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Effects of Traffic Congestion on Sustainable Livelihood in Mambanda Neighbourhood, Bonaberi, Douala IV Municipality, Littoral Region of Cameroon

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Abstract

This study examined the influence of traffic congestion on sustainable livelihoods in Mambanda Neighbourhood, Bonaberi, Douala IV Municipality, Cameroon. A mixed methods approach was adopted during the period from October 2025 to April 2026. In total, 200 individuals were randomly sampled from the community. This includes traders (34.5%), drivers (19.5%), civil servants (19.5%) and other respondents (26.5%). Ten key informants comprising of market administrators, transport workers' union representatives, police, council officers and longtime dwellers in the locality were interviewed. Descriptive analysis as well as inferential statistical test namely one-way ANOVA, Tukey HSD and one sample t-test at 5% level of significance were used for data analysis. From the findings, 77.5% considered the congestion level as high or very high. The common reasons attributed include narrow road width (26%) and street trading (24%). Fifty percent of the respondents spend between two to three hours daily in traffic. There are four types of traffic congestions namely recurrent (44.5%), bottleneck (18%), capacity (17.5%) and non-recurrent (11.5%) with a weighted average of 3.72 indicating multi-modal nature of traffic congestion. ANOVA showed significant influences on all five types of livelihood capitals. Human Capital: lateness in reaching work place (mean = 4.57; F = 9.27; p <.001); Financial Capital: reduced income (mean = 4.49; F = 6.59; p <.001); Social Capital: missed appointments (mean = 3.76); Physical Capital: vehicle damage (mean = 3.92); and Natural Capital: air pollution (mean = 4.04) and increased fuel consumption (mean = 4.28). One market administrator described the traffic congestion as "killing our business". Congestion severely undermines sustainable livelihood The study recommends road widening, enforcement of planning regulations, and promotion of alternative transport modes.

Keywords: Traffic Congestion; Sustainable Livelihood; Recurrent Congestion; Mambanda-Bonaberi; Douala IV; Urban Mobility

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Introduction

The theory of sustainable livelihoods has come a long way from when it was coined in the latter part of the 20th century. "Our Common Future," the report by the Brundtland Commission, introduced the ideas behind sustainable development by focusing on how economic development must occur without jeopardizing the capacity of future generations to satisfy their requirements [1]. Sustainable livelihoods involve the assets and abilities of individuals and communities that help them respond and recover from the shocks and maintain or enhance their welfare [1]. There are five capital assets in sustainable livelihoods, which are human capital (knowledge and skills, health), social capital (relationships, trust), natural capital (natural resources), physical capital (infrastructures and equipment), and financial capital (income, savings, and credit) [2]. These resources rely on each other, and the impact of shocks on one resource is likely to cause a chain reaction within the whole livelihood system [3].

Traffic congestion has become a serious problem in many urban settings, not only because it makes transportation systems less efficient, but also because it affects the sustainable livelihoods of urban dwellers. It is possible to trace the history of traffic congestion from the advent of the automobile in the beginning of the 20th century. With the growth of cities and the growing number of cars, the difficulties with traffic control have become more apparent. The study by the International Transport Forum [4] estimates that traffic congestion imposes billions of dollars of economic losses on economies around the world as a result of such factors as wasted productivity and environmental degradation, including air pollution and greenhouse gas emissions [5]. According to the Texas

A&M Transportation Institute [6], in 2017 the US suffered the losses worth of $166 billion because of congestion in terms of wasted time and fuel, the average commuter losing 54 hours a year in traffic. The International Transport Forum [4] suggests that global congestion costs will increase more than fivefold by 2050 compared to 2015.

However, traffic congestion is an even more significant problem in developing nations and Africa because of the increased pace of urbanization, poor infrastructure, unstructured public transport, and inadequate capacity for traffic control [7, 8]. The World Bank [7] reported that congestion levels in cities of low-and middle-income countries are three times greater than in the high-income countries. According to the African Development Bank [8], traffic congestion results in losses of $100 billion per year in African cities due to reduced productivity; these losses constitute between 2 and 5% of GDP in some nations. The average citizen of Lagos, Nigeria, wastes 3-4 hours in traffic every day and losses suffered by the city due to traffic congestion are estimated at about $10 billion annually [9, 10]. Kumar and Barrett [11] reported that traffic congestion in African cities is a problem predominantly for the poor, who have to travel in the peripheral regions where transport services are few and whose transportation expenses are 30-40% of household income.

Traffic congestion has become an important issue in Cameroon, especially in its economic capital Douala. Douala is the largest city in Cameroon, with a population of more than 3.5 million inhabitants, growing at about 4.5% per annum [12]. It acts as the economic center of Cameroon, as it is responsible for 95% of maritime trade and it houses the offices of the majority of major banks, firms and industries [13]. The road infrastructure of Douala, designed for a far smaller population, is grossly inadequate in addressing the traffic problem. The World Bank [14] estimated that traffic congestion in Douala causes Cameroon an annual loss of more than $1 billion due to inefficiency, increased fuel consumption and operational cost of vehicles. According to the Cameroon Urban Transport Authority [15], the peak hour average speed on Douala roads has dropped from 25 km/h in 2000 to less than 10 km/h in 2022.

Mambanda-Bonaberi, a suburb of the Douala IV Municipality, is one of the places in Douala which face problems with traffic congestion. It lies on the western side of the Wouri River, which links it to the central Douala across the Wouri Bridge that is highly congested at all times [16]. Over the past years, it has faced a high population rise, increasing from 75,000 people in 2005 to over 180,000 people in 2021 (increasing by 140 percent within 16 years), with the transport systems being a challenge to the livelihoods [17]. Mambanda Market (Marche de Mambanda) is the biggest market in Douala IV Municipality, which acts as the main source of supply for other markets in the area. The market opens each day but peaks on Saturdays, which is the official day for market set up by the council.

In particular, this study aims at investigating the impacts of traffic congestion on sustainable livelihood in Mambanda Neighbourhood, Bonaberi, by assessing the nature of traffic congestion, its impacts on all five livelihood capital assets, and the possible strategies to overcome such impacts as suggested by the community. This study was driven by three objectives, which include the following: (i) To investigate the nature of traffic congestion in Mambanda-Bonaberi, Douala IV; (ii) To assess the impacts of traffic congestion on sustainable livelihood in Mambanda-Bonaberi, Douala IV; and (iii) To propose possible strategies to minimize the impact of traffic congestion on sustainable livelihood in Mambanda-Bonaberi, Douala IV.

The research hypothesized that (1) the characteristics of traffic congestion in Mambanda-Bonaberi, Douala IV are significant, (2) traffic congestion has a significant effect on sustainable livelihood in Mambanda-Bonaberi, Douala IV, and (3) strategic planning can minimize the implications of traffic congestion on sustainable livelihood in Mambanda-Bonaberi, Douala IV.

Materials and Methods

Study Area

This research was conducted in Mambanda-Bonaberi, Douala IV Municipality, situated in the Wouri division of the Littoral Region in Cameroon. The geographic location of the Douala IV Municipality ranges from latitude 3°2" to 4°2" N and longitude 9°40" to 10°75" E of the Greenwich Meridian [18]. The municipality covers an approximate area of 203.9 km² of the total area of Douala city. It is surrounded by Youpwe Municipality to the North, River Wouri to the South, Deido to the East, and Dibombari to the West. Mambanda is one of the 12 neighbourhoods in the Douala IV Municipality located on the western bank of the River Wouri connecting the Central Douala through the Wouri Bridge. The name Mambanda comes from a tree called "Matanda", where Cameroonian and Nigerian fishermen rested [18]. This neighbourhood has a density of 15,000 inhabitants per km² with an area of 500 ha. According to Ngamo [19], at least three new people come into the neighbourhood each day. The latest official estimated figure for the population in 2005 was 75,000 people, but now it exceeds 180,000 [19].

The municipality of Douala IV enjoys a tropical monsoon climate, whereby there is fairly steady temperature throughout the year, with the exception of July and August when temperatures drop a little [18]. The area is marked with warm and humid weather conditions characterized by an average temperature of 27°C, with the municipality receiving an average rainfall of 3,600 mm. The driest month is December (28 mm of average rainfall), while August has the most rainfall (700 mm). This heavy rainfall is mainly due to the moisture brought by monsoon winds from the Atlantic Ocean between July and August, thus requiring flooding which leads to destruction of buildings in swampy areas. There are sandy-gravel soils found in the municipality, with the soils being mainly ferrallitic in nature and found on river plains and valleys, while water-logged soils characterize swampy areas [18]. The flat area is cut across by numerous distributaries and streams that drain into River Wouri, which in turn drains into the Atlantic Ocean. The topography of the area of Douala IV is characterized by gentle slopes that allow the construction of highways. Nevertheless, the presence of gentle slope and the closeness of the area to the Wouri River mean that the area is prone to flooding during the rainy period in the months of July to September. During the rains, floods will form on the roads when there is an accumulation of water caused by blocked drainage due to garbage from the market and homes.

The economy of Mambanda is very much dependent on secondary and tertiary sectors. Douala IV is one of the industrial sectors of Douala. As stated in the PDU report (2008) in Tamunang [18], commerce accounts for the biggest employment sector in Douala city (20.90%) next to the service sector (except commerce) which provides job opportunities for 57.80% of the population. Industrial sector and primary sector provide employment opportunities for 18.80% and 2.20% respectively. The Marche de Mambanda (Mambanda Market) is the biggest market in Douala IV municipality and is the first market from where all the other markets are supplied in the other 11

quarters. The market is situated at Rue de Marche Mambanda which a 4-6 meter wide road is providing the primary entrance to the market. The market opens daily but experiences peak activity on Saturdays.

Research Design

The study applied the mixed-methods approach as the mode of research design, incorporating the qualitative and quantitative modes of research. The adoption of the mixed-methods research design was informed by the fact that it permits the cross-verification of results from different data sources, offers a more comprehensive insight into the research problem than any of the two approaches on its own, and ensures that the researcher obtains the breadth (quantitative survey) and depth (qualitative interview) of the effects of traffic congestion on the sustainable livelihood of Mambanda [20]. The quantitative aspect of the research was aimed at establishing the prevalence and the degree of effects of congestion, while the qualitative part sought to understand the process of the impact of congestion on livelihoods and the possible solutions to congestion.

Sampling Technique

The simple random sample was adopted for conducting the Quantitative Survey. A total of 200 questionnaires were randomly administered among the traders, drivers, civil servants and other stakeholders within the area of Mambanda-Bonaberi. In the case of the qualitative research, purposive sampling was employed in identifying 10 key informants whose views were solicited through in-depth interviews. These included the market authorities (2), transport trade union representatives (2), transport police (2), Douala IV Council authority (2) and longtime residents (2) who could provide deep insights into congestion patterns and impacts over time.

The minimum sample size required for the study was computed using the Yamane formula [21]: in order to have statistical power in the sub-analysis by gender, occupation and location [22]. In the qualitative portion, 10 key informants was used since this is normally enough to attain thematic saturation in qualitative studies, when further interviews give little new information [23].

Data Collection

Data was collected from both primary and secondary sources. Primary data was collected by direct interview through the use of questionnaires. The questionnaires were administered by the researcher and two bilingual research assistants (fluent in English and French). The questionnaires were administered either in their home environment, workplace or public areas such as markets and taxi ranks. Field observation took place over a period of 10 days, during morning (6-9 am), lunchtime (12-2 pm) and evening rush hours (4-7 pm). Observation was carried out during weekday periods and weekends when the market would be open. Key informants were also interviewed. Secondary data was collected from documentary sources, such as the Douala IV Communal Development Plan, April 2004 town planning laws, reports from Cameroon Urban Transport Authority, National Institute of Statistics, World Bank and academic journals.

Data Analysis

Descriptive statistics were used to analyse the data. This included frequency, percentage, mean and standard deviation. Graphical analyses were conducted using histograms, photographs, maps and pie charts. Qualitative analysis was used to give more insight into the respondent's attitude and behaviour.

Inferential tests were used to test the hypothesis. Hypothesis One was tested using mean, standard deviation and weighted average. If the mean score was greater than 3.72 on a 5-point scale then it indicated that they recognised a mode of congestion [24]. Hypothesis Two was tested using One-Way ANOVA. This was used to compare the mean scores between different groups. Time spent in traffic was the independent variable and impacts on livelihood (human, financial and physical capital) was the dependent variable. Tukey HSD was used to see if there was any difference between the groups [25, 26]. Hypothesis Three was tested using a One Sample T-Test. This was used to compare the mean score of how effective solutions were against the test value of 4 [27]. All tests were completed at α=0.05. Effect sizes were calculated to determine the practical significance [28].

Results

Socio-Demographic Characteristics of Respondents

Table 1 presents the socio-demographics characteristics of people surveyed in Mambanda-Bonaberi. A majority (66.5%) of the respondents reside in Mambanda whilst 33.5% live in neighboring areas. This implies that the congestion issue affects not just people based in Mambanda but also those that come into Mambanda for commercial and transport purposes. There is an almost equal divide in gender with more females (50.5%) than males (49.5%) responding. This reflects the involvement of females in trading and commuting within the area. The age demographics show that the main age group is 25-34 (39.0%), closely followed by 35-44 (29.5%) and 15-24 (18.5%). A smaller proportion of the sample were aged 45-54 (9.5%) and 55+ (3.5%). The large majority of those surveyed (68.5%) were between the ages of 25-44. This shows that the population with the most issue with congestion is those who are actively working.

With regards to marital status, there was an even split between married (49.5%) and single (46.0%) respondents. Divorced (4.0%) and widowed (0.5%) make up a small proportion of the sample. In terms of education, the majority of respondents had a degree (49.5%), followed by those with a secondary education (33.5%). Fewer respondents were educated to a primary level (11.5%) and none (5.5%). This shows that Mambanda-Bonaberi has a highly educated population with many professionals, civil servants and business owners travelling to Douala city centre. The largest occupation group was traders (34.5%) highlighting Mambanda as a major trading hub. Those working as drivers (19.5%) and civil servants (19.5%) were equally represented. Other occupations (26.5%) included students, artisans and those in the informal sector.

In terms of income, those earning between 151,000-200,000 FCFA (29.0%) and above 201,000 FCFA (29.0%) were the largest group of respondents. This shows that there is a mix of middle-income earners (those earning between 151,000-200,000 FCFA) and upper middle-income earners (those earning above 201,000 FCFA). However, there were still a proportion of low-income earners (those earning less than 50,000 FCFA) (20.5%). Those earning between 51,000-100,000 FCFA (10.5%) and those earning between 101,000-150,000 FCFA (11.0%) were also present. Finally, 27.5% of those surveyed had lived in the area for longer than 20 years. This shows that there is a stable population with a high amount of local knowledge. The next largest group had lived in the area for between 6-10 years (22.5%). Those who had lived in the area for less than 5 years (19.5%) and between 11-15 years (18.0%) followed. Only 12.5% had lived in the area for between

Table 1: Socio-demographic characteristics of respondents.

Variable	Category	Frequency	Percent%
Neighborhood of Respondents	Mambanda	133	66.5
	Others	67	33.5
	Total	**200**	**100.0**
Sex of Respondents	Male	99	49.5
	Female	101	50.5
	Total	**200**	**100.0**
Age Range	15-24	37	18.5
	25-34	78	39.0
	35-44	59	29.5
	45-54	19	9.5
	55+	7	3.5
	Total	**200**	**100.0**
Marital Status	Single	92	46.0
	Married	99	49.5
	Divorced	8	4.0
	Widowed	1	.5
	Total	**200**	**100.0**
Level of Education	No formal education	11	5.5
	Primary education	23	11.5
	Secondary	67	33.5
	University	99	49.5
	Total	**200**	**100.0**
Occupation of Respondent	Trader	69	34.5
	Driver	39	19.5
	Civil servant	39	19.5
	Others	53	26.5
	Total	**200**	**100.0**
Monthly Income Range	<50000	41	20.5
	51000-100000	21	10.5
	101000-150000	22	11.0
	151000-200000	58	29.0
	201000+	58	29.0
	Total	**200**	**100.0**
Duration of Stay	Less than 5 years	39	19.5
	6-10 years	45	22.5
	11-15 years	36	18.0
	16-20 years	25	12.5
	20+	55	27.5
	Total	**200**	**100.0**

[Source: Fieldwork, 2026]

15-20 years. This shows that there is a constant flow of people moving into the area. This supports findings by Ngamo [19] who stated that at least three new people move into Mambanda daily.

Nature and Causes of Traffic Congestion

Level of Traffic Congestion: Figure 1 revealed that traffic congestion within Mambanda-Bonaberi is high, accounted by (45%) of the respondents. This was followed by very high level (32.5%), moderate (18%). While just a few accounted for very low and low

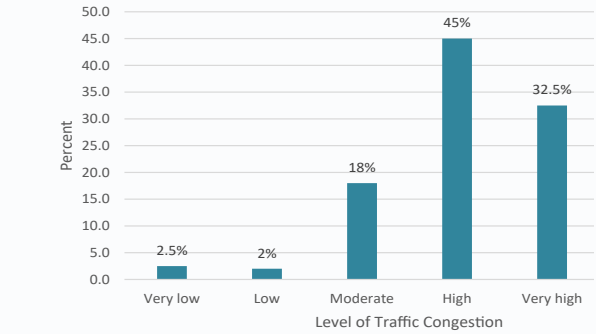


Figure 1: Level of Traffic Congestion.
[Source: Fieldwork, 2026]

Table 2: Major Causes of Traffic Congestion.

Causes	Frequency	Percent
Narrow road width	52	26.0
On-street parking	17	8.5
On-street trading	48	24.0
High number of vehicles	4	2.0
Poor road conditions(potholes)	23	11.5
Lack of traffic signals/signs	3	1.5
Informal transport behavior	26	13.0
No dedicated parking areas	1	.5
Flooding	26	13.0
Total	200	100.0

[Source: Fieldwork, 2026]

respectively at (2.5%) and (2%). This result therefore indicates that the combined majority (77.5%) of respondents acknowledges a high and very high traffic congestion, which could further be attributed to population growth, small road size with potholes, on-street trading amongst others.

Major Causes of Traffic Congestion: The main causes of congestion as identified by respondents in Table 2 shows that the most common cause of congestion in Mambanda-Bonaberi is narrow roads (26.0%). This is because the roads which were put in place have been designed for low volumes of local traffic but have become a main thoroughfare between Mambanda-Bonaberi and central Douala. The second most common cause of congestion was on-road trading (24.0%). This indicates that congestion has occurred due to the presence of trading on the roads. The informal transport activity (13.0%) and flooding (13.0%) were equally common. Poor road quality/potholes (11.5%) and on-road parking (8.5%) were also identified. Qualitative data showed that the on-road parking was an issue. A member of staff from the Council said "We try to enforce parking rules. We send our officers out; they give tickets to people who are parking illegally. Sometimes we take their cars away as well. However, the next day there are cars parked there again. We don't have enough officers to enforce it all the time. When we do enforce it, the drivers get upset. They sometimes get aggressive. It gets very tiring". The number of vehicles was identified as a cause of congestion by only (2.0%). Lack of traffic signals/signs were identified as a cause (1.5%) whilst lack of parking spaces was identified as the least common cause (0.5%). This is in line with the findings of [29] who found that on-road trading and narrow roads are the main causes of congestion in Douala's market areas.

Table 3: Experiences on the Traffic Congestion Types.

Statements	SD	D	N	A	SA	Total %
Experienced peak hour gridlock during morning (6-9 am) and evening (4-7 pm) periods.	1%	5%	6.5%	61%	31%	100.0
Accidents frequently cause significant traffic delays in this area	1%	3%	11.5%	67%	17.5%	100.0
Saturdays (market day) create severe congestion worse than weekdays	1.5%	-	27.5%	41%	30%	100.0
Flooding during the rainy season causes major traffic disruptions	1%	3.5%	18.5%	64%	13%	100.0
The Wouri Bridge is a major congestion bottleneck that causes long waiting times	6%	7%	42%	38%	7%	100.0
Carrefour Chico is a congestion hotspot where vehicles frequently queue for long periods	2.5%	4.5%	32.5%	42.5%	18%	100.0
Carrefour Alhadji is a congestion hotspot where vehicles frequently queue for long periods	2.5%	3%	23%	56.5%	15%	100.0
Road construction and repair works create additional traffic problems	2%	3%	11.5%	56%	27%	100.0
Congestion is so severe that vehicles remain stationary for more than 10 minutes at a time	1.5%	.5%	5%	57%	36%	100.0
The congestion problem has worsened significantly over the past 12 months	1.5%	3%	9.5%	55%	31%	100.0

SD= Strongly Disagree, D= Disagree, N= Neutral, A= Agree, SA= Strongly Agree.

The qualitative interviews gave more understanding on how each cause interacts to create extreme congestion. One interviewee who is a transport police officer with 12 years' experience in Douala IV Municipality said "*It is a combination of factors. The roads here are very narrow (only 4/5m wide). Traders block up the roads by putting their goods on them causing them to be only 3m wide. People then stop in the middle of the roads to buy things, drop off/pick up people which causes massive issues. In the rain (half the year in Douala) there is no drainage because the market blocks it up with rubbish causing flooding and no vehicles can go down the roads. A market official also said "Years ago the council decided this area would be a market but back then there were very few people living in the area. Now the market has expanded but the roads have not. We have over 3500 registered traders but only around 200 vehicles can park here. The rest park on the roads.*"

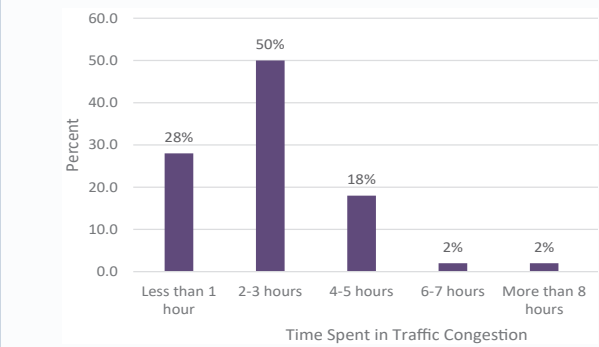


Figure 2: Time Spent in Traffic Congestion.
[Source: Fieldwork, 2026]

Traffic Congestion Experiences: Table 3 shows the experiences people had with the different types of traffic congestion in Mambanda-Bonaberi. This was measured using a 5-point likert scale (Strongly Disagree (1) to Strongly Agree (5)). The statement showing the most agreement was 'Congestion is so bad vehicles get stuck for more than 10 minutes' with (93.0%) agreeing or strongly agreeing. This means there is often extreme congestion in Mambanda-Bonaberi with vehicles getting stuck for long periods of time. This is the worst type of capacity congestion. The statement 'I have experienced gridlock during peak hours (6-9 am and 4-7 pm)' had (92.0%) agreeing or strongly agreeing. This proves that recurring congestion during the predictable peak hours is the main type of congestion. The statement 'The congestion problem has gotten worse over the last 12 months' had (86.0%) agreeing or strongly agreeing. This shows that congestion is getting worse and not stagnant. This can be linked to the increase in population (Estimated 180,000 in 2021 *vs* 132,000 in 2013) and motorisation rates. This matches with Tchouakeu et al [30] who found vehicle ownership in Douala is increasing at a far greater rate than road infrastructure causing congestion to get worse.

A total of 84.5% agreed or strongly agreed that there are often delays caused by accidents. This shows that accidents are causing a lot of issues. Roadworks were also seen as a large cause of congestion with (83%) agreeing or strongly agreeing that there are extra issues caused by roadworks. Flooding during the rainy season was also seen as a large cause of issues with (77%) agreeing or strongly agreeing. This shows that poor drainage on the roads and the effects of the weather is having an impact. (71.5%) agreed or strongly agreed that there are often queues at Carrefour Alhadji. The statement 'There is severe congestion on Saturdays (market day)' had (71.0%) agreeing or strongly agreeing. This shows that there are unique congestion issues at Mambanda Market as there are thousands more people visiting on Saturdays. Saturdays have been set by the Douala IV Council as the official market day. (60.5%) had their opinion on Carrefour Chico but this shows that it is recognised as an issue. The Wouri Bridge was not as high with only (45.0%) agreeing that there are long delays. This could be because many of the respondents live and work solely in Mambanda-Bonaberi so they are not crossing the bridge regularly. However, for those that do there are severe delays.

Time Spent in Traffic Congestion: Figure 2 shows how respondents are distributed based on how much time they spend stuck in traffic. It can be seen that the majority (50%) of respondents spend between 2-3 hours stuck in traffic. This shows that traffic is a significant problem for most residents. 28% of respondents however only spend less than an hour stuck in traffic meaning they do experience less traffic delays. 18% of respondents spend between 4-5 hours stuck in traffic showing a large percentage of residents do experience long delays. Only 2% of respondents spend between 6-7 hours stuck in traffic and another 2% spend more than 8 hours stuck in traffic showing a small percentage of people experience extreme delays.

Qualitative interviews provided powerful narratives on how

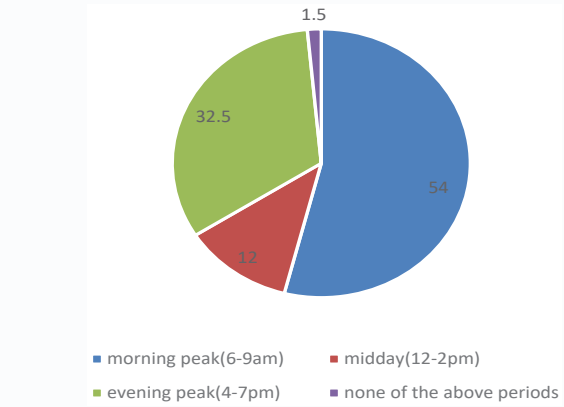


Figure 3: Periods Experienced in Traffic.

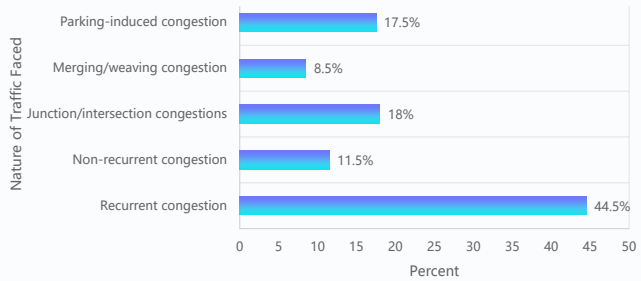


Figure 4: Nature of Traffic Faced.

congestion impacts on their lives. One woman who was a trader spoke about how she has two small children and said: "*I wake up at 4 o'clock to get my goods and my children ready for school. We leave the house at 6 o'clock. The school is only 2 km away but due to the traffic it takes us 45 mins to drop off my children. Then I go to the market which takes me another 30 mins. When I leave the market at 5 pm in the evening it takes me until 7.30 pm due to the traffic to get home. I can't cook, help my children with their homework or even relax. Every day is a struggle.*"

Time of Day Congestion: The figure 3 shows the times of day when people experience the most congestion. It shows that the most congestion happens in the morning peak time (6-9 am) which was identified by 54% of respondents. The second highest was during the evening peak time (4-7 pm) which had 32.5% of respondents. Midday (12-2 pm) does have less congestion but still had 12% of respondents. 1.5% had none of the above. This is a common issue for urban areas around the world. The times are clearly showing the double peaks as most journeys happen during these times. However, the midday congestion is interesting as it shows how Mambanda-Bonaberi is a commercial area so there are lots of market journeys which will occur throughout the day.

A key informant interview with a transport official provided insight into the dynamics of each period: *The morning peak is when traders are bringing goods to the market, students are going to school, and workers are going to offices. Everyone is trying to get somewhere so there's a lot of traffic on the road. The traffic starts to ease off by 9 AM however people come in to the market. From 10 AM to 2 PM, you have people coming to shop, delivery vehicles bringing more goods, and taxis dropping off passengers. It is not as bad as morning, but still slow. Then at 4 PM, schools close, offices close, and traders start packing up. Everyone is trying to go home at the same time. That is the worst period because everyone is tired and, in a hurry, so there are more accidents and more arguments.*

Nature of Traffic Faced: The nature of traffic congestion experienced by the respondents in Mambanda-Bonaberi is illustrated in Figure 4. From the figure above, it can be seen that the most common nature of congestion is recurrent congestion, which is experienced by (44.5%) of the respondents. Recurrent congestion is congestion that happens regularly and predictably at certain times of day, such as daily during the peak hours, because of regular travel demand exceeding the road capacity. From this, it is clear that Mambanda-Bonaberi's traffic congestion is not sporadic or random, but a systematic daily event that the residents have come to expect and to an extent plan for. Intersection/congestion is experienced by (18%) of the respondents. This is as a result of intersection points like Carrefour Chico and Carrefour Alhadji being the source of traffic congestion. Parking-related congestion is experienced by (17.5%) of the respondents. It results from people trying to park their vehicles or even parking illegally on the roads. Non-recurrent congestion resulting from accidents, breakdowns, flooding, and market days is experienced by (11.5%) of the respondents.

Test of Hypothesis for Objective One

Following the study's hypotheses, one stated as "The nature of traffic congestion in Mambanda-Bonaberi, Douala IV is significant", the Likert scale Analytical Test was conducted and results drawn taking into consideration the Weight Average Value threshold. The decision drawn at sum of Mean ÷ Total Statements = WAV as seen on table 4.

Table 4 depicts the weighted average analysis for Hypothesis One. From the table, it can be seen that out of the 10 congestion statements analyzed, 8 scored a mean score of more than 3.7, showing high perception levels, whereas two statements got a mean score of 3.33 and 3.69 which is Wouri Bridge bottleneck and Carrefour Chico hotspot respectively. The total mean scores are 37.23, and the weighted average score is 3.72 (37.23/10). Consequently, since the most of the indicators have a mean score higher than the Weighted Average Score of 3.72, we therefore accept the hypothesis as true that "The nature of traffic congestion in Mambanda-Bonaberi, Douala IV is significant."

Impacts of Traffic Congestion on Sustainable Livelihood

Impacts on Human Capital: Table 5 showed how traffic congestion influenced human capital, which refers to the set of skills, knowledge, good health, and ability to work. The table showed that traffic congestion influences all human capital significantly. Waste of time on a daily basis was responsible for (88.0%) being affected very much or extremely. Late arrival to work/school was (88.0%) of people being affected very much or extremely. This suggests that traffic congestion influences the education and employment of individuals through constant lateness. In an interview with a school teacher in Mambanda, she said: *My pupils who reside in Mambanda are late most of the days during the rainy season. The classes begin at 7:30 am, yet many come at 8:30 am or later due to the traffic they undergo. They miss the first class, sometimes even the second one. It is affecting their grades. Fatigue/exhaustion was (87.5%) affected very much or extremely. Stress/frustration accounted for (83.0%) being affected very much or extremely.*

Such observations suggest that congestion is not just a mere

Table 4: Test of hypothesis for objective one.

Statements	Mean	Std Deviation	Perception Level
Experienced peak hour gridlock during morning (6-9 am) and evening (4-7 pm) periods.	4.21	.667	High Perception
Accidents frequently cause significant traffic delays in this area	3.97	.708	High Perception
Saturdays (market day) create severe congestion worse than weekdays	3.98	.844	High Perception
Flooding during the rainy season causes major traffic disruptions	3.85	.724	High Perception
The Wouri Bridge is a major congestion bottleneck that causes long waiting times	3.33	.930	Low Perception
Carrefour Chico is a congestion hotspot where vehicles frequently queue for long periods	3.69	.904	Low Perception
Carrefour Alhadji is a congestion hotspot where vehicles frequently queue for long periods	3.79	.826	High Perception
Road construction and repair works create additional traffic problems	4.04	.832	High Perception
Congestion is so severe that vehicles remain stationary for more than 10 minutes at a time	4.26	.709	High Perception
The congestion problem has worsened significantly over the past 12 months	4.11	.807	High Perception
TOTAL	37.23	7.951	Overall High Perception

Decision= Weighted Average Value (WAV): 37.23/10 = **3.72**

Table 5: Human Capital Impacts.

Statements	Not at all	Slightly	Moderately	Very Much	Extremely
Time wasted daily	-	4.5%	7.5%	58.5%	29.5%
Late arrival to work/school	-	3.5%	8.5%	46.5%	41.5%
Fatigue/exhaustion	-	2%	10.5%	50.5%	37%
Stress/frustration	1.5%	6%	9.5%	44%	39%
Respiratory problems	4.5%	2.5%	26%	48.5%	18.5%

Table 6: Financial Capital Impacts.

Statement	Not at all	Slightly	Moderately	Very Much	Extremely
Increased transport costs	2%	5%	8.5%	58%	26.5%
Reduced income (trader/driver)	2%	3.5%	15%	51%	28.5%
Increased fuel consumption	-	3.5%	14%	45.5%	37%
Increased vehicle maintenance	.5%	5.5	16.5%	44.5%	33%

annoyance but a major cause of stress and fatigue. According to the testimony of a female trader*: The traffic exhausts me and stresses me out. By the time I get to the market, I'm already exhausted. I don't have any energy left to arrange my stuff properly or even smile at the customers. On some days I wish I could just shut down my shop and go home, but I can't because I need the money. The stress is also having an effect on my health; I have hypertension now, and the doctor said it was due to stress.* Respiratory problems were rated low in terms of percentage (67.0%).

Impacts on Financial Capital; Table 6 revealed the impacts of traffic congestion on financial capital, which encompasses income, savings, credit, and other financial resources that households use to achieve their livelihood objectives. The table revealed that traffic congestion has severe impacts across all financial capital indicators. Increased transport costs received (84.5%) affected very much or extremely. For non-vehicle owners who rely on public transport (taxis, motorbikes), congestion increases travel time, and transport operators pass on these costs to passengers through higher fares, particularly during peak periods. A motorbike driver explained: *When there is congestion, I can make fewer trips. To still earn enough money, I have to charge passengers more. Instead of 200 FCFA for a short trip, I charge 300 or 400 FCFA. The passengers complain, but what can I do? I also need to eat. The money has to come from somewhere.* Increased fuel consumption accounted for (82.5%) of respondents affected very much or extremely. This finding reflects the fuel wasted when vehicles idle in congestion or move in stop-and-go traffic, which consumes significantly more fuel per kilometer than free-flow driving. Reduced income had a respondent rate of (79.5%) affected very much or extremely. Increased vehicle maintenance registered (77.5%) affected very much or extremely.

Impacts on Social Capital: The effects of traffic congestion on social capital are illustrated in Table 7. Social capital refers to the networks, relationships, trust, social norms that allow people to work together and receive social support. From the results it can be seen that there are significant effects of traffic congestion on social capital. Whilst these effects are not as severe as effects on human and financial capital, they still have considerable impact. Missing social engagements had the highest effect on social capital with (68.0%) of respondents being very/extremely impacted. As traffic congestion is present, residents are unable to attend family events, birthdays, funerals and other important events. Within Cameroonian culture, social networks are fundamental for economic success, emotional support and community cohesion. Therefore, missing out on attending events will cause individuals to lose social connections and have less social support available to them. Having less time with family had an overall response rate of (46.5%) whilst missing out on religious services had an overall response rate of (44.5%). Having less involvement within the community had an overall response rate of

Table 7: Social Capital Impacts.

Statements	Not at all	Slightly	Moderately	Very much	Extremely
Missed social appointments	1%	5.5%	25.5%	53%	15%
Reduced time with family	1%	11%	41%	38%	8.5%
Missed religious services	3.5%	8%	44%	36.5%	8%
Reduced community participation	5.5%	9%	49.5%	25.5%	10.5%

Table 8: Physical Capital Impacts.

Statements	Not at all	Slightly	Moderately	Very much	Extremely
Vehicle damage (potholes)	2%	6%	17.5%	47.5%	27%
Limited access to healthcare	1.5%	10.5%	39%	35.5%	13.5%
Limited access to other services	3.5%	6.5%	35.5%	45.5%	9%

[Source: Fieldwork, 2026]

Table 9: Natural Capital Impacts.

Statements	Not at all	Slightly	Moderately	Very much	Extremely
Increased air pollution exposure	.5%	3.5%	12.5%	58.5%	25%
Increased fuel consumption	-	4%	11.5%	37%	47.5%

Table 10: Test of Hypothesis Two.

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Late arrival to work/school	Between Groups	18.295	4	4.574	9.273	.000
	Within Groups	96.185	195	.493		
	Total	114.480	199			
Reduced income (trader/driver)	Between Groups	17.991	4	4.498	6.594	.000
	Within Groups	133.004	195	.682		
	Total	150.995	199			
Limited access to healthcare	Between Groups	12.023	4	3.006	3.857	.005
	Within Groups	151.957	195	.779		
	Total	163.980	199			

(36.0%).

Impacts on Physical Capital: Table 8 shows the impact of traffic congestion on physical capital. Physical capital refers to infrastructure, tools, equipment, transport and other physical resources used by households to provide for their livelihoods. The damage caused to vehicles due to potholes means that 74.5% of respondents have been greatly or extremely impacted by the issue. Mambanda-Bonaberi has a large number of roads in bad condition meaning that when driving you will be going very slowly to avoid potholes, cracks and bumpy roads. This can cause damage to tyres, suspensions, axles and under bodies. (54.5%) of respondents have been greatly or extremely impacted by lack of access to other services. (49%) of respondents have been greatly or extremely impacted by lack of access to healthcare. This means that people cannot get to healthcare due to the traffic congestion. During interviews one resident mentioned they had a bad experience with the traffic congestion. "*Last year my neighbor had a baby. She went into labour at 6pm. We called an ambulance but they could not come because the road was blocked. Her husband took her on his motorbike but they got stuck in the traffic for over an hour. When they finally arrived, she had already given birth on the motorbike. They had issues and both the mother and baby almost died. This shouldn't really be happening in 2026. We are not in the middle of nowhere, we are in Douala which is the economic capital of Cameroon.*

Impacts on Natural Capital: Table 9 shows the impacts that traffic congestion has had on natural capital. This includes air and water quality and a natural resource base. The main impact was an increase in fuel usage (84.5% of respondents were very or extremely impacted). This is due to vehicles being less fuel efficient in traffic. Vehicles waste much more fuel because they are constantly accelerating and braking at low speeds. This can create issues financially but also environmentally. Fuel creates more greenhouse gases, like carbon dioxide (CO_2) when burnt causing climate change. Increased exposure to air pollution was also a major impact (83.5% of respondents were very or extremely impacted). When vehicles are stuck in traffic, they will be constantly emitting exhaust fumes causing those around them such as pedestrians, cyclists, traders by the road and local residents to inhale harmful pollutants.

Test of Hypothesis for Objective Two

Table 10 presents the results of the One-Way ANOVA used to validate the second hypothesis; 'traffic congestion has a significant influence on sustainable livelihood'. The three dependent variables were all significant ($p < 0.05$). Late arrival to work/school had an F

Table 11: Test of Hypothesis Three.

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Q44	200	3.42	2.215	.157

One-Sample Test						
	Test Value = 4					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Q44	-3.702	199	0.000	-.580	-.89	-.27

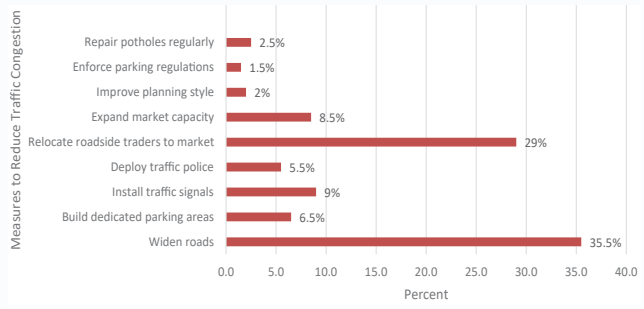


Figure 5: Measures to reduce Traffic Congestion.

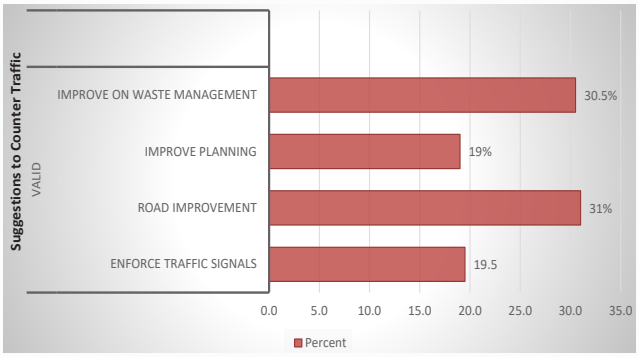


Figure 6: Key Suggestions to Counter Traffic Congestion.

value of 9.273, p = 0.000; Loss of income had an F value of 6.594, p = 0.000; and no healthcare had an F value of 3.857, p = 0.005. As all the p values are below the level of significance (0.05) the null hypothesis can be rejected 'there is no significant influence of traffic congestion on sustainable livelihoods, Douala IV' and the second hypothesis can be Accepted. This means traffic congestion does have a significant influence on sustainable livelihood. The longer people are stuck in traffic the bigger the impact will be.

Measures to Reduce Traffic Congestion

Measures to reduce Traffic Congestion: Figure 5 revealed respondents' proposed measures to reduce traffic congestion in Mambanda-Bonaberi. Road widening was the most frequently recommended measure (35.5%), reflecting the physical constraint of narrow roads (typically 4-6 meters wide) as the fundamental infrastructure problem. Relocate roadside traders to market accounted for (29.0%), install traffic signals (9.0%) were also highly recommended, indicating that respondents recognize the need for both infrastructure solutions and traffic management systems. Expand market capacity (8.5%) addresses the commercial activity dimension of congestion, recognizing that on-street trading reduces effective road width. Build dedicated parking areas (6.5%), while deploy traffic police voted (5.5%), repair potholes regularly and improve planning style account for (2.5%) and (2.0%) respectively. While enforce parking regulations represents (1.5%) which reflects the need for enforcement of existing rules which are currently poorly implemented.

Key Suggestions to Counter Traffic Congestion: Figure 6 shows other key suggestions from respondents. The most popular suggestion was improving the roads (31.0%). This is due to many people seeing that bad roads, not enough road space and the quality of the roads are a significant cause of traffic congestion. Improving roads, adding more roads and maintaining roads are seen as key ways to reduce traffic congestion. The second most popular suggestion was improving waste management (30.5%). This demonstrates many people feel that improper waste management causes congestion due to blockages in drainage, more flooding and blockage of roads from rubbish. Improving waste management will help to keep the roads accessible. Enforcing traffic lights (19.5%) shows that many people recognise the importance of having good traffic control to ensure vehicles are controlled, not causing unnecessary chaos and reducing delays. Finally, having better planning (19.0%) shows that many people agree that better planning should be carried out around the town such as land use, infrastructure and traffic policies to reduce congestion in the long term.

Test of Hypothesis for Objective Three

Table 11 shows the results of the one sample t-test used to test Hypothesis Three: "Strategic planning can reduce the implication of traffic congestion on livelihood in Mambanda-Bonaberi, Douala IV." This was done by comparing the mean score of respondents' perception of how effective strategic planning was (on a Likert Scale of 1-5 with 1 being Strongly Disagree and 5 Strongly Agree that strategic planning can reduce the implication of traffic congestion) to the test value of 4 (Agree). The sample mean was 3.42 (SD = 2.215). The results from the one sample t-test indicated that there was a significant difference between the mean scores at the 0.05 level (t (199) = -3.702, p = .000 (2-tailed)). As $p < 0.05$ we can therefore reject the null hypothesis. This means respondents agree that strategic planning can help but are not strongly agreeing. This may be because respondents have seen previous attempts of strategic planning fail due to the lack of good implementation.

Discussion

This study has shown that increase in population and economic

activities have resulted to significant increases in road dependence within the area. This has led to large issues with congestion. This is reflected by the high percentages of respondents stating that congestion in Mambanda-Bonaberi was high or very high (77.5%). This is similar to other studies within Douala [29, 30]. The average score of 3.72 (out of 5) shows that congestion is significant. The main reasons for congestion were found to be narrow roads (26%) and street trading (24%). This is supported by research conducted within Douala by Ngwa and Ngu [29] who identified that market related activities had a significant impact on reducing road capacity. However, this study has provided a quantitative analysis of how much congestion is caused by street trading and has identified the interaction between the different causes of congestion. This is because the roads are narrow (between 4-6 m) + street trading reduces the road width further to (3-4 m) + street parking reduces this further + high volumes of vehicles. Therefore, leading to gridlock. Previous studies did not identify this interaction.

Qualitative analysis provided important information to understand why the situation is occurring. An official from the market explained that street trading is permitted by the council as it brings in revenue. "We get taxes from the people trading on the streets (25,000 FCFA per month for each trader). There are 200 traders so we get 5 million FCFA per month and 60 million FCFA per year. That is quite a lot of money. If they were to move the traders inside then we would not get this revenue. Therefore, congestion is a political economy issue and not just a technical issue as the powerful are benefiting. Previous studies have only looked at technical aspects of congestion such as Daganzo [31] and Wang et al [32].

The study identified that residents were spending between 2-3 hours of their day stuck in traffic (50%). Similar to other studies looking at Lagos [9, 10] by Ogunbodede and Lawanson who identified that commuters were spending 3-4 hours. However, Mambanda-Bonaberi could have higher congestion problems based upon its population because it is a peripheral area with one entry point (Wouri Bridge). This creates a bottle neck [31] which is a major cause of delay due to congestion.

The impacts of congestion on sustainable livelihood were high for all 5 capital assets and were significant (All ANOVA <.05). The impacts on human capital (88% arrived late, 87.5% tired, 83% stressed) correlate with Ewing and Cervero's [33] Theory of Urban Congestion and Quality of Life. This theory identifies that urban congestion causes negative impacts on quality of life by increasing travel times. It also highlights the importance of urban planning. The responses indicated that many people believed that roads should be widened (35.5%) and improved (31.0%). This shows that people have an intuitive understanding that urban planning should occur. The impacts on social capital (68% missed social events, 46.5% less time with family) strongly correlate with Hine's [34] Theory of Social Disruption and Traffic Congestion. This theory identifies that social disruption occurs due to congestion. Hine argues that increased travel times and frustration caused by congestion can reduce social ties and community engagement. The fact that 68% of people missed social events is strong evidence for this. The impacts on natural capital (83.5% more air pollution, 84.5% more fuel usage) correlate strongly with [35] Theory of Environmental Quality and Traffic Congestion. Litman argues that increased congestion increases air and noise pollution. This can have a negative impact on quality of life. The fact that 83.5% responded that they had been significantly impacted by increased air pollution shows that residents are experiencing these impacts.

The responses showed that 84.5% of respondents had experienced significant increases in fuel usage. This is supported by studies showing that driving in congested areas causes inefficiencies [36]. More fuel is used per kilometer due to idling, acceleration and breaking. This not only has a financial impact but also affects the environment by causing greenhouse gases (mainly CO_2).

There was moderate agreement with hypothesis three (Mean score 3.42). This is because there is realism to the situation in Cameroon. The theory of Urban Congestion and Quality of Life [33] identifies that well planned urban areas can improve quality of life by increasing accessibility and reducing travel times. However, this assumes that planning will be put into practice. Within Mambanda-Bonaberi (and much of Cameroon) there is a big difference between planning and practice. The Communal Development Plan does not exist on the ground as the roads, bridges and parking do not exist. People are skeptical that strategic planning will reduce congestion as they have seen it fail before. "We have tried to enforce parking rules. We have officers who go out and give tickets and sometimes seize vehicles that are illegally parked. However, they park in the same places the next day. We do not have enough officers to enforce this consistently. When we do enforce there are complaints from drivers and sometimes, they become aggressive. It gets tiring." This shows that there are issues with enforcing rules are not due to a lack of rules or willingness to enforce them but due to capacity issues (not enough officers) and issues with putting plans into practice (people are resistant to following the rules). Solutions need to take these issues into consideration.

Conclusion

This study concludes that congestion in Mambanda-Bonaberi is severe, complex and impacting sustainable livelihoods. Through analysing 200 surveys and 10 key informant interviews 77.5% ranked congestion as high/very high. Congestion is caused by recurring, non-recurring, bottlenecks and capacity issues. This is mainly due to the road being too narrow (26%), street trading (24%) and poor drainage, informal transport and lack of parking. Results from ANOVA show that congestion has had a significant impact ($p < .05$) on all 5 livelihood capitals. Human capital- caused delay, tiredness, stress and respiratory problems. Financial capital- increased fuel costs, transportation costs and lower income. Social capital- missing appointments and less time with families/communities. Physical capital- damage to vehicles and less access to healthcare/services. Natural capital- increased air pollution and fuel usage. It is getting worse as 86% said it has gotten worse in the last year. Recommendations are to improve this by having a transport committee within the community. Report any violations, have staggered times. The council can widen the road on Rue de Marche Mambanda to 10 m, create 500 parking spaces, improve drainage, put traffic lights at Carrefour Chico and Alhadji, strictly enforce the 2004 planning law, ban parking and trading. The market can be expanded by creating 500 extra stalls and offering incentives. Hold quarterly transport forums. Government can provide more money to the municipality (500 million FCFA), ensure there is no corruption, create a National Urban Transport Policy and fund the BRT and electric motorcycles.

Competing Interests

Authors have declared that no competing interests exist.

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