Causes and Cost of Traffic Jams in Kampala

Dan Mambule Mwanje

Abstract

This article investigates the causes and cost of traffic jam in Kampala, through a survey of 291 road users. Narrow roads, indisciplined drivers, poor urban planning, limited car parking and concentration of most economic and social activities in the city were found to be some of the major causes of traffic jams. Travellers lose between 8 and 23 hours every month in traffic jams, with car travel speeds falling from an average of 28 km/h when there is no jam, to between 8 and 14km/h because of traffic jams. Traffic jams could also be lowering the country's GDP to the tune of UGX 55-163 billion per year due to lost productive time while stuck in traffic jams. To alleviate traffic jams, the article recommends a variety of mitigation strategies from building flyovers and improving the quality of alternative routes, to improving traffic management operations, with congestion pricing believed to likely have the most dramatic effect on traffic congestion. The article further recommends objective involvement of all key stakeholders in the process of determining mitigation policy options, team-working and coordination amongst the agencies responsible for traffic control in the city, and conducting economic analysis for all policy options and prioritizing based on their return on investment and contribution to productivity.

Key words: Traffic Jam, Costs and Benefits, Kampala

Introduction

The majority of road users in Uganda have at some point in their travel to and from Kampala had the misfortune of experiencing the effects of jammed roads especially during rush hours in the morning and evening. They have lost valuable time while creeping through the traffic jams and inhaled pollutant gas emissions released by the slow-moving vehicles (Matovu, 2014). Some people have lost property as they waited in long traffic jams. Police records indicate that mobile phones worth UGX 170m were stolen from pedestrians and motorists in Kampala between December 2015 and February 2016 (*The Daily Monitor*, 2016). Some pedestrians are knocked down by passenger service motorcycles, locally known as *boda-boda*,while competing for space along the pedestrian walkways during traffic jams. The vehicle owners incur extra costs in terms of fuel burnt due to vehicle idling and slow speeds while stuck in traffic jams.

According to the US Department of Transportation (2005), road traffic jams or traffic congestion refer to an excess of vehicles on a portion of a roadway at a particular time resulting in slow speeds. From an economic theory point of view, traffic congestion is no different from what happens in the production of outputs in a firm where output declines when inputs are used at rates beyond the production capacity of fixed capital equipment. According to Jose, William and Clifford (1999), all urban road users have at one time participated in such inefficiency during peak periods. In heavy but free-flowing traffic, an unexpected occurrence

such as accidents may force some drivers to slam their brakes and cause drivers behind them to do the same. The resulting chain reaction abruptly creates a traffic stream averaging 50km/hr into one in which all travel falls in lockstep at 10 km/hr.

In Kampala, congestion is mostly a problem at road junctions and roundabouts, near shopping centres, roadside markets, and near bus terminals. Traffic congestion used to be thought of as a rush-hour problem and an issue for the Central Business District (CBD); but now happens for multiple hours on week days and weekends, and its effects spread to the city suburbs. The Police, Kampala City Council Authority (KCCA) and Uganda Transport Operators and Drivers Association (UTODA) have tried different strategies to fight traffic jams including remodelling roundabouts, expanding some city roads, introducing single-direction roads,, installing traffic light systems at some junctions, introducing parking fees on city roads, and placing fulltime personnel at various road junctions and roundabouts to control the traffic flow. However, these strategies have registered limited success in alleviating traffic jams. According to Lopez (2016), identifying genuine solutions to a problem means knowing what the real causes of the problem are. Lopez adds that taking action without identifying what factors contribute to the problem can result in misdirected efforts and wastage of time and resources.

Objectives

The article has three objectives: (i) to investigate the causes of Kampala's traffic jams, (ii) to estimate the impact of traffic jams on road users in terms of lost time and wasted fuel, and (iii) to investigate and offer possible remedies to the problem of traffic jams in Kampala. The findings of this paper can provide independent information to guide the city planners and law enforcement bodies to respond to the challenges of traffic jams in Kampala appropriately. Further, the article aims to trigger extensive research on the subject to find more solutions to the traffic jam problem in Kampala.

Literature Review

Causes of traffic jams

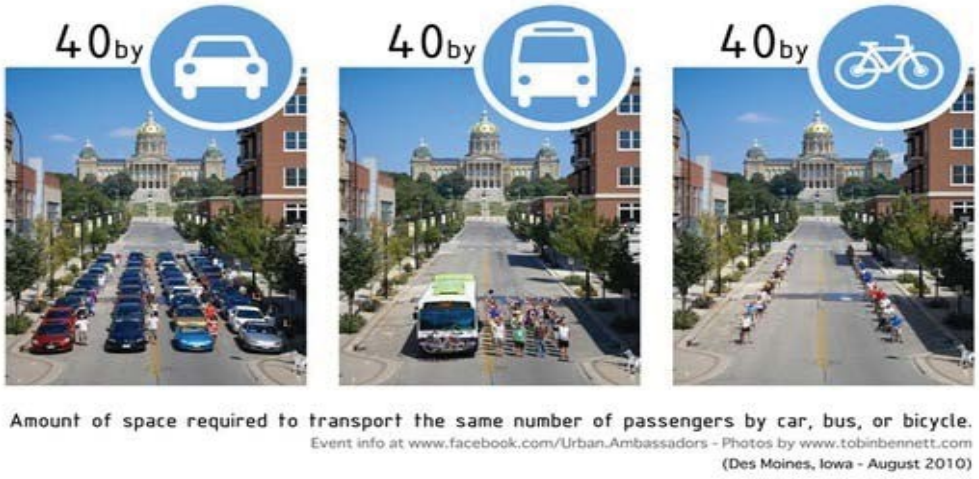
A number of studies have been conducted concerning traffic congestion and its causes. According to Chung (2012), traffic congestion is caused by the public's over-reliance on private transportation, failure to keep up with the zooming expansion of modern societies and their demands, and the poor quality and quantity of public transportation. Vijay (2010) also argues that there would be very few traffic jams if more than half of the trips (by people) were taken by public transport; to reinforce his argument, he provides a picture (Figure 1) to let it speak for itself.

Prashant (2015) blames the traffic jams in Jarkata City on lack of flyovers at crossings, and argues that there would not be any traffic jam in the city if there were flyovers at each crossing. For Anthony (2011), the major causes of traffic jams are slow drivers that cause other drivers to cautiously slow down and roads that are not properly maintained. According to Smriti (2015), failed traffic signals and drivers' ego cause traffic jams, more so when drivers

fail to cooperate. Sophia (2012) attributes traffic jams to similar basic time schedule among the working population that usually hit the road in the same time frame. Ruttoh (2014) argues that impatient drivers contribute to the slowdown.

Kev (2016) argues that many roads in Indonesia are too small for the vehicle loads. He faults the planners for having failed to predict that Jarkata would expand and start to experience traffic congestion; and further argues that the absence of organized terminals in Jarkata compels passengers to alight from taxis at random spots, which blocks traffic and results in traffic jams. As for Chouputra (2015), traffic jams are blamed on poor traffic management systems, whereas Kushal (2016) blames traffic jams on road encroachment by roadside vendors who occupy part of the road to sell their merchandise.

Figure 1: Space required to transport same number of passengers by car, bus or bicycle



According to Utomo (2015), traffic jams are blamed on mainly five factors: (i) failure to implement existing plans and in some cases, total absence of city plans (ii) confusing and inconsistent traffic signs; (iii) lack of coordination between government bodies responsible for city planning; (iv) love of private transport and laziness of residents who drive, ride or take a bus to the nearest destination; and (v) disregard of traffic rules and regulations.

Gautama (2015) argues that lack of political will to solve traffic jams is the reason jams continue to exist, while Tomson (2014) blames the jams on migrant road users from rural areas that are unaware of, or have no regard for, traffic laws and regulations. On the other hand, Kapoor (2014) and Maheshwari (2016) contend that traffic jams are largely caused by today's generation of impatient drivers that have no respect for each other while driving on the road.

Mazumdar (2013) blames traffic jams on the partial enforcement of traffic rules which makes some drivers feel that some rules may be ignored. As a result, more and more people take illegal turns, park at improper spots and cross roads at improper places. Mazumdar (2013) argues that the traffic condition may not improve if such lawlessness is not punished.

In Addis Ababa, Yared (2010) found that the main reasons for traffic congestion included the imbalance between the traffic volume and road capacity, inflexible work schedules, inadequate public transport and poor urban land-use planning. Congestion also results from traffic incidents such as vehicle breakdowns or accidents, road diversions and closures due to construction activities, disruption of traffic flows by control devices and special events that occasionally increase traffic demand (US Department of Transportation, 2005).

In Manhattan, Dubner (2007) found that availability of free parking space motivated more than a third of government workers to drive to work, thereby contributing to traffic congestion. In Japan, Freakonomics (2008) illustrated that human error is a major cause of traffic jams by conducting an experiment in which scientists recreated "shockwave" traffic jams in which one driver slowed down and created a ripple effect that moved backwards through traffic, grinding everything to a halt for miles.

In Kampala, Kiggundu and Mukiibi (2012) found that transport systems are largely inefficient because of the failure by city authorities to adopt an integrated approach towards land use and transport planning. Zhang (2011) supports this view, observing that older cities were physically laid out in pre-automotive eras and lacked streets and roads suitable for efficiently handling automobiles. A further reason is the mingling of many different modes of movement on the same roads for the obvious reason that a road hosting several kinds of road users like vehicles, buses, motorcyclists, bicyclists, horse carts cannot have an efficient traffic flow, since the fast travellers have to adapt to lower-speed travellers.

Therefore, the causes of traffic jams are many. Some traffic jams are due to deficiencies in supply of road capacity and traffic management systems, while others are due to the increased demand of road services. To establish which causes are critical in the case of Kampala's traffic jams, an analysis of selected causes of traffic jams was carried out, results of which are provided in Figure 3.

Costs and Benefits of Traffic Jams

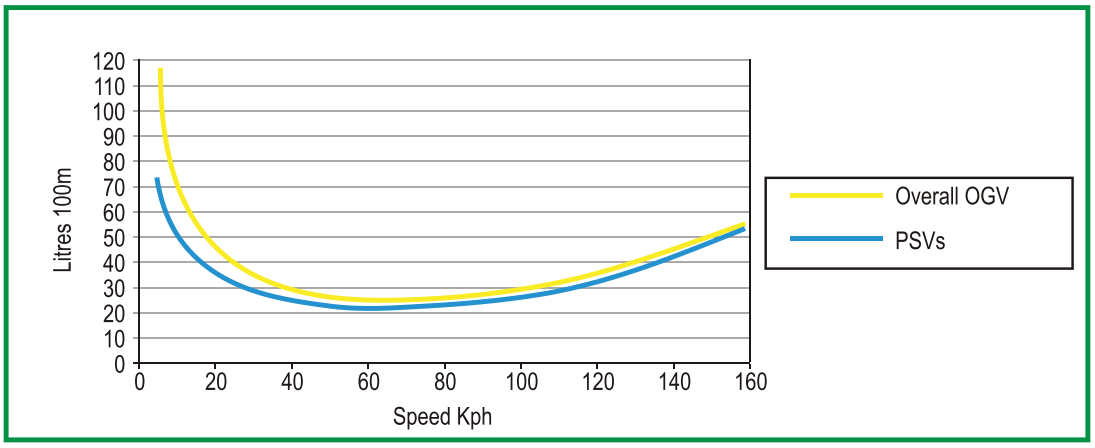
Less is known about the benefits of traffic jams. Apart from increased fuel sales by oil companies when vehicles burn more fuel in traffic jams, the other benefits of traffic jams include; (i) creation of jobs for hawkers that sell their goods to travellers stuck in traffic jams (ii) preachers and advertising firms that take advantage of stranded travellers to communicate their messages, and (iii) the increased use of motorcycle taxis locally known as *boda-boda*, a faster alternative to car transport during traffic jams, that employs about 50,000 youths in Kampala.

The above perceived benefits of traffic jams notwithstanding, literature is abundant on the cost of traffic jams. According to Bruce (2016), traffic jam costs productive time and hurts productivity. He argues that a worker who makes $10 for his company and delays in traffic jam for an hour will make less money for the company. Instead of spending ten hours in the office creating $100 for the company, s/he will spend nine hours generating revenue worth $90 for the company, implying that traffic jam will cost the company $10 per day. If 100,000 such workers get stuck in traffic for one hour per day, that would mean an assumed combined loss

of $1,000,000 per working day, or a loss of $22,000,000 in a month, or $264 million in a year, and such costs would reduce national income.

The other major cost of traffic jams is wasted fuel due to idling and very slow speeds that are associated with traffic jams. According to Tom (2014), vehicle fuel consumption is high when driving at lower speeds (see Figure 2). In a study carried out by Natural Resources Canada (2016), it was found that idling wastes fuel, emphasizing that wasted fuel is wasted money. For instance, for the average vehicle with a three-litre engine, every ten minutes of idling cost 300 millilitres in wasted fuel (about 1.8 l/h). Feldman (2014) found that a two-litre engine car burns 1.2 l/h while idling, while Tarassu (2015) found BMW diesel engines consume 1.4 l/h while idling and petrol engines consume 2-2.5 l/h, with an additional consumption of 0.5-0.8l/h if it is automatic and gear 'D' is engaged. For motorcycles, Nagarajan (2015) claims that his motorbike which consumes 30km/l at 4000R Revolutions per Minute (RPM) at 100km/h, has an idle fuel consumption rate of 0.66 l/h at an idle speed of 800 RPM.

Figure 2: Relation between vehicle fuel consumption and speed



Source: Tom (2014)

Traffic jams also impose health costs on road users and governments. According to Bruce (2014), vehicles emit unhealthy substances into the air as they burn fuel in traffic jams. These substances end up being breathed in by pedestrians who, subsequently, get exposed to respiratory diseases such as lung cancer and other infections associated with pollution. Governments in countries where health care is subsidized pay huge medical bills for the people who fall ill because of traffic jams.

Traffic congestion does not only impose costs on the road user in terms of wasted time and fuel (the pure congestion cost) but the stopping and starting it entails can also worsen atmospheric and other forms of pollution (Tom, 2014). Sorensen et al (2015) found out in a traffic congestion study in Los Angeles, that traffic congestion takes a toll on quality of life, economic competitiveness, fuel economy, driving safety, social justice, and air quality.

Jaaskelainen (2016) indicates that diesel engine vehicles, especially trucks, can have several negative impacts on the environment and economy in terms of unregulated diesel pollutants, increased engine maintenance costs, shortened engine life, impaired driver rest and

health, and elevated noise levels. Sheak Li (2012) found that traffic congestion is believed to cause road rage, road bullies and major accidents. Matovu (2014) observes that traffic jams in Kampala have not only resulted into prolonged travel times, but also high vehicle operating costs and environmental degradation. He warns that if the challenge of traffic jams is not addressed quickly, Kampala will ground to a halt and the majority of foreign investors might relocate to other better organized cities and countries.

While the literature review highlights several causes and cost of traffic jams in the various cities of the world, there is need to know which of these causes are more applicable in the case of Kampala, and their impact. The causes considered as relevant to Kampala were put to respondents to judge which ones are more critical than the others. The next section explains how the survey was carried out.

Methodology

Data were obtained from primary sources using a structured questionnaire that was administered to a sample of 350 potential respondents. Purposive sampling was used in the selection of respondents for the study. The sample focused on six groups of road users (see Table 1), based on their nature of work—since different groups of road users tend to use the road at different times. For example, people whose business begins at 8 a.m. tend to be on the road at the same time. Respondents were asked how much time they spend in traffic jams, the type of transport they usually use to reach their destinations, their perceived causes of traffic jams in Kampala, and what they thought would help alleviate traffic jams. The respondents were also asked their nature of work/business, their usual place of abode, and the area where their business/ work is located. Of the 350 questionnaires issued out, 291 were returned (see Table 1), hence a response rate of 83 per cent. Four of the returned questionnaires were unanalyzable. Data generated for the study were analyzed with the use of descriptive statistics, using pivot tables, in Excel. The survey was carried out in Kampala between 12 and 30 September 2016.

Table 1: No. of Respondents by nature of work and transport type

Respondent nature of work	No. of Respondents		Type of transport used	No. of Respondents
Cargo, Passenger Transport	8		*Boda-boda*	27
Government	32		Other	6
Private Sector	123		Own Motorcycle	5
School, University	84		Pool Transport	1
Trading	15		Private Vehicle	94
Other (e.g. NGOs)	29		Public Transport	154
Total	**291**		**Total**	**287**

Source: Researcher's survey results

To calculate the average time lost while waiting in traffic jams, respondents were asked to indicate the time they usually spend on the road travelling from their homes to their destinations when there is no traffic jam, when there is light jam, and when there is excessive jam. The

time lost was obtained by subtracting the time spent on the road when there is no jam from the time(s) spent when there is light/heavy jam. The difference between 'no jam' and 'light jam' represents the lower bound or minimum time lost, while the difference between 'no jam' and 'heavy jam' represents the upper bound or the maximum time lost, i.e.

$$\textit{Average time lost (lower bound)} = \frac{\sum_{i=1}^{n}(Travel\ time\_light\ jam_i - Travel\ time\_no\ jam_i)}{n}$$

$$\textit{Average time lost (upper bound)} = \frac{\sum_{i=1}^{n}(Travel\ time\_heavy\ jam_i - Travel\ time\_no\ jam_i)}{n}$$

where n is the number of respondents.

To estimate the average travel speeds, the distance between respondents' homes and destination points was divided by the time spent on the road when there is no jam, and when there is light/heavy jam. Estimating the wasted fuel involved multiplying the fuel consumption of the different types of transport commonly used by road users, by the [estimated] average time lost in traffic jams divided by 60 [minutes]. The four different transport types considered in the article included public transport (mainly mini buses, three-litre engine), private cars (assumed two-litre engine), *boda-boda*s and own motorcycles. The information on fuel consumption was obtained from studies conducted by Tom (2014), Natural Resources Canada (2016), Feldman (2014), Tarassu (2015) and Nagarajan (2015).

Findings and Discussion

Impact of Traffic Jams

Delayed travel due to reduced speeds

Survey results show that vehicles usually travel at an average speed of 27.48 km/h when there is no traffic jam, but the speeds drop to between 8.19 km/h and 14.51 km/h because of traffic jams (Table 2). This implies that, on average, travelers spend twice as much time during light jams as they would spend if there was no traffic jam; whereas during excessive jams, their travel times increase more than three-fold. The results further show that travellers from Entebbe side enjoy the fastest speed (at 41.5 km/h) when there is no jam, while vehicle movements within the city centre are the slowest (at 16.22 km/h) in the absence of traffic jams.

Results further show that traffic creeps faster along Entebbe Road compared to traffic on other roads, at between 12-21 km/h, while the CBD experiences the slowest jam speeds at between 5-8km/h. The extreme slow speeds within the city centre could be due to two major reasons—taxi vehicles which often move at slow speeds coupled with intermittent stops to pick and drop passengers, and the inevitable slowing down of traffic when vehicles are looking for parking especially along the single-lane city roads.

The observed travel speeds for Kampala compare well with peak and off-peak speeds for some cities in the world in the 1970s. A cross-sectional study of main urban centres (Table 3) in the West suggested that traffic cruised at an average speed of 18km/h during peak hours in

the 1970s, and 25km/h in off-peak hours (Kenneth, 2003), which compares with the observed speeds for Kampala. The speed in the indicated cities has since improved. For instance, according to Andrew (2005), traffic on urban roads in the UK currently moves at an average speed of 33.6km/h during the rush-hour and 40km/h in off-peak hours, evidence that speeds can improve with appropriate intervention

Table 2: Average speed by area of traffic origin

Area of traffic origin	Average Speed (km/h)		
	No Jam	Light Jam	Heavy Jam
Entebbe Road	41.50	20.52	11.73
Gaba-Munyonyo	27.17	12.16	7.27
Gayaza Road	25.90	14.31	7.70
Hoima Road	29.41	17.34	8.70
Jinja Road	25.95	14.46	8.36
Kampala and Suburbs	16.22	8.20	4.73
Kawempe Road	30.21	17.40	9.93
Kiwatule Naalya	26.89	13.95	7.07
Luzira	27.62	13.46	8.14
Masaka Road	24.75	14.16	8.70
Overall Average	*27.48*	*14.51*	*8.19*
Standard Deviation	*16.91*	*8.84*	*5.55*

Source: Author's computations

Table 3: Traffic speeds in selected cities

City	Year	Population (million)	City centre traffic speed (km/hr)	
			Peak hour	Off-peak
New York	1970	13.3	16.0	26.0
London	1971	7.4	20.6	20.3
Athens	1971	2.7	15.5	24.0
Calcutta	1971	7.5	11-16	19.0
Kampala	2016	3.1	8-15	27.5

Source: Kenneth (2003); Author's survey findings (for Kampala speeds)

Time lost

Travellers on average lose between 22-64 minutes per one-way trip in Kampala traffic jams (Table 4). This means that for a two-way trip, each traveller loses about an hour or two in traffic jams while moving to and from the city. For the workers, this means they lose productive time

of between 8-23 hours in a month in traffic jams, a loss of about 1-3 days of work. Assuming an hourly pay rate of UGX 4,500/- for an average worker that earns about UGX 800,000 per month, this means a loss of between UGX 36,230 and UGX 105,571 per month. With an estimated productive working population of 445,890 in Kampala, city traffic jams could be costing the economy between UGX 194-565 billion a year—which is the equivalent of money that could have been made if no time was lost in traffic jams. The 445,890 working population for Kampala is derived from two assumptions—a combined population of 4,458,900 for Kampala, Wakiso and Mukono and a 10 per cent labour participation rate (UBOS, 2015).

Table 4: Average Time Lost in minutes (by area of traffic origin)

Area of traffic origin	Average time spent on the road (minutes)			Average time lost per trip	
	No Jam	Light Jam	Heavy Jam	Light Jam	Heavy Jam
Entebbe Road	28.00	54.09	99.50	25.16	68.95
Gaba-Munyonyo	31.67	63.89	107.78	32.22	76.11
Gayaza Road	25.17	43.62	84.14	18.45	58.97
Hoima Road	28.82	48.24	94.41	19.41	65.59
Jinja Road	32.86	58.00	111.29	24.40	77.69
Kampala &Suburbs	19.34	36.56	70.98	17.21	51.64
Kawempe Road	24.52	46.08	82.60	21.56	58.08
Kiwatule Naalya	29.55	53.05	104.77	23.50	75.23
Luzira	26.82	51.82	85.91	25.00	59.09
Masaka Road	25.50	46.25	81.00	20.75	55.50
Overall Average	26.23	48.25	90.28	21.96	63.98
Standard deviation	17.11	27.45	52.89	15.62	44.51

Source: Author's computations

Travellers in private vehicles lose more time in traffic jams. Table 5 shows that travellers in private vehicles lose between 25-75 minutes in traffic jams while travellers using public transport lose between 23-68 minutes. The difference in time lost for private versus public transport vehicles could be due to the indiscipline of most taxi drivers who are usually seen outmanoeuvring and overtaking other vehicles in traffic jams by driving at road shoulders or pedestrian pathways. On the other hand, travellers on *boda-bodas* lose the least amount of time

(an average of between 9-21 minutes).

Table 5: Average time lost (by type of transport)

Type of transport	Average Time spent on the road (minutes)			Average Time Lost (minutes)	
	No Jam	Light Jam	Heavy Jam	Light Jam	Heavy Jam
Private Vehicle	25.05	50.02	100.48	24.97	75.43
Public Transport	30.24	53.61	97.75	23.37	67.50
Pool Transport	10.00	20.00	30.00	10.00	20.00
Own Motorcycle	17.00	32.00	52.00	15.00	35.00
Boda-boda	12.26	20.85	33.33	8.59	21.07
Other (train, walk)	13.00	14.50	14.50	-	-
Overall Average	26.23	48.25	90.28	21.96	63.98
Standard Deviation	17.11	27.45	52.89	15.62	44.51

Source: Author's computations

Wasted Fuel

Traffic jams cost private vehicle owners between UGX 1,548 and UGX 4,677 per trip in wasted fuel mainly due to idling, or between UGX 3,096 and UGX 9,353 for a return trip if they drive during peak hours when there is traffic congestion. On the other hand, public transport vehicles lose between UGX 1,527 and UGX 4,410 per trip on wasted fuel that is burnt during traffic jams (see Table 6b). In effect, traffic jams could be costing between UGX 75 million and UGX 223 million in wasted fuel per day (see Table 6c), which translates to a loss of between UGX 55 billion and UGX 163 billion a year, assuming a vehicle population of about 66,000 during peak hours and each vehicle driving two trips per day.

Table 6a: Estimated wasted fuel in traffic jams in Kampala

Type of transport	Fuel consumption when idling (L/hr)	Average time lost (in minutes)		Wasted fuel (in liters)	
		Light Jam	Heavy Jam	Light Jam	Heavy Jam
Private Vehicle	1.2	24.97	75.43	0.50	1.51
Public Transport	1.4	23.37	67.50	0.55	1.58
Boda-boda	0.66	8.59	21.07	0.09	0.23
Own Motorcycle	0.66	15.00	35.00	0.17	0.39

Source: Arnis (2015), Vivek (2015) and Brian (2014)—for data in second column

Table 6b: Money lost through wasted fuel

Type of transport	Estimated Fuel Wasted due to idling per trip (in liters)		Fuel price (Ushs/L)	Estimated money lost per trip *(one way)*		Estimated money lost per day *(2trips, to and from)*	
	Light Jam	Heavy Jam		Light Jam	Heavy Jam	Light Jam	Heavy Jam
Private Vehicle	0.50	1.51	3,100	1,548	4,677	3,096	9,353
Public Transport	0.55	1.58	2,800	1,527	4,410	3,053	8,820
Boda-boda	0.09	0.23	3,100	293	719	586	1,437
Own Motorcycle	0.17	0.39	3,100	512	1,194	1,023	2,387

Table 6c: Cost of wasted fuel to the economy

Type of transport	Estimated No. of Vehicles at peak hours	Estimated fuel lost *(one way trip, all vehicles)*		Estimated money lost *(one way trip, all vehicles)*	
		Light Jam	Heavy Jam	Light Jam	Heavy Jam
Private Vehicle	35,000	17,477	52,801	54,180,000	163,683,333
Public Transport	10,000	5,452	15,751	15,265,795	44,102,135
Boda-boda	25,000	1,890	4,636	5,860,148	14,372,519
Own Motorcycle	1,000	165	385	511,500	1,193,500
Total per day	*66,000*	24,985	73,573	75,817,443	223,351,487
Total per year		9,119,474	26,854,194	27,673,366,825	81,523,292,729
Total per yr (2 trips)		18,238,947	53,708,388	55,346,733,649	163,046,585,458

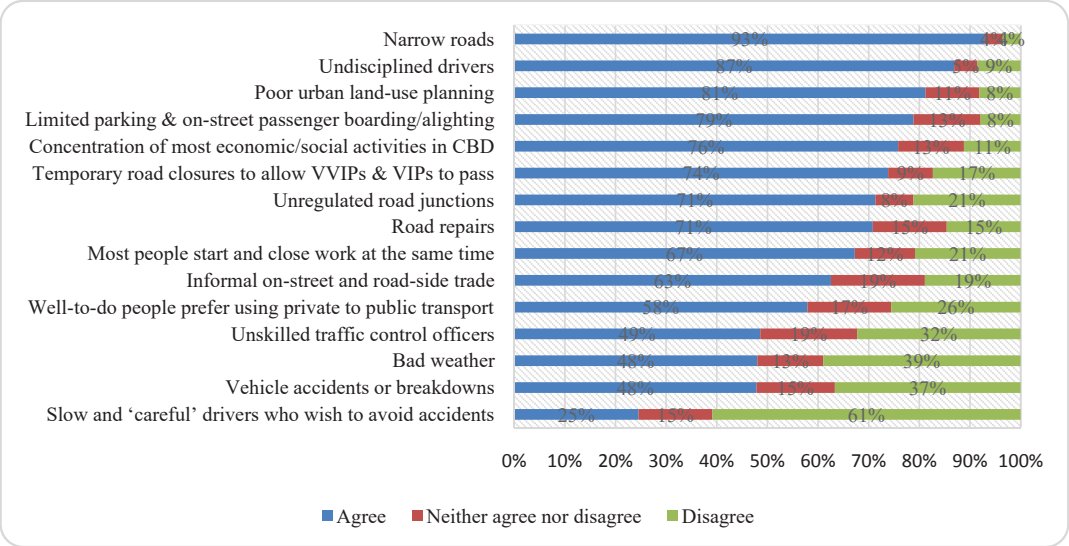
Source: Author's computations; No. of vehicles a guess estimate

Major Causes of Traffic Jams in Kampala

Narrow roads, indisciplined drivers, poor urban planning, limited parking and unregulated road junctions were named the top five major causes of traffic jams in Kampala. All these five causes were mentioned by at least 75 per cent of the respondents (see Figure 3). Ninety-three per cent (93%) of the respondents mentioned 'narrow roads' as the main cause of traffic jams. Respondents also suggested other causes of traffic jams, viz: (i) many motorcycles on the road, (ii) poor road condition of the alternative routes (by end of March 2015, condition of the roads was as follows: Paved roads—42.8% good, 39% fair, 18.2% poor; Unpaved roads—7.1% good, 43.6% fair, 49.3% poor (KCCA, 2015); (iii) limited use and lack of traffic robots, (iv) increased number of drivers with 'right of way' to overtake other drivers anyhow, anywhere (v) heavy trucks that move slowly, (vi) overpopulated city, (vii) availability of cheap cars, (viii) political demonstrations, rallies, processions and advertising events that disrupt traffic and (ix) political interference in implementation of traffic laws. Majority of respondents did not agree

that bad weather, vehicle crashes, unskilled traffic control personnel, and slow drivers are key causes of traffic jams in Kampala.

Figure 3: Extent to which respondents agree with selected causes of traffic jams

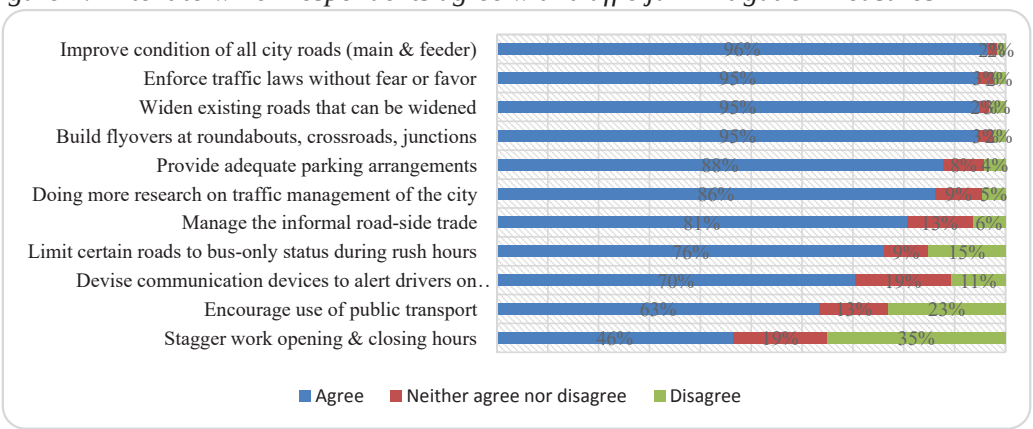


Source: Author's Analysis

Most Recommended Traffic Jam Mitigation Strategies

Physical approaches to alleviating traffic jams emerged as the most recommended by the respondents. These include: improving the road network, widening existing roads, building flyovers at road junctions, and providing adequate parking within the city (see Figure 4). The regulatory approach of enforcing traffic laws was most preferred, followed by doing more research on traffic management of the city. Encouraging people to use public transport was the second least voted measure, while staggering opening and closing work hours was the least supported. Respondents suggested several other options to alleviate traffic jams in Kampala (see Box 1), which included congestion levies against private vehicles that enter the city were also recommended.

Figure 4: Extent to which respondents agree with traffic jam mitigation measures



Source: Author's Analysis

Policy Recommendations

Different causes of traffic jams would need different mitigation measures. Using the literature review and the survey findings on the causes and solutions to traffic jams, Table 7 presents some alternative mitigation measures against each of the causes that scored at least 50 per cent of the Respondents' vote.

Table 7: Major causes of traffic jams and alternative mitigation measures

Key causes of traffic jams in Kampala	**Alternative mitigation measures**	**Remarks**
Narrow roads	Widen roads that can be widened Improve condition of feeder roads within the city	Government may consider creating an Infrastructure Bank to finance the upgrading of city roads that are in poor condition.
Undisciplined drivers	Enforce traffic laws without fear or favour Educate drivers on proper use of roads Enforce road markings Instal traffic cameras at traffic signals and at several points on the road for constant surveillance Ensure proper knowledge of road etiquette before handing over a driving licence Cancellation of offenders' driving license as well as vehicle licence after 3-5 violations	In India, Vivek (2013) interestingly observes that Indians have a problem adhering to laws but not to God. As such, the solution to traffic jams would be to put up photos of God everywhere on traffic signals with a sign-board saying "*If you break the signal, God will get angry*". That way, people would respect the traffic laws. Gikonyo (2013) urges the embracing of a system that enforces the traffic law and has *zero tolerance for traffic violation*, adding that heavy penalties should be imposed for all violations like in the West or Gulf Countries.
Poor urban land-use planning	Develop or redevelop a practicable plan for the Greater Kampala Integrate land use and transport planning	Sayid (2015) warns that some cities make plans they never follow, while some others make plans after development has taken place, yet development should be preceded by a plan and not vice versa.

Key causes of traffic jams in Kampala	Alternative mitigation measures	Remarks
Limited parking and on-street passenger boarding/alighting	Increase parking fees for parking on city roads at the busiest times Construct commercial parking bays (e.g. storied bays) in strategic areas just outside the CBD Gazette strict bus stops and ensure they are used for dropping and picking passengers for only a limited amount of time Introduce maximum time for vehicle parking on the streets Restrict peak-hour car parking on congested streets and dedicate the added capacity to bus-only lanes	Several cities in Africa (e.g. Johannesburg) have invested in secure multistoried parking bays in different locations which has eased their vehicle parking challenges and attracted vehicles away from on-street parking. According to Wenjie (2011), construction of parking lots would best be done closer to public transportation hubs outside the CBD, which could have the effect of reducing private cars in the CBD.
Concentration of most economic/social activities in CBD	Relocate day-schools, some government offices and some markets from the CBD Plan and provide better social services to strategic and other areas, and manage the process better	A number of countries (e.g. Nigeria, Tanzania) have built second cities (one commercial and another administrative) which has helped to decongest their cities.
Temporary road closures to allow VVIPs and VIPs to pass	Streamline and enforce laws on who has the right of way Modernize special events traffic management especially pre-event planning and coordination	The *Daily Star* (2016) quotes a Minister in Bangladesh who claimed that the wrong-side driving of important persons is one of the main reasons behind traffic jams in Dhaka, adding that wrong-side driving is wrong, even for ministers, describing it as a disgusting road show, and a demonstration of the abuse of power in its most flagrantly abusive form.
Unregulated road junctions	Modernize management of traffic operations Build flyovers and footbridges at the usually clogged junctions Introduce box junction system coupled with high penalties for system offenders Instal traffic lights where they are needed	The US Office of Transportation (2005) observes that improving traffic operations has the most dramatic effect on traffic congestion
Road repairs	Improve work zone management e.g. move and manage traffic more effectively through work zones particularly at peak times	Survey respondents recommended that city road repairs should be well regulated, e.g. avoiding closing two roads at the same time.

Key causes of traffic jams in Kampala	Alternative mitigation measures	Remarks
Most people start and close work at the same time	Provide travellers with real-time information on roadway conditions, where congestion has formed, how bad it is, and advice on alternative routes Stagger work opening and closing time	Staggering office opening and closing time was implemented in Ottawa (Canada) and Washington (US); however, 54% of the Survey Respondents in Kampala are not comfortable with it (see Figure 4).
Informal on-street and road-side trade	Ban on-street temporary and impromptu markets in the CBD Provide designated parking areas for roadside markets along highways and penalize vehicles that refuse to park in the designated areas	All stakeholders—executives, politicians, licensed traders, road users—need to share in the process of developing policy alternatives on this particular cause.
Well-to-do people prefer using private to public transport	Introduce congestion taxes, with the basic principle that the higher the demand for travel, the higher the congestion tax to be paid Encourage use of buses, e.g. limit certain roads to bus-only status during peak hours Run campaigns and awareness programmes to encourage car-pooling among people Use taxation to reduce the demand for private cars	In Singapore, Mr. Lee Kuan Yew (Prime Minister of Singapore during 1975) prioritized the transport system amongst the things he so much wanted to do to improve the economy. He introduced an Area Licensing Scheme (ALS) to try and control the traffic congestion in the CBD. Under the ALS, motorists were required to buy a paper ticket in order to enter the restricted zones. Cars with more than four passengers were exempted from the ALS. A raise in the tax of cars getting to the CBD was also implemented, in addition to promoting carpooling. As a result, traffic congestion was reported to have reduced by 76 per cent (Gikonyo, 2013). According to KCCA (2015), private cars account for 36.6% of vehicles on the road, but carry 8.8% of the passengers, whereas taxis account for 21% of the vehicles but carry 82.6% of passengers, while *boda-bodas* account for 42.4% of vehicles on the road, but carry 8.5% of the passengers. Thus reducing the number of private cars that access the city would most likely have significant effects on managing traffic jams in Kampala.

Sorensen et al (2015) caution that when designing traffic congestion reducing strategies, it is important to note that few congestion-reduction strategies remain effective over time. They

further note that when a congestion-reduction strategy is implemented and traffic delays are reduced, travellers who had previously altered their travel patterns to avoid congestion will notice the improvement and return to driving along the once-busy routes during the peak hours. Some will shift times, modes and routes of travel. In the end, this pattern, often described as *triple convergence*, slowly erodes the initial congestion-reduction benefits offered by most strategies.

Sorensen et al (2015) further observe that only congestion pricing strategies can resist triple convergence and manage congestion in the long run, since the pricing deters some drivers from converging on the freed capacity when prices rise with increased demand. Lewis (1991) advises that the most efficient long-term solutions for traffic delay may include a mix of major capital investments, productive base improvements and changes in operating rules and managerial practices.

Selecting mitigation measures to be implemented will require comparing the policy alternatives in terms of contribution to the reduction of traffic jams as well as productivity and economic growth within the city. This will require conducting economic analysis for every policy option and comparing congestion-reducing programmes in terms of return on investment and contribution to productivity. Lewis (1991) adds that the issue of timing the interventions will also be important, as projects can appear to offer strong returns over their useful lives, but be premature from the viewpoint of addressing the current problems.

All parties—executives, politicians, business owners, city dwellers and other stakeholders—need to share in the process of developing policy alternatives. Usually, any transportation policy or programme will have many stakeholders, including the planners, the decision makers, elected officials, users of the transportation system, businesses affected by the transportation system, and those for whom the changes in the system may have deleterious social, economic and environmental impacts. Involving stakeholders in the process of identifying alternative directions can substantially improve the likelihood of consensus on the way forward. On the other hand, the identification and application of technical alternatives must rest at the technical level, notwithstanding that good practice dictates periodic involvement of both executives and decision makers in the process of establishing the range and content of policy options (Lewis, 1991).

There is need to improve team-work and coordination among the agencies responsible for traffic control in the city. The agencies basically include KCCA, Police, Uganda National Roads Authority, and various drivers associations. Failure to identify interdependencey among these agencies can only lead to missed opportunities for innovative solutions.

Conclusion

Narrow roads, indisciplined drivers, poor urban planning, limited car parking and concentration of most economic and social activities in the city were identified as the major causes of traffic jams in Kampala. The article estimates that travellers lose between 8-23 hours every month in traffic jams with car travel speeds falling from an average of 28 km/h when there is no jam, to between 8-14 km/h because of traffic jams. The article further emphasizes that traffic jams

could be lowering the country's GDP due to lost productive time while stuck in traffic jams. To alleviate traffic jams in Kampala, the article recommends a variety of mitigation strategies from building flyovers and improving the quality of alternative routes to improving traffic management operations, with congestion pricing believed to have the most dramatic effect on traffic congestion.

The article recommends that all key stakeholders need to be involved in the process of determining mitigation policy options, and to improve team-working and coordination amongst the agencies responsible for traffic control in the city. Conducting economic analysis for all policy options based on their return on investment and contribution to productivity is also needed.

Areas for further research

Future research will need to use engineering techniques to estimate the impact of Kampala's traffic jams in terms of lost time for travellers, wasted fuel for vehicles, and the amount and effect of vehicle emissions during traffic jams, since the data used in this article, especially on distances and time, was based on respondents' estimates and not on technical measurements. More so, the results were not based on a randomly selected sample, and thus, cannot be generalized; future research will therefore need to address this limitation. Lastly, repeating the study on a periodic basis will offer insights into the dynamics of traffic jams over time.

References

Andrew, C. (2005). Leicester is traffic jam capital. Article published by *The Guardian* Newspaper, UK, downloaded from https://www.theguardian.com/uk/2005/may/27/transport.world1

Anthony, D. (2011). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Arnis, T. (2015). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jams downloaded on 25 September 2016.

Brian, F. (2014). What causes traffic jams?. Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Bruce, W. (2016). Traffic jams cost people time. Contribution to blog on traffic congestion posted on https://www.quora.com/profile/Bruce-Wu-21 downloaded on 25 September 2016.

Chouputra, C. (2015). What causes traffic jams?. Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Chung, S.L.(2012). Traffic Congestion in Malyasia https://essayforum.com/writing/traffic-congestion-fundamental-problem-modern-41605/ downloaded on 21 August 2016

Dubner, J. S. (2007). How NYC Govt. Causes Its Own Traffic Jams. Article in *N.Y. Times, http://www.nytimes.com/2007/01/12/nyregion/12traffic.html, 12 January 2007*

Freakonomics (2008). What Causes Traffic Jams? You. http://freakonomics.com/2008/03/10/what-causes-traffic-jams-you/; 10 March 2008.

Gikonyo, B. (2013). Information Systems Framework for Traffic Congestion Management: Case Study of Nairobi. A Thesis Submitted to the Faculty of Information Technology in Partial fulfilment of the Requirement for the Degree of Master of Science in Information Technology of Strathmore University Nairobi, Kenya; June, 2013.

Hannu, J. (2016). Idling Emissions. Article posted on https://www.dieselnet.com/tech/emissions_idle.php, downloaded 25 September 2016.

Ivan, G. (2015). What causes traffic jams? Contribution to article posted on https://www.quora.com/What-causes-traffic-jams downloaded 25 September 2016.

Jose A. Gomez, I., William, B. T., Clifford, W. (1999). *Essays in Transportation Economics and Policy: a handbook in honor of John R. Meyer*, published by The Brookings Institution, 1775 Massachusetts Avenue, N.W., Washington, D.C. 20036.

KCCA. (2015). State of Roads in Kampala City. A report prepared by the KCCA Directorate of Engineering and Technical Services, May 2015.

Kenneth, J. B. (2003). *Transport Economics*, 2nd Edition. Published by Edward Elgar Publishing Limited, Cheltenham, UK.

Kev, P. (2016). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Kiggundu, A. & Mukiibi, S. (2012). *Land Use and Transport Planning in the Greater Kampala, Uganda*. Published for the Faculty of Geography UGM and The Indonesian Geographers Association, ISSN 0024-9521 IJG Vol. 44, No. 1, June 2012

Kushal, G. (2016). What causes traffic jams?. Contribution to article posted tohttps://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Lewis, D. (1991). *Primer on Transportation, Productivity and Economic Development.* National Cooperative Highway Research Program Report 342, Transportation Research Board, National Research Council, Washington D.C., September 1991

Lopez, C. (2016). Analyzing Community Problems and Designing and Adapting Community Interventions; Article published by the University of Kansas. http://ctb.ku.edu/en/table-of-contents/analyze/analyze-community-problems-and-solutions/root-causes/main

Matovu, G. (2014). Improvement of Traffic Congestion/Flow in Kampala City. November 2014, article in support of a project to introduce the Bus Rapid Transport system, downloaded from www.greengrowth.org; www.escap.org

Natural Resources Canada, Government of Canada. (2016). Idling wastes fuel and money; https://www.nrcan.gc.ca/energy/efficiency/communities-infrastructure/transportation/idling/4459

Prashant, S. (2015). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Rishabh, K. (2014). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Rishipratim, M. (2013). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Ruttoh, N. (2014). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Sayid, W. U.(2015). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jams downloaded on 25 September 2016.

Smriti, I. (2015). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Sophia, S. (2012). What causes traffic jams?Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Sorensen, P., Martin, W., Endy, M. D., Aaron, K., Liisa, E., Mark, H., Allison, Y., Thomas, L., &James, G. (2015). Reducing Traffic Congestion in Los Angeles. Study conducted for Rand Corporation, 2015. http://www.rand.org/pubs/research_briefs/RB9385.html

The Daily Monitor (2016). Shs170m smartphones stolen in Kampala traffic jams. News Article published in the *Daily Monitor* of Saturday, 26 March 2016. http://www.monitor.co.ug/News/National/Smartphones-stolen-Kampala-traffic-jams/688334-3133680-9flad9z/index.html

The Daily Star (2016). Wrong side driving is wrong, even for ministers. Article issued on 23 September 2016. http://www.thedailystar.net/op-ed/politics/wrong-side-driving-wrong-even-ministers-1288402

Tom,V. M. (2014). Fuel Consumption and Emission Studies: Lecture notes in Traffic Engineering and Management. https://www.civil.iitb.ac.in/tvm/1111_nptel/583_FuelEmi/plain/plain.html

Tomson, L.(2014). What causes traffic jams?Contribution to article posted tohttps://www.quora.com/What-causes-traffic-jams downloaded on 25 September 2016.

US Department of Transportation. (2005). Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation. http://www.ops.fhwa.dot.gov/congestion_report/executive_summary.htm

Vaibhav, M. (2016). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Vijay, P. (2010). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Vivek, D. (2013). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Vivek, N. (2015). What causes traffic jams? Contribution to article posted to https://www.quora.com/What-causes-traffic-jamsdownloaded on 25 September 2016.

Wenjie, Z. (2011). Managing Traffic Congestion—case Study of Hangzhou. Master's thesis submitted to Blekinge Institute of Technology for the MSc in European Spatial Planning and Regional Development, 15 May 2011.

Yared, H. (2010). Impact of Vehicle Traffic Congestion in Addis Ababa: The case of Kolfe Sub-City: Total-Ayer Tena Road. A Thesis Submitted to the Urban Management Master's Programme, Ethiopian Civil Service College, in Partial Fulfilment of the Requirements for the Award of a Master's Degree in Urban Management, June 2010.