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# Causes of Traffic Congestion- A Case Study of Jinja Road in Central Division Kampala City, Uganda

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**ABSTRACT:** Traffic congestion is one of the most conspicuous dimensions that require compressive planning by Kampala City Authority. The number of vehicles in the central business district has more than tripled in the last twenty years, yet the roads have changed very little. The situation is often worse during the early morning and evening hours of the day where people are rushing for work and back home respectively. This study therefore was a study on traffic congestion control and modeling using a case study of Jinja road in central division Kampala city, Uganda. The study was guided by three different objectives which included to find out the causes of traffic congestion on Jinja road central division of Kampala city. The data was collected using questionnaires which asked respondents to report attitudes, experiences, and demographics in relation to traffic congestion and implementation of traffic management. The study further employed purposive sampling and random sampling strategies. From the study, it was found out that traffic congestion has been caused by numerous factors including few lanes, reckless drivers, VIP movements especially for political leaders, overtime increase of cars, increased population and poor management by traffic officers. However, strategic solutions have been suggested through modeling and these included road widening, building and encouraging bypasses and traffic management with strict laws. Controlling congestion is a constant, never-ending endeavor.

**KEYWORDS:** Control, Different roads, National authority, Quantitative survey, Traffic congestion, Traffic management

## I. INTRODUCTION

Worldwide, the congestion problem is a common problem among developed and underdeveloped countries [1]. During the past few decades, there has been rapid growth of demand for road transport and in particular, road traffic volume has increased significantly during this period, which reflects increasing economic activity, population and car ownership [2]. According to the [3], traffic measured in vehicle kilometres was around 50 billion in 1950, and this figure increases to 400 billion in 1990, more than 450 billion in 2000 and over 500 billion by 2008. Increase in road transport has brought benefits to society in terms of mobility and accessibility, it also however has costs which environmental and economical mainly caused due to traffic congestion. In developed countries, social, economic, and environmental impacts of traffic congestion in recent years are quite significant and this is witnessed in the densely populated areas where the extensive amount of delay and cost due to congestion affects the urban transportation system considerably [4] In 2014, traffic congestion cost people in the United States a total of \$160 billion from 6.9 billion extra hours traveled and 3.1 billion additional gallons of fuel purchased [5]. This happens because the existing roadways cannot accommodate the increasing number of automobiles. According to the [3], over the next 10 years, the most congested 25 cities of the U.S. were estimated to cost the drivers \$480 billion due to lost time, wasted fuel, and carbon emitted during congestion [6] This loss is also affecting the global economy to a great extent. In 2018, it was found that the total cost of lost productivity in the U.S. caused by congestion is \$87 billion.



In terms of transportation technology and policy, Africa lags behind developed countries and transport congestion in Sub-Saharan African cities is on the rise with some cities approaching gridlock [7]. Different reports show that road safety, traffic congestion, urban air pollution, road maintenance, accessibility and mobility problems are the key challenges for Sub-Saharan Africa. Rural to urban migration has contributed to a rapid expansion of cities, increasing levels of poverty and the proliferation of slums. These factors have resulted in a widening gap between urban transport supply and demand which has led to a rise in the number of motor vehicles hence traffic congestion.

Traffic congestion in Sub-Saharan Africa is generally attributed to the aging physical transportation infrastructure such as the conditions of roads, highways, or bridges are often [8]. However, congestion is also partly responsible for accelerating the physical degradation of transportation infrastructure, and consequently for reducing the transportation network performance. Several recovery strategies have been developed by African countries to improve the damaged network performance but the most of the strategies are not sufficient or even might not be applicable for congested road traffic conditions [9]. In order to ensure a sustainable and resilient transportation system, multi-disciplinary mitigation actions on combating road traffic congestions will be a necessity.

In East Africa, urban areas experience a lot of vehicular congestion and traffic jams which cost US millions of dollars every day through wasted time, environmental pollution, and increased stress [10]. In Kenya, the City of Nairobi is no exception and due to this a "Transport and Urban Decongestion Committee" was set up by Governor Evans Kidero to look into the best solutions to deal with Nairobi's congestion. Frustrated drivers in Kenya have been venting their anger after spending hours overnight in an enormous traffic jam in the capital, Nairobi. In Tanzania, traffic congestion is one of the major problems facing Dar es Salaam City and is attributed by a number of factors including rapid population increase, inadequate and poor road infrastructure, city structure, rapid increase in number of cars and lack of physical plan to control city development.

Uganda has overtime experienced high levels of rural-urban migration, making mobility in the capital city challenging and increasing traffic congestion in urban areas [11]. Most urban streets are observed to be highly flooded streets with Bodabodas, many private cars and public transport vehicles which are caught-up in traffic jams that delay people to arrive at their destinations, and costs the economy about shs 500M (150,000 euro) every day [3]. Whereas there is an existing transport strategy emphasizes that need to provide quality, quantity, cost – effectiveness, efficiency and sustainable transport infrastructure and services [12] conversely, to a surprise the Ugandan transport atmosphere is surrounded by challenges on access, development and sustainability thus blocking the state to live above a fully developed and sustainable national transport mechanism for all by 2050.

In Kampala the capital city of Uganda road transport infrastructure is faced by a significant number of challenges with traffic management and the city is characterized by heavy and chaotic traffic Jam. The main transport system in the Kampala metropolitan is largely covered by public transport, predominately 14-seat-minibuses and motor cycles. In this city, transport facilities take care of less than 10% of the urban people and 90% who walk and cycle does not have adequate facilities. Kampala's traffic jams delays people to arrive at their destinations whereby for example during peak hours given that half of the 375,324 vehicles registered in 2008 are in Kampala, and each uses a minimum of one ltr of petrol in traffic jam every day, at shs. 3500 (1.2 Euro) per ltr. This translates into losses of more than sh500m (150.000 euro) per day [13]. revealed that congestion can be categorized into recurrent and non- recurrent congestion. Recurrent congestion is caused by factors that relate to rapid growth in population, urbanization and related growth in car ownership and use. Recurrent congestion occurs mainly when there are too many vehicles at the same time, consequently reducing traffic speed and increasing personal commuting time. This occurs typically during peak hours but can also occur off- peak i.e. at other weekday hours and during the weekend. On the other hand, non-recurrent congestion is associated with random conditions or special. The main objectives as to find out the causes of traffic congestion on Jinja road central division of Kampala City.

## II. RELATED WORK

Deterministic and Stochastic Queuing Theory [14] In queuing theory helps to keep track of the numbers of vehicles in a queue. A queue starts whenever the flow to a bottleneck is larger than the bottleneck capacity, where the cars form a virtual



queue. The outflow of the queue is given by the infrastructure (it is the outflow capacity of the bottleneck, whereas the inflow is the flow towards the bottleneck. The number of vehicles in the queue represents the change in the number of vehicles in the queue likely to evolve in this way until the queue has completely disappeared. [15] revealed that rapid growth in population, urbanization and globalization cause a lot of pressure elasticity on the transport networks worldwide thus affecting citizenry social, economic and environmental sustainability with over estimate of up to \$30 trillion spent on infrastructure in the sector with large budget votes and resources directed on transport. [16] According to the state of Environment Report for Uganda 2008, the jam in the Metropolitan city was reported to be arising from huge increase in motorization that never matched proportionately with infrastructure facilities. In their study, [17] connote that traffic congestion happened in Hangzhou, is partly caused by the growing number of these three kinds of population, which encourages further growing of transportation in different ways. In general, the growth of permanent residents created more private cars; the growth of mobile population increased the number of electronic bicycles and public transit, since mobile population mostly came from relatively poor areas and they earned lower income in Hangzhou; and the growth of tourists put much more pressure on public transits system also, as most tourists come from other cities to Hangzhou, and they usually travel by public buses or taxi in Hangzhou urban districts.

According to [12] another factor for the increased traffic congestion is that older, established cities were laid out physically in pre-automotive eras; hence they lack streets and roads suitable for handling automobiles, trucks, and buses. Enlarging the capacity of streets in old city for automotive traffic is widely opposed by local residents, since their dwellings would be torn down by widening streets. Therefore, the growth of road capacity does not catch up with growth of vehicles and this mismatch could cause lots of vehicles blocked on narrow roads. [14],[15] propounded that the mingling of many different modes of movement on the same roads as a cause of congestion in developing nations. The mix of old and new transport technologies, highlighted by the shared use of road space by fast moving motorized vehicles and slow-moving human-powered and animal-drawn vehicles (such as rickshaws, hand drawn carts and animal drawn vehicles), typifies many street scenes of the Third world. [18] expounds that urban dwellers in both developed countries and developing countries tend to make full use of their daylight time and they usually go out in the early morning between 7:00 and 9:00am and back home between 4:00 and 7:00pm. So, traffic congestions in modern metropolises usually appear in rush hours, which are in the morning between 7:00 to 9:00 a.m. and in the afternoon between 4:00 to 7:00.

### III. METHODOLOGY

The study specifically focused on determining the causes of traffic congestion on Jinja road in Kampala Capital City, assessing the effects of traffic congestion and developing a model that can be used by transport planners to reduce traffic congestion Jinja road in Kampala Capital City. The study was conducted on Jinja Jinja road which stretches from Kampala, Uganda's capital and largest city, connecting the city to Jinja. It is a highway is an all-weather tarmac single carriageway road in good condition. This study was limited to a segment on jinja road which stretches from Lugogo to the electoral commission as shown in Fig. 1 and Fig.2.



Fig. 1. showing the junction with 4 access roads along the on observed points along Jinja road



Fig.2. showing the round bout with 4 access roads along the on observed points along Jinja road

The study was conducted for a period of 10 months i.e. October 2021 to July 2022. With observations on the roads for 3 days to clearly track the traffic incidents as they occur at peak and non-peak hours. The study included 100 pedestrians, 100 drivers, 100 motorcycle riders, 20 traffic police officers and 3 KCCA engineers who operated along Jinja and Entebbe roads. The Fig. 3. is conceptual framework developed to indicate clear links of independent variable (factors) and dependent variable (Traffic congestion) whilst presenting the moderating variables like Government, policies.



**Independent variable (IV)**

**Dependent Variable (DV)**

**FACTORS**

**TRAFFIC CONGESTION**

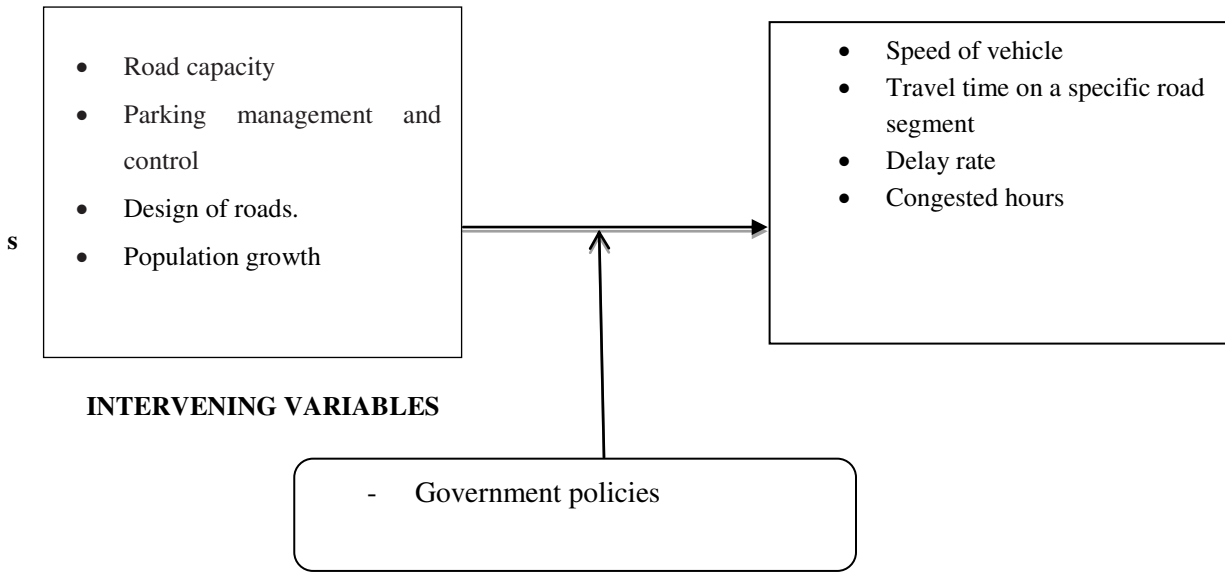


Fig.3. Conceptual framework

The study used purposive sampling and random sampling strategies. Purposive sampling, also known as judgmental, selective, or subjective sampling, is a form of non-probability sampling in which researchers rely on their own judgment when choosing members of the population to participate in their surveys. Random sampling was also followed on who driver, rider or police office to include, whomever we got across and volunteers to participate in the study were included in the study.

**Sample size and Selection**

Data from the field was compiled, sorted, edited and coded to have the required quality, accuracy and completeness. Then it will be entered into the computer using a statistical computer package known as SPSS for analysis. During the analysis of the data, descriptive statistics will be used to present the results of the sample characteristics.

Table 1: Sample size and Selection

Respondents	Sample size	Selection technique
Drivers	100	Random samplings
Motorcycle riders	100	Random samplings
Pedestrians	100	Random sampling
Traffic police officer	10	Purposive sampling
KCCA	2	Purposive sampling
Total	<b>312</b>	



Thematic analysis was adopted since it emphasized pinpointing, examining, and recording patterns within data. Field notes from interviews was compiled and edited at the end of each working day to ensure accuracy in recording and consistency of information given by respondents. The analysis constituted themes which were patterns across data sets that are important to the description of the relevant phenomena and then put in coding categories.

The research attained data about the causes through use of questionnaires, interviews and observations. Frequency, percentages, means and standard deviation was used in analyzing causes of traffic congestion on Jinja road central division of Kampala City. Options from close ended questionnaires were categorized, pre-coded and then on obtaining data, it was entered into the analysis software (SPSS) after which analysis results were obtained in form of means and standard deviation. Post-coding was used for open questions and the data presented in form of graphs, charts and tables.

#### IV. EXPERIMENTAL RESULTS

The study presents the findings that were obtained from drivers, motorcycle riders and pedestrians, KCCA engineers, traffic officers regarding the traffic congestion control and modeling along Jinja road in central division of Kampala City. The results are presented as follows. The background information of the respondents in terms of their gender, highest education qualification and age group were deemed vital for internalizing study information. These were examined and presented in this section.

The study also explored the category of respondents that were involved in the study. The findings are presented in Table 2.

Table 2: Category of respondents (Questionnaire)

Category	Frequency	Percentage
Driver	100	33.3
Pedestrian	100	33.3
Motorcyclist	100	33.3
Total	300	100.0

Results in Table 2 indicated the distribution of respondents among different categories. It indicates that (33.3%) of the respondents were pedestrians, other 33.3% respondents were drivers while other 33.3% were motorcyclists. The involvement of respondents from different categories helped the study to attain a justification in relation to traffic congestion and its causes.

The proportion of respondents basing on their gender was established as presented in Fig.4.

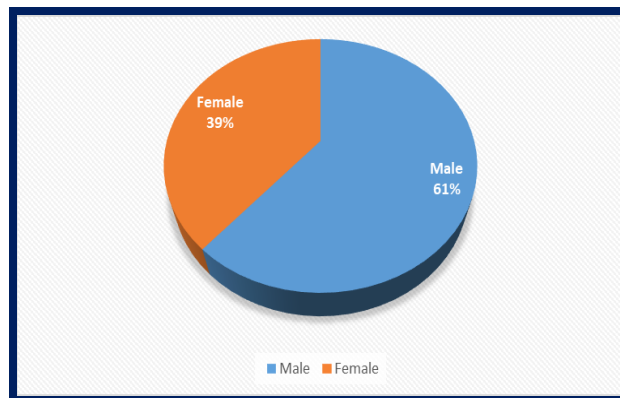


Fig .4. Gender of respondents



As indicated in Fig.2 above, (61%) of the respondents were male while (39%) were female. This shows that male respondents' views dominated the study, although both gender was involved and therefore the study was gender sensitive in data collection. This helped to obtain gender-perspectives regarding the study variables. Male respondents were the majority and this was attributed to the fact that most cyclists and drivers are men.

Age of the respondents was considered useful for explaining their experience about road projects. Findings on this aspect are presented in Fig.5.

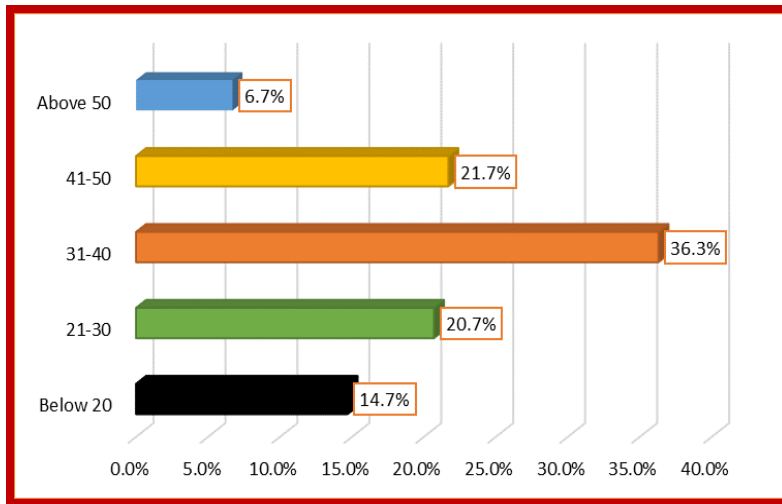


Fig.5. Age of the respondents

Results in Fig. 5 show that most (36.3%) of the respondents were aged 31-40 years and above, these were followed by 21.7% who belonged to the age range of 41-50, 20.7% were in the age group of 21-30, then 14.7% were below 20 years above whereas the minority (6.7%) of the respondents were below 20 years of age. Different respondents with different ages provided varying perspectives in relation to the study under investigation thus obtaining unbiased data.

The study sought to find out the qualifications (highest held) by respondents. The distribution obtained is shown in Table.3.

The results reveal that the highest proportion of the respondents, 127(42.3%) had attained secondary education, these were followed by 25.7% who had studied up to tertiary level, 23.7 percent had attained only primary education whereas the minority (8.0%) of the respondents who never had attained only non-formal education. This distribution of respondents was a clear representation of the sample since more respondents that are educated implied a higher ability to provide more reliable responses and fact-based results.

Table 3. Education qualifications of respondents

Education level	Frequency (N)	Percentage (%)
Non-formal	25	8.3
Primary	71	23.7
Secondary	127	42.3
Tertiary	77	25.7
<b>Total</b>	<b>300</b>	<b>100.0</b>





**Empirical findings**

**Causes of traffic congestion on Jinja road central division of Kampala City.**

The results were focused on identifying the causes of traffic congestion on Jinja road central division of Kampala City. Questionnaire items on the above objective were weighed on a 5-point Likert scale of SA= Strongly Agree, A=Agree, NS=Not Sure, Disagree = D SD=Strongly Disagree. They were scored as 5,4,3,2 and 1 respectively for further analysis. An average for relative importance index was computed. The relative importance index analysis and the results of the findings are presented in Table 4.

Table 4: Causes of traffic congestion on Jinja road central division of Kampala City

Parameters	Relative Index	Overall Ranking	Importance Level
There are few lanes which accommodate the big number of vehicles and motorcycles moving along the road.	0.800	1	High
The road is in band condition with potholes, uneven road surfaces.	0.431	7	Low
Some drivers have a bad driving behavior and even don't respect traffic rules.	0.657	4	High
In the morning and evening, traffic congestion has been increased by the VIP movements especially for political/government leaders.	0.523	6	Low
More people are owning cars but the number of roads and the size have not been modified to match the increasing number of cars.	0.743	2	High
There is increased population in Kampala implying increased number of travelers but roads have not been relatively improved.	0.729	3	High
Poor management by traffic officers has caused the contestant traffic congestion along Jinja highway.	0.544	5	Low
<b>Average RII</b>	<b>0.647</b>		

An average of relative importance index value was computed and obtained result as 0.647. Any relative index value below the average had an importance level “Low” while above as “High”. The study findings as reflected in Table 4 indicate that majority of the respondents agreed that traffic congestion has been caused by the few lanes which accommodate the big number of vehicles and motorcycles moving along the road. This is indicated with a relative importance index of 0.800. This aspect also attracted an importance level of “High” which supported its significance on traffic congestion. This implied that roads have not been expanded on the rate compared to the increase in number of cars the city.

In regards to results in Table 4 it was identified that traffic congestion has been influenced by more people owning cars but the number of roads and the size have not been modified to match the increasing number of cars. revealed by a relative importance index of 0.743, and this had a corresponding overall ranking of 2 which implied that there was a high level of impact in relation to traffic congestion. This shows that the government has not reliably planned for the dynamic increase in people owning cars. From the study findings, increased population in Kampala with increased number of as a cause for traffic congestion, was regarded to be highly significant. This is indicated by the relative index value of 0.729. The cause was ranked 3 in relation to the participants’ views and opinions. This meant that the increase in number of travelers has triggered the need for more passenger cars resulting into an increased number of cars that eventually cause traffic congestion.



From Table 4, it was found out and deduced that some drivers have a bad driving behavior and even don't respect traffic rules. This is indicated by a relative importance index (RII) of 0.657 which attracted point 4 of overall ranking. This implies that the presence of bad drivers was a leading factor to increased traffic congestion. It also summons the government to revise and formulate a systematic format of ensuring that all drivers have driving licenses and certificates that affirms that they are experienced and have knowledge about deriving rules. With consideration to results in Table 4 shows that poor management by traffic officers caused the contestant traffic congestion along Jinja highway however it had a low impact (RII=0.544). This aspect attracted an importance level "low" which depicted that there was a variation among the generated responses. This implied that to a larger extent, traffic congestion along Jinja highway has not been necessarily caused by control failure. In addition to the above, studies indicated that to some extent, in the morning and evening, traffic congestion has been increased by the VIP movements especially for political/government leaders. This was indicated by a relative importance index (RII) of 0.523 which gained position 4 of the overall ranking. This implies that VIP movements cannot be regarded as a major cause for traffic congestion along Jinja-High way. In addition to the above, results in Table 4 indicated that most respondents rejected the assertion that the road was in band condition with potholes and uneven road surface. This was clarified by a relative importance index of 0.431 and this had a corresponding overall ranking of 7 which implied that there was a high level of disagreement withing the respondents. This implies that Jinja road in central division Kampala city barely has pot holes and the biggest part of the road is in good condition.

#### V. CONCLUSION

From the study, it was found out that traffic congestion has been caused by numerous factors including few lanes, reckless drivers, VIP movements especially for political leaders, overtime increase of cars, increased population and poor management by traffic officers. However, strategic solutions have been suggested through modeling and these included road widening, building and encouraging bypasses and traffic management with strict laws. Controlling congestion is a constant, never-ending endeavor. There are tools available for this goal, some of which are more effective and more widely accepted than others, but in order to avoid the possibility of giving in to the modern scourge of traffic congestion, a set of actions that have the support of the local populace is also required.

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