

Transmicable impact

Impacto Transmicable

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The problem of mobility is one of the many issues that arise in cities. For this reason, territorial planning and how to get around is a fundamental pillar for the construction of society. In Bogotá (Colombia) the issue of mobility is very complex, especially in the most remote neighborhoods. The integrated Transmilenio system tries to control the problem, however, several factors such as population growth with an average of 1.87% per year reduce its capacity. This expansion significantly affects the environment, increases congestion, the accident rate, and creates an inability of movement and accessibility. The implementation of new transportation systems is a relevant factor for proper functioning. Projects such as the Transmicable not only provide a solution to the mobility issue but also have constructions with social benefits.

Keywords: Aerial cable, environmental impact, mobility, safety, security, social impact

El problema de la movilidad es uno de los tantos que se presentan en las ciudades. Por ello la planeación del territorio y el cómo transportarse es un pilar fundamental para la construcción de sociedad. En Bogotá (Colombia) el tema de la movilidad es muy complejo, sobre todo en los barrios más alejados. El sistema integrado de Transmilenio trata de controlar el problema, sin embargo varios factores como el crecimiento de la población con un promedio de 1.87% por año reducen su capacidad. Esta expansión afecta significativamente el medio ambiente, aumenta la congestión, la tasa de accidentes, y crea incapacidad de movimiento y accesibilidad. La implementación de nuevos sistemas de transporte es un factor relevante para el buen funcionamiento. Proyectos como el Transmicable no solo da solución al tema de movilidad sino que además cuenta con construcciones con beneficio social.

Palabras clave: Cable aéreo, impacto ambiental, impacto social, movilidad, seguridad

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Introduction

In this paper, we will talk about a new form of transportation and the impact that this is leaving in the locality of Ciudad Bolívar both environmentally, socially, and in terms of mobility, because Bogotá is a very large city, and there are places of difficult access such as the suburbs, people have to endure long journeys, traffic jams, poor road conditions, and insecurity, such journeys are very time consuming, as it used to happen to the inhabitants of the upper neighborhoods of Ciudad Bolívar, the daily commute just to get to the Tunal portal, which is the closest portal to the area, could take an hour or more (González & Sánchez, 2019). Currently, the time spent by each person is much less, reducing the dissatisfaction of people concerning the public transport system operating in the area. This and other problems were reduced when TransmiCable, the most innovative public transportation system in the capital, began operating and has been in operation for approximately two years.

Integral Transmicable Project

This project arose due to the need for a more viable means of transportation, which would improve the quality of life of the inhabitants of one of the most marginalized localities, such as Ciudad Bolívar. Therefore, in 2008, the idea of an elevated transportation system to solve the mobility of the upper neighborhoods of this locality began to be proposed. A year later, Mayor-elect Samuel Moreno was the first to announce a study of the project, which indicated that about 3,000 people per hour would travel in 20-person cabins and this project would have an initial cost of 120,000 million (Colombian pesos), however, the project was not consolidated and over time was put on hold because no progress was made.

In 2012, with a new administration in charge of Gustavo Petro, the idea of building an elevated transportation system was taken up again, but it was not possible to start the works since the Council of Bogotá denied the necessary resources to start the work. It was not until 2013, that the District would sign an agreement with Metro de Medellín to carry out the technical studies of the work and for this purpose an amount of 3,967 million pesos was allocated. In the same year, a date for the beginning of works was announced for the first time, which would be in June 2014 to start to operate approximately in 2015, which would decrease the travel time from one hour to approximately 13 minutes (Fig. 1). The work would increase by 10,000 million more than the amount proposed by Samuel Moreno.

In 2014, the Urban Development Institute (IDU) initiated the bidding process for the project. The winning firm would have to carry out the studies, propose designs, start the works and put the system into operation in 20 months. The cost of

Figure 1

Transmicable rendering (Editorial, 2016).



the work has already increased significantly from 130,000 million pesos to 164,400 million pesos. The plans were for the work to be completed in June 2016, but in December of this year, the time to complete the work would be increased to 35 months and the delivery date would be changed to early 2017.

In March 2015, the Urban Development Institute announced that firms interested in submitting their proposals would have until April since the contract would be awarded in May and by the end of that year they would have to start with the work, which would have certain conditions: it must have a length of 3.3 km. It will have four stations between El Tunal and El Paraíso, a capacity for 3,600 passengers per hour (600 passengers more than those projected by Samuel Moreno), and 160 cabins.

Finally, three groups were qualified to compete for the contract, and whoever was chosen would have five months to carry out the studies, designs, and respective approvals, one month to do the preliminaries, and 17 months to build it. In June of the same year, the IDU announced the business group in charge of carrying out the project, which was a temporary business cable union formed by Doppelmayr Colombia SAS, Constructora Colpatria SA, and Icein Ingenieros Constructores SAS.

In September of this year, the project is involved in an accusation of corruption in the management of the contract, where Rafael Rodríguez, a former district official in Petro's administration who was no longer in office, is facing criminal proceedings due to irregularities in contracting. This revolved around the company Doppelmayr Colombia SAS, Mayor Petro, his wife, and senior officials of the IDU and Transmilenio. Despite this, in November, Mayor Gustavo Petro signed the act to begin construction of the project and it would begin in March 2016.

The works began in September 2016, the year in which the purchase of most of the land was also carried out, in the Peñalosa administration, the budget increased again to

Figure 2

Civil engineering of the Transmicable (Escobar, 2016).



\$170,656 million and will be delivered in approximately 21 months (Fig. 2).

During its construction, the district planning secretary led the projects related to the equipment that would accompany the Transmicable to benefit the community of Ciudad Bolívar. By combining two projects, one dedicated to mobility and public transportation and the other to urban renewal, the "integral Transmicable project" was created, where a total of \$240,000 million were invested.

In December 2018, the transport system began operating, which has a route of 3.34 kilometers with a duration of 13 minutes. It has 4 stations each with bicycle parking and public restrooms are portal Tunal, Juan Pablo II, Manitas, and Mirador del paraíso. The mayor's office assured that state-of-the-art technology had been implemented with elements such as solar panels, automatic doors, video surveillance system, wifi, possible communication with the central office, and others. It has 163 cabins with a maximum capacity of 10 passengers, where people will not be allowed to stand, with great comfort, thus mobilizing 3600 passengers per hour/direction. And making trips with a speed of 19 km / h. generated approximately 332 jobs that are mostly people living in the same locality, including officials, technicians, operators, etc.

Transmilenio announced the notable differences with the trunk service (buses) that currently serves the entire city, to avoid misuse of the system the turnstiles were made from the floor to ceiling, thus ensuring the payment of each passenger. The frequency of the service will be 10 seconds, which means great performance, compared to the rest of public transportation in Bogotá. The means of payment is using the "Tu llave" card, it has the same fare as the Transmilenio trunk system and has the same benefits of transfers and subsidies, making it economically affordable. It operates from Monday to Saturday from 4:30 am to 10:00 pm, and Sundays and holidays from 5:30 am to 9:00 pm (Fig. 3).

Figure 3

Assessment of the social impacts projected for Transmicable around the station (Moyano et al., 2018).



People and Transmicable

Ciudad Bolívar, located in the southwest of Bogotá, is an area that has faced different problems not only in terms of transportation and mobility. It deals with different social problems that have a variety of causes such as the partial absence of the state. This is why at the same time that the mobilization problem was thought to be solved, urban renewal was also thought of; public spaces and district buildings for the people who live around the air transport system.

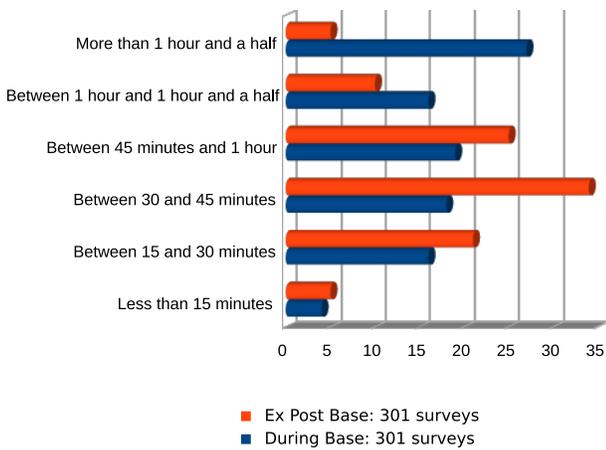
The urban development institute in its citizen satisfaction report, conducted a series of surveys in 2019, on March 4, 5, and 6. In this way it was found that the educational level of citizens is mostly up to high school, the other educational levels have lower percentages (Fig. 4). Almost 90% live in houses, a little more than half have their own home and many have lived in the area for more than 10 years. In this section of the file, it is clarified that the respondents mentioned belonging to stratum 1. As the objective of the study was to evaluate the satisfaction of the inhabitants, a comparison was made during and after the project. Taking into account that this information is the result of the perception of the inhabitants, a large amount of the data showed a good inclination. Better perception in the image of the sector, public spaces, and mobility. One of the items that did not have a significant change, but equally significant was the security in the sector, therefore, people continued to live with insecurity.

Another relevant part of the surveys was the daily travel time, where it could be seen that the expectations of reducing travel time were fulfilled, the percentage of citizens who took more than an hour and a half on regular routes went from 27% to 5%. In this way, the IDU reports that 92% of those surveyed were satisfied with the project, and their opinion was that the construction of the project was necessary, useful, and convenient.

Figure 4

Citizen satisfaction report (IDU, 2019).

What is the average travel time to your usual destination?



The positive and negative comments were based on different numbers of mentions, and despite the number of satisfaction with the project, the negative comments varied, from disagreements with the different organization and/or implements of the system (signs, lighting, turnstiles, surveillance cameras, etc.) to problems with the execution of the project (schedule, frequency, compliance with the projects in conjunction with Transmicable and fares).

The mayor’s office of Bogota leads the program of good practices, which, as its name implies, is everything that generates wellbeing, based on four criteria: effectiveness, innovation, sustainability, and. In this case, the project is referred to as a good practice.

The Transmicable construction system, using pylons, allowed the creation of the facilities, with an investment of approximately \$134 billion. The district planning secretary defined the architectural guidelines for each of the works, as well as other logistical and organizational aspects.

There are 26 works, community halls, cultural centers, the museum of the self-constructive city, the superCADE of Ciudad Bolivar, parks, the viewpoint and pedestrian walkway, a day center, and commercial plazas. Strategies were also planned, such as the habitARTE social inclusion program by the district habitat secretary, which through urban art would create social inclusion and physically improve the neighborhoods of Ciudad Bolivar. There were also resettlement processes to protect and avoid inconveniences for the citizens of the sector.

Social benefits go hand in hand with the construction of these works. Citizen attention where there was none, encouragement of good habits, such as culture, art, and education for vulnerable populations such as youth and children, in the different spaces and/or places provided by

the district entities. And the creation of public spaces where there were none (Langellier et al., 2019).

With the arrival of the Transmicable project, the inhabitants of Ciudad Bolivar, specifically the people of the upper neighborhoods, were in expectation, they had many doubts about the service, how will it be, how fast will it travel, how many people will fit in a cabin, will it be very high, will it be sustainable, all these questions began to be murmured among the inhabitants as they were at the gates of a new project in local terms, All these questions began to murmur among the inhabitants since they were at the gates of a new project in local terms, quickly the Transmicable was well received by the inhabitants, it is a fast, quiet and efficient trip through the air pleased the people who previously spent a certain amount of time (about an hour) to get down from the high neighborhoods to take transportation to their jobs and now with this means of transportation the time it takes to travel is approximately 14 minutes.

Undoubtedly, the Transmicable has considerably improved the entire sector, both in terms of mobility and social, environmental, urban, and security aspects, since the project is not only the aerial cable as such, but also goes hand in hand with an urban development that benefits the sector through which the Transmicable passes; parks, supercades, community halls, community centers and others that guarantee a safe and comfortable space for the citizens, but most of all for the residents of this locality.

Among the benefits that this project currently generates for the community are:

- A savings of approximately \$8.8 billion per year for users, which corresponds to the reduced travel time.
- A reduction of approximately 750.51 tons of carbon dioxide equivalent per year.
- Reduction of traffic accidents estimated at 119 fewer cases per year.
- Better territorial organization and therefore greater tourist attraction for people outside the community, with the artistic initiatives linked to it, such as the Urban Art Corridor.
- The better economy within the locality and the production and obtaining of direct and indirect jobs around the cable.
- Urban growth with the integration of facilities in the area of greatest influence of the stations with a Centros Día, SuperCade, public parks, centers for the elderly, and cultural centers, among others.

For Transmicable to be certified by the national environmental licensing authority (ANLA) that the equipment is creditable for sales tax (VAT) exclusion, it would have to meet certain requirements:

Figure 5

Start of operations Transmicable (Colprensa, 2018).



- Must be specifically intended to: recycle and process garbage or waste (the machine includes washing, separating, recycling and extrusion); for the purification or treatment of wastewater, atmospheric emissions, or solid waste; for the recovery of rivers or basic sanitation to achieve environmental improvement.
- Correspond to imported equipment and/or machinery that is not produced in the country.
- They must be part of a Program approved by the Ministry of Environment (Article 428 paragraph f) of the Tax Statute and Decree 1625 of 2010).

With the implementation of this project, it is expected that environmental benefits will be obtained in terms of reducing the number of atmospheric emissions generated by the different means of transportation already existing in the city (Fig. 5):

- 5,192.30 Tons of CO₂eq/year.
- 0.474 Tons of PM₁₀/year.

Finally, these environmental benefits will be achieved due to the reduction in the consumption of fossil fuels, especially diesel, which has been estimated at 162,249.11, generating a reduction in energy demand of approximately 15,764,840 KWh/year.

What Problems in the Ciudad Bolívar Sector Have Decreased Since Transmicable Began Operating?

It is considered the most problematic area of Bogotá. All the social and economic difficulties are centered there, due to the scarce representation of governmental units. It is the area of the capital with the largest displaced population (26% of the total population). Although the majority of the population is divided into socioeconomic strata 1 and 2, 17% is below poverty.

Figure 6

Start of operations Transmicable (Caracol, 2019).



In general, the houses are invasions, built by hand with materials such as cans, bricks, wood, and tiles without the need for structural analysis. Children have very few places to play and it is dangerous for them to go alone to the few parks or recreational areas because there are many criminal groups and even satanic sects.

In addition, the city is located in the hills at the southern end of the city and consists of undeveloped areas at high risk of landslides. This area covers a large part of Bogotá's rural area and many of its inhabitants are still farmers. Because of this semi-urban aspect, guerrillas and paramilitary groups have areas of control that are difficult to identify. Violence is one of the main characteristics and the place with the highest mortality rate and medical care.

Similarly, school coverage is one of the lowest in the capital district. A significant percentage of children cannot attend classes due to the lack of places in district schools and the few private schools are not accessible due to lack of resources. For this reason, many children are left home alone and have little contact with their parents who generally work long hours.

For these reasons, Mayor Enrique Peñalosa saw the need to build civil works and provide training to the inhabitants of this locality to improve their quality of life (Fig. 6).

26 works related to Transmicable were carried out to promote culture, economy, and tourism in the locality (Fig. 7). Some of the works are:

- Recreation and sports: 5 parks including courts, green areas, playgrounds, playgrounds, squares, furniture, and signage. Zonal parks were built by the IDR, such as the Illimani park, and neighborhood parks were built by the local mayor's office, such as the Pilona park.
- Illimani walkway and viewpoint: A viewpoint would be built because Ciudad Bolívar has one of the best views over Bogotá, and also seeks to prevent deaths due to earthquakes due to the location of the homes

Figure 7

Transmicabable as an engine of progress and development for the district of Ciudad Bolívar (Bogotá) (Cuevas, 2019).



of a group of inhabitants. However, with the system already operating for almost two years, the work has not been delivered and is planned to be delivered in mid-2020. As for the pedestrian walkway, it connects several places such as green areas and public spaces.

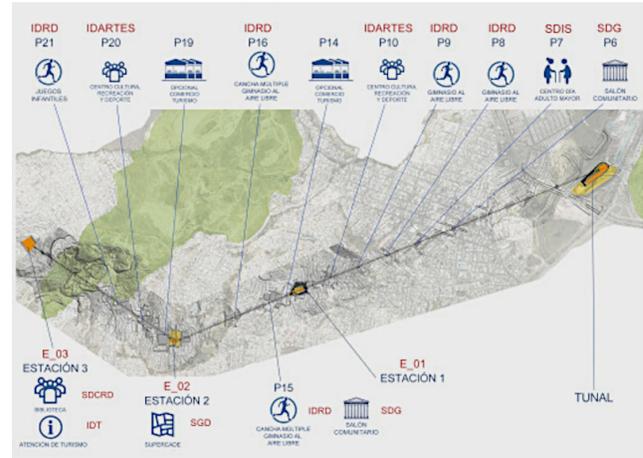
- SuperCADE Manitas: It was in charge of the general secretary of the mayor's office of Bogota. It is considered one of the most modern in Bogota and has other services aimed at social recreation.
- The museum of the self-built city: The museum will tell the story of how Bogota grew between the years 1938 and 2014.
- Cultural centers and libraries: Approximately 1,000 literature and informative books will be available at these stations.
- Happiness Center (CEFE Tunal): It will have swimming pools, a sports center, gymnasium, learning and music rooms, cinema auditorium, restaurants, and shops.

At present, several projects are still under construction or even remain unfinished projects (Fig. 8).

These complements make Transmicabable an innovative means of public transportation in both urban development and social growth. The system is functional, and most of the time it is being well-executed, it was recognized in March 2019 as a comprehensive mobility solution by the International Finance Corporation, an international development institution.

Figure 8

Transmicabable related projects (Moyano et al., 2018).



Students from the Faculty of Engineering of the Catholic University of Colombia conducted a research project entitled "Evaluation of the Social Impacts Projected for the Transmicabable around the Juan Pablo II Station in Ciudad Bolivar" (Moyano et al., 2018). They considered two variables: travel time and quality of life, depending on the former. In the document there is a great variety of information; from a summarized analysis of Bogota as a growing city, focusing on the locality of Ciudad Bolivar to the organization of data that allows knowing several characteristics of the aerial cable, implementation, types, costs, and others.

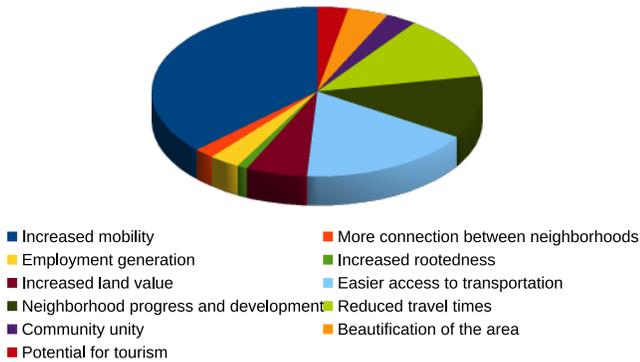
The students, who completed a thesis of more than 100 pages, provide figures and conclusions, thus; the direct benefits are: Decrease in travel times, Decrease in the cost of transportation, Public Investment, and Improvement in mobility. Also and clarifying that the difference between direct and indirect benefits, for the authors, is that the indirect benefits refer to those that are not part of the same group of services or goods in this case transportation, then they are: Decrease in insecurity, Variation in the economic activity of the community, Generation of employment, Strengthening of cultural activities of the community, Generation of sense of belonging, Valuation of real estate. Strengthening of public spaces, integration of areas, reduction of accidents, accessibility, and social inclusion. All these items have their respective analysis, in some of them a comparison is made, the quality of life as appropriate with and without the project, making use of tables, graphs, and references.

They concluded that for the most part the impact is positive and generates a benefit for the community. Where the result is not so general and has several approaches supported by its methodology. Thus using at the beginning a data collection continuing with, its identification and

Figure 9

Evaluation of the social impacts projected for Transmicable around the Juan Pablo II station in Ciudad Bolívar (Moyano et al., 2018).

Community perception



collection by ad-hoc methodology, quantitative social evaluation, and finally data aggregation (Fig. 9).

The journalist Ana Cristina Ayala in her report entitled *The lives that changed the Transmicable* published in the magazine *Semana* on its official website, on July 15, 2019 (Ayala, 2019). It exposes a series of dialogues, which in addition to generating some sentimentality, caused by the economic situation of these people, also refer to how the operation of Transmicable impacts. a solution of employment generated by tourism, comfort for people with disabilities, and easy access to local businesses, are the cases that are read in the magazine *Semana*, however, it is not accurate to generalize the impact of the means of transport with the cases of the report, but if they can be considered.

The people of Ciudad Bolívar with whom the journalist had contacted express great approval and not only that, they expect the completion of the facilities such as the viewpoint to undertake personal projects, all to improve their quality of life. Without having figures and/or percentages, and considering the context, this kind of information is considered important, since it provides data from the experience of the community.

Transmicable began to operate on December 27, 2018, with the first rides at no cost for the community to get to know the new aerial cable in the locality of Ciudad Bolívar. Upon completing one-year Transmilenio S.A. announces that it has mobilized more than 7 million passengers throughout this year.

These same numbers, i.e. with Transmicable operating for one year, almost 63% of the workers, i.e. 185 workers, live in areas surrounding the localities of Ciudad Bolívar and Tunjuelito, which Transmilenio SA describes as a *benefit for the surrounding areas*. As for the social sense that has

been given to the work, more than 320 activities were carried out with the objective of the good use of the system and the sense of belonging. For the physical well-being of the inhabitants and the care of the environment, it is known that with the service operating for one year, 756 tons of CO2 are reduced annually. It should be noted that at that time the Supercade had not yet been built, and several facilities were under construction.

The implementation of the system has been positive in many aspects, such as its good execution day by day, reducing routes, and taking care of the environment. It is also clear that the people who use the means of transport are a vital part when talking about quality, precisely because they use it daily, frequently or live in nearby areas, and they know what problems were dealt with before its operation, thus being able to determine which problems they consider have decreased since Transmicable and the equipment began to operate.

Knowing and sharing this idea, it is considered important to know and/or understand how it improved the lives of the people who developed around the work.

This transportation system since its projection was considered one of the most innovative of the city, since always to find solutions in mobility and other related issues, the mayor's office and the different institutions of urban planning considered appropriate the articulated bus system (Transmilenio), thus making trunk, after trunk, with 9 portals and 138 stations distributed throughout the city. It can be said that it is the basis of public transportation in the capital, mobilizing approximately 2560000 passengers per day, according to global BRT data. However, Transmilenio has large percentages of disapproval by the people of Bogotá.

But what is the relationship between Transmicable and Transmilenio? The aerial cable system serves as a power supply for Transmilenio, so we are talking about an innovative means of transport that works very well for citizens and another means that comes with many failures and nonconformity. Nevertheless, we are talking about the reduction of problems in the lives of the inhabitants of the locality, and taking into account that many of them use Transmilenio to get to their work, or place of study in other areas of the city, the reduction of time and money improved their quality of life. This is why it cannot be said that the mobility problem is over for the inhabitants of Ciudad Bolívar, the problem of public transportation has been reduced. To get to the portal of Tunal, each passenger spends approximately 13 minutes, and not an hour as it happened before, but still has to wait for the trunk service which is not entirely efficient, clarifying that not all citizens who use Transmicable also make use of the articulated bus system.

Transmilenio S.A. gives in its balance of operation of the first quarter of Transmilenio, announces that there is

a savings of \$8.8 billion pesos for users talking about the reduction of travel times.

This last information shows the way in which *the reduction of problems* related to the impact of Transmicable is meant to be understood. Taking into account the face-to-face surveys with structured format conducted by the Urban Development Institute on July 3, 4, 5, 6, and 7, 2015 the first survey and the second one on March 4, 5, and 6, 2019 with the objective of verifying, evaluating and observing the satisfaction of the inhabitants and merchants about the Ciudad Bolívar Transmicable project.

Regarding the knowledge and perception of the project, they were asked about the information pertinent to the project that they had received from the IDU, from which it was obtained that before the work 40% received while the remaining 60% did not have information on the project, and after the work was done the data changed, so 82% now received information on the project and 18% had not yet been provided with information on the work by the IDU directly.

Regarding the condition of the environment, the following figures were presented. Before the project the surveys showed that out of 301 surveys 14% considered it good, 23% fair and 62% totally bad. With the project completed and underway, the following results were obtained. Of the same sample (301 people) 59% considered it good, 32% fair and 8% bad. In percentage terms, the increase in the good perception of the environmental condition was 45%, which helps to verify the positive impact on environmental issues that have improved since the implementation of the project.

Transmicable Impact

If we consider the impact of the transportation system in a timeline, we have the quality of life of the inhabitants before, during, and after (nowadays) the system was built and started to operate in Ciudad Bolívar. The impact is given by the improvement, the comparison between before and after. Taking into account all the aspects that surround the work and the complementary works or equipment that currently operate or are under construction. Such as mobility, comfort, safety, security, environment, culture, and others.

With previous knowledge of the problems that the area of the locality has and/or had, before December 2018, the date when Transmicable began to operate and instant where people began to notice the reduction in some of the problems with which they lived daily.

The conformity of the users and inhabitants of the area goes hand in hand with the impact of the Transmicable since the service was born from the need of the people, then since its projection, the transportation system had to be, by and for the community that lived in the upper neighborhoods, or any person that wanted to arrive and/or leave from there. That is why it was considered that the most important thing when talking about impact, is the opinion of the users, known

through surveys and similar methods, without leaving aside, the studies and figures that clearly show the decrease of negative aspects.

Public opinion is something that is reached through many ways, one of them is the survey, and concerning the Transmicable, public entities have been the ones who have been in charge of this to corroborate the results of their work.

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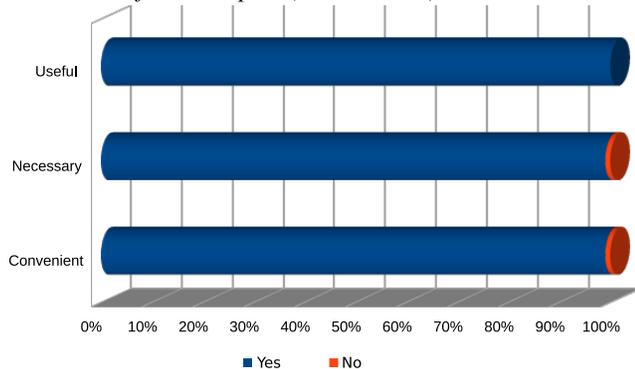
Another aspect that was surveyed is the landscape environment, which is taken advantage of by the visibility provided by the locality due to the height of its neighborhoods, in this aspect we have the following figures. During the construction stage, those surveyed considered that the visual environment was also quite good, with 51% considering it good, 38% fair and 10% poor. With the project under execution, 65% considered it good, 30% fair and 4% bad, although with the operation of the service this aspect improved by 14% concerning the previous perception of those surveyed.

Another item that was used in these surveys was the image of the sector, the image of the locality, which from the beginning was considered a good attribute of the locality by a good part of the respondents: 49% consider it good, 38% regular, and 13% bad. With the implementation of the project, an improvement of 19% is evidenced, resulting in 68% considering it good, 27% fair, and only 3% bad.

Another aspect evaluated was the public space of the locality, which during the construction process gave the following results: 34% considered it good, 46% regular, and

Figure 10

Citizen satisfaction report (Varón, 2019).



19% bad, but with the service, the perception of this aspect improved by 22%, resulting in the following percentages: 56% considered it good, 40% regular and 3% bad.

One of the two aspects that are considered the most important for the people of the community is security, which registered the following figures during the planning of the project: 20% considered it to be good, 43% considered it to be bad, and 8% considered it to be good: 20% consider it good, 43% regular, and 36% bad, even so with the implementation of the service the perception of this aspect is not that it has improved much, exactly 3%, since it is one of the strongest and most relevant problems that for a long time, unfortunately, has plagued this locality resulting in the following figures: 23% consider it good, 44% regular and 32% bad, this reflects the need of the people in this social area.

The other important aspect, which is considered one of the main objectives of the Transmicable, is mobility, which before the project had the following percentage data: only 16% considered it good, 43% regular, and 40% bad. However, with the implementation of the integral Transmicable service, the perception of mobility in the sector improved by 35%, resulting in the following survey results: 51% now consider it good, 43% regular and 6% bad.

After having evaluated some of the aspects that were considered relevant in these surveys, the next step is to observe the satisfaction of the citizens with the integral Transmicable project using the following survey. What is your level of satisfaction with this project? Of which 92% of the 301 respondents consider themselves satisfied, 6% satisfied and only 2% dissatisfied. Regarding the valuation of the local properties, the following results were obtained: 97% consider that they have increased in value, 2% that they have remained the same, and 1% that they will decrease in value over time (Fig. 10).

At the end of the questionnaire a space was set aside for suggestions, negative aspects, and positive aspects that users would like to leave, below will be some of these:

Positive comments

- Improved image
- Good service
- Good project
- Much improved mobility

Suggestions

- Place banking entities in the sector
- Improve security in the sector
- Improve garbage collection
- More transportation routes
- Lack of parking in the sector
- Place more projects like this in the city
- Invasion of public space
- Improve public lighting
- Think about the elderly
- Purchase missing plots of land
- Campaigns to improve the image of the sector
- Install the escalator as planned
- Lack of culture and more visibility of the project
- More incentive for tourism
- Do not place bollards
- Transportation subsidy for students
- There is no control over the sector's JACs

Negative remarks

- Improve road signage
- Maintenance of roads
- Fare collection between stations
- Fulfill the schedule provided by the Transmicable.
- Have not complied with the soccer field, CADE, and library.
- Very slow system

- Clear information on transfer and payment.
- Comply with the projects planned for the neighborhood.
- Noise is very annoying
- The system needs to be more integrated with the trunk lines.
- They did not develop the work as they said they would
- Interruptions in light service
- The project displaced them from the sector
- The Transmicable system is very slow
- Adapt crosswalks
- Affected commerce due to the works
- Fulfill what they promised about the project
- They left a sewer uncovered
- The finishes of the project need to be finished.
- Lack of speed bumps
- Searches in the system are uncomfortable.
- More coordination on the feeder routes
- Improve public space
- Improve connectivity of trunk lines.
- Improve mobility in the sector.
- Lighting at Manitas station
- Improve fares as it is a popular sector
- Very expensive
- Very bad transportation
- Paving streets in the sector
- Transmicable makes the doors of the houses vibrate.
- The turnstile is cumbersome
- Lack of surveillance cameras

All these percentages give us the clear idea that most of the inhabitants tend to consider the arrival and operation of the system as good, the before and after in general has a big difference. However, we have the list of negative observations, which is more extensive than the positive observations, and has a large number, because it can be seen more specified, this shows that although the percentage of

conformity is high, the commitment of public and private entities that are responsible for the work and the surrounding works is still needed.

In this way, we can conclude that, if we base ourselves on the general opinion of the people to speak of a reduction of problems, they did have a reduction, and we can speak specifically of:

- **Mobility:** Reduction of travel times, users take almost an hour less, trips of three hours were reduced to two, for example.
- **Inclusion and culture:** easy access to peripheral areas, and government presence, previously the areas were excluded due to difficult access and government neglect (lack of institutions and/or points of care).
- **Improvement of spaces:** conformity of the people living in the sector, where before it was not considered a good place to live.
- **Economy:** promotes local businesses, reduces transportation costs for families.

This transport system since its projection was considered one of the most innovative in the city, since always to find solutions in mobility and other related issues, the mayor's office and the different institutions of urban planning considered appropriate the articulated bus system (Transmilenio), thus making trunk, after trunk, with 9 portals and 138 stations distributed throughout the city. It can be said that it is the basis of public transportation in the capital, mobilizing approximately 2560000 passengers per day, according to global BRT data. However, Transmilenio has large percentages of disapproval by the people of Bogota. But what is the relationship between Transmicable and Transmilenio? The aerial cable system serves as a power supply for Transmilenio, so we are talking about an innovative means of transport that works very well for citizens and another means that comes with many failures and nonconformity. Nevertheless, we are talking about the reduction of problems in the lives of the inhabitants of the locality, and taking into account that many of them use Transmilenio to get to their work, or place of study in other areas of the city, the reduction of time and money improved their quality of life. This is why it cannot be said that the problem of mobility is over for the inhabitants of Ciudad Bolivar, the problem of public transportation was reduced. This is a concrete fact that deals with the reduction of a problem (mobility and/or public transportation). To get to the portal of Tunal each passenger spends approximately 13 minutes, and not an hour as it happened before, but still has to wait for the trunk service which is not entirely efficient, clarifying that not all citizens who use Transmicable also make use of the articulated bus system.

The figures and the collection in conjunction with the organization of the information allow us to point out what other benefits the transport system has brought. This can be specified by themes (environment, technology, economy, etc.). The care of the environment is linked to the welfare of people and the environment where they live, that is why it can be considered a necessity to take care of the environment, in this case by implementing public transport services such as Transmicable. It is a means that does not use fossil fuels and therefore cares for air quality, uses solar panels, reducing gas emissions. Being one of the works recognized so that the urban development institute received certification for complying with environmental construction standards.

Before the construction of the aerial cable, the way to travel to more central areas or to the Tunal portal was by means of buses, vehicles that expose the user to air pollutants, and because they use fossil fuels they cause many environmental problems in the long term. Therefore, the environmental benefit brought by the Transmicable is important, it reduces pollution in the area, and therefore, the health problems it can cause in the long term. And it takes care of the ecosystem, which is a place to preserve life. However, the environmental problem in Bogota is a problem that is constantly increasing due to the lack of the use of technologies such as the TransMicable, which only reduces to a very low degree the environmental problems faced by the capital and its inhabitants. This means that even so, users continue to be exposed to pollution.

The complementary works that were built and those that are in the process of being built also arose from the need of the inhabitants to have quality public common areas that would generate belonging and security. And these elements are the ones that are contemplated as "Urban Renewal" in the whole project involving Transmicable. The fact that this area of the locality now has parks and attention buildings such as the CADE, makes a difference for populations such as young people who have more recreational spaces, thus decreasing the possibility of their involvement in different social conflicts to which they are very vulnerable, such as gangs, illegal substances, etc.

The issue of security in the locality is complex and even with the system in operation, according to surveys conducted by the IDU, it did not have a very noticeable improvement, however, the mayor's office clarified that it is a system that provides security to users at all times and is constantly monitored by security cameras, something that did not happen before when people used buses and other public transport (Fig. 11).

The quality of life is closely linked to the economic level of families, and the entry into operation of the transport system-generated jobs. In the initial phase, according to the company in charge (Transmilenio S.A.), 192 people were hired, 75% of the citizens living in the locality. And in

Figure 11

Transmicable related projects (Moyano et al., 2018).



this same context, within the planning of spaces, there are commercial areas that would generate income for merchants, together with the viewpoint that is under construction, tourism would also generate income, having an economic sustainability, both for people and for the locality. The before and after in this case is quite visible since the development can be denoted, in a certain way Transmicable generated economic stability to a small percentage of families living in the area and can continue to do so at the time of completion of the pending works.

Transmicable has been in operation for approximately two years and has improved the quality of life of the local inhabitants by shortening routes, improving mobility, reducing the marginalization of the area by making it more accessible and with the necessary state presence, generating a sense of belonging for the inhabitants by making it pleasant, reducing pollution levels, protecting both public health and the ecosystem, cultural projects address the social conflicts that affect the area, providing security and comfort, and generating spaces for economic growth.

Conclusion

In conclusion, the Transmicable is one of the most innovative and inclusive works that have been carried out in the capital, since it was made in a locality of difficult access, where people are mostly poor, although this work has a high rate of conformity, there is also a lot of nonconformity since the inhabitants have denounced that the work was not carried out as promised, In addition, it has certain inconsistencies inside and outside the system (in the surrounding works), such as the lack of maintenance of the system, the lack of security inside the system and the damages that are not fixed in the surrounding works, which is why there are still people who are not satisfied with the system.

As for the environmental impact, this project is very good because it meets certain requirements that do not harm the environment, in addition to not using fossil fuels such as diesel which reduces gas emissions in the atmosphere, so this project is Eco friendly.

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