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TRAFFIC CONGESTION MITIGATION AND ALLEVIATED MEASURES IN KIGALI CITY, RWANDA

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ABSTRACT

The main focus of this research was about the study on traffic congestion in Kigali city, Rwanda and proposing the alleviated measures to overcome to the problem. The considered routes for this study were chosen based on the occurrence of high traffic congestion especially during peak hours. Both quantitative and qualitative descriptive research design have been used to overcome to the sustainable solution of the said problem of traffic congestion in Kigali city. The 270 respondents were drawn randomly from different purposively determined group of the societies of Rwanda referred their awareness about traffic congestion. Traffic survey was conducted on field. As results, it is found that traffic congestion caused by many reasons, such as imbalance between the traffic volume and road capacity, inflexible work schedules, inadequate public transport, and poor urban land-use plan are the main reasons, location of different activities in one place of Rwanda which is Kigali city and leads to the attraction of many citizens from Villages towards town. Most journeys along the road are from various peripheral areas of the city to the core areas mainly for daily work and market purposes and other related purposes. On the average interval, it is found that most people's travel at 6:00–9:00 AM and 4:00 – 8:00 PM and the Traffic is highly congested within these two peak periods. Moreover, regarding travel-time or delay, it was 58.7 secs per vehicle at Nyabugogo-town road and 58.9 secs per vehicle at Sonatubes-Rwandex. It is also found that, congestion problem can be mitigated through different strategies, such as promoting the use of public

buses and related improvement, relocating activities from Kigali to the other areas of Rwanda, apply flextime working time, suitable land management, and finally promoting e-commerce and e-learning.

KEYWORDS: Kigali city, traffic congestion, public bus, traffic signals, Rwanda.

1. GENERAL INTRODUCTION

1.1 Background of Study

Nowadays Kigali as the capital city of Rwanda is growing rapidly due to different factors such as economic growth and immigration of people from different countries after 1994 genocide. Kigali as a developing city is facing transportation challenges, especially during morning and evening hours when employees are rushing for work or going back home and this leads to traffic jam in different roads of Kigali city (Farges n.d.), (Chen, C. Jia, Z. and Varaiya, 2001). Normally, the city of Kigali is at the same time administrative, industrial, education, health centers and commercial city and for these reasons all activities are concentrated in Town (Kwikiriza, 2016). All roads network converges to Kigali city and resulting to the traffic congestion and environmental deterioration as well (Lin, Zhou, and Xi, 2016).

The population growth in Kigali is also unavoidable (UN, 2019). The provision of adequate and appropriate public transport services can be one among the significant components for well-being of growing and going up for urban areas(G. Muthumanickam and G. Balasubramanian, 2017). This research discussed in more details the problems caused by traffic congestion and proposed remedies in the studied areas of Kigali city. The public bus priority, and relocating some activities from Kigali to the other cities of Rwanda nearby the Kigali city have been discussed in this research to be the best methods which can be adopted to avoid the traffic congestion in Kigali city(Alan B, 1995), (Srinivasan D Choy M Cheu R, 2006). Therefore, this will help to build up a bus priority strategy for Kigali city within the Kigali integrated passenger transport strategy.

Traffic congestion can be the result of poor transport land planning, insufficient capacity to sustain the existing traffic volume, insufficient traffic management in the city and inadequate public transport (Vuchic, 2001). The provision of adequate and appropriate public transport services can be one among the significant components for well-being of growing and going up for these urban areas (Ogundipe O.M, 2007). Reducing the consumption of resource and

leading to less pollution, bus priority can also decrease the traffic congestion as discussed in this research (Gard J, 2007). This research will also charge as part of the project to build up a bus priority strategy for Kigali city for addition within the Kigali integrated passenger transport strategy.

Transportation planners especially in developing countries face a various number of problems which necessitate innovative solutions. Great increase in urban population and pollution have seriously compromised existing transportation systems and considerably increased the challenges of creating future transportation systems (Alan B, 1995). In Rwanda, precisely in Kigali city, there is a very serious problem of traffic congestion because there is no any policy to rectify the problem that is why the findings from this research can help the government of Rwanda to establish the new policy of promoting public bus to come up with solutions to the problems.

1.2 Problem Statement

The available infrastructures in Kigali city were supposed to accommodate 608,141 people as per last population census carried out in August 2002 by Rwanda National Institute of Statistics (RNIS) and the estimated population in the year 2018 was about three times the population of 2002 while the rate increment of infrastructures such highways and buildings is very low compared to the increase of population in Kigali city as well as in the whole country and this leads to traffic demand which is higher than the traffic supply.

In addition, the private car ownership has also been increasing rapidly and would likely to induce more and more congestion and pollution in the city and due to this fast increase of population and car ownerships resulted in traffic congestion and the deterioration of overall transport system in Kigali City(Chen, C. Jia, Z. and Varaiya, 2001). Furthermore, most of administrative, industrial, educational, health and commercial activities are located in Kigali city and for this reason, all roads network converge to Kigali and all citizens from both villages and Kigali town are attracted toward Kigali city in order to find jobs and then make money for their daily life. For the Case of Kigali city, side road bus lane and bus priority at signal are feasible and can be considered to be the sustainable solution to overcome the problems of traffic congestion in Kigali city(Hounsell, 1995).

1.3 Objective of the Study

The main objective of this research was intended to the achievement of sustainable equilibrium of traffic supply and demand for public transport as well as reducing traffic congestion in Kigali city and having a likely environment as well.

2. Concept of Public Transport Priority

Public transport may possibly not be attractive for citizens in similarity with private cars because it is found as less flexible and often journeys take long time as it does not always go directly to the traveler's destination (Prasertsubpakij, 2011). A number of stops are made for conveying to other routes or modes, or for other passengers on the way. As a result, buses and trams are often not considered as a real alternative to the car (B.S. Kerner, 2009). It is known that the increasing cost of traffic congestion requires to be addressed through an integrated multi-modal transport system. The savings to the community in facilitating a shift to public transport can be important, particularly in urban peak congested conditions. This might be enhanced through enhancements to the service provided by public transport(Cervero, 2001).

Improvements to public transport may be considered through a number of avenues as well as improvement of vehicle efficiency, transport modes integration, reduction of the service cost, reduction in travel times and comfort ability of passengers(De Palma, A. and Lindsey, 2006). Rapid growth rates of these vehicles are also expected in China and India. Bus lanes and traffic signal priority are the most common forms of bus priority and these systems can provide significant travel time savings for congested arterial roads(Chen, C. Jia, Z. and Varaiya, 2001).

2.1 Reserved Lanes

Reserved lanes for public transport vehicles can be provided. These segregated lanes are exclusively for trams and/or buses before or along entire sections of the road network which enable public transport vehicles to bypass congestion. It is also feasible to open the lanes for other particular vehicles, such as taxis (Michael S. Bronzini, 2004). To accomplish an efficient use of the lanes, it is important to launch a specific monitoring and enforcement system and identify particular categories of users such as public transport vehicles, taxis, cyclists, etc. Sometimes it may be suitable to separate tram lanes accessible for buses on crucial sections, if there is no option of creating a new separate lane(Ogundipe O.M, 2007).

Figure 1: Bus priority using dedicated bus lanes.

2.2 Buses Priority at Signals

Generally, one of the most important causes of bus delays in urban environments are signalized intersections. In order to deal with this issue, two categories of treatments are available to allow buses priority at traffic signals, especially active and passive priority. Active priority entails each bus to be selectively detected prior to an intersection and adjustments made to the signals in order to enhance bus progression whereas Passive priority involves adjustment of the traffic control system to suit the bus schedules for that route(Hounsell, 1995). These methods of traffic signal priority are considered separately. Bus signals (or B-signals) can be applied at a traffic signal where a bus lane is provided. The white B-signal activates when the presence of a bus is detected in the bus lane, providing it with a head start over traffic and has the main advantages especially to:

- Reduce corridor time for buses
- Increase the traffic flow in junction with bus lanes
- Merges traffic streams efficiently and safely

The priority given at intersections, using signal controls, was made possible by several developments in computer, communications, sensors and Automatic Vehicle Locations (AVL) (Ogundipe O.M, 2007).

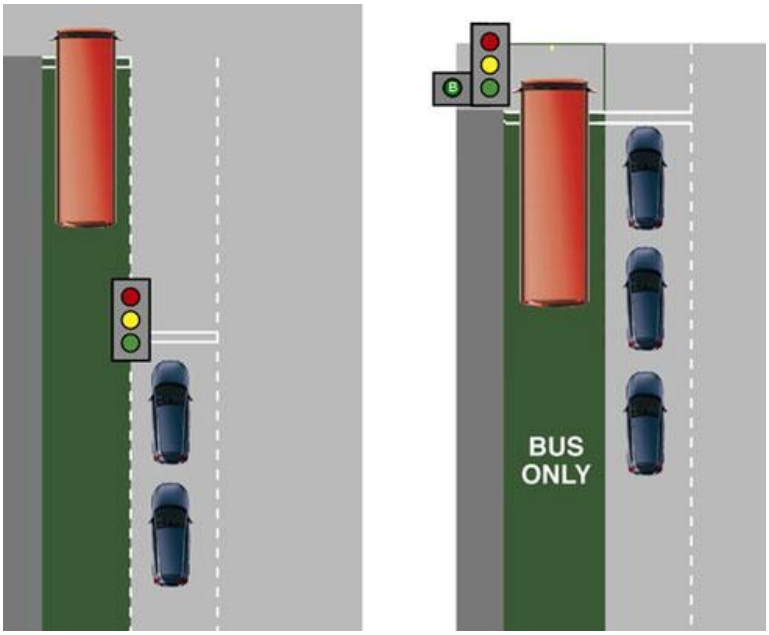


Figure 2: Bus priority signals.

3. METHODOLOGY OF THE STUDY

3.1 Study Area

The city of Kigali is challenged by an increase in congestion and pollution on its roads, especially during peak period. This phenomenon is direct result of an increasing population associated with an exponential increase in private car ownership. Public transport services consisting of buses, mini-bus taxes and motorcycle taxes are poor largely informal and uncoordinated.

Research design, study areas, sampling procedures, targeted and sample population, data collection and analysis and management were the methods used so as to achieve to the main target of the study. Questionnaires, interview guides, field observation and documentation analysis were the tools of data collection. Focus group discussions were also used to gather data from community members living in Kigali. Questionnaires and interview guides were used to gather quantitative data from passengers regarding to the strategies used and challenges first in the implementation of public bus transport priority.

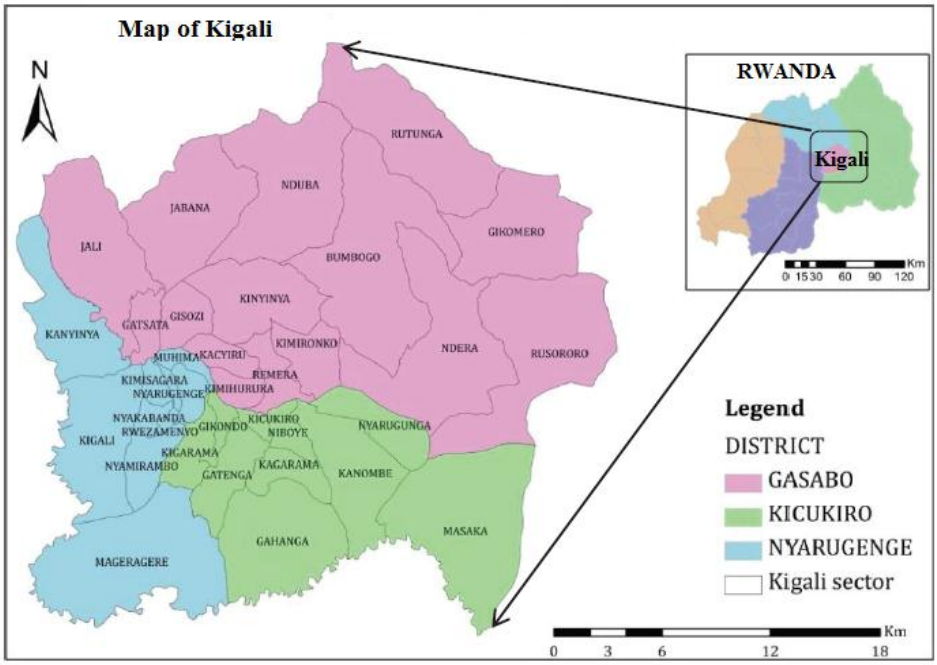


Figure 3: Map of Kigali City.

3.2 Considered Traffic Counting Stations

The traffic counting were conducted on the following points or stations of Kigali city: Nyabugogo Taxi Park, Yamaha Intersection, Rwandex Intersection, and Sonatubes roundabout. These points or stations were chosen based on high traffic jam which are occurring during peak hours.

3.3 RESEARCH DESIGN

The research design is the conceptual structure within which the research is conducted, it constitutes the design for data collection, measurement and analysis of data (Badami, 2007). The non-experiment research design specifically correlation research design was used to this study (C.R. Kothari, 2004). Different reports which have been established by people in charge of transportation in Kigali City, Rwanda transport development agency (RTDA), Rwanda utility regulation Authority (RURA) and other documentations and literatures related to public transport system in Kigali City were used as quantity data in this study. The quality data which have been used in this study includes geometric survey and pavement investigation. This design was selected due to its usefulness to the nature of study under investigation as the research is to deal with the respondents at one point in time.

3.4 Target Population

With regard to the specific needs and interest of this study, the targeted population was people who are in charge of public transport in Rwanda such as Kigali city, Rwanda transport development agency (RTDA), Rwanda utility regulation Authority (RURA) and passengers(C.R. Kothari, 2004). The basis of selecting these groups is that, they are good target for assessing the implementation and performance of public bus priority.

3.5 Study Area and Choice of Case Study

In this study, the study area meant the spatial extent to which the study covered. In order to make this study achievable and realistic, the study covered some routes in Kigali city which are most congested. The basis of selecting the most congested routes in Kigali city as the case study is that, promoting public bus priority is one among the solution not only for public transport service improvement but also for rectifying the problem of congestion. The following routes: Gatsata-Nyabugogo, Nyabugogo-Kacyiru- Remera, Nyabugogo-Kigali roundabout-Rwandex-Sonatube-Remera and ETO Muhima- Nyamirambo, were chosen as potential places to be studied since they are most congested in Kigali city.

3.6 Sampling Technique

To achieve the stated objective with resource on hand, as the sample frame (passengers) is greater than 10,000 per day, the sample size is determined as follows.

$$n = \frac{z^2 * p * q}{d^2}$$

Where:

z= is the standard normal variable at required level of confidence

p =is the proportion in the target population to have characteristics being measured

q=1-p: is the opposite of “p” above

d= is the sample error

Therefore:

Level of confidence is 90% (z-value is 1.645).

p = 0.5

q = 1- 0.5 = 0.5

d = 5%

3.7 Rationale for Used Sampling Technique

1. In providing true information, peoples may need some knowledge or experience on traffic congestion
2. The population size is large and contains different groups.

Because of these two reasons, the sample size increased by minimizing the sample error to 5%, and it is 90% certainly that sample respondents gave true information on the population parameters and 10% out of the true answer (C.R. Kothari, 2004).

Therefore, $n = \frac{1.645^2 * 0.5 * 0.5}{0.05^2}$ = **270** respondents

3.8 Measuring Delay through Queue Observation

The number of vehicles queuing will be counted at a fixed interval of time, usually for 15 or 30 seconds, over a period of five or ten minutes (ORN11, 1993).

$d = \frac{t*Q}{f}$ Where: d = estimate of average delay per vehicle (sec/veh) over time period

Q = average number of vehicle (or people) in queue over time period

f = throughput of vehicle (or people) over time period

t = length of time period (sec)

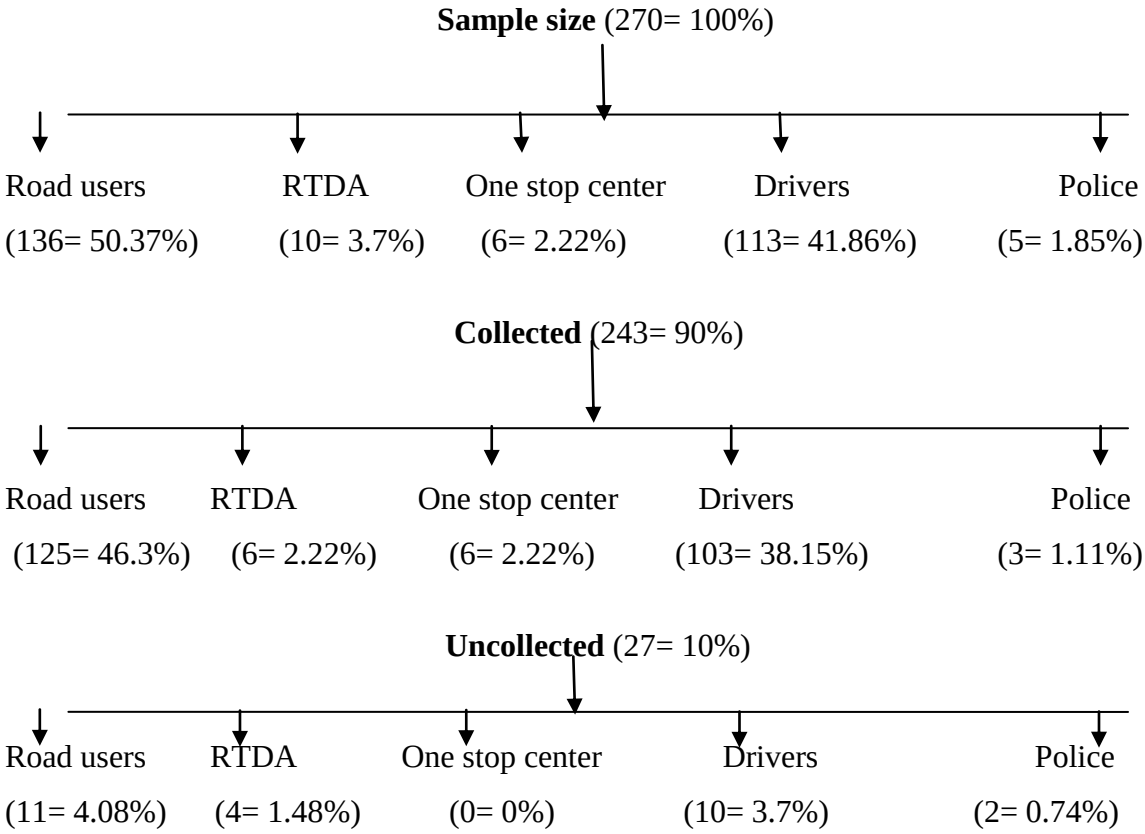
3.9 Data Collection Methods

During the collection of the data used in this research, both primary and secondary data were collected from targeted areas. The primary data involved different techniques such as questionnaires, informal interview and site observation while secondary data involve documentary analysis(C.R. Kothari, 2004).

4. Data Analysis and Interpretation

Different types of data were collected which is relevant in assessing the current traffic flow status of the city. Results are presented and discussed through various statistical tools at the same time in respect to the research objective on hand (C.R. Kothari, 2004). The following are the 270 targeted people consulted during the research based on their awareness related to traffic congestion in Kigali city. Here the target population was 136 passengers (Road users), 10 people from Rwanda Transport Development Agency (RTDA), 6 people from One Stop Center, 113 drivers and 5people from Police Agency.

4.1 Response Rate



From a total of 270 questionnaires distributed to respondents, 243 which is equal to 90% was collected whereas 27 which is equal to10% of the total sample was not collected.

4.2 Causes of Congestion in Kigali City

Based on the responses from the targeted population, the following Table1 contains the proposed causes of traffic congestion in Kigali city.

Table 1: Factors for traffic congestion.

No	Variables	People	Percentage(%)
1	Imbalance between the vehicles volume and road capacity	103	42.38
2	Un-integrated urban land-use planning of the city	25	10.3
3	Inflexible work schedule of people	43	17.69
4	Traffic accident	5	2.06
5	Inadequacy of public transport	40	16.46
6	Poor vehicle condition	7	2.88
7	Lack of transparent & good parking service delivery system	20	8.23
		Total=243	100

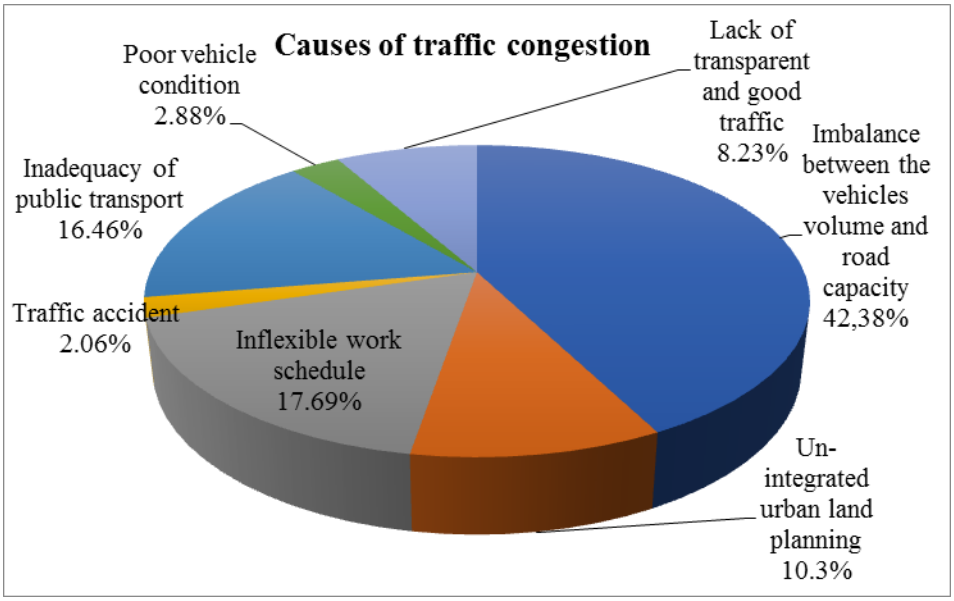


Figure 4: Variables for traffic congestion in Kigali city, Rwanda.

The above Table1 illustrates the distribution of variables that cause congestion in Kigali city as viewed by the respondents. For example, from 243 respondents about 103 (42.38%) argue that the existing vehicles volume exceeds road capacity and it is the major factor for congestion problem. Inflexible work schedule is suggested to be the second factor, 43 (17.69%) which followed by inadequacy of public transport, 40 (16.46%), and the fourth cause was proposed to be un-integrated urban land-use planning of the city, 25 (10.3 %). In addition, polices in charge of traffic in Kigali city 3 (1.11%) of the targeted population also agreed that high traffic volume is a major factor for congestion which occurred on a regular base (Recurrent type of congestion).

Other causes of Traffic congestion in Kigali city

- All-important activities are concentrated in Kigali city like administration, commercial, industrial, education, health centers, supermarkets and other related important marks, all roads/highways are converging towards Kigali and due to these reasons, many citizens are attracted towards Kigali for different purposes as indicated in the research.
- After 1994, all Rwandan refugees who were outside of the country came back Rwanda and all of them preferred to stay in Kigali city and this also contribute in traffic congestion.

4.3 Degree of Congestion

The figure below indicates the degree of Congestion in the considered routes Kigali city during the research. From 243 respondents, over 49% revealed that the proposed routes were congested, 29% of respondent said that those routes are very congested, and about 19% of respondents said that the routes are medium congested and lastly 3% of respondents thought that the proposed routes are low congested.

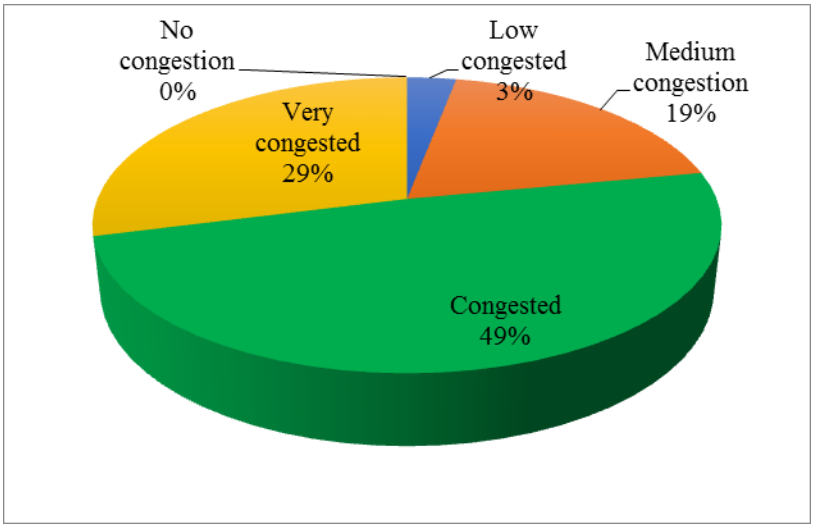


Figure 5: Degree of congestion for the studied routes of Kigali.

4.4 Frequency of Traffic Jam

During the research, it was found that the days which are more congested with high traffic jam are Monday, Wednesday and Friday. As indicated on the below figure9, the traffic jam is very high on Monday, and this is because all employees are supposed to go to job and some of them are from weekend and also Monday is the beginning of the week. Friday is the beginning of the weekend; all employees are using their own cars going to enjoy the weekend and this leads to high traffic jam in Kigali city.

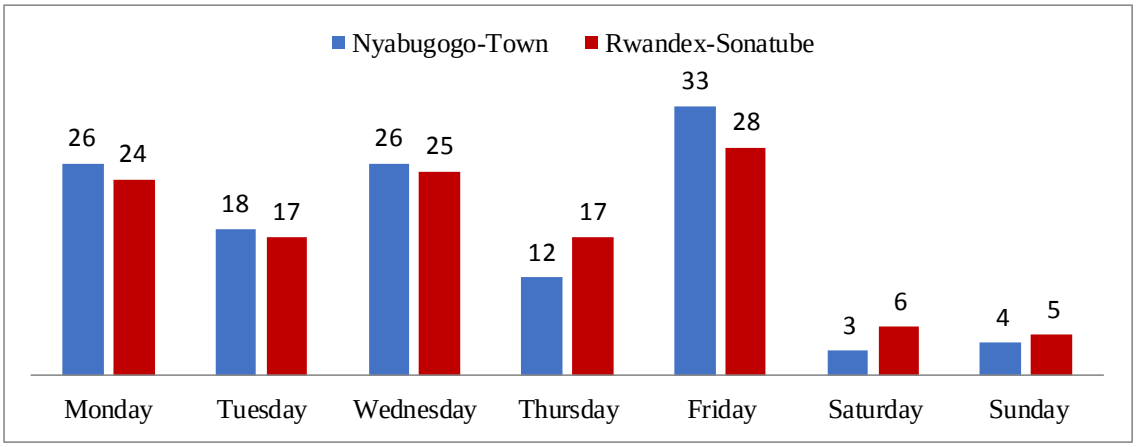


Figure 6: Frequency of traffic jam for the proposed routes of Kigali city.

4.5 Purpose of Travel

During the study, we need to know the trip purposes and why people need to travel and based on the responses from targeted population, it was found that the purposes of travel were for job, shopping, recreation, education and other purposes and their corresponding rates of travel purposes were 26.34%, 23.46%, 18.93%, 22% and 9.47% respectively.

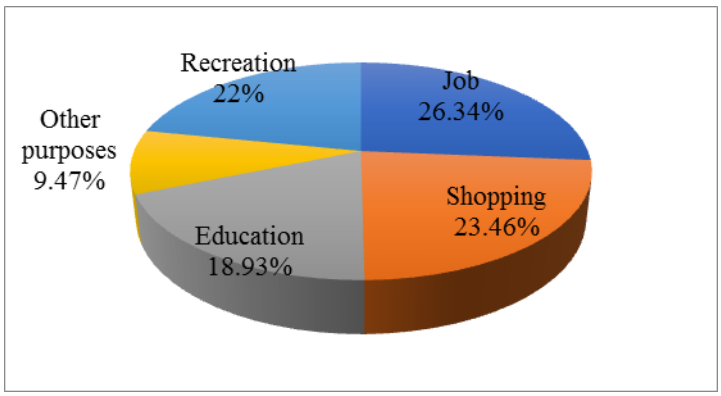


Figure 7: Travel purpose.

4.6 Time Occurrence of Traffic Jam

From 243 respondents, 211 (86.8%) agreed that congestion happens from 6:00-9:00 AM and 4:00-8:00 PM, 30 (12.3%) of the respondents agreed that congestion happens from 9:00-11:00 AM and 2:00-4:00 PM lastly but not the least 2 respondents agreed that congestion happens from 12:00-2:00 PM.

Table 2: Time occurrence of traffic jam.

Time	Respondents	%
6:00-9:00AM and 4:00-8:00PM	211	86.8
9:00-11:00AM and 2:00-4:00 PM	30	12.3
12:00-2:00 PM	2	0.8
Total	243	100

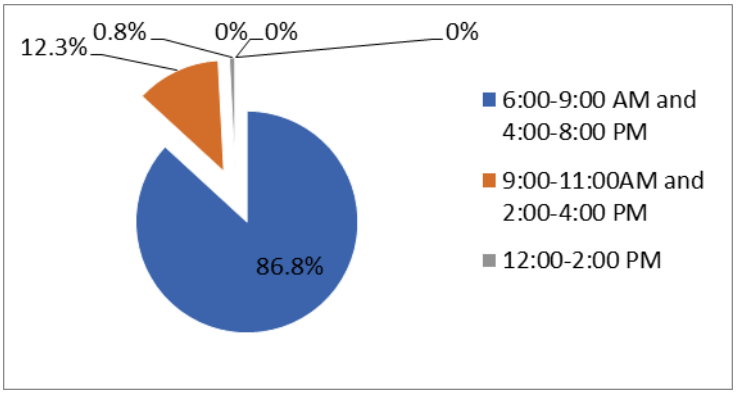


Figure 8: Time occurrence of congestion.

4.7 Traffic Volume Analysis

Table 3: Maximum flow rate.

Days	Nyabugogo Taxi Park (veh/h)	Yamaha Intersection (veh/h)	Rwandex Intersection (veh/h)	Sonatube Roundabout (veh/h)
Monday	1844	1752	1288	1176
Wednesday	1700	1764	1384	1252
Friday	1600	1532	1284	1216

Table 4: 1Average peak hour.

Days	Nyabugogo Taxi Park (veh/h)	Yamaha Intersection (veh/h)	Rwandex Intersection (veh/h)	Sonatube Roundabout (veh/h)
Monday	1474	1420	1162	1106
Wednesday	1485	1431	1165	1119
Friday	1430	1400	1153	1109

The above Table 3 indicates the maximum flow rate surveyed during the study and also the above Table 4 indicates the average peak hour and this was conducted and assessed during the study. Monday, Wednesday and Friday were chosen due to the surveyed high traffic volume or high traffic congestion during the research. The targeted populations also confirmed that during the mentioned days, in Kigali city there is a high traffic congestion.

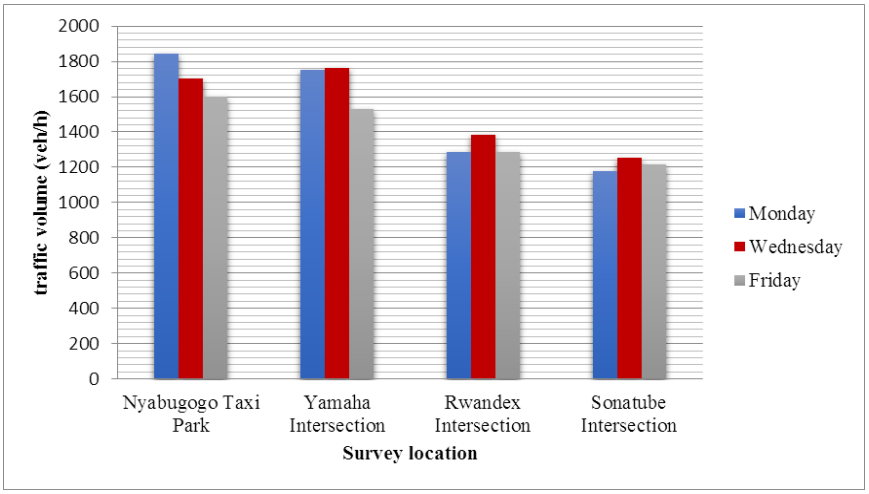


Figure 9: Average traffic volumes.

Computation of the Average daily traffic (ADT)

ADT=AHT*f knowing that f=1/ (d*k) →f=1/ (0.15*0.65) =10.26

Where,

AHT=average hourly traffic (peak)

d=coefficient of proportion of peak hour

k= directional peak hour factor

For urban areas d= 0.65 to 0.85 and k=0.15 to 0.25 (Roess, et al, 2004, p.109)

1. **Nyabugogo Taxi Park**

AHT= (1474+1485+1430)/3= 1463veh/h

ADT= 1463*10.26= **15,011veh/day**

2. **Yamaha Intersection**

AHT= (1420+1431+1400)/3= 1417veh/h

ADT= 1417*10.26= **14,539veh/day**

3. **Rwandex Intersection**

AHT= (1162+1165+1153)/3=1160veh/h

ADT= 1160*10.26= **11,902veh/day**

4. **Sonatube Roundabout**

AHT= (1106+1119+1109)/3= 1113

ADT= 1113*10.26= **11,420veh/day**

Based on the collected during the study, it has been found that at Nyabugogo Taxi Park only 407 buses passed in an interval of one hour which is only 2.7% of the total average daily traffic and at Yamaha intersection 250 buses passed in an hour which is 1.72% of the average daily traffic. At Rwandex intersection 283 buses passed in an hour which is 2.37% of the average daily traffic and at Sonatube roundabout 287 buses passed in an hour which is 2.5% of the average daily traffic. Referred to the above results, it is found that in the considered areas Kigali city there is a serious problem of traffic congestion due to poor planning of public transport.

4.8 Delay Survey

d= (t*Q)/f

Where d=estimate of average delay per vehicle (secs/veh) over survey time period

Q=average number of vehicles in queue over survey time period

f=throughput of vehicle over survey time period (=your traffic count, all classes combined)

t=length of survey time period (secs).

A. Nyabugogo-Town road

t=1h30'= 5400 Secs

f= 2320 Vehs

Q=1160/46= 25.22 Vehs

d= 5400*25.22/2320= **58.7 Secs/vehicle**

B. Rwandex-Sonatube road

t=1h30'= 5400 Secs

f= 1708 Vehs

Q=858/46= 18.65Vehs

d=5400*18.65/1708= **58.9 Secs/ vehicle**

4.9 Level of Service

The below Table 5 indicates the delay in each Level of Service (LOS) and referred to the above calculation, we can do classification of the chosen area based on the level of service by (Orn 2004).

Table 5: Delay in each LOS for intersections and Street/roads.

LOS	At signalized intersection (second/vehicle)	At un-signalized intersection (second/vehicle)	At Streets/roads (Using queue)	Remark
A	<10	<10	<15	There is a high delay at Streets than un-signalized & signalized
B	10 – 20	10 – 15	15 – 30	
C	20 – 35	15 – 25	30 – 55	
D	35 – 55	25 – 35	55 – 85	
E	55 – 80	35 – 50	85 – 120	
F	>80	>50	Unstable	

Source: (Orn 2004)

From the analyzed data, at Nyabugogo-Town road delay was **d=58.7 Secs/vehicle** which makes it to be classified in the level of service **E** and at Rwandex-Sonatube road delay was **d=58.9 Secs/vehicle** and it is classified in the level of service **E**. therefore, based on the level of services for these chosen area, it is recommended to do a suitable management of congestion so as to overcome to the sustainable solution of traffic congestion control in Kigali city.

4.10 Awareness on the Use Public Transport In Kigali City

The direct interview has been given to the passengers just to know how they think about public bus priority. The interview was given to different people referred to the ages. Bus stops have been chosen because these are the places where always passengers stand for waiting buses which help them to perform their trip attraction. The below figure indicates the degree of awareness to the use of public transport in Kigali city.

Table 6: Passengers 'awareness to public bus priority.

Passengers age interval	% age of awareness
15-20	53
20-25	60
25-30	75
30-35	80
35-40	96
40-45	85
45-50	65
50-55	56
55-60	51
60-65	47
65-70	44
70-75	31

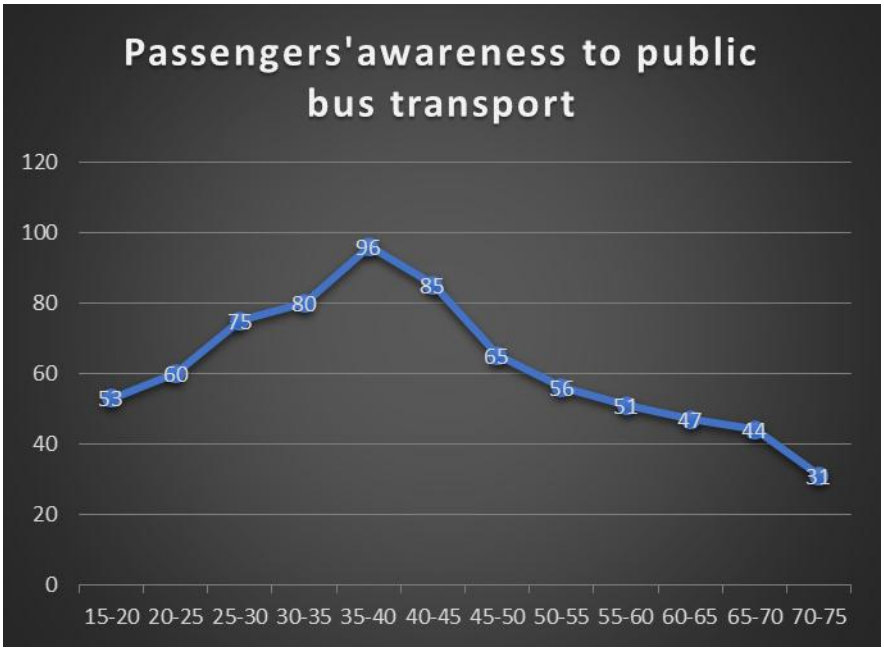


Figure 10: Passengers 'awareness to the use of public bus.

Based on the responses from passengers, the awareness to the use of public bus priority was very high to the people of age interval of 35-40 ages and it also was found that the people who use to travel a lot are those ones of age interval in between 30-50years.

4.11 Measures to Alleviate Traffic Congestion in Kigali

4.11.1 Relocating Activities

Most of activities are located in Kigali city and this leads to traffic congestion. The government of Rwanda can help in relocating some activities from Kigali to other cities of Rwanda. The other activities which need to be relocated are educational, health centers, supermarkets, industrial etc. This can be a sustainable solution in the reduction of congestion in Kigali city. It is better to promote electronic commerce (e-commerce), and electronic learning (e-learning). This con also contribute much in the reduction of congestion in Kigali city.

4.11.2 Public Bus Priority

Generally Public bus transport is not attractive for passengers compared to private cars because people like being luxury and it is known that Public buses do not always go directly to the passengers' destination. Based on the findings from this research, the following are the proposed sustainable solutions to alleviate traffic congestion in Kigali city like construction of Bus Rapid Transit, construction of dedicated bus lanes and installation of Signal priority for buses.

Bus Rapid Transit (BRT)

Bus Rapid Transit is a modern, comfortable, high ability public transportation solution which can accommodate a mass of people at once. The implementation of this transport system in Kigali city can be a sustainable solution in reduction of traffic congestion.

Dedicated bus lanes

Promoting kerb-side dedicated bus lanes because the lanes are separated from normal mixed traffic can be the best solution to solve the problems of congestion and traffic jam in Kigali city.

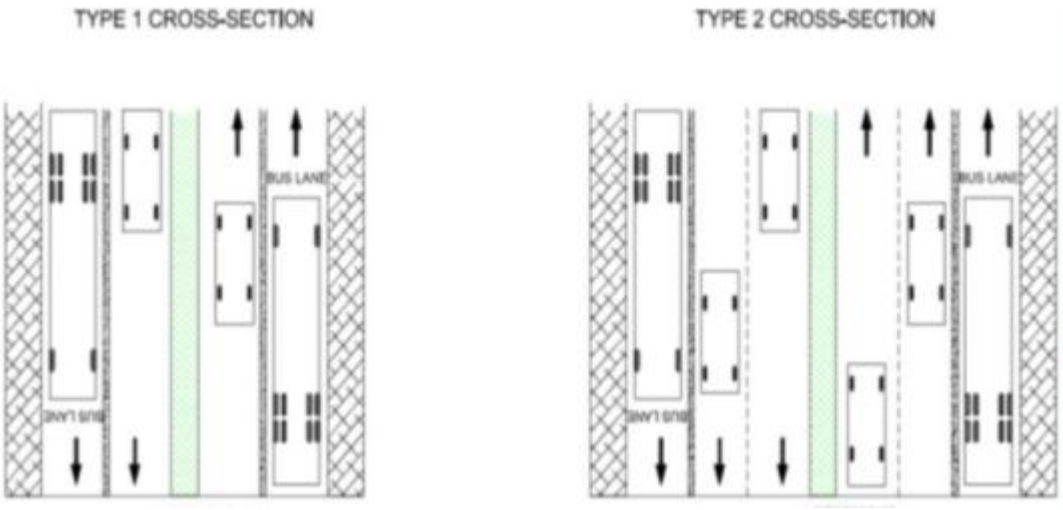


Figure 11: Proposed dedicated bus lanes in Kigali City.

Bus priority on traffic signals

Based on the observation from the field, the feasibility on implementation of bus priority on traffic signals is reasonable. This traffic control system has to be redesigned in Rwanda, especially in Kigali city. This is because the existing traffic signals in Kigali city are designed in respect with traditional system which makes traffic police to operate at the conflicting points generally simulating an uncoordinated signal cycle.

5. Concluding Remarks

Regarding to the current traffic flow and causes of vehicle congestion in the considered roads of Kigali city, the survey found that travel demand was reaching the peak between 6:00 – 9:00 AM and 4:00 – 8:00 PM and relatively drop down between 9:00 AM to 4:00 PM and 8:00 PM to 6:00 AM. Both primary and secondary data were used in the analysis of the traffic congestion within this research. The results showed that Congestion is occurred

frequently and the major factor for congestion problem along the roads are an imbalance between the current traffic volume and road capacity, fixed work schedule, unavailability of public transport, and poor land-use planning. The other causes are due to the concentration of all activities in Kigali city and this makes people travelling towards Kigali for fulfilling their daily basic needs.

As results, it is found that by promoting the use of public buses in Kigali city, relocating some important activities from Kigali to others cities like administration activities, educational activities, industrial activities, shopping moles and super markets can be one among the sustainable solution in reduction of traffic congestion in Kigali city. Promoting the use of Electronic commerce and e-learning can also be a solution to overcome the presented problem of traffic congestion in Kigali city.

The government of Rwanda and other stakeholders of transport in Rwanda are recommended to put in place the proposed sustainable solutions within the research. The quick solutions were found to be dedicating bus lanes and public buses prioritization at signals.

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