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INTERMODALITY BETWEEN ARTISANAL TRANSPORT AND PUBLIC TRANSPORT BY BUS IN GRAND LOMÉ

Summary. Intermodal practices are related to the use of several distinct modes of transport during the same displacement. This study analyses the articulation between institutional transport insured by motorbike taxis and the Lomé Transport Company (Sotral) in Grand Lomé. In particular, it explores two intermodal practices between both actors, mainly the drawdown and broadcasting of Sotral users on/and from bus stopping, the main intermodality points after the bus stations in Grand Lomé. The methodology relies on a mixed approach, combining quantitative and qualitative methods for data collection and analysis. The first descriptive approach has allowed us to observe the phenomenon, to reinforce knowledge through the analysis of documents, and to obtain actors' opinions. The second quantitative approach is based on the interviews carried out with drivers and motorbike taxi and bus users, the counting of broadcasting and drawdown modes at the stopping points, and the mapping of the study area as well as the Sotral network. The results show that the current facilities of Sotral bus stopping points do not encourage/promote the interaction and/or cohabitation between different modes of transport, such as motorbike taxis. These infrastructures are out of phase with the intermodal practices of the population of Grand Lomé, who use artisanal and structured public transport in their daily movements. In fact, motorbike taxis do not have a dedicated facility for drop-off/pick-up of passengers at the Sotral bus stopping points. The drawdown and broadcasting by these means of artisanal transport at bus stops are generally made on sidewalks and sometimes on roadways, which is a source of road insecurity. This failure leads to friction between Sotral and motorbike taxis on the use of facilities dedicated to Sotral buses, creating an absence of cohabitation between two main actors of mobility in Grand Lomé. An approach focused on the flexibility and efficiency of intermodal points or the connection between motorbike taxis and Sotral allows good coexistence and constitutes a component of a sustainable mobility strategy.

1. INTRODUCTION

Intermodal practices are based on the articulation and organization of transport offers that coordinate several modal systems by management and specific development of interfaces between the movement of different modes SCNTU (Studying Center on Networks) [5]. In the literature, intermodality describes the fluency by which these users switch from one mode to another, where the core service of a mobility operator is to facilitate transactions, articulations, and modal interfaces [20].

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According to transport system studies, the connection is capable of optimizing network performance. Implementing a mass transport line, for instance, makes it possible to optimize the operation of an urban public transport network through the reorganization of bus services and the best articulation between different systems [24]. Thus, “efficient transport systems are those in which the articulation between the various modes is the finest, reducing to a minimum the breaks that lengthen distances and increase risks, and therefore costs” [21]. The concept of intermodality, therefore, enables us to associate the competition between modes in space on the one hand and their complementarity in time on the other hand [22].

Combining artisanal and public transport is a very practical idea for passengers this system is relatively inexpensive for the community and brings customers to the institutional transport company by autobus (Improvement and Development Cooperation of Urban and Peri-Urban Transports) [3]. Informal public transport responds to a request that generally could not be satisfied in its absence. Motorbike taxis, a proximity transport mode that is flexible and fast, are useful in more or less landlocked places, preferably within districts where roads are generally in poor conditions, while public taxis and autobuses cover both short and long distances on asphalt roads.

Indeed, the synergy of transport modes helps to offer travelers an advantageous alternative to the use of a single mode. “Different transport offers are insufficiently organized and not coordinated at all, in Grand Lomé. The transport network by autobus, urban city-taxis, motorbike-taxis and tricycles operate independently” [13]. The articulation between public transport and artisanal transport remains defective. In fact, motorbike taxis do not have a dedicated facility for dropping off/picking up passengers at the stopping points of Sotral. The drawdown and broadcasting of these means of artisanal transport at bus stops are generally made on sidewalks and sometimes on roadways, which is a source of road insecurity.

The main purpose of the present work is to apprehend intermodal practices between motorbike taxis and Sotral in order to propose strategies for improving these intermodal practices for sustainable mobility in Grand Lomé.

The methodology calls upon the classic techniques of field surveys in human and social sciences. It is based on a mixed approach combining qualitative and quantitative methods for data collection and analysis. The first approach is useful for descriptive data analysis and the factors that are not visible with the simple statistical measure. It makes it possible to observe the phenomenon, to reinforce the knowledge from document analysis, and to collect the opinions of some road users through interviews and questionnaires. The quantitative approach is based on numerical data collection and analysis obtained through self-directed empirical investigation (primary data) and from the existing database (secondary data). Both methods provided distinct information to enrich this work.

In fact, two types of observation are used during field visits: simple observation and armed observation. The first, simple observation, is practiced visually, without any special instruments; the second, armed observation, is carried out with instruments. The tool used in the second type is the observation essentially based on physical features of corresponding points between transport networks, accessibility, signage, information to passengers, and the facilities and equipment of bus stopping points. The consulted resources/documents are based on the organization and management of different exchange hubs on the one hand and the articulation between informal transport modes and public or institutional transport on the other hand.

The second aspect of this qualitative approach is the documentation/implementation that has been useful in listing all the work done on urban transport modes and the theme of intermodality between different transport modes. The emphasis is laid on work relating to main subjects that concern the governance of urban transport and the management of different transport networks. It also concerns the articulation between different modes of transport. Apart from the scientific documents of some researchers from the academic and professional worlds, more complementary work on Sotral is consulted. These concern the investigation reports on the knowledge of Sotral daily customers, counting reports on Sotral lines, and investigation reports on network wrapping.

In short, 110 interviews were conducted, including 30 with motorbike taxi drivers, 10 with Sotral drivers, and 70 with motorbike taxi users who use Sotral buses daily. The drawdown mode counting took place for two days at the strategic stopping points of Sotral according to the customers’ living areas. Gulf prefecture constitutes the high-density area of the network of Sotral, where 60% counting and

customers interviews took place. Furthermore, an observation grid allowed the identification of inherent malfunctions in the fittings of bus stopping points. The counting of collected information was done on a computer using Excel software by categorizing the results according to the customers' living areas.

The analysis of data collected enabled us to realize thematic maps in order to better explain the phenomena observed for the best legibility of places and networks. These maps are produced manually before being processed using ArcGIS 10 software. The internet research also made it possible to obtain some physical data for our study site using Google Earth and Global Mapper software.

2. GENERAL CONTEXT OF MOBILITY IN GRAND LOMÉ

2.1. Urban growth structured by the development of generator poles of displacement

Grand Lomé is located in the southwest part of Togo, along the coast of the Gulf of Guinea. It has become an autonomous district since 2019, bringing together the Gulf prefecture consisting of seven municipalities and the Agoènyivé prefecture, which is made up of six municipalities. The Gulf prefecture is a high-density population area and the network coverage of Sotral. The following map shows the location of Grand Lomé on the global map, the administrative division of the district, and the Sotral road network (Fig. 1).

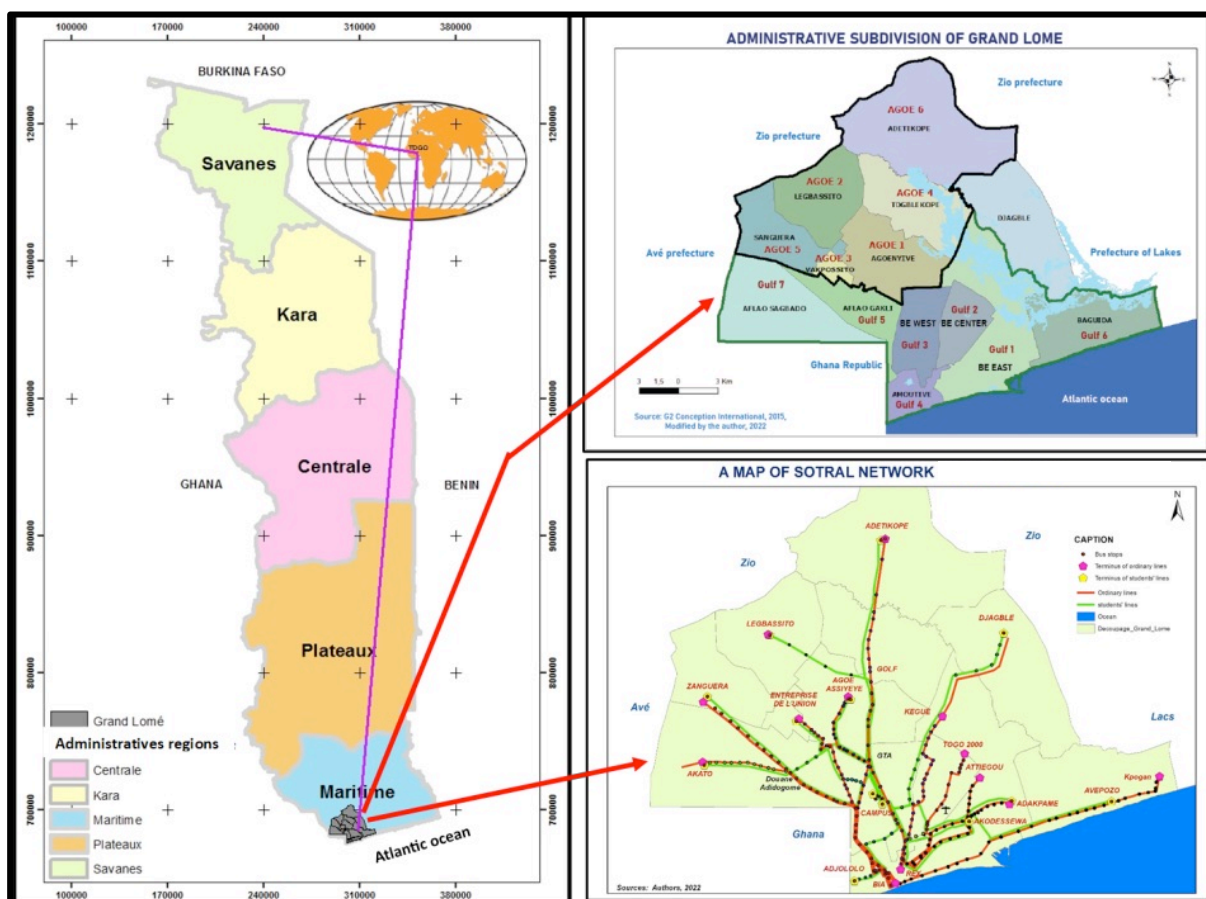


Fig. 1. Location and administrative subdivisions of the study area

The urban growth of Grand Lomé is highly structured by the development of economic activities and the settlement of newcomers along communication lines. The structuring of traffic routes constitutes the development areas from urban to the periphery and participation of the emergence of new polarities

around the formed nodes by connecting several routes. In the urban structure of Grand Lomé, we distinguish more or less extensive major poles of activities and the secondary poles [2].

The industrial and port area is located five kilometers from the east of the town center on the coastline. It constitutes the most important employment pool, which attracts a large population of heterogeneous workers, feeding intense flows of transport. The administrative district is the oldest business center of the formal tertiary sector, concentrating central administrative services such as ministries and general management.

For a decade, we have observed the transfer of a part of administrative services from the Lomé II administrative area. The administrative district once occupied a central part of the city, easily accessible by the radial axes that connect it to other peripheral districts. With the development of the city on the tray of Tokoin and the dynamic of Grand Lomé, the administrative district now seems eccentric concerning the whole city. Due to the poor grip of radial tracks in front of large flows of vehicles, which drain the population of workers from the pericentral and peripheral districts, its service has become critical. Next to it is the large market of Adawlato, the main and oldest center of economic activity in Lomé. To these main mobility-generating hubs are added the commercial areas of Hédzranawoé and Atikoumè, the airport industrial area, the University of Lomé, the Industrial Plateform of Adétikopé, and many other economic polarities scattered along major axes [12]. Below is a map illustrating the different polarities of Grand Lomé (Fig. 2).

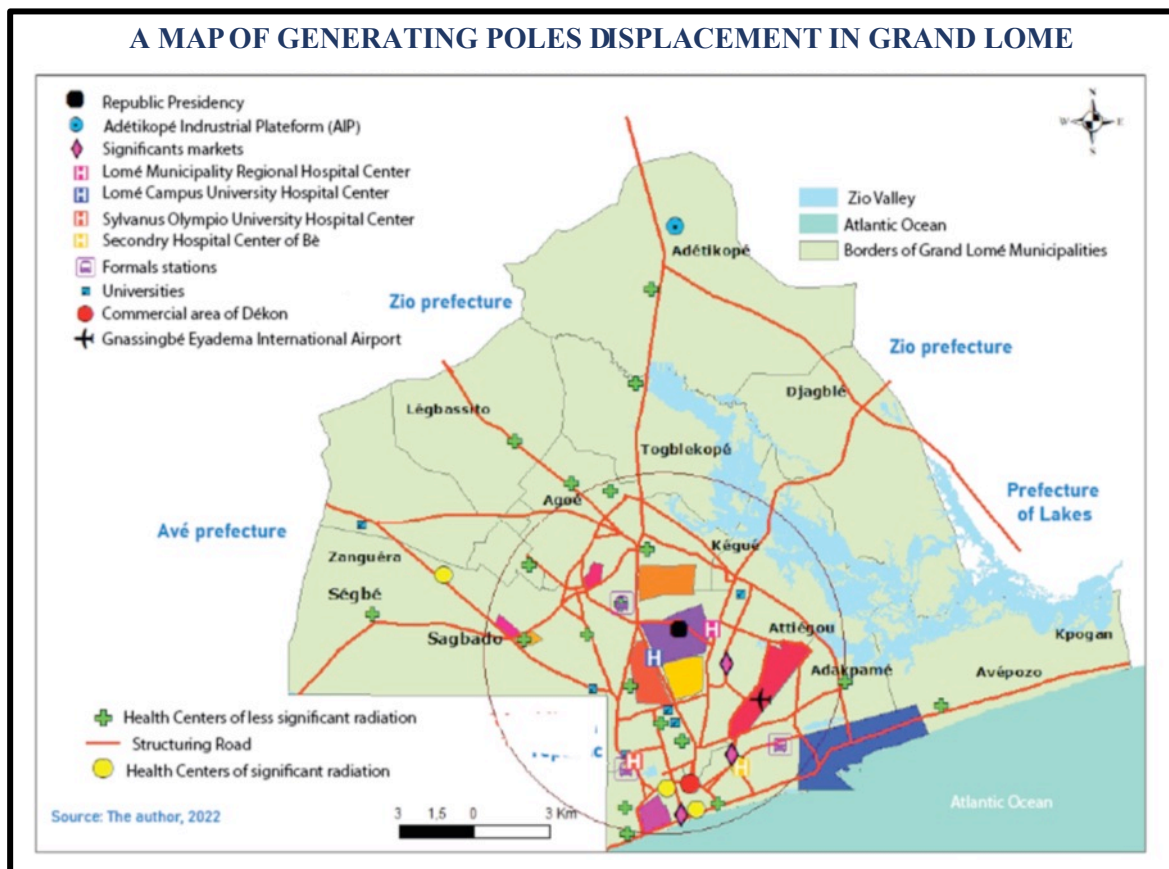


Fig. 2. Different polarities of Grand Lomé

The natural demographic growth of the population contributes to the densification of the ancient urban fabrics and the reinforcement of the urban sprawl process by looking for land availabilities cheaper on the periphery. According to the results of the 4th General Population and Housing Census, Grand Lomé is the most populated agglomeration in Togo. In 2020, this territory had an estimated population of 2,362,366, or 23.9% of the national population; by comparison, the population was

1,591,746 in 2010 [18]. According to the demographic projections of a growth rate of +4.03%/year in Grand Lomé, this population will increase to 2,877,955 in 2025 and 4,271,274 inhabitants in 2035 [19].

2.2. Mobility in full evolution dominated by vehicles with two wheels

In Grand Lomé, the mobility is in full evolution. Since the disappearance of the Municipal Authority for Urban Transport of Lomé in the 1980s. Urban transport was left to the informal sector and was highly concentrated on a reduced asphalt road network. With the progressive emergency of the public transport network and the reinforcement of arterial road weft, behaviors and flows have evolved. According to a series of counts made in 2011, the motorbike was the dominant mode of transport on the road network of Grand Lomé. At five intersections observed on the road of Grand Lomé, motorbikes represent more than 45% of vehicles. The car share is lower, with 28% of displacements, but seems more important in town centers with high concentrations of administrative services and less important in essentially residential peripheral districts [2]. Another count carried out in 2021 within the framework of a study at the bus stopping points, collective taxis, and motorized two- and three-wheel vehicles in Grand Lomé revealed that the urban transport in Grand Lomé essentially relies on vehicles with two wheels, which represent 73% of counted vehicles in rush hour against 25% of cars. Smaller in size, vehicle with two wheels only occupy 36% of the roadway against 58% for cars. Buses and trucks hardly represent 1% of observed vehicles.

2.3. A public transport system dominated by motorbike taxis

Grand Lomé is an agglomeration dominated by vehicles with two wheels like the large African metropolises. In this city, public transport is essentially based on motorbike taxis that appeared in 1992 “in favor of an unlimited general strike in November, 1992” and were quickly “adopted by the whole population” [8]. The flexibility of prices, the strong territorial coverage, and the accessibility to difficult areas explain the emergency and the large presence of motorbike taxis in the Lomé public transport system. The motorbike taxis were estimated at more than 58,000 and would ensure nearly two-thirds of public transport trips in Grand Lomé, with 1,475,000 displacements per day [14]. They also constitute the second mode of drawdown on Sotral lines, with nearly 21.3% of the modal share after walking, according to Sotral’s Daily Customers Knowledge report [15].

The motorbike taxi sector is becoming more and more dynamic and professional with the birth of new companies offering more structured offers. Some companies, such as Gozem, provide their services through online reservations. Others do not rely on online services.

This is the case of Olé Togo, which makes motorbikes available to drivers provided that they follow some criteria (a meter that sets the price for customers, possession of a driving license, vest, and so on.). If these new companies offer secure services and are cheaper than their colleagues, the “zémidjans,” they are increasingly contested by the latter [6]. The second urban transport mode in Grand Lomé is the city-taxi, also called the collective/public taxi. The appearance of the first city taxis in Lomé dates back to the colonial period (in the 1950s). They are, therefore, the oldest urban transport means. This transport offer is provided through lightweight vehicles with five seats.

In contrast with motorbike taxis, for which there are no specific formalities for entry into the profession, the practice of the profession of city-taxi is subject to obtaining a driving license. This license consists of a simple declaration at the time of registration of the vehicle, marked by the installation of a yellow registration plate by the opposition to the private vehicles equipped with a white plate. In 2019, the estimated number of collective taxis was 8,500 and could ensure nearly 270,000 displacements per day, or 7% of displacements by public transport in Grand Lomé [14].

The third urban transport mode used by people in Grand Lomé is the Sotral autobus. With barely a 1% modal share, it remains the only collective autobus transport institutional structure in Grand Lomé. Sotral started its activities on September 15, 2008, with the operation of the first experimental line (Lomé-Adidogomé), 26 years after the liquidation of MAUT in 1982.

In 2021, Sotral’s fleet was made up of 60 vehicles, according to the annual activity report. Sotral pricing is based on distance. Five ranges of transport fees are distinguished, which vary from CFA 150

to 350, depending on the sectioning at the distances of the network ordinary lines. The first section of each line costs CFA 150 francs, and for each additional section, the price increases by CFA 50. On student lines, students benefit from preferential pricing of CFA 150 per ticket and per trip regardless of the distance and a monthly subscription of CFA 6,500 [16].

Tricycles for passenger transportation are recent and present an embryonic number in Grand Lomé. They have three seats in the back of the vehicle. According to statistics provided by the Road and Rail Transport Department, the number of registered tricycles from 2017 to September 2021 in Grand Lomé is 2,711 [4].

3. ORGANIZATION OF MOTORBIKE TAXIS AND SOTRAL STOPPING POINTS AND LINES

3.1. Unorganized motorbike taxi stopping points and lines

Motorbike taxis have neither pre-defined lines nor official stopping points. The picking up of the passengers takes place informally at the defined stopping points or by marauding in general traffic. Indeed, motorbike taxis drive around anywhere, and only 20% follow the lines [7]. In accordance with a diagnostic report study on bus stopping points, vehicles with two and three wheels and collective taxis in Grand Lomé do not have fixed stopping points. The drop-off/pick-up of passengers takes place anywhere at the customer's request. This drop-off/pick-up system of motorbike taxis ensures maximum proximity and flexibility for users. Long-term parking occurs on undedicated public spaces, sidewalks, and even in notches reserved for Sotral buses, which leads to conflicts with other modes of transport. The short-term stoppings generally occur inadvertently and in the middle of the track [12].

Motorbike taxi stopping points are located as close as possible to the demand, either at major points of intersection or close to generator poles such as schools, markets, medical centers, and other important places. The location of these stops is often defined by the customer rather than the transport operator, who only follows the demand. However, the operator generally favors the requests of their customers rather than their security and comfort: stops and parking in the middle of the road, lack of waiting space, restricted visibility, and disrupted traffic flow. Field data reveal that these artisanal stopping points are shared with other modes of transport, with a few rare exceptions where only motorbike taxis operate (Fig. 3).

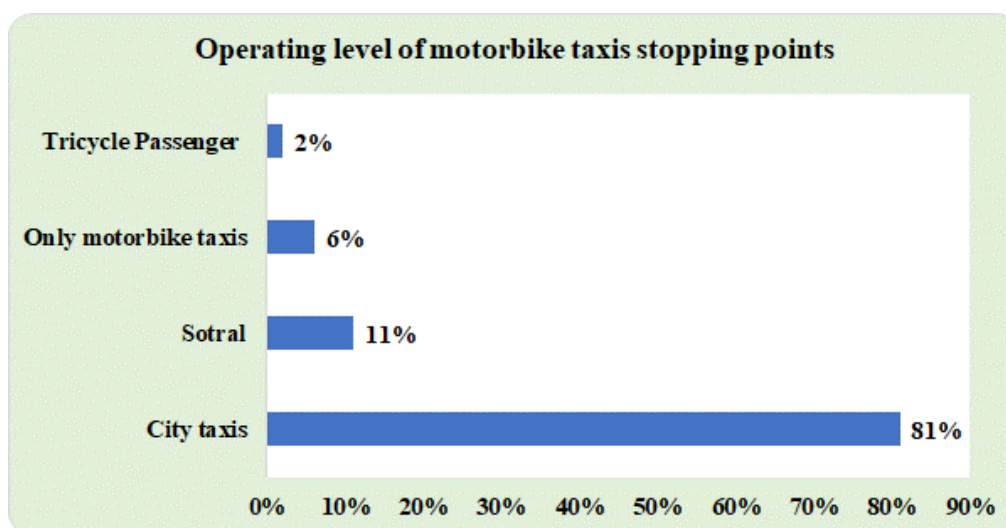


Fig. 3. Operating levels of motorbike taxi stopping points. Source: Our fieldwork, 2022

The data analysis of the graphic below shows that 81% of motorbike stopping points are shared with city taxis and 11% are shared with the Sotral. The share of tricycles is low (2%). Recently introduced, these tricycle passengers only operate on the large bypass from the Autonomous Port of Lomé to Légbassito and, to a lesser extent, the RN°2. All these modes are frequent at almost all stopping points, either in competition or in synergy, through the drawdown of motorbike taxi passengers to the Sotral or city taxi and vice versa. The spatial organization of the stopping points differs depending on the context: cohabitation of all modes in the same space, or fragmentation of modes between several spaces. All transport modes are often found in a Sotral notch or under a service station in the middle of the lane.

In general, motorbike taxis do not have facilities dedicated to dropping off/picking up or waiting areas (user and driver spaces). By default, motorbike taxi operators tend to divert public space to ensure their service. Dropping off/picking up and parking are generally carried out in Sotral notches and on the emergency stopping strips or in full swing in the absence of the first two solutions. In addition, motorbike taxis, which are flexible, also use sidewalks and service stations. Motorbike taxi stops also often correspond to Sotral stops, as these two systems offer a local service and make frequent stops as close as possible to demand. However, apart from these exceptions, only Sotral possesses specific facilities for stopping, namely notches, bus shelters, and poles. As a result, there is often disagreement between Sotral and artisanal transport over the use of Sotral facilities (notches and bus shelters).

3.2. An urban collective transport network well-organized at bus stopping points and lines

Only Sotral has well-arranged official stopping points and lines. In 2021, the collective transport network by autobus within the perimeter of Grand Lomé consisted of 20 lines, including 10 radial and ordinary lines converging towards the center of the town center and 10 lines dedicated exclusively to students of the University of Lomé. The total length of the network is 299 km, or an average of 14.14 km per line (Fig. 4). The total number of stopping points is 478, 42 of which are equipped with bus shelters. In addition, 24 terminals were created, including two in the city center, two at the campus of Lomé, and 20 in the outlying districts [16].

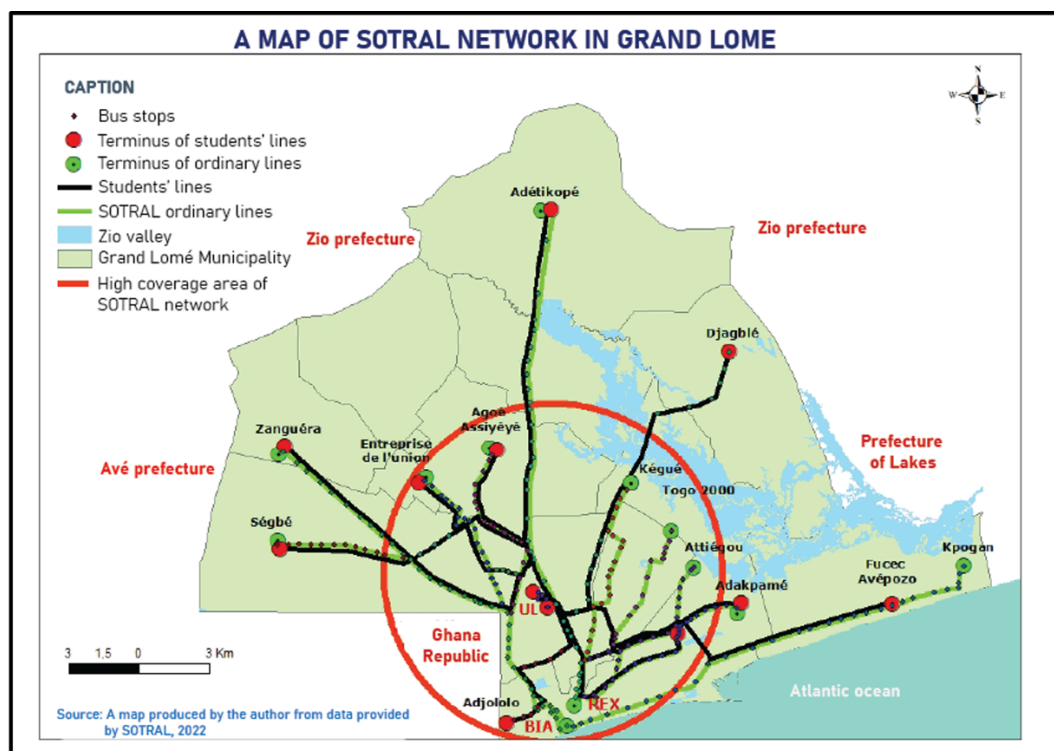


Fig. 4. Sotral network in Grand Lomé

The analysis of Sotral network coverage in Grand Lomé shows a high density of lines in the center of the town. The density decreases toward the peripheral districts. Based on the statistics provided by the Sotral Study Department, the network coverage rate is 42% within the boundaries of the Lomé former municipality and 38% for the whole Grand Lomé. Thus, customers' movement times and distance from their dwelling to the bus stopping points are more important in peripheral districts than in the center of the town.

Artisanal transport stopping points are surveyed in the field and reported in addition to Sotral stops. The results show that 40% percent of paratransit stoppages are carried out on full roadways or a mix between full roadways and the shoulders when they are accessible. One can note that 28% percent of these stops are on emergency stopping strips, and the remaining 30% are on Sotral notches (15%) and notches dedicated to artisanal transport and other vehicles (17%).

4. ANALYSIS OF INTERMODAL PRACTICES BETWEEN MOTORBIKE TAXIS AND SOTRAL

Mobility practices are important when addressing issues related to intermodality. This section is devoted to the analysis of the supply and intramodality practices between Sotral and motorbike taxis.

4.1. Motorbike taxi: A motorized means of drawdown and broadcasting on and from bus stopping points favored by Sotral users

In all theories on urban mobilities, a classic model of displacement is defined as dwelling (origin) and destination (work or other place) [11]. A transport mode on its own cannot fulfill all the mobility needs of a territory. Thus, the combination of several successive modes is necessary for accessible mobility. The main route is preceded by a route said to be “drawdown,” followed by another route said to be “broadcasting.” A drawdown route is the first displacement mode used. It takes place between the originated place of displacement and the first exchange hub. The broadcasting route is the last displacement mode used (Fig. 5). This last route occurs between the exchange hub and the final destination [13].

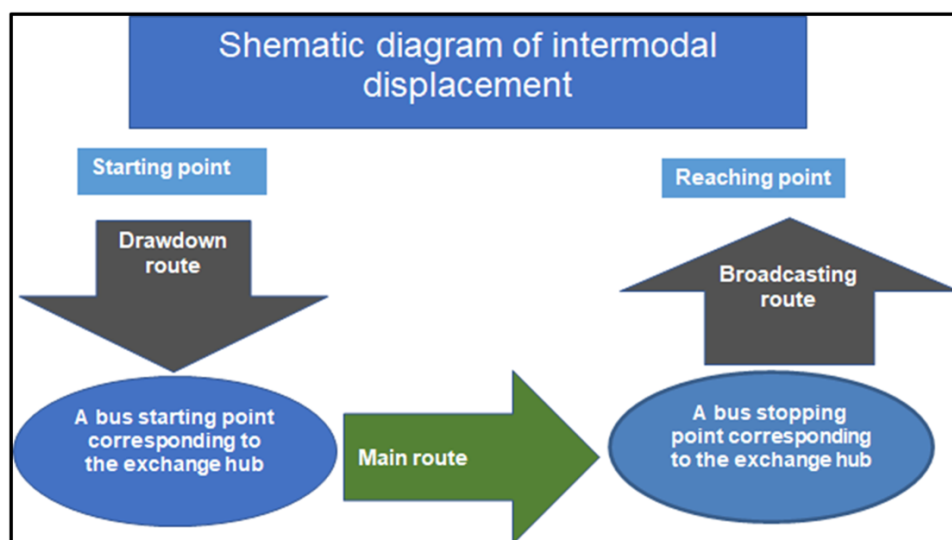


Fig. 5. Schematic diagram of intermodal displacement. Source: Scheme realized by the author (2022) under the conceived model by the Urbanism Agency for the Development of Lyon Agglomeration [1]

As shown in Fig. 6, the motorbike taxi is the first motorized transport means to make the routes of drawdown on Sotral stopping points. The results show that walking is the first mode of drawdown of Sotral users at the bus stops (75.34%).

Motorbike taxis (22.47%) constitute the second means of drawdown (22.47%). They are followed by public transport (7.51%) and individual transport (4.25%). The analysis of broadcasting practices from stopping shows the same tendency.

The analysis exclusively based on the use of motorized means of displacement reveals that the motorbike taxi is the first means of drawdown and broadcasting used by Sotral customers to get to or from bus stops. City taxis represent 4.02%, and only 2.64% of customers use individual transport.

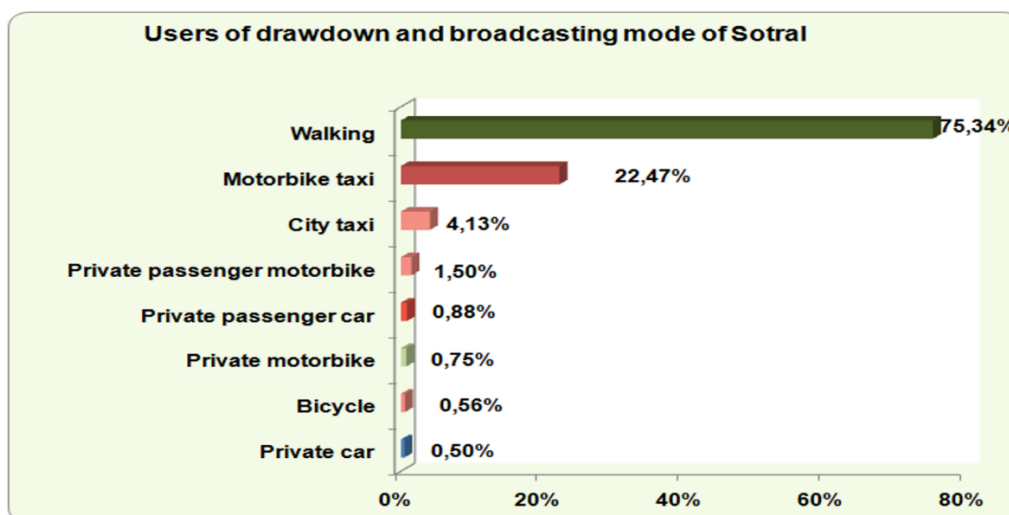


Fig. 6. Users of drawdown and broadcasting mode of Sotral. Source: Our fieldwork, 2022

An analysis of these means of drawdown and broadcasting by customer dwelling zone reveals opposite trends. In peripheral districts, the use of motorbike taxis as a means of drawdown and broadcasting is more important than walking. It accounts for an average of 54% against 22% for walking and other drawdown and broadcasting means from the bus stops.

This inversion of tendency can be explained by the low Sotral network coverage, which forces the customers to travel long distances by motorbike in order to get back to or depart from the bus stops (Fig. 7).

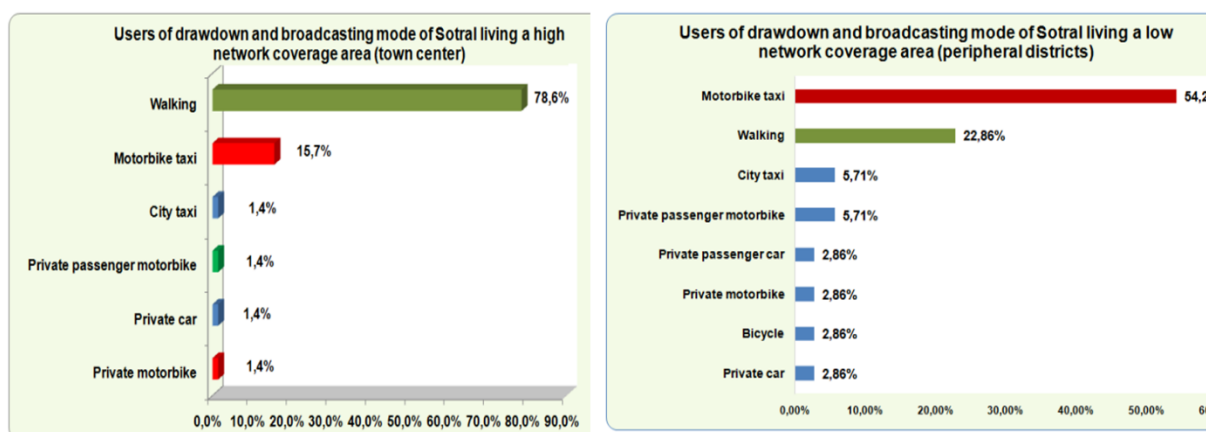


Fig. 7. Users of drawdown and broadcasting modes of Sotral living in high- and low-network coverage areas (town center and peripheral districts). Source: Our fieldwork, 2022

A significant part of motorbike taxis in drawdown and broadcasting routes at and from bus stops is explained by their flexibility and adaptability to the streets of Grand Lomé. According to Guézéré

(op cit), “Apart from their strong accessibility,” motorbike taxis “cannot impose the packing deadline and waste time to the customers before the leaving.” Therefore, they are more requested by the population despite their high costs in relation to other transport modes. “I have no choice but to take a motorbike taxi to go to the bus stop or finish my journey after getting off the Sotral bus. That is the only transport mode which desserts our districts which are difficult to be accessed.

Other means of transport such as city taxis no longer provide door to door transport”, motorbike taxis and Sotral user aged 36.

Motorbike taxis offer complementary services as the system of drawdown elements. The current service advantages of motorbike taxis can be used without creating competition in the network. In fact, for users who live near (less than five kilometers) destinations, despite their relative discomfort, motorbike taxis are the favored choice owing to their speed and flexibility. For users living far away (more than five kilometers) from destinations, the favored choice is Sotral, which offers less expensive services in safe conditions and within more or less suitable timing.

The “advantages in terms of spatial coverage and frequencies thereby could be more important for the users than the disadvantages of quality and comfort in the vehicles” [3]. The results of this study show that nearly 90% of customers of the Sotral network get off over five kilometers from their venue to the bus stopping points. As far as the course time is concerned, slightly more than two or three take less than 10 minutes to get to the bus stop or to get back to their destinations by motorbike taxi after getting off the bus.

4.2. Bus stopping point facilities unfavorable to intermodal practices with motorbike taxis

The intermodal offer is in a deficit. Motorbike taxis do not have a plan dedicated to dropping off/picking up passengers at Sotral stopping points. Motorbike taxi drawdown and broadcasting on Sotral stopping are generally performed on sidewalks and sometimes on roadways, which is a source of road insecurity. According to the report of a diagnostic study on bus stopping points, collecting taxis and the vehicles with two and three wheels in Grand Lomé, «the anarchic location of the motorbike stopping points, often on sidewalks and roadway, constitutes, on the one hand, a real constraint for pedestrians, who view themselves deprived from their space and, a source of road insecurity mainly based on conductors behavior, to their ignorance of traffic and absence of adapted planning and regulation on the other hand » [12].

The Sotral stopping points do not promote cohabitation or intermodality with other modes of displacements. The bus stops are reported by the standards or bus shelters. Some bus stops do not have notches for bus notching (Fig. 8).



Fig. 8. Image of a Sotral bus stopping post taken during a stop (a) and Image of a Sotral bus shelter taken at the Agbalépédogan post stop (b)

In the absence of facilities dedicated to dropping off/picking up passengers at Sotral bus stopping points, motorbike taxis use the facilities made for the Sotral buses. These defects explain the presence of control agents at certain Sotral stopping to prevent the occupation of Sotral notches by other types of transport. “Here at the CHU Tokoin stop, the agents who ensure the security of Sotral network, forbid us to stop to pick up or drop off customers. According to them, these transport spaces are only dedicated to Sotral buses.” However, “we provide them with customers” testified a motorbike taxi driver who has about six (6) years of experience in this activity. “I find the cohabitation at the bus stopping point with buses weak: Sotral drivers are less careful to the motorbike taxis and city taxis. They express much humor movement by chasing all other conductors. In fact sorry, Sotral,” has supported another motorbike taxi driver at the 3K stopping in the Doumassessé district.

5. CONCLUSION AND PERSPECTIVES

The drawdown of informal transport means on public transport is completely complementary. It is the association of two transport means that satisfy the customer. Informal collective transport replies to an application that could not generally be satisfied in its absence. The synergy of transport modes helps to offer travelers an advantageous alternative compared to the use of a single mode. The passage from motorbike taxi mode to public transport mode (or vice versa) in Lomé is not easy for the users due to failures in terms of bus stopping point planning, which do not facilitate intermodality and cohabitation.

It would not be prudent to encourage people to go beyond 10 kilometers in motorbike taxis in the morning or evening in a large city that is constantly expanding and concentrates on administrative services. The improvement of Sotral offers by reorganizing bus stopping points and integrating the concerns of the modal shift to/from motorbike taxis would make it possible to limit the conflict of use with motorbike taxis, the first mode of drawdown on Sotral lines. These measures, coupled with the reinforcement of institutional transport service offers (increase in rolling stock, improvement in bus frequencies, network validity, bus commercial speeds, and so on), would reframe the operating territory of motorbike taxis, which will only provide drawdown and broadcasting services on the main roads operated by buses. Sotral will then be able to focus on the main roads such as Bangkok, where “institutional transports are concentrated on urban axes where the demand for public transport is massive” however, “when the users leave these main routes, they face with in inadequate provision by institutional transport services, including feeder services, to reach their final destination. Users then turn to the modes of the public transit service” [10-17].

The reorganization of bus stopping points integrating other transport modes would also make the public space more pleasant and secure for all modes of displacement while exhibiting good cohabitation between transport actors.

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