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Article

Externalities of urban mobility and challenges for sustainable development in Grand Lomé, Togo

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Abstract: Urban mobility in Grand Lomé is affected by several negative externalities, including road congestion, insecurity and environmental pollution. Traffic jams cause considerable economic losses, estimated at more than 13,000 CFA francs per month for some public officials, and represent a financial drain of several million CFA francs per day on the Togolese economy. These challenges are accentuated by rapid urbanization and a dizzying increase in the number of vehicles, especially motorcycle taxis. These factors not only cause economic losses, but also to the deterioration of the quality of life of the inhabitants. On average, motorists lose up to 49.5 min per day in traffic jams, with fuel and time costs estimated at hundreds of thousands of CFA francs per year for each user of the main boulevards. Through an in-depth analysis of the impacts of these negative externalities on mobility and sustainable development, this study reveals that traffic congestion, combined with the lack of road infrastructure, generates considerable economic and environmental costs. These traffic jams also worsen air pollution, making the transport sector responsible for 80% of greenhouse gas emissions. These proposed solutions include: 1) The modernization of road infrastructure, culminating in the construction of new lanes entirely dedicated to public and non-motorized transport. 2) The regulation of motorcycle taxis, inspired by regional examples, to improve safety and efficiency. 3) The introduction of rapid transit systems, such as Bus Rapid Transit (BRT), to make travel more fluid. 4) The implementation of strict environmental standards and regular technical controls to reduce greenhouse gas emissions. These proposals aim to reduce social and economic costs, while promoting sustainable mobility and a better quality of life for residents.

Keywords: urban mobility; negative externalities; road congestion; air pollution; sustainable development; informal transport

1. Introduction

The challenges of urban mobility in Greater Lomé are aggravated by environmental issues, such as pollution due to an ageing car fleet and chronic traffic jams. In addition, there are technical problems, including deteriorating road infrastructure and insufficient regulation, which seriously compromise road safety. In addition, the lack of effective traffic management systems contributes to the increase in accidents, particularly during peak hours. To address these issues, it is essential to adopt a comprehensive approach that integrates environmental, technical and safety dimensions, while promoting sustainable and innovative solutions.

Traffic jams in Lomé generate significant economic losses and worrying environmental impacts, in particular due to the high CO_2 emissions produced by

vehicles that are often poorly maintained. Technical aspects, such as the dilapidated road infrastructure and the lack of adequate regulation of traffic flows, also contribute to the weakening of road safety. As a result, traffic accidents are recurrent, exacerbated by congestion at rush hour and a glaring lack of suitable facilities.

Grand Lomé does not yet have a structured network of modern public transport. Motorcycle taxis, which are part of the informal sector, remain the dominant mode, while public transport carried by SOTRAL buses is not able to cover the ever-growing demand of the Lomé metropolis and its surroundings. This situation sufficiently demonstrates the limits of the sector's governance and a lack of proactive planning, thus aggravating the economic and social challenges related to mobility. Indeed, urban mobility is one of the major challenges faced by major African metropolises, and Grand Lomé is no exception. In the West African sub-region, accelerated urbanization, combined with an average population growth of 2.7% per year (World Bank, 2023), is putting strong pressure on urban infrastructure, amplifying mobility challenges. Getting around the city is made difficult by road phenomena such as congestion, traffic accidents, and poor infrastructure management. These challenges are not without consequences: studies show that traffic congestion costs about 2 to 4% of annual GDP in countries such as Ghana and Senegal (Faye, 2020; World Bank, 2021). Guézéré (2008) adopts the same position when he states that traffic jams are one of the main obstacles to the accessibility of workplaces and residences, with direct impacts on the productivity of citizens and the national economy. This situation is exacerbated by the exponential increase in motorcycle taxis, an informal mode of transport that generates many negative externalities, particularly in terms of safety and pollution (Quénot-Suarez, 2012). However, as Gnakouri (2019) demonstrates, the regulation of the motorcycle taxi sector, through the introduction of driving licenses and licenses, as was done in Cotonou, could improve safety and reduce accidents. Urban mobility encompasses the ability of people to move efficiently through urban space, a key factor in economic and social development. However, gaps in governance and inadequate urban planning compound challenges in West Africa, including in Grand Lomé. In this city, rapid urbanization has led to an often-uncontrolled spatial occupation of the urban perimeter, characterized by an increase in intra-urban distances and a concentration of activities in the city center. This phenomenon confirms a trend observed in other metropolises such as Lagos or Abidjan, where the absence of integrated urban mobility policies accentuates socio-economic imbalances (SSATP, 2023). These dynamics lead to an overload of existing road infrastructure, intensifying congestion problems and compromising access to economic opportunities for a large part of the population (Figaro, 2008). Negative externalities, such as traffic accidents, environmental pollution and the disruption of transport systems, are direct consequences of this urban mismanagement. Indeed, ageing vehicles, mostly imported second-hand, are responsible for the emission of significant quantities of greenhouse gases (OECD, 2016), while road safety remains a major problem. In this regard, the WHO (2013) reports that road traffic accidents cost nearly 1.4 million lives worldwide each year, with alarming rates in sub-Saharan Africa. A recent study by the Ministry of Security and Civil Protection in Togo (2020) found a significant increase in road accidents, mainly attributable to human factors such as speeding and non-compliance with traffic lights.

Faced with these challenges, it is essential to adopt an integrated approach to rethink urban mobility in Grand Lomé, taking into account the economic, environmental and social dimensions. The economic impacts of congestion, such as the cost of delays to households and businesses, require solutions inspired by successful initiatives elsewhere, such as the Bus Rapid Transit (BRT) system implemented in Nairobi, which has reduced travel times by up to 30% in some areas (Mwangi, 2017). Similarly, the introduction of structured regulations for the informal motorcycle taxi sector, like the reforms undertaken in Cotonou, could improve road safety and the organization of transport flows (Gnakouri, 2019). Environmental impacts, including CO_2 emissions from traffic congestion, are also exacerbating climate change, requiring investment in green modes of transport. Environmental impacts, including CO_2 emissions from traffic congestion, are also exacerbating climate change, requiring investment in green modes of transport. This study aims to analyze the impacts of negative externalities on mobility in Grand Lomé, while exploring solutions adapted to local specificities, drawing inspiration from effective practices in other African countries.

2. Methodology

The methodology of this study is based on a mixed approach, combining quantitative and qualitative methods, in order to provide a comprehensive view of the negative externalities related to urban mobility in Grand Lomé. This methodological combination was chosen to build on the strengths of each approach: quantitative methods can accurately measure the magnitude of phenomena (such as economic losses from traffic jams or lost travel times), while qualitative methods provide a better understanding of the perceptions, behaviors and social impacts of mobility externalities. Such an approach is particularly advantageous in the urban context of Grand Lomé, where mobility dynamics are influenced by complex factors, such as user behaviors and the state of infrastructure, which require a thorough and nuanced understanding. In addition, it ensures that data are triangulated, thus enhancing the reliability of the results and the relevance of the recommendations.

2.1. Study sites and selection of road sections

The study focused on the main traffic axes of Grand Lomé, namely the Boulevard Gnassingbé Eyadema, the Boulevard du 30 Août, the Carrefour GTA, and the Port CIMAO Roundabout. Boulevard Gnassingbé Eyadema and Boulevard du 30 Août are essential arteries for intra-urban traffic, very busy and marked by high levels of congestion. Similarly, the GTA Junction and the Port CIMAO Roundabout are nerve centers of Lomean road network, recognized for their strategic importance and the frequent traffic jams that characterize them. These sections, which are among the most used by road users, are experiencing significant congestion. Their selection can be explained by their determinant and crucial role in intra-urban traffic and the recurrence of traffic jams observed, which makes them priority sites for in-depth study (see **Figure 1**).

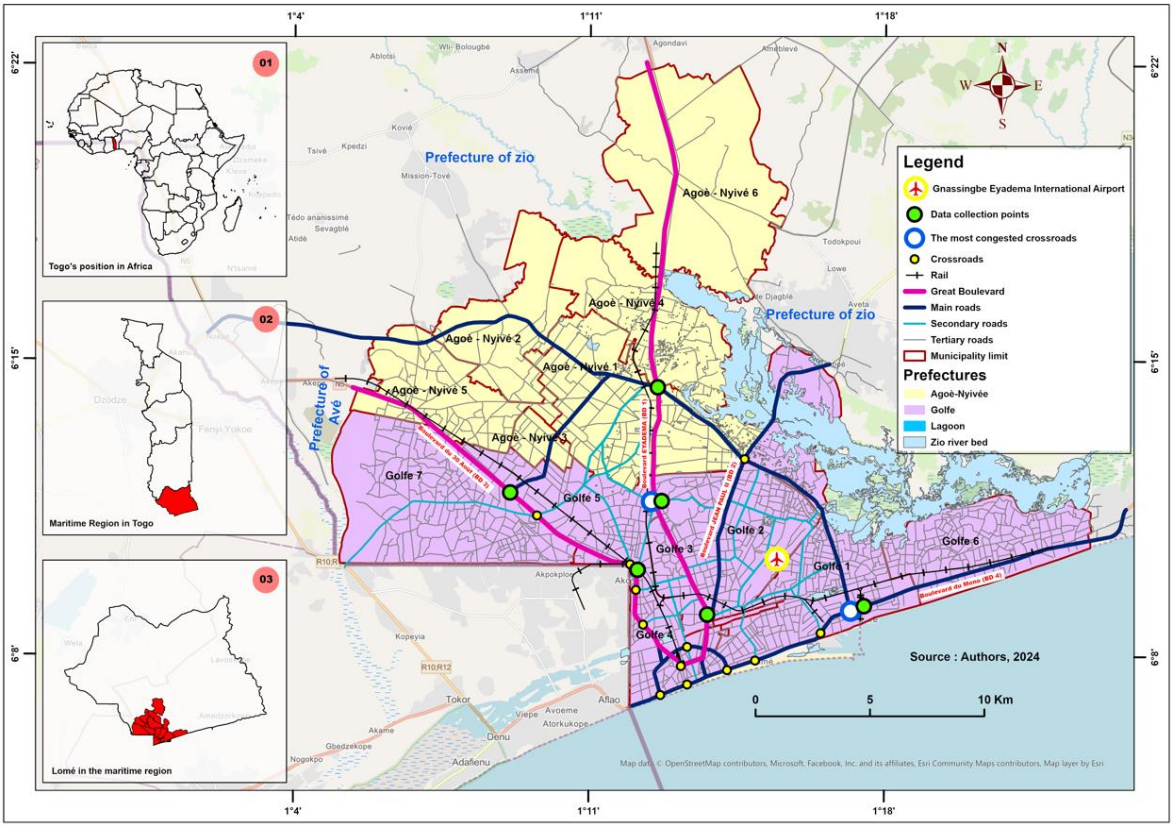

Figure 1. Main traffic routes and strategic points in Grand Lomé.
Source: INSEED, and fieldwork, 2024.

The map presents an overview of Grand Lomé, highlighting the specific sections studied as well as the data collection points. These sections have been selected to reflect the most representative areas of the urban transport network. A total of six collection points were identified across the city, each chosen based on its relevance to the analysis of traffic congestion and the impact of the transport system on traffic flow. These points serve as benchmarks to collect essential data to assess the traffic situation and its influence on transport users.

2.2. Data collection

Data collection was done via a mixed approach, combining direct observations and surveys of transport users. This mixed approach is adopted to obtain a global and in-depth view of traffic congestion phenomena and their impact on users. The direct observations were made during peak hours, i.e., during periods of particularly heavy traffic (from 6: 15 a.m. to 9 a.m. and from 5 p.m. to 7: 30 p.m.). These time slots were chosen because they show a high level of traffic on these roads by users, thus making it possible to observe the most significant behaviours and effects of traffic jams. During these periods, this collection technique made it possible to observe several key parameters:

- Traffic jam duration: Measuring the time between the beginning and the end of vehicle queues in specific areas;
- The main causes of congestion: Identification of the factors that contribute to traffic jams, such as accidents, faulty traffic lights, vehicle breakdowns, or

problems related to the road infrastructure such as lane narrowing, poor traffic conditions, etc.

- The impact on travel times: Analysis of the effect of congestion on the duration of users' journeys, by comparing travel times during congestion periods with those outside peak hours.

In parallel with the observations, surveys were conducted among a representative sample of road users, composed of motorists, motorcyclists and motorcycle taxi drivers.

This sample was selected to reflect the diversity of users affected by congestion, taking into account different modes of transport and demographic profiles. Detailed questionnaires were distributed to these users to collect their perceptions and experiences of congestion (**Table A1** in Appendix). These questionnaires focused on several key areas:

- Economic losses: Users were invited to express their opinions on the financial consequences of traffic jams, in particular in terms of additional costs (fuel, vehicle maintenance) and productivity losses due to delays;
- Delays caused: Participants were asked about the frequency and extent of delays they experience during their daily commute due to traffic jams;
- The impact on quality of life: The surveys also provided an understanding of how congestion affects users' daily lives, particularly in terms of stress, personal well-being, and effects on physical and mental health.

Data were collected by the research team led by the author, in collaboration with technicians specializing in urban studies and field surveys. They were trained to administer the questionnaires systematically and to accurately record the participants' responses. They were also instructed on how to observe user behaviour and note traffic conditions during rush hour. A strict protocol was followed to ensure the reliability and representativeness of the data.

The questionnaire is administered to 450 respondents including motorists, motorcyclists, and motorcycle taxi drivers. These respondents were distributed proportionately among the strategic sites selected for the study. This randomly selected sample size was considered sufficient to ensure representativeness of the results and analyses.

The combination of the two data collection techniques (direct observations and surveys) made it possible to collect quantitative data (travel time, duration of traffic jams) and qualitative data (user perceptions, impacts on quality of life), thus offering a well-in-depth overview of the factors contributing to congestion and its consequences on users.

2.3. Data processing and analysis

This phase took place in two stages. The first step relates to the quantitative analysis where the delay times and traffic jams were converted into economic costs based on the Average Base Salary (ABS) of permanent civil servants. These costs were calculated per minute of delay on the different sections studied, based on the total number of minutes of work per month (14,400 min). Regarding the second phase of qualitative analysis, users' comments and perceptions regarding the impact of traffic

jams on their quality of life made it possible to better understand the social and psychological repercussions of road congestion.

This section presents only the findings from the study methodology, without incorporating the external context or background information, which are discussed elsewhere.

3. Results

In Lomé, the transport offer is largely dominated by shared taxis and motorcycle taxis, because public bus transport remains insufficient and poorly developed. Indeed, the buses of the Lomé Transport Company (Société des Transports de Lomé: SOTRAL (SOTRAL is the only conventional public transport operator in Greater Lomé)) cover only 30% of the daily demand for transport, forcing a majority of inhabitants to turn to informal solutions such as motorcycle taxis, city taxis and personal means of transport. This situation, which leads to a strong dependence on private vehicles and means of artisanal transport, contributes to increasing road congestion. This provides more clarity on the causes of congestion and explains the effects of the current transport system in more detail. In this section, we present the results obtained from the different data collection methods put in place to analyze traffic jams and their impacts on transport users.

3.1. Non-recurring traffic jams

Also called incident congestion, they are due to random phenomena, and are caused locally by an accident, a breakdown, a construction site. They can occur at any time of the day. The French daily “Le Figaro” in its issue of 2 April 2008, reported that non-recurring traffic jams are described as “mechanical congestion” and are linked to “an accident, roadworks and traffic lights at half-mast”. These phenomena contribute to changing car traffic on the road section concerned. The duration of the traffic jam in this case depends on the inconvenience and the number of vehicles involved. Frequent lane changes are also the cause of this type of congestion since they also cause these untimely braking.

In Lomé, traffic jams take place during rush hour and on the main arteries of the agglomeration. They express the notion of the recurrence of transport demand, and more specifically express the fact that the volume of traffic exceeds the (fixed) supply of the road network. This situation sometimes leads to road accidents. The demand for transport is linked to the travel generated by the daily activities of city dwellers (studies, work, and leisure). It therefore tends to be concentrated in short periods of time called rush hour. Peak hours are observed twice during the day: In the morning from 6: 15 a.m. to 9 a.m. and in the evening from 5 p.m. to 7: 30 p.m. This means that recurrent congestion is heavier in the mornings and evenings during rush hour when workers leave (in the morning) and return (in the evening) (Quénot-Suarez, 2012, p. 20).

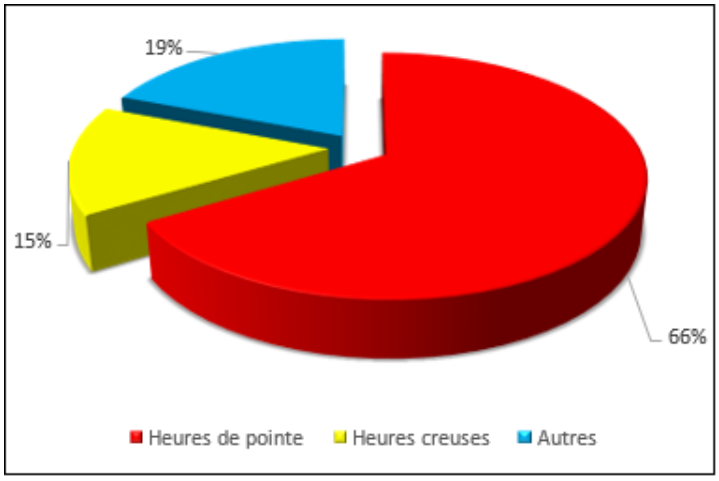

Figure 2. Figure showing the times of congestion.
Source: Fieldwork, 2024.

Figure 2 shows that in the city of Lomé, 66% of traffic jams occur during peak hours, i.e., in the morning from 6: 15 a.m. to 9 a.m. and in the evenings from 5 p.m. to 7:30 p.m., compared to 15% for those on non-peak hours. “Traffic jams also occur during unforeseen phenomena such as accidents, sudden vehicle breakdowns, or malfunctioning traffic lights, etc. These represent 19% of cases.”

Drivers in Lomé are confronted with traffic jams on a daily basis, the intensity and frequency of which vary according to the areas of the city. These traffic jams occur repeatedly during rush hour, in the morning and evening. The mobility problems observed on the streets of Lomé greatly affect road users. In particular, there is a lack of security and regulatory agents, such as the police and the Motorized Brigade, at strategic points such as the main roundabouts and intersections. This, combined with the lack of traffic lights or their malfunction, leaves drivers driving in a disorderly manner, leading to an increased risk of accidents. In addition, the inadequacy and poor condition of traffic lights at several intersections are frequent causes of traffic congestion and accidents. It is common to see many traffic lights at roundabouts in poor condition or completely out of service (**Figure 3**).

Figure 3. Malfunctioning traffic light on ECOWAS Boulevard.
Source: Fieldwork, 2024.

Figure 3 shows the malfunctioning state of the traffic lights on the roads in the city of Lomé. The photo shows a fire that breaks down in the middle of the night and is marked by the absence of road safety officers. Under these conditions, accidents that cause congestion are inevitable. Field work has shown that more than 45% of traffic lights are in poor condition (**Table 1**).

Table 1. Share of inactive traffic lights on the four main roads in the city of Lomé (%).

Boulevards	**Recorded traffic lights**		**Total number of traffic lights out of service (%)**
	Available	**Inactive**	
Gnassingbé Eyadema	14	6	30%
Mono	3	1	25%
30 Août	6	3	50%
Jean Paul 2	5	3	38%
Total	28	13	46.42%

Source: Fieldwork, 2024.

Table 1 shows the state of the traffic lights on the four main roads structuring the city of Lomé. Out of a total of 28 traffic lights identified, nearly half do not work. We have a total of thirteen (13) malfunctioning red lights are 46% against only 15 (53.58%) in operation.

On Boulevard Gnassingbé Eyadema (Bd1), 6/14 traffic lights are not working. On Boulevard Jean Paul (Bd2) 2, 3/5 of the traffic lights are in a state of malfunction. On the Boulevard du 30 Août (Bd3), we have a ratio of 3/6 of traffic lights that are in a state of malfunction while the Boulevard du Mono (Bd4) has a total of 1/3 red lights broken. According to the explanations of the interviewees, fires that appear to be in good condition are not always in good condition. This means that the 53.58% of traffic lights that are in good working order are not permanently working well. A driver of a personal vehicle confesses in these terms:

“Every morning when I pass, some lights don’t work and when the police are not there to guide us, everyone drives according to them.” A motorcycle taxi driver adds that “traffic jams are more accentuated by the poor condition of the roads and their lack of signaling light equipment”.

To fill this gap and ensure smooth traffic, the ministries responsible for road safety and urban traffic deploy their officers at intersections without traffic signs or at sites where traffic lights are out of service. The officers’ role is to control and regulate traffic on the roads (**Figure 4**).

Figure 4. A police officer at the CCL intersection to regulate traffic.
Source: Fieldwork, 2024.

Figure 4 shows a police officer at a crossroads on National Road No. 2. Its presence replaces traffic lights. It should be noted that in this intersection the traffic lights are present but do not work. At intersections such as GTA, Agoè and Kégué interchanges, CIMAO, Port roundabout, customs roundabout and Saint-Joseph roundabout, police officers regularly replace or compensate for the work of traffic lights that are insufficient in number or broken. There is also a lack of road signs on the tracks.

The weakness or non-existence of the regulatory framework also results in insufficient and poor design of the pathways. Insufficient parking lots, and the narrowness of the roads, which vary for the most part from 5 cm to 6 cm in width, are clear proofs. The insufficient number of dual carriageways leads to the crowding of users on a single carriageway. This leads to long-term traffic jams. The case is remarkable on the Boulevard du 30 Août and the Boulevard des Armées, which are one carriageway away despite being the boulevards best frequented by the Loméans. On these lanes, the “round trip” movements of users are carried out on the same roadway with a corporation of users without distinction of mode of chartered transport. Bicycle cyclists, motorcyclists and even vehicle drivers all find themselves on the same roadway.

Each user tries to make his way through the road congestion with all kinds of reprisals. The situation becomes more delicate when the machines involved are in large numbers and exceed the capacity of the road. This is what justifies the long-tail traffic jams that can be observed in the streets of Lomé. The Avénou-Total, Atikoumé-Donou and Akosombo red light intersections (on the Boulevard du 30 Août), Agoè-interchange, GTA, CFAO and Colombe de la paix (on the Boulevard Gnassingbé Eyadema), port roundabout, CIMAO and Palm Beach (on the Boulevard du Zio) and Kégué-interchange and Saint-Joseph (on the Boulevard Jean-Paul II) are illustrative examples. These different junctions are the main congestion points in the city of Lomé.

3.2. The economic losses inherent in road congestion in Grand Lomé

The economic benefits of traffic jams are apprehended by taking into account the loss of time on the roads, the delays that this causes and the analysis of the estimated cost of these lost times during traffic jams on the four sections targeted by this work.

3.2.1. Time lost by road users in Grand Lomé

In the city of Lomé, traffic jams cause a daily loss of time that accumulates and, at the end of the month, represents a considerable amount of time that should not be overlooked. These lost times represent more than a quarter of the normal travel time that users would have to take. **Figure 5** shows the time lost by motorists stuck in traffic jams according to the route taken to access the city center.

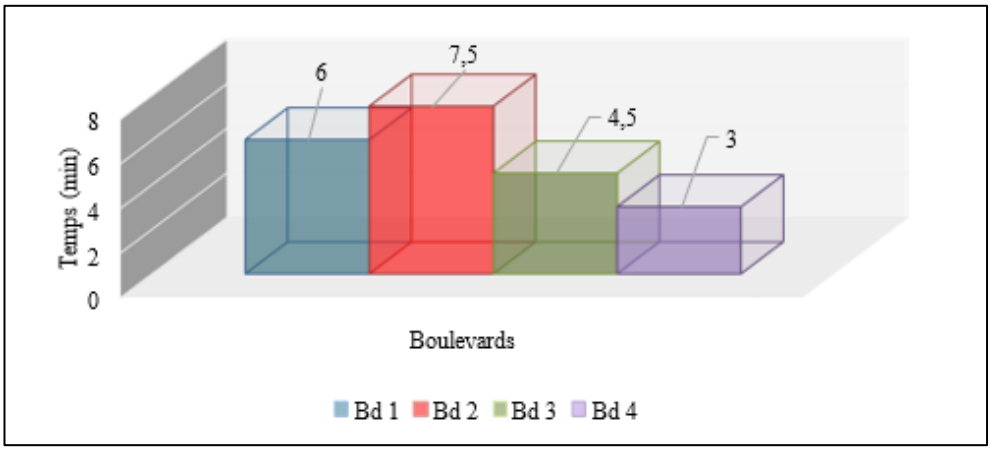

Figure 5. Time lost by motorists by section during traffic congestion at morning rush hour (6:15–8:15 min).
Source: fieldwork, 2024.

The analysis of **Figure 5** shows that in the morning, vehicle users each lose an average of 6 min, 7 min, 5 min, 4 min, 5 min and 3 min in traffic jams on boulevards 1, 2, 3 and 4 respectively. The time lost by vehicle drivers on the Bd 1 and Bd 2 segments is higher compared to that lost on the Bd 3 and Bd 4 sections. This situation is justified by the fact that in the morning a large number of motorists take the Boulevard du 30 Août and the Boulevard de Gnassingbé Eyadema to reach the city center. As a result, these two lanes represent the most congested lanes where motorists lose more time during rush hour. **Figure 6** illustrates how congestion threatens mobility on Bd 1.

Figure 6. Traffic jam at the GTA junction.
Source: Fieldwork 2024.

Figure 6 shows a congestion situation at the GTA crossroads. The density of

congestion explains the loss of time observed during the comings and goings of users on Boulevard 1. As for the low time lost at Bd 3 and Bd 4, this is explained by their low use. On Boulevard 3, few people from the Eastern suburbs frequent the city centre. This flow from the East is absorbed by the port area and its ancillary economic activities. Also, Bd 3 is less congested because when they arrive at the Kégué Interchange crossroads, most motorists veer east to go to work at the port. For these reasons, traffic on both boulevards is less dense during the morning rush hour. Congestion is also observed in the evenings at the end of the service period (**Figure 7**).

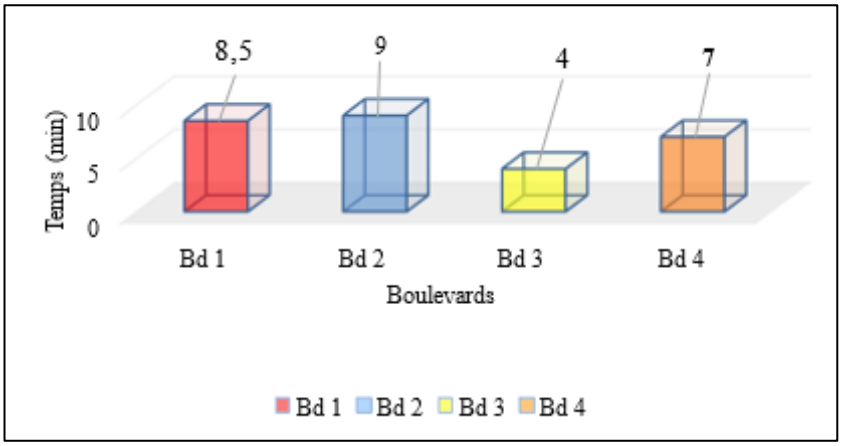

Figure 7. Time lost by motorists by section during congestion at the evening rush hour (5:30 pm–7:45 pm UTC).
Source: Fieldwork, 2024.

According to **Figure 7**, in the evening all four lanes recorded congestion. The high density of traffic is still present on Bd 1 and Bd 2 with successively 8.5 min and 9 min of time lost in traffic jams on the return of services. The loss of time is also accentuated on Bd 4 min where 7 min of time lost by motorists are recorded. This traffic jam recorded in the evenings on Bd 4 can be explained by the fact that port employees living in the northeastern suburbs go to the central districts to stock up on foodstuffs of all kinds before returning home. No longer able to bypass to return to the CIMTOGO roundabout, they are forced to take Boulevard Jean-Paul 2 to return to their residence.

Motorcycles suffer the same cost. The share of time lost by motorcyclists in traffic jams is shown in **Table 2**.

Table 2. Time spent by a motorcyclist during morning rush hours (6: 15a.m.–8: 15 a.m.) and evenings (5: 30a.m.–7: 45 p.m.).

Boulevards	**Bd 1**		**Bd 2**		**Bd 3**		**Bd 4**	
Avarage time lost (min)	M	S	M	S	M	S	M	S
	4.5	6.75	5.1	5.9	3.8	4	4.3	3.25

Source: Fieldwork, 2024.

Table 2 shows that in the morning, motorcycles lose an average of 4.5 min; 5.1 min; 3.8 min; 4.3 min respectively on boulevards 1, 2, 3 and 4. The time lost on Bd 1

and Bd 2 is higher compared to Bd 3 and Bd 4. This situation is due to the fact that many users of the northern and north-western peripheral districts (Adidogomé, Zanguéra, Sogbossito, Légbassito, Agoènyivé, Togblékopé and Adétikopé) use boulevards 1 and 2 to get to the city center in the mornings. The importance of the time lost by motorcycle drivers on these arteries can be explained by the density of traffic jams. Boulevards 3 and 4 are experiencing less dense traffic jams. In the evening, on the way back from the office, motorcyclists lose an average of 6.75 min; 5.9 min; 4 min and 3.25 min respectively on boulevards 1, 2, 3 and 4 according to **Table 2**. They therefore lose more time in congestion on boulevards 1 and 2 than on boulevards

However, it should be noted that there is a traffic jam on the four boulevards at the time of departure from service in the evening (**Figure 8**).

Figure 8. Traffic jams on the main roads in Lomé.
Source: Fieldwork, 2024.

Figure 8 shows how the other sections are congested during rush hour. “On this board, we can see Bd 1, Bd 2 and Bd 3 in a situation of congestion in the evening, during the peak period.” “This is due to the influx of users who have travelled, largely using individual means of transport.”

In view of the different results, it should be noted that in the morning, sections 3 and 4 are not congested, while in the evening, all sections experience a real traffic jam at rush hour. Data collected in the field reveal that on the four boulevards for a trip from the outskirts to the city center, motorcyclists lose less time in traffic jams than motorists. Motorists spend 49.5 min in traffic jams, an average of 12.3 min of lost time, while motorcyclists lose a total of 37.58 min with an average of 9.3 min. There are several reasons for these disparities. The ease of handling motorcycles, the ability of motorcyclists to easily weave through the rows and the volume of space that motorcycles occupy on the lane next to cars are the reason for the less time that the latter spend in congestion. The time lost on the four arteries causes delays in the services of civil servants and economic operators. It also has repercussions on the

national economy.

3.2.2. Time lost in congestion, a loss of income for users and the State from an economic point of view

The time lost in traffic jams has consequences for the quality of life of individuals as well as effects on the economy as a whole (CCA, 2016, p. 5). The costs related to the loss of time in traffic jams on the four lanes are analysed by taking into account only the Permanent State Agents (PSA) according to whether they are in the category of civil servants A, B, C, or D. The study only takes into account the EPAs due to the lack of availability of data on other types of road users working in the private sector. The analysis uses the calculation of the Average Cost of Time Lost in Traffic Jams (ACTLTJ) on the four boulevards. Thus, this ACTLTJ will concern motorists and motorcyclists. The following indicators are considered:

- Average Base Salary by Category (ABS/Category)

ABS/Category = BS/12 (12 being the number of steps per category and ABS the average basic salary of the APEs according to their category. Data on ABS are collected from the Togolese State Treasury. Thus,

ABS category A = 33.519 CFA francs

ABS category B = 26.658.36 CFA francs

ABS category C = 17.981.14 CFA francs

ABS category D = 13.848.43 CFA francs

- Average Base Salary per minute (ABS/min)

ABS/min = ABS/Category ÷ 14,400 (14,400 being the number of minutes of work in a month. It is considered that 1 day = 8 h of work and 1 month = 240 h of work. Thus, 1 month of work corresponds to 14,400 min of work, especially since the time lost in traffic jams is estimated in minutes).

The ABS/min is summarized in **Table 3** according to the different routes.

Table 3. Summary table of ABS/min by category.

Civil servant category	**A**	**B**	**C**	**D**
ABS/min (Fcfa)	2.32	1.85	1.24	0.96

Source: Fieldwork, 2024.

Table 3 shows the cost of time lost by a PSA according to the category of civil servant to which he belongs. The analysis of the data contained in the table shows that senior civil servants (those in category A) lose 2.32 CFA francs for one minute lost in traffic jams while category D EPAs lose 0.96 CFA francs per minute. The Average Base Wage per Minute was used to calculate the Average Cost of Time Lost in Traffic Jams (ACTLTJ) on each of the four arteries.

ACTLTJ = ABS/min × TLTJ/min

ACTLTJ: Average Cost of Time Lost in Traffic Jams

ABS/min: Average Base Salary per Minute

TLTJ/min: Time Lost in Traffic Jams per Minute

This cost is estimated according to whether the PSA is a motorist or a motorcyclist (**Tables 3** and **4**).

Table 4. Estimate of the daily and monthly cost of time lost in traffic jams by an APE in a car on boulevards 1 and 2.

PSA category	**A**		**B**		**C**		**D**	
Boulevards	Bd 1	Bd 2	Bd 1	Bd 2	Bd1	Bd 2	Bd 1	Bd 2
ACTLTJ/day (Fcfa)	33. 64	38. 28	26.82	30.52	17.98	20.46	13.92	15. 84
ACTLTJ/Month (Fcfa)	1 009.2	1148.4	804.6	915.6	539.4	613.8	417.6	475.2

Source: Fieldwork, July 2020.

According to the data in **Table 4**, it can be seen that vehicle drivers incur enormous financial costs due to the time lost in traffic jams. The example considered in the table concerns boulevards 1 and 2. We realize that a category An APE loses more than 1.000 CFA francs per month in congestion. This is the case on Bd 2 where an APE/A loses 1148.4 CFA francs per month; which is equivalent to a sum of 13,780.8 CFA francs per year. An APE/D loses on Bd 2 on average 475.2 CFA francs, the equivalent of 5702.4 CFA francs. According to the data in **Table 5**, four agents of different categories cause the Togolese State to lose 5923.8 CFA francs per month, or 71,085.6 CFA francs per year on the two tracks.

Table 5. Estimated daily and monthly cost of time lost in traffic jams by an APE on a motorcycle on boulevards 3 and 4.

PSA category	**A**		**B**		**C**		**D**	
Boulevards	Bd 3	Bd 4	Bd 3	Bd 4	Bd 3	Bd 4	Bd 3	Bd 4
ACTLTJ/ day (Fcfa)	18.09	16.88	14.43	13.46	9.67	9.02	7.48	6.98
ACTLTJ/month (Fcfa)	542.7	506.4	432.9	403.8	290.1	270.6	224.4	209.4

Source: Fieldwork, 2024.

Table 5 shows that the cost of time lost in traffic jams by officers using motorcycles as a means of transport differs according to the category and the route taken. Boulevards 3 and 4 are analysed in this part of the study. Indeed, an APE on a motorcycle in a traffic jam cuts the national economy by an average of 542.7 and 506.4; 432.9 and 403.8; 290.1 and 270.6; 224.4 and 209.4 CFA francs per month respectively on boulevard 3 and 4 depending on whether it belongs to category A, B, C or D, i.e., 6512.4 and 6076.8 respectively; 5194.8 and 4845.6; 3481.2 and 3247.2; 2692.8 and 2512.8 CFA francs on average per year. Four agents, each in a category, cause the State to lose a sum of 17,881.2 CFA francs per month, or 16,682.4 CFA francs per year.

In view of the thousands of APEs who use these different arteries every day to access the city center, not to mention those in the private sector, it should be noted that the Togolese State loses millions of CFA francs every day due to traffic jams with the loss of time and fuel on these arteries. “In addition to the economic impacts of congestion, the environment is also affected by the effects of these traffic jams in Grand Lomé.”

3.2.3. The impact of congestion on environmental components

The transport sector is the source of environmental pollution. Around 28% of total CO_2 emissions come from the transport sector. CO_2 is one of the main culprits of the greenhouse effect. Road transport accounts for about 80% of total greenhouse gas

emissions from transport (OECD, 2016). According to Edoh (2014, p. 256), it is "the very high proportion of used cars (VO), very old, moreover, within the Togolese car fleet" which constitutes the great handicap of vehicles on the move in the environment. This handicap is much greater when these vehicles get stuck in traffic jams as observed on the main roads of the city of Lomé. The role of recovery vehicles in the environmental pollution of the Togolese capital is not negligible.

3.3. Road safety weakened by congestion on Lomé's roads

Travel allows urban dwellers to reach the various places of work (jobs, markets, schools, hospitals). However, Edoh (2014, p. 273) has shown that "the intensification of urban traffic leads to malfunctions that most often result in accidents that endanger the lives and physical integrity of users and goods". According to the WHO (2013), road accidents cause 1.4 million deaths per year and "the probability of dying from them depends on where you live". This focus on road accidents shows how congestion affects mobility.

However, traffic accidents are frequent. The data are collected from the national police services and the central fire service. The Gnassingbé Eyadema Boulevard, for example, has accidents almost every day. A resident near the boulevard in the Agoè-sorad district says: "For me, it's the ambulance whistles that serve as an alarm every morning." Indeed, this interviewee finds that accidents are frequent on this boulevard to the point of comparing the whistles of emergency ambulances to the alarm bell. A petrol station attendant located on the edge of the Boulevard du 30 Août in front of the "Le Champions" supermarket says: "On this road, accidents are frequent, especially when civil servants go to work in the mornings and leave work in the evenings".

This focus on rush-hour road accidents on these sections shows how much rush hour congestion affects the mobility of people on the roads in the city.

The compilation of the data collected shows that the number of accidents in the city of Lomé has been increasing steadily over the years. **Figure 9** shows the evolution of traffic accident cases from 2010 to 2023 in Lomé.

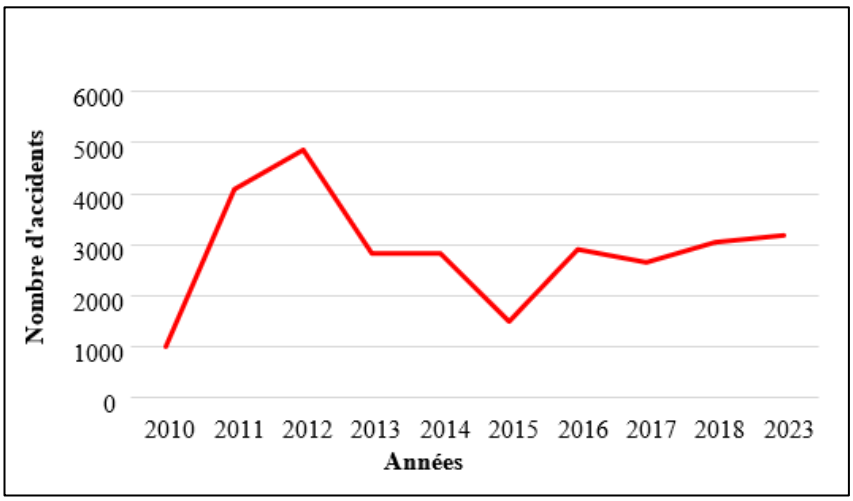

Figure 9. Evolution of road accidents from 2010–2023 in the Lomé agglomeration.
Source: MSPC, 2020.

Figure 9 traces the evolution of traffic accidents in the city of Lomé during the

decade 2010–2019. In 2010, the number of accidents was 1004. It has increased over the years and reached 4843 in 2012 due, among other things, to non-compliance with the highway code and the poor condition of the roads. The recurrence of traffic jams was the main cause of accidents, especially during rush hour. The decrease in the number of accidents during 2013 with a total of 2824 is linked to the adoption of the new Highway Code by the Togolese National Assembly. This explains the presence of the police on the roads to regulate traffic and reduce the number of accidents as much as possible. This led to a decline in the number of accidents, which only experienced a rather mild and oscillatory evolution between 2013 and 2023, when it stabilized at 3178.

3.4. Technical factors

As mentioned above, the increase in the number of cars is a source of many accidents, due to its obsolescence. However, this growth became more significant in the aftermath of the country's independence year.

From 25,655 vehicles between 1963 and 1989, the number of registered vehicles, all categories combined, reached 687,643 units during the decade 2001–2011. At the same time, the evolution of the number of two-wheeled machines from 50 to 125cm^3 and more has evolved exponentially. It went from 1601 units registered in 1991 to 14,445 registrations in 1997 to reach 42,283 mopeds registered in 2011. In 2018, the number of motorcycles registered was 43,063 units, far exceeding the number of vehicles (21,283). Today, the number of motorcycles in the country is close to one million, making Togo "a country of two wheels". According to the Directorate of Road and Rail Transport, at least 70% of the machinery (vehicles and motorcycles) is concentrated in Greater Lomé. And according to 21% of those surveyed, the recurrence of traffic accidents is attributable to the growth in the number of cars and motorcycles in Lomé.

The second technical factor, which also contributes to traffic accidents, is that many drivers do not have the required documents to drive: the driver's license. Indeed, the work on the ground has confirmed the reality of this fact. It appears according to the categories of users that 75% of motorcyclists do not have a driving licence, as do 15% of motorists. Generally speaking, only 40% of road users in Lomé (all categories combined) have a driving license compared to 50% who do not. The remaining 10% did not decide whether or not they had this famous document. This is a serious obstacle to road safety.

The third factor that also contributes to the redundancy of traffic accidents in Lomé and which relates to vehicles is the technical inspection. Indeed, this technical inspection is the guarantee or even the insurance that the DTRF gives to a vehicle for its registration. However, it is important to note that some vehicles, whose technical inspection has expired for a quarter or even a half-year, circulate without being worried. Similarly, it is not unusual in Grand Lomé to see police officers stop vehicles that have not committed any offence and whose technical inspection is up to date. And it is during discussions with the agent that many realize that their technical visits are not real. And yet, it was issued to the DTRF. Indeed, despite all the measures taken to modernize the control and ensure the reliability of vehicles, fraud and corruption

persist in this sector.

Another factor, which also deals a hard blow to road safety in Togo, is: oversized loading. Normally reprimanded or even repressed by the traffic police, oversized loading has become a godsend for them to fill their pockets. The presence of the police, far from ensuring road safety, rather ensures the safety of their pockets. This is a real boost to road safety, especially in the country and in Lomé. In addition to the factors mentioned above, other factors related to traffic lanes also play a role in traffic accidents.

3.5. Environmental factors

Although human factors are the primary causes of traffic accidents associated with technical factors, other factors are also involved in the occurrence of traffic accidents. These are factors related to traffic routes, i.e., the environment in which mobility takes place. As we pointed out in the previous chapter, efforts have been made for almost ten years. “However, much more needs to be done, as better roads generally improve road safety.” In this sense, investments for the construction, rehabilitation and improvement of road infrastructure are of paramount importance if we really want to improve road safety in Togo.

4. Discussion

Traffic congestion is a major challenge for Grand Lomé, similar to the problems encountered in other West African metropolises, such as Accra and Lagos. According to Quénot-Suarez (2012), rapid urbanization and the growth of informal settlements contribute to structuring Accra’s urban landscape by creating significant traffic constraints. These challenges are compounded by inadequate public transport infrastructure. In response, Lagos has invested in rapid transport infrastructure, but the results show that it remains insufficient to absorb the constant influx of vehicles (Ajayi, 2018). Similarly, Nairobi in East Africa has implemented a Bus Rapid Transit (BRT) system, which has reduced travel time in some areas by 30% (Mwangi, 2017). However, Lomé does not yet benefit from such modern infrastructure, thus limiting its ability to effectively manage its traffic flows, especially at peak times. The adoption of rapid transport solutions could, as the experiences of Nairobi and Lagos suggest, offer a viable alternative to alleviate road congestion in Lomé.

The informal motorcycle taxi sector, particularly popular in Grand Lomé, plays a crucial role in urban mobility. Guézéré (2008) notes that more than 50% of city dwellers use this mode of transport for daily trips. Although it meets a need for accessibility and mobility, it also poses challenges in terms of road safety and urban organization. In comparison, Cotonou (Benin) has put in place regulatory measures for the “zémidjans” sector, including licenses and driving licenses for drivers (Gnakouri, 2019). This has improved safety and reduced the number of accidents it also poses challenges in terms of road safety and urban organization. In comparison, Cotonou (Benin) has put in place regulatory measures for the “zémidjans” sector, including licenses and driving licenses for drivers (Gnakouri, 2019). This has improved safety and reduced the number of accidents. In Kampala (Uganda), a strategy to integrate “boda-bodas” motorcycle taxis into the formal transport system

has also been initiated (Kasumba, 2016), by providing road safety training and formal registration. These examples underline that the implementation of a structured regulation for the motorcycle taxi sector could not only strengthen the safety of users in Lomé, but also optimize the organization of traffic flows by integrating this modality into the formal framework of urban mobility.

Traffic congestion in Grand Lomé leads to substantial economic losses. Field work (2024) shows that some permanent state agents (PTAs) lose an average of more than some permanent state agents (APEs) lose an average of more than 13.000 CFA francs per month due to congestion, a cost that accumulates to affect the national economy. In comparison, Faye (2020) estimates that congestion in the city of Dakar costs about 2.6% of annual GDP. To remedy this situation, Dakar has invested in a Regional Express Train (TER) project to improve the fluidity of travel and limit economic losses. A similar solution could enable Grand Lomé to reduce the economic impact of traffic congestion and improve the efficiency of its urban travel.

The environmental impact of traffic congestion in Lomé is compounded by the predominant use of poorly maintained used vehicles, which emit high levels of CO_2 and fine particulate matter (Edoh, 2014). According to the OECD (2016), about 28% of total CO_2 emissions come from the transport sector, and road transport accounts for 80% of greenhouse gas emissions from transport. This phenomenon is similar in Lagos, where recent initiatives have introduced regular checks to reduce vehicle emissions. In global contexts, cities like London have implemented Low Emission Zones to reduce urban pollution. Johannesburg, South Africa, has adopted strict measures to improve the quality of vehicles and promote green transport, such as electric buses (Smith and Chido, 2015). For Lomé, the introduction of environmental standards and regular checks could also help reduce pollution and promote sustainable urban development.

Road safety policies, inspired by the examples of cities such as Nairobi, which have integrated more sophisticated signalling systems and increased surveillance, could mitigate risks in Lomé. Moreover, in East Africa, initiatives for the modernization of urban infrastructure, such as non-motorized transport corridor projects (Klopp and Cavoli, 2019), offer examples of proactive planning. These pedestrian and cyclist-only infrastructures reduce conflicts between different types of users and contribute to safe travel. A similar approach to Greater Lomé could also improve road safety and reduce the frequency of accidents, by ensuring that each mode of transport has suitable lanes.

In terms of recommendations for future research, the focus should be on the use of new technologies in traffic management, such as ride-sharing apps and intelligent transport systems (Mbatha, 2018). The evaluation of sustainable mobility policies and the comparative study with other African cities would also make it possible to identify solutions adapted to the context of Lomé. Finally, it would be relevant to analyse the social and environmental impact of green public transport through approaches based on longitudinal data and modelling of mobility flows.

5. Limitations and future research directions

Despite the valuable insights it provides, this study has some limitations, notably

its use of cross-sectional data, which may not fully capture long-term dynamics and trends. Future research could further this work by exploring more advanced approaches, such as predictive traffic modeling, in-depth assessment of the socio-economic impacts of public transport systems, and integration of real-time data analytics. These approaches would make it possible to develop evolving and innovative solutions to better meet the complex challenges of urban mobility.

6. Conclusion

The negative externalities related to urban mobility in Greater Lomé have significant repercussions on the sustainable development of the city. Recurrent traffic jams during rush hour, caused by a demand for transport that exceeds supply, compromise accessibility to economic and social centers, while generating significant economic losses for users. These problems are exacerbated by inadequate road infrastructure and a lack of regulation, particularly in the motorcycle taxi sector. Despite their crucial economic role, these motorcycle taxis contribute significantly to traffic accidents, jeopardizing road safety. On the environmental front, traffic congestion and the predominant use of used vehicles, often poorly maintained, lead to high levels of air pollution, accentuating the impact of greenhouse gas emissions. Compared to other cities in sub-Saharan Africa and the world, Lomé has not yet put in place adequate policies or infrastructure to mitigate these externalities, as shown by the examples of rapid transit systems in Nairobi (Kenya) or motorcycle taxi regulation initiatives in Cotonou (Benin). These shortcomings highlight the need for local authorities to rethink urban mobility management by adopting sustainable solutions. Similarly, it is essential to strengthen the regulation of the informal transport sector, to invest in modern and environmentally friendly infrastructure, and to promote more efficient modes of public transport. Concerted and integrated policies, inspired by successful practices in other contexts, could reduce the social, economic and environmental costs of mobility in Lomé, while ensuring a sustainable improvement in the quality of life of the inhabitants. Such a holistic and proactive approach is crucial to achieving harmonious and sustainable urban development, in line with the development goals set at the international level and by regional institutions, including ECOWAS.

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Appendix

Table A1. Questionnaires for surveys of road users (motorists, motorcyclists and motorcycle taxi drivers).

Code	Questions	Proposed answers	Answers
1	What time do you leave your home to go to work? Proposed answers?	1 = 6 h–7 h 2 = 7 h–8 h 3 = 8 h–9 h 4 = 9 h–10 h 5 = 10 h–11 h 6 = 11 h–12 h 7 = Afternoon	
2	What is your main mode of transport?	1 = Personal car 2 = Motorcycle 3 = Motorcycle taxi 4 = Public transit 5 = Other (specify):	
3	How often do you travel?	1 = Very often 2 = Often 3 = Sometimes 4 = Rarely 5 = Never	
4			
5	How long does it take you to get to work?	1 = −15 min 2 = 15 min–30 min 3 = 30 min–45 min 4 = 45 min–60 min 5 = +60 min	
6	What do you think are the hours during which the city center is more difficult to access?	1 = Peak hours 2 = Off-peak hours	
7	What do you think are the rush hours in the city of Lomé? (Rush hour=Hour of service when everyone is on the go)	Morning Evening 1 = 6–7 4 = 5–6PM 2 = 7–8 4 = 6–7PM 3 = 8–9 5 = 7– 8PM	
8	Are you already surprised by the phenomenon of traffic jams when you travel?	1 = Yes 2 = No If no, go to question 47	
9	If so, do you frequently attend them?	1 = Yes 2 = No	
10	Do you find yourself facing a traffic jam every day of the week or just a few times	1 = Daily 2 = Only a few times (estimate number of times per week)	
11	What do you think are the causes?	1 = Urban dynamics 2 = The growth of the vehicle fleet 2 = Traffic light malfunction 3 = Inadequacy, narrowness and poor condition of the road network 4 = The concentration of activities and services in the city center 5 = Traffic Violations 6 = The inadequacy of public transport 7 = Other... (to be specified)	

Table A1. (*Continued*).

Code	Questions	Proposed answers	Answers
12	What do you think the consequences of a traffic jam can be?	1 = Service delays 2 = Traffic accidents 3 = Unnecessary waste of time 4 = financial losses 5 = Environmental pollution 6 = Development of pathologies 7 = Other... (to be specified briefly)	
13	At what precise times do the traffic jams you have witnessed occur?	1 = Peak hours 2 = Off-peak hours 3 = Both	
14	How many minutes do the traffic jams you have already witnessed last?	1 = −5 min 2 = 5 min–10 min 3 = More than 10 min	
15	These traffic jams only occur at intersections or at Any place on the streets?	1 = Hubs 2 = At any location along the arteries	
16	Is the time wasted in traffic jams a big blow to your working time?	1 = Yes 2 = No	
17	If so, from what point of view?	1 = Unnecessary waste of time 2 = Unfinished work due to short time available Other.... To be specified	
18	In your opinion, are traffic jams an obstacle to access to downtown Lomé?	1 = Yes 2 = No	
19	If so, from what point of view?		
20	What are the approaches to be taken to decongest the roads of the city of Lomé and make the city center accessible to users?		
21	What is your gender?	1 = Male 2 = Female	
22	How old are you?	1 = Under 18 years of age 2 = 18–30 years old 3 = 31–45 years old 4 = 46–60 years old 5 = Over 60 years of age	
23	What is your level of education?	1 = No diploma 2 = High school diploma 3 = Higher degree 4 = Other (specify):	