



METRO POLIS *in* MOTION

TOWARDS A SUSTAINABLE URBAN MOBILITY PLAN



metropolis ●

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TOWARDS A SUSTAINABLE URBAN MOBILITY PLAN

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Executive Summary

This document presents the results obtained from the global cooperation project “Metropolis in Movement” elaborated by the cities of Medellin-Colombia, Quito-Ecuador, Rosario-Argentina, and Tijuana-Mexico.

From late 2018 to mid-2019, Metropolis in Motion curated a series of exchanges and technical visits which addressed the underlying mobility problems of each of the partner cities. These included their processes of planning and implementation of strategic actions aimed at transforming the mobility of cities towards an environment of sustainability, security, and equity.

These exchanges translate into two major products, a conceptualization of the Integrated Plans for Sustainable Urban Mobility (PIMUS) addressing basic concepts about its usefulness, benefits, and process of development. Secondly, a brief narrative on the experience that had the participating cities to discuss their respective PIMUS.

Subsequently, a metropolitan comparison is presented, where the cities develop a series of case studies relating to walkability and technological innovation in the area of sustainable urban mobility. In this case, studies include aspects of legislation, multisectoral coordination, financing, the implementation process, and the social legitimization involved in each of these actions.

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1. Introduction

1.1 Background on Metropolis in Motion

The Board of Directors of Metropolis, meeting on the occasion of the “Annual Meeting of Metropolis 2018”, which took place from 26 to 29 August in the Province of Gauteng, validated and ratified five new pilot projects.

An international jury selected the five projects that were submitted to the Board of Directors for its approval.

ratification, among which is the project called: “Metropolis on the move”, presented by the cities of Tijuana, Quito, Medellín and Rosario.

Following the unanimous approval of the Board of Directors of the International Metropolis Association, for the “Metropolis on the move” project, this collaboration of cities is granted a resource of 26,000 euros to be used in the field of urban mobility in metropolitan areas.

***“We seek
to improve
sustainable mobility
and making cities
more accessible
and safe for all”***

The pilot projects, which are financially supported by Metropolis, promote training and techniques for exchanging knowledge and good practices on metropolitan management among the members of the association within the framework of specific projects.

Metropolis in motion aims to identify important elements that allow for the correct drafting of mobility plans for the cities that implement this process, as well as to achieve a dialogue regarding the mobility problems faced by metropolitan cities, mitigation measures and possible solutions.

In April 2019, an addendum to the collaboration agreement between the world association of major metropolises and the leader of the Metropolis in Motion Project, Tijuana City Council, is presented.

In March 2019, the World Association of Major Metropolises was asked to shorten the project's implementation time, which was planned for 30 June 2020.

1.2 Project Partners

The principal partners of the Metropolis in Motion project are: Medellín - Colombia, Quito - Ecuador, Rosario - Argentina, Tijuana – Mexico



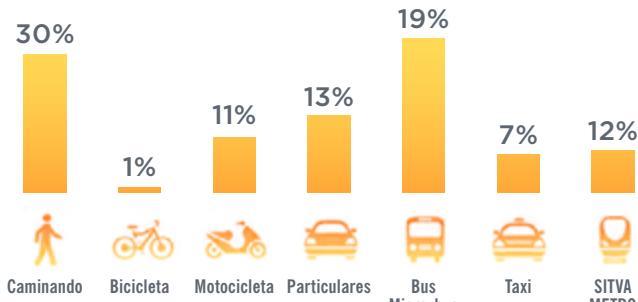
MEDELLÍN

Colombia

The city of Medellín:

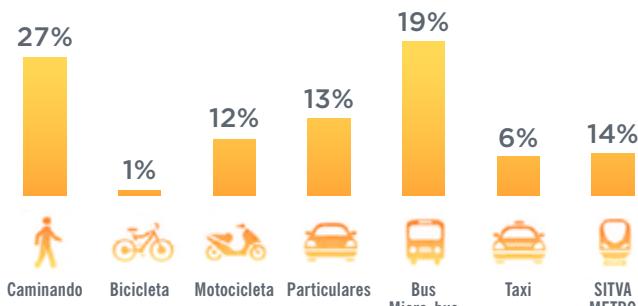
- Population: The city of Medellín has approximately 2'508,000 inhabitants and the Aburrá Valley metropolitan area has 3'591,000 inhabitants.
- Surface Area: The area of the city of Medellín is 381 Km² and the metropolitan area is 1157.5 Km².
- Density: The city of Medellín has approximately 6222 (hab/Km²) and the metropolitan area of the Aburrá Valley has 3104 (hab/Km²).
- Mobility Indicators:

According to the latest survey on origin and destination of the Aburrá Valley, the following information is available for the city of Medellín (trips in the urban and rural perimeter of the municipality):



Fuente: Encuesta Origen destino y del valle de Aburrá (2017)

Regarding travel in the Metropolitan Area we have the following:



Fuente: Encuesta Origen destino y del valle de Aburrá (2017)

Some issues and challenges facing the municipality of Medellín today are:



Medellín has been developing a sustainable mobility model that consists of:

- Public transport systems
 - Integration of the SITVA (Integrated Transport System of the Aburrá Valley) in its massive components (Metro, tram, aerial cables, BRT systems among others) and collective (City bus system).
 - EnCicla's public bicycle system
 - Individual public transport system (Taxi)
- Infrastructure for non-motorized modes
 - Cyclorutas, 125 km to December 2019
 - 2000 modules in cyclo-park installed by December 2019
 - 80 EnCicla stations by December 2019

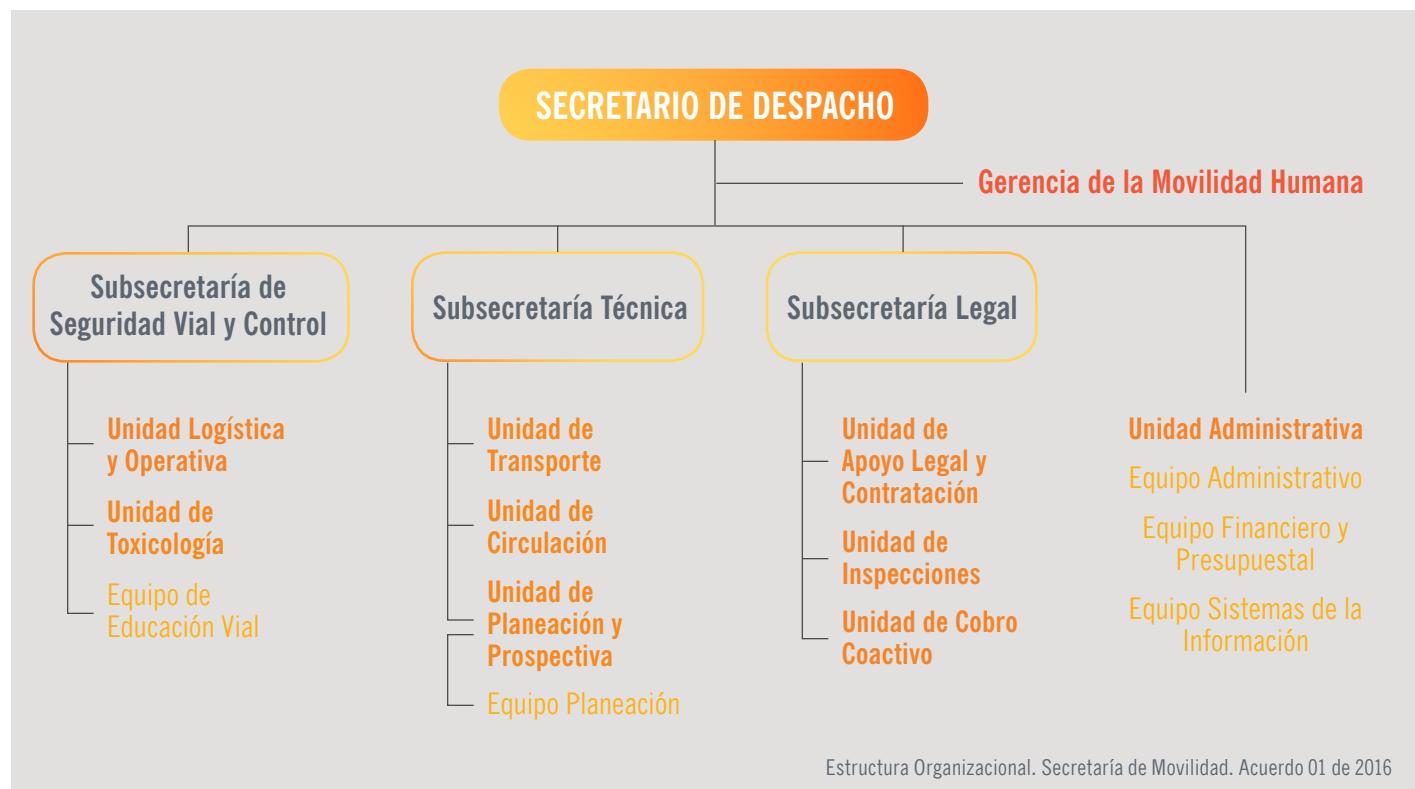
Mobility Agency of Medellín

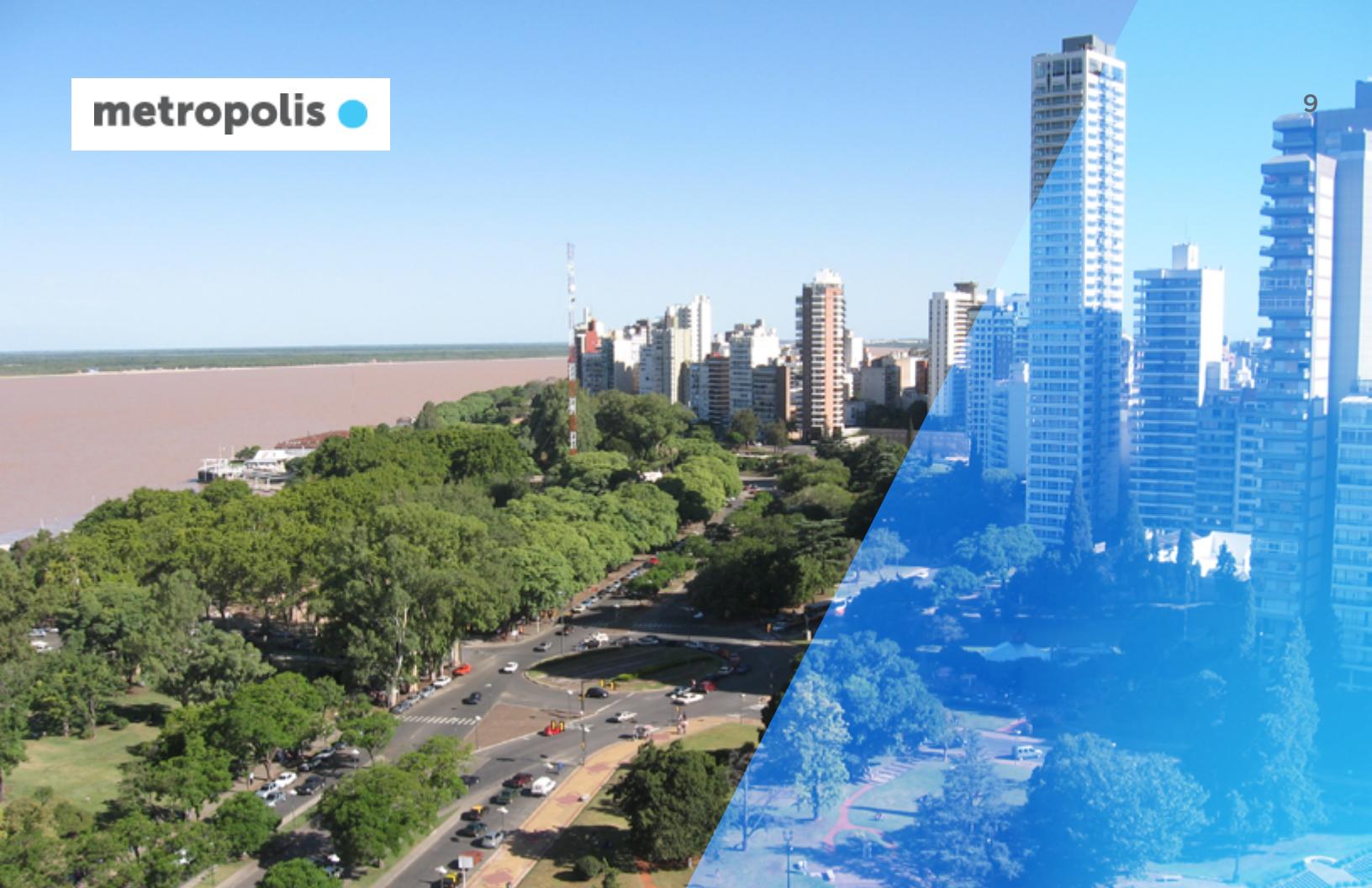
The Secretariat of Mobility of Medellín is a central level agency that will be responsible for: Defining Mobility policies, as well as planning, design, coordination, implementation and evaluation of information, corporate, institutional and mobilization strategies of the Municipal Administration.

The Secretariat of Mobility of Medellin makes use of new information and communication technologies (Intelligent Transportation Systems - ITS); collects, processes and analyzes traffic data to develop strategies and actions to reduce the negative effects of vehicular traffic. Improving attention times, regulation and traffic control and contributing to the reduction of road accidents.

The objective of the mobility secretary of the municipality of Medellín is:

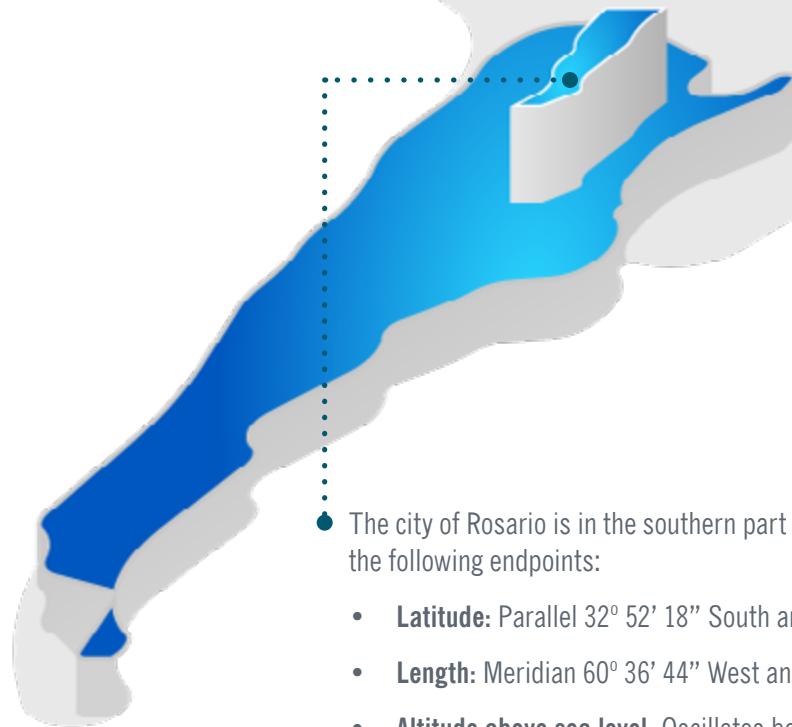
"To plan, regulate and control aspects related to land transport activity, pedestrian and vehicular circulation, in accordance with the model of social and economic development of the city. And to provide services that meet the needs of the user, promoting road safety culture and a healthy environment".





ROSARIO

Argentina



- The city of Rosario is in the southern part of the province of Santa Fe, Republic of Argentina, between the following endpoints:
 - **Latitude:** Parallel 32° 52' 18" South and 33° 02' 22" South.
 - **Length:** Meridian 60° 36' 44" West and 60° 47' 46" West.
 - **Altitude above sea level:** Oscillates between 22.5 and 24.6.

The municipality of Rosario has a total surface of 178,69 km², of which the urbanized surface is 120,37 km².



Green Spaces

The urban green space is distributed into:

- | | |
|---|--|
| <ul style="list-style-type: none">• 24 parks• 124 squares• 51 small squares | <ul style="list-style-type: none">• 24 promenades• And 228 other green spaces |
|---|--|

Total surface area of green spaces:

11.264.550 m² (11,265 km²), 6,3% of the total surface area of the city

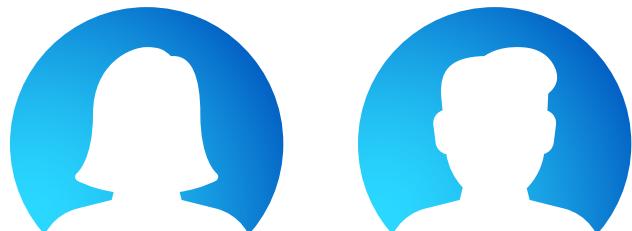
Urban green space per inhabitant in 2014 (as projected by the 2010 Census):

12,5 m²

Population

National Population Census, Households and Housing Census
2010 (last census): 948,312 inhabitants.

Estimated population 2017: 992,323 inhabitants.



WOMEN
52,5%

MALES
47,5%

District	Center	North	North East	South	South East	West
Population	243.650 Inhabitants (25,69% of total)	137.883 Inhabitants (14,54% of total)	170.765 Inhabitants (18,01% of total)	146.257 Inhabitants	117.086 Inhabitants	135.481 Inhabitants (14,29% of total)
Surface	20,66 km ² (11,56% of total)	34,88 km ² (19,52% of total)	43,82 km ² (24,52% of total)	18,78 km ² (10,51% of total)	20,13 km ² (11,27% of total)	40,42 km ² (22,62% of total)
Green spaces	2 km ²	1,97 km ²	4,41 km ²	1,35 km ²	0,74 km ²	0,81 km ²
Quantity Neighborhood Blocks	1227	1520	1950	1264	1155	1155
Blocks	2434	3060	3587	2323	2126	2333
Population Density	11.793,33 Inhabitants/km ²	3.953,08 Inhabitants/km ²	3.896,96 Inhabitants/km ²	7.787,91 Inhabitants/km ²	5.676,90 Inhabitants/km ²	3.351,83 Inhabitants/km ²
Housing	142.830 units	46.624 units	49.950 units	48.606 units	32.584 units	36.532 units

<https://www.rosario.gob.ar/web/ciudad/caracteristicas/informacion-territorial>
<https://www.rosario.gob.ar/web/ciudad/caracteristicas/indicadores-demograficos>



Mobility Agency of Rosario

Objective, mission, vision of the Secretariat of Transport and Mobility

"Under the concepts of territorial integration, social inclusion and sustainable development, interventions are carried out to improve urban mobility by integrating transport, traffic engineering and urban planning policies."

EMR ENTE DE LA MOVILIDAD
DE ROSARIO



QUITO

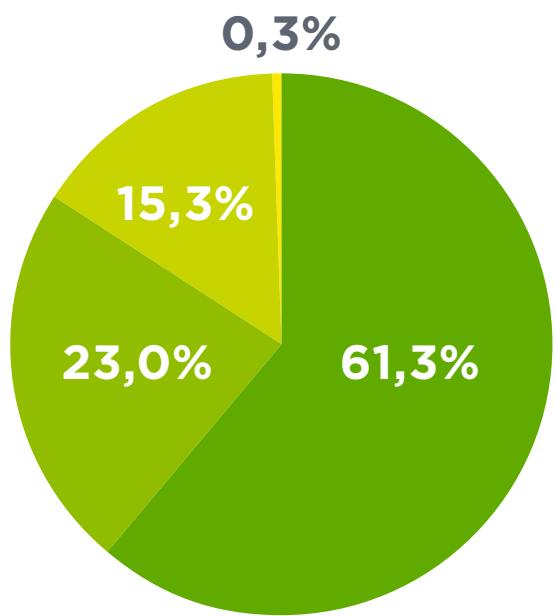
Ecuador

The City of Quito:

The Mobility Department of the city of Quito through the Metropolitan Directorate of sustainable modes of transport is responsible for data management, issuing policies, regulations and control over the mobility of the city and specifically with sustainable transport methods. And responsible for ensuring its progressive implementation as a substantial part of the city and the quality of life of the people of Quito.

- The population of Quito including the Metropolitan District to the suburban localities of the city, as well as considering the parishes of Conocoto, Amaguaña, Cumbayá, Nayón, Zámbiza, Llano Chico, Calderón, Pomasqui, San Antonio, Tumbaco, Guangopolo, Puembo, Alangasi, La Merced, and Sangolquí, amounts an actual population of 2,495,043 inhabitants in the City of Quito.
- The city has a total area of 372.39 km² which includes sub urban and peripheral areas known as “the valleys”.
- Quito has a population density of 7347.1 inhabitants/km².
- The use of the private vehicle in the city is approximately 23%, with reference data from 2015.
- The Walkability Index in the city is 15.3% according to the latest study conducted by the National Polytechnic University in 2015.
- Green spaces in the city of Quito are 20.2 m²/hab.

- Percentages of transfer modes used in the city of Quito is shown in the graph below:



- Transporte Público
- Transporte Privado
- Andando
- Bicicleta

Mobility Agency of Quito

The Municipality of the Metropolitan District of Quito develops planning processes for a flowing and sustainable mobility according to the 10 principles of mobility: Security, Accessibility, Efficiency, Equity and Inclusion, Multimodality, Sustainable and Healthy Environment, Citizen Participation, Productivity and Economic Development, Quality, Technological Innovation.

The Department of Mobility and its entities undertake a broad and comprehensive work, thorough the deployment of actions that contribute to the development and strengthening of the road transport system. Always thinking about citizenship and its entitlement, promoting harmonious coexistence among all users in high quality public space.

Affiliated entities

- Empresa Pública Metropolitana de Movilidad y Obras Públicas EPMMOP
- Empresa de Pasajeros de Quito
- Revisión Técnica Vehicular
- Empresa Pública Metropolitana Metro de Quito
- BiciQuito
- Agencia Metropolitana de Tránsito AMT
- Dirección Metropolitana de Políticas y Planeamiento de la Movilidad
- Dirección Metropolitana de Gestión del Transporte Público
- Dirección Metropolitana de Desarrollo Tecnológico de la Movilidad

Undertake an emerging action to build together, with citizens and the competent authorities in other levels of government, a new model that corrects the vices of urban growth that originate the mobility problems that this territory is experiencing today and reverses the tendencies in the displacements. Conceptualizing mobility, as an element of the system of inclusion and social equity that seeks proper living.



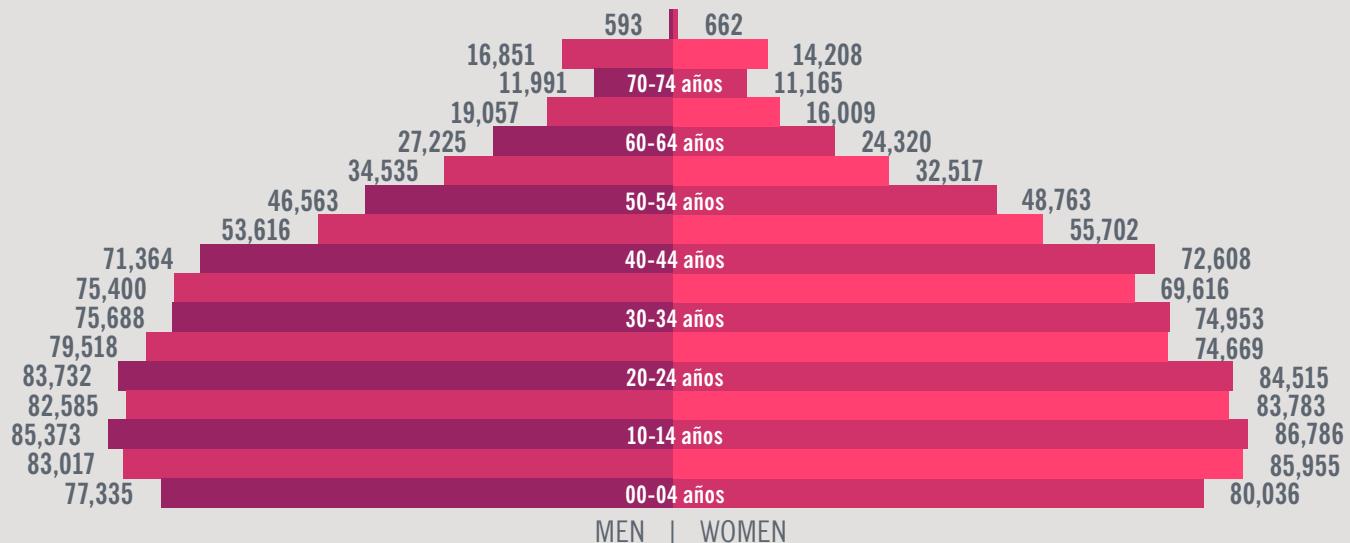


TIJUANA

México

The Metropolitan Zone of Tijuana (ZMT) is considered the sixth metropolitan area in Mexico, made up of the municipalities of Tijuana, Tecate and Playas de Rosarito. By 2015 it had a population of 1,810,710 inhabitants, with an annual growth rate of 1% tending to decrease.

Gráfica. Estructura de edades en la Zona Metropolitana 2015.

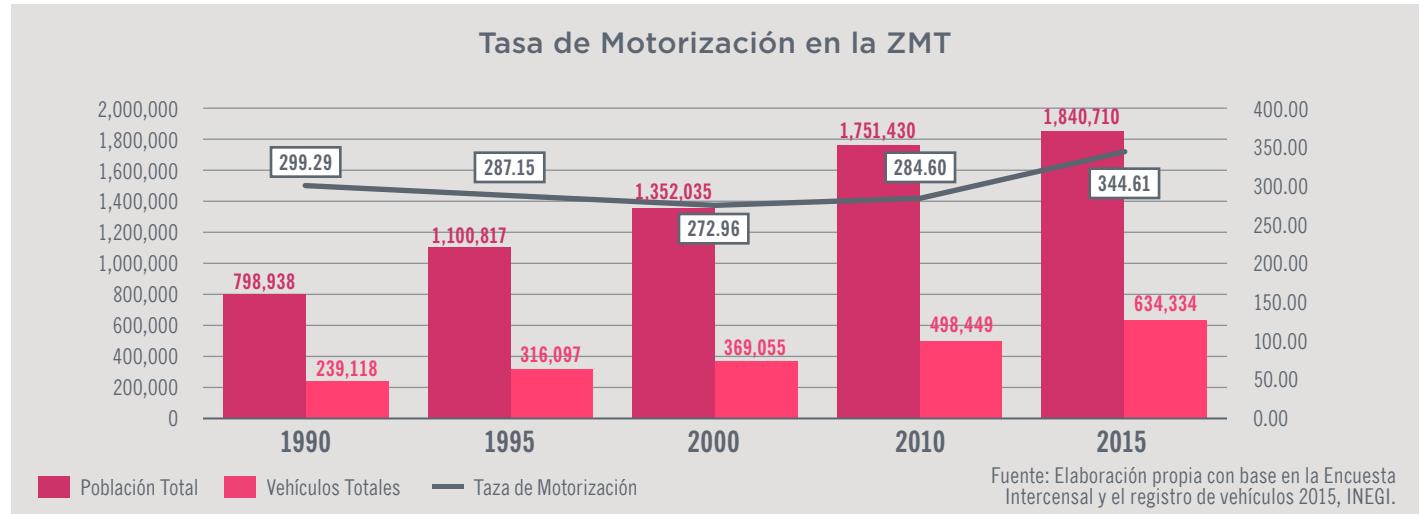


Fuente: IMPLAN, con base en la Encuesta Intercensal 2015, INEGI.

Use of the vehicle in the Tijuana Metropolitan Area

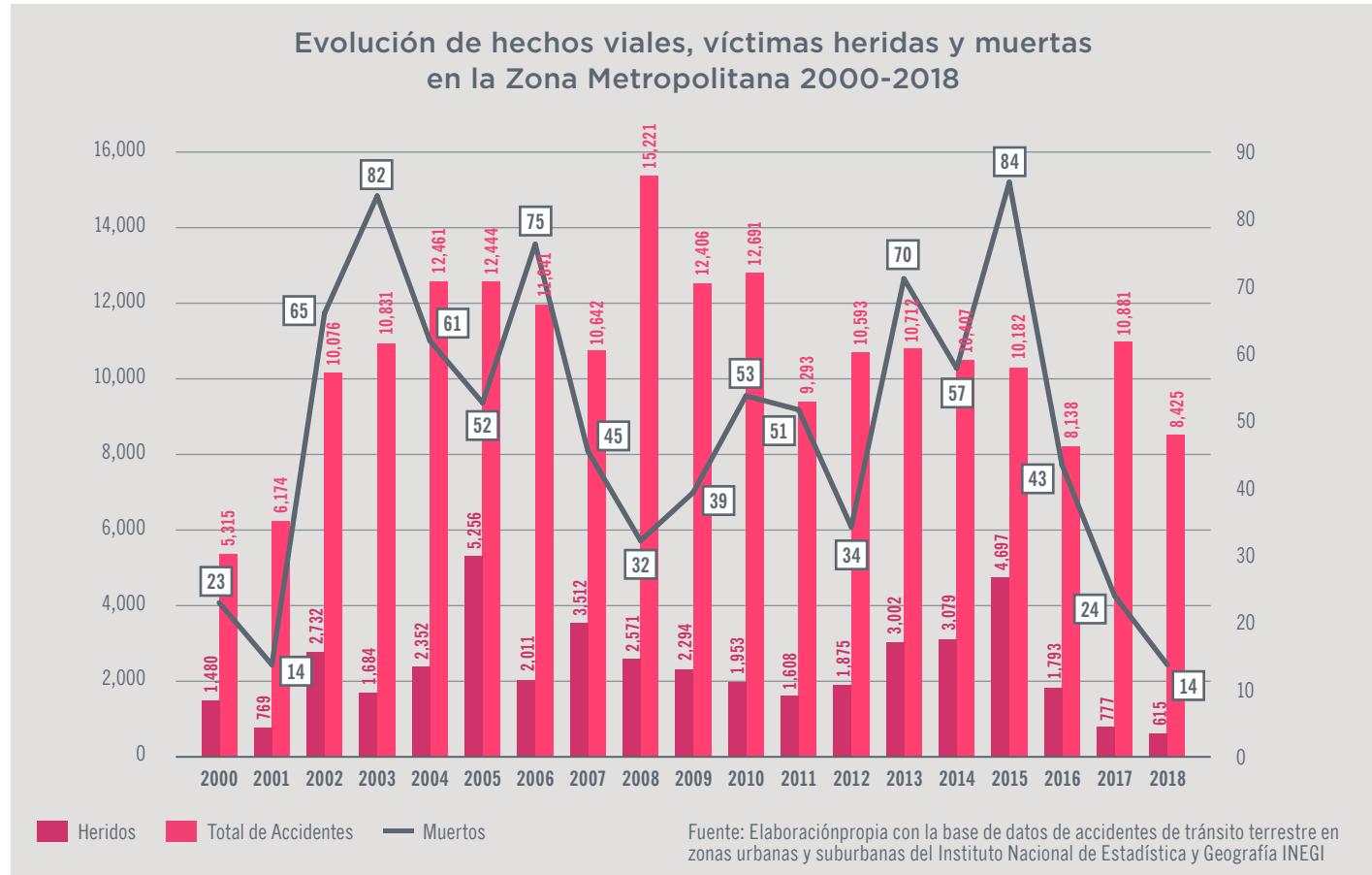
The Metropolitan Area has presented an increase in the vehicle ownership rate of 15.14% from 1990 to 2015. With 344.61 registered vehicles per 1000 inhabitants, only considering the registered vehicles. In addition to this and due to the shared border with the United States, there is an irregular vehicle fleet made up of foreign vehicles that have not carried out an import process and are not registered or regularized by the country.

Tasa de Motorización en la ZMT



Statistics of road incidents

During 2018, a total of 8,425 traffic accidents were registered in the ZMT, the highest number of fatalities belongs to the category of drivers with 50%, followed by 29% that corresponds to pedestrians of the total registered for 2018.



Environment

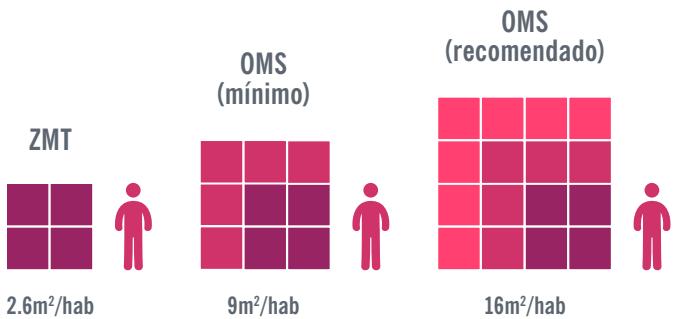
According to the ZMT profile, prepared in 2018 by LSECities, a research center at the London School of Economics and Political Science. The ZMT has 2.6 m² of green areas per capita.

Air Quality (PM2.5) 23.0 ug/m³ annual average

WHO Global Urban Ambient Air Pollution Database

CO₂ emissions per capita: 1.44 (tonnes per inhabitant)

OECD Metropolitan eXplorer



Walking Infrastructure

According to the data presented in the National Housing Inventory drawn up by the National Institute of Statistics and Geography (INEGI), in the metropolitan area there are only 4 % of ramps that allow free access to pedestrian sidewalks.

The 37% of the roads in the ZMT have sidewalks, however, these usually present inappropriate dimensions, hindered by posts, vertical signage, street furniture, etc.. Hindering adequate pedestrian movement.



Survey origin destination

During 2017 the ZMT carried out the implementation of a Destination Origin Survey, allowing to highlight the following findings:

- The most common reason of transfer is for work reasons
- The most frequent mode of transfer is the automobile
- 7 out of 10 households in the Tijuana Metropolitan Area have at least one vehicle

Currently the ZMT has only 2% of users who make their transfers by bicycle, additionally 60% of the sample alleges that they would not use the bicycle as a means of transport despite the existence of an adequate infrastructure.

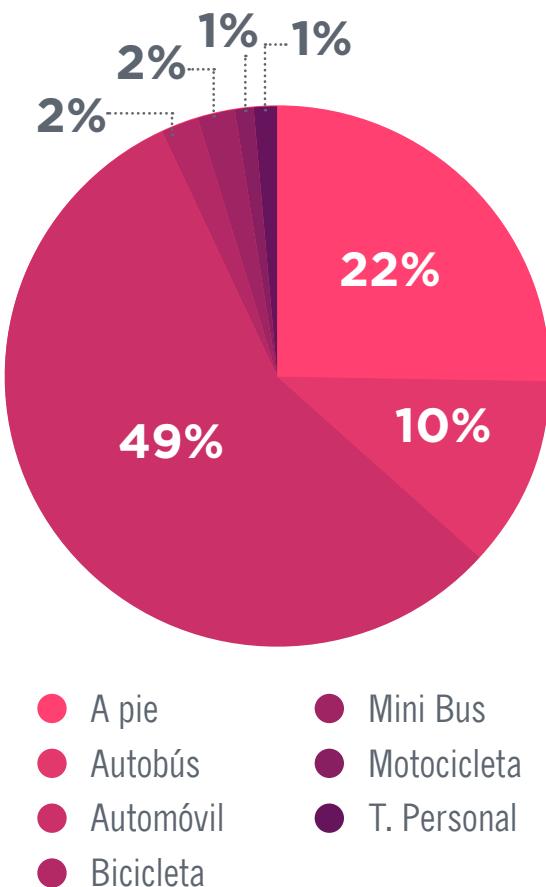
The research center LSECities was able to detect that only 16.3% of the urban population of the ZMT live within a radius of 500 meters to a public transport system.

The distribution of average daily transport expenditure is clearly different for each type of transport:

Non-motorized	\$ 0
Public Transportation	\$ 63.60
Automobile	\$ 104.98

Fuente: Elaboración propia con base en la información presentada en la EOD 2017 elaborada por Transneti

Frecuencia de Modos para los traslados en la ZMT



Fuente: Elaboración propia con base en la EPD 2017 elaborada por Transneti S.A de C.V



Mobility Agency of Tijuana

The Secretariat of Sustainable Urban Mobility of Tijuana is a municipal agency head of sector, operational and vigilant that regulations are applied, specializing in sustainable urban mobility for the city.

This agency must work together with the citizens and the competent authorities to build the new model of city, for which it must rely on the principles of transport in urban life: walking, pedaling, connecting, transporting, mixing, densifying, compacting and changing.

The Secretary of Mobility must ensure the effective exercise of the right to mobility, promoting road safety and care for the environment.



Secretaría de Movilidad
Urbana Sustentable
SEMOV

Social Focus of SEMOV



Fuente: Elaboración propia

This agency is supported in the areas of public space, public transportation, road projects, mass transportation systems and municipal planning, in turn works in coordination with the other Secretariats to address transverse problems that afflict the municipality.



The SEMOV coordinates and directly supports the following areas:

- The Direction of Sustainable Urban Mobility
- The Public Transportation Directorate of Tijuana
- Municipal Organization for the Operation of the Urban Mass Transportation System of Passengers of Tijuana, Baja California.
- Metropolitan Planning Institute of Tijuana



1.3 What motivated the partners to participate jointly in this project?

Urban mobility planning is an effective public policy tool for eliminating social inequalities and achieving sustainability in cities.

To date, its potential has not been exploited in Mexico. On the contrary, urban mobility planning has traditionally been thought of as a function of the automobile and has generated severe environmental and equity problems.

If these trends continue, they will seriously affect the social, economic and environmental viability of cities.¹

The main intention of this collaboration is to improve and generate an exchange, a dynamic between one city and another in order to strengthen some of the schemes they have in common, new problems to seek solutions together and disseminate them through this forum. This type of collaboration allows us to learn from the experience of other cities, broaden our range of options, giving us the ability to discern which are feasible in our respective territories.²

Regardless of the situation or the actions that are being worked on individually as a city to transcend in parallel, we must form **global cooperation networks** in which the same information that you, as a city, are generating serves someone else and the information that they generate serves you

1.4 List of workshops

Metropolis on the Move - Launch Meeting, 03-05 October 2018, Tijuana, Mexico:

The launch meeting of the Metropolis in Motion pilot project consisted of a series of technical exchanges between representatives of the project's partner city, the general context of their metropolis as well as the main problems they face in terms of mobility.

The motives behind the project were presented, and the objectives and expected results were established under a scheduled work plan. In addition, emblematic technical visits were made in the area of mobility to the Tijuana Metropolitan Area.

Metropolis on the Move - Second Workshop, presentation of the final draft, 29-30 August 2019, Medellín, Colombia:

The objective of the second workshop was to present the draft of the final contents of the Metropolis on the Move project in its most advanced stage. The presentation of these advances will be lead by the city of Tijuana.

Additionally, there will be technical visits and exchanges with public officials regarding mobility in the city of Medellín.

UCLG World Congress, Presentation of the work Metropolis on the Move - Global launch of the guide, 15 November 2019, Durban, South Africa:

There will be a presentation of the work done in this pilot project as well as the official launch of the final products of this metropolitan collaboration.

¹ Retomado del Plan Integral de Movilidad Urbana Sustentable para la Zona Metropolitana de Tijuana, Tecate y Playas de Rosarito

² Entrevista a Daniel Rivera Basulto referente a la Asociación mundial de las grandes Metrópolis por Rene Peralta

2. Conceptualization of a Comprehensive Sustainable Urban Mobility Plan (PIMUS).

Urban mobility planning must focus on two fundamental issues:

How to think about urban mobility in terms of equity and sustainability?

It implies considering urban mobility not as a function of moving cars but as a means of getting people to enjoy access to goods and services.

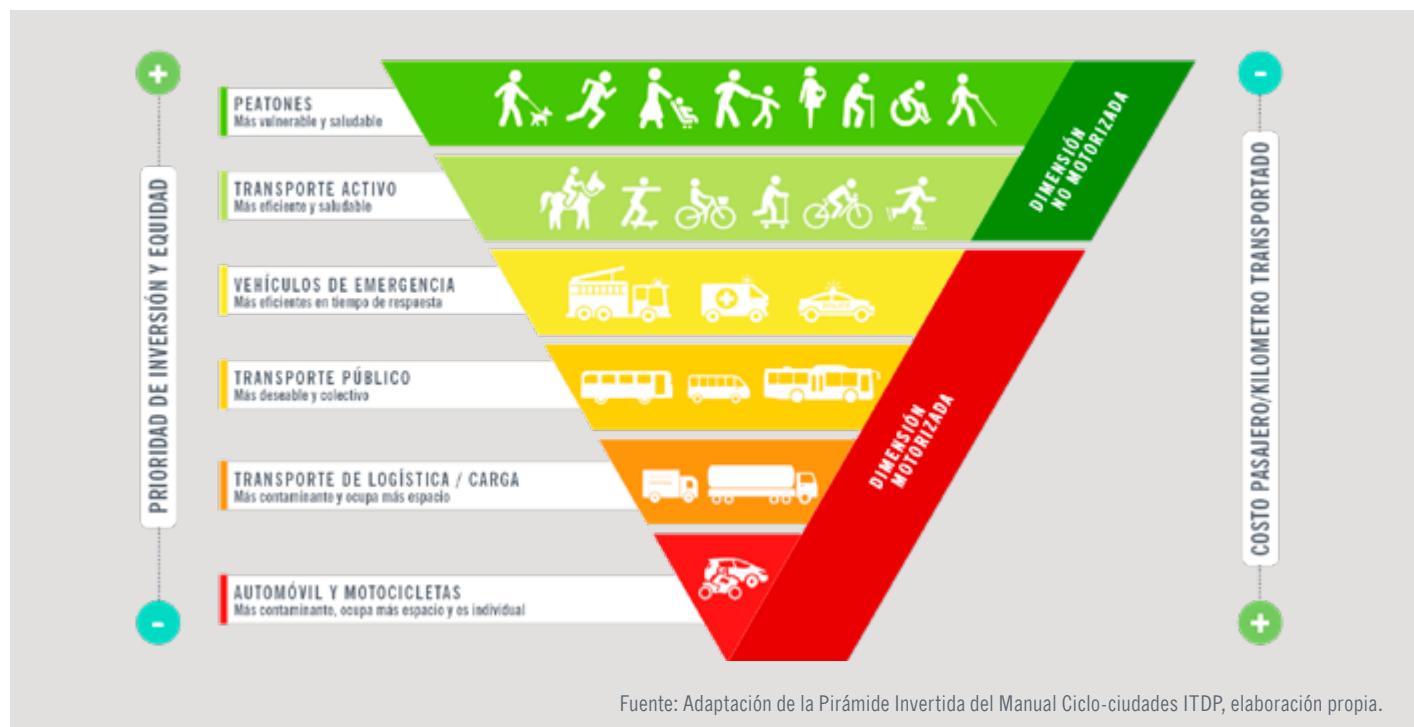
This results in the natural prioritization of pedestrians, cyclists and public transport in public policies. It also implies that car users must bear the cost of the environmental and social impacts of using their vehicles.

By opting for this approach, it is possible to reduce social inequalities and achieve sustainability.

How can these solutions be implemented so that the population can appropriate them?

This involves establishing a mobility plan with a sustainable and participatory approach.

The process of elaborating and monitoring the plan necessarily requires the active involvement of society.



2.1 What is a PIMUS?

The PIMUS concept is not a rigid definition of what urban planning should look like, or a single approach to urban mobility planning. It is rather a set of guiding principles that can be adapted to the specific circumstances of the urban area under consideration.³

Integrated Urban Mobility Plans are adaptable instruments that seek to integrate mobility planning into urban and economic development plans at the municipal level, so that the city can be provided with quality public spaces and people can move more quickly through different modes of transportation connected to each other, always with optimal standards of quality and comfort.⁴

A PIMUS is, in essence, a planning document, and due to its elaboration methodology, it is an action that promotes the coordination, agreement and teamwork of multiple sectors.⁵

2.2 What are the objectives of a PIMUS?

A PIMUS seeks to promote a compact and sustainable city; promote policies to reduce the use of the automobile; prioritize the implementation of more sustainable forms of travel within a city; that is, modes of transport that make economic growth, social cohesion and environmental protection compatible, thus ensuring a better quality of life for citizens.

A PIMUS must ensure the application of the following principles and public policies:

- Establish measures that encourage and promote the use of public transport and the rational use of the private car;
- Adopt measures to guarantee the protection of life and physical integrity, especially of persons with disabilities and/or limited mobility, and
- Ensure that mobility promotes sustainable urban development and the functionality of public roads, in compliance with the provisions relating to land use and the urban image (in relation to the supply of public transport).



Fuente: Acción Empresas, por un desarrollo sostenible, wbcsd.

³ <https://sumbilbao19.com/sustainable-urban-mobility-plans-a-new-way-of-planning-urban-mobility/>

⁴ WRI México , <http://wriciudades.org/our-work/project-city/pimus-planes-integrales-de-movilidad-urbana-sustentable>

⁵ Plan Integral de Movilidad Urbana Sustentable ZMT

2.3 What is it for and why do we need a PIMUS?

The current patterns of urban mobility are at the origin of a significant number of negative impacts related to health, the environment and equity. In recent years, there has been a growing consensus that PMUS is the ideal tool to combat this situation.⁶

As a planning instrument, it will allow us to support, plan, order, disseminate and prioritize strategic mobility projects.

The benefits of the PIMUS approach are diverse. The following list provides the top ten reasons for developing and implementing a Sustainable Urban Mobility Plan⁷:

- Improve quality of life
- Save costs - creating economic benefits
- Contribute to better health and the environment
- Make mobility smoother and improve access
- Make more effective use of limited resources
- Gain public support
- Prepare better plans
- Effectively comply with legal obligations
- Use synergies, increasing relevance
- Moving towards a new culture of mobility

2.4 How do you elaborate a PIMUS? (Method guide for the elaboration of Integral plans of sustainable urban mobility)

First and foremost, it's necessary to make clear that a PIMUS is not the Panacea to solve the mobility problems immediately. It's a script to work with, that requires the management and monitoring like any other planning instrument being deployed in developed countries.

In order to develop the Integrated Sustainable Urban Mobility Plan⁸, the guide entitled "Integrated Mobility Plans: Guidelines for Sustainable Urban Mobility"⁹, has been used, as well as the construction of the "General Terms of Reference¹⁰ for the Integrated Sustainable Urban Mobility Plan (PIMUS).

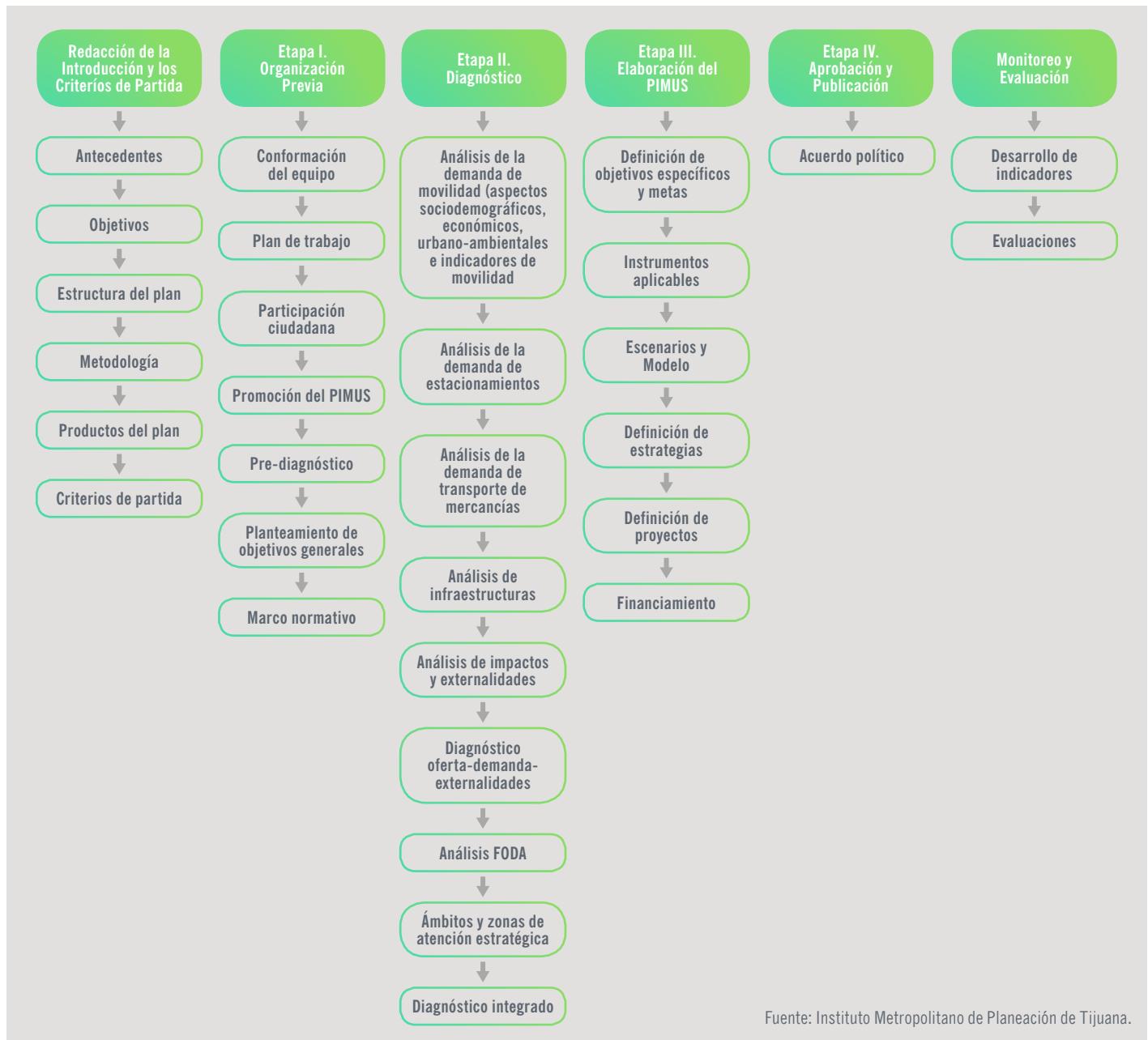
⁶ <http://www.s453960241.mialojamiento.es/PMUS30/index.php/introduccion/que-es-un-pmus>

⁷ <https://sumbilao19.com/sustainable-urban-mobility-plans-a-new-way-of-planning-urban-mobility/>

⁸ Capítulo Metodológico, Plan Integral de Movilidad Urbana Sustentable de la ZMTTPR

⁹ <http://mexico.itdp.org/wp-content/uploads/Planes-integrales-de-movilidad-lineamientos.pdf>

¹⁰ Términos de referencia, es el documento que contiene los lineamientos generales, las especificaciones técnicas, los objetivos, alcance, enfoque, metodología, actividades a realizar, estructura, programa de manejo, entre otros aspectos que se emiten para elaborar un trabajo determinado.



The first step is to progressively develop a preliminary organization phase, in which the main actors involved, the sources of financing to be managed and the preliminary tasks to be carried out should be identified.

For the formation of the work team, the guidelines ideally assign this role to the Institute in charge of city planning. The City

Councils are in charge of leading institutionally the PIMUS and the coordinating organ of the technical process is the planning institute of the city.

In the work team it is recommended to gather specialists in the following areas: urban development planning, mobility planning, social participation, modeling, and analysis of urban transport,

non-motorized mobility, traffic engineering, environment, project evaluation, environmental and social impacts, public policies, urban law, geographic information systems (GIS), urban design and institutional and business development.

Posteriormente, se deberá describir una breve relatoria del plan de trabajo a implementar para elaborar el PIMUS, este deberá componerse de las actividades a realizar, los responsables de las actividades, los tiempos de ejecución planificados y reales, así como los costos ejercidos.

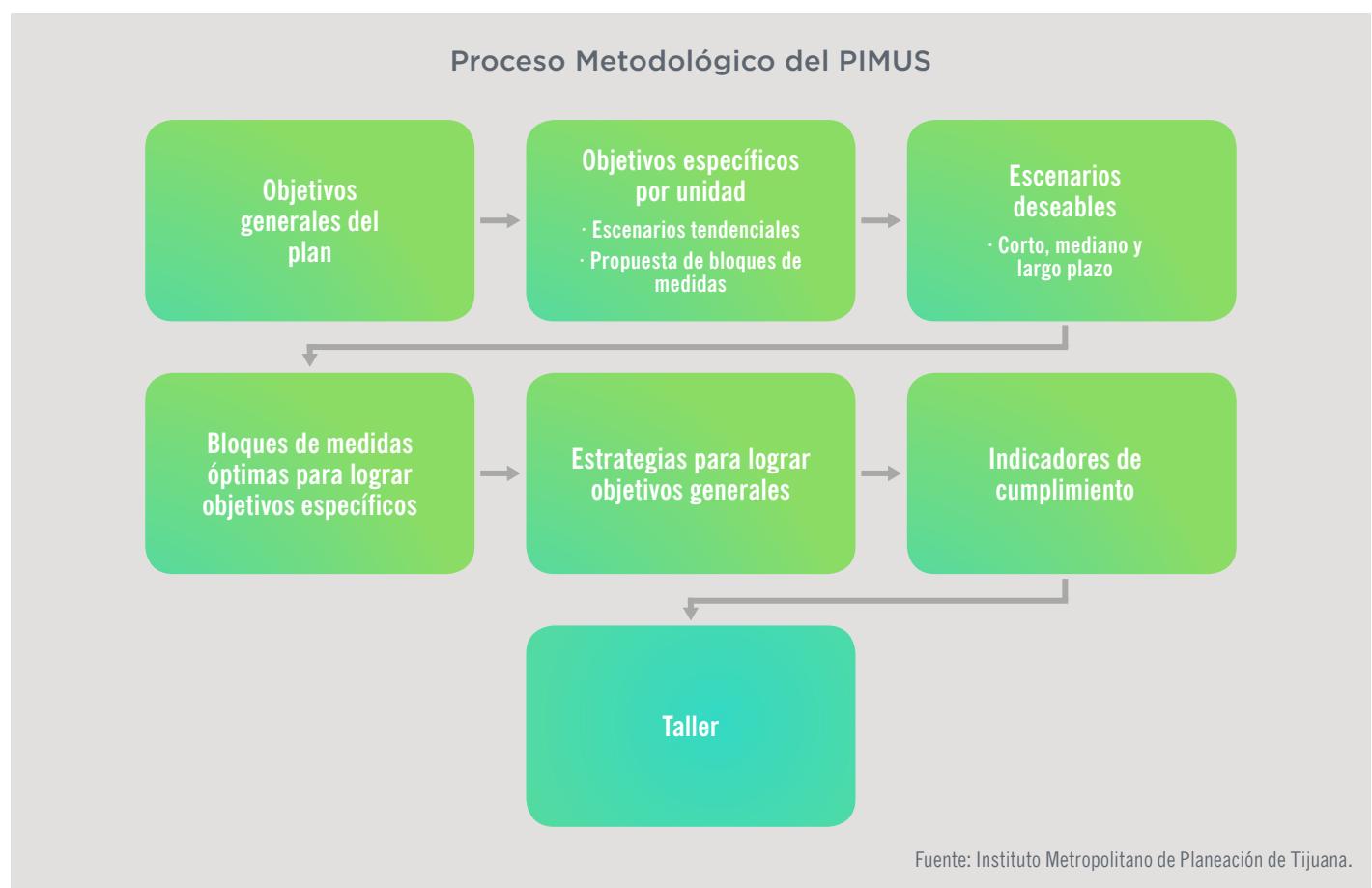
It should be composed of the activities to be carried out, those responsible for the activities, the planned and actual execution times, as well as the costs incurred.

Mechanisms should be designed for citizen participation¹¹, which will become important from the attainment of resources and the impulse for the elaboration, until the final integration of the Plan; which will also give continuity during its operation and execution

together with the authorities.

A dissemination and socialization plan should be designed to access the entire target population, in order to ensure their participation and knowledge, which gradually lays the foundations for a transformation of the culture and paradigm of how we conceive urban mobility.

In order to establish the starting point for the following section, it is necessary to construct a preliminary diagnosis, in which the data, research and previous processes related to the topic at the local and regional level should be recovered, and the general objectives of the document should be proposed. It is possible to take as a starting point those proposed by the ITDP in the form of global aspects: Favoring the compact city; Reducing the use of the automobile; Prioritizing the most efficient modes of transport; and Sustainability of mobility.



¹¹ El Manual de Participación en políticas de movilidad y desarrollo urbano desarrollado por el ITDP puede resultar de gran utilidad para seleccionar el mecanismo de participación más adecuado.

2.5 What was the experience of the partners as to the elaboration of their respective PIMUS??

Rosario

In the city of Rosario, we evaluated the experience as extremely positive. We believe that its success, in addition to the quality of the content itself, comes from the fact that we conceived the Integral Mobility Plan (PIM) as a consensual agreement, with high citizen participation, building a mobility model adapted to contemporary needs.

Its preparation implied the combination of different perceptions, knowledge and experiences of three support actors:

citizenship and more than 100 institutions: which interacted through participatory debate workshops;

the international experts: who contributed their great trajectory in the matter and

the local experts: who added the prestige of the National University of Rosario and a technical team of specialists in different areas such as planning, transport engineering, urbanism, railway transport and economics.

With its discussion, subsequent publication and the signing of the mobility pact in December 2010, the City had a clear horizon where the actions to be taken had paved the long but necessary road to consensus. The promotion of mass public transport, the development of non-motorized transport and the dissuasion of the use of private motorized transport were a common objective. As a public policy with the necessary support affirming that by following this path, Rosario and its metropolitan area began to build an efficient and inclusive mobility capable of satisfying the needs of its current and future inhabitants.

Medellín

The purpose of the Integrated Sustainable Mobility Plan for Medellín (PIMS) is for the city to gain a sustainable mobility plan in environmental, socioeconomic, urban and security terms.

The formulation of this plan is the responsibility of the

Administrative Department of Planning and the National University of Colombia (U.N.) Medellín Headquarters.

The initial diagnostic phase began in 2016, when researchers observed whether the 2014 Land Use Plan (POT) for a strip of the city comprising the Centre and the cross-cutting features of Santa Elena and La Iguaná was being complied with.

For this first part, the research team searched for information in plans submitted by entities such as the Administrative Department of Planning, the Secretariat of Mobility, the Urban Development Company, the Secretariat of Physical Infrastructure of the Municipality and the Metropolitan Area; with its location on a map the state of planning for the central strip of the city was analyzed.

A second study was carried out in 2017, in which “the diagnosis was extended to the entire city, but this time primary information was analyzed from vehicle gauges and more than ten participatory workshops with mobility actors such as users, public and private institutions, and transporters.

In addition, more than 200 city planning documents were reviewed at the macro (national and regional), meso (municipal) and micro (specific areas or scopes) scales.

The diagnosis showed that there are problems of institutional coordination, citizen culture and topography, and from there arose a series of planning decisions and behaviors of the actors that lead to the discriminated use of individual mobility solutions.

For the formulation phase, in 2018 the 133 kilometers chosen for intervention were covered.

The structuring corridors were defined based on the proposals of the POT; the existing mass transport network and the Medellín metro proposals; the suggestions of transporters and users, and the analysis of mobility desires resulting from the 2017 survey.

The PIMS will be presented to the community after the Metropolitan Area completes simulations of the proposals and are endorsed by the U.N. and the Administrative Department of Planning.¹²

¹² <https://agenciadenoticias.unal.edu.co/detalle/article/avanza-plan-integral-de-movilidad-sostenible-para-medellin.html>

Quito

For the city of Quito, it has been a complicated process and has required the will of members of the Metropolitan Council of Quito, members of the cycling and pedestrian associations, authorities of several municipal institutions and the experience of other cities around the world.

In Quito, the pre-contractual process of the PIMUS is underway and the experience of other cities is being considered to highlight the validity, the adaptable, the applicable and the non-applicable for a plan as complex as the PIMUS.

The process of recruiting a multidisciplinary team to develop the Terms of Reference has been vital and allocating much of the resource to active citizen participation has been a key element in these early stages of plan development.

Tijuana

In the case of Tijuana, one of the main reasons why the city needed to generate its PIMUS is that at the Federal level the Secretary of Agrarian, Territorial and Urban Development SEDATU launches the National Strategy for Sustainable Urban Mobility; likewise, as part of the requirements to access federal funds for mobility cities needed to have a PIMUS.

Because the city needed to update its Municipal Urban Development Plan, as well as its Urban Development Program

for the Population Center, this opportunity was secured and in an economy of scales the information collected for these instruments could also benefit the development of the PIMUS. Additionally, and as a great advantage, the three-year public administration was commencing, and part of their objectives was the formulation of this plan.

The metropolitan PIMUS obtained financing from the State of Baja California, the Development Councils and the Metropolitan Fund for its elaboration.

The Metropolitan Planning Institute of Tijuana oversaw carrying out the process, where a multidisciplinary work team met for the development of the Plan, while more specific inputs were subcontracted to local consultants.

The plan consisted of different stages, where in each of them specialized participation workshops were held as citizens for the construction of the instrument.

Throughout the whole process there were notable difficulties, from the reluctance to change, the real time required for the elaboration of the plan and the need to develop a permanent effective participation system. Normally this process of "participation" was prearranged more as a launch of a finished product where citizens were never involved.

3. Metropolitan Comperatives: Case Studies, Walkability, Technological Innovation in the area of Sustainable Urban Mobility.



MEDELLÍN

Colombia

3.1 Case Studies, Pedestrianization and Walkability in Medellín

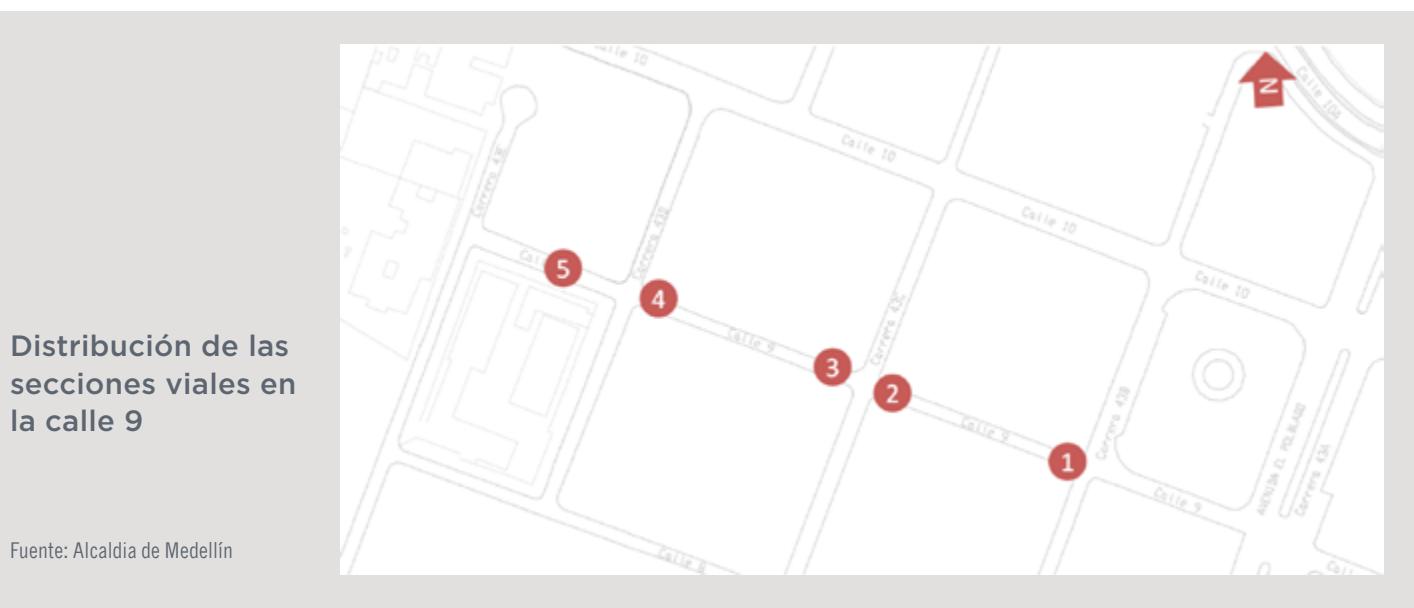
The 9th Street Road Walking Network

It is in the Astorga neighborhood and is framed between Poblado Avenue to the east, bordering with El Poblado neighborhood; the canal of La Presidenta Creek to the south and west, bordering with Patio Bonito neighborhood; and 10th Street to the north, bordering with Manila neighborhood.

Traditionally Astorga has been a commercial and services district, because of the convergence of restaurants, hostels, educational centers, medical institutes, among others, such as the church and the notary's office. These attractive centers generate a great number of trips to the sector and therefore a high pedestrian flow. It is necessary to emphasize that in the neighborhood there is the Parks of the Dancer, and the Poblado Park, which is a reference in the city, promoting greater social interaction in public space.

The night-time dynamics of the sector generates pedestrian movements until late into the evening, especially on weekends. Yet, the physical state of the platforms does not favour pedestrians (wide vehicular road sections and small platforms with obstacles and little accessibility) and even impede the circulation of people with reduced mobility on platforms.

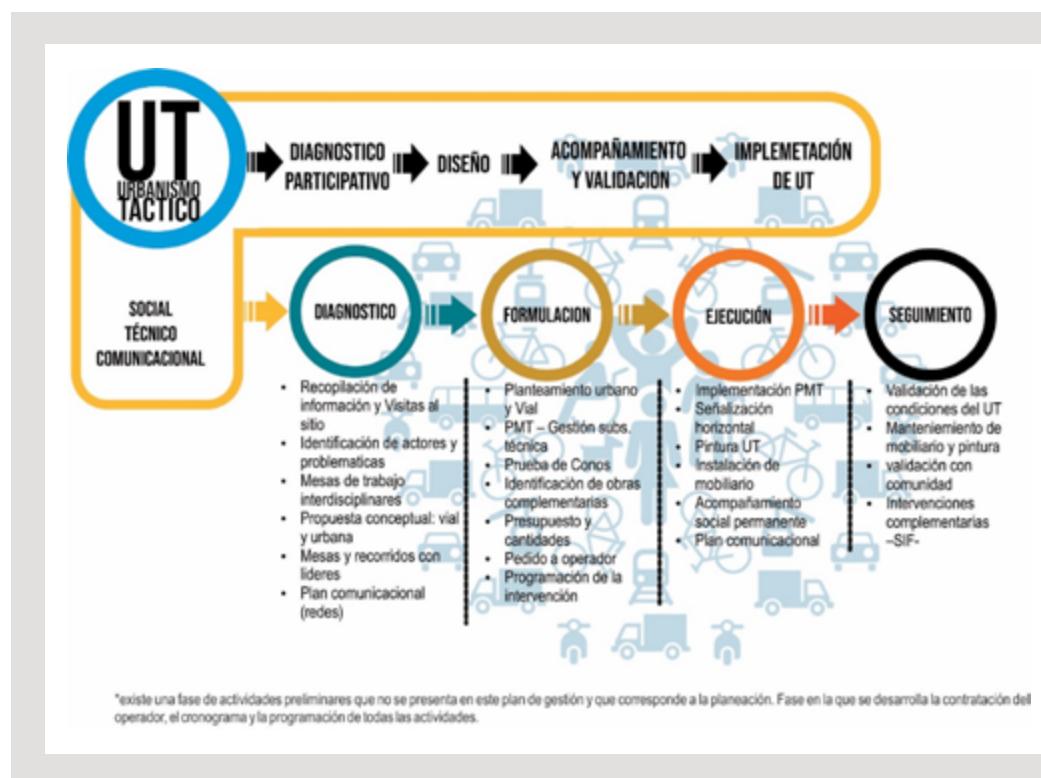
The road geometry was diagnosed by measuring the critical sections for each of the blocks:



The intervention was approached from a systemic perspective of road safety, and as an integral intervention. But having as a primary objective to improve pedestrian safety conditions in the area and generate pedestrian connectivity between the Poblado station of the subway and the Poblado park, this intervention was proposed as a pilot for the implementation of a road network and was the first strategy of its kind in the city of Medellín. The primary objective was to improve safety conditions for pedestrians and people with disabilities vis-à-vis other actors on the road.

The Human Mobility Management of Medellín developed a methodology that would allow the implementation of any tactical

urbanism in any point of the city. This tactic responds to the ideal of developing specific and necessary interventions, which are identified and developed with direct support from the community. This methodology proposes the development of four phases (diagnosis, formulation, execution and follow-up), which will have the permanent presence of a technical, social and communicational team, allowing that prior to an implementation of definitive character, participative analyses will be carried out that will result in interventions designed with a high social validation.



Fuente: Gerencia de Movilidad Humana de Medellín

The Human Mobility Management carried out the social support to the proposed pilot project, in such a way that mechanisms of participation and socialization were implemented so that the execution of the project would be coherent with the needs of the communities in the neighborhoods of El Poblado and Astorga.

The social support to the communities consisted of citizen participation where the Human Mobility Management, through the social team, contacted with community leaders of the sector, which allowed the creation of the primary meeting, being this a favorable space for the proposal of ideas that could be integrated into the definitive design. The community's needs were evaluated together with the intervention that was going to be proposed, which allowed a deep analysis of the difficulties and problems to be improved within the project. With the above, an arrangement and prioritization of needs was made, which provided extremely valuable information for the proposal of the design of the intervention of the 9th Street Road Walking Network.

As a result of the whole social process and the continuous dialogue with the community, the following problems became evident which contributed to the decision making and the relevance of the project:

- Problems of pedestrian mobility and conflicts between actors.
- Unsafe road crossings for pedestrians.
- Inadequate behavior of road users.
- Infrastructure of poorly maintained platforms and in many cases with different barriers that did not allow the mobilization of people.
- Dangerous maneuvers by drivers that put pedestrians at risk.
- High speeds at which vehicles travel.
- Deficient parking on the road, hindering the entry to properties
- Risk or exposure of pedestrians on the road

Following these findings, the pilot test was carried out with cones, of the road network on 9th Street, which is followed by a constant monitoring process that allows for the evaluation of the interventions and the knowledge of the community's perception, which made it possible to identify the following:

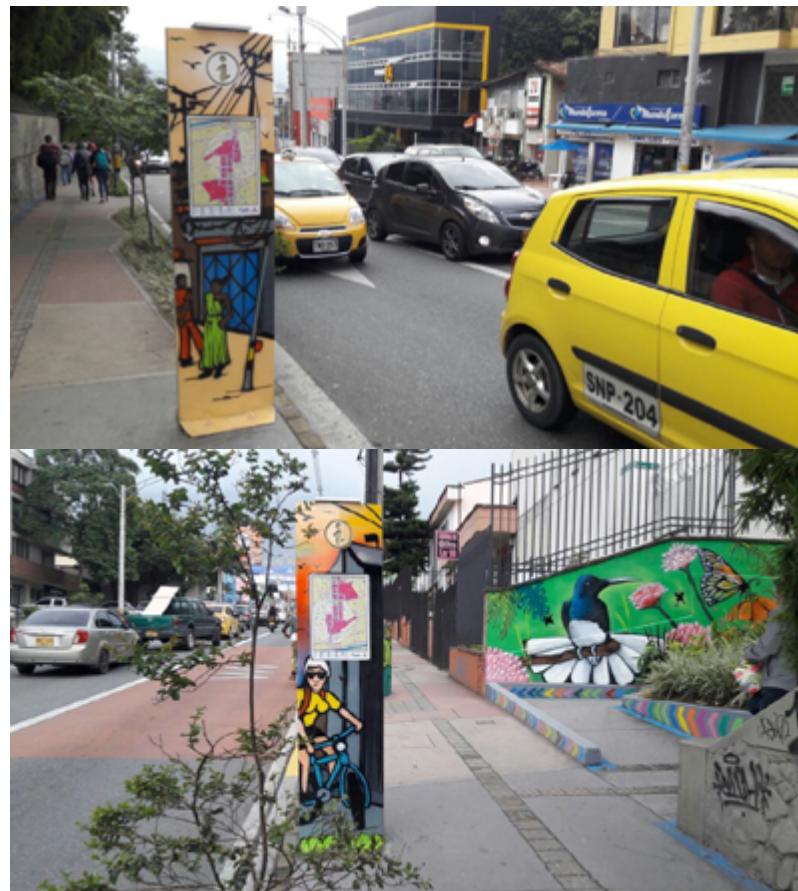
- There was a noticeable improvement in the behavior of drivers on the road, because with the adaptations of the intervention, inappropriate parking on road junctions is no longer permitted.
- Decrease in dangerous maneuvers that endanger the lives of passers-by.
- Decrease in vehicle transit speeds in the area.
- Decrease in the risk or exposure of pedestrians on the road.
- Recovery of spaces for the use and enjoyment of people.
- Identified appropriation of the gardeners by the local.





With this intervention, it was meant to offer a space to improve the conditions of walkability and accessibility for pedestrians and people in situation of disability that transit daily by the sector, and at the same time to orient the users between the station Poblado of the subway and the park the Poblado. It was proposed to improve the pedestrian crossings, to optimize the vehicular lanes, to propose alternatives to the bad parking, reduce vehicular speed and with it to strive for the reduction of the accidents.

As with all tactical urban planning and road network interventions, this consisted of a light intervention, where paint was applied to demarcate the pedestrian space and redistribute the axis of the vehicular roadway, as well as the installation of gardeners that serve as a separation between vehicular and pedestrian flows, providing greater pedestrian safety. In the following images you can see the appropriation of the users of the sector to the road network.



Case Studies, Innovation and Technology in Sustainable Urban Mobility in Medellín

Medellin Public Transportation System TPM

The SITP is a generic name for the company Metro and its integrated systems that refers to the integration of the intermodal system made up of the Metro, Tram, Metrobus (BRT), Metrocables and bus feeder routes. And the SITVA (Integrated Transport System of the Aburrá Valley) organized by the Mobility Sub-Directorate of the Metropolitan Area as an authority in massive and collective metropolitan public transport also seeks the integration of the intermodal system of the Metro company with the other operators (Metroplús, TPC, etc.) for the entire metropolitan area.¹



Fuente: Recorrido Metropolis en Movimiento, Medellín agosto 2019, Fernando de la Torre Serratore, Metro



Fuente: Recorrido Metropolis en Movimiento, Medellín agosto 2019, Tranvía, Metrocable



Fuente: Grupo Azvi, Metroplús (BRT) de Medellín²

¹ Observatorio de Políticas Públicas del concejo de Medellín, Movilidad Segura en Medellín, mayo-junio 2017, <http://www.eafit.edu.co/centros/analisis-politico/publicaciones/observatorio/Documents/7.pdf>

² <http://www.azvi.es/?actividades=metroplus-de-medellin>

SITVA³ is the set of public transport modes that allows metropolitan citizens to move around the ten municipalities of the Aburrá Valley. The SITVA is made up of the following subsystems, which provide integrated service to citizens in a safe, efficient and comfortable way:

- **The Metro:** The Aburrá Valley has 31.3 kilometers of metro that moves 800,000 people a day at an average speed of 37 km/h. The subway began operating in 1995 and today has two lines, 27 stops and a fleet of 80 train units.
- **Los Cables:** the cable lines extend up the slopes of Medellín and one of them is for tourist transfers to Arví Park. In total, there are 11.9 km of cables with 12 stops spread over five lines and a fleet of 362 gondolas that mobilizes 41,000 passengers daily. The city's first cable was put into service in 2004.
- **The Tramway:** started operating in 2016, provides service with a single line of 4.3 km and nine stops crossed by a fleet of twelve trams that mobilize 45,000 passengers per day. The social accompaniment in its construction phase made it possible to turn the tram corridor into an urban gallery, a route with a memory that today allows us to see the landscape of the eastern slope, murals and the local gastronomy.
- **The Metroplús:** mobilizes 125,000 passengers daily on two lines that total 26 km of travel, has 48 stops served by a fleet of 30 articulated buses and 47 standards. Since the beginning of its operation in 2011, the efficiency of Metroplús' trips has been evident since taking advantage of the exclusive lanes and the proximity of the connection with the Envigado and Itagüí systems are another step towards the complete integration of the system.

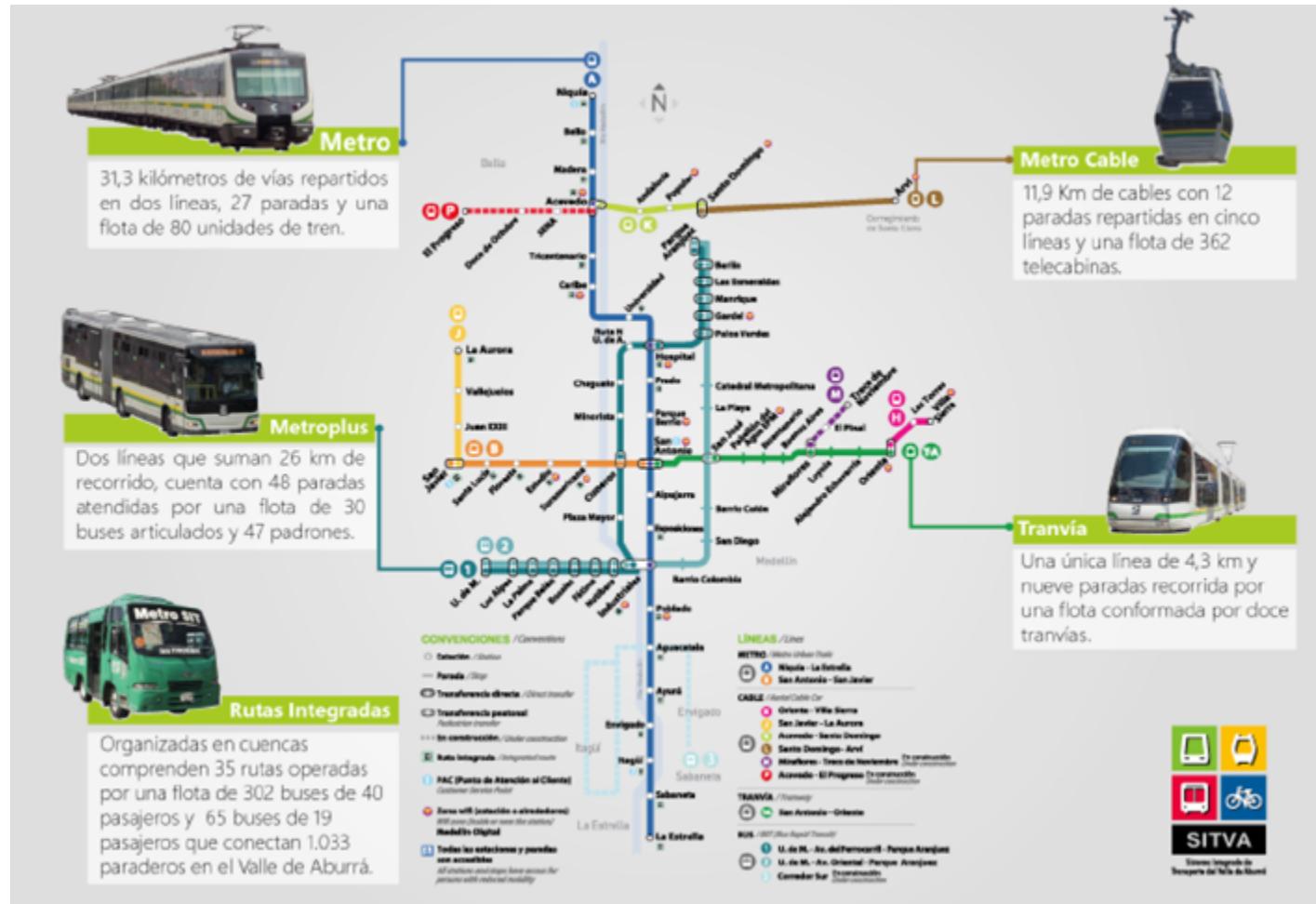
- **Feeder buses and integrated routes:** organized by basins complete the system that understands how people move in the Aburrá Valley and facilitates their movements in terms of fares and efficiency. The system mobilizes 110,000 people daily on 35 routes operated by a fleet of 302 buses of 40 passengers and 65 buses of 19 passengers connecting 1,033 bus stops in the Aburrá Valley.
- **Public passenger transport (PST):** within a municipal and metropolitan radius of action, it is made up of the routes that pass through two or more municipalities within the Metropolitan Area of the Aburrá Valley. TPC is organized in basins that are operated by different transport companies.
- **Aburrá Valley Public Bicycle System - Encicla:** is a bicycle system in public space for citizens to use and move between the stations of the same system.



Fuente: El Tiempo, Medellín 06 julio 2018 , Guillermo Ossa⁴

³ <https://www.metropol.gov.co/movilidad/Paginas/transporte-publico/sitva.aspx>

⁴ <https://www.eltiempo.com/colombia/medellin/en-el-centro-de-medellin-comenzó-expansión-del-sistema-de-bicicletas-hacia-el-valle-de-aburra-240090>



Fuente: Sistema Integrado de Transporte del Valle de Aburrá, SITVA

In terms of infrastructure, all stations are accessible and have, depending on their architecture, elevators, mechanical platforms, electric stairs and/or ischiatric supports. Likewise, the stations have low public telephones for people of short stature.⁵

⁵ <https://www.metrodemedellin.gov.co/viajeconnosotros/accesibilidad>

Some of the services available at the stations⁶

- Customer Service Point
- Civic Recharge Machines
- Bicycle Parking
- Public Bathrooms
- BiblioMeter
- Elements for Accessibility
- Electronic teller machines
- Commercial Spaces



Fuente: Recorrido Metropolis en Movimiento, Medellín agosto 2019

Green Recharge Locations

Metro de Medellín's environmental program promotes sustainable mobility through the recycling of plastic bottles in different stations of the metro network. For each bottle that is taken to the collection machines, the user receives the immediate transfer of 50 pesos to his personal Civic card to be used for travel in the system.⁷



Fuente: Mi Buenos Aires Medellín, 14 septiembre 2018, Punto de Recarga Verde, Tranvia de Ayacucho

⁶ Dicha disponibilidad de servicios varía de estación a estación

⁷ <https://www.metrodemedellin.gov.co/al-d%C3%ADa/noticias-metro/artmid/6905/articleid/551/la-recarga-verde-llega-al-coraz21n-del-sistema-metro>

Bibliometro

In 2006, the Comfama⁸ Libraries Program, through an agreement with the Medellín Metro System, developed the Bibliometro. These are located within stations of the city's Metro system and arise as an alternative to introduce the population of Medellín and the metropolitan area to reading in everyday spaces through bibliographic and information services.

- Consultation
- Loan and renovation of books
- Reservation and web renewal
- Online Catalog
- Wi-fi
- Cinema a la carte
- Internet access
- Rolling Words



Fuente: Recorrido Metropolis en Movimiento, Medellin agosto 2019

⁸ Comfama es una empresa social de carácter privado, autónoma, vigilada por el Estado colombiano, que cubre con sus acciones a 4'600.000 personas en el Departamento de Antioquia y aporta a su bienestar y felicidad entregando servicios de salud, educación, crédito, subsidio cuota monetaria, empleabilidad, vivienda, recreación y cultura. https://www.comfama.com/contenidos/servicios/Nuestra%20organizaci%C3%B3n/Qu%C3%A9nes%20somos/Qu%C3%A9%20es/que_es.asp



Fuente: Recorrido Metropolis en Movimiento, Medellín agosto 2019

Tarjeta Cívica⁹

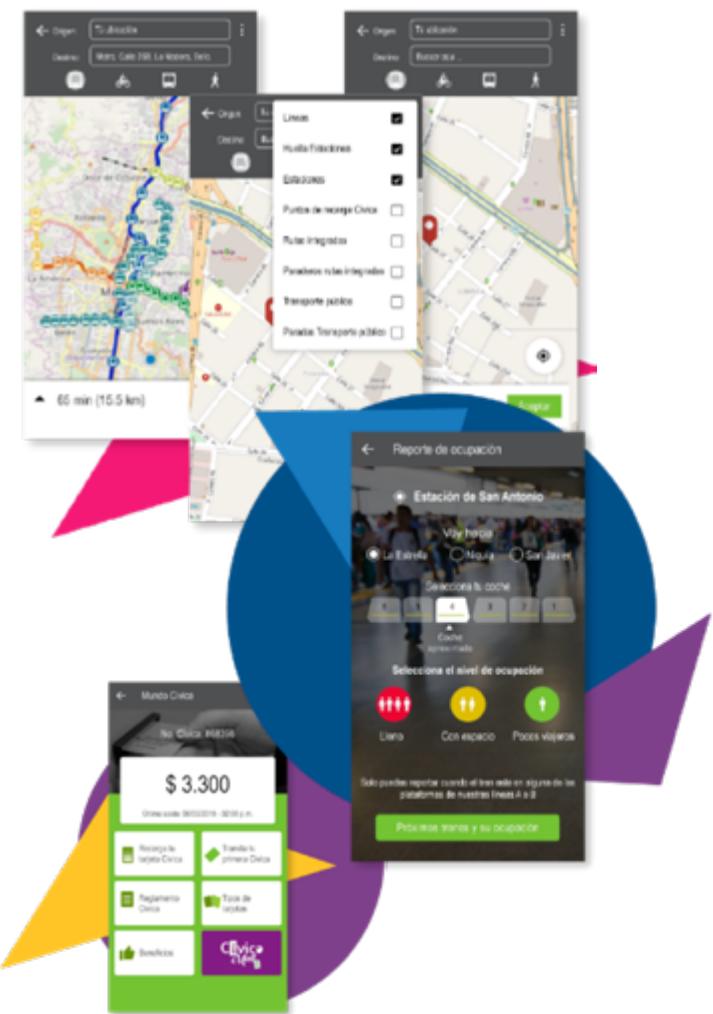
In terms of fare integration, understood as the unification of payment systems in public transport, which implies the existence of a common technological means to integrated services. Metro's SITP represents the greatest advance in the city in that it implements the Civic Smart Card, which functions as a single system that allows people to move around in the different means of transport that make up the system, being able to make transfers between one and the other.¹⁰

In 2007 the Empresa de Transporte Masivo del Valle de Aburrá began the implementation of Cívica for the collection and entrance to the METRO System, for its economic, operational and environmental benefits compared to the paper ticket. This Intelligent Card without physical contact (TISC), allows to store money and pay trips in the system, saving time, improving the security while on a trip due to that great amounts of money are not transported in cash. In the same way the civic card grants economic benefits to its users.

App Metro de Medellín

Users will be able to find information on integrated and feeder routes, check the balance of their Civic card and have a complete travel planner at their disposal.

As a novelty, users will be able to report in real time how loaded are the train cars so that other users, in the following stations, can move on the platforms and thus improve the quality of the journey.



Fuente: Metro de Medellín, Calidad de Vida, App Metro de Medellín¹¹

⁹ Para mayores informes respecto a los beneficios y tipos de tarjetas que maneja el sistema, favor de consultar <https://civica.metrodemedellin.gov.co/>

¹⁰ Observatorio de Políticas Públicas del concejo de Medellín (PPCM) Movilidad Segura en Medellín, Mayo Junio 2017, <http://www.eafit.edu.co/centros/analisis-politico/publicaciones/observatorio/Documents/7.pdf>

¹¹ <https://www.metrodemedellin.gov.co/al-dia/descarga-nuestra-app>

Intelligent Mobility System, Transit Control Center in Medellín

Medellín's Intelligent Mobility System (SIMM) is a project that makes use of information and communication technologies to improve the conditions of the public's mobility through the streets of the city. It applies a set of strategies and actions to reduce the negative effects of vehicular traffic. It also improves incident response times, and regulates and controls traffic and contributes to the reduction of accidents.

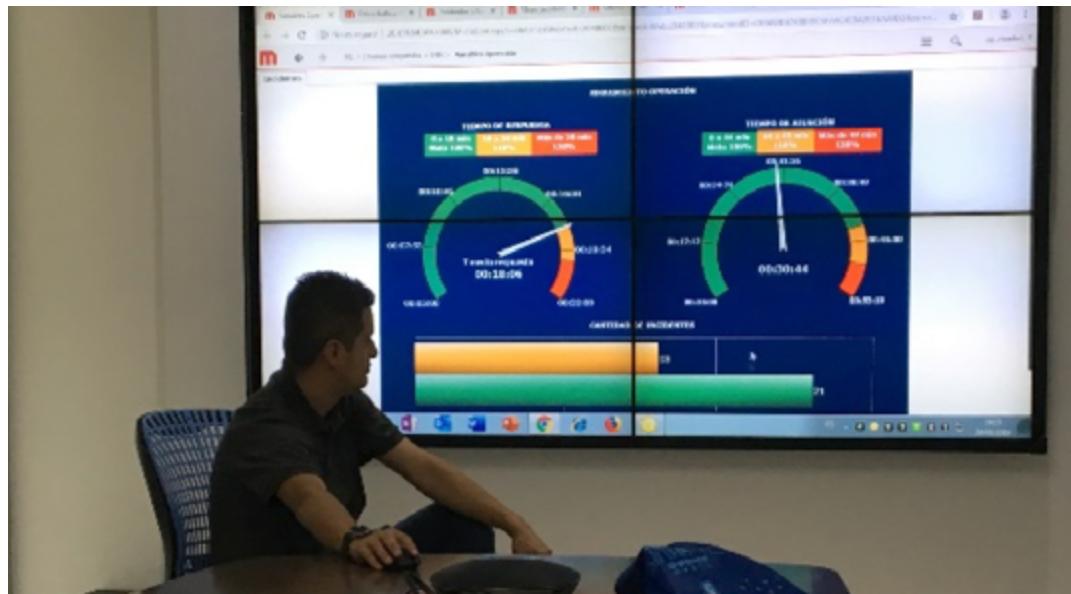


This unit works 24 hours a day, 365 days a year and has qualified personnel who support the processes of planning, operation and mobility analysis.

SIMM is a pioneering project in Colombia. It collects videos, photographs and data through cameras to determine possible traffic infractions. These evidences are reviewed and analyzed by transit agents, who are the sole authority for the validation of digital arraignments.



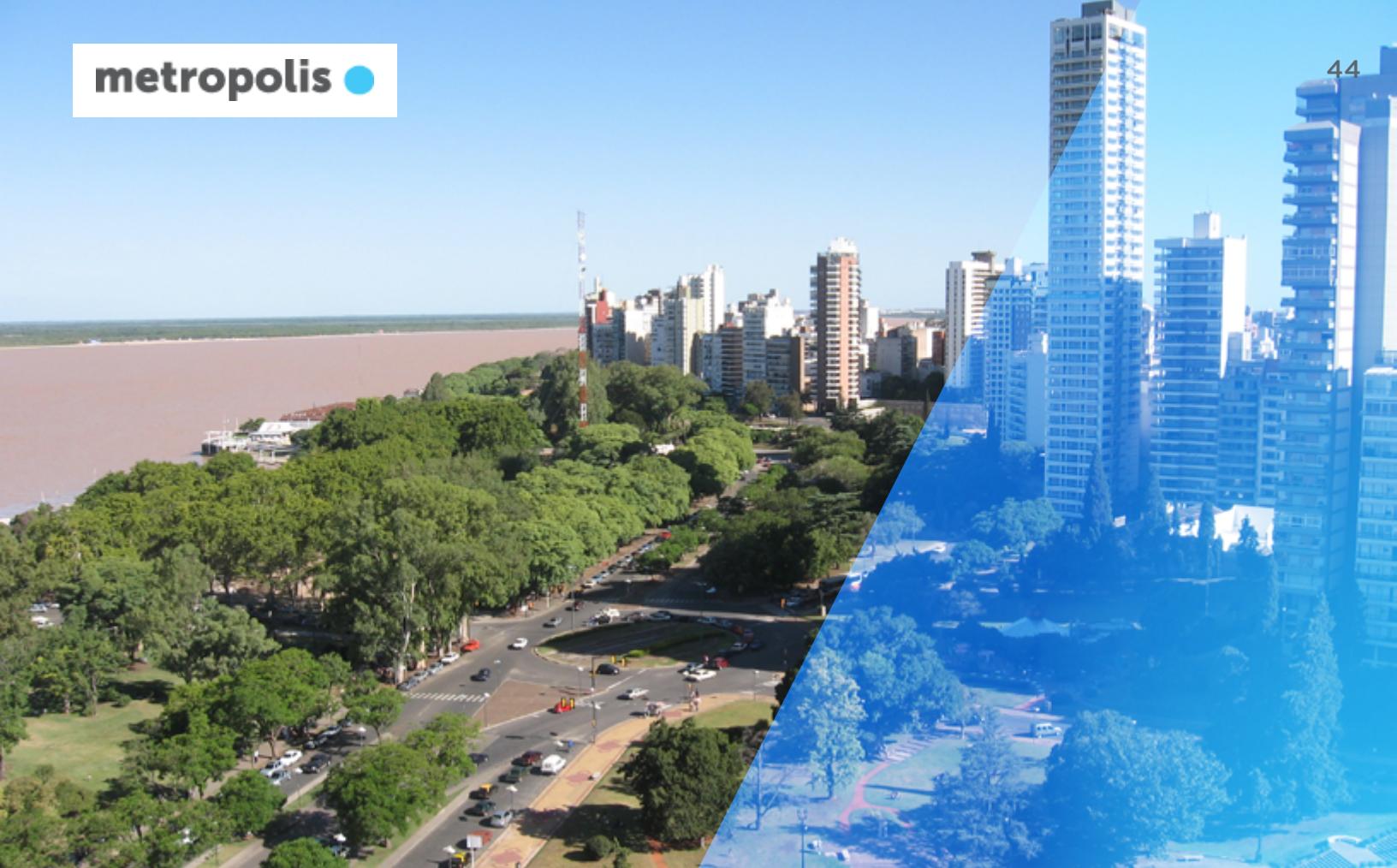
Fuente: Recorrido Metropolis en Movimiento, Medellín agosto 2019



At present there are 40 cameras around 70 points that contribute to the reduction of accident rates in different areas. They operate from 5:00 a.m. to 10:00 p.m. from Monday to Sunday. The speeding, photo-detection cameras operate 24 hours a day.

From the Transit Control Center there are 80 cameras for visual monitoring with the purpose of detecting incidents that may affect mobility. Through these cameras, a qualified human team generates a report on the state of the roads for the timeliest attention to incidents. In addition, more than 800 ESU (Empresa de Seguridad Urbana) cameras visualize the timely attention of incidents on the roads.¹²

¹² <https://www.metropol.gov.co/noticias/elmetropolitano-movilidad/sistema-inteligente-de-movilidad>

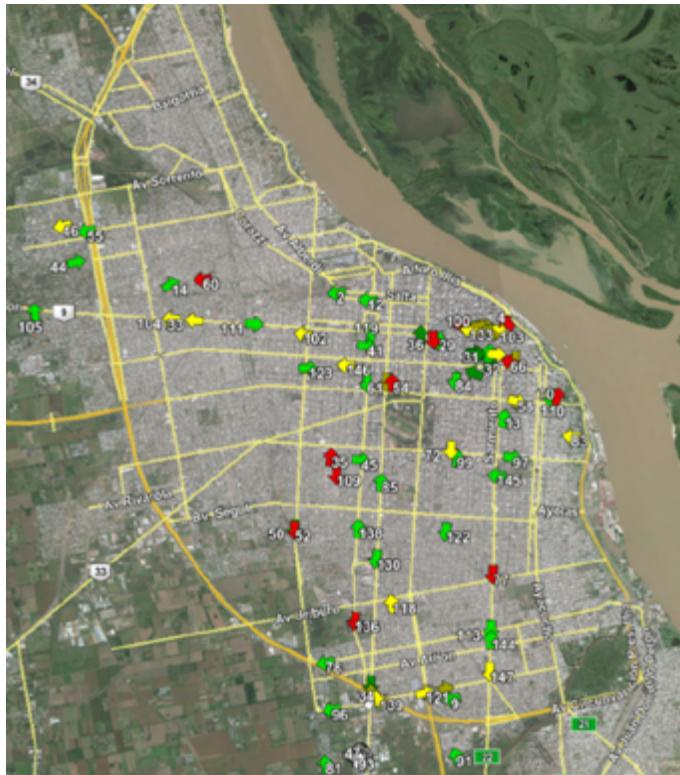


ROSARIO

Argentina

3.2 Caso de estudio, Rosario, Argentina

The city of Rosario has a wide range of technological innovation in the field of mobility. Perhaps the most concrete starting point can be set in 2009, with the installation of GPS devices in all public transport units. This significant milestone established the starting point for beginning to work in a coordinated manner both in the control of the service and in the planning, management and a large amount of valuable dynamic information for passengers.



What enabled the use of GPS?

The GPS (satellite positioning) module, which works linked to the GPRS (transmission) was installed in the equipment that we call "canceller". Its name derives from the cancellation, i.e. the payment of the ticket. Since it is integrated with the rest of the hardware, multiple benefits were generated, the most visible being the possibility of georeferencing each cancellation and the use of that satellite position to carry out controls and provide information to the public.

Mobility Monitoring Center

In the first instance, the car's real-time positioning data was used for service monitoring: knowing the car's location, it could be compared with the planned schedule and detect delays and advances in the provision of the service.

In the images, you can see the arrows that identify each car, representing their respective direction and status:

→ on schedule → anticipated * → delayed

*The advance is the least desired state, since it leaves stranded those who wait for the car to pass at the correct time.

At the same time, as the following image shows, with only one click you can access the data of the unit: line, branch, driver, speed, section and report date.



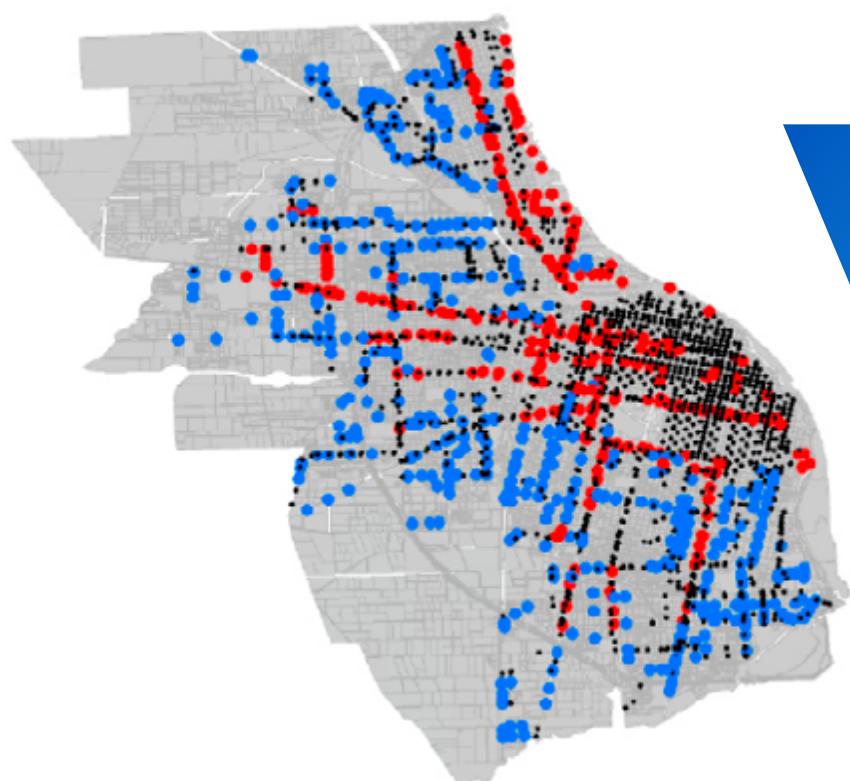
The next step was to process this vast source of information, with the aim of improving the quality of service through dynamic passenger information. We started georeferencing each transport stop in the city, identifying them with a unique number. Then, using an algorithm that took into account the average times in different scenarios, we were able to calculate quite accurately the delay time for the arrival of the next unit. We call this service "when does it arrive" and it had an extraordinary reception among the population. Rosario was the first city in the country - an accolade it held for years - to inform the public about all the urban lines, in real time, 24 hours a day, 365 days a year.

The information was made available in a first memento (year 2010) via SMS text messages. Then it was incorporated in the website of the Ente de la Movilidad (www.emr.gob.ar) and in screens with LED technology installed in the stops of greater demand. Finally, new technologies made their way: applications

for smart phones, by the popular messaging application WhatsApp and Web Services to be consumed by other sites (open data). While in the public thoroughfare several types of urban equipment were installed, such as anti-vandalism color panels with sound and contactless card reader at stops in the north zone corridor, or totems with electronic ink screens or e-paper in the macro-center zone.

This modernization process also made it possible to renovate the interior of the cars, today a complete multimedia system has been installed. Both from inside and outside the unit, audible alerts can be perceived indicating the proximity of the high-demand stop or the arriving line. LED displays show useful information and Wi-Fi coverage is offered on board the unit.

Below are images alluding to the development process as well as to the different implementations of this technology.



Georreferenciación y rotulación de paradas de TUP

- Refugio A
- Refugio B
- Poste



Gradually, this technology was making its way beyond public passenger transport. GPS modules were incorporated in all taxis in the city and also in cars, motorcycles and cranes that provide a public service.





This allowed the mobility monitoring center to be transformed into an Integrated Operations Center, where in addition to monitoring, multimodal integration, citizen service and planning tasks are added. The maximum objective was to optimize resources through available information (GPS, cameras and sensors) to provide a better response time.

The means of payment: another technological link

In our City, we went from a means of payment in legal tender coins to a prepaid system of cardboard cards with a magnetic stripe. The implementation was a success and its use was extended for more than 15 years, between 1996 and 2011. At that time, the technology (Wayfarer, of English origin) began to show signs of obsolescence, hindering the availability of spare parts and updates.

The transition to a contactless card model seemed obvious but required in-depth analysis due to the technology to be adopted. In the middle of 2010, the Municipal Council issued the ordinances that gave us the framework to integrate different uses that were transcending public transportation, such as taxis, metered



parking, bicycles and other services. There the directives were established to implement an extended electronic payment system that extends its use beyond urban transport

Moreover, without losing sight of the goal of transforming our card into a virtual purse, involving more actors and making it a multi-application, we chose for the first time in South America the technology "Mifare DESFire EV1" in combination with security module "Mifare SAM AV2".

This path gave us security, versatility and flexibility as primary characteristics and gave us the privilege of being on par with the major cities of the world in terms of technology imposed on the payment of public services (London, Melbourne, Madrid, among others).

The Desfire EV1 version achieves the international safety certification EAL 4+ (Evaluation Assurance Level). It includes multiple improvements in terms of application growth, files, maximum memory capacity, flexibility and security.

By way of reference, we can say that the MIFARE Classic standard, the most widespread contactless card in the world -especially in previous decades-, dates from 1994; while the MIFARE DESfire standard was introduced in 2002. This represents an evolution from one technology to another, the latter being much more robust, secure and versatile.

The first tests began in the middle of 2011 and the implementation was staggered, which allowed us to test, adjust and guarantee the correct functioning of the complete circuit. Initially, some lines representing a few cars were involved, and there was a reduced load network. In this framework, the analysis of the data collected through permanent monitoring forged the necessary conviction to move forward coordinated and united towards the new system. The transport companies and the municipality made a great effort in economic matters, as well as in studies and technical work to solve and support the novel solution.

The system works in all the cars of the urban passenger transport system (about 800) and progressively its use was extended to other horizons: parking meters of the metered parking system, stations of the public bicycle system and as identification of the person or payment of access in many municipal sites (swimming pools, sports centers, triptychs and museums among others).

The TsC acquired a strong identity that was consolidated with the name and brand “Movi”. Here are some of the impressions on its front:



Today, the charging network reaches almost 1000 points, with recharges carried out through POS terminals, PC (with USB card reader), self-consultation terminals or virtually (automatic teller machines or home banking). Useful procedures such as personalization and balance transfer (in cases of malfunction, breakage, loss or theft) can be carried out in the user service centers.

There is also an area within the EMR that is responsible for regular tasks such as the Activation of Contactless Cards, the testing and configuration of all applications and devices involved, the analysis of new Requirements related to the System and the processing of the Data transmitted by all devices. Banco Municipal de Rosario is the financial entity that works in coordination with EMR in processes such as the management

of the loading network or the selection of suppliers and the purchase of cards and supplies.

Over time features and functionalities have been added to both the TsC Movi and the system in general. This is a list of the most relevant:

TRANSFERS: Through this service, citizens have access to the benefit of transferring from one line to another by paying only 33% in the second tariff. By only bringing the TsC closer to the payer, the value of the ticket is debited by issuing a legend that identifies it. The validity is calculated automatically taking into account the previous trip. After the first journey, a transfer is permitted provided that more than 5 minutes and less than 1 hour have elapsed for working days during daylight hours and

2 hours for nights, weekends and holidays. Transfers are not permitted if the second journey is made on the same line as the first. For these calculations it is vital that the validation machines have the unified timetable.

PASSAGE PLUS: This service has been in operation since April 2013. It allows UPT users to make up to two trips without having enough credit to pay for them. Once the user recharges his TsC, in the next cancellation the machine automatically discounts the cost of tickets plus that the passenger owes. The user can make use of this benefit on all lines and as many times as needed, with the limit of up to 2 tickets, as long as he reloads his card after the use of the service.

Recharge at ATMs and Home banking: It will be available at Red Link ATMs from October 2013 and at the Banelco network a little over a year later. It can be used with all TsCs, whether or not they are personalized. In order to load the balance, users must foresee that the amount will be credited to the card with the first payment of a journey made up to 48 hours after the transaction has been confirmed at the ATM. Once a first recharge has been made at the ATM, the operation will be enabled to be carried out in the Home banking system.

Although the discount on the account is instant, its accreditation is deferred, as the data is communicated through web services to the central server. Then a new entry is generated in the action list that is transmitted to all cars in the system. Usually these pending actions make up a list called "white list" on the machine aboard the cars. Once the TsC is read, if it appears in the white list, the accreditation is proceeded to the same moment of the cancellation of the trip. The tolerance time of 48 hours is derived from the maximum duration stipulated for the execution of the protocol of action that comprises these processes. Our system executes these action lists in different peripherals: validators on board all cars, public bicycle system stations, PC recharge terminals, dynamic information totems. In this way, the user has around 800 points where the money corresponding to his recharge can be credited. In some, the recharge will be available almost instantly, while in others it will take longer.

FRANCHISES: Currently there are two different types of franchises: one is the total franchise, aimed at over 69 years (retired), disabled, neighborhood and firefighters, and the other corresponds to the student franchise intended for students either at secondary level or primary level, being able to use it in hours and days. Currently the TsC makes it possible to pay and register the student franchise, as the beneficiaries have their own credit card where you can see their picture and some personal data.

METERED PARKING: Metered parking is another service that can be paid for through the MOVI card. With the advent of the new parking meters, the product of a new and renewed concession in 2018, the 200 teams available in the City can read and write in the MOVI, which allows both the payment of the service, as well as the consultation of balance and recharge.

PUBLIC BICYCLE SYSTEM: With the arrival of the public bicycle system in the City, the TsC consolidated its nature as a means of intermodal payment, being a protagonist in the implementation of the system. Even as a result of this project, the TsC changed its name to "MOVI" and renewed its image in the eyes of citizens. The MOVI card is the means by which the users of the system can acquire subscriptions (daily, monthly or annual) and it is also the physical support by which they identify themselves and have access to unhook their bicycles at the stations.



Multi-sectoral coordination and funding

Although the title itself deals with two major themes, in our case we have worked on the basis of unifying them into a single premise. In order to tackle the arduous tasks of the process of technological renewal and innovation, together with the commitment that came from them; the municipality and the EMR took on the roles of managers and coordinators of the different subprojects. It was essential to add the technical capacity and experience of each of the three transport companies as well as the direct participation or contribution of local entrepreneurs. The strategic planning of many of these initiatives arose from the Strategic Mobility Plan (PIM), a sectoral plan that installed mobility as a fundamental part of urban-territorial planning and defined lines of action and specific projects coordinated and agreed between actors of various kinds to improve the movement of people and loads in the city and its metropolitan area. Resulting in the joint signing of a document agreed between citizens, social actors and municipal management. Both documents are available on the EMR website: <http://www.emr.gob.ar/publicaciones.php>

There were also other factors that favored the economic scenario. In everything that had to do with the dynamic information system for citizens ("when does it arrive" system and LED information screens) the innovation of the project itself was influenced, with the interest of external suppliers in participating in a pioneering system. The development of the algorithms and the implementation was planned and executed jointly, with the provider having access to practically zero costs

on the condition of being able to replicate the model in future private projects. Within this framework, we worked together with the technological company that provided AVL support to the city's transportation companies. In the other great project, the canceling machines and the Mifare DESfire EV1 technology as a means of payment, what alleviated the financial burden was the fact of working in an integrated manner with the technological areas of the transportation companies, which had an advanced development. EMR technicians joined company technicians and the advice of an external consultancy to forge knowledge and implement customized solutions, without the high costs of other proprietary solutions or closed systems of the "turnkey" type. The local company Rosario Bus S.A. even manufactured its own cancellation machines, while for the other companies it had the contribution of a company with national capital. The implementation was progressive and the contribution of the municipal bank of Rosario as a financial partner was also added.

Social legitimacy:

Citizen acceptance is reflected both in the number of queries, with sustained growth from the beginning, and in the adoption of technology by the rosarinis and rosarios. The latter refers to the relevant importance of the service, which in the beginning was an additional information tool, to today's status, where there is an urgent need for the service to remain operational, almost as if it were vital to the system. We believe it has to do with people's appropriation of the dynamic information system, because they found it to be an extremely useful and reliable tool.

During 2018, an average of more than 3 million “when does it arrive” queries per month were recorded, considering all channels.

3 Consultation modes (channels):

- MOVI application (Android and IOs)
- Web page and web services for other sites and apps
- Telefónica, 147 line + SMS + IVR + WhatsApp bot

Number of consultations per modality:

- Citizen service 147: 2 % (calls and IVR service)
- Text message (SMS): < 1 %.
- EMR website: 27 %.
- App mobile: 70 %.

Dynamic user information:

- Intelligent stops: 68
- Self-consultation positions: 19

At the same time, another milestone to consider is the low percentage of vandalism.



QUITO

Ecuador

3.3 Case Studies, Pedestrian areas and walkability in Quito

In the case of the city of Quito, even though there is still no structured Sustainable Mobility Plan, strategies have been made to grant pedestrian preference in the streets, increase safety or even their pedestrian quality. These efforts date back to the 1990's when the streets of the Historical Center were closed for pedestrians, and a great part of the argument to achieve the closing of the vehicular path was the protection of the patrimonial buildings in the zone.

Infografía de las vías exclusivas actuales y planificadas para los peatones en el Centro Histórico de Quito



During 2016, the project titled “My Street” was carried out and executed by the municipality through the Metropolitan Public Company of Mobility and Public Works. This project involved more than 200 residents of the traditional neighborhood “La Floresta” who partook in citizen participation workshops for the design and conceptualization of the initiative.

One of the project’s focus was to incorporate inclusive mobility and turn the neighborhood into zone 30. This means that vehicles will be able to circulate at a maximum speed of 30km/h.²

As part of the intervention, eight safe crossings were generated for passers-by and 38 ramps were placed in the corners to improve universal accessibility. These interventions covered the extensions of sidewalks, known as “elephant ears”, which contribute to generating safe mobility for pedestrians. These road level extensions must be respected by motor vehicle drivers.

Mountable curbs and plastic bollards with reflective tapes were placed in the spaces. These are elements intended to help user safety, as they provide greater visibility to flowerpots and sidewalk extensions. For the benefit of cyclists in the neighborhood, 18 bicycle parking spaces were installed at strategic points, in addition to the existing ones. This is in order to have around 4.5 bicycle parking spaces for every 10 car parking spots and become a bicycle-friendly neighborhood.

¹ <https://www.elcomercio.com/actualidad/calles-centro-quito-avanza-peatonalizacion.html>

² Buscando reducir accidentes en número y gravedad, así como el ruido, mejorar la calidad del aire y el flujo de tráfico, y animar los paseos en bicicleta, a pie o en transporte público. Para más información al respecto consultar <http://en.30kmh.eu/why-30kmh-20-mph/>

In order to improve the landscape environment of the place, 111 flowerpots with ornamental species were planted. More than 90 were planted totaling 65 new “green strips”.

This project generated around 1,000 m² of new public space, as well as a greater sense of belonging and citizen participation. It also helped to create the neighborhood road safety culture and transformed it into a living area, not a passageway.

Corner of the streets Vizcaya and Valladolid after reform of walkways as part of the project “Mi Calle” Quito

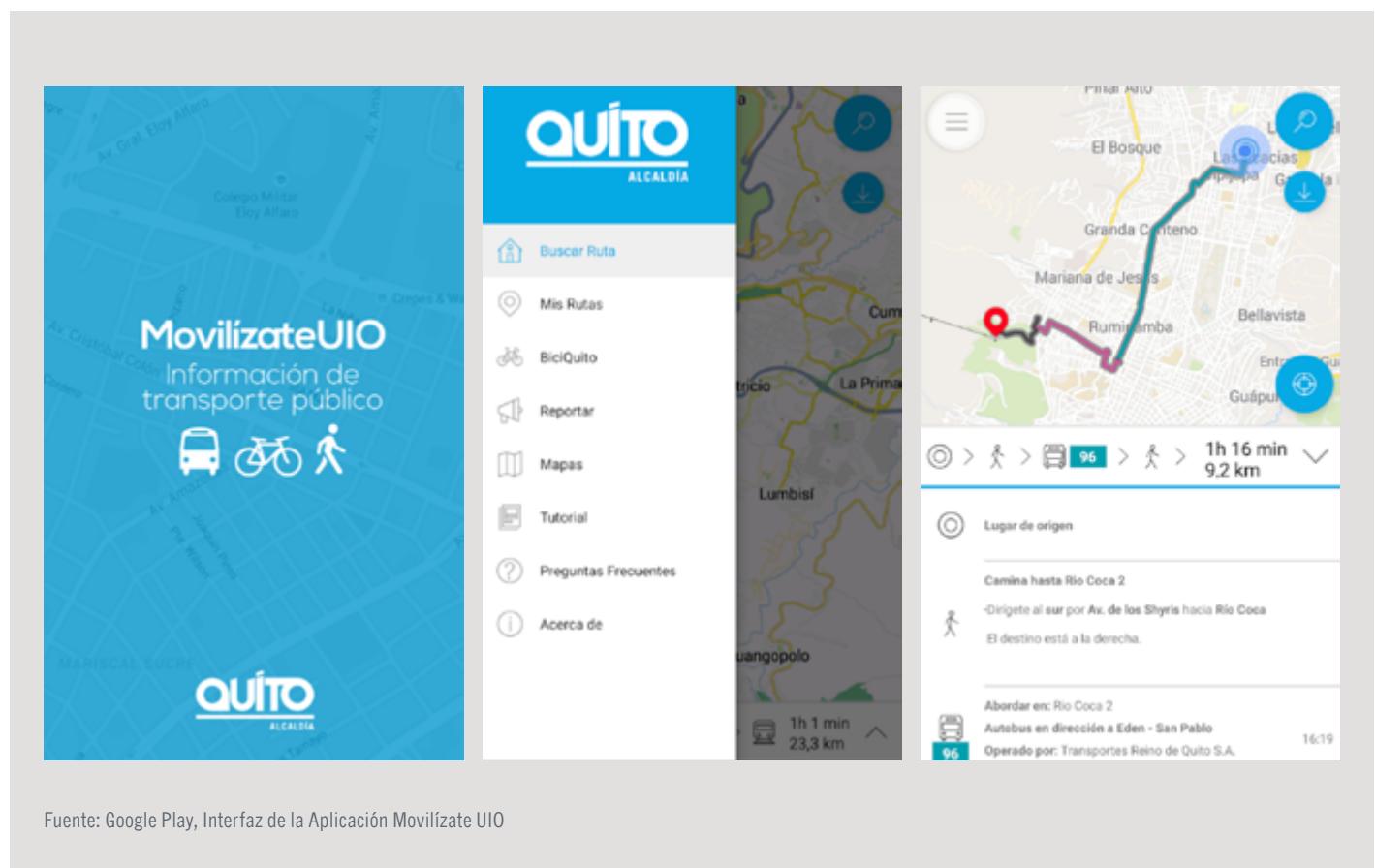


Fuente: Fuente: Eduardo Terán / El Comercio, 25 de mayo 2016³

³ <https://www.elcomercio.com/actualidad/micalle-lafloresta-quito-barrio-jardineras.html>

Case Studies, Innovation and Technology in the area of Sustainable Urban Mobility in Quito

In the area of technology, the Mobilízate UIO application was launched in September 2017. Its objective is to provide local and foreign citizens with timely information on public transportation and BiciQuito; improve travel planning to discourage private vehicle use; provide a technological channel to report incidents such as experiences and complaints to improve service quality; and allow a direct connection to inform users of news, closures and data on mobility.



Fuente: Google Play, Interfaz de la Aplicación Movilízate UIO

“MovilízateUIO”, which offers the following functionalities:⁴

Routes and Frequencies of the Integrated and Conventional Transport System

- Find the fastest route to get around by public transport from one point to another within the Metropolitan District of Quito – DMQ⁵
- Know the approximate time it would take to get from one point to another in the DMQ, moving by public transport
- Save the routes consulted, even if there is no Internet connection

Cycling routes and Biciquito stations

- Visualize the DMQ cycle track network
- Consult the locations of all DMQ BicycleQuito stations

Incident reporting on mobility issues

- The function of reporting incidents on the service and infrastructure of public transport, bicycle lanes and pedestrian networks, was designed under the concept of “crowdsourcing”, which takes advantage of the collective knowledge of citizens, to systematize and channel experiences through a digital tool. In this way it will allow the authorities to have information generated on site and to focus their resources/projects correctly.
- The categories to report incidents are the following: Public transport routes, Public transport stops, Experience of public transport service, Bicycle lanes and BiciQuito, Pedestrian infrastructure.



Fuente: Quito Informa, 19 septiembre 2017⁶

In 2019, the application will be reactivated and significant funding is being obtained for its development and improvement in order to relaunch the platform with greater scope and technological potential.

⁴ <https://play.google.com/store/apps/details?id=com.municipioUIO.movilizate&hl=en>

⁵ Distrito Metropolitano de Quito

⁶ <http://www.quitoinforma.gob.ec/2017/09/19/municipio-de-quito-lanza-movilizate-uio-la-primer-a-aplicacion-movil-de-transporte-publico-del-ecuador/>

Integrated Metropolitan Transport System of Quito, SITM-Q⁷



SISTEMA METROPOLITANO DE TRANSPORTE



Fuente: Quito, Transporte de Pasajeros,
15 de marzo 2017⁸

⁷ <http://www.quito.gob.ec/index.php/municipio/245-sistema-metropolitano-de-transporte>

⁸ <https://www.trolebus.gob.ec/index.php/servicios/mapa-del-sistema-integrado-de-transporte>

Quito trolley

The **Quito trolley** (also called Troncal Central Trolebús, or Trole) is a public transport system of the city of Quito (Ecuador). It is part of the Metrobus-Q system, which in turn constitutes the city's Integrated Metropolitan Transport System (SITM-Q). Since its conception, the system took as a reference the trolleys and BRT of the Brazilian city of Curitiba (Brazil), a world forerunner in this type of mass transport.



QUITO TROLLEY

Corridor Information	Start date: December 17, 1995 Number of circuits: 5 Types of service: Main Feeder Integration with feeder: Physical and tariffed Integration between corridors: Physical and tariffed with Ecovía and sur Occidental; Physical with Corredor Central Norte
Characteristics	Longitude: Total 22,5 km loop Counterflow: No Lanes per direction: 1 lane Type of separation: Physical barrier Position of lanes: Center Location of doors: To the right Lane pavement: Concrete and asphalt Paving in stations: Concrete Intersection treatment: Shared lane
Stations and stops	Stations / Stops: 39 between Quitumbe y Carcelén Transfer Stations: 4 Distance between stations: 400mts on average Prepayment: Yes Boarding: Middle platform Automatic doors: Yes Passing lane: No Map / Station list: Yes
Vehicles	Main Fleet Trolebús: 49 Biarticulados: 55 Voice Information: Yes Visual information: Yes Preferential Seats: Yes
Offer and demand	Daily demand: 281 thousand passengers on average Tariffs: \$0,25 ctv normal \$0,12 ctv reduced \$0,10 ctv preferential

Fuente: Quito, Transporte de Pasajeros, 15 de marzo 2017⁹

⁹ <https://www.trolebus.gob.ec/index.php/gestion/nuestras-paradas#trolebus>



The Eastern Main Branch

Through its exclusive lanes, the corridor crosses part of the northeastern flank of the city through avenues 6 de diciembre, Gran Colombia and Pichincha; connecting it from the center-north, in the Río Coca station, to the historical center, in Playón de La Marín. Its main longitudinal service extends to the peripheral sectors through a system of urban buses called “feeders”.

It became the second planned mass transit system in the city, after the Trolleybus.

EASTERN MAIN BRANCH

Corridor Information	Start date: Year 2002 Number of circuits: 7 Type of service: Main Feeder Integration with feeder: Physical and tariffed Integration between corridors: Physical and tariffed
Characteristics	Longitude: Total 20,9 km loop Lanes per direction: 1 lane Type of separation: Physical barrier Position of lanes: Center Location of doors: To the left Lane pavement: Asphalt Paving in stations: Concrete Intersection treatment: Shared lane
Stations and stops	Stations / Stops: 38 between Quitumbe, Terminal Sur Ecovía and Terminal Río Coca. Transfer stations: Río Coca and Playón de la Marín Distance between stations: 400mts on average Prepayment: Yes Boarding: High Platform Automatic doors: Yes Passing lane: No Map / Station list: Yes
Vehicles	Main Fleet Biarticulados: 20 Voice information: Yes Visual Information: Yes Preferential Seats: Yes
Offer and demand	Daily demand: 229 thousand passengers on average Tariffs: \$0,25 ctv normal \$0,12 ctv reduced \$0,10 ctv preferential

Fuente: Quito, Transporte de Pasajeros, 15 de marzo 2017

The Western Branch

The Western Branch runs through the city from the Quitumbe Terrestrial Terminal to the south to the La Ofelia Terminal in the north of the city. Previously this branch was divided into 2 lines known as “Corredor Central Norte” and “Corredor Sur Occidental”. It is the only Metrobus-Q (BRT) line whose operation also includes private participation.



WESTERN BRANCH	
Corridor Information	Start date: May 11, 2012 Number of circuits: 1 main, 5 feeders and 17 subdivisions Type of service: Open with subdivisions Integration with feeder: Physical and tariffed Integration between corridors: Physical and tariffed
Characteristics	Longitude: Total 28 km loop Lanes per direction: 1 lane Position of lanes: Center Location of doors: To the left Lane pavement: Concrete and asphalt Paving in stations: Concrete Intersection treatment: Shared lane
Stations and stops	Stations / Stops: 21 Transfer stations: 2 Distance between stations: 400mts on average Prepayment: Yes Boarding: High Platform Automatic doors: Yes Passing lane: No Map / Station list: Yes
Vehículos	Main Fleet: Standard 100% Quantity: 301 Voice information: No Información visual: Yes Visual Information: Yes
Offer and demand	Daily demand: 235 thousand passengers on average Tariffs: \$0,25 ctv normal \$0,12 ctv reduced \$0,10 ctv preferential

Fuente: Quito, Transporte de Pasajeros, 15 de marzo 2017

BiciQuito¹⁰

Is the public bicycle rental system of the city of Quito, capital of Ecuador, which was inaugurated in 2012. The system consists of almost two thousand bicycles with a unique design, distributed in 30 stations located in places near the points of greater affluence or commercial, banking, tourist and student interest.

To access the system users must register on the website [Biciquito.gob.ec](http://www.biciquito.gob.ec) and sign a contract of good use, then he is given a card that serves to make use of bicycles in a schedule of seven in the morning to seven at night throughout the year (except January 1).

The perimeter of use of the system is in the so-called "Hipercentro" between the historic center of Quito and the sector of "La Y", to the north, and is planned to expand south of the city to the park Las Cuadras, in Quitumbe. Each bicycle can be used for one hour and must be delivered at any station (the average distance between stations is ten minutes), but if the user has completed that time and has not reached its destination, there is a ten minutes wait before being able to access the system again.



¹⁰ <http://www.biciquito.gob.ec/index.php/info/que-es.html>

PERÍMETRO DE CIRCULACIÓN BICIQUITO

AGENCIA METROPOLITANA DE TRÁNSITO

BiciQuito
BICICLETA PÚBLICA

QUITO
ALCALDÍA

PARTES PRINCIPALES BICICLETA ELÉCTRICA

- MOTOR
- BATERÍA
- CONTROLADOR

● Puede un botón de encendido y tres marchas:

1. Asistencia efectiva donde no se requiere mayor esfuerzo.
2. Asistencia uniforme para trayectos largos.
3. Asistencia para trayectos que requieren mayor potencia.

www.biciquito.gob.ec | [@BiciQuito](#) | [@BiciQuito](#)

AGENCIA METROPOLITANA DE TRÁNSITO | **QUITO** ALCALDÍA

Until October 2013 the service had a cost of \$25 per year, but to strengthen non-motorized mobility, the Mayor's Office of Quito made the service free at the beginning of January 2015. The Construbiris-Linkearnet Consortium ended the contract for the operation of the public bicycle, and the Productivity Training Corporation was responsible for operating the system since then. By the end of February 2016, the Municipality revoked this concession and is currently operating the public bicycle through its Secretariat of Mobility.

In its first year the system had 425 conventional bicycles, adding 200 more in September 2014 and another lot in 2015. In mid-2016, a total of 895 bicycles were added, 595 conventional and 300 electric, the latter can be found in twelve of the twenty-five stations.



TIJUANA

México

3.4 Case Studies, Pedestrian areas and Walkability in Tijuana

With the approval and publication of its first Sustainable Urban Mobility Plan (PIMUS), the city of Tijuana is at a key moment that, if taken advantage of, could radically change the way in which its inhabitants interact with their community and environment. Although at the planning level there was a series of projects that sought to reorient the city to more sustainable practices of mobility, these had not reached a phase of implementation. With the existence of the PIMUS, such projects can be supported by a planning instrument that is accessible to bring them to reality.

Jane Jacobs Walk 2019, Redesigning the Streets and Sidewalks of Tijuana¹⁰

Tijuana is finally taking firm steps toward this change, during the month of June 2019 and as part of the work to legitimize the Comprehensive Plan for Sustainable Urban Mobility, the first Jane Jacobs Walk took place in the city. An activity aimed at taking a tour directed by the neighborhood, walking, cycling or on transportation systems, to encourage observation, dialogue, debate, exploring the vision of local culture, social history, and space planning challenges to discuss. These tours encourage participants to connect with their environment and community.

The walks inspire participants to make a difference by discovering and responding to the complexities of the city and environment through personal and shared observation.¹¹

In this case, the path was focused on pedestrians, in order to change the way we design the streets of the city, we require the community to be part of the process. This walk consisted of observing the current design of our streets, identifying limitations in pedestrian mobility and, above all, where are the opportunities for improvement. During the walk, key public spaces in the center of the city were explored, and expert support from the Metropolitan Planning Institute of Tijuana guided participants in the assessment and interpretation of their space.



2019 Walks, 2019, Mexico

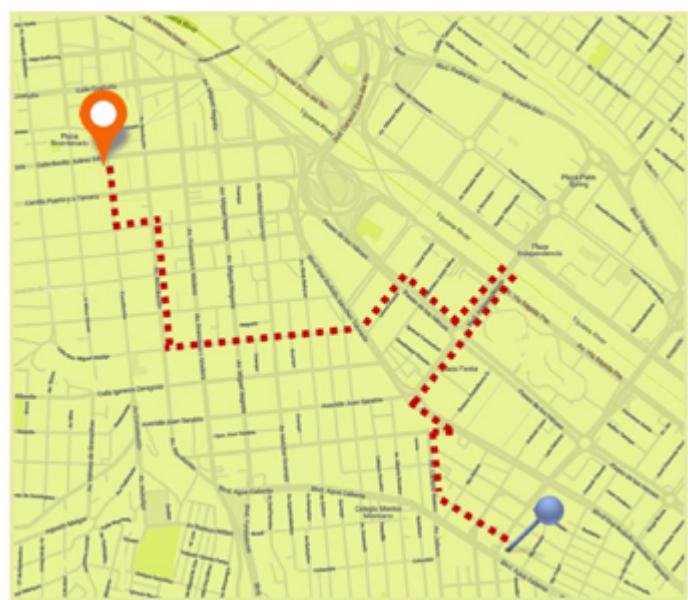
México: Rediseñando las Calles y Banquetas de Tijuana

Tuesday, June 18, 2019

9:00 AM – 10:30 AM

Bvd. Cuauhtémoc #2340, Col. Revolución, Tijuana, Baja California 22400 Mexico (map)

Fuente: Jane Jacobs Walk, Find a Walk, 2019



Fuente: Reforma Urbana Lab, Marco Martínez O'daly



¹⁰ Actividad promovida por el Instituto Metropolitano de Planeación de Tijuana y el servicio de consultoría Reforma Urbana LAB

¹¹ <http://www.janejacobswalk.org/what-is-jane-jacobs-walk>



Walkway Pedestrian Plaza Financiera

An intervention of the public space is proposed in Zona Rio, characterized by being the core of commerce and important services of the city of Tijuana. The site sits promptly on Plaza Financiera, a space that currently houses large parking lots, office complexes and banking facilities, although it has a spacious pedestrian infrastructure, the space for pedestrians is very small despite it is a very popular area, this is because it does not offer any attraction for people who transit through the area, so the space is underutilized.

The proposal consists of the development of a pedestrian walkway in which cultural and commercial events typical of this city can be accommodated, among these we can find:

- A Book Fair¹²
- The Entijuanarte Cultural Festival¹³
- Food Truck Fest
- Opera on the Street¹⁴
- Paella and Wine Festivals



Fuente: Síntesis TV Liliana Ibarra 2019¹⁵/ San Diego Red 2016¹⁶/ Zeta 2019¹⁷

¹² <https://www.feriadelibrotijuana.com/nuestraferia>

¹³ <https://www.fundacionentijuanarte.org/>

¹⁴ <http://www.operadetijuana.org/index.php/festivales/festival-opera-en-la-calle>

¹⁵ <http://sintesistv.com.mx/feria-del-libro-se-realizara-del-17-al-26-de-mayo/>

¹⁶ <https://www.sandiegored.com/es/noticias/129427/Comienza-la-cuenta-regresiva-para-entijuanarte-2016>

¹⁷ <https://zetatijuana.com/2018/06/anuncia-opera-de-tijuana-el-festival-opera-en-la-calle/>

Currently, these events are hosted in different locations in the city, with the temporary closure of some roads during the festivities. Yet, these events far exceed the capacity of the roads where they are usually hosted, so we seek to take advantage of this underutilized space to give it a new meaning.

The proposal not only contemplates the rehabilitation of the pedestrian walkway, improvements in the urban image and reforestation but also consider the following program:

- Attention modules
- Tents of approximately 1,875 m²
- Stages 2 modules Total capacity 360 people seated
- Food Trucks approx. 17 units
- Table areas
- Bicycle parking area
- Urban furniture
- Green pergolas
- Sanitary modules
- Lighting

APPROXIMATE COST: \$ 8,786,370.00 MXN

Planta de Conjunto, localización de las intervenciones



Fuente: Instituto Metropolitano de Planeación de Tijuana

Comparativa del espacio con la implementación del proyecto y el estado actual



Fuente: Instituto Metropolitano de Planeación de Tijuana

Improvement of the Central Zone and the Tijuana Border Crossing

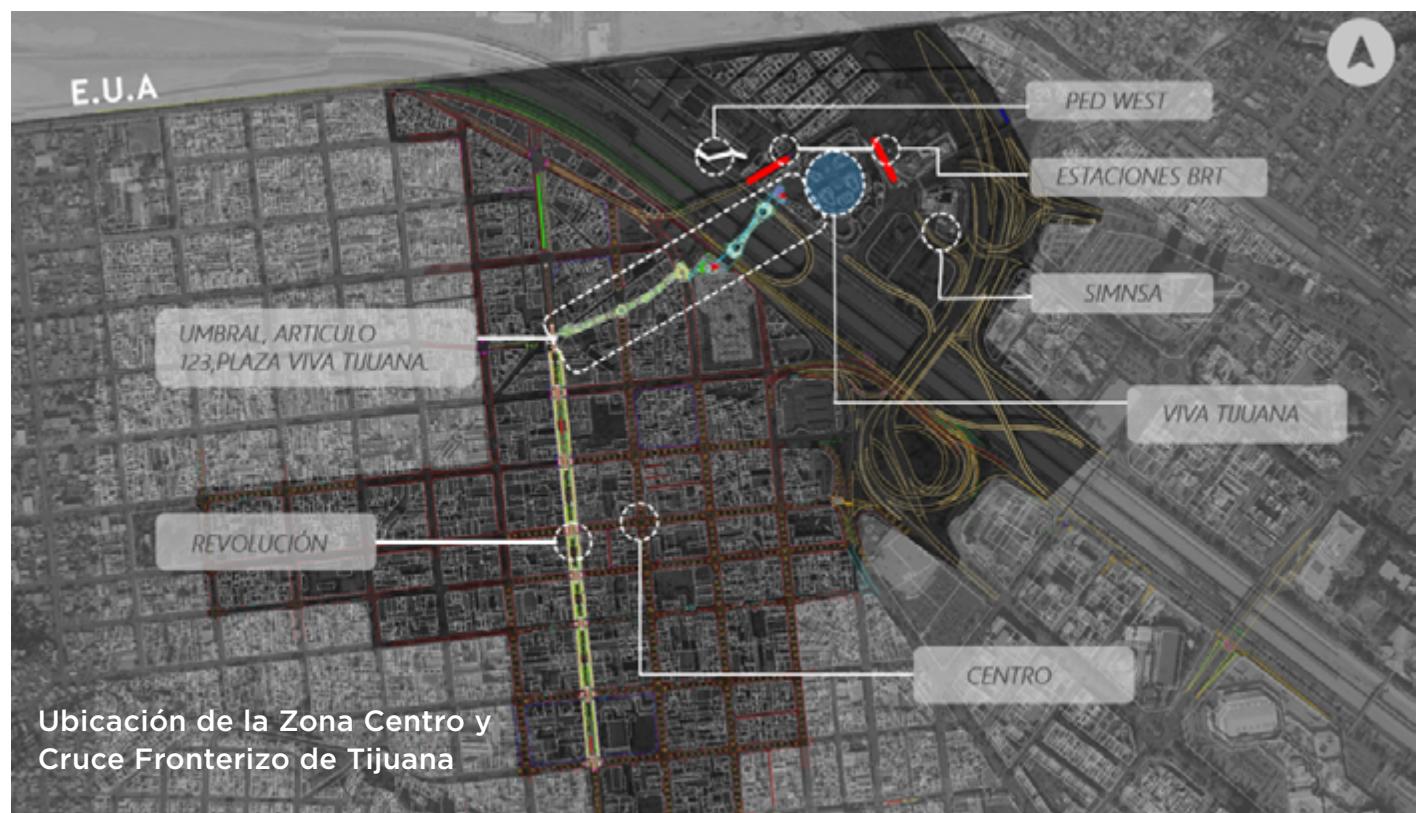
The border region of Tijuana-San Diego is a unique urban environment where an infinite number of diverse exchanges take place. The global conditions of today's world, the circumstances, and differences of national policies and the structural differences of each country over time have left a very singular mark that can be read through the dynamic conformation of the urban environment of this region.

In order to understand the significance of this place, it is necessary to recognize its privileged geographical location in the international sphere, the impact and importance it has in the region and the country, as well as the valuation of its historical origin.

The city was created by decree of April 26, 1940. The population was basically settled on the plateau where today the Central Zone

of the city is located. Additionally, the northern area must be included, an area between the First Street and the International Border. At the most western part, the river crosses the border. Previously this area was used for agriculture taking advantage of the excellent fertility of its soil, however, with the passage of time the agricultural land turned into housing. As a result of this, First Street was extended to the International Dividing Border, and now the direction of the streets of the Central Zone runs from south to north.¹⁸

Whether for its strategic location or its historical relevance, this area demands conservation and improvement. At the same time, there is a considerate necessity for this area to become a dynamic, modern and functional center that takes advantage of the comparative advantages of its strategic location.



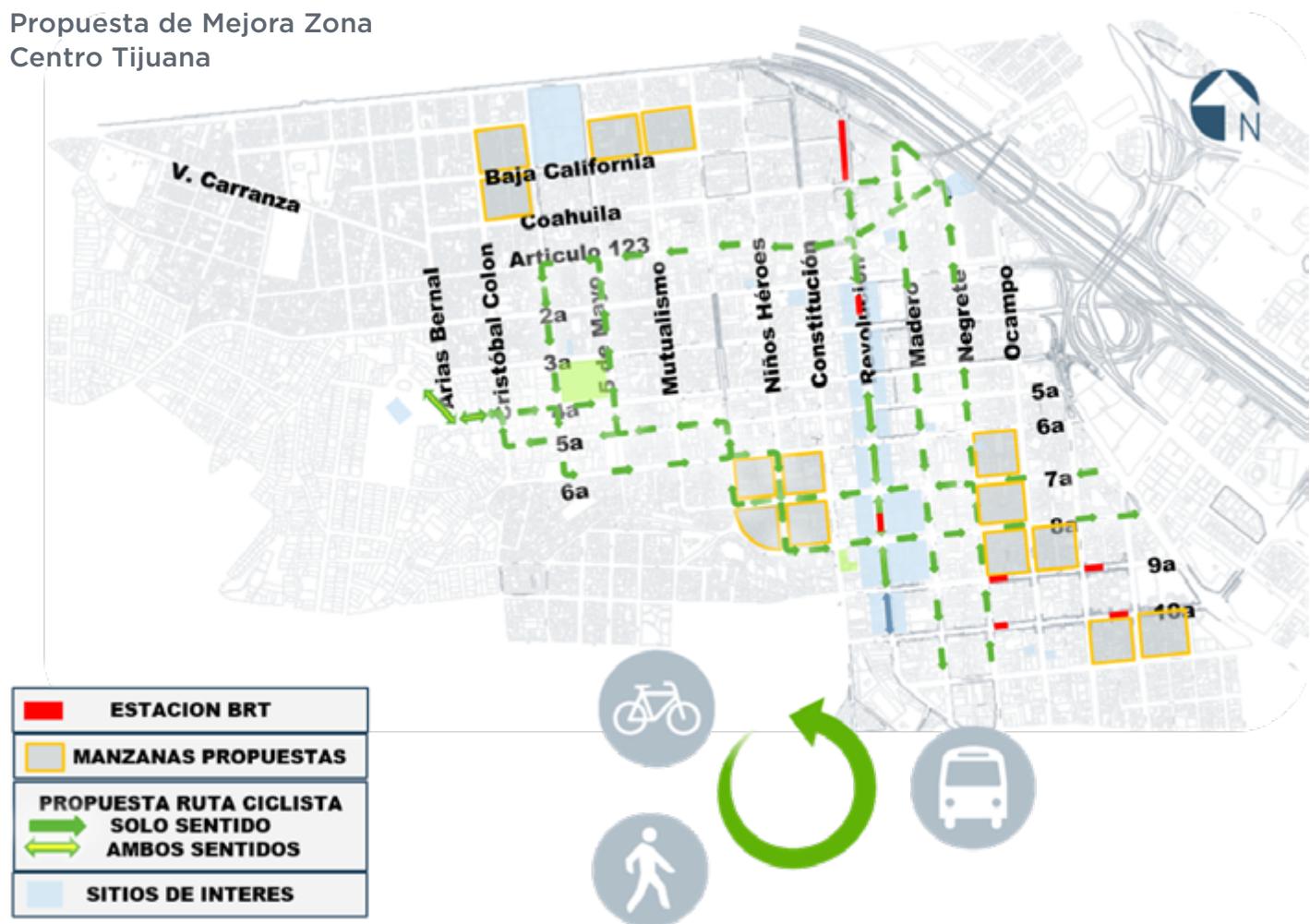
Fuente: Instituto Metropolitano de Planeación de Tijuana

¹⁸ Para más detalles del desarrollo urbano de la ciudad de Tijuana, <http://www.tijuana.gob.mx/ciudad/CiudadDesarrollo.aspx> , Antonio Padilla Corona

It seeks to reach the scale of an urban cell called “Superblocks” referring to safe spaces for pedestrians and bicycle users, where services and amenities are at accessible distances for citizens, 400 to 500 meters. Its focus is to improve urban space and mobility, developing the availability and quality of public space for pedestrians.

The proposal seeks to consider the rule used by the Secretariat of Agrarian, Territorial and Urban Development, SEDATU to promote verticality. With the vertical building proportion of 1.7 times the width of the track, better use of the indicated areas is achieved, generating mixed land uses that allow the formality of trade, the homogenization of the urban image and the strengthening of the social fabric through “City Making”. Lived spaces.

Propuesta de Mejora Zona Centro Tijuana



Fuente: Instituto Metropolitano de Planeación de Tijuana

Tourist Walkway Avenida Revolución

The recovery of public spaces can take us to complete streets¹⁹, which are ways of designing so that people of all ages and abilities can live and travel in a safe, accessible and an efficient way.

To achieve a complete street, you must consider:

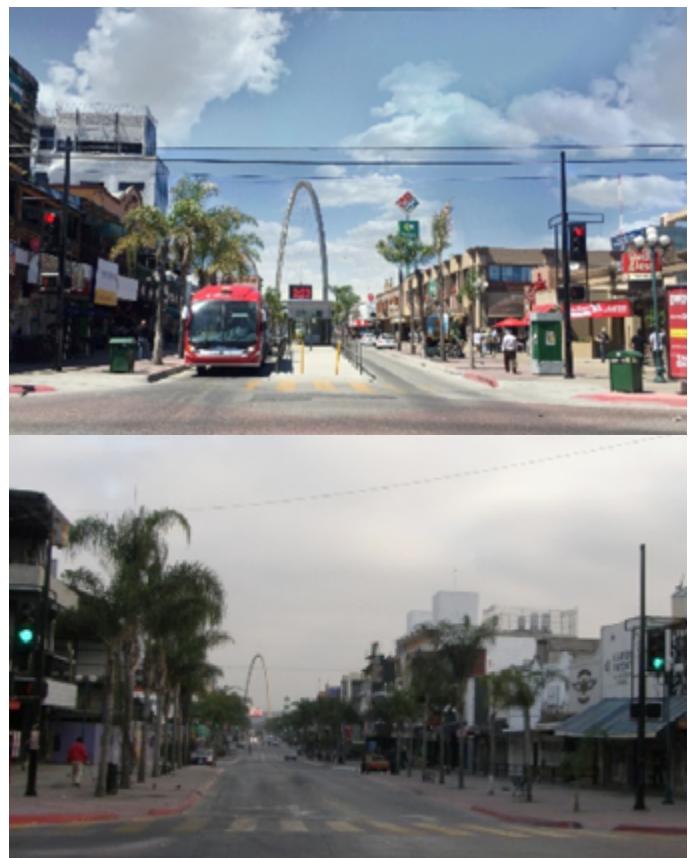
- Redesign of intersections with universal design criteria.
- Expansion of sidewalks or shared spaces for pedestrian and vehicular circulation.
- Resizing lanes to promote safe speeds and provide space for pedestrians and cyclists.
- Exclusive lanes for public transportation with established stops.
- Cycling infrastructure (shared bicycle lane, bicycle lane, or bicycle lane).
- Improvement of traffic light times, including pedestrian times.
- Pedestrian and cyclist information systems.
- Reconfiguration of urban space to revitalize public space, local commerce and real estate development.

Revolucion Avenue is one of the most famous avenues in the city of Tijuana. In the 1970s the urban area occupied approximately 6,500 hectares, located mainly on a very rugged topography. Today It's the main axis of development known as Revolucion Avenue – Agua Caliente Boulevard.²⁰

The “Revu” as it is locally identified, gained much of its popularity in the twenties because along this road there were countless nightclubs, bars, restaurants, and craft shops, and it was once considered a center of entertainment during prohibition in United States of America.

Presently, urban developers have preferred other areas of the city, leaving the historical center in the background. However,

Avenida Revolución estado actual



Fuente: Instituto Metropolitano de Planeación de Tijuana

Revolution Avenue continues to attract large numbers of tourists and pedestrian due to the diversity of the concentrated commercial shops. Yet, the strip has sought to reorient Its image to a different one, away from the banned amusement park near California.

¹⁹ Para más detalles, se recomienda consultar el manual de calles completas de la plataforma Ciudad Equitativa, Ciudad Inclusiva (CECI) <http://ceci.itdp.mx/>

²⁰ Para más detalles del desarrollo urbano de la ciudad de Tijuana, <http://www.tijuana.gob.mx/ciudad/CiudadDesarrollo.aspx> , Antonio Padilla Corona

Comparativa esquemática del espacio con la implementación del proyecto y el estado actual



Fuente: Instituto Metropolitano de Planeación de Tijuana

Visualización esquemática del proyecto



Fuente: Instituto Metropolitano de Planeación de Tijuana

In recent years there have been several initiatives for the transformation and improvement of Avenida Revolucion. It has been contemplated to close vehicle access to this emblematic avenue, transforming the space into a predominantly pedestrian zone, which coexists with the BRT system of the city as well as the proposed cycling infrastructure.

The proposal seeks to generate an urban image with an appearance that has positive effects. It needs to have well organized public spaces, install urban equipment, give accessibility to people with disabilities and elderly people, as well as the implementation of non-motorized systems and urban reforestation activities in the area.



Fuente: Instituto Metropolitano de Planeación de Tijuana

The Comprehensive Urban Planning Project for Revolution Avenue develops equitable, safe spaces in which the coexistence of pedestrians, bicycle users and BRT transport system is promoted.

Guidelines for the improvement and supervision of building facades should be encouraged.

The reorganization of urban equipment is essential for a constant flow and hardly any obstacles as possible. Equipment and trees need to be grouped in directionally for the absorption of humidity and to cluster luminaries, benches or trash cans and mailboxes.

APPROXIMATE COST: \$ 30,000,000.00 MXN

Plaza Viva Tijuana

As part of the efforts to promote the central district of the city, a proposal for the adjustments in the Plaza Viva Tijuana a site that heads the connection of the central zone of the city with the small border neighborhood called Colonia Federal, the International Border and two of the most important pedestrian border points of entry in the city, PedEast and PedWest. Plaza Viva Tijuana is the site that distributes the pedestrian flows from the border crossings because of its direct connection with the downtown area of the city, its transportation network and its extensive offer of medical tourism services.

However, and despite its privileged location and high potential as a key public space for the city, it currently is in a state of deterioration, a situation of abandonment, and a risk environment late at night.

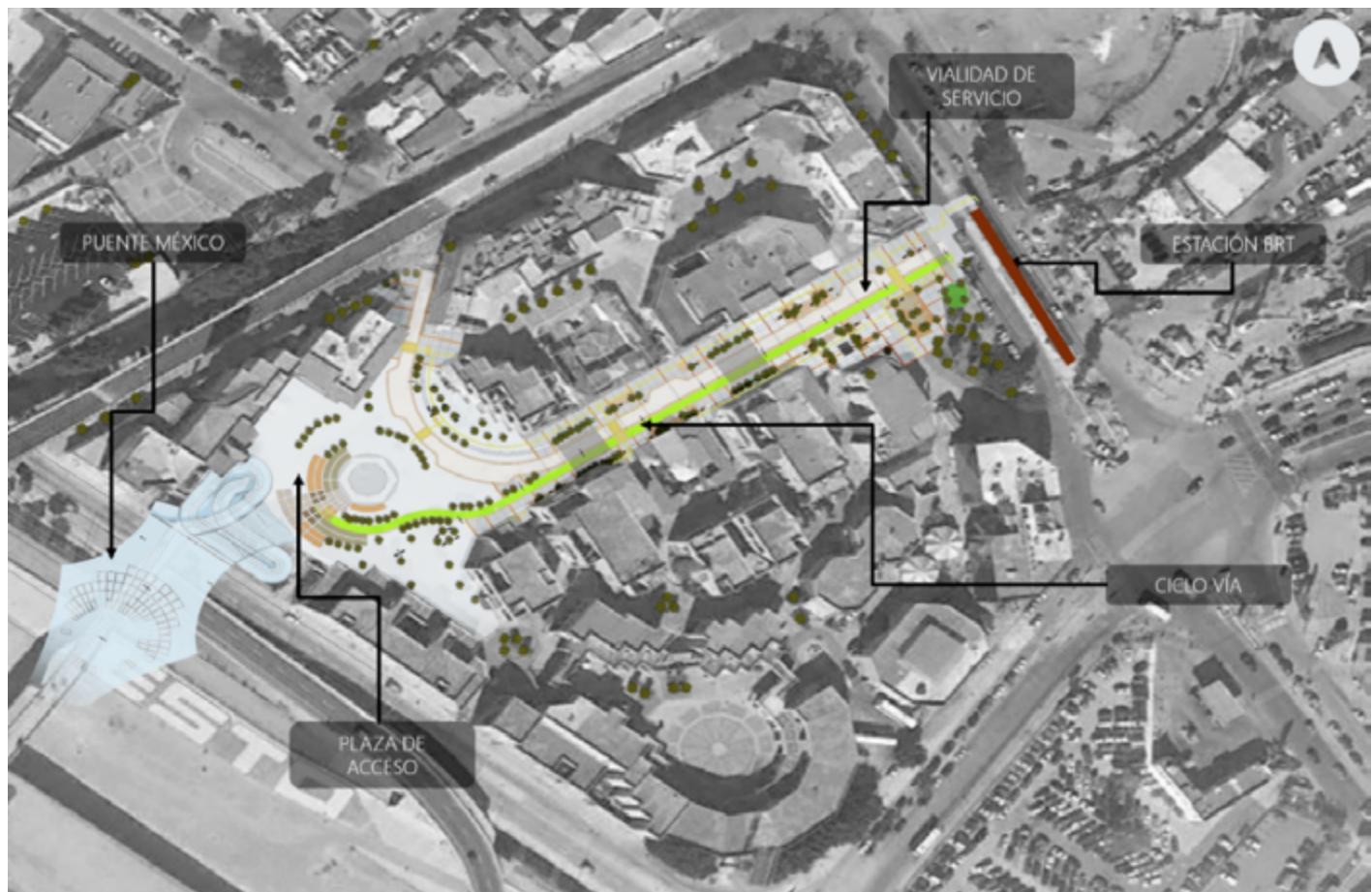
The very design of the square does not help much to detonate coexistence, as it presents a series of disjunctions with the commercial accesses limiting the interaction of passers-by with their surroundings.

Estado actual del área de intervención



Fuente: Instituto Metropolitano de Planeación de Tijuana

Planta de Conjunto, localización de las intervenciones



Fuente: Instituto Metropolitano de Planeación de Tijuana

The proposal seeks to integrate principles of universal design to guarantee accessibility as a basic right for all people, regardless of age, gender, economic condition or physical abilities. The plan seeks to generate well-being and comfort in travel for all people, as an articulated, fluid and continuous network both for buildings and public transport jointly contributing to the quality of life of citizens.

The Plaza Viva Tijuana project contemplates improvements to its urban image, reforestation of the area, as well as the development of universal pedestrian criteria distributed more equitably among the public spaces. As well as a cycling route that will generate connections to the BRT station and border ports.

Visualización esquemática del proyecto



Fuente: Instituto Metropolitano de Planeación de Tijuana

The project consists of leveling the plaza's platforms to be able to access the commercial premises without having any obstacle. This also includes the development of pedestrian ramps, new vegetation areas, cycling infrastructure, renovation of urban furniture, lighting, and implementation of a tactile route for pedestrians with visual disabilities. New vehicle lanes will serve people drop-off areas at the square and supply service to the commercial premises.

APPROXIMATE COST: \$ 8,146,406.00 MXN

Case Studies, Innovation and Technology in Sustainable Urban Mobility in Tijuana

The case of the Integral Transport System of Tijuana, SITT

In the case of the city of Tijuana, the process of innovation and implementation of mobility technology was a tortuous process and probably the most tangible advance was the installation of the BRT trunk feeder system in 2016.

The process of implementing the Tijuana BRT or Integrated Transport System of Tijuana, SITT as locally known has been documented since 2004²¹ when it began with the installation of infrastructure for the operation of the system. However, these actions lacked a process of socialization with key players, and in later years the city would opt for other alternatives and proceed to remove the confinements installed.

Nevertheless, the process lacked social legitimization and in 2016 there were few individuals who knew the details of the system.

The project was financed with federal funds and the approval of the National Infrastructure Fund FONADIN and the Secretariat of Communications and Transport SCT. The financing for the project was managed under a Pari Passu scheme where FONADIN would invest 482 million pesos as a non-refundable fund, and the City of Tijuana would have to invest an equal amount plus taxes on the value-added. A request was made for support from the World Bank under a soft loan in the amount of 262 million pesos in two exhibitions of 131 million each. On the other hand, the National Bank and Public Services, BANOBRAs played the role of managing the trust for the application of the resource contributed by FONADIN.

In November 2016 the SITT finally started operations and as part of the communication strategy for the introduction of the system to the public, a free month of travel was offered in order to make the system known.



Fuente: Tercer Informe de Gobierno XXII Ayuntamiento de Tijuana

²¹ Para más detalles sobre este proceso se recomienda consultar el trabajo desarrollado por Dueñas, M.Á (2014) Sistema de transporte de Tijuana: Análisis de su proceso de modernización e implicaciones en la movilidad urbana. Un acercamiento desde la Sustentabilidad. Tijuana, B.C. México: El Colegio de la Frontera Norte.

Acceso universal al Sistema Integral de Transporte de Tijuana



Fuente: Tercer Informe de Gobierno XXII Ayuntamiento de Tijuana

The main route has buses equipped with the latest generation of passenger counters bars, payments on-site, Wi-fi connection, GPS equipment and surveillance systems connected to a control center, which tracks the location and speeds of units.

Both the stations and the main route units are designed to serve all types of users, managing level height accesses, 2400 linear meters of podotáctil route, seats and preferential tariffs.

COMPONENTES OPERACIONALES

RUTAS TRONCALES:



CORREDORES PRE-TRONCALES:



RUTAS ALIMENTADORAS:



Fuente: San Diego Red, Conozcan todo sobre el nuevo sistema integral de transporte de Tijuana²²

²² <https://www.sandiegored.com/es/noticias/105395/Conozcan-todo-sobre-el-nuevo-Sistema-Integral-de-Transporte-de-Tijuana>

Sistema de expedición de tarjetas en las estaciones del SITT



Fuente: Zeta Tijuana, Licitación a modo para el recaudo de Tarifa, 30 enero, 2017²³

Sistema de recaudo a bordo de las unidades del SITT



Fuente: Diario Tijuana, 14 octubre 2018, El pago del pasaje en el SITT se hace en efectivo²⁴

²³ <https://zetatijuana.com/2017/01/operador-del-sitt-ligado-a-empresas-de-padre-de-chris-lopez/>

²⁴ <https://diariotijuana.info/el-pago-del-pasaje-en-el-sitt-se-hace-en-efectivo/>

Centro de control del SITT



Fuente: Tercer Informe de Gobierno del XXII Ayuntamiento de Tijuana

The SITT Control Center currently monitors the fleet with the following ranges:

- Location in real-time: Allowing to manage a correct fluidity on the route traced in the system, monitoring the operational plan.
- Approximate arrivals: We provide the user with specific information about the arrival time of the desired station.
- Speed: We monitor the appropriate established speed and be able to guarantee safety and reliability to the user.
- Maintenance: We guarantee the optimal time to provide corrective and preventive maintenance on each transport unit based on the mileage covered in a given time.
- Reports: We generate statistics and determine times of greater user demand.
- Surveillance: Surveillance cameras inside the bus and stations, thus guaranteeing user safety.



Fuente: Cadena Noticias 03 abril 2017, Estaciones destruidas por vandalismo²⁵/ Juan Ojeda, Agreden a Usuarios del SITT 12 abril 2018²⁶

However, as a result of strong conflicts of interest and a precarious process of legitimization of the project, the installed infrastructure suffered a series of attacks that made it necessary to launch a project to restore the system in 2017. These attacks were not limited to the infrastructure of the SITT, on repeated occasions, the units and users were attacked by groups dissatisfied with the operation of the system.

²⁵ <https://cadenanoticias.com/nacional/2017/4/estaciones-de-ruta-troncal-inconclusas-y-destruidas-por-vandalismo>
²⁶ <http://semanariobaluncanan.com/2018/04/12/agreden-a-usuarios-del-sistema-de-integral-de-transporte-de-tijuana-sitt/>

Modernization of the parking meter system

In accordance with the objectives pursued by the ZMT's Comprehensive Plan for Sustainable Urban Mobility, measures should be adopted to encourage and promote the rational use of the private car. The foregoing municipality of Tijuana took on the task of modernizing the city's parking meter system, which operated in the city's downtown, financial zone, and river district.

In January, the bidding process for the operation of the city's parking meter system was initiated through a restricted invitation to companies that demonstrated the technical, operational and experience to operate the system. The bid was open on April 2019, to begin the replacement of the 2,497 existing parking meters for the installation of the new system in June.

The collection of income generated by the system, 40% corresponds to the City and should be reinvested in mobility projects.

The system operates Monday through Saturday from 9:00 am to 8:00 pm, while on Sundays and holidays the service will be free.

A parking user must approach the parking meter located on the nearest sidewalk and enter the license plate number of your car and pay twelve pesos for each hour. The system has a mobile application that allows registration and payment through a mobile device, this method offers the advantage for the user by only paying for the time and space its occupied. Since the system it is open until the user finishes his activities and concludes his stay in the parking space, the application will charge the credit card that the user has affiliated to his Parkmun account.

Replacement of the old parking meter system



Fuente: El Sol de Tijuana, Karina Torres, Estacionómetros ¿Cómo funcionan? ²⁷

²⁷ <https://www.elsoldetijuana.com.mx/local/estacionometros-como-funcionan-3893385.html>

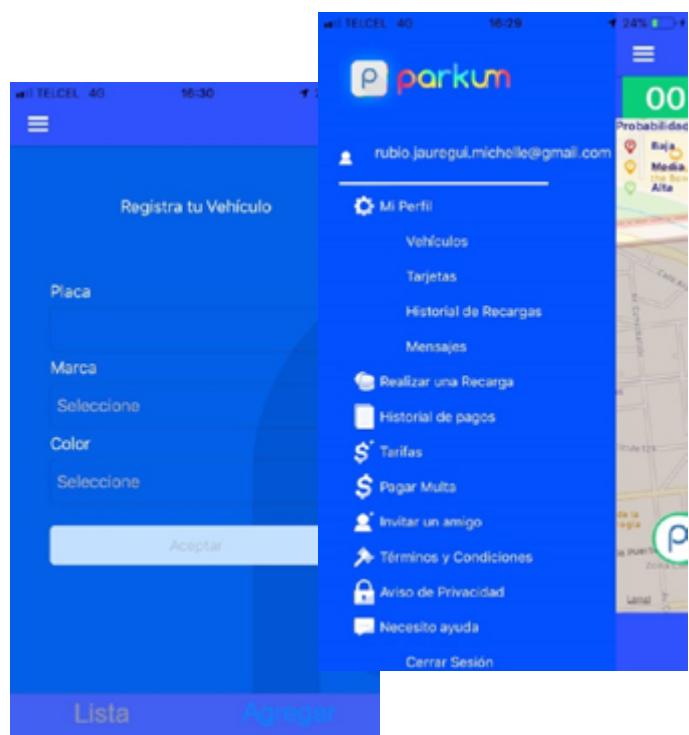
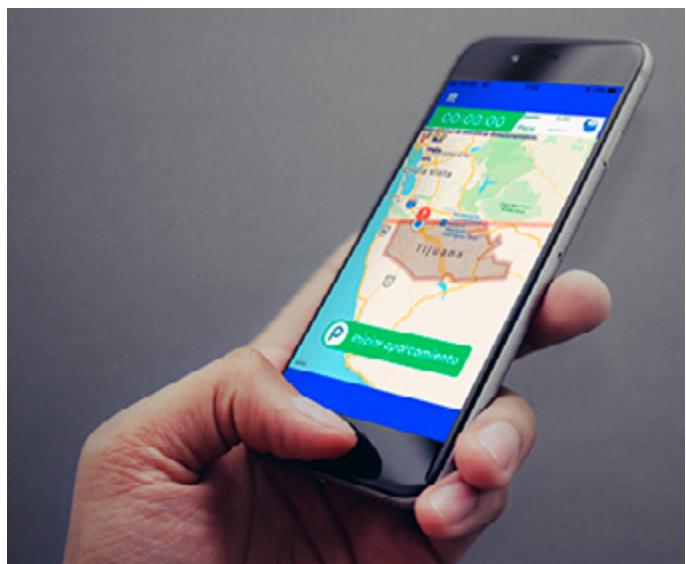
Benefits of modernizing the parking meter system for the public:

- Free access for people with disabilities
- Increased turnover of space for local businesses
- Illegal or improper use of the public roadway will be inhibited.
- Parking search times will be shortened.
- Reduction of pollution and traffic caused by vehicles looking for a place to park

Benefits of the modernization of the parking meter system in the City of Tijuana:

- 18 million pesos are projected directly for the city
- The concessionaire assumes all the expenses generated by the operation of the system.
- The municipality was not required to invest resources in this modernization.
- Previously, 15 million were invested in maintaining and operating the meters that were replaced.

Interfaz de la aplicación de aparcamiento en la vía publica, Parkmun, iOS



Fuente: Elaboración propia mediante capturas de pantalla de la aplicación Parkmun 2019



Fuente: PSN, Ivonne Hernandez, agosto 2019²⁸

Prior to the formal launch of the new system, there was a two-week trial period and adaptation so that citizens could familiarize themselves with the equipment. During this period parking space, payments could be tested without the consequence of a fine. Despite several informative announcements and the trial period, the modernization of the system generated controversy and even requested its removal by several sectors of citizens.

After a few months of operation, some users have complained about the complexity of filling information in the machines or the requirement for exact change. Some are unable to make their payments because the system does not recognize the custom plates of their vehicles.

²⁸ Tijuanenses prefieren pagar un estacionamiento privado que un estacionómetro en la vía pública: <https://psn.si/tijuanenses-estacionamiento-parquimetro-ih/2019/08/>

Implementation and development of mobile applications and platforms for an urban intelligence system in Tijuana

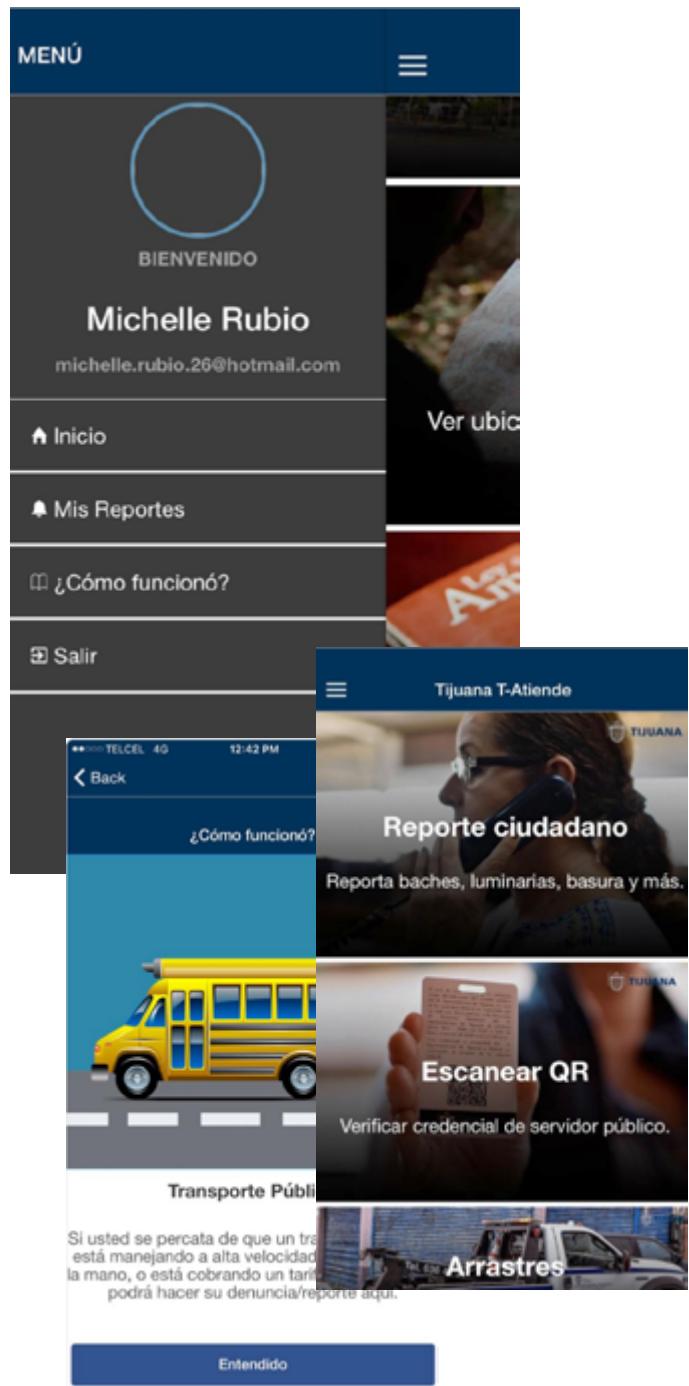
Tijuana T-Atiende

In July 2018 Tijuana City Council launched the mobile application called Tijuana T-Atiende, designed to facilitate and modernize the citizen reporting process regarding services provided by the City.

- Report of non-working luminaires
- Report of potholes in the city
- Garbage Report
- Public transport report
- Verification of credentials of public officials using QR code
- Validation of documents issued by the municipality using QR codes

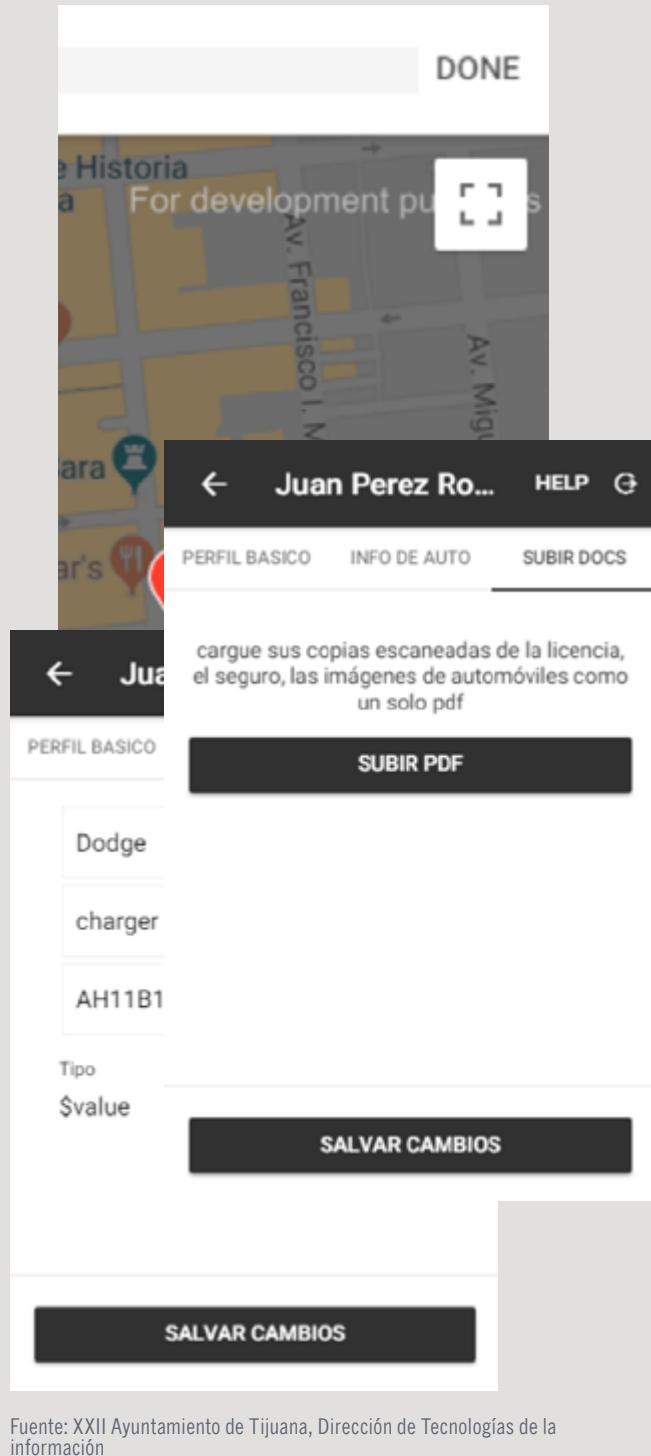
With regard to mobility, the application allows users to report public transport operators when they are driving in an unsafe manner, using a cell phone, charging unauthorized fares or any failure to comply with regulations. The authorities will follow up on the case and within a period of no more than 24 hours must resolve the citizen complaint.

Interfaz de la aplicación Tijuana T-Atiende, iOS



Fuente: Elaboración propia mediante capturas de pantalla de la aplicación Tijuana T-Atiende 2019

Interfaz de desarrollador de la aplicación de Taxis libres, Tappxi



Fuente: XXII Ayuntamiento de Tijuana, Dirección de Tecnologías de la información

Taximeter App, transport by digital request, Tappxi

By virtue of improving the quality of the city's public transport services, the city council undertook the task of developing a mobile taximeter application for units operating under this modality. The application would allow the user to request a free taxi through the mobile application, consult the credentials of the driver of the unit, the fare calculated by the taximeter regulated by the city, real-time monitoring via GPS, panic button, QR code scanning for citizen reports and payment with cash or credit card.

There would be two versions of this application, one designed for the user and the other for the driver where he can consult his work history, the wallet of completed trips, and the interface of travel requests.

The public transport service providers in the free taxi mode showed interest in the development of this application, as it will allow them to raise the quality of their service to compete with companies under digital application such as Uber and Cabify.

Citizen consultation and participation platform for Mobility, PIMUS ZMT consultation

This digital platform for permanent consultation was launched by the Metropolitan Planning Institute of Tijuana on March 15, 2019, to support the processes of consultation, communication and legitimization of the Integrated Plan for Sustainable Urban Mobility of the Metropolitan Area of Tijuana, PIMUS ZMT. On the website, you can find different tabs that provide information to the user regarding objectives, phases, and tools of PIMUS.

Platform interface for permanent consultation of PIMUS ZMT



The platform not only offers information regarding the development of the plan but also invites citizens to participate in public consultations and in the stock of mobility projects in the metropolitan area, where you can participate in two ways:

Project reception interface for consultation platform of PIMUS ZMT

¿Cómo puedes participar?



Registrando la necesidad de un proyecto

¿No tienes una idea concreta? Imagina la aplicación de proyectos definidos para la zona que más te interese.



Registrando un Proyecto Existente

Participa con tu idea de proyecto y categorízalo por temas.

²⁹ <https://www.pimuszmtijuana.com/página-principal>

Recepción de proyectos

Escoge el perfil que más se acerque a tu experiencia con propuestas de proyectos.



Ciudadanos



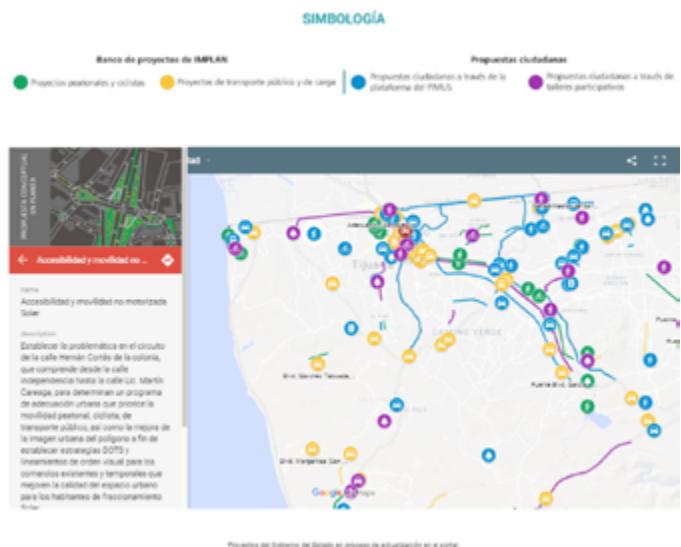
Técnicos

In the first modality, users can consult existing proposals and projects and propose replicating them in areas where they consider it necessary.

In the second modality offers the possibility of uploading a new project to the platform with two different profiles according to the needs of the user, where some data of the project in question will be requested before registering it in the bank of online mobility proposals.

In the proposed stock of projects, you can see the ones contributed by government agencies by modality, as well as the citizen proposals that have been uploaded to the portal for public consultation. These proposals were assessed along with face-to-face workshops during the elaboration of the PIMUS and generated a portfolio of strategic projects for the instrument.

Interfaz del banco de propuestas de la plataforma Consulta PIMUS ZMT



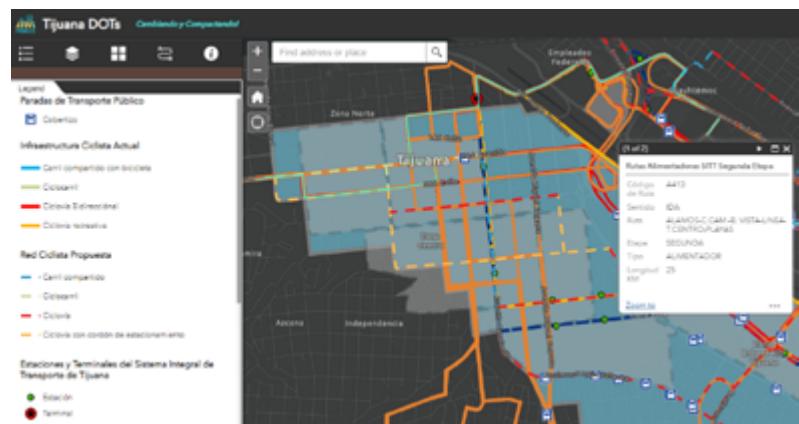
Web App, Tijuana DOT's Changing and Compacting

Tijuana DoT³⁰ is a web app developed on ESRI's servers, designed as an easy consultation tool allowing the user to interact in a practical way with some of the fundamental aspects that promote new approaches to mobility:

- Access to mass public transport
- Public transport itineraries and fares
- Arrangement of transport stops at convenient walking distances
- Availability of pedestrian and cyclist infrastructure
- Free access to public roads and highways
- Design of cities into dense units and neighborhoods.
- Systems aimed at discouraging the use of private vehicles.

The platform is presented as an interactive map where users can make use of the available tools allowing them to obtain practical data on mobility. From obtaining directions to reach their destination, check operational information on mass transit routes in the city, check the areas of the parking meter system, availability of pedestrian infrastructure, proposals for the municipal public bicycle system, as well as checking which are the nearest public transport stops within a radius of 400 meters.

Interfaz Web APP Tijuana DOT's, Consulta de una ruta alimentadora del SITT



Interfaz Web APP Tijuana DOT's, Consulta de disponibilidad de infraestructura peatonal

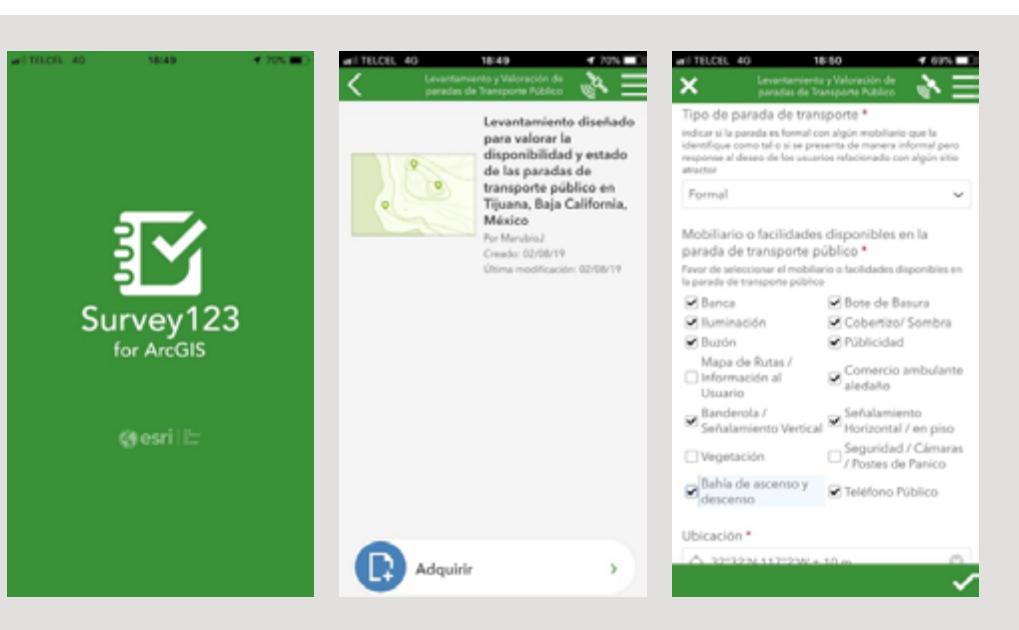


Fuente: elaboración propia mediante la plataforma de Argis Online

³⁰ <https://marubioj.maps.arcgis.com/apps/webappviewer/index.html?id=7b0b0e058b7f4994b5c610583f93afe8>

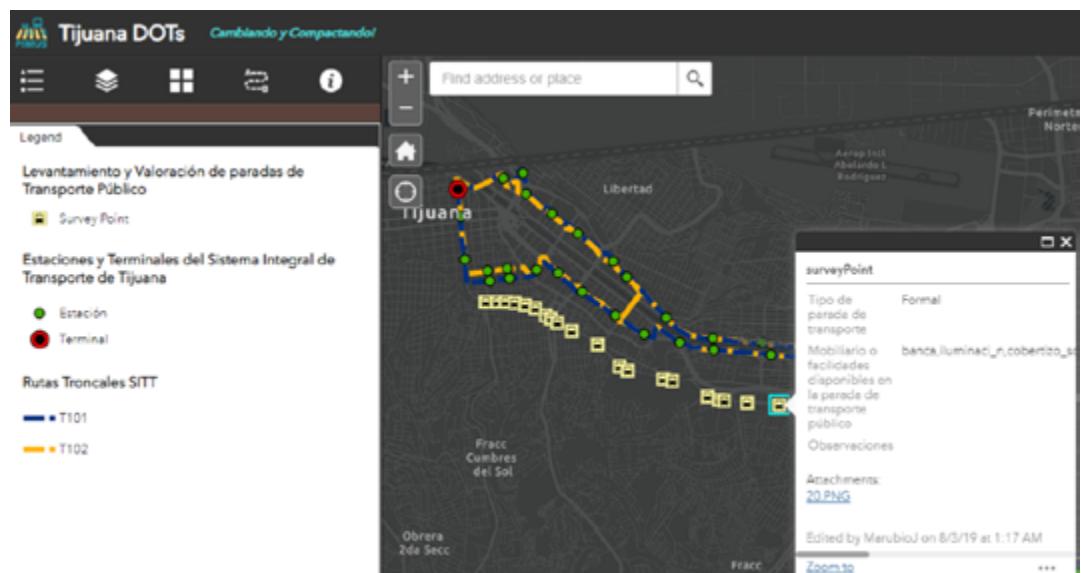
Interfaz del cuestionario para levantamiento y valoración de paradas de transporte público de Tijuana

Fuente: elaboración propia mediante la aplicación Survey 123



Tijuana DOT's can be accessed in real-time by means of a questionnaire called “Survey and evaluation of public transport stops in Tijuana, Baja California Mexico”, developed in the Survey 123 platform from ArcGis.

Visualización de cuestionarios levantados mediante Survey123 en la Web APP de Tijuana DOT's



Fuente: elaboración propia mediante la plataforma de Argis Online

4. Principal challenges and lessons to elaborate and implement a PIMUS.

One of the main challenges is undoubtedly the change in the way we perceive and interact with our cities, which must be reflected in our education. This is not a problem that is limited to convincing citizens about the benefits we could find by generating changes in the paradigm of mobility, sometimes the problem is presented in a latent way within the body of public officials, whether due to lack of knowledge, out-of-date, or simple reluctance to change, the problem of urban mobility generally wants to be addressed in terms of decreasing traffic, increasing speeds, creating more roads, developing new road infrastructure, nodes, junctions, etc. Instead of seeing mobility and urban development from a more “human” perspective, it is necessary to respond according to people’s needs. It implies not only understanding the new ways of making a city but also having the capacity to transmit these ideas in the most accurate way possible if we have the capacity to transmit this refocusing of needs, the process of change will be simpler.

5. Final conclusions and recommendations.

We consider that this work of coordination between cities, although they have different problems, policies, and ways of approaching and giving solution to the problems that afflict them; represent a valuable instrument for the rest of the world. Their contributions as a unit derived from their experiences seek to compile and document the troubled experience presented by changing mobility paradigms in cities. Yet at the same time providing a consensual vision among four Latin American metropolises that use best practices to overcome challenges and implement successful plans. This is meant to be shared with cities that are willing to venture into the process and learn from their mistakes and achievements, trying to save them time, resources and even possible disappointments they may find along the way. We hope that this document will help readers and interested parties to dimension the work required to lead cities towards equitable and sustainable mobility.

METRO POLIS in MOTION

TOWARDS A SUSTAINABLE URBAN MOBILITY PLAN

metropolis •