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ESTIMATION OF THE ECONOMIC COST OF TRAFFIC CONGESTION: A CASE STUDY OF A MAJOR ARTERIAL IN KANDY, SRI LANKA

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Abstract

In most of the developing countries, traffic congestion prevails in major cities and suburbs is identified as a pervasive concern which has a number of adverse impacts. Sri Lanka is no exception to this norm and most of the major cities in the country are significantly affected by the traffic congestion incurring an enormous economic cost. Against this backdrop, this study aims to examine the economic cost of traffic congestion in Kandy city and potential root causes. The study focuses on the dynamics of the people who enter to Kandy using the Kadugannawa to Kandy route by collecting primary data based on the random sampling method. Estimates indicate that travel time cost and vehicle operational cost of Kadugannawa to Kandy per day is LKR 11.7 million and LKR 4 million respectively. The study also provides quantitative evidence to support the popular claim which states that the higher usage of private vehicles is the major factor for traffic congestion. Based on these findings, this study argues that in the event of improving public transport is allowing a significant reduction of traffic congestion, thus minimize the economic burden on the national economy.

Key Words: Economic Cost of Traffic Congestion; Kandy; Traffic Congestion; Travel Time Cost; Vehicle Operational Cost

Introduction

Massive traffic congestion can be identified as the most visible and pervasive transport problem plaguing the major cities of developing countries on a daily basis where Sri Lanka is not an exception (Kumarage, 2019). When the economy reaches greater development levels with higher per capita income, subsequently vehicle population increases (Kumarage, 2019). As Goodwin (2004) emphasized, the main cause of road traffic congestion is that the volume of traffic is too close to the maximum capacity of a road or network. The traffic congestion tends to prolong, hinder, and is unfavorable to many economic activities (Ali et al., 2019). Further, several externalities such as air and noise pollution and adverse health impact make the situation more complicated and serious. When all these conditions are taken into account, it is prominent that traffic congestion creates an alarming impact on all the living beings and the national economy hence should be tackled immediately.

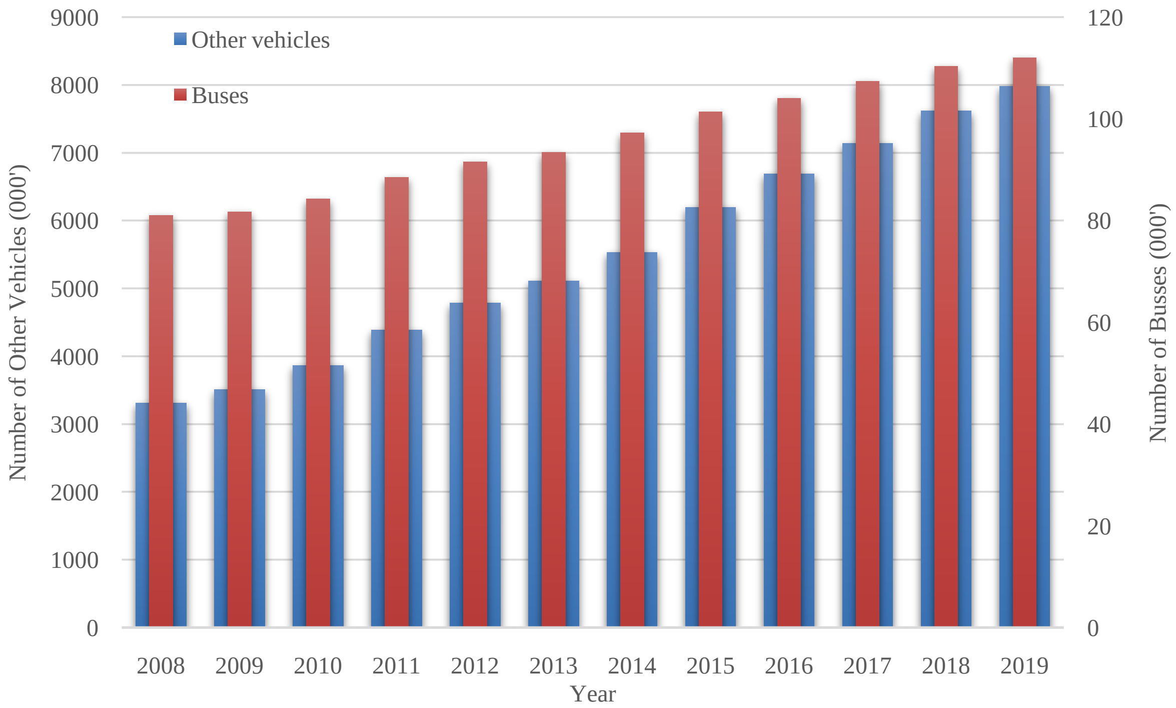
According to data from the Department of Motor Traffic of Sri Lanka, the number of buses has increased by 38 percent, while the other vehicle population has surged by 141 percent from 2008 to 2019. Busses have increased at an average annual rate of 3 percent while other vehicles increased by 8 percent. Furthermore, the contribution of buses to the total vehicle population was 2% in 2008 and this declined to 1% in 2019. All this shows that there is an over-reliance on private vehicles and under-reliance on public transportation. Kandy, one of the main cities in Sri Lanka is subjected to this severe traffic congestion daily and Jayatilaka (2003) revealed, 331000 passengers enter the city daily and 69 percent of them travel by bus while only 31 percent use other modes of transport.

But, the contribution of buses and other modes of transport for traffic congestion are 14 percent and 86 percent respectively which highlight the massive usage of private vehicles. The increasing vehicle population growth coupled with high-intensity urbanization makes the traffic condition worse in Kandy city.

Additionally, limited area, topographic features, location of major institutions such as hospitals, schools, railway stations, and bus stand, etc., massive private vehicle usage, and weak Public Transport (PT) make the traffic congestion worse in Kandy (Jayathilaka, 2003).

On that account, it is essential to estimate the cost of traffic congestion by considering all the important factors. Mainly traffic congestion incurs substantial financial loss not only to the individuals but also to the entire economy due to the massive wastage of fuel coupled with vehicle depreciation. Contrastingly, high delay time due to traffic congestion increases the greater opportunity cost to individuals hence, national economy aggregately. Given the factors, financial cost analysis is insufficient to provide insights hence, the economic cost of traffic congestion should be estimated to investigate the real loss to the national economy.

Figure 1. Total Vehicle Population



Note. Department of Motor Traffic of Sri Lanka

Research Objectives

General objective of this study is to estimate the cost of traffic congestion in Kandy city. The study has four specific objectives,

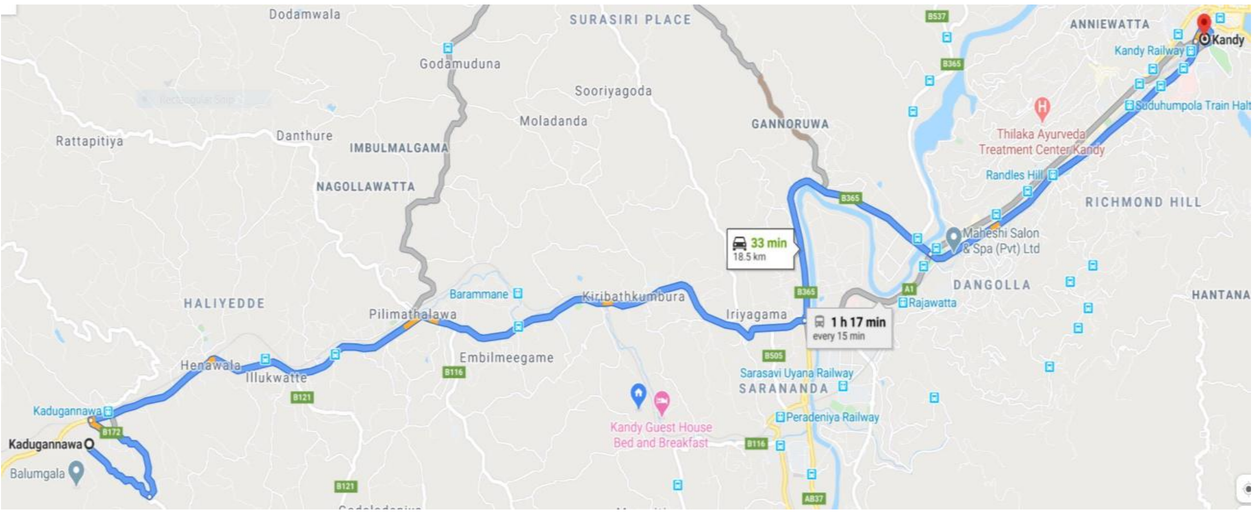
1. Identify the essential cost attributes related to cost of traffic congestion in Kandy city.
2. Estimate the cost of traffic congestion in Kandy city by taking identified cost attributes into account.
3. Identify the major root causes for the cost of traffic congestion
4. Identify feasible policy recommendations to mitigate the traffic congestion in Kandy city.

Location

As previously mentioned, this study is conducted to estimate the cost of traffic congestion in Kandy, Sri Lanka. Kandy has main three corridors to enter the city namely, Peradeniya to Kandy, Katugasthota to Kandy, and Thennekumbura to Kandy. Peradeniya to Kandy corridor can be divided into two parts, which are Kadugannawa to Peradeniya and Gampola to Peradeniya. In this study, the author attempts to estimate the cost of traffic congestion from Kadugannawa to Kandy which is the main corridor to enter the Kandy from the capital of Sri Lanka, Colombo. As Kandy city is located in the middle of the country, it instinctively acts as one of the major transport hubs in the country. Hence, several types of journeys take place throughout the city for various purposes.

Further, Kadugannawa to Kandy corridor is not only an entrance to the city but also a hub that gives access to several other cities such as Nuwaraeliya, Badulla, Bandarawela, Ampara, Mathale, Kurunagala, Dambulla, etc. Therefore, Kadugannawa – Kandy corridor can be considered as one of the most important and the busiest corridors to enter the Kandy and thus, needs immediate attention to the problem of traffic congestion.

Figure 2. Route from Kadugannawa to Kandy



Note. Google Maps

Materials and Methods

Sources of Data

This study is entirely based on a cross-sectional design, which uses both primary and secondary data.In order to collect primary data, face-to-face interviews were conducted based on a structured questionnaire including both the close-ended and open-ended questions. The questionnaire contains three sections which include socio-demographic questions, ability to pay questions and questions related to the cost of traffic congestion estimation. The survey was conducted within the period of 12th October 2019 to 20th October 2019 and the sample was selected based on the random sampling method. Ten "GramaNiladhari"[1](Village Officer) Divisions were selected from Kadugannawa Urban Council. The selected "GramaNiladhari" divisions were Kadugannwa Town, Panabokka, Urapola, Pilimathalawa, Madarangoda, Kadawathgama, Kandangama North, Ilkuwaththa, Govindala, and Urapola. Further, 389 respondents were selected from the electoral lists of respective GramaNiladhari Divisions according to the random numbers generated by Microsoft Excel.

Secondary data was also utilized to fulfill the objectives of the study. Mainly traffic data of Kandy city such as Average Daily Traffic and contribution of each vehicle type for the traffic were obtained from the Road Development Authority of Sri Lanka (RDASL). In addition, findings of previous transportation and traffic studies of Kandy city were used as sources of secondary data for the calculations.

Estimate the Cost of Traffic Congestion

Even though the different studies employed different cost attributes to estimate the total cost of traffic congestion, Travel Time Cost (TTC) and Vehicle Operational Cost (VOC) have been taken by all the researchers into consideration as main elements (Khan & Islam, 2013; Shoaeb., 2016). In this context, the author attempts to estimate the following Total Traffic Congestion Cost (TTCC) function,

$$\mathrm{TTCC} = \mathrm{TTC} + \mathrm{VOC} \tag{1}$$

Various studies have adopted several methods to estimate traffic congestion. This study adopts the following formula (Ali et al., 2014) for the TTC estimation.

$$\mathrm{TTC} = \sum_{m=1}^{m} (VOT_{\mathrm{m}} \times \mathrm{Delay}_{\mathrm{m}} \times \mathrm{V}_{\mathrm{m}} \times \mathrm{Vocc}_{\mathrm{m}}) \tag{2}$$

[1] Smallest administrative unit of Sri Lanka

Where, OC = Opportunity Cost of traffic congestion, VOT_m = Value of time for specific mode m, $Delay_m$ = Travel delay in unit time observed for mode m (estimated at some reference speed), V_m = number of vehicles of type m per day, $Vocc_m$ = Average vehicle occupancy for specific mode m.

Further, Jayasuriya and Bandari (2017) used the following formula for time delay estimations,

$$TimeDelay = \frac{TotalDistance}{AverageActualSpeed} - \frac{TotalDistance}{AverageDesignSpeed} \quad (3)$$

Literature suggests several methods to estimate the Value of Time (VOT). Patni, et al., (2017) used the following formula to estimate the VOT as part of their congestion cost estimation study,

$$\text{Value of Time (VOT)} = \frac{\text{Annual Average Income per person}}{365 \times 24} \quad (4)$$

The study follows the below method in order to estimate the vehicle operational cost based on Ali, et al., (2014), and calculations are carried out separately for a different mode of transport in the traffic stream same as travel time cost estimation.

$$VOC = L \times \sum_{m=1}^{m}(FC_m \times Delay_m \times V_m) \quad (5)$$

Where, VOC = Vehicle Operation Cost, FC_m = Fuel cost LKR/hour for specific mode m, V_m and $Delay_m$have the same meaning mentioned earlier and L = length of stretch in km. Where, FC_mcan be calculated,

$$FC_m = \sum_{Ft=1}^{3}(Fcq_m^{Ft} \times Fq^{Ft} \times \mu^{Ft}) \quad (6)$$

Where, Fcq_m= Fuel consumption quantity in liters/km (or Kg/km) of mode m, Fq^{Ft} = Fuel price of specific fuel types Ft = 1, 2, & 3 such as CNG, Gasoline and Diesel respectively in Rs/liters or Rs/kg. μ^{Ft} = proportion of specific mode type m using a particular fuel type for travelling on that road section.
But inputs of the equation (6) does not lead to Fuel cost LKR/hour for specific mode m, average speed of vehicle type m incorporate with the equation and adjust as follows,

$$FC_m = \sum_{Ft=1}^{3}(Fcq_m^{Ft} \times Fq^{Ft} \times Avg.S_m \times \mu^{Ft}) \quad (7)$$

Where, $Avg.s_m$ = average speed of vehicle type m in km/hour. It is identified as a limitation of the equation (6) which is weaken the findings of previous studies.

As mentioned above, equation (5) is based on the findings of equation (6). As emphasized through equation (3), delay time is estimated for the entire route and hence, include both delay time and length of stretch leads to overestimate the VOC by subjecting to double counting error. To overcome this limitation of equation (5), following adjusted version of equation (5) is adopted for the study.

$$VOC = \sum_{m=1}^{m}(FC_m \times Delay_m \times V_m) \quad (8)$$

To achieve the objective of estimating the cost of traffic congestion in Kandy city, Microsoft Excel was used to generate descriptive statistics by using both primary and secondary data. The study considers two main cost attributes namely, Travel Time Cost (TTC) and Vehicle Operating Cost (VOC).

This method could be considered a reliable method as it accounts for different modes of transport separately (Jayasooriya&Bandara, 2017). However, this study has taken only five vehicle categories (bus, car/van, MB, TWL, lorry) into consideration to estimate the cost of traffic congestion with the objective of reducing the complexity. Car and van are considered as one category for the simplicity of the calculations. The average daily cost of transportation should be calculated from the usual modes of transport used by passengers. The above-mentioned modes of transports were selected according to this reasoning. Calculating VOT and delay time are pre-requirements to estimate both TTC and VOC. VOT was estimated through equation (4) and delay time is calculated based on data obtained through a structured questionnaire. Respondents were asked about the average Travel Time (TT) of respective modes of transport which they use in both peak and off-peak traffic hours and this was converted into the average speed.

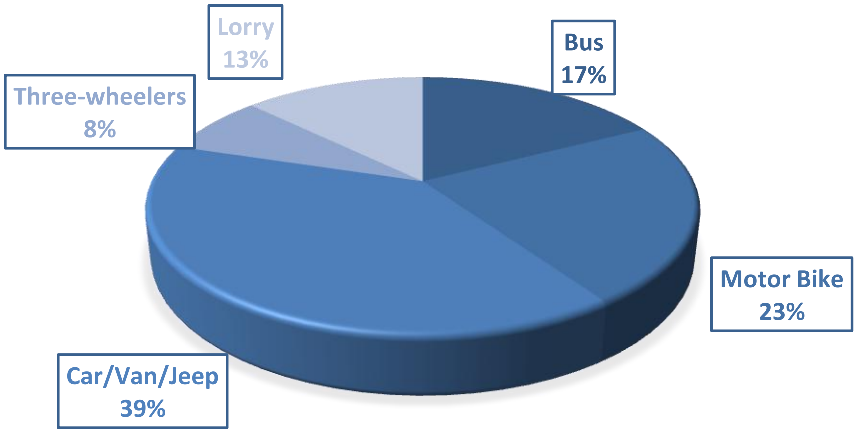
Further, the regulated speed limits of Sri Lanka were taken as the reference speed to estimate the average delay time of each mode of transport. Estimated values and data regarding each mode of transport such as VOT, average delay time, vehicle occupancy, and vehicle amount were used for the TTC estimation based on equation (2). Differently, VOC is estimated based on equation (8), and fuel cost, delay time, and vehicle amount was used for the calculations. Moreover, fuel consumption quantity, fuel price, average speed, and μ factor was used for the fuel cost estimation (equation 7).

Results

Estimating Travel Time Cost

Figure 3 depicts the contribution of each vehicle type to traffic congestion from Kadugannawa to Kandy. This data is based on the vehicle count conducted only for 12 hours in 2017 and the study assumes that the percentage share of the mode of transport to traffic congestion from Kadugannawa to Kandy in 2019 is also the same as 2017. Figure 3 emphasizes that the majority of vehicles in traffic congestion from Kadugannawa to Kandy comprise of cars and vans (39 percent). Motorbike is the highest single contributor to traffic congestion which is 23 percent while the contribution of lorries and three-wheelers are 13 percent and 8 percent respectively. This emphasizes the fact that, approximately, 82 percent of the vehicles in traffic congestion are private vehicles against 17 percent of busses.

Figure 3Percentage share of Mode of Transport



Note. Road Development Authority of Sri Lanka

According to RDASL, the Average Daily Traffic (ADT) from Kadugannawa to Kandy in 2017 is 23033 vehicles. The study assumes that the traffic density growth from 2017 to 2019 is 1.5 percent (Jayasooriya&Bandara, 2017), and calculates the daily average bidirectional traffic volume based on the mode of transport from Kadugannawa to Kandy as in Table 1. Further, vehicle occupancy data were obtained from the Kandy City Transport study which was conducted by the University of Moratuwa (2011) and the author assumes, the vehicle occupancy of the traffic congestion from Kadugannawa to Kandy in 2019 is the same as the vehicle occupancy of Kandy city in 2011.

Table 1Number of Vehicles and Vehicle Occupancy

Mode	Number of vehicles in 2017[a]	Number of vehicles in 2019	Vehicle Occupancy[b]
Motor Bike	4007.742	6011.6	1.307
Three-wheeler	5260.737	7891.1	1.433
Car/Van	9051.969	13578.0	3.195

Bus	1718.262	2577.4	39.597
Lorry	2934.404	4401.6	2.028

Note.[a]Road Development Authority of Sri Lanka. [b](University of Moratuwa in association with UOP, 2011)

A four-step process was adopted to estimate the average delay time for the modes of transport. Firstly, by considering the practical condition of the traffic congestion in Kandy city and pervious literature, main three periods of the day were recognized as peak traffic hours, which are 6.00 am to 8.00 am, 1.30 pm to 2.30 pm and 4.00 pm to 6.00 pm (Jayatilaka, 2003). Starting and ending hours of workplaces and schools are the major root cause for the high traffic congestion in these periods.

Secondly, respondents were asked about the travel time of their journey to Kandy and distance between their home and city based on the above peak and off-peak classification. Average speed for both peak and off-peak time were calculated for each mode of transport based on the answers for above questions.

Next, deciding a reference speed to calculate the delay time for the modes of transport has risen as a pre-requirement. The Sri Lankan government has regulated driving speed by Motor Traffic (Speed Limits) Regulations, Gazette No. 1763/26 of 2012. According to this, the Sri Lankan road network can be divided into two sections, namely, Built-up areas and Non-Built-up areas. All automobiles which are functioning in a "Built-up area" are subjected to a 50kmph speed restriction while land vehicles, motor tricycles, motor tricycle vans, and special purpose vehicles are subject to a 40kmph speed restriction. All other road segments in Sri Lanka which are not specified in the schedule to these guidelines are known as "Non-Built-up areas" and the speed limit relevant to these road segments is 70kmph for all categories of automobiles and 60kmph for all motor coaches and lorries.

The considered area for this study is Kadugannawa to Kandy which comprises 92.75 percent of "Built-up areas" and 0.073 percent of "Non-Built-up areas". The average delay time for peak and off-peak hours were calculated by considering these regulated speed limits as the reference speed. Finally, the average delay time for each mode of transport which is calculated by using equation (3), and peak and off-peak hours were considered as weights for the calculation (Table 2).

Delay time for the lorry is lower relative to three-wheel and car/van which was not expected previously. This can be mainly due to the responses of the people regarding the travel time which can be identified as a limitation of the study.

Table 2Average speed and Average Delay Time

Mode	Average Speed at peak hours	Average Speed at off-peak hours	Average Delay Time (Minutes/veh.)
Motor Bike	20.94	28.25	22
Three-wheeler	16.24	23.10	32
Car/Van	14.62	20.84	38
Bus	13.04	19.61	55
Lorry	18.98	23.42	28

Note. Author's compilation based on the survey data

Average VOT for each mode of transport was estimated by employing equation (4). Estimated VOT values are depict in Table 3.

Table 3. Average Value of Time

Mode	VOT (LKR)
Motor Bike	68.23
Three-wheeler	70.88
Car/Van	141.41
Bus	72.45
Lorry	111.30

Note. Author's compilation

Based on the above findings Travel Time Cost (TTC) for each mode of transport was estimated based on the equation (2).

Estimated TTC for each mode of transport depicts in Table 4.

Table 4. Travel Time Cost

Mode	TTC (LKR)
Motor Bike	198689.73
Three-wheeler	429526.33
Car/Van	3855596.02
Bus	6758774.85
Lorry	463918.34
Total	11706505.27

Note. Author's compilation

Estimating Vehicle Operational Cost

Fuel price for the date of 26th December 2019, is used to estimate the Fuel Cost (FC). Even though several fuel types are available in the country, the study assumes that Lanka Petrol 92 Octane (LKR 137 per litter) is used for all the petrol and petrol/electric vehicles while Lanka Auto Diesel (LKR 104 per litter) is used for all the diesel vehicles. As mentioned in the literature review, 'μ' factors denote the proportion of each mode of transport according to the fuel type. 'μ' factors are calculated using statistical data available in the Department of Motor Traffic, Sri Lanka (Table 5).

Table 5. Proportion of Each Modes of Transport According to Fuel Types

Mode	Diesel	Petrol	Petrol/ Electric	Diesel / Electric	Electric
Motor Bike	-	0.999	0.000	-	0.000
Three-wheeler	0.061	0.938	-	-	-
Car/Van/Jeep	0.240	0.453	0.282	0.001	0.023
Bus	1	-	-	-	-
Lorry	1	-	-	-	-

Note. Author's compilation based on RDASL data

Fuel cost was estimated based on the equation (7). First, fuel consumption quantity was estimated based on the survey results. Respondents were asked about the fuel consumption quantity of their vehicles in km/litter form and converted it to litter/km form. In the case of busses, fuel consumption was estimated by conducting interviews with bus drivers of the considered bus route and the same adjustments were made. Second, based on the fuel consumption quantity (litter/ km) and average speed of vehicles (km/hour) in peak and off-peak hours, fuel consumption quantity per hour (litter/hour) is calculated as in Table 6. Finally, fuel cost per hour (LKR/Hour) is calculated by considering the estimated fuel consumption quantity per hour (litter/hour) and 'μ' factors (Table 6).

Table 6. Fuel Consumption Quantity and Fuel Cost

Mode	Average Fuel Consumption Quantity (litter/hour)	Fuel Cost (LKR/Hour)
Motor Bike	0.941	128.74
Three-wheeler	0.993	134.02
Car/Van/Jeep	1.349	169.85
Bus	5.623	584.79
Lorry	1.666	173.26

Note. Author's compilation

By using estimated Fuel cost (LKR/Hour), average delay time for each mode of transport for the entire route (hours) and number of vehicles of each mode of transport, VOC was estimated based on equation (8). Estimated VOC for each mode of transport is shown in Table 7.

Table 7. Vehicle Operational Cost

Mode	VOC (LKR)
Motor Bike	286834.95
Three-wheeler	566877.60
Car/Van	1449495.44
Bus	1377740.66
Lorry	356107.81
Total	4037056.47

Note. Author's compilation

Economic cost of traffic congestion

As previous findings emphasize, the total TTC and total VOC of the traffic congestion from Kadugannawa to Kandy are LKR 11706505 and LKR 4037056 respectively. Further, traffic congestion may lead to higher depreciation of vehicles than in normal conditions as it increases the functioning of all vehicles. Hence, it is assumed that 10 percent of VOC can be added for the lubricants and additional maintenance of the vehicles which should be included in the cost of traffic congestion (LKR 403705). By taking only estimated cost attributes (TTC and VOC) and wear and tear cost, the estimated Total Traffic Congestion Cost (TTCC) per day for Kadugannawa to Kandy is LKR 16.14 million. As mentioned above, if it is considered as the distance from Kadugannawa to Kandy as approximately 16 km, TTCC per km per day is approximately LKR 1 million. Further, with the assumption of the similar intensity of traffic every day for the entire year, TTCC for a year is LKR 5.89 billion for the entire distance from Kadugannawa to Kandy while, TTCC per km per year is LKR 368.35 million approximately. According to the RDASL, the total length of "A" and "B" class roads in Sri Lanka is 12224.661 km. If it assumes only 10 percent of "A" and "B" class roads are subjected to equal intensity of traffic congestion as Kadugannawa to Kandy, TTCC for a year is approximately LKR 450.3 billion (USD 2.5 billion)[2] which is an equivalent of approximately 3 percent of the GDP in Sri Lanka in 2019.

[2] Exchange Rate between USD and LKR is assumed as USD 1=LKR 180

Table 8. Economic Cost of Traffic Congestion A

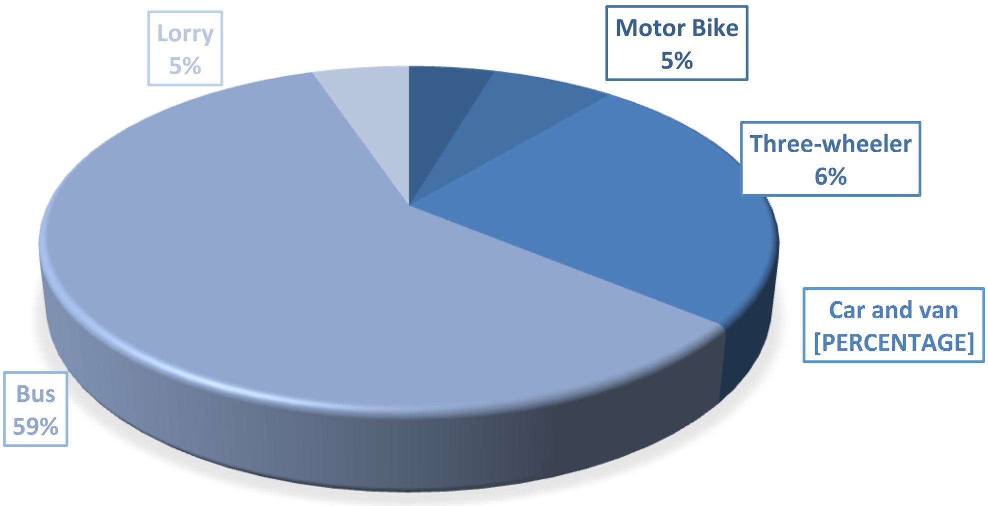
Heads	Loss in LKR
TTC	11,706,505
VOC	4,037,056
Wear and Tear Cost (10% of VOC)	403,705
TTCC per day	16,147,266
TTCC per year	5,893,752,309

Note. Author's compilation

Discussion

As the above findings reveal, traffic congestion incurs an enormous loss to the national economy and it can be identified as a major constraint to a developing country like Sri Lanka. Even though this study does not consider the environmental and health externalities of traffic congestion, that may also play a substantial role in increasing the economic loss, further. As this study suggests at the beginning, massive usage of private vehicles has a significant impact on this issue and thus must be addressed immediately.

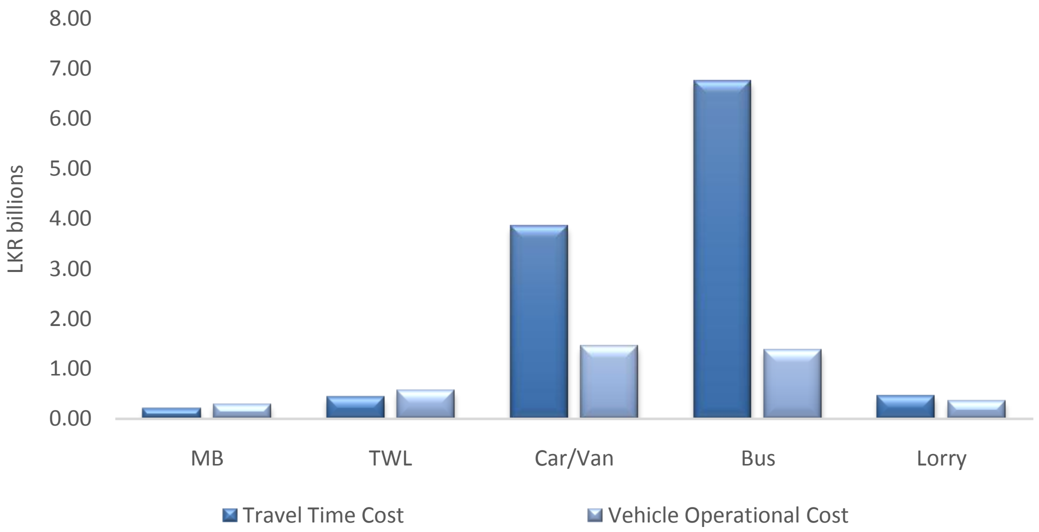
Figure 4. Passenger share of modes.



Note. Author's compilation based on the vehicle population data (RDASL) and vehicle occupancy data to the Kadugannawa – Kandy route(University of Moratuwa in association with UOP, 2011)

Model share of the traffic congestion emphasizes the fact that busses are only 17 percent of the vehicles and the rest can be identified as private vehicles (83 percent). On the other hand, passengers share shows an entirely different outlook regarding buses and other modes of transport. As Figure 4 depicts, 59 percent of the passengers have fulfilled their transport requirements through busses while only 41 percent of passengers use other modes of transport. It means private vehicles which are 83 percent of all modes of transport are used by 41 percent of passengers on the Kadugannawa to Kandy route. This is again a manifestation of the huge burden of private transport on congestion and hence, it can be argued that this massive usage of private vehicles intensifies the economic loss to a greater extent.

Figure 5. Mode wise travel time cost and vehicle operational cost

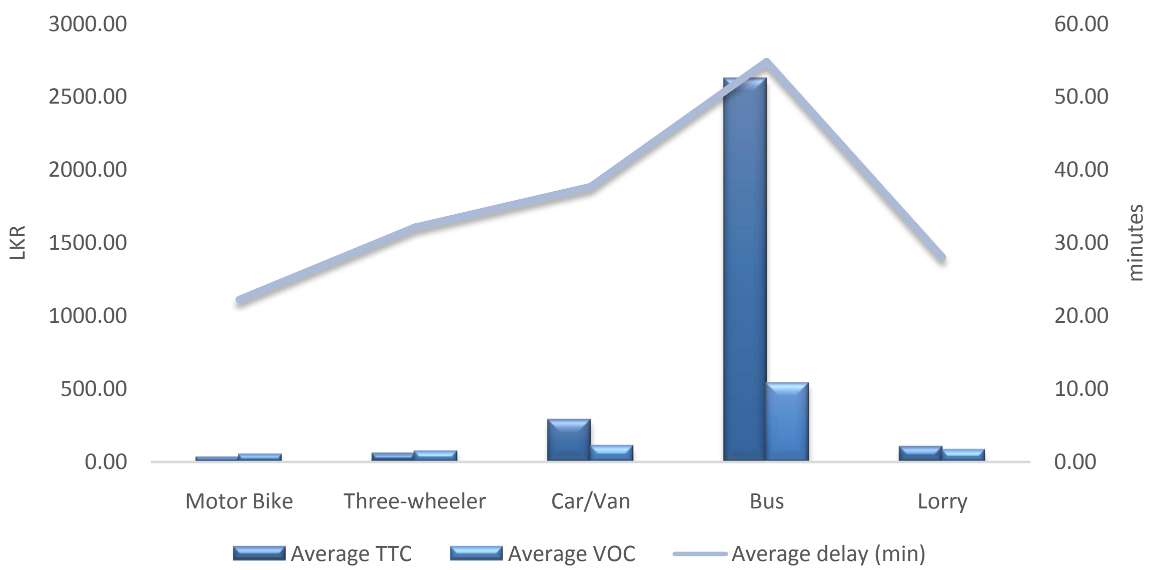


To investigate this scenario further, Figure 5 depicts the TTC and VOC of each mode of transport separately. It highlights that the highest TTC is incurred by buses which are followed by cars/vans, three-wheelers, lorries, and motorbikes respectively. TTC is mainly affected by the delay time (extra travel time) of each mode of transport which can be taken as a proxy for the efficiency of respective modes. Specifically, buses has the highest average delay time and is the mode of transport for the majority of the people with a vehicle occupancy of 39.5. Therefore, the delay time of buses affects a significant proportion of people's opportunity cost and at the same time, it leads to an increase in the TTC.

Also, it is important to examine the behavior of average TTC and average VOC to get a better and deep idea about root causes. As Figure 6 emphasizes, buses incur the highest average VOC and average TTC. The main reason for this high average TTC is the relatively higher VOCC of busses. Therefore, the massive delay time of busses creates an enormous negative impact on the economy through the people's opportunity cost of time. Further, Figure 6 highlights the impact of the higher delay time of busses on the VOC and TTC also.

On the other hand, busses have the highest average VOC, as the higher the delay time of buses, the higher the fuel consumption and it leads to an increase in the operational cost per bus. Based on these facts it can be argued that focus on minimizing private vehicle usage is not adequate to reduce the economic cost of congestion without answering the problems of inefficiencies in PT as PT itself is responsible for 57 percent of the total TTC and 34 percent of the total VOC.

Figure 6. Average TTC and VOC against average delay time



Conclusion

The study mainly focuses on estimating two cost attributes which are Travel Times Cost (TTC) and Vehicle Operational Cost (VOC). Additionally, wear and tear costs are also considered for the analysis by including allowances based on literature. As the findings reveal, the total TTC and VOC for the route of Kadugannawa to Kandy are approximately LKR 11 million and LKR 4 million respectively. It emphasizes that the total estimated cost per day for the considered route is LKR 16 million and per year it would be approximately LKR 5.8 billion. Further, subject to certain assumptions, TTCC for the entire country for a year is approximately LKR 450 billion (USD 2.5 billion) which is 3 percent of GDP (2019) at the current market price in Sri Lanka. This situation highlights, the real burden of traffic congestion on the national economy.

Further, the study revealed the importance of efficient public transport in addressing the issue of traffic congestion and its consequences. As the analysis stresses, buses have the highest average delay time hence, higher TTC and VOC. More specifically, it can be argued that the high delay time of buses is a major reason for passengers to use more private vehicles instead of depends on public transport. This situation makes traffic congestion worsen and increase the travel time of all the vehicles. This formula can be used backward to reduce traffic congestion by providing improved public transport service with less travel time. It will motivate private vehicle users to reconsider the mode of transport which can be led to reducing the usage of private vehicles, minimize traffic congestion, and hence, lower the burden on the national economy.

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