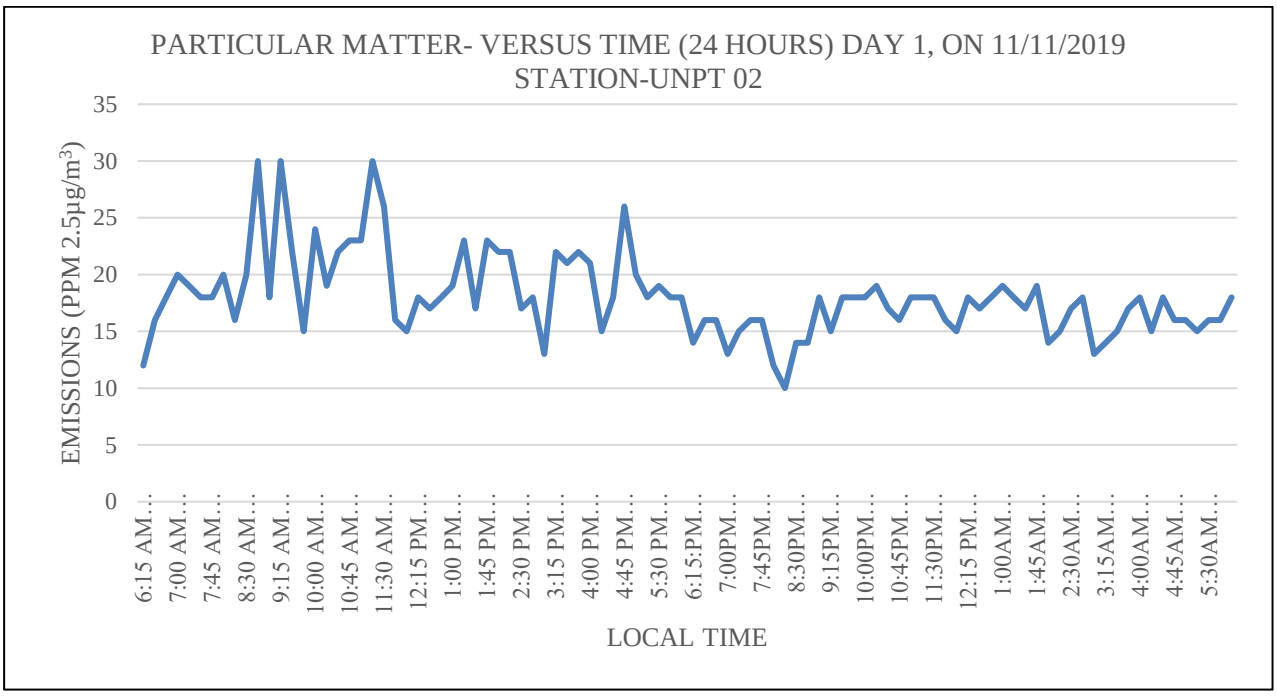


Figure 4.23: Day 1 Hourly Traffic Emission Variations Station UNPT 02

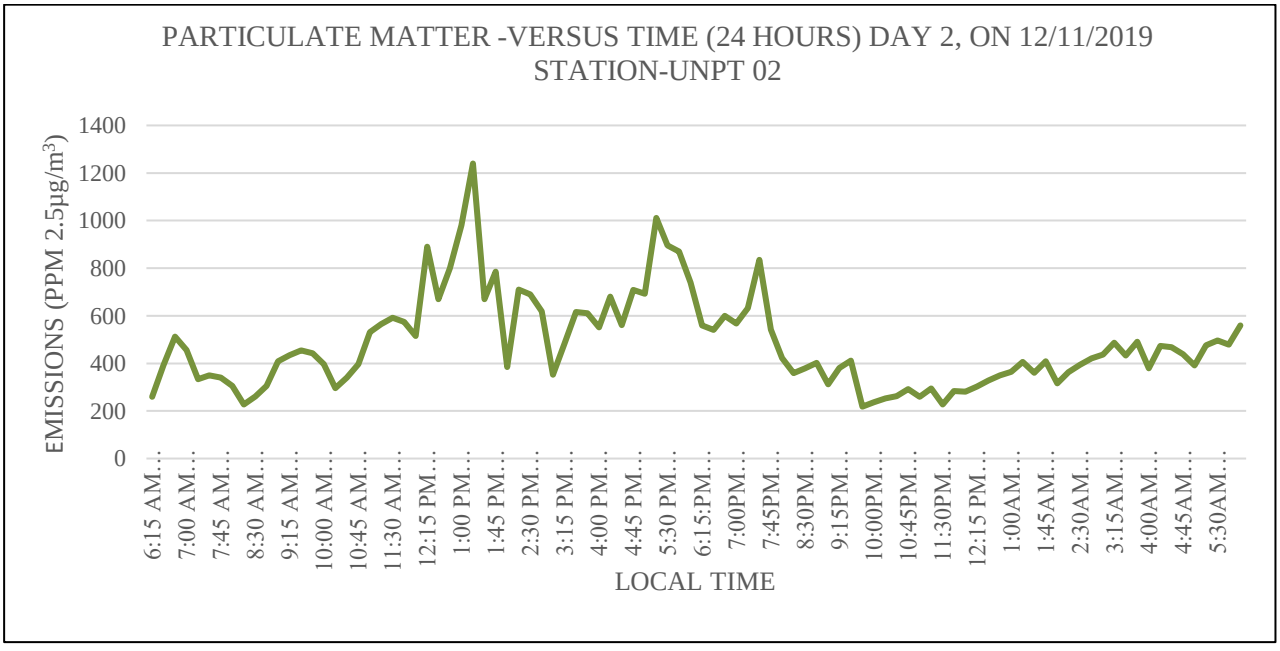


Figure 4.24: Day 2 Hourly Traffic Emission Variations Station UNPT 02

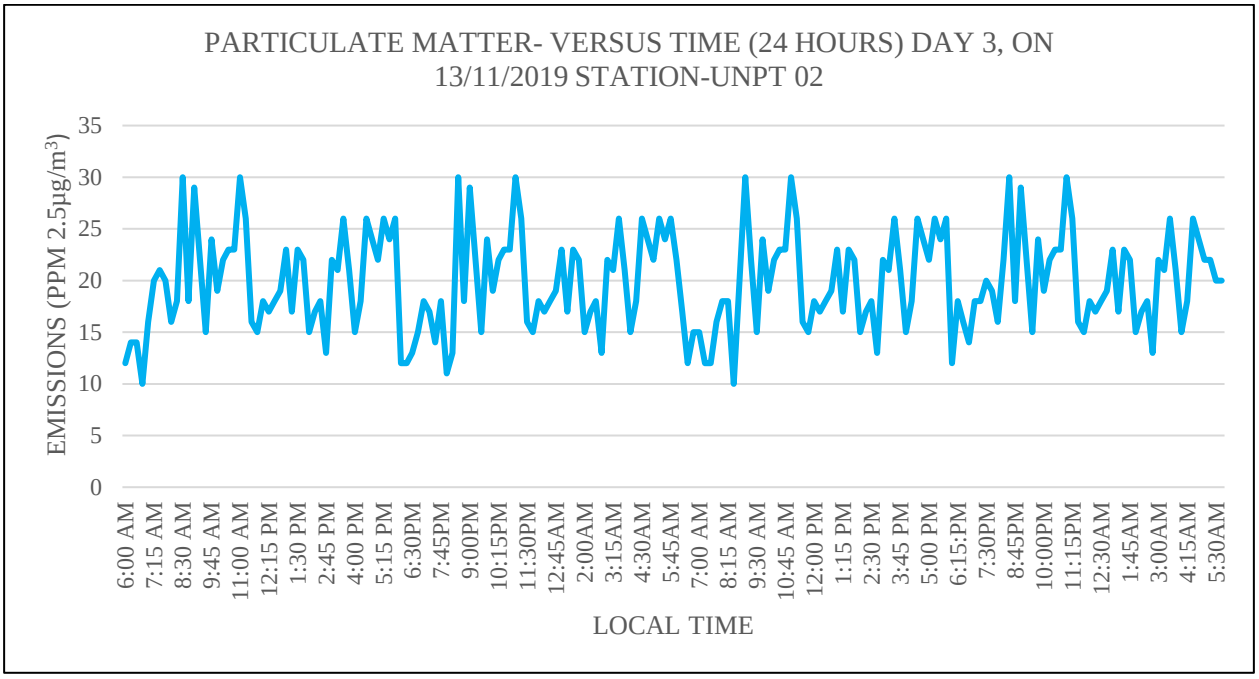


Figure 4.25: Day 3 Hourly Traffic Emission Variations Station UNPT 02

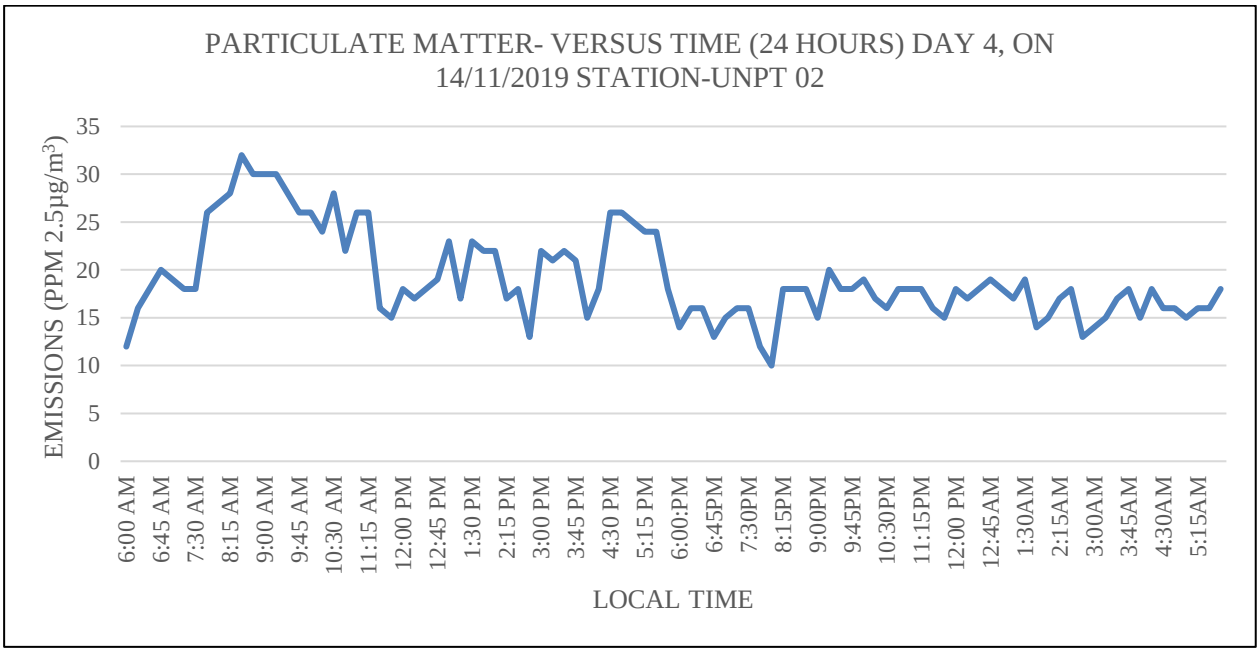


Figure 4.26: Day 4 Hourly Traffic Emission Variations Station UNPT 02

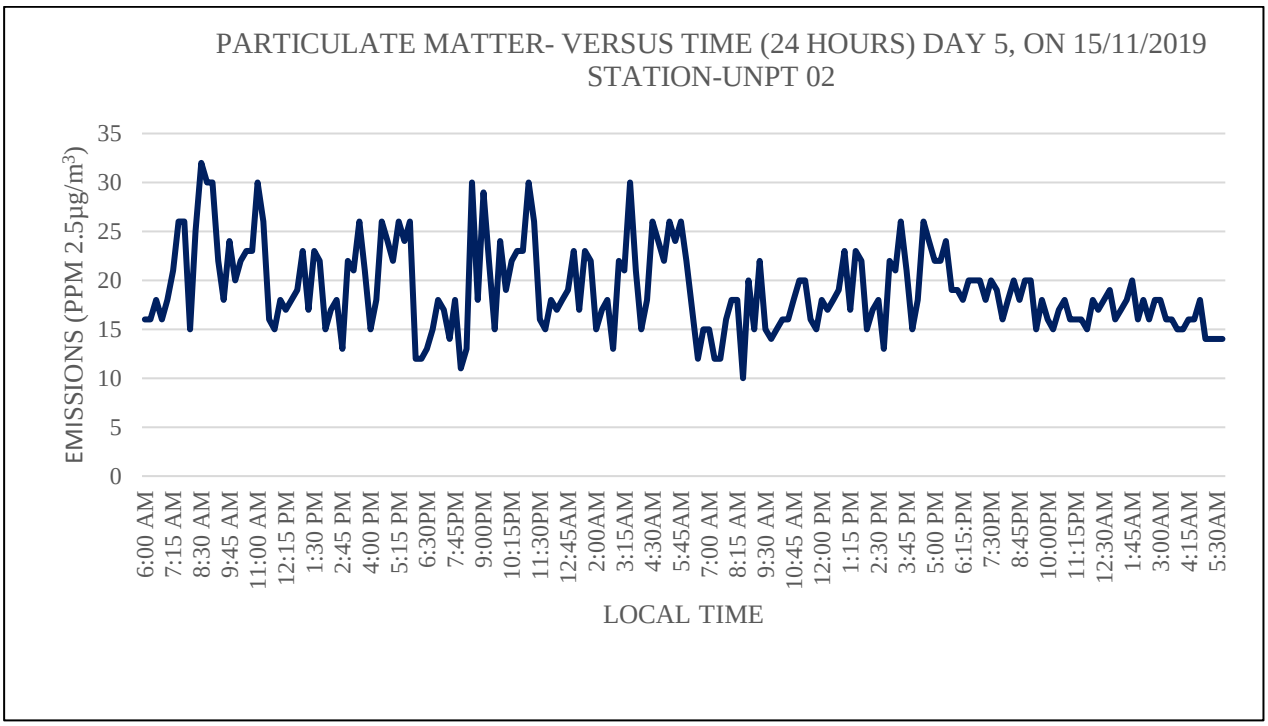


Figure 4.27: Day 5 Hourly Traffic Emission Variations Station UNPT 02

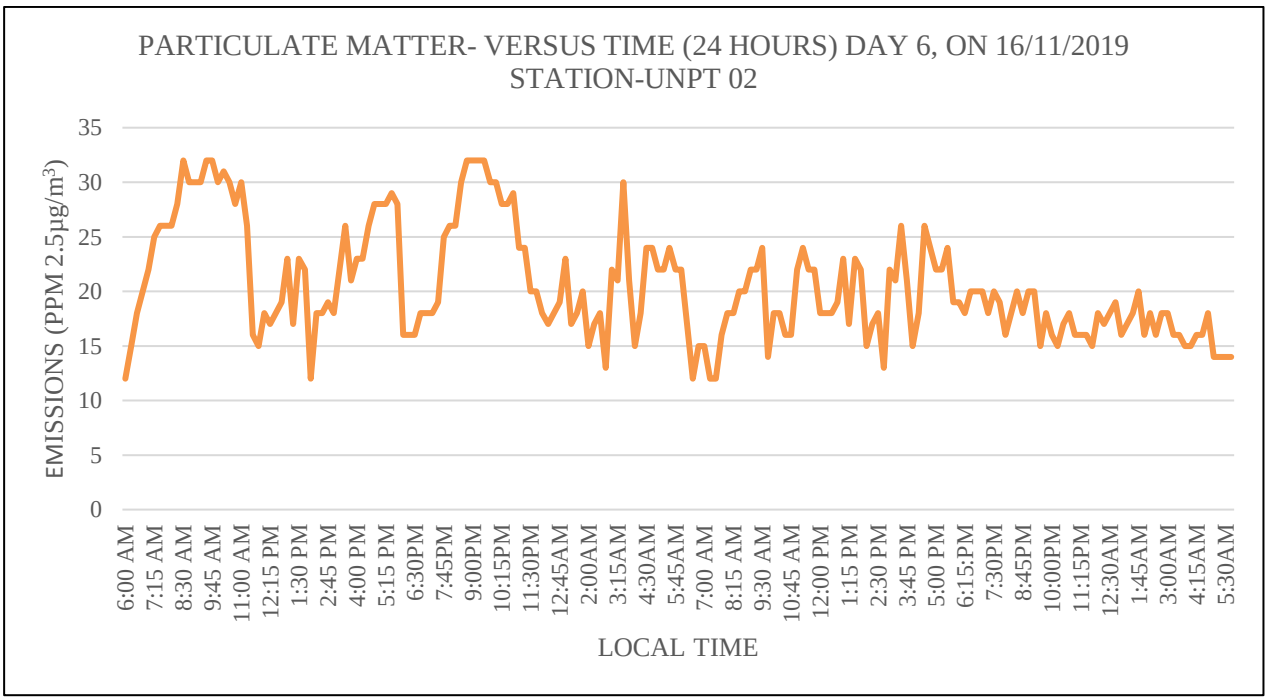


Figure 4.28: Day 6 Hourly Traffic Emission Variations Station UNPT 02

4.3 Analysis of Trends of Daily Traffic Volumes-Versus Emissions

Traffic volume data for both direction of travel for the two stations NRU 01 and UNPT 02 were plotted against emissions to obtain trends for comparison. Details of the Daily Traffic volume and measured parameters are attached in Appendix 1.

4.3.1 Daily Traffic Volumes-Versus Emissions for Station NRU 01

A summary of Daily Traffic Volume -versus Emissions for Nairobi railways underpass NRU 01 station in both direction - A (Approach from Nyayo Exit to CBD) and B (Approach from CBD Exit to Nyayo) are shown on Table 4.3 and Figures 4.29, 4.30 respectively.

Table 4.3: Daily Traffic Volume - versus Average 24 hours' sampling period Emissions Station NRU 01

	NEAR NAIROBI RAILWAY UNDERPASS STATION-NRU 01							
Day of the week	**NRU 01**	**Vehicle Volume**	**CO PPM**	**NOx PPM**	**SOx PPM**	**PM2.5 µg/m^3**	**HCHO mg/m^3**	**TVOC mg/m^3**
Monday	DAY 1A	39216	3.71	0.50	0.37	18.31	0.06	0.36
11/11/2019	DAY 1B	34361	3.73	0.50	0.37	18.47	0.06	0.36
Tuesday	DAY 2A	23016	3.73	0.50	0.37	18.47	0.06	0.36
12/11/2019	DAY 2B	27538	3.73	0.50	0.37	18.47	0.06	0.36
Wednesday	DAY 3A	26144	3.73	0.50	0.37	18.47	0.06	0.36
13/11/2019	DAY 3B	22907	3.73	0.50	0.37	18.47	0.06	0.36
Thursday	DAY 4A	21186	3.73	0.50	0.37	18.47	0.06	0.36
14/11/2019	DAY 4B	23658	3.73	0.50	0.37	18.47	0.06	0.36
Friday	DAY 5A	19180	3.74	0.51	0.38	18.83	0.06	0.35
15/11/2019	DAY 5B	22948	3.73	0.50	0.37	18.47	0.06	0.36
Saturday	DAY 6A	16297	3.73	0.50	0.37	18.47	0.06	0.36
16/11/2019	DAY 6B	18198	3.73	0.50	0.37	18.47	0.06	0.36

NB: A (Approach from Nyayo Exit to CBD) and B (Approach from CBD Exit to Nyayo)

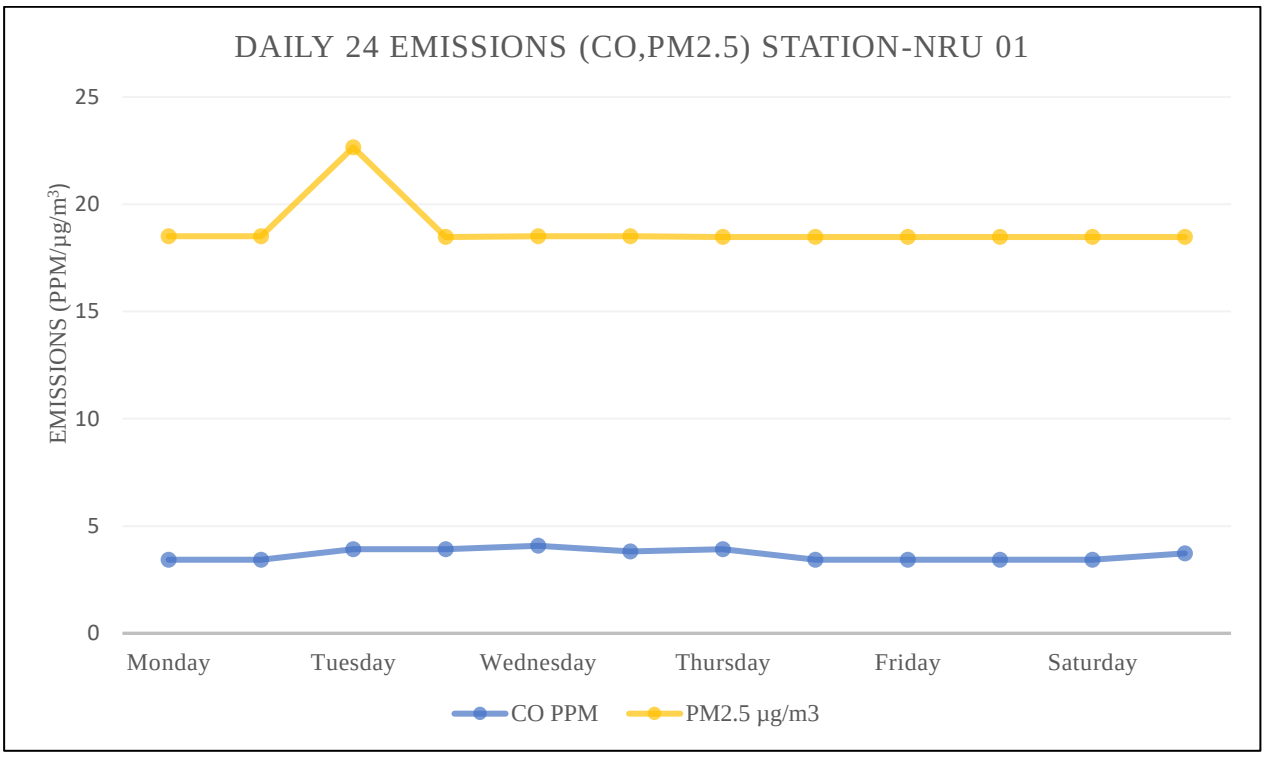


Figure 4.29: Daily Traffic Emissions Station NRU 01

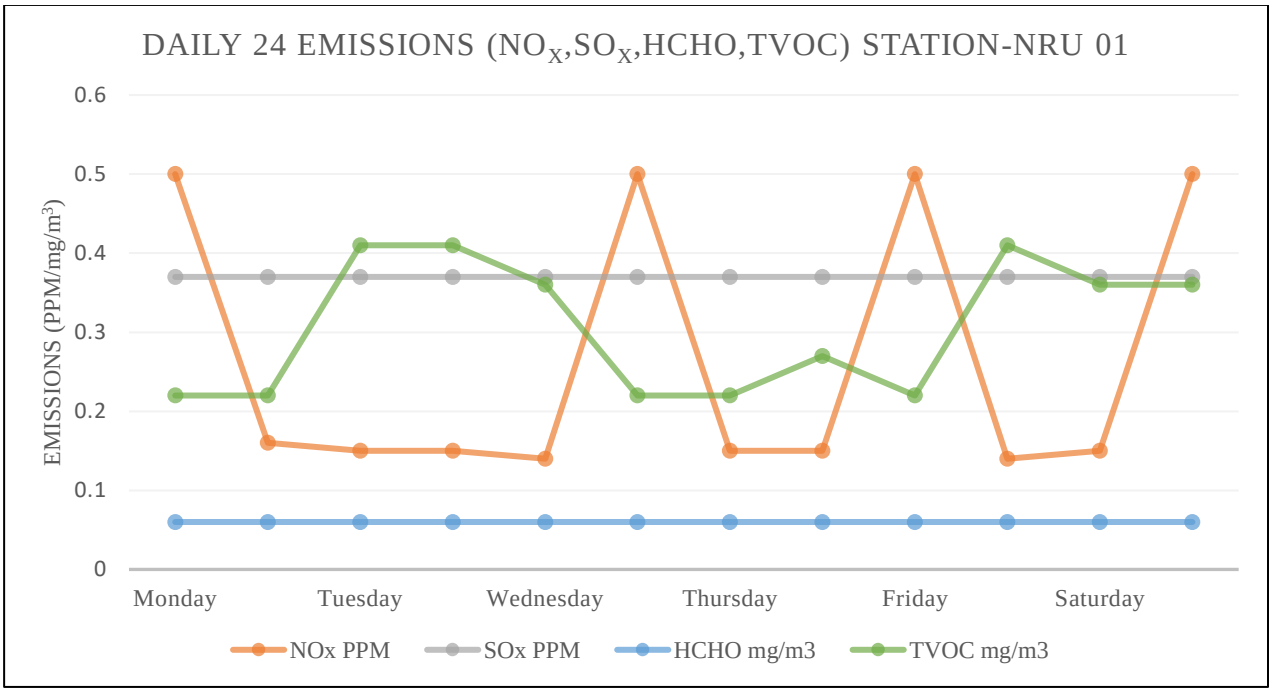


Figure 4.30: Daily Traffic Emissions Station NRU 01

A summary of Traffic Volume -Versus Emissions for Nairobi railways underpass station NRU 01

Table 4.3 presents the overall results of the ambient levels PM2.5, HCHO, SOx, CO, NOx and TVOC. On the basis of 15 minutes observations from the study.

The PM2.5 levels were found to be higher than the recommended WHO guidelines; the levels were higher in the mid mornings and evenings hours when the motor vehicles movements were higher.

The PM2.5 levels were higher on Tuesday at 22.67mg/m^3 with 18.47mg/m^3 averagely for the rest of the days of the week.

The study recorded CO average of 3.72ppm for NRU 01 which was within the WHO tolerable levels of 10mg/m^3.

CO values at NRU 01 was attributed to high traffic flow of vehicles with reduced wind speed averagely 3m/s during the study.

PM2.5. HCHO, SOx, CO and TVOC, all decreased with decrease in vehicle volume; however, NOx values ranged between 0.15 to 0.5 µg/m^3.

HCHO levels were averagely 0.06mg/m^3 throughout the week for NRU 01.

Values obtained for this study compared to those of other similar studies reported in the literature review, Table 2.6 and 2.7 present the relevant data of the ambient concentration of the parameters studied.

4.3.2 Daily traffic Volumes-Versus Emissions for Station UNPT 02

A summary of Traffic Volume -versus Emissions for University of Nairobi Pedestrian Tunnel UNPT 02 station in both direction - A (Approach from CBD Exit to West lands) and B (Approach from West lands Exit to CBD) are shown on Table 4.4 and Figures 4.31, 4.32 respectively.

Table 4.4: Daily Traffic Volume - Versus Average 24 Hours Sampling Period Emissions Station UNPT 02

NEAR UNIVERSITY OF NAIROBI PEDESTRIAN TUNNEL STATION-UNPT 02								
Day of the week	**Station UNPT 01**	**Vehicle Volume**	**CO PPM**	**NOx PPM**	**SOx PPM**	**PM2.5 µg/m^3**	**HCHO mg/m^3**	**TVOC mg/m^3**
Monday 11/11/2019	DAY 1A	32806	3.43	0.50	0.37	18.51	0.06	0.22
	DAY 1B	21821	3.43	0.16	0.37	18.51	0.06	0.22
Tuesday 12/11/2019	DAY 2A	16403	3.92	0.15	0.37	22.65	0.06	0.41
	DAY 2B	19215	3.92	0.15	0.37	18.47	0.06	0.41
Wednesday 13/11/2019	DAY 3A	21870	4.08	0.14	0.37	18.51	0.06	0.36
	DAY 3B	14547	3.82	0.50	0.37	18.51	0.06	0.22
Thursday 14/11/2019	DAY 4A	2765	3.92	0.15	0.37	18.47	0.06	0.22
	DAY 4B	25709	3.43	0.15	0.37	18.47	0.06	0.27
Friday 15/11/2019	DAY 5A	25143	3.43	0.50	0.37	18.47	0.06	0.22
	DAY 5B	19134	3.43	0.14	0.37	18.47	0.06	0.41
Saturday 16/11/2019	DAY 6A	19215	3.43	0.15	0.37	18.47	0.06	0.36
	DAY 6B	25709	3.73	0.50	0.37	18.47	0.06	0.36

NB: A (Approach from CBD Exit to West lands) and B (Approach from West lands Exit to CBD)

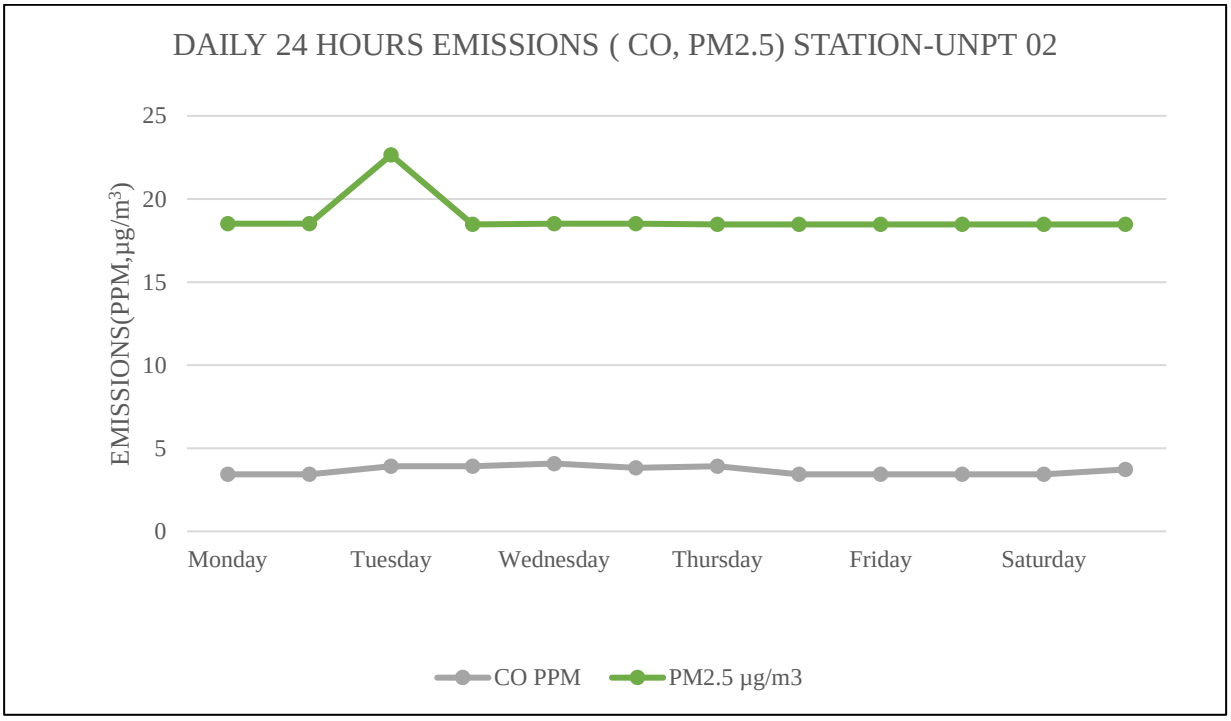


Figure 4.31: Daily Traffic Emissions Station UNPT 02

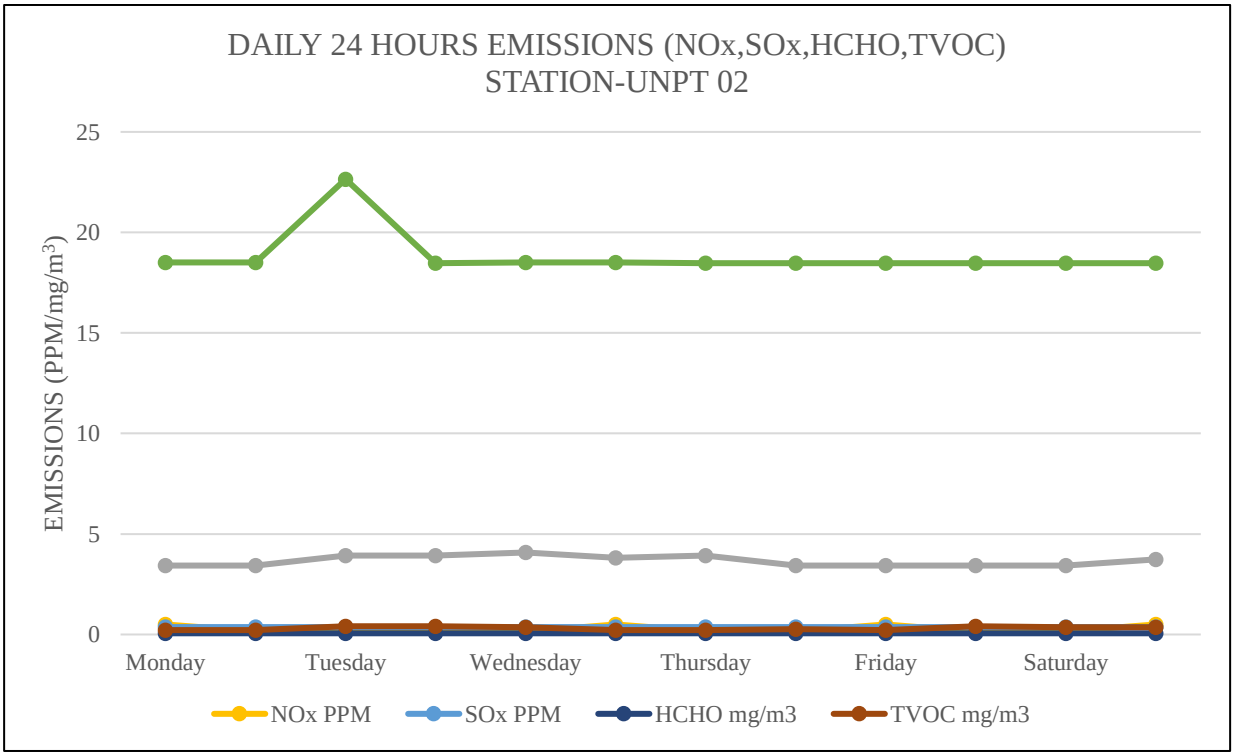


Figure 4.32: Daily Traffic Emissions Station UNPT 02

Table 4.4 presents the overall results of the ambient levels PM2.5, HCHO, SOx, CO, NO_x and TVOC. On the basis of 15 minutes observations from the study.

The PM2.5 levels were found to be higher than the recommended WHO guidelines; the levels were higher in the mid mornings and evenings hours when the motor vehicles movements were higher.

The PM2.5 levels were higher on Tuesday at 22.67mg/m^3 with 18.47mg/m^3 averagely for the rest of the days of the week.

The study recorded CO average of 3.76ppm which was within the WHO tolerable levels of 10mg/m^3.

CO values at UNTP 02 were attributed to high traffic flow of vehicles with reduced wind speed averagely 3m/s during the study.

PM2.5. HCHO, SOx, CO and TVOC, all decreased with decrease in vehicle volume; however, NOx values ranged between 0.15 to 0.5 µg/m^3.

HCHO levels were averagely 0.06mg/m^3 throughout the week for UNPT 02.

Values obtained for this study compared to those of other similar studies reported in the literature review, Table 2.6 and 2.7 present the relevant data of the ambient concentration of the parameters studied.

A summary of Traffic Emissions for Nairobi Uhuru Highway Corridor for the two Stations NRU 01 and UNPT 02

Table 4.5 and 4.6 presents in summary the results of ambient emissions of CO, SO_2, NOx, HCHO, TVOC, and PM2.5 at two measuring stations namely road side near Nairobi railways underpass NRU 01 and near the University of Nairobi pedestrian tunnel UNPT 02. On the basis of 15 minutes measured observations the lowest value of PM2.5 at station NRU 01 was at 18.39µg/m^3 and the highest being station UNPT 02 at 18.56µg/m^3 which were found to be above the tolerable level of 10mg/$m^3$of WHO. It was additionally found that CO values were 3.72ppm for NRU 01 and 3.76ppm for UNPT 02. SOx for the two stations NRU 01 and UNPT 02 were 0.37ppm. Volatile Organic Compounds (TVOC) for the stations were highest at NRU 01 at 0.36ppm and least at UNPT 02 at 0.32ppm. Nitrogen dioxide (NO_2) was least at UNPT 02 at 0.32ppm and highest at

NRU 01 at 0.50ppm.Sulphur dioxide (SO_2) was 0.37ppm for the two Stations NRU 01 and UNPT 02.

Table 4.5: Peaks of Air Quality PM2.5 (Particulate Matter Levels)

Sampling Location	**Dust Concentration Levels PM2.5 (Mg/m^3)**	**Tolerable Levels PM2.5 (Mg/m^3)**	**Remarks**
Near railways underpass Station NRU 01	18.39	10	Above the Limit
University of Nairobi pedestrian tunnel Station UNPT 02	18.56	10	Above the Limit

Table 4.6: Peaks of Air Quality (Emission Level)

Location	**Carbon Monoxide (CO)**	**Sulphur Dioxide (SO_2)ppm**	**Volatile Organic Compounds (TVOC)**	**Nitrogen Dioxide (NO_2)ppm**
Station NRU 01	3.72	0.37	0.36	0.50
Station UNPT 02	3.76	0.37	0.32	0.32
TLV	10ppm	$0.125mg/m^3$	70ppm	$0.150mg/m^3$
Comments	Within the limit	Above the limit	Within the limit	Above the limit

4.4 Discussions

From the obtained results at the two sites of data collection, there was an indication of an averagely values of pollution. It can be deduced that the site NRU 01, had the lowest value of ADT 69783 followed by, UNPT 02 with ADT 60479. The high levels of PM2.5, NOx and SOx measured for the NRU 01 and UNPT 02 could be attributed to the high traffic volume with reduced speeds of 26 Kph leading to high ambient air pollutants.

Comparison of Emissions with WHO Guidelines

The results analyzed for stations NRU 01 and UNPT 02 were within the limits of WHO standards for ambient emissions for CO 10ppm, TVOC 70ppm but above the limits for SOx 0.125mg/m^3, NOx 0.150mg/m^3 and PM2.5ppm of 10mg/m^3 (WHO 2012) Diesel Engine Exhausted Carcigenic in Cancer IAIRO (Ed), World Health Organization).

Effect of Wind Speed and Wind Direction on Pollutants

Generally, the variability of pollutant concentration levels strongly depends on the origin of the air masses arriving at the sampling site and the concentration of pollutants in the ambient air influenced by the direction from which wind blew. During this study, the wind direction was predominantly from east to west with an average speed of 3m/s.

The Table 4.7 shows the average weather parameters in 24 hours during the data collection period for the stations NRU 01 and UNPT 02 sampling stations.

Table 4.7: Average Weather Parameters in 24 Hours

Parameters	Wind speed (m/s)	Temperature (°C)
NRU 01	3.566	18.3
UNPT 02	2.365	22.21

4.5 Correlation of Traffic Volume with CO, NO_X. SO_X, PM2.5, HCHO and TVOC for Station NRU 01 and UNPT 02.

Traffic flow showed a significant influence on the emissions and particulate matter, observations were made in ambient air at the two stations NRU 01 and UNPT 02. In the correlation analysis, all the six pollutants concentrations and their corresponding traffic numbers were considered. The Table 4.8 and Figures 4.33 to 4.44 show the Correlation Matrix for stations NRU 01 and UNPT 02. These Correlations were significant for all parameters analyzed for the two Stations raging between R^2(0.766-0.861) for Linear Trend Lines and R^2(0.817-0.984) for Curvilinear Trend Line. Linear Correlations (R^2) were less than the Curvilinear (R^2) Correlations as illustrated on Table 4.8.

Table 4.8: Comparison of Traffic Volume and Emissions Correlation Matrix-Linear and Curvilinear Tread Lines for the Station NRU 01 and UNPT 02

	Linear Trend Lines (R^2) Station NRU 01	Linear Trend Lines (R^2) Station UNPT 02	Curvilinear Trend Lines (R^2) Station NRU 01	Curvilinear Trend Lines (R^2) Station UNPT 02
CO	0.850	0.835	0.851	0.855
NOx	0.766	0.823	0.837	0.823
SOx	0.817	0.836	0.817	0.836
PM2.5	0.843	0.851	0.946	0.851
HCHO	0.803	0.836	0.916	0.836
TVOC	0.827	0.841	0.870	0.851

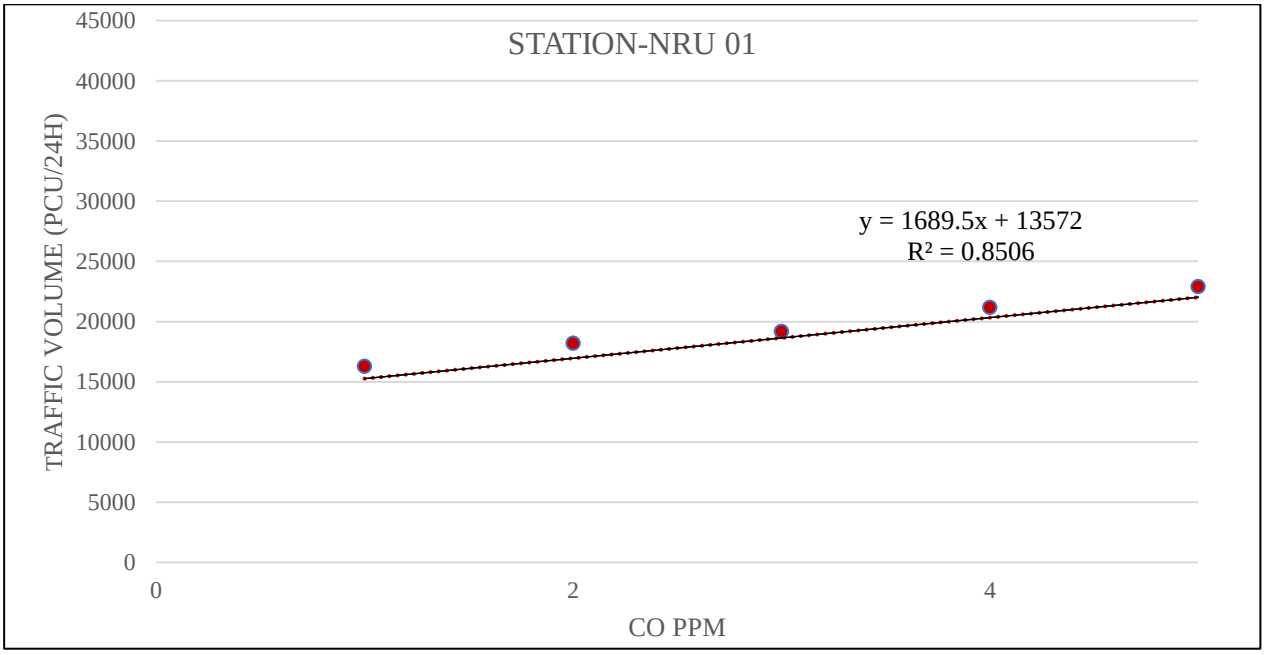


Figure 4.33: Correlation plots of Traffic Volume and CO for Station NRU 01

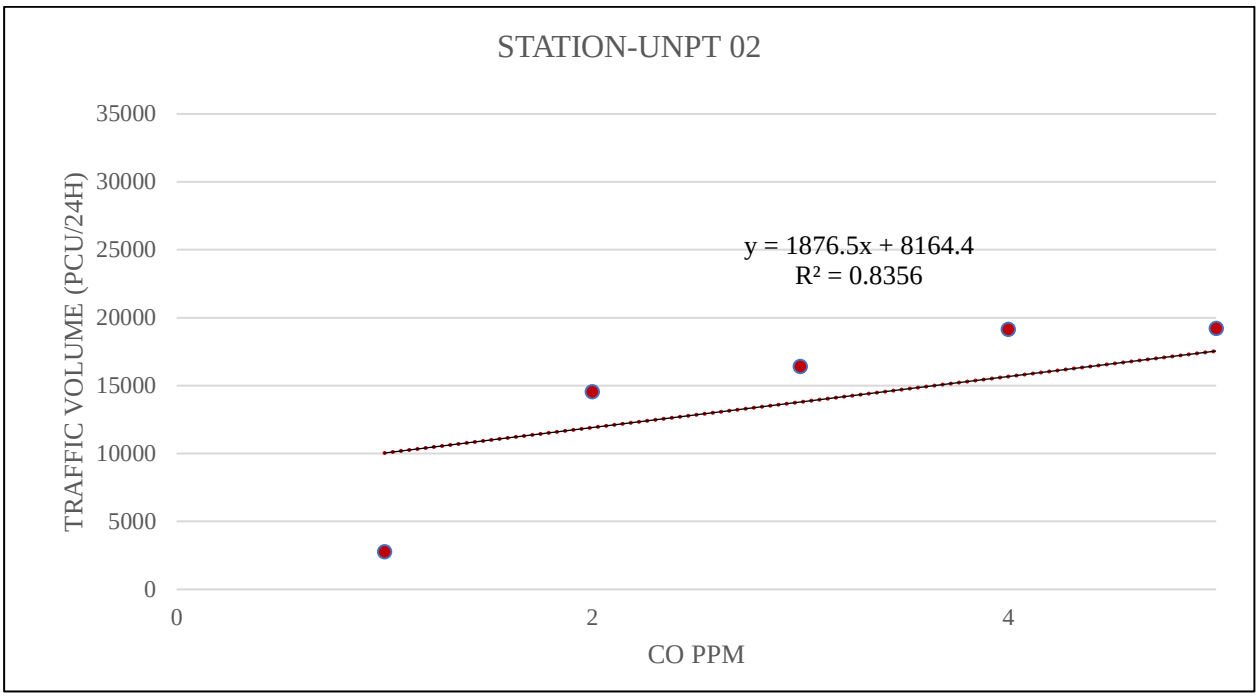


Figure 4.34: Correlation plots of Traffic Volume and CO for Station UNPT 02

Analysis of Carbon Monoxide (CO)

For Carbon monoxide in Figures 4.33 and 4.34, both equations showed positive constant values which are nearly parallel. The reasons could be CO was emitted mainly by the petrol run vehicle, as a form of unburnt fuel. The number of light vehicles, which were the leading emitter of CO, were more than heavy vehicles and hence CO values were higher, in comparison to others.

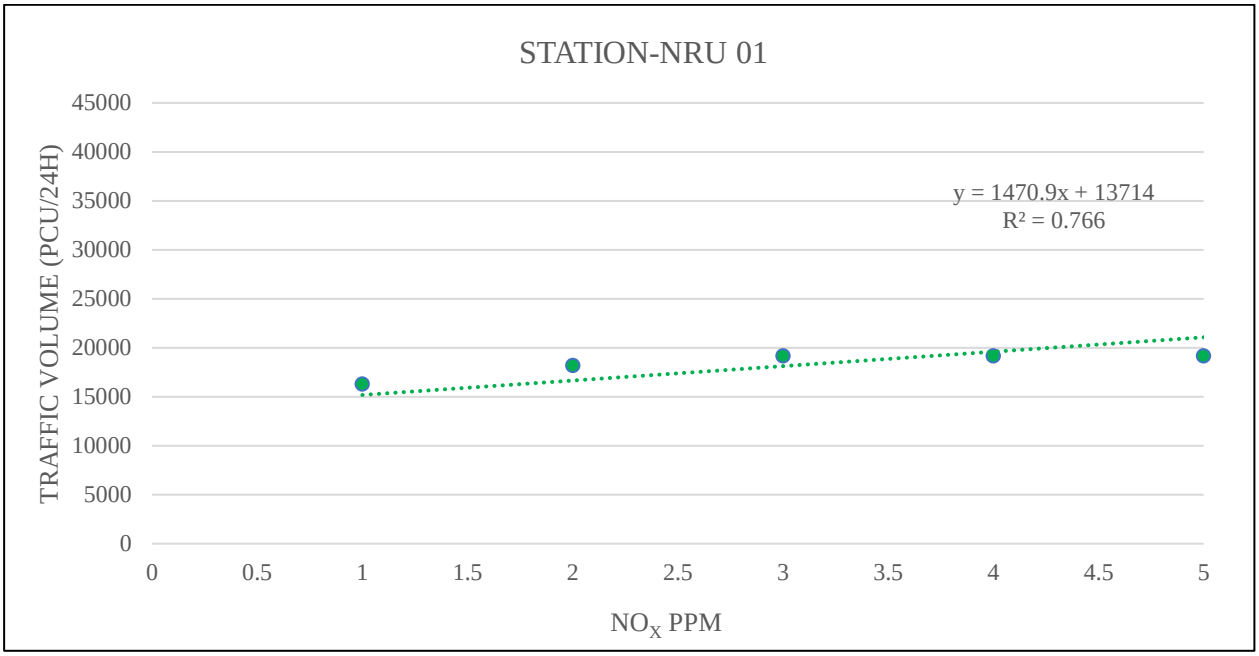


Figure 4.35: Correlation plots of Traffic Volume and NOx for Station NRU 01

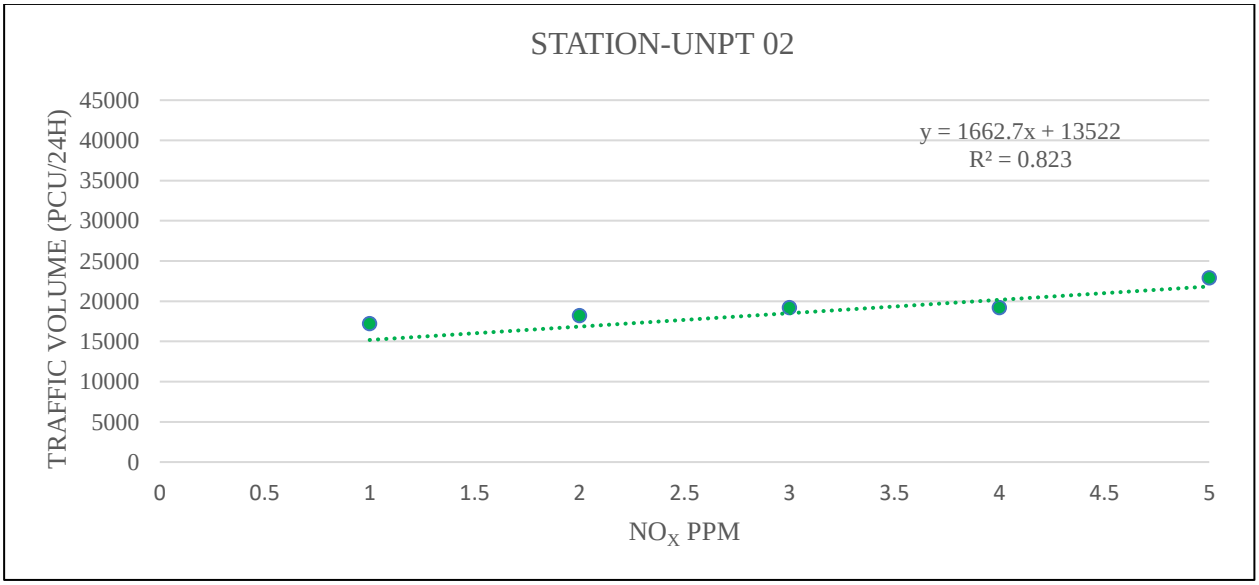


Figure 4.36: Correlation plots of Traffic Volume and NOx for Station UNPT 02

Analysis of Nitrogen Oxide (NOx)

For Carbon Nitrogen Oxide Figures 4.35 and 4.36, both equations showed positive constant values which are nearly parallel. Only heavy vehicles, which could be identified as diesel-driven vehicles, emit NOx, and thus, the overall amounts of NOx emission were relatively less as compared to Carbon Monoxide.

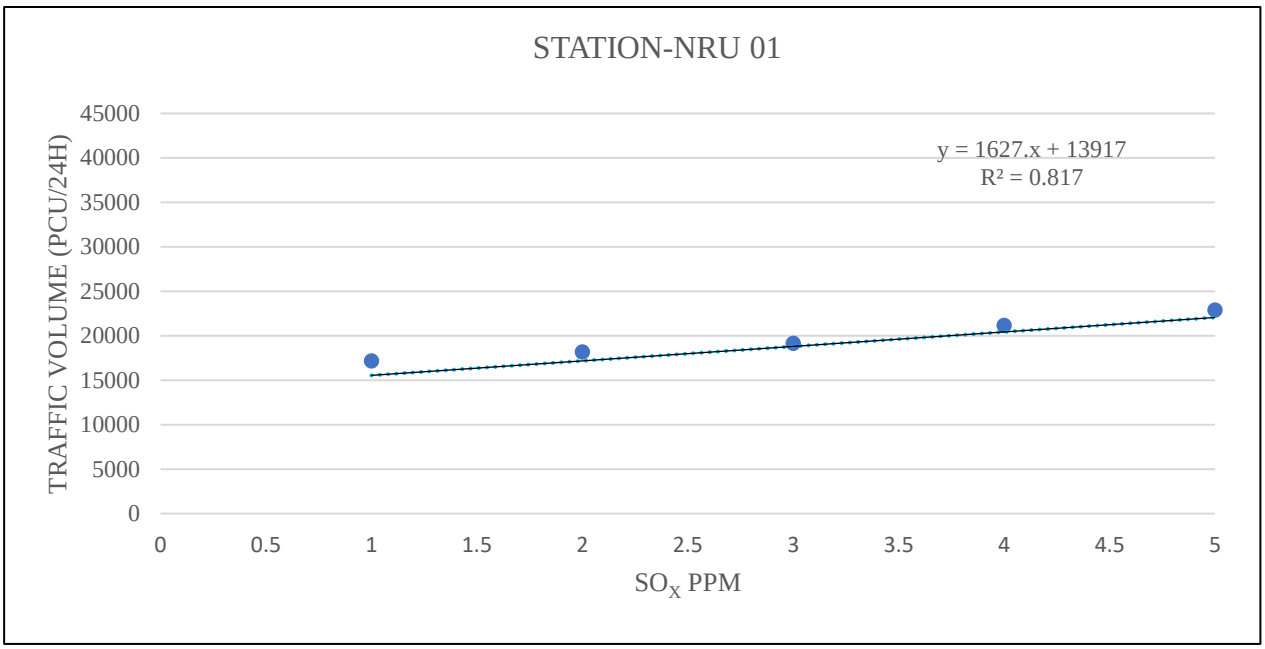


Figure 4.37: Correlation plots of Traffic Volume and SOx for Station NRU 01

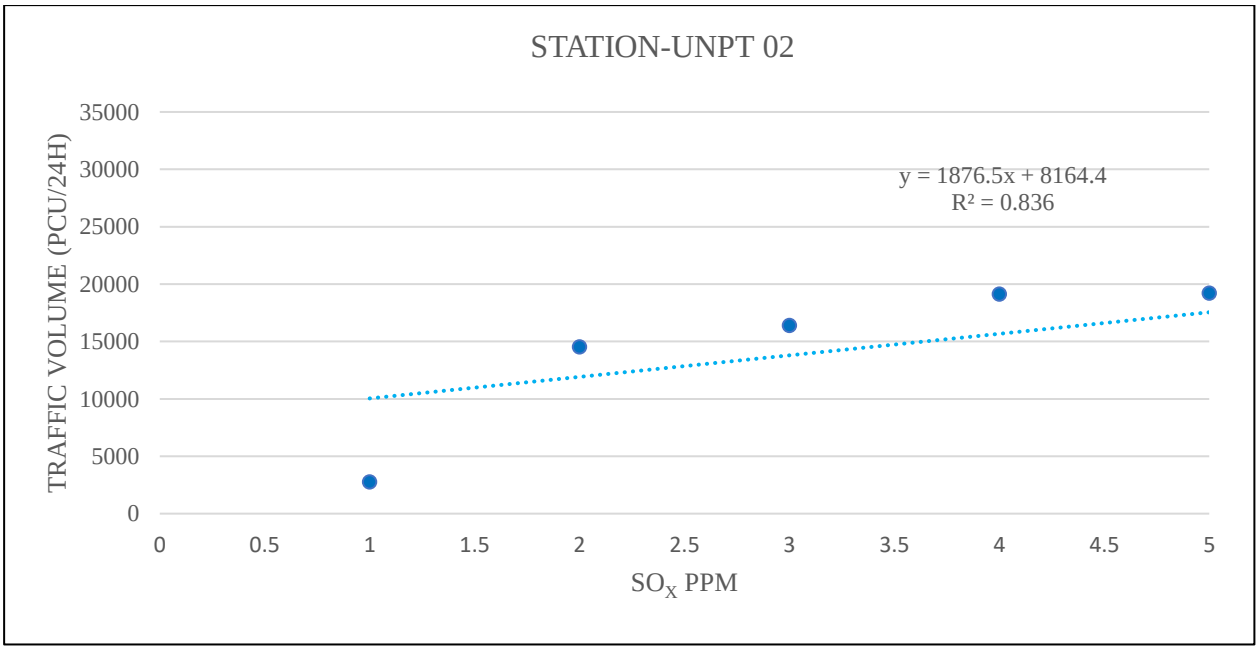


Figure 4.38: Correlation plots of Traffic Volume and SOx for Station UNPT 02

Analysis of Sulphur Oxide (SOx)

For Sulphur Oxide Figures 4.37 and 4.38, both equations showed positive constant higher values, the reason could be SOx Emissions occurs only by the Sulphur burning compounds, which could be identified as diesel-driven vehicles.

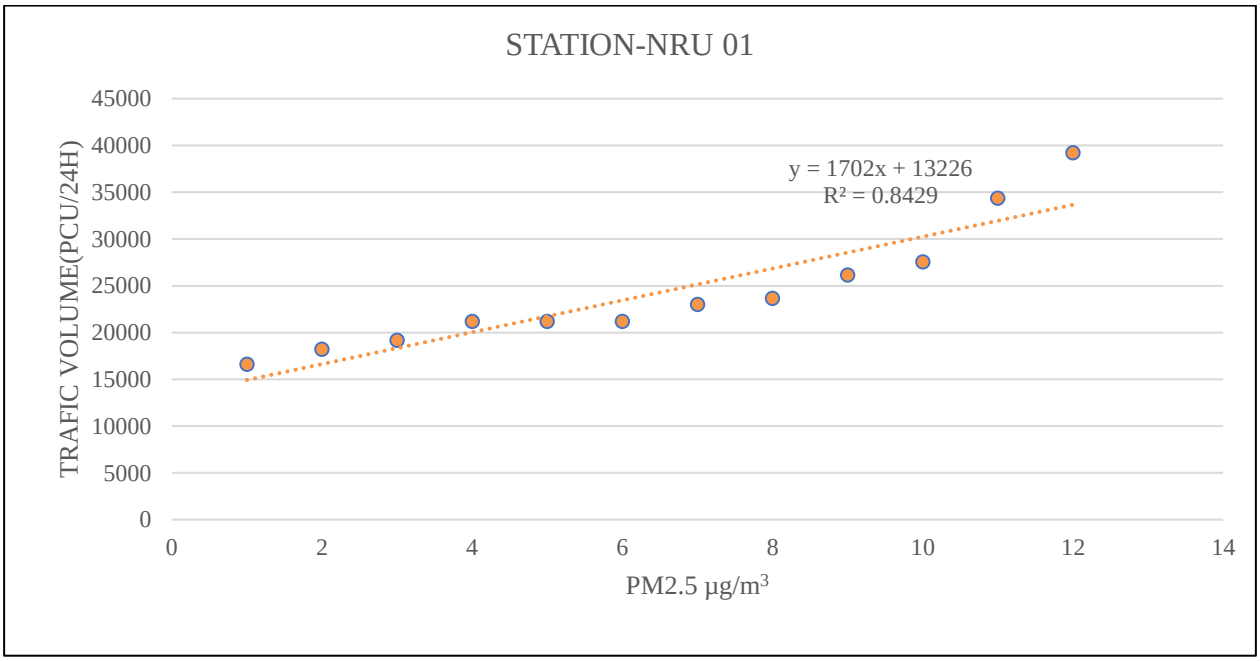


Figure 4.39: Correlation plots of Traffic Volume and PM2.5 for Station NRU 01

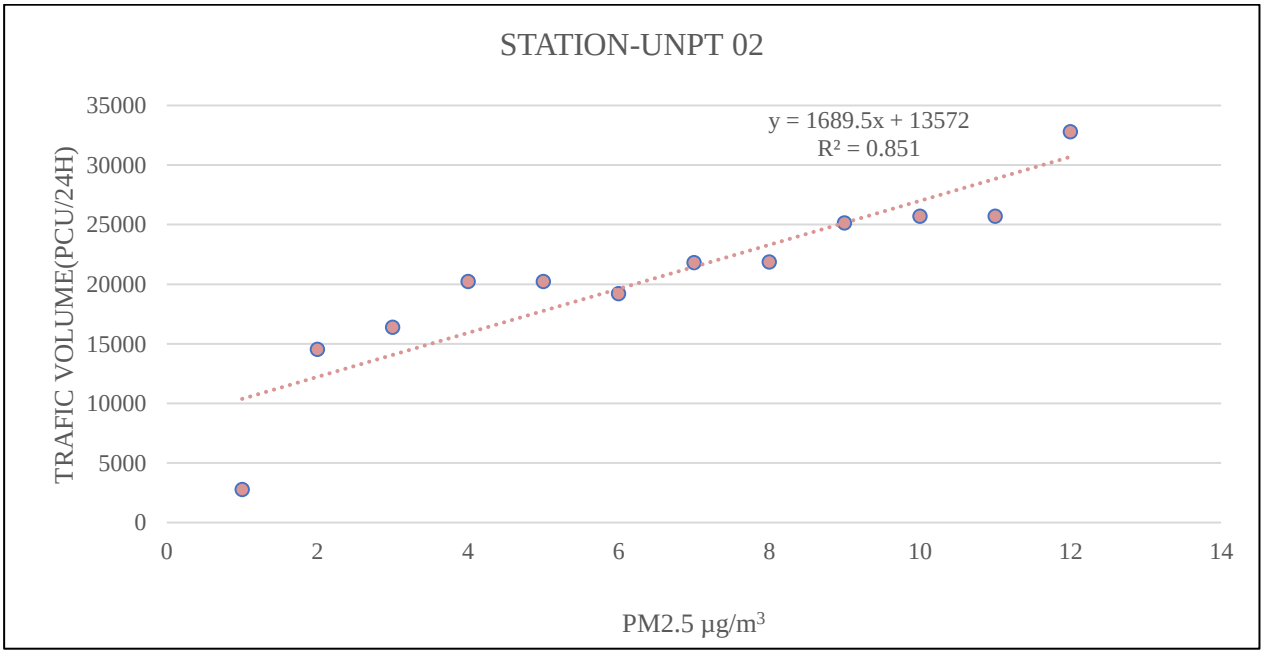


Figure 4.40: Correlation plots of Traffic Volume and PM2.5 for Station UNPT 02

Analysis of Particulate Matter (PM2.5)

For Particulate Matter (PM2.5) Figures 4.39 and 4.40, both equations showed positive constant higher values which are nearly parallel. Correlations between (PM2.5) were strong, positive, and significant.

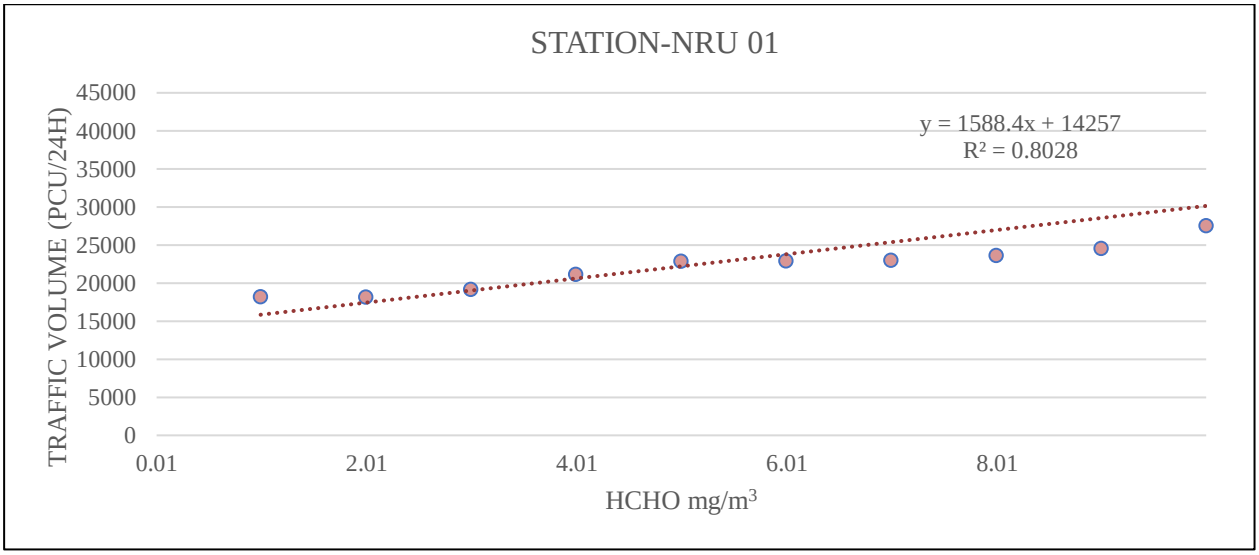


Figure 4.41: Correlation plots of Traffic Volume and HCHO for Station NRU 01

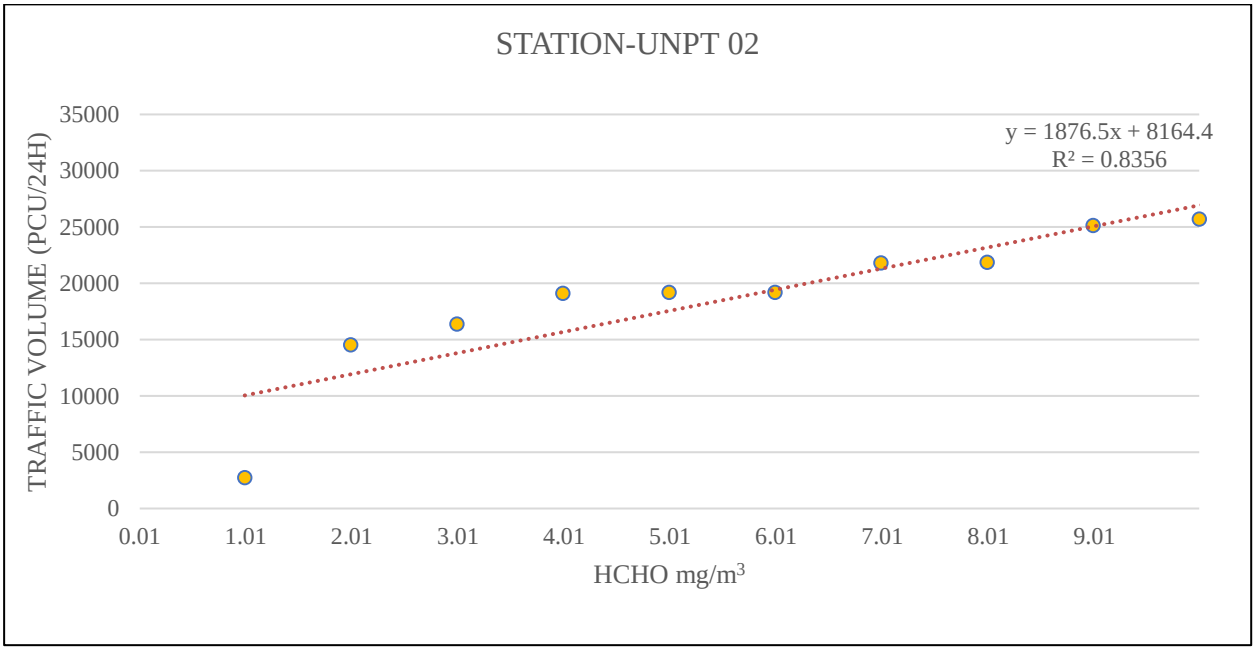


Figure 4.42: Correlation plots of Traffic Volume and HCHO for Station UNPT 02

Analysis of Hydrocarbons (HCHO**)**

For Hydrocarbons (HCHO) Figures 4.41 and 4.42, both equations showed positive constant higher values which were nearly parallel, HCHO is mostly emitted by petrol driven vehicles than diesel driven vehicles which were more dominant, however **(**HCHO) remained almost the same as CO emissions.

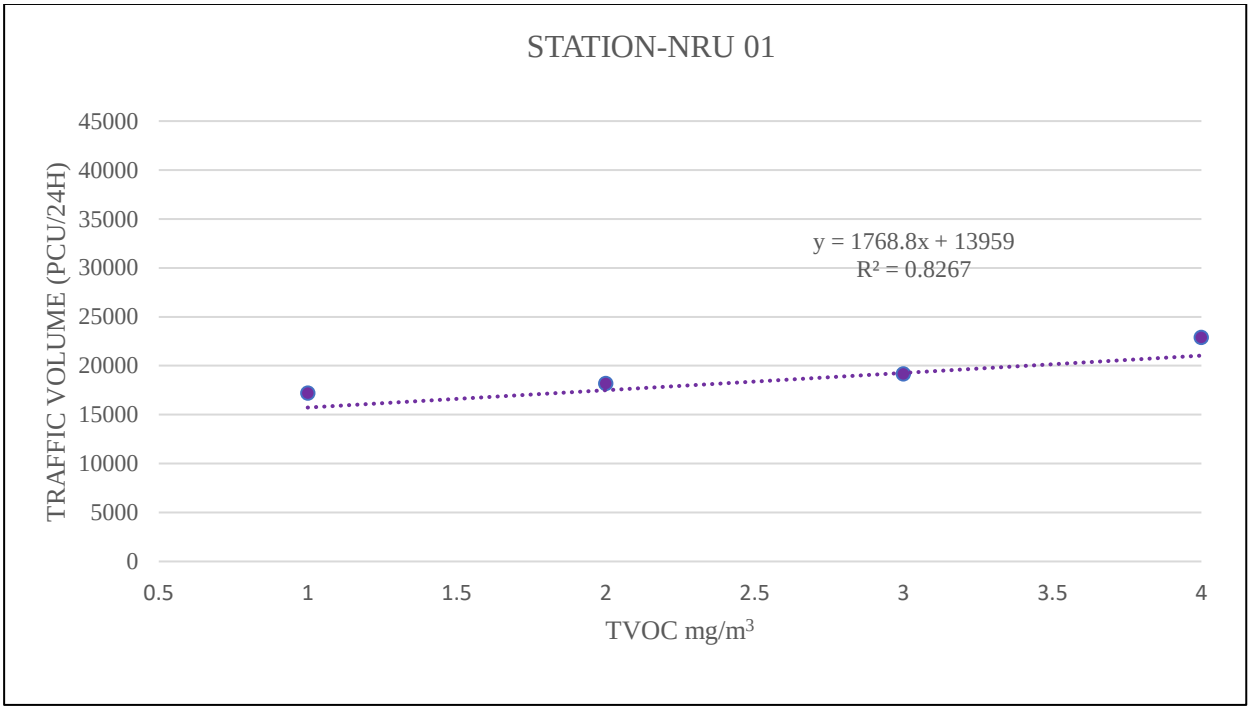


Figure 4.43: Correlation plots of Traffic Volume and TVOC for Station NRU 01

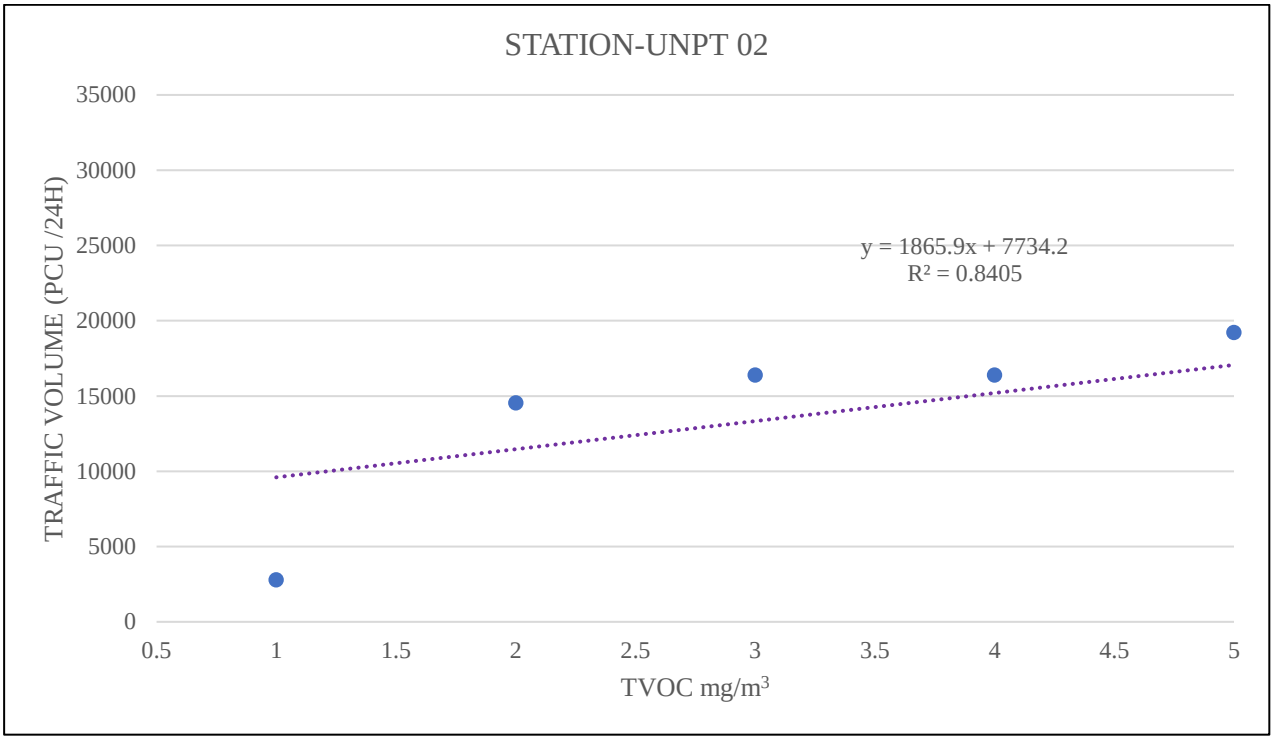


Figure 4.44: Correlation plots of Traffic Volume and TVOC for Station UNPT 02

Analysis of Total Volatile Organic Compounds (TVOC)

For particulate matter (TVOC) Figures 4.43 and 4.44, both equations showed positive higher constant values, the reason could be that Total Volatile Organic Compounds (TVOC)

Emissions occurs only by the Sulphur burning compounds, which could be identified as diesel-driven vehicles, these were less in comparison to light vehicles.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The trends determined that, the ambient vehicular pollutions within Uhuru Highway Corridor (A8) (stations NRU 01 and UNPT 02) depended on the vehicle Volume. PM2.5. HCHO, SOx, NOx. CO and TVOC, all decreased with decrease in vehicle volume.

These Correlations were significant suggesting the strong association between vehicular volumes and emissions for all parameters analyzed for the two Sites raging between R^2(0.766-0.861) for Linear Trend Lines and R^2(0.817-0.984) for Curvilinear Trend Line.

The ambient vehicular pollutions for the corridor were within the limits of WHO standards of (10mg/m^3) with an exception on PM2.5 which was found to be 18.39mg/m^3 and 18.56mg/m^3 for Stations NRU 01 and UNPT 02 respectively. The diurnal mean of SOx over the two sites were above the WHO limit with the highest amount recorded at 0.37ppm for Stations NRU 01 and UNPT 02 respectively. The mean 24-hour amount of CO in all the sites was above the background concentration of between 0.05-0.12ppm NRU 01 recording the highest amount at 1.73ppm.

The concentrations of pollutants and emissions were attributed to vehicular volumes, sharp graphs were recorded during morning and evening rush high volumes and spread graphs during reduced traffic volumes, mostly afternoons and late hours during the nights.

5.2 Recommendations

The reduction of speed within the corridor increased the traffic volumes which lead to further traffic air pollutions.

5.2.1 Recommendations for adoption by the industry

The government should develop measures to reduce emissions such as pollution control from source by improving vehicle design and maintenance, patronage of public transportation system, alternatives means of transportation, staggering working hours to reduce the number of vehicles and traffic congestions, restraining parking areas within the central business districts, stopping engines from running during traffic congestions, construction of ring roads and by-passes to reduce traffic congestion in towns and legislative enactment of pollutant emissions.

The reduction of speed within the corridor increased the traffic volumes which lead to further traffic air pollutions, the study therefore:

5.2.2 Recommends for further research

- Building scientific evidence for policy, legislative and regulatory interventions for air quality management.
- Raising public awareness on the health and environmental impacts of air pollution.
- Developing effective approaches for air quality management; and
- Building an effective implementation and enforcement programme for air quality legislation.

REFERENCES

Australian Road Research Board (2002) *"Road & transport Research"* Volume11. Published by Australian Road Research Board, Limited University of Michigan.

Behera S. N. and Balasubramanian R., (2016), "*The Air Quality Influences of Vehicular Traffic Emissions."* DOI: 10.5772/64692.

Bennett C. and Paterson B. (2019*), "A Guide to Calibration and Adaptation" HDM-MM 4 Manual*, Volume-5. HDM Global publications.

Bickel, P., and R. Friedrich (eds.) (2005), "*ExternE-Externalities of Energy*: *Methodology 2005 Update."* Directorate-General for Research Sustainable Energy Systems. Published by European Communities, Luxemburg. ISBN: 92-79-00423-9.

Carslaw D. C., & Glyn Rhys Tyler (2013), "*New insights from comprehensive on-road measurements of NOx, NO_2 and NH_3 from vehicle emission remote sensing in London, UK."* Published Atmospheric Environment Volume 81, Pages 339-347 https://doi.org/10.1016/j.atmosenv.2013.09.026

Chapman, L., (2007) "*Transport and climate change:"* a review. Journal of Transport Geography, 15(5), Pages 354 - 367. https://doi.org/10.1016/j.jtrangeo.2006.11.008

COWI A/S, Otieno Odongo & Partners Consulting Engineers, & QUTEP Limited (2012) "*Traffic Volume along Uhuru Highway Corridor*".

Walsh M. P., (2001) European Conference of Ministers of Transport, *"Vehicle Emission Reductions, Volume 425"* Published by OECD Publishing, the University of Michigan. Page 2-132. ISBN 9282113639, 978928211363.

Faiz A., Sinha K., Walsh M. & Varma A., (1990), "*Automotive Air Pollution: Issues and Options for Developing Countries*." Policy Research Working Paper Series 492. Published by The World Bank.

Friedrich R. and Bickel P. (2001), "*Environmental External Costs of Transport*." Springer Science & Business Media. Springer-Verlag, Berlin Heidelberg, Germany. Pages 11-30; 35-85.

Friedrich, R. and Bickel, P. (2005) "*PM2.5 has been proved to cause mortality and morbidity, both acute (short-term) and chronic (long-term).*"

Government of Kenya (1987), "Kenya: *National State of the Environment Report Vol 2,"* Kenya Ministry of Environment and National Resources supported by the United Nations Environment Programme. Pages 17-73 https://wedocs.unep.org/handle/20.500.11822/29794

Government of Kenya (2022), "*Design Manual for Urban Roads and Streets (DMRURS) 2019 (Low Res)"* Ministry of Transport, Infrastructure, Housing, Urban Development and Public Works. Revised Edition. https://africa.itdp.org/wp-content/uploads/2020/06/Street-Design-Manual-for-Urban-Areas-in-Kenya-220225.pdf

Haneen K., Mark N., Zietsman J., Ramani T., (2020) "Traffic-Related Air Pollution" Published by Elsevier Science, pages 45-325. ISBN 0128181222, 9780128181225.

Mensink C., Kallos G., (2018) "Air Pollution Modeling and its Application XXV" Springer International Publishing, Pages 114-501; ISBN 978-3-319-57644-2. DOI 10.1007/978-3-31957645-9.

Mock P., (2019) "*On the finishing line - The German automobile manufacturers in the context of the European CO_2 specifications for 2017*" International Council *on* Clean Transportation.

Mortier R. Y., Fox M. F., Orszulik S. T., (2011), "*Chemistry and Technology of Lubricants*" Published by Springer Dordrecht Heidelberg, 3rd Edition Page 295. ISBN 978-1-4020-8661-8. DOI 10.1023/b105569.

Mukaria S.M., Thenya T., Raphael G., Wahome and Karatu K., (2017) *"Analysis and Perception*

of Health Impact of Motor Vehicle Emissions on Traffic Police in Nairobi, Kenya." Journal of Environment Pollution and Human Health*;* Volume 5 (3): Pages 104-110. DOI: 10.12691/jephh5-3-5.

Nairobi City County Government - NCCG, (2014). "*Integrated Urban Development Master Plan for the City of Nairobi*."

https://www.kpda.or.ke/nairobi-integrated-urban-development-master-plan

Nairobi City County Government –NCCG, (2018), "*Air Quality Action Plan (2019-2023)*"

Supported by United National Environment Programme in partnership with Environmental Compliance Institute.

Nippon Koei Co., Ltd, (2014). *"The Project on Integrated Development Master Plan for City of Nairobi Republic of Kenya,"* Technical Support from Japan International Cooperation Agency (JICA).

Pan Chan, (2010*), "Performance Rating System of Sustainable Transport."* University of Waterloo.

Puckett, S.M., Noel, G.J., Jackson, L., Marjoncu, E., Razo, M., & Reed, E.M. (2015). "*Congestion Mitigation and Air Quality (CMAQ) Improvement Program: Cost-Effectiveness Tables Development and Methodology*" Published by Environmental Science for Transportation Research Board.

Richardson A. J., Ampt E. S. and Meyburg A. H. (1995), "*Survey Methods for Transport Planning*", Eucalyptus Press: Melbourne. Pages 271-388; 407-489 ISBN 064621439X, 9780646214399.

Robert K., Fred T., Schroeder J. (2015) "*Assessing Roadway Traffic Count Duration and Frequency Impacts on Annual Average Daily Traffic Estimation: Assessing Accuracy Issues Related to Short-Term Count Durations*" U.S. Department of Transportation Federal Highway Administration. Pages 2-45

https://www.fhwa.dot.gov/policyinformation/travel_monitoring/pubs/aadt/aadt_task_3_final_report_nov_2015.pdf

Samson M.M, Thuita T, Raphael G.W.Kiemo K, Michael G.Analysis and Perception of Health Impact of Motor Vehicle Emissions on Traffic Police in Nairobi, Kenya. *Journal of Environment Pollution and Human Health*, 2017, Vol 5, No3, 104-110.

Schindlbacher S., Tista M., Gager M., Haider S., Moosmann L., Kampel E. and European Environment Agency (2013), "*European Union (EU) emission inventory report 1990-2011 under the UNECE Convention on Long -range Trans-Boundary Air Pollution (LRTAP)".* Published by the European Environment Agency, ISBN 9292134000, 9789292134006. Pages 14-96; 110-125.

Sehlstedt M., Annelie F., Behndig, Christoffer B., Blomberg A., Sandström T., & Pourazar J., (2010) "*Airway inflammatory response to diesel exhaust generated at urban cycle running conditions, Inhalation Toxicology,"* Volume 22:14, Pages 1144-1150. DOI:10.3109/08958378.2010.529181.

Selin E. N. et al (2005), "*Global health and economic impacts of future ozone pollution"* Environmental Research. Published under license by IOP Publishing Limited.

Suleman M., Gaylard M., Tshaka S. and Snyman C. (2015) "*Accelerating the Transition to Green Transport: Towards a South African Cities Network Green Transport Programme. Green Economy Research Report No. 1,"* Green Fund, Development Bank of Southern Africa, Midrand. Page 3 - 42.

Transportation Research Board (2010) "Highway *Capacity Manual*" Transportation Research Board, National Research Council, Washington D.C. Volume 1, Page 782–793.

Vollmer D., (2011), "*Pathways to Urban Sustainability: The Atlanta Metropolitan Region: Summary*" by National Research Council, Policy and Global Affairs, Science and Technology for Sustainability Program, Committee on Regional Approaches to Urban Sustainability.

World Health Organization (2012) "*Diesel Engine Exhaused Carcigenic in Cancer IAIRO (Ed)*"

Published by World Health Organization.

World Health Organization (2018) "*Ambient outdoor Air quality and Health Facts*"

https://web.archive.org/web/20180425044313/https://www.who.int/en/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

World Health Organization, (2021*), "WHO global air quality guidelines: particulate matter*

(PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide" Contributors Organización Mundial de la Salud, European Centre for Environment and Health, Published by World Health Organization Page 23-45; 56-153. ISBN 9240034226, 9789240034228.

APPENDICES

APPENDIX 1: ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC (24 HOURS)

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	MOMBASA ROAD	**Count Location:**	NRU 01	**Period of S**	DAY
Enumerators name		**Weather:**		**Day of the Week:**	MONDAY
NRU 01	Both directions			**Date:**	11/11/2019
Start Time (hour):	6:00 AM	**Finish Time (hour):**	6:00 PM		
Time (hour)					

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	TOTAL vehicles	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00 AM	6:15 AM	12	360	188	84	281	143	165	11	5	0	0	0	**1247**	3	0.3	0.3	9	0.065	0.429
6:15 AM	6:30 AM	29	545	269	44	320	92	188	0	0	8	0	0	**1491**	4	0.2	0.2	11	0.058	0.389
6:30 AM	6:45 AM	15	546	254	111	272	120	173	29	15	8	0	0	**1541**	3	0.4	0.5	8	0.057	0.413
6:45 AM	7:00 AM	32	441	195	89	279	144	152	26	12	9	2	0	**1379**	3	0.4	0.2	7	0.067	0.355
7:00 AM	7:15 AM	35	324	146	107	257	237	86	11	5	3	0	0	**1208**	3	0.4	0.4	5	0.053	0.376
7:15 AM	7:30 AM	29	390	201	102	335	180	50	12	2	0	0	0	**1299**	2	0.4	0.4	7	0.046	0.414
7:30 AM	7:45 AM	35	282	131	72	219	194	147	8	0	0	0	0	**1086**	3	0.4	0.5	5	0.066	0.447
7:45 AM	8:00 AM	38	228	110	51	161	155	113	0	3	5	0	0	**861**	4	0.4	0.5	5	0.054	0.334
8:00 AM	8:15 AM	16	484	250	116	397	198	227	14	6	0	0	0	**1708**	4	0.4	0.3	10	0.065	0.402
8:15 AM	8:30 AM	39	767	374	63	447	125	257	0	0	11	0	0	**2083**	4	0.4	0.5	10	0.064	0.564
8:30 AM	8:45 AM	20	763	349	154	383	166	239	37	20	10	0	0	**2142**	3	0.5	0.3	29	0.069	0.415
8:45 AM	9:00 AM	45	611	261	122	400	207	204	33	16	13	2	0	**1914**	2	0.5	0.4	18	0.063	0.526
9:00 AM	9:15 AM	48	456	203	146	365	328	116	14	6	5	0	0	**1687**	3	0.5	0.3	29	0.067	0.598
9:15 AM	9:30 AM	40	536	277	141	470	239	69	16	2	0	0	0	**1790**	4	0.5	0.5	22	0.067	0.435
9:30 AM	9:45 AM	50	400	179	100	309	270	209	10	0	0	0	0	**1527**	5	0.5	0.5	15	0.061	0.459
9:45 AM	10:00 AM	54	321	153	71	232	220	160	0	5	7	0	0	**1223**	5	0.4	0.4	24	0.009	0.059
10:00 AM	10:15 AM	21	654	335	161	564	277	315	18	8	0	0	0	**2353**	5	0.4	0.3	19	0.044	0.266
10:15 AM	10:30 AM	54	1085	523	92	630	171	353	0	0	17	0	0	**2925**	3	0.4	0.4	22	0.068	0.529
10:30 AM	10:45 AM	28	1072	484	214	544	230	332	49	28	14	0	0	**2995**	4	0.4	0.2	23	0.063	0.375
10:45 AM	11:00 AM	64	852	351	168	577	298	276	44	22	18	3	0	**2672**	3	0.4	0.5	23	0.063	0.375
11:00 AM	11:15 AM	68	645	284	202	522	456	159	19	8	7	0	0	**2368**	3	0.4	0.5	30	0.064	0.239
11:15 AM	11:30 AM	57	741	384	195	664	318	96	21	3	0	0	0	**2480**	3	0.5	0.5	26	0.053	0.435
11:30 AM	11:45 AM	73	571	246	140	437	379	299	13	0	0	0	0	**2157**	4	0.5	0.5	16	0.031	0.446
11:45 AM	12:00 PM	78	454	215	100	336	316	228	0	7	10	0	0	**1744**	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	20	192	167	72	108	110	65	5	9	2	0	0	**747**	3	0.5	0.2	18	0.064	0.279
12:15 PM	12:30 PM	23	278	222	33	99	62	38	0	9	0	0	0	**762**	4	0.5	0.3	17	0.061	0.201
12:30 PM	12:45 PM	26	384	260	84	99	92	29	20	6	13	0	0	**1010**	5	0.6	0.3	18	0.009	0.059
12:45 PM	1:00 PM	38	356	180	105	87	53	17	9	9	17	3	0	**873**	5	0.7	0.3	19	0.044	0.266
1:00 PM	1:15 PM	30	354	206	75	90	60	54	5	6	3	0	0	**882**	5	0.7	0.4	23	0.068	0.529
1:15 PM	1:30 PM	20	326	218	39	75	38	23	0	11	11	0	0	**758**	4	0.7	0.5	17	0.063	0.375
1:30 PM	1:45 PM	39	306	173	66	80	62	23	8	11	2	2	0	**768**	4	0.7	0.4	23	0.063	0.375
1:45 PM	2:00 PM	27	327	204	50	86	78	32	12	6	0	5	0	**825**	5	0.6	0.4	22	0.064	0.239
2:00 PM	2:15 PM	26	845	333	160	462	197	248	4	12	8	0	0	**2295**	5	0.6	0.4	15	0.053	0.435
2:15 PM	2:30 PM	60	588	208	115	544	317	129	4	10	12	0	0	**1987**	5	0.6	0.3	17	0.031	0.446
2:30 PM	2:45 PM	55	635	320	124	478	304	90	4	5	8	0	0	**2023**	3	0.6	0.4	18	0.055	0.371
2:45 PM	3:00 PM	48	506	338	115	495	90	81	6	7	7	0	0	**1692**	3	0.6	0.4	13	0.064	0.279
3:00 PM	3:15 PM	77	544	190	96	342	272	255	0	2	7	2	0	**1787**	4	0.6	0.3	22	0.061	0.201
3:15 PM	3:30 PM	78	479	246	85	342	295	203	1	9	12	0	0	**1750**	4	0.5	0.3	21	0.009	0.059
3:30 PM	3:45 PM	13	261	148	56	98	66	39	5	12	2	0	0	**701**	3	0.5	0.3	26	0.044	0.266
3:45 PM	4:00 PM	20	187	134	31	60	40	23	1	7	1	0	0	**504**	4	0.5	0.3	21	0.068	0.529
4:00 PM	4:15 PM	89	404	264	108	185	156	128	36	14	9	2	0	**1393**	2	0.5	0.4	15	0.063	0.375
4:15 PM	4:30 PM	53	374	266	156	194	135	140	18	6	12	2	2	**1355**	2	0.5	0.4	18	0.063	0.375
4:30 PM	4:45 PM	63	390	230	98	194	89	132	41	23	14	3	0	**1274**	2	0.6	0.3	26	0.064	0.239
4:45 PM	5:00 PM	54	434	252	110	183	114	132	30	11	11	0	0	**1329**	4	0.6	0.3	24	0.053	0.435
5:00 PM	5:15 PM	83	308	227	101	159	126	126	36	18	9	0	5	**1196**	4	0.6	0.4	22	0.031	0.446
5:15 PM	5:30 PM	66	336	215	92	216	150	134	38	11	9	5	0	**1269**	5	0.6	0.4	26	0.055	0.371
5:30 PM	5:45 PM	80	407	219	134	185	120	149	21	15	5	0	0	**1332**	5	0.5	0.4	24	0.064	0.279
5:45 PM	6:00 PM	96	378	227	77	174	149	102	14	8	6	0	0	**1229**	4	0.5	0.3	26	0.061	0.201
TOTALS		**2,158**	**23,122**	**11,800**	**5,024**	**14,429**	**8,632**	**6,995**	**697**	**406**	**320**	**29**	**6**	**73618**	**3.7083333**	**0.5**	**0.3708333**	**18.3125**	**0.055145833**	**0.360020833**

NRU 01	Both directions							Date:		11/11/2019									
Start Time (hour):			6:00PM				Finish Time (hour):			6:00AM									
Time (hour)																			
From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	TOTAL traffic vehicles	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00:PM	6:15:PM	12	360	188	84	281	143	165	11	5	0	0	0	**1247**	3	0.3	0.3	9	0.065	0.429
6:15:PM	6:30PM	29	545	269	44	320	92	188	0	0	8	0	0	**1491**	4	0.2	0.2	11	0.058	0.389
6:30PM	6:45PM	15	546	254	111	272	120	173	29	15	8	0	0	**1541**	3	0.4	0.5	8	0.057	0.413
6:45PM	7:00PM	32	441	195	89	279	144	152	26	12	9	2	0	**1379**	3	0.4	0.2	7	0.067	0.355
7:00PM	7:15PM	35	324	146	107	257	237	86	11	5	3	0	0	**1208**	3	0.4	0.4	5	0.053	0.376
7:15PM	7:30PM	29	390	201	102	335	180	50	12	2	0	0	0	**1299**	2	0.4	0.4	7	0.046	0.414
7:30PM	7:45PM	35	282	131	72	219	194	147	8	0	0	0	0	**1086**	3	0.4	0.5	5	0.066	0.447
7:45PM	8:00PM	38	228	110	51	161	155	113	0	3	5	0	0	**861**	4	0.4	0.5	5	0.054	0.334
8:00PM	8:15PM	16	484	250	116	397	198	227	14	6	0	0	0	**1708**	4	0.4	0.3	10	0.065	0.402
8:15PM	8:30PM	39	767	374	63	447	125	257	0	0	11	0	0	**2083**	4	0.4	0.5	10	0.064	0.564
8:30PM	8:45PM	20	763	349	154	383	166	239	37	20	10	0	0	**2142**	3	0.5	0.3	29	0.069	0.415
8:45PM	9:00PM	45	611	261	122	400	207	204	33	16	13	2	0	**1914**	2	0.5	0.4	18	0.063	0.526
9:00PM	9:15PM	48	456	203	146	365	328	116	14	6	5	0	0	**1687**	3	0.5	0.3	29	0.067	0.598
9:15PM	9:30PM	40	536	277	141	470	239	69	16	2	0	0	0	**1790**	4	0.5	0.5	22	0.067	0.435
9:30PM	9:45PM	50	400	179	100	309	270	209	10	0	0	0	0	**1527**	5	0.5	0.5	15	0.061	0.459
9:45PM	10:00PM	54	321	153	71	232	220	160	0	5	7	0	0	**1223**	5	0.4	0.4	24	0.009	0.059
10:00PM	10:15PM	21	654	335	161	564	277	315	18	8	0	0	0	**2353**	5	0.4	0.3	19	0.044	0.266
10:15PM	10:30PM	54	1085	523	92	630	171	353	0	0	17	0	0	**2925**	3	0.4	0.4	22	0.068	0.529
10:30PM	10:45PM	28	1072	484	214	544	230	332	49	28	14	0	0	**2995**	4	0.4	0.2	23	0.063	0.375
10:45PM	11:00PM	64	852	351	168	577	298	276	44	22	18	3	0	**2672**	3	0.4	0.5	23	0.063	0.375
11:00PM	11:15PM	68	645	284	202	522	456	159	19	8	7	0	0	**2368**	3	0.4	0.5	30	0.064	0.239
11:15PM	11:30PM	57	741	384	195	664	318	96	21	3	0	0	0	**2480**	3	0.5	0.5	26	0.053	0.435
11:30PM	11:45PM	73	571	246	140	437	379	299	13	0	0	0	0	**2157**	4	0.5	0.5	16	0.031	0.446
11:45PM	12:00MN	78	454	215	100	336	316	228	0	7	10	0	0	**1744**	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	20	192	167	72	108	110	65	5	9	2	0	0	**747**	3	0.5	0.2	18	0.064	0.279
12:15AM	12:30AM	23	278	222	33	99	62	38	0	9	0	0	0	**762**	4	0.5	0.3	17	0.061	0.201
12:30AM	12:45AM	26	384	260	84	99	92	29	20	6	13	0	0	**1010**	5	0.6	0.3	18	0.009	0.059
12:45AM	1:00AM	38	356	180	105	87	53	17	9	9	17	3	0	**873**	5	0.7	0.3	19	0.044	0.266
1:00AM	1:15AM	30	354	206	75	90	60	54	5	6	3	0	0	**882**	5	0.7	0.4	23	0.068	0.529
1:15AM	1:30AM	20	326	218	39	75	38	23	0	11	11	0	0	**758**	4	0.7	0.5	17	0.063	0.375
1:30AM	1:45AM	39	306	173	66	80	62	23	8	11	2	2	0	**768**	4	0.7	0.4	23	0.063	0.375
1:45AM	2:00AM	27	327	204	50	86	78	32	12	6	0	5	0	**825**	5	0.6	0.4	22	0.064	0.239
2:00AM	2:15AM	26	845	333	160	462	197	248	4	12	8	0	0	**2295**	5	0.6	0.4	15	0.053	0.435
2:15AM	2:30AM	60	588	208	115	544	317	129	4	10	12	0	0	**1987**	5	0.6	0.3	17	0.031	0.446
2:30AM	2:45AM	55	635	320	124	478	304	90	4	5	8	0	0	**2023**	3	0.6	0.4	18	0.055	0.371
2:45AM	3:00AM	48	506	338	115	495	90	81	6	7	7	0	0	**1692**	3	0.6	0.4	13	0.064	0.279
3:00AM	3:15AM	77	544	190	96	342	272	255	0	2	7	2	0	**1787**	4	0.6	0.3	22	0.061	0.201
3:15AM	3:30AM	78	479	246	85	342	295	203	1	9	12	0	0	**1750**	4	0.5	0.3	21	0.009	0.059
3:30AM	3:45AM	13	261	148	56	98	66	39	5	12	2	0	0	**701**	3	0.5	0.3	26	0.044	0.266
3:45AM	4:00AM	20	187	134	31	60	40	23	1	7	1	0	0	**504**	4	0.5	0.3	21	0.068	0.529
4:00AM	4:15AM	89	404	264	108	185	156	128	36	14	9	2	0	**1393**	2	0.5	0.4	15	0.063	0.375
4:15AM	4:30AM	53	374	266	156	194	135	140	18	6	12	2	2	**1355**	2	0.5	0.4	18	0.063	0.375
4:30AM	4:45AM	63	390	230	98	194	89	132	41	23	14	3	0	**1274**	2	0.6	0.3	26	0.064	0.239
4:45AM	5:00AM	54	434	252	110	183	114	132	30	11	11	0	0	**1329**	4	0.6	0.3	24	0.053	0.435
5:00AM	5:15AM	83	308	227	101	159	126	126	36	18	9	0	5	**1196**	4	0.6	0.4	22	0.031	0.446
5:15AM	5:30AM	66	336	215	92	216	150	134	38	11	9	5	0	**1269**	5	0.6	0.4	26	0.055	0.371
5:30AM	5:45AM	80	407	219	134	185	120	149	21	15	5	0	0	**1332**	5	0.5	0.4	24	0.064	0.279
5:45AM	6:00AM	96	378	227	77	174	149	102	14	8	6	0	0	**1229**	4	0.5	0.3	26	0.061	0.201
TOTALS		**863**	**23,122**	**11,800**	**5,024**	**14,429**	**8,632**	**6,995**	**697**	**406**	**320**	**29**	**6**	**72323**	**3.7083333**	**0.5**	**0.3708333**	**18.3125**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	MOMBASA ROAD	**Count Location:**	NRU 01	**Period of St**	DAY
Enumerators name		**Weather:**		**Day of the Week:**	TUESDAY
NRU 01	Both directions			**Date:**	12/11/2019
Start Time (hour):	6:00 AM	**Finish Time (hour):**		6:00 PM	

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00 AM	6:15 AM	35	364	217	52	120	51	96	7	8	0	0	0	**949**	3	0.3	0.3	9	0.065	0.429
6:15 AM	6:30 AM	39	337	199	44	108	57	82	5	2	0	0	0	**873**	4	0.2	0.2	11	0.058	0.389
6:30 AM	6:45 AM	67	411	262	62	124	64	92	8	5	2	0	0	**1098**	3	0.4	0.5	8	0.057	0.413
6:45 AM	7:00 AM	60	350	218	60	98	68	99	6	1	0	0	0	**960**	3	0.4	0.2	7	0.067	0.355
7:00 AM	7:15 AM	38	384	241	53	121	56	94	7	7	0	0	0	**1002**	3	0.4	0.4	5	0.053	0.376
7:15 AM	7:30 AM	44	356	223	46	104	55	76	6	2	0	0	0	**913**	2	0.4	0.4	7	0.046	0.414
7:30 AM	7:45 AM	76	444	293	65	127	62	88	10	6	2	0	0	**1173**	3	0.4	0.5	5	0.066	0.447
7:45 AM	8:00 AM	69	370	244	64	96	66	94	6	1	0	0	0	**1009**	4	0.4	0.5	5	0.054	0.334
8:00 AM	8:15 AM	78	350	233	31	31	115	31	5	8	0	0	0	**883**	4	0.4	0.3	10	0.065	0.402
8:15 AM	8:30 AM	123	365	256	35	118	115	37	12	6	0	0	0	**1066**	4	0.4	0.5	10	0.064	0.564
8:30 AM	8:45 AM	116	301	286	38	71	48	26	19	8	0	0	0	**914**	3	0.5	0.3	29	0.069	0.415
8:45 AM	9:00 AM	150	356	257	59	145	138	18	24	0	0	0	0	**1147**	2	0.5	0.4	18	0.063	0.526
9:00 AM	9:15 AM	47	499	288	72	169	67	139	9	11	0	0	0	**1302**	3	0.5	0.3	29	0.067	0.598
9:15 AM	9:30 AM	51	461	261	60	156	84	123	7	3	0	0	0	**1205**	4	0.5	0.5	22	0.067	0.435
9:30 AM	9:45 AM	88	555	345	86	173	92	135	11	6	2	0	0	**1494**	5	0.5	0.5	15	0.061	0.459
9:45 AM	10:00 AM	77	481	288	83	141	97	145	7	1	0	0	0	**1320**	5	0.4	0.4	24	0.009	0.059
10:00 AM	10:15 AM	51	517	314	73	168	73	134	10	10	0	0	0	**1351**	5	0.4	0.3	19	0.044	0.266
10:15 AM	10:30 AM	57	479	288	62	149	80	113	8	3	0	0	0	**1239**	3	0.4	0.4	22	0.068	0.529
10:30 AM	10:45 AM	97	589	379	88	175	89	127	12	7	3	0	0	**1567**	4	0.4	0.2	23	0.063	0.375
10:45 AM	11:00 AM	88	498	316	86	136	94	136	8	1	0	0	0	**1364**	3	0.4	0.5	23	0.063	0.375
11:00 AM	11:15 AM	98	468	306	41	42	168	42	6	12	0	0	0	**1183**	3	0.4	0.5	30	0.064	0.239
11:15 AM	11:30 AM	162	476	339	45	168	167	52	17	8	0	0	0	**1434**	3	0.5	0.5	26	0.053	0.435
11:30 AM	11:45 AM	154	398	378	52	98	69	34	26	11	0	0	0	**1220**	4	0.5	0.5	16	0.031	0.446
11:45 AM	12:00 PM	200	468	336	80	206	197	24	33	0	0	0	0	**1544**	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	26	282	107	79	143	71	59	12	7	5	0	0	**791**	3	0.5	0.2	18	0.064	0.279
12:15 PM	12:30 PM	14	274	119	66	133	46	40	24	10	6	0	0	**731**	4	0.5	0.3	17	0.061	0.201
12:30 PM	12:45 PM	24	260	72	84	126	74	50	12	14	1	0	0	**719**	5	0.6	0.3	18	0.009	0.059
12:45 PM	1:00 PM	19	260	102	62	142	91	71	11	8	0	0	0	**767**	5	0.7	0.3	19	0.044	0.266
1:00 PM	1:15 PM	11	230	54	58	101	73	42	8	4	0	0	0	**581**	5	0.7	0.4	23	0.068	0.529
1:15 PM	1:30 PM	35	152	70	72	72	31	36	8	4	0	0	0	**480**	4	0.7	0.5	17	0.063	0.375
1:30 PM	1:45 PM	29	214	73	98	133	67	46	4	7	0	0	0	**671**	4	0.7	0.4	23	0.063	0.375
1:45 PM	2:00 PM	12	206	103	108	90	47	32	6	7	0	0	0	**612**	5	0.6	0.4	22	0.064	0.239
2:00 PM	2:15 PM	99	189	117	30	85	68	67	8	3	2	0	0	**667**	5	0.6	0.4	15	0.053	0.435
2:15 PM	2:30 PM	126	282	184	63	109	91	81	4	4	1	1	0	**946**	5	0.6	0.3	17	0.031	0.446
2:30 PM	2:45 PM	92	182	130	44	88	68	70	2	3	1	1	0	**681**	3	0.6	0.4	18	0.055	0.371
2:45 PM	3:00 PM	119	234	149	42	130	67	102	0	1	0	0	0	**844**	3	0.6	0.4	13	0.064	0.279
3:00 PM	3:15 PM	145	261	150	37	132	78	68	1	2	0	0	0	**875**	4	0.6	0.3	22	0.061	0.201
3:15 PM	3:30 PM	96	296	159	37	111	60	60	3	4	0	0	1	**826**	4	0.5	0.3	21	0.009	0.059
3:30 PM	3:45 PM	107	316	168	31	94	53	71	2	4	2	0	0	**848**	3	0.5	0.3	26	0.044	0.266
3:45 PM	4:00 PM	94	256	156	27	86	31	33	3	1	0	0	0	**686**	4	0.5	0.3	21	0.068	0.529
4:00 PM	4:15 PM	164	314	194	49	142	114	112	13	5	4	0	0	**1111**	2	0.5	0.4	15	0.063	0.375
4:15 PM	4:30 PM	210	469	306	106	182	152	134	6	7	2	1	0	**1577**	2	0.5	0.4	18	0.063	0.375
4:30 PM	4:45 PM	154	304	216	73	146	114	116	4	5	2	1	0	**1135**	2	0.6	0.3	26	0.064	0.239
4:45 PM	5:00 PM	198	390	248	71	216	112	169	0	2	0	0	0	**1406**	4	0.6	0.3	24	0.053	0.435
5:00 PM	5:15 PM	242	436	250	61	220	131	113	2	4	0	0	0	**1458**	4	0.6	0.4	22	0.031	0.446
5:15 PM	5:30 PM	160	493	265	61	185	100	100	5	7	0	0	1	**1376**	5	0.6	0.4	26	0.055	0.371
5:30 PM	5:45 PM	179	527	281	52	157	88	118	4	6	4	0	0	**1414**	5	0.5	0.4	24	0.064	0.279
5:45 PM	6:00 PM	156	426	259	46	144	52	55	5	1	0	0	0	**1144**	4	0.5	0.3	26	0.061	0.201
TOTALS		**4,576**	**17,532**	**10,696**	**2,893**	**6,212**	**4,053**	**3,881**	**414**	**250**	**41**	**4**	**2**	**50553**	**3.7083333**	**0.5**	**0.3708333**	**18.3125**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	MOMBASA ROAD	**Count Location:**	NRU 01	**Period of St**	DAY
Enumerators name		**Weather:**		**Day of the Week:**	TUESDAY
NRU 01	Both directions			**Date:**	12/11/2019
Start Time (hour):	6:00PM	**Finish Time (hour):**		6:00AM	
Time (hour)					

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00:PM	6:15:PM	35	364	217	52	120	51	96	7	8	0	0	0	949	3	0.3	0.3	24	0.065	0.429
6:15:PM	6:30PM	39	337	199	44	108	57	82	5	2	0	0	0	873	4	0.2	0.2	22	0.058	0.389
6:30PM	6:45PM	67	411	262	62	124	64	92	8	5	2	0	0	1098	3	0.4	0.5	22	0.057	0.413
6:45PM	7:00PM	60	350	218	60	98	68	99	6	1	0	0	0	960	3	0.4	0.2	16	0.067	0.355
7:00PM	7:15PM	38	384	241	53	121	56	94	7	7	0	0	0	1002	3	0.4	0.4	12	0.053	0.376
7:15PM	7:30PM	44	356	223	46	104	55	76	6	2	0	0	0	913	2	0.4	0.4	10	0.046	0.414
7:30PM	7:45PM	76	444	293	65	127	62	88	10	6	2	0	0	1173	3	0.4	0.5	9	0.066	0.447
7:45PM	8:00PM	69	370	244	64	96	66	94	6	1	0	0	0	1009	4	0.4	0.5	8	0.054	0.334
8:00PM	8:15PM	78	350	233	31	31	115	31	5	8	0	0	0	883	4	0.4	0.3	10	0.065	0.402
8:15PM	8:30PM	123	365	256	35	118	115	37	12	6	0	0	0	1066	4	0.4	0.5	10	0.064	0.564
8:30PM	8:45PM	116	301	286	38	71	48	26	19	8	0	0	0	914	3	0.5	0.3	13	0.069	0.415
8:45PM	9:00PM	150	356	257	59	145	138	18	24	0	0	0	0	1147	2	0.5	0.4	18	0.063	0.526
9:00PM	9:15PM	47	499	288	72	169	67	139	9	11	0	0	0	1302	3	0.5	0.3	29	0.067	0.598
9:15PM	9:30PM	51	461	261	60	156	84	123	7	3	0	0	0	1205	4	0.5	0.5	22	0.067	0.435
9:30PM	9:45PM	88	555	345	86	173	92	135	11	6	2	0	0	1494	5	0.5	0.5	15	0.061	0.459
9:45PM	10:00PM	77	481	288	83	141	97	145	7	1	0	0	0	1320	5	0.4	0.4	24	0.009	0.059
10:00PM	10:15PM	51	517	314	73	168	73	134	10	10	0	0	0	1351	5	0.4	0.3	19	0.044	0.266
10:15PM	10:30PM	57	479	288	62	149	80	113	8	3	0	0	0	1239	3	0.4	0.4	22	0.068	0.529
10:30PM	10:45PM	97	589	379	88	175	89	127	12	7	3	0	0	1567	4	0.4	0.2	23	0.063	0.375
10:45PM	11:00PM	88	498	316	86	136	94	136	8	1	0	0	0	1364	3	0.4	0.5	23	0.063	0.375
11:00PM	11:15PM	98	468	306	41	42	168	42	6	12	0	0	0	1183	3	0.4	0.5	30	0.064	0.239
11:15PM	11:30PM	162	476	339	45	168	167	52	17	8	0	0	0	1434	3	0.5	0.5	26	0.053	0.435
11:30PM	11:45PM	154	398	378	52	98	69	34	26	11	0	0	0	1220	4	0.5	0.5	16	0.031	0.446
11:45PM	12:00MN	200	468	336	80	206	197	24	33	0	0	0	0	1544	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	26	282	107	79	143	71	59	12	7	5	0	0	791	3	0.5	0.2	18	0.064	0.279
12:15AM	12:30AM	14	274	119	66	133	46	40	24	10	6	0	0	731	4	0.5	0.3	20	0.061	0.201
12:30AM	12:45AM	24	260	72	84	126	74	50	12	14	1	0	0	719	5	0.6	0.3	24	0.009	0.059
12:45AM	1:00AM	19	260	102	62	142	91	71	11	8	0	0	0	767	5	0.7	0.3	24	0.044	0.266
1:00AM	1:15AM	11	230	54	58	101	73	42	8	4	0	0	0	581	5	0.7	0.4	26	0.068	0.529
1:15AM	1:30AM	35	152	70	72	72	31	36	8	4	0	0	0	480	4	0.7	0.5	25	0.063	0.375
1:30AM	1:45AM	29	214	73	98	133	67	46	4	7	0	0	0	671	4	0.7	0.4	23	0.063	0.375
1:45AM	2:00AM	12	206	103	108	90	47	32	6	7	0	0	0	612	5	0.6	0.4	22	0.064	0.239
2:00AM	2:15AM	99	189	117	30	85	68	67	8	3	2	0	0	667	5	0.6	0.4	28	0.053	0.435
2:15AM	2:30AM	126	282	184	63	109	91	81	4	4	1	1	0	946	5	0.6	0.3	30	0.031	0.446
2:30AM	2:45AM	92	182	130	44	88	68	70	2	3	1	1	0	681	3	0.6	0.4	32	0.055	0.371
2:45AM	3:00AM	119	234	149	42	130	67	102	0	1	0	0	0	844	3	0.6	0.4	23	0.064	0.279
3:00AM	3:15AM	145	261	150	37	132	78	68	1	2	0	0	0	875	4	0.6	0.3	34	0.061	0.201
3:15AM	3:30AM	96	296	159	37	111	60	60	3	4	0	0	1	826	4	0.5	0.3	33	0.009	0.059
3:30AM	3:45AM	107	316	168	31	94	53	71	2	4	2	0	0	848	3	0.5	0.3	29	0.044	0.266
3:45AM	4:00AM	94	256	156	27	86	31	33	3	1	0	0	0	686	4	0.5	0.3	34	0.068	0.529
4:00AM	4:15AM	164	314	194	49	142	114	112	13	5	4	0	0	1111	2	0.5	0.4	36	0.063	0.375
4:15AM	4:30AM	210	469	306	106	182	152	134	6	7	2	1	0	1577	2	0.5	0.4	40	0.063	0.375
4:30AM	4:45AM	154	304	216	73	146	114	116	4	5	2	1	0	1135	2	0.6	0.3	42	0.064	0.239
4:45AM	5:00AM	198	390	248	71	216	112	169	0	2	0	0	0	1406	4	0.6	0.3	43	0.053	0.435
5:00AM	5:15AM	242	436	250	61	220	131	113	2	4	0	0	0	1458	4	0.6	0.4	44	0.031	0.446
5:15AM	5:30AM	160	493	265	61	185	100	100	5	7	0	0	1	1376	5	0.6	0.4	26	0.055	0.371
5:30AM	5:45AM	179	527	281	52	157	88	118	4	6	4	0	0	1414	5	0.5	0.4	24	0.064	0.279
5:45AM	6:00AM	156	426	259	46	144	52	55	5	1	0	0	0	1144	4	0.5	0.3	26	0.061	0.201
TOTALS		**4,576**	**17,532**	**10,696**	**2,893**	**6,212**	**4,053**	**3,881**	**414**	**250**	**41**	**4**	**2**	**50553**	**3.7083333**	**0.5**	**0.3708333**	**23.83333333**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	MOMBASA ROAD	**Count Location:**	NRU 01
Enumerators name		**Weather:**	
NRU 01	Both directions		
Start Time (hour):	6:00 AM	**Finish Time (hour):**	6:00 PM
Time (hour)			

Period of St	DAY
Day of the Week:	WENESDAY
Date:	13/11/2019

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00 AM	6:15 AM	8	240	125	56	187	95	110	7	6	0	0	0	**834**	3	0.3	0.3	9	0.065	0.429
6:15 AM	6:30 AM	19	363	179	29	213	61	125	0	2	5	0	0	**996**	4	0.2	0.2	11	0.058	0.389
6:30 AM	6:45 AM	10	364	169	74	181	80	115	19	10	5	0	0	**1027**	3	0.4	0.5	8	0.057	0.413
6:45 AM	7:00 AM	21	294	130	59	186	96	101	17	8	6	1	0	**919**	3	0.4	0.2	7	0.067	0.355
7:00 AM	7:15 AM	23	216	97	71	171	158	57	7	5	2	0	0	**807**	3	0.4	0.4	5	0.053	0.376
7:15 AM	7:30 AM	19	260	134	68	223	120	33	8	1	0	0	0	**866**	2	0.4	0.4	7	0.046	0.414
7:30 AM	7:45 AM	23	188	87	48	146	129	98	5	2	0	0	0	**726**	3	0.4	0.5	5	0.066	0.447
7:45 AM	8:00 AM	25	152	73	34	107	103	75	0	2	3	0	0	**574**	4	0.4	0.5	5	0.054	0.334
8:00 AM	8:15 AM	11	323	167	77	265	132	152	9	8	0	0	0	**1143**	4	0.4	0.3	10	0.065	0.402
8:15 AM	8:30 AM	26	511	249	42	298	83	171	0	3	8	0	0	**1392**	4	0.4	0.5	10	0.064	0.564
8:30 AM	8:45 AM	14	509	233	103	256	110	159	25	14	7	0	0	**1428**	3	0.5	0.3	29	0.069	0.415
8:45 AM	9:00 AM	30	408	174	81	267	138	136	22	11	8	1	0	**1276**	2	0.5	0.4	18	0.063	0.526
9:00 AM	9:15 AM	32	304	135	98	243	219	78	9	7	3	0	0	**1128**	3	0.5	0.3	29	0.067	0.598
9:15 AM	9:30 AM	27	357	185	94	313	159	46	11	2	0	0	0	**1194**	4	0.5	0.5	22	0.067	0.435
9:30 AM	9:45 AM	33	267	119	67	206	180	139	7	3	0	0	0	**1021**	5	0.5	0.5	15	0.061	0.459
9:45 AM	10:00 AM	36	214	102	48	155	147	107	0	3	5	0	0	**815**	5	0.4	0.4	24	0.009	0.059
10:00 AM	10:15 AM	14	436	224	108	376	185	210	12	12	0	0	0	**1575**	5	0.4	0.3	19	0.044	0.266
10:15 AM	10:30 AM	36	723	348	61	420	114	235	0	5	11	0	0	**1954**	3	0.4	0.4	22	0.068	0.529
10:30 AM	10:45 AM	19	715	323	143	362	153	221	33	19	10	0	0	**1997**	4	0.4	0.2	23	0.063	0.375
10:45 AM	11:00 AM	43	568	234	112	384	199	184	29	15	12	2	0	**1782**	3	0.4	0.5	23	0.063	0.375
11:00 AM	11:15 AM	46	430	189	135	348	304	106	12	10	5	0	0	**1583**	3	0.4	0.5	30	0.064	0.239
11:15 AM	11:30 AM	38	494	256	130	442	212	64	14	2	0	0	0	**1653**	3	0.5	0.5	26	0.053	0.435
11:30 AM	11:45 AM	48	380	164	93	292	253	199	8	5	0	0	0	**1443**	4	0.5	0.5	16	0.031	0.446
11:45 AM	12:00 PM	52	303	144	67	224	210	152	0	5	7	0	0	**1163**	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	13	128	111	48	72	73	43	3	6	1	0	0	**498**	3	0.5	0.2	18	0.064	0.279
12:15 PM	12:30 PM	15	185	148	22	66	41	25	0	6	0	0	0	**508**	4	0.5	0.3	17	0.061	0.201
12:30 PM	12:45 PM	17	256	173	56	66	61	19	13	4	9	0	0	**674**	5	0.6	0.3	18	0.009	0.059
12:45 PM	1:00 PM	25	237	120	70	58	35	11	6	6	12	2	0	**582**	5	0.7	0.3	19	0.044	0.266
1:00 PM	1:15 PM	20	236	137	50	60	40	36	3	4	2	0	0	**588**	5	0.7	0.4	23	0.068	0.529
1:15 PM	1:30 PM	13	217	145	26	50	25	15	0	7	7	0	0	**505**	4	0.7	0.5	17	0.063	0.375
1:30 PM	1:45 PM	26	204	115	44	53	41	15	5	7	1	1	0	**512**	4	0.7	0.4	23	0.063	0.375
1:45 PM	2:00 PM	18	218	136	33	57	52	21	8	4	0	3	0	**550**	5	0.6	0.4	22	0.064	0.239
2:00 PM	2:15 PM	18	563	222	107	308	131	165	3	8	5	0	0	**1530**	5	0.6	0.4	15	0.053	0.435
2:15 PM	2:30 PM	40	392	139	77	363	211	86	3	7	8	0	0	**1325**	5	0.6	0.3	17	0.031	0.446
2:30 PM	2:45 PM	37	423	213	83	319	203	60	3	9	5	0	0	**1354**	3	0.6	0.4	18	0.055	0.371
2:45 PM	3:00 PM	32	338	225	76	330	60	54	4	5	5	0	0	**1128**	3	0.6	0.4	13	0.064	0.279
3:00 PM	3:15 PM	52	363	127	64	228	181	170	0	7	5	2	0	**1197**	4	0.6	0.3	22	0.061	0.201
3:15 PM	3:30 PM	52	319	164	56	228	197	136	1	6	8	0	0	**1167**	4	0.5	0.3	21	0.009	0.059
3:30 PM	3:45 PM	9	174	99	37	66	44	26	4	8	1	0	0	**468**	3	0.5	0.3	26	0.044	0.266
3:45 PM	4:00 PM	14	125	89	21	40	27	15	1	5	1	0	0	**336**	4	0.5	0.3	21	0.068	0.529
4:00 PM	4:15 PM	59	269	176	72	123	104	85	24	9	6	1	0	**928**	2	0.5	0.4	15	0.063	0.375
4:15 PM	4:30 PM	35	249	177	104	129	90	93	12	4	8	1	1	**903**	2	0.5	0.4	18	0.063	0.375
4:30 PM	4:45 PM	42	260	153	65	129	59	88	27	15	9	2	0	**849**	2	0.6	0.3	26	0.064	0.239
4:45 PM	5:00 PM	36	289	168	73	122	76	88	20	7	7	0	0	**886**	4	0.6	0.3	24	0.053	0.435
5:00 PM	5:15 PM	55	205	151	67	106	84	84	24	12	6	0	3	**797**	4	0.6	0.4	22	0.031	0.446
5:15 PM	5:30 PM	44	224	143	61	144	100	89	25	7	6	3	0	**846**	5	0.6	0.4	26	0.055	0.371
5:30 PM	5:45 PM	53	271	146	89	123	80	99	14	10	3	0	0	**888**	5	0.5	0.4	24	0.064	0.279
5:45 PM	6:00 PM	64	252	151	51	116	99	68	9	5	4	0	0	**819**	4	0.5	0.3	26	0.061	0.201
TOTALS		**1,439**	**15,415**	**7,867**	**3,349**	**9,619**	**5,755**	**4,663**	**465**	**324**	**213**	**19**	**4**	**49132**	**3.7083333**	**0.5**	**0.3708333**	**18.3125**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	MOMBASA ROAD			**Count Location:**	NRU 01		**Period of Stu**	DAY													
Enumerators name		**Weather:**					**Day of the Week:**	WENESDAY													
NRU 01	Both directions						**Date:**	13/11/2019													
Start Time (hour):	6:00PM			**Finish Time (hour):**	6:00AM																
Time (hour)																					

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00PM	6:15PM	8	240	125	56	187	95	110	7	6	0	0	0	**834**	3	0.3	0.3	9	0.065	0.429
6:15PM	6:30PM	19	363	179	29	213	61	125	0	2	5	0	0	**996**	4	0.2	0.2	11	0.058	0.389
6:30PM	6:45PM	10	364	169	74	181	80	115	19	10	5	0	0	**1027**	3	0.4	0.5	8	0.057	0.413
6:45PM	7:00PM	21	294	130	59	186	96	101	17	8	6	1	0	**919**	3	0.4	0.2	7	0.067	0.355
7:00PM	7:15PM	23	216	97	71	171	158	57	7	5	2	0	0	**807**	3	0.4	0.4	5	0.053	0.376
7:15PM	7:30PM	19	260	134	68	223	120	33	8	1	0	0	0	**866**	2	0.4	0.4	7	0.046	0.414
7:30PM	7:45PM	23	188	87	48	146	129	98	5	2	0	0	0	**726**	3	0.4	0.5	5	0.066	0.447
7:45PM	8:00PM	25	152	73	34	107	103	75	0	2	3	0	0	**574**	4	0.4	0.5	5	0.054	0.334
8:00PM	8:15PM	11	323	167	77	265	132	152	9	8	0	0	0	**1143**	4	0.4	0.3	10	0.065	0.402
8:15PM	8:30PM	26	511	249	42	298	83	171	0	3	8	0	0	**1392**	4	0.4	0.5	10	0.064	0.564
8:30PM	8:45PM	14	509	233	103	256	110	159	25	14	7	0	0	**1428**	3	0.5	0.3	29	0.069	0.415
8:45PM	9:00PM	30	408	174	81	267	138	136	22	11	8	1	0	**1276**	2	0.5	0.4	18	0.063	0.526
9:00PM	9:15PM	32	304	135	98	243	219	78	9	7	3	0	0	**1128**	3	0.5	0.3	29	0.067	0.598
9:15PM	9:30PM	27	357	185	94	313	159	46	11	2	0	0	0	**1194**	4	0.5	0.5	22	0.067	0.435
9:30PM	9:45PM	33	267	119	67	206	180	139	7	3	0	0	0	**1021**	5	0.5	0.5	15	0.061	0.459
9:45PM	10:00PM	36	214	102	48	155	147	107	0	3	5	0	0	**815**	5	0.4	0.4	24	0.009	0.059
10:00PM	10:15PM	14	436	224	108	376	185	210	12	12	0	0	0	**1575**	5	0.4	0.3	19	0.044	0.266
10:15PM	10:30PM	36	723	348	61	420	114	235	0	5	11	0	0	**1954**	3	0.4	0.4	22	0.068	0.529
10:30PM	10:45PM	19	715	323	143	362	153	221	33	19	10	0	0	**1997**	4	0.4	0.2	23	0.063	0.375
10:45PM	11:00PM	43	568	234	112	384	199	184	29	15	12	2	0	**1782**	3	0.4	0.5	23	0.063	0.375
11:00PM	11:15PM	46	430	189	135	348	304	106	12	10	5	0	0	**1583**	3	0.4	0.5	30	0.064	0.239
11:15PM	11:30PM	38	494	256	130	442	212	64	14	2	0	0	0	**1653**	3	0.5	0.5	26	0.053	0.435
11:30PM	11:45PM	48	380	164	93	292	253	199	8	5	0	0	0	**1443**	4	0.5	0.5	16	0.031	0.446
11:45PM	12:00MN	52	303	144	67	224	210	152	0	5	7	0	0	**1163**	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	13	128	111	48	72	73	43	3	6	1	0	0	**498**	3	0.5	0.2	18	0.064	0.279
12:15AM	12:30AM	15	185	148	22	66	41	25	0	6	0	0	0	**508**	4	0.5	0.3	17	0.061	0.201
12:30AM	12:45AM	17	256	173	56	66	61	19	13	4	9	0	0	**674**	5	0.6	0.3	18	0.009	0.059
12:45AM	1:00AM	25	237	120	70	58	35	11	6	6	12	2	0	**582**	5	0.7	0.3	19	0.044	0.266
1:00AM	1:15AM	20	236	137	50	60	40	36	3	4	2	0	0	**588**	5	0.7	0.4	23	0.068	0.529
1:15AM	1:30AM	13	217	145	26	50	25	15	0	7	7	0	0	**505**	4	0.7	0.5	17	0.063	0.375
1:30AM	1:45AM	26	204	115	44	53	41	15	5	7	1	1	0	**512**	4	0.7	0.4	23	0.063	0.375
1:45AM	2:00AM	18	218	136	33	57	52	21	8	4	0	3	0	**550**	5	0.6	0.4	22	0.064	0.239
2:00AM	2:15AM	18	563	222	107	308	131	165	3	8	5	0	0	**1530**	5	0.6	0.4	15	0.053	0.435
2:15AM	2:30AM	40	392	139	77	363	211	86	3	7	8	0	0	**1325**	5	0.6	0.3	17	0.031	0.446
2:30AM	2:45AM	37	423	213	83	319	203	60	3	9	5	0	0	**1354**	3	0.6	0.4	18	0.055	0.371
2:45AM	3:00AM	32	338	225	76	330	60	54	4	5	5	0	0	**1128**	3	0.6	0.4	13	0.064	0.279
3:00AM	3:15AM	52	363	127	64	228	181	170	0	7	5	2	0	**1197**	4	0.6	0.3	22	0.061	0.201
3:15AM	3:30AM	52	319	164	56	228	197	136	1	6	8	0	0	**1167**	4	0.5	0.3	21	0.009	0.059
3:30AM	3:45AM	9	174	99	37	66	44	26	4	8	1	0	0	**468**	3	0.5	0.3	26	0.044	0.266
3:45AM	4:00AM	14	125	89	21	40	27	15	1	5	1	0	0	**336**	4	0.5	0.3	21	0.068	0.529
4:00AM	4:15AM	59	269	176	72	123	104	85	24	9	6	1	0	**928**	2	0.5	0.4	15	0.063	0.375
4:15AM	4:30AM	35	249	177	104	129	90	93	12	4	8	1	1	**903**	2	0.5	0.4	18	0.063	0.375
4:30AM	4:45AM	42	260	153	65	129	59	88	27	15	9	2	0	**849**	2	0.6	0.3	26	0.064	0.239
4:45AM	5:00AM	36	289	168	73	122	76	88	20	7	7	0	0	**886**	4	0.6	0.3	24	0.053	0.435
5:00AM	5:15AM	55	205	151	67	106	84	84	24	12	6	0	3	**797**	4	0.6	0.4	22	0.031	0.446
5:15AM	5:30AM	44	224	143	61	144	100	89	25	7	6	3	0	**846**	5	0.6	0.4	26	0.055	0.371
5:30AM	5:45AM	53	271	146	89	123	80	99	14	10	3	0	0	**888**	5	0.5	0.4	24	0.064	0.279
5:45AM	6:00AM	64	252	151	51	116	99	68	9	5	4	0	0	**819**	4	0.5	0.3	26	0.061	0.201
TOTALS		**1,439**	**15,415**	**7,867**	**3,349**	**9,619**	**5,755**	**4,663**	**465**	**324**	**213**	**19**	**4**	**49132**	**3.7083333**	**0.5**	**0.3708333**	**18.3125**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	MOMBASA ROAD	**Count Location:**	NRU 01	**Period of St**	DAY
Enumerators name		**Weather:**		**Day of the Week:**	THURSDAY
NRU 01	Both directions			**Date:**	14/11/2019
Start Time (hour):	6:00 AM	**Finish Time (hour):**		6:00 PM	

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00 AM	6:15 AM	27	149	88	27	57	47	47	4	3	6	1	0	**457**	3	0.3	0.3	9	0.065	0.429
6:15 AM	6:30 AM	44	249	121	28	57	42	43	6	5	4	0	0	**599**	4	0.2	0.2	11	0.058	0.389
6:30 AM	6:45 AM	63	234	110	26	84	33	54	8	7	13	2	0	**634**	3	0.4	0.5	8	0.057	0.413
6:45 AM	7:00 AM	51	228	133	57	92	25	34	4	11	8	0	0	**644**	3	0.4	0.2	7	0.067	0.355
7:00 AM	7:15 AM	33	179	103	31	69	55	57	5	4	8	1	0	**545**	3	0.4	0.4	5	0.053	0.376
7:15 AM	7:30 AM	52	296	140	34	69	48	53	7	7	5	0	0	**711**	2	0.4	0.4	7	0.046	0.414
7:30 AM	7:45 AM	75	274	127	31	100	39	66	9	8	16	3	0	**749**	3	0.4	0.5	5	0.066	0.447
7:45 AM	8:00 AM	61	268	153	65	109	30	42	5	13	10	0	0	**757**	4	0.4	0.5	5	0.054	0.334
8:00 AM	8:15 AM	72	263	65	25	88	29	43	9	5	14	0	0	**612**	4	0.4	0.3	10	0.065	0.402
8:15 AM	8:30 AM	73	303	56	29	56	26	70	9	9	10	3	0	**644**	4	0.4	0.5	10	0.064	0.564
8:30 AM	8:45 AM	49	293	49	27	57	48	57	10	7	7	0	0	**605**	3	0.5	0.3	29	0.069	0.415
8:45 AM	9:00 AM	57	309	61	25	46	36	46	5	5	8	0	0	**598**	2	0.5	0.4	18	0.063	0.526
9:00 AM	9:15 AM	53	264	138	41	72	57	64	4	8	7	0	0	**708**	3	0.5	0.3	29	0.067	0.598
9:15 AM	9:30 AM	76	290	160	42	90	70	67	8	6	11	0	0	**822**	4	0.5	0.5	22	0.067	0.435
9:30 AM	9:45 AM	79	339	164	30	116	36	45	13	12	16	4	0	**854**	5	0.5	0.5	15	0.061	0.459
9:45 AM	10:00 AM	52	338	198	85	134	51	71	7	12	10	2	0	**961**	5	0.4	0.4	24	0.009	0.059
10:00 AM	10:15 AM	64	319	161	49	88	65	78	5	9	9	0	0	**846**	5	0.4	0.3	19	0.044	0.266
10:15 AM	10:30 AM	92	341	184	50	109	81	84	9	7	14	0	0	**971**	3	0.4	0.4	22	0.068	0.529
10:30 AM	10:45 AM	93	396	189	36	138	42	55	15	15	20	4	0	**1003**	4	0.4	0.2	23	0.063	0.375
10:45 AM	11:00 AM	77	348	202	94	141	40	55	7	15	15	0	0	**995**	3	0.4	0.5	23	0.063	0.375
11:00 AM	11:15 AM	122	378	74	32	90	34	78	8	7	16	0	0	**838**	3	0.4	0.5	30	0.064	0.239
11:15 AM	11:30 AM	80	398	98	31	98	46	83	17	13	9	4	0	**879**	3	0.5	0.5	26	0.053	0.435
11:30 AM	11:45 AM	70	427	60	37	63	69	71	12	9	11	0	0	**829**	4	0.5	0.5	16	0.031	0.446
11:45 AM	12:00 PM	69	556	121	52	84	52	80	11	9	11	0	0	**1047**	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	209	514	299	44	152	95	12	9	9	4	0	0	**1347**	3	0.5	0.2	18	0.064	0.279
12:15 PM	12:30 PM	228	553	346	27	114	94	12	17	10	5	0	0	**1405**	4	0.5	0.3	17	0.061	0.201
12:30 PM	12:45 PM	324	707	413	42	228	103	22	17	20	5	7	0	**1887**	5	0.6	0.3	18	0.009	0.059
12:45 PM	1:00 PM	237	710	455	31	300	117	31	13	9	4	0	0	**1907**	5	0.7	0.3	19	0.044	0.266
1:00 PM	1:15 PM	218	579	312	44	150	151	12	7	7	4	0	0	**1482**	5	0.7	0.4	23	0.068	0.529
1:15 PM	1:30 PM	190	594	391	39	135	124	14	17	12	4	0	0	**1520**	4	0.7	0.5	17	0.063	0.375
1:30 PM	1:45 PM	278	612	471	47	194	90	22	18	12	4	6	0	**1753**	4	0.7	0.4	23	0.063	0.375
1:45 PM	2:00 PM	242	651	376	44	203	144	33	9	10	3	0	0	**1715**	5	0.6	0.4	22	0.064	0.239
2:00 PM	2:15 PM	94	208	155	21	64	45	37	0	2	4	0	0	**630**	5	0.6	0.4	15	0.053	0.435
2:15 PM	2:30 PM	57	262	134	72	65	37	77	2	3	4	0	0	**713**	5	0.6	0.3	17	0.031	0.446
2:30 PM	2:45 PM	110	258	148	74	90	57	50	5	7	2	0	0	**800**	3	0.6	0.4	18	0.055	0.371
2:45 PM	3:00 PM	102	287	184	90	76	90	24	5	5	1	0	0	**864**	3	0.6	0.4	13	0.064	0.279
3:00 PM	3:15 PM	96	339	224	30	102	87	31	7	5	2	1	0	**924**	4	0.6	0.3	22	0.061	0.201
3:15 PM	3:30 PM	128	352	284	46	106	83	70	5	6	1	0	0	**1080**	4	0.5	0.3	21	0.009	0.059
3:30 PM	3:45 PM	142	222	155	95	112	112	50	5	7	3	0	0	**903**	3	0.5	0.3	26	0.044	0.266
3:45 PM	4:00 PM	123	306	218	68	116	125	80	5	6	1	0	0	**1048**	4	0.5	0.3	21	0.068	0.529
4:00 PM	4:15 PM	116	228	155	27	75	35	40	5	4	0	0	0	**685**	2	0.5	0.4	15	0.063	0.375
4:15 PM	4:30 PM	78	224	125	68	68	42	99	9	7	0	0	0	**718**	2	0.5	0.4	18	0.063	0.375
4:30 PM	4:45 PM	92	233	111	73	70	34	69	10	5	4	0	0	**701**	2	0.6	0.3	26	0.064	0.239
4:45 PM	5:00 PM	72	212	135	94	70	55	59	16	5	3	0	0	**719**	4	0.6	0.3	24	0.053	0.435
5:00 PM	5:15 PM	60	308	186	30	103	96	29	1	3	0	0	0	**815**	4	0.6	0.4	22	0.031	0.446
5:15 PM	5:30 PM	83	289	218	49	153	111	61	3	4	5	0	0	**976**	5	0.6	0.4	26	0.055	0.371
5:30 PM	5:45 PM	108	220	204	91	152	152	44	3	5	1	0	0	**980**	5	0.5	0.4	24	0.064	0.279
5:45 PM	6:00 PM	96	264	190	69	144	138	70	3	7	1	0	0	**982**	4	0.5	0.3	26	0.061	0.201
TOTALS		**5,065**	**16,568**	**8,846**	**2,298**	**5,150**	**3,316**	**2,491**	**388**	**375**	**323**	**38**	**0**	**44858**	**3.7083333**	**0.5**	**0.3708333**	**18.3125**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	MOMBASA ROAD	**Count Location:**	NRU 01	**Period of Stu**	DAY
Enumerators name		**Weather:**		**Day of the Week:**	THURSDAY
NRU 01	Both directions			**Date:**	14/11/2019
Start Time (hour):	6:00PM	**Finish Time (hour):**		6:00AM	
Time (hour)					

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00:PM	6:15:PM	27	149	88	27	57	47	47	4	3	6	1	0	**457**	3	0.3	0.3	9	0.065	0.429
6:15:PM	6:30PM	44	249	121	28	57	42	43	6	5	4	0	0	**599**	4	0.2	0.2	11	0.058	0.389
6:30PM	6:45PM	63	234	110	26	84	33	54	8	7	13	2	0	**634**	3	0.4	0.5	8	0.057	0.413
6:45PM	7:00PM	51	228	133	57	92	25	34	4	11	8	0	0	**644**	3	0.4	0.2	7	0.067	0.355
7:00PM	7:15PM	33	179	103	31	69	55	57	5	4	8	1	0	**545**	3	0.4	0.4	5	0.053	0.376
7:15PM	7:30PM	52	296	140	34	69	48	53	7	7	5	0	0	**711**	2	0.4	0.4	7	0.046	0.414
7:30PM	7:45PM	75	274	127	31	100	39	66	9	8	16	3	0	**749**	3	0.4	0.5	5	0.066	0.447
7:45PM	8:00PM	61	268	153	65	109	30	42	5	13	10	0	0	**757**	4	0.4	0.5	5	0.054	0.334
8:00PM	8:15PM	72	263	65	25	88	29	43	9	5	14	0	0	**612**	4	0.4	0.3	10	0.065	0.402
8:15PM	8:30PM	73	303	56	29	56	26	70	9	9	10	3	0	**644**	4	0.4	0.5	10	0.064	0.564
8:30PM	8:45PM	49	293	49	27	57	48	57	10	7	7	0	0	**605**	3	0.5	0.3	29	0.069	0.415
8:45PM	9:00PM	57	309	61	25	46	36	46	5	5	8	0	0	**598**	2	0.5	0.4	18	0.063	0.526
9:00PM	9:15PM	53	264	138	41	72	57	64	4	8	7	0	0	**708**	3	0.5	0.3	29	0.067	0.598
9:15PM	9:30PM	76	290	160	42	90	70	67	8	6	11	0	0	**822**	4	0.5	0.5	22	0.067	0.435
9:30PM	9:45PM	79	339	164	30	116	36	45	13	12	16	4	0	**854**	5	0.5	0.5	15	0.061	0.459
9:45PM	10:00PM	52	338	198	85	134	51	71	7	12	10	2	0	**961**	5	0.4	0.4	24	0.009	0.059
10:00PM	10:15PM	64	319	161	49	88	65	78	5	9	9	0	0	**846**	5	0.4	0.3	19	0.044	0.266
10:15PM	10:30PM	92	341	184	50	109	81	84	9	7	14	0	0	**971**	3	0.4	0.4	22	0.068	0.529
10:30PM	10:45PM	93	396	189	36	138	42	55	15	15	20	4	0	**1003**	4	0.4	0.2	23	0.063	0.375
10:45PM	11:00PM	77	348	202	94	141	40	55	7	15	15	0	0	**995**	3	0.4	0.5	23	0.063	0.375
11:00PM	11:15PM	122	378	74	32	90	34	78	8	7	16	0	0	**838**	3	0.4	0.5	30	0.064	0.239
11:15PM	11:30PM	80	398	98	31	98	46	83	17	13	9	4	0	**879**	3	0.5	0.5	26	0.053	0.435
11:30PM	11:45PM	70	427	60	37	63	69	71	12	9	11	0	0	**829**	4	0.5	0.5	16	0.031	0.446
11:45PM	12:00MN	69	556	121	52	84	52	80	11	9	11	0	0	**1047**	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	209	514	299	44	152	95	12	9	9	4	0	0	**1347**	3	0.5	0.2	18	0.064	0.279
12:15AM	12:30AM	228	553	346	27	114	94	12	17	10	5	0	0	**1405**	4	0.5	0.3	17	0.061	0.201
12:30AM	12:45AM	324	707	413	42	228	103	22	17	20	5	7	0	**1887**	5	0.6	0.3	18	0.009	0.059
12:45AM	1:00AM	237	710	455	31	300	117	31	13	9	4	0	0	**1907**	5	0.7	0.3	19	0.044	0.266
1:00AM	1:15AM	218	579	312	44	150	151	12	7	7	4	0	0	**1482**	5	0.7	0.4	23	0.068	0.529
1:15AM	1:30AM	190	594	391	39	135	124	14	17	12	4	0	0	**1520**	4	0.7	0.5	17	0.063	0.375
1:30AM	1:45AM	278	612	471	47	194	90	22	18	12	4	6	0	**1753**	4	0.7	0.4	23	0.063	0.375
1:45AM	2:00AM	242	651	376	44	203	144	33	9	10	3	0	0	**1715**	5	0.6	0.4	22	0.064	0.239
2:00AM	2:15AM	94	208	155	21	64	45	37	0	2	4	0	0	**630**	5	0.6	0.4	15	0.053	0.435
2:15AM	2:30AM	57	262	134	72	65	37	77	2	3	4	0	0	**713**	5	0.6	0.3	17	0.031	0.446
2:30AM	2:45AM	110	258	148	74	90	57	50	5	7	2	0	0	**800**	3	0.6	0.4	18	0.055	0.371
2:45AM	3:00AM	102	287	184	90	76	90	24	5	5	1	0	0	**864**	3	0.6	0.4	13	0.064	0.279
3:00AM	3:15AM	96	339	224	30	102	87	31	7	5	2	1	0	**924**	4	0.6	0.3	22	0.061	0.201
3:15AM	3:30AM	128	352	284	46	106	83	70	5	6	1	0	0	**1080**	4	0.5	0.3	21	0.009	0.059
3:30AM	3:45AM	142	222	155	95	112	112	50	5	7	3	0	0	**903**	3	0.5	0.3	26	0.044	0.266
3:45AM	4:00AM	123	306	218	68	116	125	80	5	6	1	0	0	**1048**	4	0.5	0.3	21	0.068	0.529
4:00AM	4:15AM	116	228	155	27	75	35	40	5	4	0	0	0	**685**	2	0.5	0.4	15	0.063	0.375
4:15AM	4:30AM	78	224	125	68	68	42	99	9	7	0	0	0	**718**	2	0.5	0.4	18	0.063	0.375
4:30AM	4:45AM	92	233	111	73	70	34	69	10	5	4	0	0	**701**	2	0.6	0.3	26	0.064	0.239
4:45AM	5:00AM	72	212	135	94	70	55	59	16	5	3	0	0	**719**	4	0.6	0.3	24	0.053	0.435
5:00AM	5:15AM	60	308	186	30	103	96	29	1	3	0	0	0	**815**	4	0.6	0.4	22	0.031	0.446
5:15AM	5:30AM	83	289	218	49	153	111	61	3	4	5	0	0	**976**	5	0.6	0.4	26	0.055	0.371
5:30AM	5:45AM	108	220	204	91	152	152	44	3	5	1	0	0	**980**	5	0.5	0.4	24	0.064	0.279
5:45AM	6:00AM	96	264	190	69	144	138	70	3	7	1	0	0	**982**	4	0.5	0.3	26	0.061	0.201
TOTALS		**5,065**	**16,568**	**8,846**	**2,298**	**5,150**	**3,316**	**2,491**	**388**	**375**	**323**	**38**	**0**	**44858**	**3.7083333**	**0.5**	**0.3708333**	**18.3125**	**0.055145833**	**0.360020833**

Road/Link Name:		MOMBASA ROAD			**Count Location:**		NRU 01		**Period of St**	DAY										
Enumerators name			**Weather:**					**Day of the Week:**		FRIDAY										
NRU 01		Both directions						**Date:**		15/11/2019										
Start Time (hour):			6:00 AM			**Finish Time (hour):**				6:00 PM										
Time (hour)																				
From	**To**	**Motorcyle**	**Private Cars**	**Jeeps / 4WD's/utility vehicle**	**pickup/vans**	**Matatu (9 - 25 seats)**	**Small buses**	**Large Bus (>27 passengers)**	**Light Trucks 2 axles (single rear wheel)**	**Medium Trucks (2 axles, Double rear wheels)**	**Heavy Trucks (3, 4 axle)**	**Artics / Draw - bar Trucks (>4 axles)**	**Other (Agricultural tractors, grader etc.)**	**Total traffic volume**	**CO PPM**	**NOx PPM**	**SOxPPM**	**PM2.5µg/m³**	**HCHO mg/m³**	**TVOC mg/m³**
6:00 AM	6:15 AM	29	303	181	43	100	42	80	6	6	0	0	0	**791**	3	0.3	0.3	9	0.065	0.429
6:15 AM	6:30 AM	33	281	166	36	90	48	69	4	2	0	0	0	**728**	4	0.2	0.2	11	0.058	0.389
6:30 AM	6:45 AM	56	343	218	52	103	53	77	7	4	2	0	0	**915**	3	0.4	0.5	8	0.057	0.413
6:45 AM	7:00 AM	50	292	182	50	82	56	83	5	1	0	0	0	**800**	3	0.4	0.2	7	0.067	0.355
7:00 AM	7:15 AM	32	320	201	44	101	47	78	6	6	0	0	0	**835**	3	0.4	0.4	5	0.053	0.376
7:15 AM	7:30 AM	37	297	186	38	87	46	63	5	2	0	0	0	**761**	2	0.4	0.4	7	0.046	0.414
7:30 AM	7:45 AM	63	370	244	54	106	52	73	8	5	2	0	0	**977**	3	0.4	0.5	5	0.066	0.447
7:45 AM	8:00 AM	58	308	203	53	80	55	78	5	1	0	0	0	**841**	4	0.4	0.5	5	0.054	0.334
8:00 AM	8:15 AM	65	292	194	26	26	96	26	4	7	0	0	0	**736**	4	0.4	0.3	10	0.065	0.402
8:15 AM	8:30 AM	103	304	213	29	98	96	31	10	5	0	0	0	**889**	4	0.4	0.5	10	0.064	0.564
8:30 AM	8:45 AM	97	251	238	32	59	40	22	16	7	0	0	0	**762**	3	0.5	0.3	29	0.069	0.415
8:45 AM	9:00 AM	125	297	214	49	121	115	15	20	0	0	0	0	**956**	2	0.5	0.4	18	0.063	0.526
9:00 AM	9:15 AM	39	416	240	60	141	56	116	8	9	0	0	0	**1085**	3	0.5	0.3	29	0.067	0.598
9:15 AM	9:30 AM	42	384	217	50	130	70	103	5	3	0	0	0	**1004**	4	0.5	0.5	22	0.067	0.435
9:30 AM	9:45 AM	73	463	287	72	145	77	113	9	5	2	0	0	**1245**	5	0.5	0.5	15	0.061	0.459
9:45 AM	10:00 AM	64	401	240	69	118	81	121	6	1	0	0	0	**1100**	5	0.4	0.4	24	0.009	0.059
10:00 AM	10:15 AM	42	431	262	61	140	61	111	8	9	0	0	0	**1125**	5	0.4	0.3	19	0.044	0.266
10:15 AM	10:30 AM	47	399	240	52	125	66	94	6	3	0	0	0	**1032**	3	0.4	0.4	22	0.068	0.529
10:30 AM	10:45 AM	81	491	316	74	146	74	106	10	6	2	0	0	**1306**	4	0.4	0.2	23	0.063	0.375
10:45 AM	11:00 AM	73	415	263	71	114	78	114	7	1	0	0	0	**1136**	3	0.4	0.5	23	0.063	0.375
11:00 AM	11:15 AM	82	390	255	34	35	140	35	5	10	0	0	0	**986**	3	0.4	0.5	30	0.064	0.239
11:15 AM	11:30 AM	135	397	283	38	140	140	44	14	7	0	0	0	**1195**	3	0.5	0.5	26	0.053	0.435
11:30 AM	11:45 AM	128	332	315	43	82	58	28	22	9	0	0	0	**1016**	4	0.5	0.5	16	0.031	0.446
11:45 AM	12:00 PM	167	390	280	67	171	164	20	27	0	0	0	0	**1286**	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	22	235	89	66	119	59	49	10	6	4	0	0	**659**	3	0.5	0.2	18	0.064	0.279
12:15 PM	12:30 PM	12	228	99	55	111	38	33	20	8	5	0	0	**609**	4	0.5	0.3	17	0.061	0.201
12:30 PM	12:45 PM	20	217	60	70	105	62	42	10	12	1	0	0	**599**	5	0.6	0.3	18	0.009	0.059
12:45 PM	1:00 PM	16	217	85	52	118	76	59	9	7	0	0	0	**639**	5	0.7	0.3	19	0.044	0.266
1:00 PM	1:15 PM	9	192	45	48	84	61	35	7	3	0	0	0	**484**	5	0.7	0.4	23	0.068	0.529
1:15 PM	1:30 PM	29	127	58	60	60	26	30	7	3	0	0	0	**400**	4	0.7	0.5	17	0.063	0.375
1:30 PM	1:45 PM	24	178	61	82	111	56	38	3	6	0	0	0	**559**	4	0.7	0.4	23	0.063	0.375
1:45 PM	2:00 PM	10	172	86	90	75	39	27	5	6	0	0	0	**510**	5	0.6	0.4	22	0.064	0.239
2:00 PM	2:15 PM	82	157	97	25	71	57	56	7	2	2	0	0	**556**	5	0.6	0.4	15	0.053	0.435
2:15 PM	2:30 PM	105	235	153	53	91	76	67	3	4	1	1	0	**788**	5	0.6	0.3	17	0.031	0.446
2:30 PM	2:45 PM	77	152	108	37	73	57	58	2	2	1	1	0	**568**	3	0.6	0.4	18	0.055	0.371
2:45 PM	3:00 PM	99	195	124	35	108	56	85	0	1	0	0	0	**703**	3	0.6	0.4	13	0.064	0.279
3:00 PM	3:15 PM	121	218	125	31	110	65	56	1	2	0	0	0	**729**	4	0.6	0.3	22	0.061	0.201
3:15 PM	3:30 PM	80	247	133	31	92	50	50	2	4	0	0	1	**688**	4	0.5	0.3	21	0.009	0.059
3:30 PM	3:45 PM	89	263	140	26	79	44	59	2	3	2	0	0	**707**	3	0.5	0.3	26	0.044	0.266
3:45 PM	4:00 PM	78	213	130	23	72	26	28	2	1	0	0	0	**572**	4	0.5	0.3	21	0.068	0.529
4:00 PM	4:15 PM	137	262	162	41	118	95	93	11	4	3	0	0	**926**	2	0.5	0.4	15	0.063	0.375
4:15 PM	4:30 PM	175	391	255	88	152	127	112	5	6	2	1	0	**1314**	2	0.5	0.4	18	0.063	0.375
4:30 PM	4:45 PM	128	253	180	61	122	95	97	3	4	2	1	0	**946**	2	0.6	0.3	26	0.064	0.239
4:45 PM	5:00 PM	165	325	207	59	180	93	141	0	2	0	0	0	**1172**	4	0.6	0.3	24	0.053	0.435
5:00 PM	5:15 PM	202	363	208	51	183	109	94	2	3	0	0	0	**1215**	4	0.6	0.4	22	0.031	0.446
5:15 PM	5:30 PM	133	411	221	51	154	83	83	4	6	0	0	1	**1147**	5	0.6	0.4	26	0.055	0.371
5:30 PM	5:45 PM	149	439	234	43	131	73	98	3	5	3	0	0	**1178**	5	0.5	0.4	24	0.064	0.279
5:45 PM	6:00 PM	130	355	216	159	120	43	46	4	1	0	0	0	**1074**	4	0.5	0.3	26	0.061	0.201
TOTALS		**3,814**	**14,610**	**8,913**	**2,532**	**5,177**	**3,377**	**3,234**	**345**	**208**	**34**	**3**	**2**	**42,249**	**3.7083333**	**0.5**	**0.3708333**	**18.3125**	**0.055145833**	**0.360020833**

Road/Link Name:	MOMBASA ROAD				**Count Location:**	NRU 01		**Period of St**	DAY											
Enumerators name		**Weather:**						**Day of the Week:**	FRIDAY											
NRU 01	Both directions							**Date:**	15/11/2019											
Start Time (hour):	6:00PM				**Finish Time (hour):**			6:00AM												
Time (hour)																				
From	**To**	**Motorcyle**	**Private Cars**	**Jeeps / 4WD's/utility vehicle**	**pickup/vans**	**Matatu (9 - 25 seats)**	**Small buses**	**Large Bus (>27 passengers)**	**Light Trucks 2 axles (single rear wheel)**	**Medium Trucks (2 axles, Double rear wheels)**	**Heavy Trucks (3, 4 axle)**	**Artics / Draw - bar Trucks (>4 axles)**	**Other (Agricultural tractors, grader etc.)**	**Total traffic volume**	**CO PPM**	**NOx PPM**	**SOxPPM**	**PM2.5µg/m³**	**HCHO mg/m³**	**TVOC mg/m³**
6:00:PM	6:15:PM	29	303	181	43	100	42	80	6	6	0	0	0	**791**	3	0.3	0.3	9	0.065	0.429
6:15:PM	6:30PM	33	281	166	36	90	48	69	4	2	0	0	0	**728**	4	0.2	0.2	11	0.058	0.389
6:30PM	6:45PM	56	343	218	52	103	53	77	7	4	2	0	0	**915**	3	0.4	0.5	8	0.057	0.413
6:45PM	7:00PM	50	292	182	50	82	56	83	5	1	0	0	0	**800**	3	0.4	0.2	7	0.067	0.355
7:00PM	7:15PM	32	320	201	44	101	47	78	6	6	0	0	0	**835**	3	0.4	0.4	5	0.053	0.376
7:15PM	7:30PM	37	297	186	38	87	46	63	5	2	0	0	0	**761**	2	0.4	0.4	7	0.046	0.414
7:30PM	7:45PM	63	370	244	54	106	52	73	8	5	2	0	0	**977**	3	0.4	0.5	5	0.066	0.447
7:45PM	8:00PM	58	308	203	53	80	55	78	5	1	0	0	0	**841**	4	0.4	0.5	5	0.054	0.334
8:00PM	8:15PM	65	292	194	26	26	96	26	4	7	0	0	0	**736**	4	0.4	0.3	10	0.065	0.402
8:15PM	8:30PM	103	304	213	29	98	96	31	10	5	0	0	0	**889**	4	0.4	0.5	10	0.064	0.564
8:30PM	8:45PM	97	251	238	32	59	40	22	16	7	0	0	0	**762**	3	0.5	0.3	29	0.069	0.415
8:45PM	9:00PM	125	297	214	49	121	115	15	20	0	0	0	0	**956**	2	0.5	0.4	18	0.063	0.526
9:00PM	9:15PM	39	416	240	60	141	56	116	8	9	0	0	0	**1085**	3	0.5	0.3	29	0.067	0.598
9:15PM	9:30PM	42	384	217	50	130	70	103	5	3	0	0	0	**1004**	4	0.5	0.5	22	0.067	0.435
9:30PM	9:45PM	73	463	287	72	145	77	113	9	5	2	0	0	**1245**	5	0.5	0.5	15	0.061	0.459
9:45PM	10:00PM	64	401	240	69	118	81	121	6	1	0	0	0	**1100**	5	0.4	0.4	24	0.009	0.059
10:00PM	10:15PM	42	431	262	61	140	61	111	8	9	0	0	0	**1125**	5	0.4	0.3	19	0.044	0.266
10:15PM	10:30PM	47	399	240	52	125	66	94	6	3	0	0	0	**1032**	3	0.4	0.4	22	0.068	0.529
10:30PM	10:45PM	81	491	316	74	146	74	106	10	6	2	0	0	**1306**	4	0.4	0.2	23	0.063	0.375
10:45PM	11:00PM	73	415	263	71	114	78	114	7	1	0	0	0	**1136**	3	0.4	0.5	23	0.063	0.375
11:00PM	11:15PM	82	390	255	34	35	140	35	5	10	0	0	0	**986**	3	0.4	0.5	30	0.064	0.239
11:15PM	11:30PM	135	397	283	38	140	140	44	14	7	0	0	0	**1195**	3	0.5	0.5	26	0.053	0.435
11:30PM	11:45PM	128	332	315	43	82	58	28	22	9	0	0	0	**1016**	4	0.5	0.5	16	0.031	0.446
11:45PM	12:00MN	167	390	280	67	171	164	20	27	0	0	0	0	**1286**	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	22	235	89	66	119	59	49	10	6	4	0	0	**659**	3	0.5	0.2	18	0.064	0.279
12:15AM	12:30AM	12	228	99	55	111	38	33	20	8	5	0	0	**609**	4	0.5	0.3	17	0.061	0.201
12:30AM	12:45AM	20	217	60	70	105	62	42	10	12	1	0	0	**599**	5	0.6	0.3	18	0.009	0.059
12:45AM	1:00AM	16	217	85	52	118	76	59	9	7	0	0	0	**639**	5	0.7	0.3	19	0.044	0.266
1:00AM	1:15AM	9	192	45	48	84	61	35	7	3	0	0	0	**484**	5	0.7	0.4	23	0.068	0.529
1:15AM	1:30AM	29	127	58	60	60	26	30	7	3	0	0	0	**400**	4	0.7	0.5	17	0.063	0.375
1:30AM	1:45AM	24	178	61	82	111	56	38	3	6	0	0	0	**559**	4	0.7	0.4	23	0.063	0.375
1:45AM	2:00AM	10	172	86	90	75	39	27	5	6	0	0	0	**510**	5	0.6	0.4	22	0.064	0.239
2:00AM	2:15AM	82	157	97	25	71	57	56	7	2	2	0	0	**556**	5	0.6	0.4	15	0.053	0.435
2:15AM	2:30AM	105	235	153	53	91	76	67	3	4	1	1	0	**788**	5	0.6	0.3	17	0.031	0.446
2:30AM	2:45AM	77	152	108	37	73	57	58	2	2	1	1	0	**568**	3	0.6	0.4	18	0.055	0.371
2:45AM	3:00AM	99	195	124	35	108	56	85	0	1	0	0	0	**703**	3	0.6	0.4	13	0.064	0.279
3:00AM	3:15AM	121	218	125	31	110	65	56	1	2	0	0	0	**729**	4	0.6	0.3	22	0.061	0.201
3:15AM	3:30AM	80	247	133	31	92	50	50	2	4	0	0	1	**688**	4	0.5	0.3	21	0.009	0.059
3:30AM	3:45AM	89	263	140	26	79	44	59	2	3	2	0	0	**707**	3	0.5	0.3	26	0.044	0.266
3:45AM	4:00AM	78	213	130	23	72	26	28	2	1	0	0	0	**572**	4	0.5	0.3	21	0.068	0.529
4:00AM	4:15AM	137	262	162	41	118	95	93	11	4	3	0	0	**926**	2	0.5	0.4	15	0.063	0.375
4:15AM	4:30AM	175	391	255	88	152	127	112	5	6	2	1	0	**1314**	2	0.5	0.4	18	0.063	0.375
4:30AM	4:45AM	128	253	180	61	122	95	97	3	4	2	1	0	**946**	2	0.6	0.3	26	0.064	0.239
4:45AM	5:00AM	165	325	207	59	180	93	141	0	2	0	0	0	**1172**	4	0.6	0.3	24	0.053	0.435
5:00AM	5:15AM	202	363	208	51	183	109	94	2	3	0	0	0	**1215**	4	0.6	0.4	22	0.031	0.446
5:15AM	5:30AM	133	411	221	51	154	83	83	4	6	0	0	1	**1147**	5	0.6	0.4	26	0.055	0.371
5:30AM	5:45AM	149	439	234	43	131	73	98	3	5	3	0	0	**1178**	5	0.5	0.4	24	0.064	0.279
5:45AM	6:00AM	130	355	216	159	120	43	46	4	1	0	0	0	**1074**	4	0.5	0.3	26	0.061	0.201
TOTALS		**3,814**	**14,610**	**8,913**	**2,532**	**5,177**	**3,377**	**3,234**	**345**	**208**	**34**	**3**	**2**	**42,249**	**3.7083333**	**0.5**	**0.3708333**	**18.3125**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	MOMBASA ROAD	**Count Location:**	NRU 01	**Period of St**	DAY
Enumerators name		**Weather:**		**Day of the Week:**	SATURDAY
NRU 01	Both directions			**Date:**	16/11/2019
Start Time (hour):	6:00 AM	**Finish Time (hour):**	6:00 PM		

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00 AM	6:15 AM	21	115	68	20	44	36	36	3	3	5	1	0	**351**	3	0.3	0.3	9	0.065	0.429
6:15 AM	6:30 AM	34	191	93	22	44	32	33	4	4	3	0	0	**461**	4	0.2	0.2	11	0.058	0.389
6:30 AM	6:45 AM	49	180	85	20	65	25	41	6	5	10	2	0	**488**	3	0.4	0.5	8	0.057	0.413
6:45 AM	7:00 AM	39	175	103	44	71	20	26	3	9	7	0	0	**495**	3	0.4	0.2	7	0.067	0.355
7:00 AM	7:15 AM	25	138	79	24	53	42	44	4	3	6	1	0	**419**	3	0.4	0.4	5	0.053	0.376
7:15 AM	7:30 AM	40	228	108	26	53	37	41	5	5	4	0	0	**547**	2	0.4	0.4	7	0.046	0.414
7:30 AM	7:45 AM	58	211	98	24	77	30	51	7	6	12	2	0	**576**	3	0.4	0.5	5	0.066	0.447
7:45 AM	8:00 AM	47	206	118	50	84	23	32	4	10	8	0	0	**582**	4	0.4	0.5	5	0.054	0.334
8:00 AM	8:15 AM	55	202	50	19	68	22	33	7	4	11	0	0	**471**	4	0.4	0.3	10	0.065	0.402
8:15 AM	8:30 AM	56	233	43	22	43	20	54	7	7	8	2	0	**495**	4	0.4	0.5	10	0.064	0.564
8:30 AM	8:45 AM	38	225	38	21	44	37	44	8	5	5	0	0	**465**	3	0.5	0.3	29	0.069	0.415
8:45 AM	9:00 AM	44	238	47	19	35	28	35	4	4	6	0	0	**460**	2	0.5	0.4	18	0.063	0.526
9:00 AM	9:15 AM	41	203	106	32	56	44	49	3	6	6	0	0	**545**	3	0.5	0.3	29	0.067	0.598
9:15 AM	9:30 AM	59	223	123	33	69	54	52	6	5	8	0	0	**632**	4	0.5	0.5	22	0.067	0.435
9:30 AM	9:45 AM	61	261	126	23	89	28	35	10	10	13	3	0	**657**	5	0.5	0.5	15	0.061	0.459
9:45 AM	10:00 AM	40	260	152	66	103	40	55	5	9	8	1	0	**739**	5	0.4	0.4	24	0.009	0.059
10:00 AM	10:15 AM	49	245	124	38	67	50	60	4	7	7	0	0	**651**	5	0.4	0.3	19	0.044	0.266
10:15 AM	10:30 AM	71	262	142	39	84	62	64	7	6	10	0	0	**747**	3	0.4	0.4	22	0.068	0.529
10:30 AM	10:45 AM	72	305	146	27	106	32	43	11	11	15	3	0	**771**	4	0.4	0.2	23	0.063	0.375
10:45 AM	11:00 AM	59	267	155	72	109	31	43	5	12	12	0	0	**766**	3	0.4	0.5	23	0.063	0.375
11:00 AM	11:15 AM	94	291	57	25	69	26	60	6	6	12	0	0	**645**	3	0.4	0.5	30	0.064	0.239
11:15 AM	11:30 AM	62	306	76	24	76	35	64	13	10	7	3	0	**676**	3	0.5	0.5	26	0.053	0.435
11:30 AM	11:45 AM	54	328	46	29	49	53	54	9	7	8	0	0	**638**	4	0.5	0.5	16	0.031	0.446
11:45 AM	12:00 PM	53	428	93	40	65	40	62	9	7	8	0	0	**805**	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	161	395	230	34	117	73	9	7	7	3	0	0	**1036**	3	0.5	0.2	18	0.064	0.279
12:15 PM	12:30 PM	175	425	266	21	88	72	9	13	8	4	0	0	**1081**	4	0.5	0.3	17	0.061	0.201
12:30 PM	12:45 PM	249	544	318	32	175	79	17	13	15	4	6	0	**1452**	5	0.6	0.3	18	0.009	0.059
12:45 PM	1:00 PM	182	546	350	24	231	90	24	10	7	3	0	0	**1467**	5	0.7	0.3	19	0.044	0.266
1:00 PM	1:15 PM	168	445	240	34	115	116	9	5	5	3	0	0	**1140**	5	0.7	0.4	23	0.068	0.529
1:15 PM	1:30 PM	146	457	301	30	104	95	11	13	9	3	0	0	**1169**	4	0.7	0.5	17	0.063	0.375
1:30 PM	1:45 PM	214	471	362	36	149	69	17	14	9	3	5	0	**1349**	4	0.7	0.4	23	0.063	0.375
1:45 PM	2:00 PM	186	501	289	34	156	111	25	7	8	2	0	0	**1319**	5	0.6	0.4	22	0.064	0.239
2:00 PM	2:15 PM	72	160	119	16	49	35	28	0	2	3	0	0	**485**	5	0.6	0.4	15	0.053	0.435
2:15 PM	2:30 PM	44	202	103	55	50	28	59	2	2	3	0	0	**549**	5	0.6	0.3	17	0.031	0.446
2:30 PM	2:45 PM	85	199	114	57	69	44	38	4	6	1	0	0	**616**	3	0.6	0.4	18	0.055	0.371
2:45 PM	3:00 PM	78	221	142	69	59	69	19	4	4	1	0	0	**664**	3	0.6	0.4	13	0.064	0.279
3:00 PM	3:15 PM	74	260	172	23	79	67	24	5	4	2	1	0	**711**	4	0.6	0.3	22	0.061	0.201
3:15 PM	3:30 PM	98	271	219	35	81	64	54	4	4	1	0	0	**831**	4	0.5	0.3	21	0.009	0.059
3:30 PM	3:45 PM	109	170	119	73	86	86	39	4	5	3	0	0	**694**	3	0.5	0.3	26	0.044	0.266
3:45 PM	4:00 PM	94	235	168	52	90	96	62	4	4	1	0	0	**806**	4	0.5	0.3	21	0.068	0.529
4:00 PM	4:15 PM	89	175	119	21	58	27	31	4	3	0	0	0	**527**	2	0.5	0.4	15	0.063	0.375
4:15 PM	4:30 PM	60	172	96	52	52	32	76	7	5	0	0	0	**552**	2	0.5	0.4	18	0.063	0.375
4:30 PM	4:45 PM	71	179	85	56	54	26	53	8	4	3	0	0	**539**	2	0.6	0.3	26	0.064	0.239
4:45 PM	5:00 PM	55	163	104	72	54	42	45	12	4	2	0	0	**553**	4	0.6	0.3	24	0.053	0.435
5:00 PM	5:15 PM	46	237	143	23	79	74	22	1	2	0	0	0	**627**	4	0.6	0.4	22	0.031	0.446
5:15 PM	5:30 PM	64	222	168	38	118	85	47	2	3	4	0	0	**751**	5	0.6	0.4	26	0.055	0.371
5:30 PM	5:45 PM	83	169	157	70	117	117	34	2	4	1	0	0	**754**	5	0.5	0.4	24	0.064	0.279
5:45 PM	6:00 PM	74	203	146	53	111	106	54	2	5	1	0	0	**755**	4	0.5	0.3	26	0.061	0.201
TOTALS		**3,896**	**12,745**	**6,804**	**1,767**	**3,962**	**2,551**	**1,916**	**299**	**289**	**249**	**29**	**0**	**34,506**	**3.7083333**	**0.5**	**0.3708333**	**18.3125**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	MOMBASA ROAD	**Count Location:**	NRU 01	**Period of St**	DAY
Enumerators name		**Weather:**		**Day of the Week:**	SATURDAY
NRU 01	Both directions			**Date:**	16/11/2019
Start Time (hour):	6:00PM	**Finish Time (hour):**		6:00AM	

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00:PM	6:15:PM	21	115	68	20	44	36	36	3	3	5	1	0	**351**	3	0.3	0.3	9	0.065	0.429
6:15:PM	6:30PM	34	191	93	22	44	32	33	4	4	3	0	0	**461**	4	0.2	0.2	11	0.058	0.389
6:30PM	6:45PM	49	180	85	20	65	25	41	6	5	10	2	0	**488**	3	0.4	0.5	8	0.057	0.413
6:45PM	7:00PM	39	175	103	44	71	20	26	3	9	7	0	0	**495**	3	0.4	0.2	7	0.067	0.355
7:00PM	7:15PM	25	138	79	24	53	42	44	4	3	6	1	0	**419**	3	0.4	0.4	5	0.053	0.376
7:15PM	7:30PM	40	228	108	26	53	37	41	5	5	4	0	0	**547**	2	0.4	0.4	7	0.046	0.414
7:30PM	7:45PM	58	211	98	24	77	30	51	7	6	12	2	0	**576**	3	0.4	0.5	5	0.066	0.447
7:45PM	8:00PM	47	206	118	50	84	23	32	4	10	8	0	0	**582**	4	0.4	0.5	5	0.054	0.334
8:00PM	8:15PM	55	202	50	19	68	22	33	7	4	11	0	0	**471**	4	0.4	0.3	10	0.065	0.402
8:15PM	8:30PM	56	233	43	22	43	20	54	7	7	8	2	0	**495**	4	0.4	0.5	10	0.064	0.564
8:30PM	8:45PM	38	225	38	21	44	37	44	8	5	5	0	0	**465**	3	0.5	0.3	29	0.069	0.415
8:45PM	9:00PM	44	238	47	19	35	28	35	4	4	6	0	0	**460**	2	0.5	0.4	18	0.063	0.526
9:00PM	9:15PM	41	203	106	32	56	44	49	3	6	6	0	0	**545**	3	0.5	0.3	29	0.067	0.598
9:15PM	9:30PM	59	223	123	33	69	54	52	6	5	8	0	0	**632**	4	0.5	0.5	22	0.067	0.435
9:30PM	9:45PM	61	261	126	23	89	28	35	10	10	13	3	0	**657**	5	0.5	0.5	15	0.061	0.459
9:45PM	10:00PM	40	260	152	66	103	40	55	5	9	8	1	0	**739**	5	0.4	0.4	24	0.009	0.059
10:00PM	10:15PM	49	245	124	38	67	50	60	4	7	7	0	0	**651**	5	0.4	0.3	19	0.044	0.266
10:15PM	10:30PM	71	262	142	39	84	62	64	7	6	10	0	0	**747**	3	0.4	0.4	22	0.068	0.529
10:30PM	10:45PM	72	305	146	27	106	32	43	11	11	15	3	0	**771**	4	0.4	0.2	23	0.063	0.375
10:45PM	11:00PM	59	267	155	72	109	31	43	5	12	12	0	0	**766**	3	0.4	0.5	23	0.063	0.375
11:00PM	11:15PM	94	291	57	25	69	26	60	6	6	12	0	0	**645**	3	0.4	0.5	30	0.064	0.239
11:15PM	11:30PM	62	306	76	24	76	35	64	13	10	7	3	0	**676**	3	0.5	0.5	26	0.053	0.435
11:30PM	11:45PM	54	328	46	29	49	53	54	9	7	8	0	0	**638**	4	0.5	0.5	16	0.031	0.446
11:45PM	12:00MN	53	428	93	40	65	40	62	9	7	8	0	0	**805**	4	0.5	0.3	15	0.055	0.371
12:00 PM	12:15 PM	161	395	230	34	117	73	9	7	7	3	0	0	**1036**	3	0.5	0.2	18	0.064	0.279
12:15AM	12:30AM	175	425	266	21	88	72	9	13	8	4	0	0	**1081**	4	0.5	0.3	17	0.061	0.201
12:30AM	12:45AM	249	544	318	32	175	79	17	13	15	4	6	0	**1452**	5	0.6	0.3	18	0.009	0.059
12:45AM	1:00AM	182	546	350	24	231	90	24	10	7	3	0	0	**1467**	5	0.7	0.3	19	0.044	0.266
1:00AM	1:15AM	168	445	240	34	115	116	9	5	5	3	0	0	**1140**	5	0.7	0.4	23	0.068	0.529
1:15AM	1:30AM	146	457	301	30	104	95	11	13	9	3	0	0	**1169**	4	0.7	0.5	17	0.063	0.375
1:30AM	1:45AM	214	471	362	36	149	69	17	14	9	3	5	0	**1349**	4	0.7	0.4	23	0.063	0.375
1:45AM	2:00AM	186	501	289	34	156	111	25	7	8	2	0	0	**1319**	5	0.6	0.4	22	0.064	0.239
2:00AM	2:15AM	72	160	119	16	49	35	28	0	2	3	0	0	**485**	5	0.6	0.4	15	0.053	0.435
2:15AM	2:30AM	44	202	103	55	50	28	59	2	2	3	0	0	**549**	5	0.6	0.3	17	0.031	0.446
2:30AM	2:45AM	85	199	114	57	69	44	38	4	6	1	0	0	**616**	3	0.6	0.4	18	0.055	0.371
2:45AM	3:00AM	78	221	142	69	59	69	19	4	4	1	0	0	**664**	3	0.6	0.4	13	0.064	0.279
3:00AM	3:15AM	74	260	172	23	79	67	24	5	4	2	1	0	**711**	4	0.6	0.3	22	0.061	0.201
3:15AM	3:30AM	98	271	219	35	81	64	54	4	4	1	0	0	**831**	4	0.5	0.3	21	0.009	0.059
3:30AM	3:45AM	109	170	119	73	86	86	39	4	5	3	0	0	**694**	3	0.5	0.3	26	0.044	0.266
3:45AM	4:00AM	94	235	168	52	90	96	62	4	4	1	0	0	**806**	4	0.5	0.3	21	0.068	0.529
4:00AM	4:15AM	89	175	119	21	58	27	31	4	3	0	0	0	**527**	2	0.5	0.4	15	0.063	0.375
4:15AM	4:30AM	60	172	96	52	52	32	76	7	5	0	0	0	**552**	2	0.5	0.4	18	0.063	0.375
4:30AM	4:45AM	71	179	85	56	54	26	53	8	4	3	0	0	**539**	2	0.6	0.3	26	0.064	0.239
4:45AM	5:00AM	55	163	104	72	54	42	45	12	4	2	0	0	**553**	4	0.6	0.3	24	0.053	0.435
5:00AM	5:15AM	46	237	143	23	79	74	22	1	2	0	0	0	**627**	4	0.6	0.4	22	0.031	0.446
5:15AM	5:30AM	64	222	168	38	118	85	47	2	3	4	0	0	**751**	5	0.6	0.4	26	0.055	0.371
5:30AM	5:45AM	83	169	157	70	117	117	34	2	4	1	0	0	**754**	5	0.5	0.4	24	0.064	0.279
5:45AM	6:00AM	74	203	146	53	111	106	54	2	5	1	0	0	**755**	4	0.5	0.3	26	0.061	0.201
TOTALS		**3,896**	**12,745**	**6,804**	**1,767**	**3,962**	**2,551**	**1,916**	**299**	**289**	**249**	**29**	**0**	**34,506**	**3.7083333**	**0.5**	**0.3708333**	**18.3125**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02	**Period of St**	
Enumerators name	MOSES	**Weather:**		**Day of the Week:**	MONDAY
Both directions				**Date:**	11/11/2019
Start Time (hour):	6:00 AM			**Finish Time (hour):**	6:00 PM

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00 AM	6:15 AM	8	90	119	29	60	24	5	8	9	5	0	0	**355**	1	0.3	0.4	12	0.064	0.426
6:15 AM	6:30 AM	12	300	167	36	57	54	6	14	5	2	0	0	**651**	2	0.2	0.2	9	0.044	0.261
6:30 AM	6:45 AM	12	485	302	20	84	45	5	18	14	6	0	0	**989**	2	0.4	0.5	8	0.039	0.259
6:45 AM	7:00 AM	15	630	318	42	63	26	5	20	11	9	0	0	**1137**	3	0.4	0.2	6	0.034	0.227
7:00 AM	7:15 AM	20	581	305	21	63	17	3	14	9	5	0	0	**1035**	3	0.4	0.4	6	0.039	0.223
7:15 AM	7:30 AM	45	504	324	39	48	12	5	11	8	6	0	0	**1001**	2	0.4	0.4	7	0.064	0.224
7:30 AM	7:45 AM	74	548	284	44	35	17	8	11	14	0	2	0	**1032**	3	0.4	0.5	5	0.065	0.239
7:45 AM	8:00 AM	122	611	324	32	39	6	21	14	8	3	2	0	**1179**	4	0.4	0.5	5	0.064	0.239
8:00 AM	8:15 AM	94	257	148	22	65	29	4	11	8	4	0	0	**640**	4	0.4	0.3	10	0.053	0.435
8:15 AM	8:30 AM	122	321	162	34	52	64	3	14	6	5	0	0	**784**	4	0.4	0.5	10	0.031	0.446
8:30 AM	8:45 AM	116	435	171	31	87	55	6	14	5	3	0	0	**923**	3	0.5	0.3	30	0.055	0.371
8:45 AM	9:00 AM	119	381	174	23	71	30	5	16	5	4	0	0	**827**	2	0.5	0.4	18	0.064	0.279
9:00 AM	9:15 AM	114	390	144	24	55	18	5	8	8	0	1	0	**768**	3	0.5	0.3	29	0.061	0.201
9:15 AM	9:30 AM	98	298	112	34	37	13	5	7	4	2	1	0	**609**	4	0.5	0.5	22	0.064	0.327
9:30 AM	9:45 AM	143	383	201	32	21	16	3	7	6	3	0	0	**816**	5	0.5	0.5	15	0.065	0.429
9:45 AM	10:00 AM	181	392	172	44	36	8	23	11	5	1	0	0	**874**	5	0.4	0.4	24	0.058	0.389
10:00 AM	10:15 AM	204	442	224	29	39	25	0	11	17	4	0	0	**996**	5	0.4	0.3	19	0.057	0.413
10:15 AM	10:30 AM	243	342	162	40	41	47	5	13	16	6	0	0	**915**	4	0.4	0.4	22	0.067	0.355
10:30 AM	10:45 AM	232	407	147	32	41	26	2	10	15	3	0	0	**916**	4	0.4	0.2	23	0.053	0.376
10:45 AM	11:00 AM	246	395	120	31	35	27	2	13	10	4	0	0	**884**	3	0.4	0.5	23	0.046	0.414
11:00 AM	11:15 AM	225	537	231	34	42	28	4	8	18	0	1	0	**1129**	3	0.4	0.5	30	0.043	0.112
11:15 AM	11:30 AM	201	389	121	40	47	51	8	12	13	2	1	0	**885**	3	0.5	0.5	26	0.049	0.291
11:30 AM	11:45 AM	194	436	176	30	50	30	24	5	12	1	0	0	**957**	2	0.5	0.5	16	0.065	0.259
11:45 AM	12:00 PM	192	500	187	30	72	33	14	7	19	1	1	0	**1055**	2	0.5	0.3	15	0.064	0.212
12:00 PM	12:15 PM	248	432	191	38	51	53	6	11	18	5	0	0	**1050**	2	0.5	0.2	18	0.069	0.269
12:15 PM	12:30 PM	240	429	197	63	44	30	6	11	14	2	0	0	**1034**	4	0.5	0.3	17	0.063	0.256
12:30 PM	12:45 PM	285	479	195	39	44	30	0	20	18	6	0	0	**1115**	5	0.6	0.3	18	0.067	0.198
12:45 PM	1:00 PM	309	555	305	54	42	33	2	14	20	9	0	0	**1342**	5	0.7	0.3	19	0.067	0.135
1:00 PM	1:15 PM	324	582	182	40	66	59	6	17	19	5	0	0	**1300**	5	0.7	0.4	23	0.061	0.109
1:15 PM	1:30 PM	296	483	186	46	52	33	5	12	18	6	0	0	**1137**	4	0.7	0.5	17	0.054	0.134
1:30 PM	1:45 PM	315	596	193	47	47	33	6	16	19	0	2	0	**1273**	4	0.7	0.4	23	0.061	0.118
1:45 PM	2:00 PM	248	628	256	55	49	35	5	12	16	3	2	0	**1307**	4	0.6	0.4	22	0.071	0.195
2:00 PM	2:15 PM	298	520	229	45	62	64	7	13	22	5	0	0	**1265**	4	0.6	0.4	15	0.075	0.151
2:15 PM	2:30 PM	273	532	229	77	80	34	28	9	11	2	0	0	**1274**	4	0.6	0.3	17	0.073	0.126
2:30 PM	2:45 PM	285	630	282	52	103	42	15	14	27	7	0	0	**1458**	3	0.6	0.4	18	0.078	0.115
2:45 PM	3:00 PM	371	614	306	70	68	45	18	13	14	11	0	0	**1529**	3	0.6	0.4	13	0.069	0.102
3:00 PM	3:15 PM	385	754	251	57	85	64	30	13	15	5	0	0	**1660**	3	0.6	0.3	22	0.073	0.116
3:15 PM	3:30 PM	318	689	209	54	90	63	33	11	12	7	0	0	**1484**	3	0.5	0.3	21	0.074	0.059
3:30 PM	3:45 PM	316	738	257	55	117	57	18	9	18	0	2	0	**1586**	3	0.5	0.3	26	0.071	0.128
3:45 PM	4:00 PM	212	515	173	66	95	73	19	11	10	4	2	0	**1178**	3	0.5	0.3	21	0.075	0.019
4:00 PM	4:15 PM	297	687	278	48	72	42	35	8	20	2	0	0	**1487**	2	0.5	0.4	15	0.079	0.129
4:15 PM	4:30 PM	297	774	290	47	105	47	20	12	29	2	2	0	**1622**	2	0.5	0.4	18	0.078	0.178
4:30 PM	4:45 PM	321	797	300	45	65	48	23	5	5	0	0	0	**1607**	2	0.6	0.3	26	0.074	0.178
4:45 PM	5:00 PM	329	690	305	44	63	71	36	3	5	2	0	0	**1545**	4	0.6	0.3	24	0.077	0.148
5:00 PM	5:15 PM	243	806	303	68	92	72	39	8	9	0	0	0	**1638**	4	0.6	0.4	22	0.067	0.139
5:15 PM	5:30 PM	354	767	297	39	110	66	21	3	6	3	0	0	**1665**	5	0.6	0.4	26	0.068	0.025
5:30 PM	5:45 PM	257	668	233	44	99	86	17	9	12	2	0	0	**1424**	5	0.5	0.4	24	0.069	0.096
5:45 PM	6:00 PM	207	635	201	39	99	72	29	2	3	0	0	0	**1286**	5	0.5	0.3	26	0.067	0.135
TOTALS		**10,057**	**25,047**	**10,637**	**2,000**	**3,033**	**1,948**	**590**	**524**	**600**	**164**	**16**	**0**	**54,616**	**3.4166667**	**0.5**	**0.3729167**	**18.35416667**	**0.06225**	**0.2221875**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02	**Period of St**	
Enumerators name	MOSES	**Weather:**		**Day of the Week:**	MONDAY
Both directions				**Date:**	11/11/2019
Start Time (hour):	6:00PM			**Finish Time (hour):**	6:00AM

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³
6:00PM	6:15PM	8	90	119	29	60	24	5	8	9	5	0	0	**355**	1	0.3	0.4	12
6:15PM	6:30PM	12	300	167	36	57	54	6	14	5	2	0	0	**651**	2	0.2	0.2	9
6:30PM	6:45PM	12	485	302	20	84	45	5	18	14	6	0	0	**989**	2	0.4	0.5	8
6:45PM	7:00PM	15	630	318	42	63	26	5	20	11	9	0	0	**1137**	3	0.4	0.2	6
7:00PM	7:15PM	20	581	305	21	63	17	3	14	9	5	0	0	**1035**	3	0.4	0.4	6
7:15PM	7:30PM	45	504	324	39	48	12	5	11	8	6	0	0	**1001**	2	0.4	0.4	7
7:30PM	7:45PM	74	548	284	44	35	17	8	11	14	0	2	0	**1032**	3	0.4	0.5	5
7:45PM	8:00PM	122	611	324	32	39	6	21	14	8	3	2	0	**1179**	4	0.4	0.5	5
8:00PM	8:15PM	94	257	148	22	65	29	4	11	8	4	0	0	**640**	4	0.4	0.3	10
8:15PM	8:30PM	122	321	162	34	52	64	3	14	6	5	0	0	**784**	4	0.4	0.5	10
8:30PM	8:45PM	116	435	171	31	87	55	6	14	5	3	0	0	**923**	3	0.5	0.3	30
8:45PM	9:00PM	119	381	174	23	71	30	5	16	5	4	0	0	**827**	2	0.5	0.4	18
9:00PM	9:15PM	114	390	144	24	55	18	5	8	8	0	1	0	**768**	3	0.5	0.3	29
9:15PM	9:30PM	98	298	112	34	37	13	5	7	4	2	1	0	**609**	4	0.5	0.5	22
9:30PM	9:45PM	143	383	201	32	21	16	3	7	6	3	0	0	**816**	5	0.5	0.5	15
9:45PM	10:00PM	181	392	172	44	36	8	23	11	5	1	0	0	**874**	5	0.4	0.4	24
10:00PM	10:15PM	204	442	224	29	39	25	0	11	17	4	0	0	**340**	5	0.4	0.3	19
10:15PM	10:30PM	243	342	162	40	41	47	5	13	16	6	0	0	**346**	4	0.4	0.4	22
10:30PM	10:45PM	232	407	147	32	41	26	2	10	15	3	0	0	**320**	4	0.4	0.2	23
10:45PM	11:00PM	246	395	120	31	35	27	2	13	10	4	0	0	**453**	3	0.4	0.5	23
11:00PM	11:15PM	225	537	231	34	42	28	4	8	18	0	1	0	**455**	3	0.4	0.5	30
11:15PM	11:30PM	201	389	121	40	47	51	8	12	13	2	1	0	**885**	3	0.5	0.5	26
11:30PM	11:45PM	194	436	176	30	50	30	24	5	12	1	0	0	**957**	2	0.5	0.5	16
11:45PM	12:00MN	192	500	187	30	72	33	14	7	19	1	1	0	**654**	2	0.5	0.3	15
12:00 PM	12:15 PM	248	432	191	38	51	53	6	11	18	5	0	0	**456**	2	0.5	0.2	18
12:15AM	12:30AM	240	429	197	63	44	30	6	11	14	2	0	0	**623**	4	0.5	0.3	17
12:30AM	12:45AM	285	479	195	39	44	30	0	20	18	6	0	0	**590**	5	0.6	0.3	18
12:45AM	1:00AM	309	555	305	54	42	33	2	14	20	9	0	0	**456**	5	0.7	0.3	19
1:00AM	1:15AM	324	582	182	40	66	59	6	17	19	5	0	0	**334**	5	0.7	0.4	23
1:15AM	1:30AM	296	483	186	46	52	33	5	12	18	6	0	0	**432**	4	0.7	0.5	17
1:30AM	1:45AM	315	596	193	47	47	33	6	16	19	0	2	0	**324**	4	0.7	0.4	23
1:45AM	2:00AM	248	628	256	55	49	35	5	12	16	3	2	0	**721**	4	0.6	0.4	22
2:00AM	2:15AM	298	520	229	45	62	64	7	13	22	5	0	0	**732**	4	0.6	0.4	15
2:15AM	2:30AM	273	532	229	77	80	34	28	9	11	2	0	0	**643**	4	0.6	0.3	17
2:30AM	2:45AM	285	630	282	52	103	42	15	14	27	7	0	0	**360**	3	0.6	0.4	18
2:45AM	3:00AM	371	614	306	70	68	45	18	13	14	11	0	0	**490**	3	0.6	0.4	13
3:00AM	3:15AM	385	754	251	57	85	64	30	13	15	5	0	0	**500**	3	0.6	0.3	22
3:15AM	3:30AM	318	689	209	54	90	63	33	11	12	7	0	0	**345**	3	0.5	0.3	21
3:30AM	3:45AM	316	738	257	55	117	57	18	9	18	0	2	0	**512**	3	0.5	0.3	26
3:45AM	4:00AM	212	515	173	66	95	73	19	11	10	4	2	0	**230**	3	0.5	0.3	21
4:00AM	4:15AM	297	687	278	48	72	42	35	8	20	2	0	0	**329**	2	0.5	0.4	15
4:15AM	4:30AM	297	774	290	47	105	47	20	12	29	2	2	0	**423**	2	0.5	0.4	18
4:30AM	4:45AM	321	797	300	45	65	48	23	5	5	0	0	0	**540**	2	0.6	0.3	26
4:45AM	5:00AM	329	690	305	44	63	71	36	3	5	2	0	0	**500**	4	0.6	0.3	24
5:00AM	5:15AM	243	806	303	68	92	72	39	8	9	0	0	0	**700**	4	0.6	0.4	22
5:15AM	5:30AM	354	767	297	39	110	66	21	3	6	3	0	0	**700**	5	0.6	0.4	26
5:30AM	5:45AM	257	668	233	44	99	86	17	9	12	2	0	0	**800**	5	0.5	0.4	24
5:45AM	6:00AM	207	635	201	39	99	72	29	2	3	0	0	0	**600**	5	0.5	0.3	26
TOTALS		**16,947**	**54,768**	**22,628**	**3,905**	**6,261**	**1,785**	**1,518**	**4,690**	**4,458**	**1,354**	**213**	**9**	**118,536**	**3.4166667**	**0.5**	**0.3729167**	**18.35416667**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02	**Period of St**	DAY
Enumerators name	MOSES	**Weather:**		**Day of the Week:**	TUESDAY
Approach from	Both directions			**Date:**	12/12/2019
Start Time (hour):	6:00 AM	**Finish Time (hour):**		6:00 PM	

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00 AM	6:15 AM	39	164	86	26	36	2	15	5	7	6	0	0	**86**	2	0.12	0.4	14	0.002	0.021
6:15 AM	6:30 AM	33	242	123	35	47	7	18	7	17	6	0	0	**181**	3	0.14	0.2	23	0.004	0.031
6:30 AM	6:45 AM	46	409	193	30	44	2	13	10	30	7	1	0	**313**	2	0.14	0.5	30	0.009	0.059
6:45 AM	7:00 AM	39	427	207	49	50	7	14	10	11	9	1	2	**404**	3	0.14	0.2	26	0.044	0.266
7:00 AM	7:15 AM	15	355	171	21	38	3	13	7	7	5	0	0	**402**	5	0.13	0.4	26	0.068	0.529
7:15 AM	7:30 AM	37	339	196	33	44	6	15	8	16	7	0	0	**404**	4	0.14	0.4	26	0.063	0.375
7:30 AM	7:45 AM	49	401	168	39	39	4	14	7	26	3	2	0	**358**	3	0.14	0.5	26	0.063	0.375
7:45 AM	8:00 AM	56	386	206	38	45	5	13	9	8	6	2	0	**422**	4	0.14	0.5	30	0.064	0.239
8:00 AM	8:15 AM	84	292	116	20	34	4	15	10	13	7	0	0	**210**	5	0.14	0.3	30	0.053	0.435
8:15 AM	8:30 AM	91	274	127	36	30	3	14	12	11	10	0	0	**218**	5	0.14	0.5	25	0.031	0.446
8:30 AM	8:45 AM	116	401	126	27	33	4	3	16	9	3	1	0	**243**	3	0.13	0.3	30	0.055	0.371
8:45 AM	9:00 AM	125	348	129	34	46	6	27	21	17	5	1	0	**216**	2	0.13	0.4	18	0.064	0.279
9:00 AM	9:15 AM	105	410	151	39	28	2	8	5	12	3	0	0	**245**	3	0.13	0.3	29	0.061	0.201
9:15 AM	9:30 AM	96	367	165	40	24	3	6	12	8	5	0	0	**189**	4	0.13	0.5	22	0.064	0.327
9:30 AM	9:45 AM	110	435	154	31	23	2	5	7	10	3	0	0	**218**	5	0.13	0.5	15	0.065	0.429
9:45 AM	10:00 AM	106	363	144	40	23	2	7	10	9	1	5	0	**237**	5	0.13	0.4	24	0.058	0.389
10:00 AM	10:15 AM	118	368	153	26	30	3	3	8	6	3	1	0	**252**	5	0.18	0.3	19	0.057	0.413
10:15 AM	10:30 AM	128	339	166	35	33	3	5	15	6	5	1	0	**262**	4	0.18	0.4	22	0.067	0.355
10:30 AM	10:45 AM	121	422	156	32	27	5	8	10	4	3	0	0	**292**	4	0.18	0.2	23	0.053	0.376
10:45 AM	11:00 AM	120	392	142	32	30	3	5	17	5	3	0	0	**260**	3	0.16	0.5	23	0.046	0.414
11:00 AM	11:15 AM	131	518	167	36	28	2	7	9	12	1	1	0	**294**	4	0.16	0.5	30	0.066	0.447
11:15 AM	11:30 AM	106	398	142	40	25	2	8	11	10	1	6	0	**227**	4	0.16	0.5	26	0.054	0.334
11:30 AM	11:45 AM	121	431	168	26	27	5	6	6	5	1	1	0	**284**	5	0.16	0.5	26	0.065	0.402
11:45 AM	12:00 PM	120	408	173	30	37	3	6	16	7	2	1	0	**281**	2	0.16	0.3	26	0.064	0.564
12:00 PM	12:15 PM	124	455	189	46	32	2	8	5	14	5	0	0	**303**	3	0.16	0.2	18	0.069	0.415
12:15 PM	12:30 PM	134	449	216	55	30	4	7	14	9	6	0	0	**329**	4	0.18	0.3	18	0.063	0.526
12:30 PM	12:45 PM	147	528	192	39	32	2	5	12	14	4	0	0	**350**	5	0.18	0.3	18	0.067	0.598
12:45 PM	1:00 PM	160	424	188	47	26	3	7	13	13	5	6	0	**364**	5	0.18	0.3	19	0.067	0.435
1:00 PM	1:15 PM	166	488	172	33	39	4	4	9	6	3	1	0	**406**	5	0.12	0.4	23	0.061	0.459
1:15 PM	1:30 PM	156	435	178	38	43	4	7	18	6	5	1	0	**361**	5	0.15	0.5	23	0.054	0.334
1:30 PM	1:45 PM	141	510	197	42	31	5	11	11	8	1	1	0	**409**	5	0.15	0.4	23	0.051	0.345
1:45 PM	2:00 PM	120	461	162	45	33	3	6	20	5	3	1	0	**316**	4	0.15	0.4	22	0.071	0.451
2:00 PM	2:15 PM	146	498	189	39	41	5	5	18	13	5	1	0	**364**	4	0.15	0.4	15	0.075	0.443
2:15 PM	2:30 PM	166	475	192	60	58	8	34	26	21	5	1	0	**394**	4	0.15	0.3	17	0.073	0.366
2:30 PM	2:45 PM	156	529	220	52	40	2	8	10	18	7	0	0	**420**	3	0.15	0.4	18	0.078	0.505
2:45 PM	3:00 PM	187	491	259	59	31	4	6	17	14	11	0	0	**437**	3	0.13	0.4	18	0.069	0.567
3:00 PM	3:15 PM	192	647	200	44	38	3	6	13	13	4	1	0	**487**	2	0.13	0.3	22	0.073	0.567
3:15 PM	3:30 PM	176	510	185	46	35	3	8	14	13	4	6	0	**433**	2	0.13	0.3	21	0.074	0.565
3:30 PM	3:45 PM	177	553	206	42	42	3	7	9	9	1	2	0	**491**	3	0.13	0.3	26	0.071	0.567
3:45 PM	4:00 PM	142	481	189	50	45	3	8	19	6	4	2	0	**379**	3	0.13	0.3	21	0.075	0.566
4:00 PM	4:15 PM	93	546	216	33	25	8	13	11	8	2	0	0	**473**	5	0.14	0.4	15	0.079	0.449
4:15 PM	4:30 PM	109	491	190	36	37	3	6	22	10	2	1	0	**468**	5	0.14	0.4	18	0.078	0.549
4:30 PM	4:45 PM	97	452	187	38	28	2	8	9	10	1	0	0	**439**	5	0.14	0.3	26	0.074	0.546
4:45 PM	5:00 PM	95	450	202	31	25	3	9	11	10	1	6	0	**392**	4	0.14	0.3	24	0.077	0.546
5:00 PM	5:15 PM	79	475	209	42	42	6	7	9	4	1	1	0	**476**	4	0.14	0.4	22	0.067	0.546
5:15 PM	5:30 PM	140	536	204	34	43	5	10	17	5	4	1	0	**497**	5	0.16	0.4	22	0.068	0.325
5:30 PM	5:45 PM	124	608	198	43	38	5	9	8	15	4	0	0	**479**	5	0.16	0.4	24	0.069	0.496
5:45 PM	6:00 PM	119	776	601	38	33	5	8	13	10	6	0	0	**436**	5	0.16	0.3	24	0.067	0.435
TOTALS		**5,456**	**21,151**	**8,865**	**1,825**	**1,691**	**184**	**454**	**575**	**514**	**196**	**57**	**2**	**16,398**	**3.8958333**	**0.1466667**	**0.3729167**	**22.625**	**0.060625**	**0.409958333**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02	**Period of St**	DAY
Enumerators name	MOSES	**Weather:**		**Day of the Week:**	TUESDAY
Approach from	Both directions			**Date:**	12/12/2019
Start Time (hour):	6:00PM	**Finish Time (hour):**		6:00AM	

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00PM	6:15PM	39	164	86	26	36	2	15	5	7	6	0	0	**86**	2	0.12	0.4	14	0.002	0.021
6:15PM	6:30PM	33	242	123	35	47	7	18	7	17	6	0	0	**181**	3	0.14	0.2	23	0.004	0.031
6:30PM	6:45PM	46	409	193	30	44	2	13	10	30	7	1	0	**313**	2	0.14	0.5	30	0.009	0.059
6:45PM	7:00PM	39	427	207	49	50	7	14	10	11	9	1	2	**404**	3	0.14	0.2	26	0.044	0.266
7:00PM	7:15PM	15	355	171	21	38	3	13	7	7	5	0	0	**402**	5	0.13	0.4	26	0.068	0.529
7:15PM	7:30PM	37	339	196	33	44	6	15	8	16	7	0	0	**404**	4	0.14	0.4	26	0.063	0.375
7:30PM	7:45PM	49	401	168	39	39	4	14	7	26	3	2	0	**358**	3	0.14	0.5	26	0.063	0.375
7:45PM	8:00PM	56	386	206	38	45	5	13	9	8	6	2	0	**422**	4	0.14	0.5	30	0.064	0.239
8:00PM	8:15PM	84	292	116	20	34	4	15	10	13	7	0	0	**210**	5	0.14	0.3	30	0.053	0.435
8:15PM	8:30PM	91	274	127	36	30	3	14	12	11	10	0	0	**218**	5	0.14	0.5	25	0.031	0.446
8:30PM	8:45PM	116	401	126	27	33	4	3	16	9	3	1	0	**243**	3	0.13	0.3	30	0.055	0.371
8:45PM	9:00PM	125	348	129	34	46	6	27	21	17	5	1	0	**216**	2	0.13	0.4	18	0.064	0.279
9:00PM	9:15PM	105	410	151	39	28	2	8	5	12	3	0	0	**245**	3	0.13	0.3	29	0.061	0.201
9:15PM	9:30PM	96	367	165	40	24	3	6	12	8	5	0	0	**189**	4	0.13	0.5	22	0.064	0.327
9:30PM	9:45PM	110	435	154	31	23	2	5	7	10	3	0	0	**218**	5	0.13	0.5	15	0.065	0.429
9:45PM	10:00PM	106	363	144	40	23	2	7	10	9	1	5	0	**237**	5	0.13	0.4	24	0.058	0.389
10:00PM	10:15PM	118	368	153	26	30	3	3	8	6	3	1	0	**252**	5	0.18	0.3	19	0.057	0.413
10:15PM	10:30PM	128	339	166	35	33	3	5	15	6	5	1	0	**262**	4	0.18	0.4	22	0.067	0.355
10:30PM	10:45PM	121	422	156	32	27	5	8	10	4	3	0	0	**292**	4	0.18	0.2	23	0.053	0.376
10:45PM	11:00PM	120	392	142	32	30	3	5	17	5	3	0	0	**260**	3	0.16	0.5	23	0.046	0.414
11:00PM	11:15PM	131	518	167	36	28	2	7	9	12	1	1	0	**294**	4	0.16	0.5	30	0.066	0.447
11:15PM	11:30PM	106	398	142	40	25	2	8	11	10	1	6	0	**227**	4	0.16	0.5	26	0.054	0.334
11:30PM	11:45PM	121	431	168	26	27	5	6	6	5	1	1	0	**284**	5	0.16	0.5	26	0.065	0.402
11:45PM	12:00MN	120	408	173	30	37	3	6	16	7	2	1	0	**281**	2	0.16	0.3	26	0.064	0.564
12:00 PM	12:15 PM	124	455	189	46	32	2	8	5	14	5	0	0	**303**	3	0.16	0.2	18	0.069	0.415
12:15AM	12:30AM	134	449	216	55	30	4	7	14	9	6	0	0	**329**	4	0.18	0.3	18	0.063	0.526
12:30AM	12:45AM	147	528	192	39	32	2	5	12	14	4	0	0	**350**	5	0.18	0.3	18	0.067	0.598
12:45AM	1:00AM	160	424	188	47	26	3	7	13	13	5	6	0	**364**	5	0.18	0.3	19	0.067	0.435
1:00AM	1:15AM	166	488	172	33	39	4	4	9	6	3	1	0	**406**	5	0.12	0.4	23	0.061	0.459
1:15AM	1:30AM	156	435	178	38	43	4	7	18	6	5	1	0	**361**	5	0.15	0.5	23	0.054	0.334
1:30AM	1:45AM	141	510	197	42	31	5	11	11	8	1	1	0	**409**	5	0.15	0.4	23	0.051	0.345
1:45AM	2:00AM	120	461	162	45	33	3	6	20	5	3	1	0	**316**	4	0.15	0.4	22	0.071	0.451
2:00AM	2:15AM	146	498	189	39	41	5	5	18	13	5	1	0	**364**	4	0.15	0.4	15	0.075	0.443
2:15AM	2:30AM	166	475	192	60	58	8	34	26	21	5	1	0	**394**	4	0.15	0.3	17	0.073	0.366
2:30AM	2:45AM	156	529	220	52	40	2	8	10	18	7	0	0	**420**	3	0.15	0.4	18	0.078	0.505
2:45AM	3:00AM	187	491	259	59	31	4	6	17	14	11	0	0	**437**	3	0.13	0.4	18	0.069	0.567
3:00AM	3:15AM	192	647	200	44	38	3	6	13	13	4	1	0	**487**	2	0.13	0.3	22	0.073	0.567
3:15AM	3:30AM	176	510	185	46	35	3	8	14	13	4	6	0	**433**	2	0.13	0.3	21	0.074	0.565
3:30AM	3:45AM	177	553	206	42	42	3	7	9	9	1	2	0	**491**	3	0.13	0.3	26	0.071	0.567
3:45AM	4:00AM	142	481	189	50	45	3	8	19	6	4	2	0	**379**	3	0.13	0.3	21	0.075	0.566
4:00AM	4:15AM	93	546	216	33	25	8	13	11	8	2	0	0	**473**	5	0.14	0.4	15	0.079	0.449
4:15AM	4:30AM	109	491	190	36	37	3	6	22	10	2	1	0	**468**	5	0.14	0.4	18	0.078	0.549
4:30AM	4:45AM	97	452	187	38	28	2	8	9	10	1	0	0	**439**	5	0.14	0.3	26	0.074	0.546
4:45AM	5:00AM	95	450	202	31	25	3	9	11	10	1	6	0	**392**	4	0.14	0.3	24	0.077	0.546
5:00AM	5:15AM	79	475	209	42	42	6	7	9	4	1	1	0	**476**	4	0.14	0.4	22	0.067	0.546
5:15AM	5:30AM	140	536	204	34	43	5	10	17	5	4	1	0	**497**	5	0.16	0.4	22	0.068	0.325
5:30AM	5:45AM	124	608	198	43	38	5	9	8	15	4	0	0	**479**	5	0.16	0.4	24	0.069	0.496
5:45AM	6:00AM	119	776	601	38	33	5	8	13	10	6	0	0	**436**	5	0.16	0.3	24	0.067	0.435
TOTALS		**5,456**	**21,151**	**8,865**	**1,825**	**1,691**	**184**	**454**	**575**	**514**	**196**	**57**	**2**	**16,398**	**3.8958333**	**0.1466667**	**0.3729167**	**22.625**	**0.060625**	**0.409958333**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02	**Period of St**	DAY
Enumerators name	MOSES	**Weather:**		**Day of the Week:**	WEDNESDAY
Approach from	Both directions			**Date:**	13/11/2019
Start Time (hour):	6:00 AM	**Finish Time (hour):**		6:00 PM	

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00 AM	6:15 AM	5	60	79	19	40	16	3	5	6	3	0	0	**236**	3	0.15	0.4	12	0.065	0.429
6:15 AM	6:30 AM	8	200	111	24	38	36	4	9	3	1	0	0	**434**	3	0.15	0.2	9	0.058	0.389
6:30 AM	6:45 AM	8	323	201	13	56	30	3	12	9	4	0	0	**659**	4	0.15	0.5	8	0.057	0.413
6:45 AM	7:00 AM	10	420	212	28	42	17	3	13	7	6	0	0	**758**	4	0.15	0.2	6	0.067	0.355
7:00 AM	7:15 AM	13	387	203	14	42	11	2	9	6	3	0	0	**690**	5	0.15	0.4	6	0.053	0.376
7:15 AM	7:30 AM	30	336	216	26	32	8	3	7	5	4	0	0	**667**	5	0.14	0.4	7	0.046	0.414
7:30 AM	7:45 AM	49	365	189	29	23	11	5	7	9	0	1	0	**688**	5	0.14	0.5	5	0.066	0.447
7:45 AM	8:00 AM	81	407	216	21	26	4	14	9	5	2	1	0	**786**	4	0.14	0.5	5	0.054	0.334
8:00 AM	8:15 AM	62	172	98	14	43	19	2	7	5	2	0	0	**427**	4	0.13	0.3	10	0.065	0.402
8:15 AM	8:30 AM	82	214	108	23	35	43	2	9	4	4	0	0	**523**	5	0.13	0.5	10	0.064	0.564
8:30 AM	8:45 AM	77	290	114	20	58	37	4	9	4	2	0	0	**615**	3	0.17	0.3	30	0.069	0.415
8:45 AM	9:00 AM	79	254	116	16	47	20	4	11	3	2	0	0	**551**	3	0.17	0.4	18	0.063	0.526
9:00 AM	9:15 AM	76	260	96	16	37	12	4	5	5	0	1	0	**512**	3	0.17	0.3	29	0.067	0.598
9:15 AM	9:30 AM	65	199	74	23	25	8	3	5	2	1	1	0	**406**	4	0.17	0.5	22	0.067	0.435
9:30 AM	9:45 AM	95	256	134	21	14	11	2	5	4	2	0	0	**544**	5	0.12	0.5	15	0.061	0.459
9:45 AM	10:00 AM	121	261	115	30	24	6	15	7	3	1	0	0	**583**	5	0.12	0.4	24	0.009	0.059
10:00 AM	10:15 AM	136	295	149	19	26	17	0	7	12	3	0	0	**664**	5	0.13	0.3	19	0.044	0.266
10:15 AM	10:30 AM	162	228	108	27	27	32	3	9	10	4	0	0	**610**	4	0.14	0.4	22	0.068	0.529
10:30 AM	10:45 AM	155	271	98	21	27	17	2	7	10	2	0	0	**611**	4	0.14	0.2	23	0.063	0.375
10:45 AM	11:00 AM	164	263	80	21	23	18	1	9	6	3	0	0	**589**	3	0.12	0.5	23	0.063	0.375
11:00 AM	11:15 AM	150	358	154	23	28	18	3	5	12	0	1	0	**753**	3	0.16	0.5	30	0.064	0.239
11:15 AM	11:30 AM	134	259	80	27	31	34	5	8	9	1	1	0	**590**	4	0.15	0.5	26	0.053	0.435
11:30 AM	11:45 AM	129	290	117	20	33	20	16	3	8	1	0	0	**638**	4	0.15	0.5	16	0.031	0.446
11:45 AM	12:00 PM	128	333	125	20	48	22	9	5	12	1	1	0	**703**	4	0.14	0.3	15	0.055	0.371
12:00 PM	12:15 PM	165	288	127	25	34	35	4	7	12	3	0	0	**700**	4	0.14	0.2	18	0.064	0.279
12:15 PM	12:30 PM	160	286	131	42	29	20	4	7	10	1	0	0	**690**	4	0.14	0.3	17	0.061	0.201
12:30 PM	12:45 PM	190	319	130	26	29	20	0	13	12	4	0	0	**743**	5	0.14	0.3	18	0.009	0.059
12:45 PM	1:00 PM	206	370	203	36	28	22	1	9	13	6	0	0	**894**	5	0.14	0.3	19	0.044	0.266
1:00 PM	1:15 PM	216	388	121	26	44	40	4	11	13	3	0	0	**867**	5	0.13	0.4	23	0.068	0.529
1:15 PM	1:30 PM	197	322	124	31	34	22	3	8	12	4	0	0	**758**	4	0.13	0.5	17	0.063	0.375
1:30 PM	1:45 PM	210	398	129	31	31	22	4	11	12	0	1	0	**849**	4	0.13	0.4	23	0.063	0.375
1:45 PM	2:00 PM	165	419	171	36	33	23	3	8	11	2	1	0	**871**	4	0.13	0.4	22	0.064	0.239
2:00 PM	2:15 PM	199	347	153	30	41	42	5	8	15	4	0	0	**843**	4	0.18	0.4	15	0.053	0.435
2:15 PM	2:30 PM	182	355	152	51	53	23	19	6	7	1	0	0	**850**	4	0.12	0.3	17	0.031	0.446
2:30 PM	2:45 PM	190	420	188	35	68	28	10	10	18	5	0	0	**972**	3	0.15	0.4	18	0.055	0.371
2:45 PM	3:00 PM	248	409	204	47	45	30	12	8	9	7	0	0	**1019**	3	0.15	0.4	13	0.064	0.279
3:00 PM	3:15 PM	257	503	167	38	57	43	20	8	10	4	0	0	**1106**	5	0.15	0.3	22	0.061	0.201
3:15 PM	3:30 PM	212	459	139	36	60	42	22	7	8	5	0	0	**989**	5	0.15	0.3	21	0.009	0.059
3:30 PM	3:45 PM	211	492	172	37	78	38	12	6	12	0	1	0	**1057**	5	0.15	0.3	26	0.044	0.266
3:45 PM	4:00 PM	141	344	115	44	63	49	13	7	7	2	1	0	**785**	3	0.15	0.3	21	0.068	0.529
4:00 PM	4:15 PM	198	458	185	32	48	28	23	5	13	1	0	0	**991**	4	0.13	0.4	15	0.063	0.375
4:15 PM	4:30 PM	198	516	193	31	70	31	13	8	19	1	1	0	**1081**	4	0.13	0.4	18	0.063	0.375
4:30 PM	4:45 PM	214	531	200	30	43	32	15	3	3	0	0	0	**1071**	5	0.13	0.3	26	0.064	0.239
4:45 PM	5:00 PM	219	460	203	29	42	47	24	2	3	1	0	0	**1030**	4	0.13	0.3	24	0.053	0.435
5:00 PM	5:15 PM	162	537	202	45	61	48	26	5	6	0	0	0	**1092**	4	0.13	0.4	22	0.031	0.446
5:15 PM	5:30 PM	236	511	198	26	73	44	14	2	4	2	0	0	**1110**	5	0.14	0.4	26	0.055	0.371
5:30 PM	5:45 PM	171	445	155	29	66	57	11	6	8	1	0	0	**949**	3	0.14	0.4	24	0.064	0.279
5:45 PM	6:00 PM	138	423	134	26	66	48	19	1	2	0	0	0	**857**	5	0.14	0.3	26	0.061	0.201
TOTALS		**6,705**	**16,698**	**7,092**	**1,333**	**2,022**	**1,299**	**393**	**349**	**400**	**109**	**11**	**0**	**36411**	**4.1041667**	**0.14229167**	**0.3729167**	**18.35416667**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02	**Period of St**	DAY
Enumerators name	MOSES	**Weather:**		**Day of the Week:**	WEDNESDAY
Approach from	Both directions			**Date:**	13/11/2019
Start Time (hour):	6:00PM	**Finish Time (hour):**	6:00AM		

Time (hour)																			
From	**To**	**Motorcyle**	**Private Cars**	**Jeeps / 4WD's/utility vehicle**	**pickup/vans**	**Matatu (9 - 25 seats)**	**Small buses**	**Large Bus (>27 passengers)**	**Light Trucks 2 axles (single rear wheel)**	**Medium Trucks (2 axles, Double rear wheels)**	**Heavy Trucks (3, 4 axle)**	**Artics / Draw - bar Trucks (>4 axles)**	**Other (Agricultural tractors, grader etc.)**	**Total traffic volume**	**CO PPM**	**NOx PPM**	**SOxPPM**	**PM2.5µg/m³**	**HCHO mg/m³**	**TVOC mg/m³**
6:00PM	6:15PM	5	60	79	19	40	16	3	5	6	3	0	0	**236**	3	0.15	0.4	12	0.065	0.429
6:15PM	6:30PM	8	200	111	24	38	36	4	9	3	1	0	0	**434**	3	0.15	0.2	9	0.058	0.389
6:30PM	6:45PM	8	323	201	13	56	30	3	12	9	4	0	0	**659**	4	0.15	0.5	8	0.057	0.413
6:45PM	7:00PM	10	420	212	28	42	17	3	13	7	6	0	0	**758**	4	0.15	0.2	6	0.067	0.355
7:00PM	7:15PM	13	387	203	14	42	11	2	9	6	3	0	0	**690**	5	0.15	0.4	6	0.053	0.376
7:15PM	7:30PM	30	336	216	26	32	8	3	7	5	4	0	0	**667**	5	0.14	0.4	7	0.046	0.414
7:30PM	7:45PM	49	365	189	29	23	11	5	7	9	0	1	0	**688**	5	0.14	0.5	5	0.066	0.447
7:45PM	8:00PM	81	407	216	21	26	4	14	9	5	2	1	0	**786**	4	0.14	0.5	5	0.054	0.334
8:00PM	8:15PM	62	172	98	14	43	19	2	7	5	2	0	0	**427**	4	0.13	0.3	10	0.065	0.402
8:15PM	8:30PM	82	214	108	23	35	43	2	9	4	4	0	0	**523**	5	0.13	0.5	10	0.064	0.564
8:30PM	8:45PM	77	290	114	20	58	37	4	9	4	2	0	0	**615**	3	0.17	0.3	30	0.069	0.415
8:45PM	9:00PM	79	254	116	16	47	20	4	11	3	2	0	0	**551**	3	0.17	0.4	18	0.063	0.526
9:00PM	9:15PM	76	260	96	16	37	12	4	5	5	0	1	0	**512**	3	0.17	0.3	29	0.067	0.598
9:15PM	9:30PM	65	199	74	23	25	8	3	5	2	1	1	0	**406**	4	0.17	0.5	22	0.067	0.435
9:30PM	9:45PM	95	256	134	21	14	11	2	5	4	2	0	0	**544**	5	0.12	0.5	15	0.061	0.459
9:45PM	10:00PM	121	261	115	30	24	6	15	7	3	1	0	0	**583**	5	0.12	0.4	24	0.009	0.059
10:00PM	10:15PM	136	295	149	19	26	17	0	7	12	3	0	0	**664**	5	0.13	0.3	19	0.044	0.266
10:15PM	10:30PM	162	228	108	27	27	32	3	9	10	4	0	0	**610**	4	0.14	0.4	22	0.068	0.529
10:30PM	10:45PM	155	271	98	21	27	17	2	7	10	2	0	0	**611**	4	0.14	0.2	23	0.063	0.375
10:45PM	11:00PM	164	263	80	21	23	18	1	9	6	3	0	0	**589**	3	0.12	0.5	23	0.063	0.375
11:00PM	11:15PM	150	358	154	23	28	18	3	5	12	0	1	0	**753**	3	0.16	0.5	30	0.064	0.239
11:15PM	11:30PM	134	259	80	27	31	34	5	8	9	1	1	0	**590**	4	0.15	0.5	26	0.053	0.435
11:30PM	11:45PM	129	290	117	20	33	20	16	3	8	1	0	0	**638**	4	0.15	0.5	16	0.031	0.446
11:45PM	12:00MN	128	333	125	20	48	22	9	5	12	1	1	0	**703**	4	0.14	0.3	15	0.055	0.371
12:00 PM	12:15 PM	165	288	127	25	34	35	4	7	12	3	0	0	**700**	4	0.14	0.2	18	0.064	0.279
12:15AM	12:30AM	160	286	131	42	29	20	4	7	10	1	0	0	**690**	4	0.14	0.3	17	0.061	0.201
12:30AM	12:45AM	190	319	130	26	29	20	0	13	12	4	0	0	**743**	5	0.14	0.3	18	0.009	0.059
12:45AM	1:00AM	206	370	203	36	28	22	1	9	13	6	0	0	**894**	5	0.14	0.3	19	0.044	0.266
1:00AM	1:15AM	216	388	121	26	44	40	4	11	13	3	0	0	**867**	5	0.13	0.4	23	0.068	0.529
1:15AM	1:30AM	197	322	124	31	34	22	3	8	12	4	0	0	**758**	4	0.13	0.5	17	0.063	0.375
1:30AM	1:45AM	210	398	129	31	31	22	4	11	12	0	1	0	**849**	4	0.13	0.4	23	0.063	0.375
1:45AM	2:00AM	165	419	171	36	33	23	3	8	11	2	1	0	**871**	4	0.13	0.4	22	0.064	0.239
2:00AM	2:15AM	199	347	153	30	41	42	5	8	15	4	0	0	**843**	4	0.18	0.4	15	0.053	0.435
2:15AM	2:30AM	182	355	152	51	53	23	19	6	7	1	0	0	**850**	4	0.12	0.3	17	0.031	0.446
2:30AM	2:45AM	190	420	188	35	68	28	10	10	18	5	0	0	**972**	3	0.15	0.4	18	0.055	0.371
2:45AM	3:00AM	248	409	204	47	45	30	12	8	9	7	0	0	**1019**	3	0.15	0.4	13	0.064	0.279
3:00AM	3:15AM	257	503	167	38	57	43	20	8	10	4	0	0	**1106**	5	0.15	0.3	22	0.061	0.201
3:15AM	3:30AM	212	459	139	36	60	42	22	7	8	5	0	0	**989**	5	0.15	0.3	21	0.009	0.059
3:30AM	3:45AM	211	492	172	37	78	38	12	6	12	0	1	0	**1057**	5	0.15	0.3	26	0.044	0.266
3:45AM	4:00AM	141	344	115	44	63	49	13	7	7	2	1	0	**785**	3	0.15	0.3	21	0.068	0.529
4:00AM	4:15AM	198	458	185	32	48	28	23	5	13	1	0	0	**991**	4	0.13	0.4	15	0.063	0.375
4:15AM	4:30AM	198	516	193	31	70	31	13	8	19	1	1	0	**1081**	4	0.13	0.4	18	0.063	0.375
4:30AM	4:45AM	214	531	200	30	43	32	15	3	3	0	0	0	**1071**	5	0.13	0.3	26	0.064	0.239
4:45AM	5:00AM	219	460	203	29	42	47	24	2	3	1	0	0	**1030**	4	0.13	0.3	24	0.053	0.435
5:00AM	5:15AM	162	537	202	45	61	48	26	5	6	0	0	0	**1092**	4	0.13	0.4	22	0.031	0.446
5:15AM	5:30AM	236	511	198	26	73	44	14	2	4	2	0	0	**1110**	5	0.14	0.4	26	0.055	0.371
5:30AM	5:45AM	171	445	155	29	66	57	11	6	8	1	0	0	**949**	3	0.14	0.4	24	0.064	0.279
5:45AM	6:00AM	138	423	134	26	66	48	19	1	2	0	0	0	**857**	5	0.14	0.3	26	0.061	0.201
TOTALS		**6,705**	**16,698**	**7,092**	**1,333**	**2,022**	**1,299**	**393**	**349**	**400**	**109**	**11**	**0**	**36411**	**4.1041667**	**0.14229167**	**0.3729167**	**18.35416667**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02
Enumerators name	MOSES	**Weather:**	
Approach from	Both directions		
Start Time (hour):	6:00 AM	**Finish Time (hour):**	6:00 PM
Time (hour)			

Period of St

Day of the Week: THURSDAY

Date: 14/11/2019

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00 AM	6:15 AM	52	450	154	29	58	7	22	6	4	5	0	0	**786**	2	0.12	0.3	9	0.064	0.426
6:15 AM	6:30 AM	77	492	200	24	63	8	25	5	17	5	0	0	**917**	3	0.14	0.2	11	0.044	0.261
6:30 AM	6:45 AM	92	655	216	31	93	7	20	6	23	5	1	0	**1151**	2	0.14	0.5	8	0.039	0.259
6:45 AM	7:00 AM	74	594	223	42	70	8	19	7	12	6	4	2	**1062**	3	0.14	0.2	7	0.034	0.227
7:00 AM	7:15 AM	43	375	128	24	48	8	16	8	4	4	0	0	**659**	5	0.13	0.4	5	0.039	0.223
7:15 AM	7:30 AM	64	410	167	20	53	7	21	5	16	4	0	0	**768**	4	0.14	0.4	7	0.064	0.224
7:30 AM	7:45 AM	77	546	180	26	78	6	19	8	24	7	5	0	**975**	3	0.14	0.5	5	0.065	0.239
7:45 AM	8:00 AM	62	495	186	35	58	7	24	11	12	4	3	0	**898**	4	0.14	0.5	5	0.064	0.239
8:00 AM	8:15 AM	80	490	188	22	52	6	23	8	13	5	1	0	**890**	5	0.14	0.3	10	0.053	0.435
8:15 AM	8:30 AM	67	557	214	28	68	7	22	14	13	11	0	0	**1000**	5	0.14	0.5	10	0.031	0.446
8:30 AM	8:45 AM	107	588	215	30	48	6	16	20	13	2	1	0	**1047**	3	0.13	0.3	29	0.055	0.371
8:45 AM	9:00 AM	115	547	210	33	69	8	39	25	22	3	3	0	**1076**	2	0.13	0.4	18	0.064	0.279
9:00 AM	9:15 AM	128	778	266	43	54	5	14	6	15	4	1	0	**1313**	3	0.13	0.3	29	0.061	0.201
9:15 AM	9:30 AM	118	570	238	42	39	7	11	12	7	6	0	0	**1050**	4	0.13	0.5	22	0.064	0.327
9:30 AM	9:45 AM	114	674	237	25	35	4	13	6	8	1	0	0	**1116**	5	0.13	0.5	15	0.065	0.429
9:45 AM	10:00 AM	145	665	231	27	59	6	11	9	7	1	5	0	**1166**	5	0.13	0.4	24	0.058	0.389
10:00 AM	10:15 AM	120	665	230	28	41	5	8	6	6	2	3	0	**1113**	5	0.18	0.3	19	0.057	0.413
10:15 AM	10:30 AM	117	587	250	32	48	8	8	17	4	3	1	0	**1074**	4	0.18	0.4	22	0.067	0.355
10:30 AM	10:45 AM	122	716	274	27	51	7	14	8	4	1	0	0	**1223**	4	0.18	0.2	23	0.053	0.376
10:45 AM	11:00 AM	161	640	253	35	40	6	11	18	6	4	3	0	**1175**	3	0.16	0.5	23	0.046	0.414
11:00 AM	11:15 AM	130	731	253	34	45	4	16	12	13	1	2	0	**1241**	4	0.16	0.5	30	0.043	0.112
11:15 AM	11:30 AM	168	870	296	42	53	4	13	10	11	0	6	0	**1472**	4	0.16	0.5	26	0.049	0.291
11:30 AM	11:45 AM	138	643	232	37	43	6	10	8	5	4	1	0	**1126**	5	0.16	0.5	16	0.065	0.259
11:45 AM	12:00 PM	134	667	279	26	56	5	16	19	8	2	1	0	**1211**	2	0.16	0.3	15	0.064	0.212
12:00 PM	12:15 PM	122	625	280	42	49	5	29	14	20	3	0	0	**1189**	3	0.16	0.2	18	0.069	0.269
12:15 PM	12:30 PM	115	505	308	42	70	6	18	13	12	5	2	0	**1095**	4	0.18	0.3	17	0.063	0.256
12:30 PM	12:45 PM	113	620	195	30	110	7	18	13	14	6	0	0	**1124**	5	0.18	0.3	18	0.067	0.198
12:45 PM	1:00 PM	137	500	208	35	62	5	28	19	19	0	6	0	**1018**	5	0.18	0.3	19	0.067	0.135
1:00 PM	1:15 PM	118	510	210	27	88	6	25	15	12	1	4	0	**1015**	5	0.12	0.4	23	0.061	0.109
1:15 PM	1:30 PM	114	501	211	32	99	7	16	17	13	4	3	0	**1015**	5	0.15	0.5	17	0.054	0.134
1:30 PM	1:45 PM	116	552	193	39	58	10	17	11	2	3	1	0	**1001**	5	0.15	0.4	23	0.061	0.118
1:45 PM	2:00 PM	150	525	182	41	56	5	16	16	4	1	0	0	**997**	4	0.15	0.4	22	0.071	0.195
2:00 PM	2:15 PM	228	557	200	33	63	10	11	19	8	4	1	0	**1136**	4	0.15	0.4	15	0.075	0.151
2:15 PM	2:30 PM	253	553	185	43	74	10	42	23	21	4	1	0	**1207**	4	0.15	0.3	17	0.073	0.126
2:30 PM	2:45 PM	178	557	206	41	92	7	15	6	10	5	0	0	**1117**	3	0.15	0.4	18	0.078	0.115
2:45 PM	3:00 PM	118	378	190	43	52	6	12	13	14	7	0	0	**833**	3	0.13	0.4	13	0.069	0.102
3:00 PM	3:15 PM	160	567	191	36	48	9	9	13	10	2	1	0	**673**	2	0.13	0.3	22	0.073	0.116
3:15 PM	3:30 PM	190	483	170	38	43	5	16	11	13	0	6	0	**974**	2	0.13	0.3	21	0.074	0.059
3:30 PM	3:45 PM	141	453	166	36	82	7	12	10	6	5	1	0	**919**	3	0.13	0.3	26	0.071	0.128
3:45 PM	4:00 PM	171	445	185	43	57	6	20	22	10	2	1	0	**962**	3	0.13	0.3	21	0.075	0.019
4:00 PM	4:15 PM	183	545	221	30	56	11	17	12	3	3	0	0	**1082**	5	0.14	0.4	15	0.079	0.129
4:15 PM	4:30 PM	204	535	180	36	57	6	16	18	5	1	0	0	**1057**	5	0.14	0.4	18	0.078	0.178
4:30 PM	4:45 PM	142	445	185	32	97	8	15	10	8	3	0	0	**945**	5	0.14	0.3	26	0.074	0.178
4:45 PM	5:00 PM	68	315	136	33	55	5	14	12	17	1	9	0	**666**	4	0.14	0.3	24	0.077	0.148
5:00 PM	5:15 PM	107	410	170	27	59	11	8	12	4	3	1	0	**812**	4	0.14	0.4	22	0.067	0.139
5:15 PM	5:30 PM	160	486	161	32	62	6	16	18	7	2	1	0	**952**	5	0.16	0.4	26	0.068	0.025
5:30 PM	5:45 PM	107	505	166	46	90	7	18	9	17	8	5	0	**978**	5	0.16	0.4	24	0.069	0.096
5:45 PM	6:00 PM	157	697	584	46	52	6	22	21	17	6	3	0	**1610**	5	0.16	0.3	26	0.067	0.135
TOTALS		**6,058**	**26,672**	**10,403**	**1,624**	**2,954**	**322**	**841**	**599**	**529**	**166**	**87**	**2**	**23,873**	**3.8958333**	**0.1466667**	**0.3708333**	**18.3125**	**0.06225**	**0.2221875**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02	**Period of St**	
Enumerators name	MOSES	**Weather:**		**Day of the Week:**	THURSDAY
Approach from	Both directions			**Date:**	14/11/2019
Start Time (hour):	6:00PM	**Finish Time (hour):**		6:00AM	

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)		CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00PM	6:15PM	52	450	154	29	58	7	22	6	4	5	0	0	**786**	2	0.12	0.3	9	0.064	0.426
6:15PM	6:30PM	77	492	200	24	63	8	25	5	17	5	0	0	**917**	3	0.14	0.2	11	0.044	0.261
6:30PM	6:45PM	92	655	216	31	93	7	20	6	23	5	1	0	**1151**	2	0.14	0.5	8	0.039	0.259
6:45PM	7:00PM	74	594	223	42	70	8	19	7	12	6	4	2	**1062**	3	0.14	0.2	7	0.034	0.227
7:00PM	7:15PM	43	375	128	24	48	8	16	8	4	4	0	0	**659**	5	0.13	0.4	5	0.039	0.223
7:15PM	7:30PM	64	410	167	20	53	7	21	5	16	4	0	0	**768**	4	0.14	0.4	7	0.064	0.224
7:30PM	7:45PM	77	546	180	26	78	6	19	8	24	7	5	0	**975**	3	0.14	0.5	5	0.065	0.239
7:45PM	8:00PM	62	495	186	35	58	7	24	11	12	4	3	0	**898**	4	0.14	0.5	5	0.064	0.239
8:00PM	8:15PM	80	490	188	22	52	6	23	8	13	5	1	0	**890**	5	0.14	0.3	10	0.053	0.435
8:15PM	8:30PM	67	557	214	28	68	7	22	14	13	11	0	0	**1000**	5	0.14	0.5	10	0.031	0.446
8:30PM	8:45PM	107	588	215	30	48	6	16	20	13	2	1	0	**1047**	3	0.13	0.3	29	0.055	0.371
8:45PM	9:00PM	115	547	210	33	69	8	39	25	22	3	3	0	**1076**	2	0.13	0.4	18	0.064	0.279
9:00PM	9:15PM	128	778	266	43	54	5	14	6	15	4	1	0	**1313**	3	0.13	0.3	29	0.061	0.201
9:15PM	9:30PM	118	570	238	42	39	7	11	12	7	6	0	0	**1050**	4	0.13	0.5	22	0.064	0.327
9:30PM	9:45PM	114	674	237	25	35	4	13	6	8	1	0	0	**1116**	5	0.13	0.5	15	0.065	0.429
9:45PM	10:00PM	145	665	231	27	59	6	11	9	7	1	5	0	**1166**	5	0.13	0.4	24	0.058	0.389
10:00PM	10:15PM	120	665	230	28	41	5	8	6	6	2	3	0	**1113**	5	0.18	0.3	19	0.057	0.413
10:15PM	10:30PM	117	587	250	32	48	8	8	17	4	3	1	0	**1074**	4	0.18	0.4	22	0.067	0.355
10:30PM	10:45PM	122	716	274	27	51	7	14	8	4	1	0	0	**1223**	4	0.18	0.2	23	0.053	0.376
10:45PM	11:00PM	161	640	253	35	40	6	11	18	6	4	3	0	**1175**	3	0.16	0.5	23	0.046	0.414
11:00PM	11:15PM	130	731	253	34	45	4	16	12	13	1	2	0	**1241**	4	0.16	0.5	30	0.043	0.112
11:15PM	11:30PM	168	870	296	42	53	4	13	10	11	0	6	0	**1472**	4	0.16	0.5	26	0.049	0.291
11:30PM	11:45PM	138	643	232	37	43	6	10	8	5	4	1	0	**1126**	5	0.16	0.5	16	0.065	0.259
11:45PM	12:00MN	134	667	279	26	56	5	16	19	8	2	1	0	**1211**	2	0.16	0.3	15	0.064	0.212
12:00 PM	12:15 PM	122	625	280	42	49	5	29	14	20	3	0	0	**1189**	3	0.16	0.2	18	0.069	0.269
12:15AM	12:30AM	115	505	308	42	70	6	18	13	12	5	2	0	**1095**	4	0.18	0.3	17	0.063	0.256
12:30AM	12:45AM	113	620	195	30	110	7	18	13	14	6	0	0	**1124**	5	0.18	0.3	18	0.067	0.198
12:45AM	1:00AM	137	500	208	35	62	5	28	19	19	0	6	0	**1018**	5	0.18	0.3	19	0.067	0.135
1:00AM	1:15AM	118	510	210	27	88	6	25	15	12	1	4	0	**1015**	5	0.12	0.4	23	0.061	0.109
1:15AM	1:30AM	114	501	211	32	99	7	16	17	13	4	3	0	**1015**	5	0.15	0.5	17	0.054	0.134
1:30AM	1:45AM	116	552	193	39	58	10	17	11	2	3	1	0	**1001**	5	0.15	0.4	23	0.061	0.118
1:45AM	2:00AM	150	525	182	41	56	5	16	16	4	1	0	0	**997**	4	0.15	0.4	22	0.071	0.195
2:00AM	2:15AM	228	557	200	33	63	10	11	19	8	4	1	0	**1136**	4	0.15	0.4	15	0.075	0.151
2:15AM	2:30AM	253	553	185	43	74	10	42	23	21	4	1	0	**1207**	4	0.15	0.3	17	0.073	0.126
2:30AM	2:45AM	178	557	206	41	92	7	15	6	10	5	0	0	**1117**	3	0.15	0.4	18	0.078	0.115
2:45AM	3:00AM	118	378	190	43	52	6	12	13	14	7	0	0	**833**	3	0.13	0.4	13	0.069	0.102
3:00AM	3:15AM	160	567	191	36	48	9	9	13	10	2	1	0	**673**	2	0.13	0.3	22	0.073	0.116
3:15AM	3:30AM	190	483	170	38	43	5	16	11	13	0	6	0	**974**	2	0.13	0.3	21	0.074	0.059
3:30AM	3:45AM	141	453	166	36	82	7	12	10	6	5	1	0	**919**	3	0.13	0.3	26	0.071	0.128
3:45AM	4:00AM	171	445	185	43	57	6	20	22	10	2	1	0	**962**	3	0.13	0.3	21	0.075	0.019
4:00AM	4:15AM	183	545	221	30	56	11	17	12	3	3	0	0	**1082**	5	0.14	0.4	15	0.079	0.129
4:15AM	4:30AM	204	535	180	36	57	6	16	18	5	1	0	0	**1057**	5	0.14	0.4	18	0.078	0.178
4:30AM	4:45AM	142	445	185	32	97	8	15	10	8	3	0	0	**945**	5	0.14	0.3	26	0.074	0.178
4:45AM	5:00AM	68	315	136	33	55	5	14	12	17	1	9	0	**666**	4	0.14	0.3	24	0.077	0.148
5:00AM	5:15AM	107	410	170	27	59	11	8	12	4	3	1	0	**812**	4	0.14	0.4	22	0.067	0.139
5:15AM	5:30AM	160	486	161	32	62	6	16	18	7	2	1	0	**952**	5	0.16	0.4	26	0.068	0.025
5:30AM	5:45AM	107	505	166	46	90	7	18	9	17	8	5	0	**978**	5	0.16	0.4	24	0.069	0.096
5:45AM	6:00AM	157	697	584	46	52	6	22	21	17	6	3	0	**1610**	5	0.16	0.3	26	0.067	0.135
TOTALS		**6,058**	**26,672**	**10,403**	**1,624**	**2,954**	**322**	**841**	**599**	**529**	**166**	**87**	**2**	**23,873**	**3.8958333**	**0.1466667**	**0.3708333**	**18.3125**	**0.06225**	**0.2221875**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02	**Period of St**	DAY
Enumerators name	MOSES	**Weather:**		**Day of the Week:**	FRIDAY
Approach from	Both directions			**Date:**	15/11/2019
Start Time (hour):	6:00 AM	**Finish Time (hour):**	6:00 PM		

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00 AM	6:15 AM	77	215	252	29	50	5	5	2	1	0	0	0	**636**	1	0.3	0.3	9	0.064	0.426
6:15 AM	6:30 AM	76	415	258	31	51	4	6	3	1	1	0	0	**847**	2	0.2	0.2	11	0.044	0.261
6:30 AM	6:45 AM	59	298	192	22	46	2	8	1	2	0	0	0	**449**	2	0.4	0.5	8	0.039	0.259
6:45 AM	7:00 AM	79	386	219	23	68	4	6	2		1	0	0	**625**	3	0.4	0.2	7	0.034	0.227
7:00 AM	7:15 AM	100	395	216	24	42	2	5	2	5	1	0	0	**792**	3	0.4	0.4	5	0.039	0.223
7:15 AM	7:30 AM	102	244	149	15	38	4	3	4	2	1	0	0	**465**	2	0.4	0.4	7	0.064	0.224
7:30 AM	7:45 AM	124	283	148	22	75	2	6	2	3	0	0	0	**519**	3	0.4	0.5	5	0.065	0.239
7:45 AM	8:00 AM	129	218	169	22	37	3	6	3	3	3	1	0	**595**	4	0.4	0.5	5	0.064	0.239
8:00 AM	8:15 AM	155	280	166	16	63	5	3	5	2	1	0	0	**534**	4	0.4	0.3	10	0.053	0.435
8:15 AM	8:30 AM	147	325	191	20	70	2	7	2	3	0	0	0	**597**	4	0.4	0.5	10	0.031	0.446
8:30 AM	8:45 AM	169	251	174	21	114	3	7	4	4	3	1	0	**750**	3	0.5	0.3	29	0.055	0.371
8:45 AM	9:00 AM	165	342	181	26	49	2	11	6	6	0	0	0	**615**	2	0.5	0.4	18	0.064	0.279
9:00 AM	9:15 AM	134	203	131	19	47	1	4	4	6	1	0	0	**403**	3	0.5	0.3	29	0.061	0.201
9:15 AM	9:30 AM	177	204	164	14	33	1	1	4	6	3	1	0	**607**	4	0.5	0.5	22	0.064	0.327
9:30 AM	9:45 AM	169	214	164	18	38	3	1	8	4	1	0	0	**419**	5	0.5	0.5	15	0.065	0.429
9:45 AM	10:00 AM	153	238	145	43	58	2	0	6	5	1	0	0	**463**	5	0.4	0.4	24	0.058	0.389
10:00 AM	10:15 AM	156	154	123	23	51	1	1	5	8	1	0	0	**319**	5	0.4	0.3	19	0.057	0.413
10:15 AM	10:30 AM	156	266	145	40	50	1	2	7	8	4	0	0	**679**	4	0.4	0.4	22	0.067	0.355
10:30 AM	10:45 AM	173	222	136	30	43	1	2	6	5	1	1	0	**456**	4	0.4	0.2	23	0.053	0.376
10:45 AM	11:00 AM	140	207	261	27	38	1	4	5	1	1	0	0	**531**	3	0.4	0.5	23	0.046	0.414
11:00 AM	11:15 AM	189	193	155	18	35	1	3	3	5	1	0	0	**383**	3	0.4	0.5	30	0.043	0.112
11:15 AM	11:30 AM	169	194	179	16	69	1	1	4	6	3	1	0	**641**	3	0.5	0.5	26	0.049	0.291
11:30 AM	11:45 AM	163	203	131	27	37	3	1	8	4	1	0	0	**398**	2	0.5	0.5	16	0.065	0.259
11:45 AM	12:00 PM	165	226	161	27	68	2	0	6	5	1	0	0	**440**	2	0.5	0.3	15	0.064	0.212
12:00 PM	12:15 PM	176	290	170	24	60	2	5	5	8	2	0	0	**576**	2	0.5	0.2	18	0.069	0.269
12:15 PM	12:30 PM	222	291	210	21	140	1	1	6	9	4	1	0	**906**	4	0.5	0.3	17	0.063	0.256
12:30 PM	12:45 PM	214	305	207	26	45	4	1	12	6	1	0	0	**598**	5	0.6	0.3	18	0.067	0.198
12:45 PM	1:00 PM	194	340	190	42	70	3		9	7	1	0	0	**661**	5	0.7	0.3	19	0.067	0.135
1:00 PM	1:15 PM	196	220	155	17	45	2	2	7	11	1	0	0	**456**	5	0.7	0.4	23	0.061	0.109
1:15 PM	1:30 PM	198	380	188	40	57	2	3	10	12	5	0	0	**895**	4	0.7	0.5	17	0.054	0.134
1:30 PM	1:45 PM	230	317	174	46	71	1	3	9	7	2	1	0	**651**	4	0.7	0.4	23	0.061	0.118
1:45 PM	2:00 PM	181	295	356	42	62	2	6	7	1	1	0	0	**758**	4	0.6	0.4	22	0.071	0.195
2:00 PM	2:15 PM	215	276	172	38	59	2	5	5	8	2	0	0	**547**	4	0.6	0.4	15	0.075	0.151
2:15 PM	2:30 PM	217	276	208	29	58	1	1	6	9	4	1	0	**809**	4	0.6	0.3	17	0.073	0.126
2:30 PM	2:45 PM	180	290	180	37	52	4	1	11	6	1	0	0	**568**	3	0.6	0.4	18	0.078	0.115
2:45 PM	3:00 PM	236	323	226	40	54	3	0	9	7	1	0	0	**628**	3	0.6	0.4	13	0.069	0.102
3:00 PM	3:15 PM	212	209	192	20	92	2	2	7	10	1	0	0	**433**	3	0.6	0.3	22	0.073	0.116
3:15 PM	3:30 PM	208	361	186	50	55	2	3	10	11	5	0	0	**890**	3	0.5	0.3	21	0.074	0.059
3:30 PM	3:45 PM	272	301	185	26	85	1	3	9	7	2	1	0	**618**	3	0.5	0.3	26	0.071	0.128
3:45 PM	4:00 PM	213	280	359	24	70	2	6	7	1	1	0	0	**720**	3	0.5	0.3	21	0.075	0.019
4:00 PM	4:15 PM	168	375	206	18	171	1	8	11	12	2	2	0	**701**	2	0.5	0.4	15	0.079	0.129
4:15 PM	4:30 PM	161	355	188	19	57		7	8	8	3	2	0	**809**	2	0.5	0.4	18	0.078	0.178
4:30 PM	4:45 PM	165	305	202	26	75	2	5	4	5			0	**619**	2	0.6	0.3	26	0.074	0.178
4:45 PM	5:00 PM	179	402	211	25	53	2	2	3	6	2	2	0	**745**	4	0.6	0.3	24	0.077	0.148
5:00 PM	5:15 PM	135	252	170	24	59			3	4	0	0	0	**477**	4	0.6	0.4	22	0.067	0.139
5:15 PM	5:30 PM	181	350	197	55	85	1	2	1	3	1	1	0	**877**	5	0.6	0.4	26	0.068	0.025
5:30 PM	5:45 PM	184	365	232	45	83	3	8	4	9	1	1	0	**689**	5	0.5	0.4	24	0.069	0.096
5:45 PM	6:00 PM	170	340	196	48	70	2	8	1	4		1	0	**613**	5	0.5	0.3	26	0.067	0.135
TOTALS		**8,034**	**12,365**	**9,171**	**1,356**	**2,999**	**100**	**173**	**265**	**264**	**70**	**17**	**0**	**25143**	**3.4166667**	**0.5**	**0.3708333**	**18.3125**	**0.06225**	**0.2221875**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02	**Period of St**	DAY
Enumerators name	MOSES	**Weather:**		**Day of the Week:**	FRIDAY
Approach from	Both directions			**Date:**	15/11/2019
Start Time (hour):	6:00PM	**Finish Time (hour):**		6:00AM	
Time (hour)					

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)		CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00PM	6:15PM	77	215	252	29	50	5	5	2	1	0	0	0	**636**	1	0.3	0.3	9	0.064	0.426
6:15PM	6:30PM	76	415	258	31	51	4	6	3	1	1	0	0	**847**	2	0.2	0.2	11	0.044	0.261
6:30PM	6:45PM	59	298	192	22	46	2	8	1	2	0	0	0	**449**	2	0.4	0.5	8	0.039	0.259
6:45PM	7:00PM	79	386	219	23	68	4	6	2		1	0	0	**625**	3	0.4	0.2	7	0.034	0.227
7:00PM	7:15PM	100	395	216	24	42	2	5	2	5	1	0	0	**792**	3	0.4	0.4	5	0.039	0.223
7:15PM	7:30PM	102	244	149	15	38	4	3	4	2	1	0	0	**465**	2	0.4	0.4	7	0.064	0.224
7:30PM	7:45PM	124	283	148	22	75	2	6	2	3	0	0	0	**519**	3	0.4	0.5	5	0.065	0.239
7:45PM	8:00PM	129	218	169	22	37	3	6	3	3	3	1	0	**595**	4	0.4	0.5	5	0.064	0.239
8:00PM	8:15PM	155	280	166	16	63	5	3	5	2	1	0	0	**534**	4	0.4	0.3	10	0.053	0.435
8:15PM	8:30PM	147	325	191	20	70	2	7	2	3	0	0	0	**597**	4	0.4	0.5	10	0.031	0.446
8:30PM	8:45PM	169	251	174	21	114	3	7	4	4	3	1	0	**750**	3	0.5	0.3	29	0.055	0.371
8:45PM	9:00PM	165	342	181	26	49	2	11	6	6	0	0	0	**615**	2	0.5	0.4	18	0.064	0.279
9:00PM	9:15PM	134	203	131	19	47	1	4	4	6	1	0	0	**403**	3	0.5	0.3	29	0.061	0.201
9:15PM	9:30PM	177	204	164	14	33	1	1	4	6	3	1	0	**607**	4	0.5	0.5	22	0.064	0.327
9:30PM	9:45PM	169	214	164	18	38	3	1	8	4	1	0	0	**419**	5	0.5	0.5	15	0.065	0.429
9:45PM	10:00PM	153	238	145	43	58	2	0	6	5	1	0	0	**463**	5	0.4	0.4	24	0.058	0.389
10:00PM	10:15PM	156	154	123	23	51	1	1	5	8	1	0	0	**319**	5	0.4	0.3	19	0.057	0.413
10:15PM	10:30PM	156	266	145	40	50	1	2	7	8	4	0	0	**679**	4	0.4	0.4	22	0.067	0.355
10:30PM	10:45PM	173	222	136	30	43	1	2	6	5	1	1	0	**456**	4	0.4	0.2	23	0.053	0.376
10:45PM	11:00PM	140	207	261	27	38	1	4	5	1	1	0	0	**531**	3	0.4	0.5	23	0.046	0.414
11:00PM	11:15PM	189	193	155	18	35	1	3	3	5	1	0	0	**383**	3	0.4	0.5	30	0.043	0.112
11:15PM	11:30PM	169	194	179	16	69	1	1	4	6	3	1	0	**641**	3	0.5	0.5	26	0.049	0.291
11:30PM	11:45PM	163	203	131	27	37	3	1	8	4	1	0	0	**398**	2	0.5	0.5	16	0.065	0.259
11:45PM	12:00MN	165	226	161	27	68	2	0	6	5	1	0	0	**440**	2	0.5	0.3	15	0.064	0.212
12:00 PM	12:15 PM	176	290	170	24	60	2	5	5	8	2	0	0	**576**	2	0.5	0.2	18	0.069	0.269
12:15AM	12:30AM	222	291	210	21	140	1	1	6	9	4	1	0	**906**	4	0.5	0.3	17	0.063	0.256
12:30AM	12:45AM	214	305	207	26	45	4	1	12	6	1	0	0	**598**	5	0.6	0.3	18	0.067	0.198
12:45AM	1:00AM	194	340	190	42	70	3		9	7	1	0	0	**661**	5	0.7	0.3	19	0.067	0.135
1:00AM	1:15AM	196	220	155	17	45	2	2	7	11	1	0	0	**456**	5	0.7	0.4	23	0.061	0.109
1:15AM	1:30AM	198	380	188	40	57	2	3	10	12	5	0	0	**895**	4	0.7	0.5	17	0.054	0.134
1:30AM	1:45AM	230	317	174	46	71	1	3	9	7	2	1	0	**651**	4	0.7	0.4	23	0.061	0.118
1:45AM	2:00AM	181	295	356	42	62	2	6	7	1	1	0	0	**758**	4	0.6	0.4	22	0.071	0.195
2:00AM	2:15AM	215	276	172	38	59	2	5	5	8	2	0	0	**547**	4	0.6	0.4	15	0.075	0.151
2:15AM	2:30AM	217	276	208	29	58	1	1	6	9	4	1	0	**809**	4	0.6	0.3	17	0.073	0.126
2:30AM	2:45AM	180	290	180	37	52	4	1	11	6	1	0	0	**568**	3	0.6	0.4	18	0.078	0.115
2:45AM	3:00AM	236	323	226	40	54	3	0	9	7	1	0	0	**628**	3	0.6	0.4	13	0.069	0.102
3:00AM	3:15AM	212	209	192	20	92	2	2	7	10	1	0	0	**433**	3	0.6	0.3	22	0.073	0.116
3:15AM	3:30AM	208	361	186	50	55	2	3	10	11	5	0	0	**890**	3	0.5	0.3	21	0.074	0.059
3:30AM	3:45AM	272	301	185	26	85	1	3	9	7	2	1	0	**618**	3	0.5	0.3	26	0.071	0.128
3:45AM	4:00AM	213	280	359	24	70	2	6	7	1	1	0	0	**720**	3	0.5	0.3	21	0.075	0.019
4:00AM	4:15AM	168	375	206	18	171	1	8	11	12	2	2	0	**701**	2	0.5	0.4	15	0.079	0.129
4:15AM	4:30AM	161	355	188	19	57		7	8	8	3	2	0	**809**	2	0.5	0.4	18	0.078	0.178
4:30AM	4:45AM	165	305	202	26	75	2	5	4	5			0	**619**	2	0.6	0.3	26	0.074	0.178
4:45AM	5:00AM	179	402	211	25	53	2	2	3	6	2	2	0	**745**	4	0.6	0.3	24	0.077	0.148
5:00AM	5:15AM	135	252	170	24	59			3	4	0	0	0	**477**	4	0.6	0.4	22	0.067	0.139
5:15AM	5:30AM	181	350	197	55	85	1	2	1	3	1	1	0	**877**	5	0.6	0.4	26	0.068	0.025
5:30AM	5:45AM	184	365	232	45	83	3	8	4	9	1	1	0	**689**	5	0.5	0.4	24	0.069	0.096
5:45AM	6:00AM	170	340	196	48	70	2	8	1	4		1	0	**613**	5	0.5	0.3	26	0.067	0.135
TOTALS		**8,034**	**12,365**	**9,171**	**1,356**	**2,999**	**100**	**173**	**265**	**264**	**70**	**17**	**0**	**25143**	**3.4166667**	**0.5**	**0.3708333**	**18.3125**	**0.06225**	**0.2221875**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02	**Period of Sto**	DAY
Enumerators name	MOSES	**Weather:**		**Day of the Week:**	SATURDAY
Approach from	Both directions			**Date:**	16/11/2019
Start Time (hour):	6:00 AM	**Finish Time (hour):**		6:00 PM	

Time (hour)

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00 AM	6:15 AM	52	450	154	29	58	7	22	6	4	5	0	0	**786**	1	0.12	0.3	9	0.065	0.429
6:15 AM	6:30 AM	77	492	200	24	63	8	25	5	17	5	0	0	**917**	2	0.14	0.2	11	0.058	0.389
6:30 AM	6:45 AM	92	655	216	31	93	7	20	6	23	5	1	0	**1151**	2	0.14	0.5	8	0.057	0.413
6:45 AM	7:00 AM	74	594	223	42	70	8	19	7	12	6	4	2	**1062**	3	0.14	0.2	7	0.067	0.355
7:00 AM	7:15 AM	43	375	128	24	48	8	16	8	4	4	0	0	**659**	3	0.13	0.4	5	0.053	0.376
7:15 AM	7:30 AM	64	410	167	20	53	7	21	5	16	4	0	0	**768**	2	0.14	0.4	7	0.046	0.414
7:30 AM	7:45 AM	77	546	180	26	78	6	19	8	24	7	5	0	**975**	3	0.14	0.5	5	0.066	0.447
7:45 AM	8:00 AM	62	495	186	35	58	7	24	11	12	4	3	0	**898**	4	0.14	0.5	5	0.054	0.334
8:00 AM	8:15 AM	80	490	188	22	52	6	23	8	13	5	1	0	**890**	4	0.14	0.3	10	0.065	0.402
8:15 AM	8:30 AM	67	557	214	28	68	7	22	14	13	11	0	0	**1000**	4	0.14	0.5	10	0.064	0.564
8:30 AM	8:45 AM	107	588	215	30	48	6	16	20	13	2	1	0	**1047**	3	0.13	0.3	29	0.069	0.415
8:45 AM	9:00 AM	115	547	210	33	69	8	39	25	22	3	3	0	**1076**	2	0.13	0.4	18	0.063	0.526
9:00 AM	9:15 AM	128	778	266	43	54	5	14	6	15	4	1	0	**1313**	3	0.13	0.3	29	0.067	0.598
9:15 AM	9:30 AM	118	570	238	42	39	7	11	12	7	6	0	0	**1050**	4	0.13	0.5	22	0.067	0.435
9:30 AM	9:45 AM	114	674	237	25	35	4	13	6	8	1	0	0	**1116**	5	0.13	0.5	15	0.061	0.459
9:45 AM	10:00 AM	145	665	231	27	59	6	11	9	7	1	5	0	**1166**	5	0.13	0.4	24	0.009	0.059
10:00 AM	10:15 AM	120	665	230	28	41	5	8	6	6	2	3	0	**1113**	5	0.18	0.3	19	0.044	0.266
10:15 AM	10:30 AM	117	587	250	32	48	8	8	17	4	3	1	0	**1074**	4	0.18	0.4	22	0.068	0.529
10:30 AM	10:45 AM	122	716	274	27	51	7	14	8	4	1	0	0	**1223**	4	0.18	0.2	23	0.063	0.375
10:45 AM	11:00 AM	161	640	253	35	40	6	11	18	6	4	3	0	**1175**	3	0.16	0.5	23	0.063	0.375
11:00 AM	11:15 AM	130	731	253	34	45	4	16	12	13	1	2	0	**1241**	3	0.16	0.5	30	0.064	0.239
11:15 AM	11:30 AM	168	870	296	42	53	4	13	10	11	0	6	0	**1472**	3	0.16	0.5	26	0.053	0.435
11:30 AM	11:45 AM	138	643	232	37	43	6	10	8	5	4	1	0	**1126**	2	0.16	0.5	16	0.031	0.446
11:45 AM	12:00 PM	134	667	279	26	56	5	16	19	8	2	1	0	**1211**	2	0.16	0.3	15	0.055	0.371
12:00 PM	12:15 PM	122	625	280	42	49	5	29	14	20	3	0	0	**1189**	2	0.16	0.2	18	0.064	0.279
12:15 PM	12:30 PM	115	505	308	42	70	6	18	13	12	5	2	0	**1095**	4	0.18	0.3	17	0.061	0.201
12:30 PM	12:45 PM	113	620	195	30	110	7	18	13	14	6	0	0	**1124**	5	0.18	0.3	18	0.009	0.059
12:45 PM	1:00 PM	137	500	208	35	62	5	28	19	19	0	6	0	**1018**	5	0.18	0.3	19	0.044	0.266
1:00 PM	1:15 PM	118	510	210	27	88	6	25	15	12	1	4	0	**1015**	5	0.12	0.4	23	0.068	0.529
1:15 PM	1:30 PM	114	501	211	32	99	7	16	17	13	4	3	0	**1015**	4	0.15	0.5	17	0.063	0.375
1:30 PM	1:45 PM	116	552	193	39	58	10	17	11	2	3	1	0	**1001**	4	0.15	0.4	23	0.063	0.375
1:45 PM	2:00 PM	150	525	182	41	56	5	16	16	4	1	0	0	**997**	4	0.15	0.4	22	0.064	0.239
2:00 PM	2:15 PM	228	557	200	33	63	10	11	19	8	4	1	0	**1136**	4	0.15	0.4	15	0.053	0.435
2:15 PM	2:30 PM	253	553	185	43	74	10	42	23	21	4	1	0	**1207**	4	0.15	0.3	17	0.031	0.446
2:30 PM	2:45 PM	178	557	206	41	92	7	15	6	10	5	0	0	**1117**	3	0.15	0.4	18	0.055	0.371
2:45 PM	3:00 PM	118	378	190	43	52	6	12	13	14	7	0	0	**833**	3	0.13	0.4	13	0.064	0.279
3:00 PM	3:15 PM	160	567	191	36	48	9	9	13	10	2	1	0	**673**	3	0.13	0.3	22	0.061	0.201
3:15 PM	3:30 PM	190	483	170	38	43	5	16	11	13	0	6	0	**974**	3	0.13	0.3	21	0.009	0.059
3:30 PM	3:45 PM	141	453	166	36	82	7	12	10	6	5	1	0	**919**	3	0.13	0.3	26	0.044	0.266
3:45 PM	4:00 PM	171	445	185	43	57	6	20	22	10	2	1	0	**962**	3	0.13	0.3	21	0.068	0.529
4:00 PM	4:15 PM	183	545	221	30	56	11	17	12	3	3	0	0	**1082**	2	0.14	0.4	15	0.063	0.375
4:15 PM	4:30 PM	204	535	180	36	57	6	16	18	5	1	0	0	**1057**	2	0.14	0.4	18	0.063	0.375
4:30 PM	4:45 PM	142	445	185	32	97	8	15	10	8	3	0	0	**945**	2	0.14	0.3	26	0.064	0.239
4:45 PM	5:00 PM	68	315	136	33	55	5	14	12	17	1	9	0	**666**	4	0.14	0.3	24	0.053	0.435
5:00 PM	5:15 PM	107	410	170	27	59	11	8	12	4	3	1	0	**812**	4	0.14	0.4	22	0.031	0.446
5:15 PM	5:30 PM	160	486	161	32	62	6	16	18	7	2	1	0	**952**	5	0.16	0.4	26	0.055	0.371
5:30 PM	5:45 PM	107	505	166	46	90	7	18	9	17	8	5	0	**978**	5	0.16	0.4	24	0.064	0.279
5:45 PM	6:00 PM	157	697	584	46	52	6	22	21	17	6	3	0	**1610**	5	0.16	0.3	26	0.061	0.201
TOTALS		**6,058**	**26,672**	**10,403**	**1,624**	**2,954**	**322**	**841**	**599**	**529**	**166**	**87**	**2**	**49,884**	**3.4166667**	**0.1466667**	**0.37083333**	**18.3125**	**0.055145833**	**0.360020833**

ANALYSIS OF MANUAL CLASSIFIED TRAFFIC VOLUME COUNT - NORMAL TRAFFIC

Road/Link Name:	WAIYAKI WAY	**Count Location:**	UNPT 02	**Period of St**	DAY
Enumerators name	MOSES	**Weather:**		**Day of the Week:**	SATURDAY
Approach from	Both directions			**Date:**	16/11/2019
Start Time (hour):	6:00PM	**Finish Time (hour):**		6:00AM	
Time (hour)					

From	To	Motorcyle	Private Cars	Jeeps / 4WD's/utility vehicle	pickup/vans	Matatu (9 - 25 seats)	Small buses	Large Bus (>27 passengers)	Light Trucks 2 axles (single rear wheel)	Medium Trucks (2 axles, Double rear wheels)	Heavy Trucks (3, 4 axle)	Artics / Draw - bar Trucks (>4 axles)	Other (Agricultural tractors, grader etc.)	Total traffic volume	CO PPM	NOx PPM	SOxPPM	PM2.5µg/m³	HCHO mg/m³	TVOC mg/m³
6:00:PM	6:15:PM	52	450	154	29	58	7	22	6	4	5	0	0	**786**	1	0.12	0.3	9	0.065	0.429
6:15:PM	6:30PM	77	492	200	24	63	8	25	5	17	5	0	0	**917**	2	0.14	0.2	11	0.058	0.389
6:30PM	6:45PM	92	655	216	31	93	7	20	6	23	5	1	0	**1151**	2	0.14	0.5	8	0.057	0.413
6:45PM	7:00PM	74	594	223	42	70	8	19	7	12	6	4	2	**1062**	3	0.14	0.2	7	0.067	0.355
7:00PM	7:15PM	43	375	128	24	48	8	16	8	4	4	0	0	**659**	3	0.13	0.4	5	0.053	0.376
7:15PM	7:30PM	64	410	167	20	53	7	21	5	16	4	0	0	**768**	2	0.14	0.4	7	0.046	0.414
7:30PM	7:45PM	77	546	180	26	78	6	19	8	24	7	5	0	**975**	3	0.14	0.5	5	0.066	0.447
7:45PM	8:00PM	62	495	186	35	58	7	24	11	12	4	3	0	**898**	4	0.14	0.5	5	0.054	0.334
8:00PM	8:15PM	80	490	188	22	52	6	23	8	13	5	1	0	**890**	4	0.14	0.3	10	0.065	0.402
8:15PM	8:30PM	67	557	214	28	68	7	22	14	13	11	0	0	**1000**	4	0.14	0.5	10	0.064	0.564
8:30PM	8:45PM	107	588	215	30	48	6	16	20	13	2	1	0	**1047**	3	0.13	0.3	29	0.069	0.415
8:45PM	9:00PM	115	547	210	33	69	8	39	25	22	3	3	0	**1076**	2	0.13	0.4	18	0.063	0.526
9:00PM	9:15PM	128	778	266	43	54	5	14	6	15	4	1	0	**1313**	3	0.13	0.3	29	0.067	0.598
9:15PM	9:30PM	118	570	238	42	39	7	11	12	7	6	0	0	**1050**	4	0.13	0.5	22	0.067	0.435
9:30PM	9:45PM	114	674	237	25	35	4	13	6	8	1	0	0	**1116**	5	0.13	0.5	15	0.061	0.459
9:45PM	10:00PM	145	665	231	27	59	6	11	9	7	1	5	0	**1166**	5	0.13	0.4	24	0.009	0.059
10:00PM	10:15PM	120	665	230	28	41	5	8	6	6	2	3	0	**1113**	5	0.18	0.3	19	0.044	0.266
10:15PM	10:30PM	117	587	250	32	48	8	8	17	4	3	1	0	**1074**	4	0.18	0.4	22	0.068	0.529
10:30PM	10:45PM	122	716	274	27	51	7	14	8	4	1	0	0	**1223**	4	0.18	0.2	23	0.063	0.375
10:45PM	11:00PM	161	640	253	35	40	6	11	18	6	4	3	0	**1175**	3	0.16	0.5	23	0.063	0.375
11:00PM	11:15PM	130	731	253	34	45	4	16	12	13	1	2	0	**1241**	3	0.16	0.5	30	0.064	0.239
11:15PM	11:30PM	168	870	296	42	53	4	13	10	11	0	6	0	**1472**	3	0.16	0.5	26	0.053	0.435
11:30PM	11:45PM	138	643	232	37	43	6	10	8	5	4	1	0	**1126**	2	0.16	0.5	16	0.031	0.446
11:45PM	12:00MN	134	667	279	26	56	5	16	19	8	2	1	0	**1211**	2	0.16	0.3	15	0.055	0.371
12:00 PM	12:15 PM	122	625	280	42	49	5	29	14	20	3	0	0	**1189**	2	0.16	0.2	18	0.064	0.279
12:15AM	12:30AM	115	505	308	42	70	6	18	13	12	5	2	0	**1095**	4	0.18	0.3	17	0.061	0.201
12:30AM	12:45AM	113	620	195	30	110	7	18	13	14	6	0	0	**1124**	5	0.18	0.3	18	0.009	0.059
12:45AM	1:00AM	137	500	208	35	62	5	28	19	19	0	6	0	**1018**	5	0.18	0.3	19	0.044	0.266
1:00AM	1:15AM	118	510	210	27	88	6	25	15	12	1	4	0	**1015**	5	0.12	0.4	23	0.068	0.529
1:15AM	1:30AM	114	501	211	32	99	7	16	17	13	4	3	0	**1015**	4	0.15	0.5	17	0.063	0.375
1:30AM	1:45AM	116	552	193	39	58	10	17	11	2	3	1	0	**1001**	4	0.15	0.4	23	0.063	0.375
1:45AM	2:00AM	150	525	182	41	56	5	16	16	4	1	0	0	**997**	4	0.15	0.4	22	0.064	0.239
2:00AM	2:15AM	228	557	200	33	63	10	11	19	8	4	1	0	**1136**	4	0.15	0.4	15	0.053	0.435
2:15AM	2:30AM	253	553	185	43	74	10	42	23	21	4	1	0	**1207**	4	0.15	0.3	17	0.031	0.446
2:30AM	2:45AM	178	557	206	41	92	7	15	6	10	5	0	0	**1117**	3	0.15	0.4	18	0.055	0.371
2:45AM	3:00AM	118	378	190	43	52	6	12	13	14	7	0	0	**833**	3	0.13	0.4	13	0.064	0.279
3:00AM	3:15AM	160	567	191	36	48	9	9	13	10	2	1	0	**673**	3	0.13	0.3	22	0.061	0.201
3:15AM	3:30AM	190	483	170	38	43	5	16	11	13	0	6	0	**974**	3	0.13	0.3	21	0.009	0.059
3:30AM	3:45AM	141	453	166	36	82	7	12	10	6	5	1	0	**919**	3	0.13	0.3	26	0.044	0.266
3:45AM	4:00AM	171	445	185	43	57	6	20	22	10	2	1	0	**962**	3	0.13	0.3	21	0.068	0.529
4:00AM	4:15AM	183	545	221	30	56	11	17	12	3	3	0	0	**1082**	2	0.14	0.4	15	0.063	0.375
4:15AM	4:30AM	204	535	180	36	57	6	16	18	5	1	0	0	**1057**	2	0.14	0.4	18	0.063	0.375
4:30AM	4:45AM	142	445	185	32	97	8	15	10	8	3	0	0	**945**	2	0.14	0.3	26	0.064	0.239
4:45AM	5:00AM	68	315	136	33	55	5	14	12	17	1	9	0	**666**	4	0.14	0.3	24	0.053	0.435
5:00AM	5:15AM	107	410	170	27	59	11	8	12	4	3	1	0	**812**	4	0.14	0.4	22	0.031	0.446
5:15AM	5:30AM	160	486	161	32	62	6	16	18	7	2	1	0	**952**	5	0.16	0.4	26	0.055	0.371
5:30AM	5:45AM	107	505	166	46	90	7	18	9	17	8	5	0	**978**	5	0.16	0.4	24	0.064	0.279
5:45AM	6:00AM	157	697	584	46	52	6	22	21	17	6	3	0	**1610**	5	0.16	0.3	26	0.061	0.201
TOTALS		**6,058**	**26,672**	**10,403**	**1,624**	**2,954**	**322**	**841**	**599**	**529**	**166**	**87**	**2**	**49,884**	**3.4166667**	**0.1466667**	**0.37083333**	**18.3125**	**0.055145833**	**0.360020833**