



The Scope of Public Transportation in the City of Bogota, an Overview of Its Coverage from the Emergence of Informal Modes of Transport

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The scope of public transportation in the city of Bogota, an overview of its coverage from the emergence of informal modes of transport

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Abstract

The operation of transportation in the city of Bogota evaluated from the lack of coverage, justified from the emergence of informal transport. A research is presented that isolates the operation of public transport and focuses on the coverage presented by the same, where the emergence of informal transport, born to the transportation needs of users justifies the lack of scope of the transport in complementary transport trips. Through the evaluation of a case study, it is demonstrated that in the sector, the coverage of transport is insufficient; the existence and intermodal articulation of formal and informal public transport is evaluated due to the lack of coverage of the formal public transport. The research is based on the evaluation of the area of influence of Toberín of Transmilenio station, the area is characterized, and the coverage, the existence of informal transportation modes and their interaction with the formal transportation are evaluated, as well as the users' perception of the informal service. In view of this, the modal articulation between formal and informal modes of transport is evidenced, born in response to the mobilization needs of users, taking into account informality as a complementary service to formal transport, focused in the last mile.

Keywords: Public transport, Last mile, Informal transport, Bicitaxi, Transport stages

1. Introduction

Bogota, center of development and influx of visitors, presents a controversial public transportation system, which is the basis of this research, which aims to evaluate the scope that this public transportation system gives in its complementary stages, not focusing on the operation of Transmilenio (buses, stations, infrastructure ...) but in other stages, which under the perception of citizens have no scope, for a system as robust and with such a demand as Transmilenio.

This research focuses on how the last mile transport is covered and how informal transport is articulated. The absence of formal public transport coverage, as an opportunity to offer informal modes of transport, when presented through organizations that cover needs unsatisfied by formal transport.

Based on the assumption of the adequate operation of Transmilenio, the research focuses on the last mile stage, which, for the city of Bogotá, presents specific needs, such as overcoming the wide gaps in distances to be covered, given the extension of the city and taking into account that to date there are areas without coverage by the public transport system.

Informality in public transportation is born from unsatisfied needs, proposed as an adaptive mode of transportation in the absence of formal transportation. One of the modes of informal transportation seen in Bogotá corresponds to the Bicitaxi, a mode of transportation preferred for short trips, effective for last mile trips, highlighting that for the city of Bogotá this is not a legally established mode of transportation, which does not have regulatory conditions to present passenger transportation service.

The focus of this research focuses on answering the question of the existence of intermodal interaction between formal and informal modes of transport and how to meet the needs of a society in terms of passenger transport, as well as answering how such articulation becomes an intermodal



transport system. The research evaluates informal transport, the reasons for its emergence and acceptance.

The research presents the informal transportation of the Toberín Transmilenio station, characterizes the area, evaluates aspects such as scope, transportation routes, user's perception and preferences for transportation in the stage. We seek to evaluate whether there are relationships between formal and informal transportation and how this intermodality contributes to the city's transportation. It is shown how informal transportation, although with precarious conditions, solves the needs of users.

2. Literature review

Intermodality as part of transportation planning becomes important to generate networks that facilitate mobility between the system, the planning of which is born after the adaptation to the needs of each population. The experiences with intermodality in the world have been so successful that the concept is presented as a necessity for transportation systems. Worldwide there are cases of intermodality, which allow users to be transported in different modes or vehicles, which are integrated and complementary, thus presenting opportunities for extensive trips and greater coverage, favoring the user and mobility. (cortes, et.al, 2013).

The success of public transport planning is based on the scope given to each of its stages, taking into account that it seeks to meet the particular needs of each of these, such as route planning and location of stops, which facilitate accessible routes for users in their first or last mile, as well as planning of feeder systems that make a sweep through the basins and planning of complementary routes, factors that somehow provide user satisfaction at each stage. Agarwal et al. (2019), (Garnica Quiroga, 2021).

Informal transport as a nascent offer in the absence of legally constituted public systems, highlighting the existing link between this and the concepts of planning and expansion of the territories (Carmona, 2020), the offer is given as a complement to the legally established and has great acceptance by the citizen who seeks multimodality in transport and comfort in their trips, as indicated by (cervero, 2000: 9) in his book Informal transport in development world, informality is assumed as the complement in the face of the vacuum of transport services and absence of the state, promoted by the populations that have the need to transport themselves. Informality is a response to the social situation and the shortcomings of territorial planning.

The use of the bicycle cab as an alternative is being presented as a preferential mode for short trips, it has been formally established in many countries, where transport systems articulate it as a feeder and as a mode used in complementary stages, systems that are regulated and generate modal integration through connection platforms with subway, train and bus systems (Mercado Velandia, 2012).

The evaluation of the articulation of the bicycle cab to the integrated transportation system of the city of Bogotá, has been evaluated by (Mellado Aranzalez & Morales Pérez, 2018), who presents an investigation in order to know the environment, the user and the service presented, evaluating the results in order to be able to articulate it and present improvement strategies, the results obtained for the case study, show major shortcomings in the operation of the mode, focused on the lack of optimal spaces for the circulation of the vehicle and the operating conditions of the vehicles, denoting the lack of compliance with minimum safety conditions, where the rating for the average evaluated is 31. 5% for vehicle safety and 58.2% for vehicle design, being a vehicle of poor quality and presenting unsafe conditions for passenger transportation.

3. Methodology and procedures

A methodological planning organized in three chapters is presented to reach the objective of characterizing the transportation of the area, starting with a preliminary investigation, the selection of a critical area with the presence of informal modes of transportation and the structuring of a methodology that allows to know the characteristics and answer the question: How is there intermodal articulation between formal and informal modes of transportation?



Chapter I: characterization of the area

Approach to know the current conditions and how is the existing public transport behavior, the state of the infrastructure, the behavior and relationship between formal and informal.

The collection of information of the sector is done through public base information, to characterize the study area, based on the capacity of public transport users in the sector, also the collection of geographic information allows to use it in the GIS, where the supply of formal public transport and particularities in the sector are identified. The geographical evaluation of the service basin of the Transmilenio station is carried out, where the area of influence and catchment area of Transmilenio users is delimited. Subsequently, the evaluation of road and public space conditions is carried out, showing where the preferred modes of transportation for the last mile transit.

Transportation in the area and its articulation (formal and informal) is evaluated, verifying SITP routes, coverage, walking distances to stops, route schedules. Evaluation of emerging informal transport systems and verification of their relationship to the mass public transport system. The results are presented by means of a map that delimits the service basin, routes, coverage areas and the supply of informal transportation, providing a general overview of the transportation networks present in such an extensive coverage area of a station.

Chapter II: Evaluation of informal transport

Characterize the informal transport in the last mile of the area of influence of the station, making a comprehensive assessment of the modes of transport found in the study area, where an approach to the working groups is made and the conditions of the vehicles that provide the service in informality are evaluated, identifying relevant aspects of the service, working conditions, among others, evaluating the actors involved in the activity of informal transport, seeking to identify the weaknesses, threats, strengths and opportunities that may present particularly and the contribution of these to the last mile transport. Evidencing through the present the existing organization in the informal transportation modes, which work under certain parameters imposed by themselves with the objective of covering the areas of low reach of the formal public service.

Chapter III: evaluation of user preferences

We seek to evaluate the preferences in the choice of transportation modes, where we approach the users and evaluate how they make use of the intermodality between formal and informal transportation modes, to evaluate the shortcomings of the city's transportation system, by means of surveys, which allow us to illustrate a general panorama of the perception of transportation users about the bicitaxi. It is perceived that the mode is accepted as it is useful for the routes of the complementary stages, in addition to being the best alternative offered even though it has so many operational shortcomings, since there are no formal modes of transport that provide the same coverage and scope compared to the bicitaxi.

4. Results and discussion

In order to make an evaluation of the transportation basin, the starting point is the selection of a basin that is critical in the emergence of informal modes of transportation, for which the Toberín station was chosen, which is a Transmilenio station that offers transportation routes that connect with the north portal and with the other Transmilenio trunk lines. Its location is on the north highway between streets 163 and 167. With an approximate population in its basin of 91,313 inhabitants and characterized by having commercial, industrial and residential sectors, with a flat topography and towards its eastern and western mountainous limits, its socio-economic classification is composed of middle and upper classes.

The definition of the basin is made, based on the geographical disposition of the sector and the transportation offers, the delimitation from north to south is delimited with the average distance between Toberín and the nearby Transmilenio stations, towards the south side the station corresponds to Calle 161, towards the north side, In this case, Calle 170 Avenue is used as a boundary. The delimitation of the basin on the eastern and western sides is based on the presence of informal modes of transportation that bring users to the station, The routes and monitoring of



informal transportation in the basin, to delimit the scope of the same from the maximum routes it performs, towards the east the scope is towards the area known as the butterfly, on the other hand, the area is delimited towards the west, where the coverage is given by the "pirate cars" and bicycle cabs, to Boyacá Avenue, where they pick up passengers who come from the sector of Carrera 74, taking into account that there the urban area is delimited with the hill.

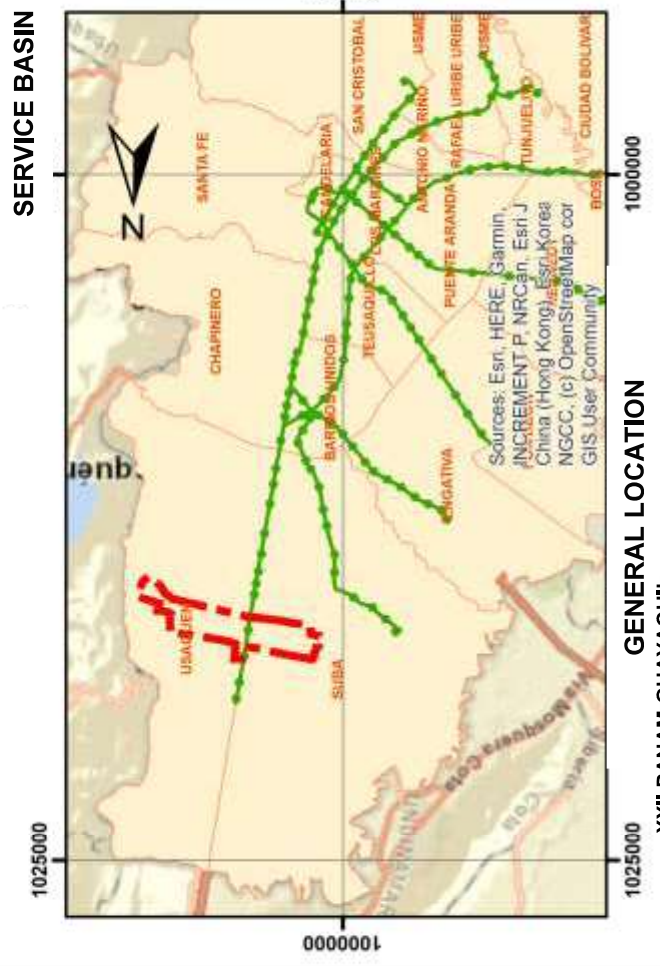
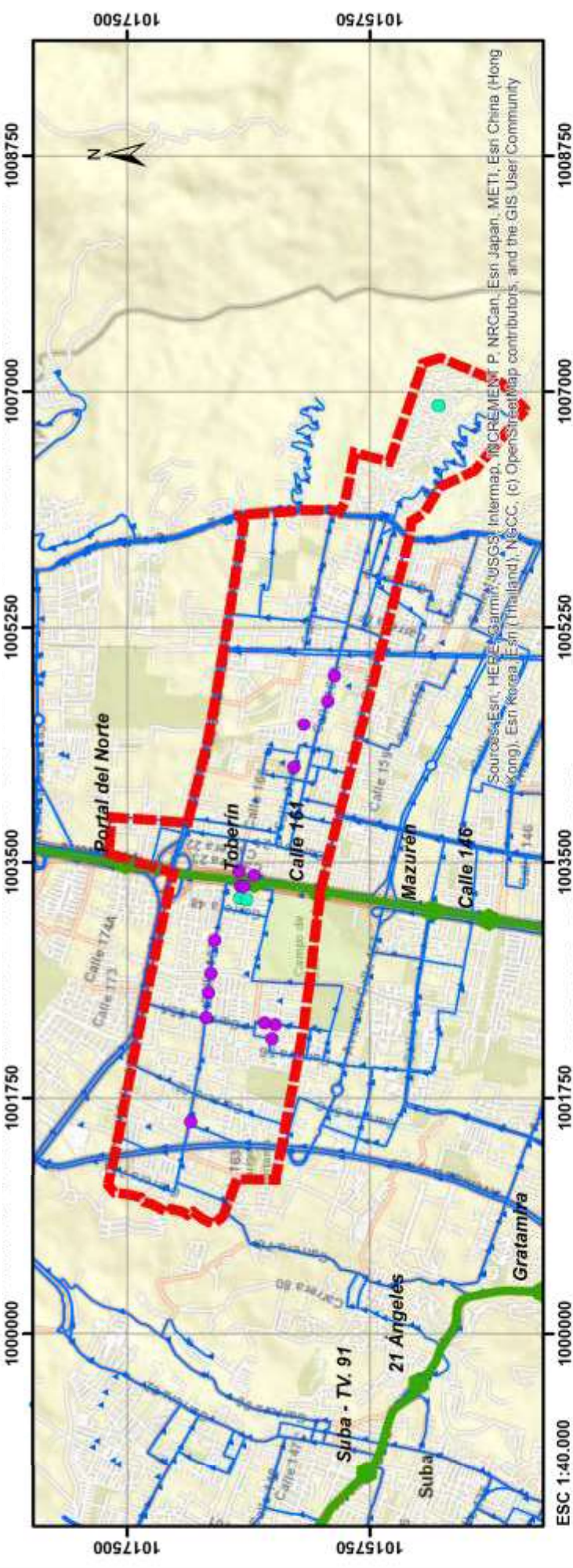
Informal transportation groups of bicycle taxi drivers have set up stops around the station's basin, where they take and pick up users, as well as propose routes and maximum range. In the Toberin station service basin there are 230 bicycle cabs with working hours from 5:00 am to 11:00 pm. Informal transportation groups of bicycle taxi drivers have set up stops around the station's service basin, where they take and pick up users, as well as propose routes and maximum reach. In the Toberin station service basin there are 230 bicitaxi with working hours from 5:00 am to 11:00 pm.

For the understanding of transportation in the study area, an evaluation of the services offered is made, in addition to the existence of Transit Analysis Zones (ZAT), where surveys related to transportation and mobility in sectors of the city are monitored and conducted, according to the mobility surveys of 2019, for the ZAT, included in the delimitation of the basin, in the area approximately 71,484 daily trips are made from the area and 72,948 daily trips to the area, having a total of 144,432 daily trips.

As a product, a general characterization map is presented to illustrate the transportation conditions and coverage presented by the service basin, taking into account that the coverage of the basin is quite wide and the walking distances for access exceed 6 km, making the system not very accessible to all users. Although there are transportation systems and SITP routes in the area, they are scarce for the high demand presented by the users that generate trips in the sector and to the sector, added to the inconvenience of not having good conditions of public space and stops. That evidences the extent of the service basin, a high demand for the service station that has specific needs for transportation in the complementary stages, solved from emerging informal modes of transportation that seek to cover the unsatisfied demand and fulfills the role of feeding the station and being the preferred mode of transportation for the last mile.



TOBERIN STATION SERVICE BASIN CHARACTERIZATION



CONVENTIONS

- - - BASIN
- TRANSMILENIO STATIONS
- TRANSMILENIO TRUNKS
- INFORMAL MINIBUS
- BICITAXIS
- SITP ROUTES

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 Illustration 1: Transport characterization plan of the Toberin station service basin.
 Source: Own

Although an evaluation of the bicitaxi system in general, it could be said that it is a mode of transport with great acceptance, it fulfills the role of generating connectivity in sectors where it is difficult to use public transport or to reduce the gap between origins/destinations and public transport stops.

The bicitaxi and minibus services, although not working together, complement each other by generating transportation alternatives within the service basin, where public transportation does not reach or is difficult to access, taking into account that the characteristics of the two modes of transportation mentioned above are adapted to different user needs.

A review of the users' perceptions shows that the public transportation of passengers evaluated for the complementary stages presents shortcomings, the lack of coverage of the transportation systems is identified, since, due to conditions such as lack of planning, high demands and population growth, the demand generated is not fully covered, leaving the complementary stages unattended.

It is highlighted that with the long distances to travel to access public transportation where users take more than 15 minutes to access a station or stop, and travel distances of more than 1000 meters, thus reflecting the coverage and scope of the stations and the shortcomings for the population.

Likewise, it is possible to show that there is a standard average time of 15 minutes per trip for complementary routes, and that there should be a minimum of half an hour for complementary routes, taking into account that this is added to the waiting time and the main trip time, generating long travel times.

Road safety of the bicitaxi, takes a very important role in the mobility of a city like Bogota, (Silva, 2015) analyzes the bicitaxi and its interaction with the infrastructure and determines that there is no adequate space for the transit of these. Although it is a useful service, most respondents showed concern for road and labor safety conditions, as indicated by Colmenares et al. (2018) who states that an important factor in the relationship between the bicitaxi and road safety corresponds to the safety and health conditions of the operators.

5. Conclusions and future research

Through the research, an integral evaluation of transportation and its incidence with informal transportation for the intermodal articulation with public transportation systems in the last mile in the case study is carried out, where the characterization of the area in geographical aspects, limits, behavior, transportation networks and user perception allows identifying the amplitude of the service basin of the Toberín station, with a service area of 6.81 Km² and maximum travel distances of 6 km to access the station. Although SITP routes are offered, users who need to access the Transmilenio service must use transportation such as walking, bicycles or informal services.

The high supply of informal transportation services is justified given the demand of users who require movements in the last and first mile stages, where 70.1% of those surveyed stated that the transportation service at this stage is insufficient, in addition to the long waiting times at bus stops, which for 66.3% of users is more than 15 minutes.

It is demonstrated that the coverage in the basin of formal public transport service is insufficient and that there are distances for the last or first mile that exceed what a user is willing to walk, where the bicycle cab makes up for the lack of coverage. It is evident that there is an articulation between modes of transport and it is born from the lack of coverage, a system is created in which the informal modes of transport are presented as feeders and collectors of users.

The approach to the users allows us to identify their perception of the coverage of the public transport system in complementary stages, where they state that the service does not provide coverage and 64.8% indicate that the stations are far from their starting point, such perception of the users indicates the lack of coverage of the system.

Knowing the informal modes of transport from the approach and use of the modes allowed us to identify the existence of organizations that keep the system regulated and seek ways to provide an optimal service, also taking into account the intention of the users to organize themselves.

The effectiveness of modes of transport such as the bicycle cab is overshadowed by the urgency of its regulation, since the potential of the mode is evidenced by an organization and the lack of a strategic and rigorous organization of the conditions for it to be an efficient service.

In conclusion, there is an intermodal articulation between formal and informal modes of transport in the service basin, given the lack of coverage of public transport systems, to which informal systems fulfill the task of complementing and meeting unsatisfied needs.

The idea of implementing bicitaxi as a feeder and preferential system for the last mile is correct, taking into account that this would require an integral evaluation of aspects that involve other areas, which, if managed integrally, could generate a very good complement to the city's transportation system.



Even after the approaches presented here, it is proposed to carry out studies in different areas of the city that ratify the modal articulation between formal and informal transport, taking into account that these studies should be given a multidisciplinary scope that allows to give an overview of the behavior of the bicitaxi and the importance of its use.

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