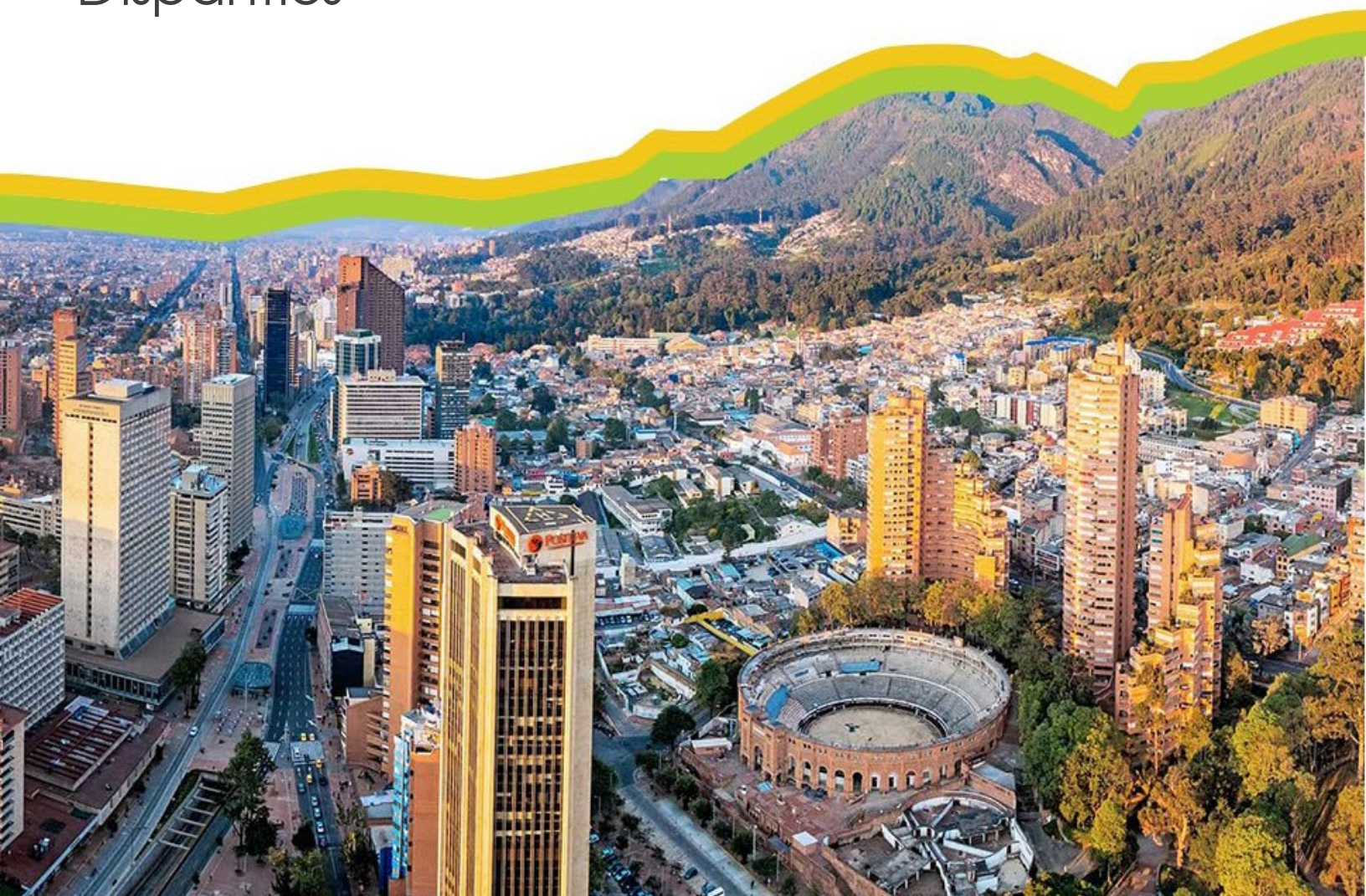
City Planning Studio
Fall 2023
University of Pennsylvania

Urban Expansion & Equity in Bogotá

Examining Housing & Transportation Disparities



About the Team

Sustainable Transportation & Infrastructure Planning
Michael Dunst
Xiayuanshan Gao
Yanbing (Evan) Zhao
Ke Zhou

Housing Community & Economic Development
Naomi Tariku

Land Use & Environmental Planning
Alexa Ringer

Public-Private Development
Jared Jackson
Brianna Thornhill
Ann Zhang

Smart Cities
Teresa Chang

Urban Design
Elaine Zhang

Acknowledgmenets

We want to sincerely thank to Erik Vergel and Diego Romero for their guidance and support while traveling through Bogotá, enriching our understanding of the urban dynamics of the city and surrounding municipalities. The collaboration with the students at Universidad de Los Andes has provided diverse perspectives into our research. We extend our appreciation to Erick Guerra for his expertise, which has greatly enhanced our studio and additionally, a thanks to Patrick Bransfield for planning our trip. Their collective assistance has been crucial in helping us find solutions to make the urban environment more accessible and equitable for everyone in Bogotá.

Contents

01 Introduction

Our Vision

A holistic approach to urban development, where the integration of affordable housing, cohesive transit systems, environmental sustainability, and safety considerations collectively contributes to shaping a vibrant and sustainable cityscape.

Executive Summary

In this graduate studio project centered on Bogotá, Colombia, our class collaboraed with Professor Erick Guerra, partners, and knowledgeable advisors to propose plans, policies, and site interventions. We are focusing on fostering social housing in proximity to existing and future high-capacity transit stations. The overarching objectives are twofold: to actively contribute to the ongoing urban planning strategies for Bogotá and to adeptly address the key challenges while uncovering latent opportunities within the urban landscape.

The studio's journey unfolds with the gathering of crucial data specific to Bogotá. The second phase sees the development of a studio framework, complete with a problem statement, planning principles, and conceptual plans, each refined iteratively through mid-semester feedback. Transitioning into the third phase, our focus sharpens on translating this comprehensive framework into a high-level plan, where considerations span finance, spatial alignments, and strategic phasing. Concurrently, the fourth phase encompasses individual or small-group projects seamlessly aligned with the overarching plan, delving into facets such as transit integration, housing policy proposals, and community development, thereby fostering a holistic approach to urban planning within Bogotá.

At the heart of our exploration lies an investigation into the mobility patterns in Bogotá and the surrounding municipalities. This multifaceted analysis spans both residential and destination mobility, aiming to discern where individuals reside, the factors influencing their choices, and the key locations that serve as the lifeblood of the city. Our study then extends to the city's transportation systems, identifying and unpacking the challenges inherent in the existing infrastructure. Central to this examination is the TransMilenio Bus Rapid Transit system, an integral piece in Bogotá's transportation network. We aim to comprehend its impact and dynamics, especially considering its imminent connection to the planned metro sytem.

As Bogotá expands its transportation infrastructure and housing development, we raise a question: Is the expansion of these systems necessary to provide a safe, sustainable, and equitable city for Bogotá? How can the city provide housing and transportation in a way that does not sprawl outwards and promotes development where it is needed?

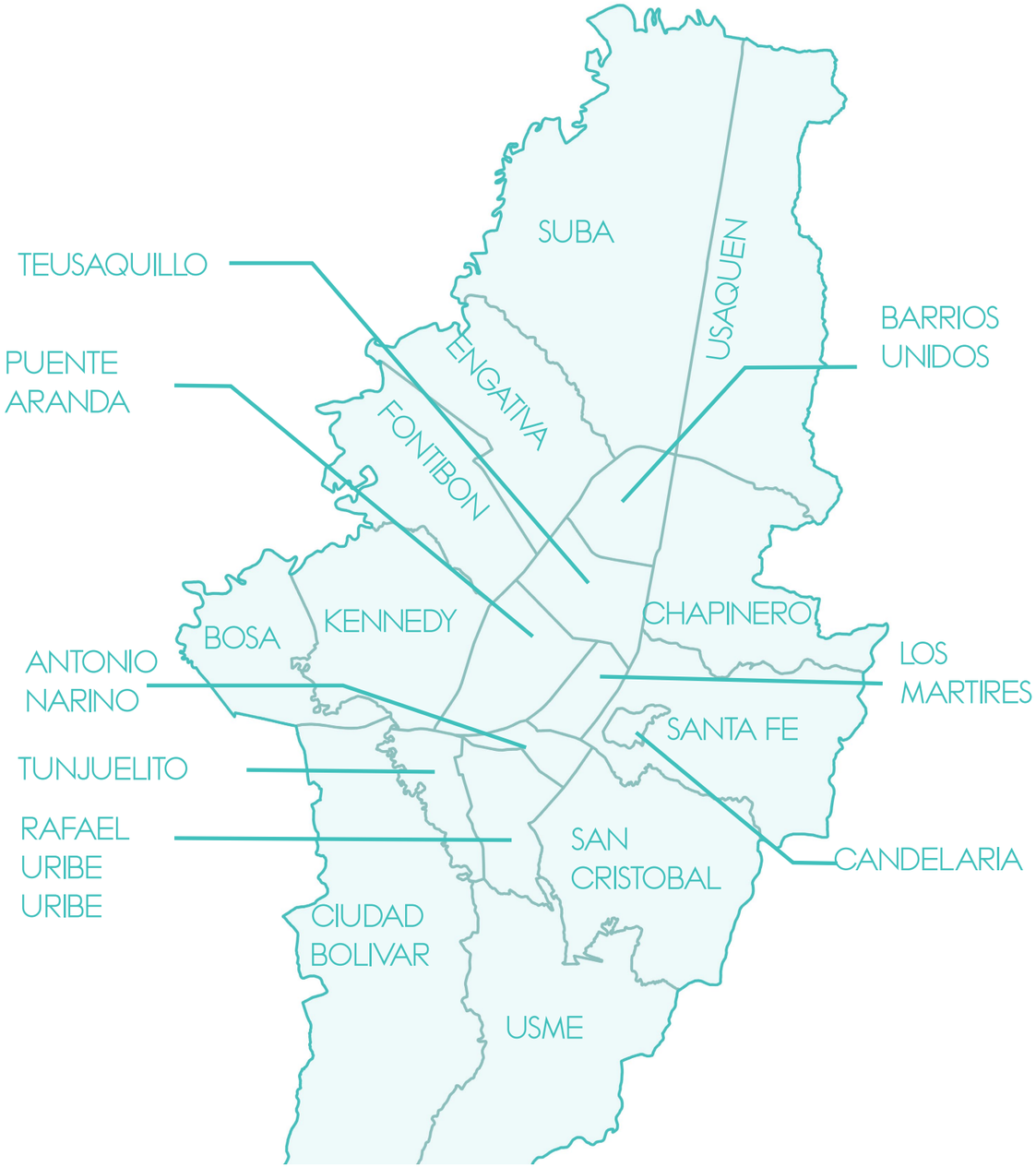
We also investigated and visited several housing projects. We visited large-scale social housing projects like Ciudad Verde, and neighborhoods fitting populations of small cities like Ciudad Bolivar. We toured private developments such as Parque de las Américas and Lagos de Torca and examined how all of these housing projects - public and private - fit transportation, equity, and sustainability into the places being created.

The studio then pivots towards diverse site projects that delve into Housing Evaluation Toolkits, Transit-Oriented Development financing, planning, and design. A spotlight is cast on creating a Low Emission Corridor, aligning with a broader vision to promote electric vehicles and public transit, thereby contributing to a healthier atmosphere and more vibrant outdoor spaces in Bogotá. The Safer Travel Better Experience project seamlessly integrates enhancements in sidewalks and streetlights, alongside permeability improvements tailored for "Natural Surveillance." This comprehensive strategy demonstrates our studio's commitment to addressing a spectrum of urban challenges, spanning housing, transit-oriented development, environmental sustainability, and safety considerations for vulnerable groups.

In conclusion, our studio project seeks to deliver an insightful understanding of Bogotá's urban dynamics. The recommendations originating from our research will be centered on enhancing mobility, addressing housing disparities, and promoting sustainability. This cohesive approach aligns seamlessly with the overarching goals of Bogotá's urban development, with an emphasis on navigating and enhancing the connectivity between the TransMilenio BRT system and the anticipated metro system.

University of Pennsylvania, Fall 2023

Context



Bogotá D.C.

Background

General background

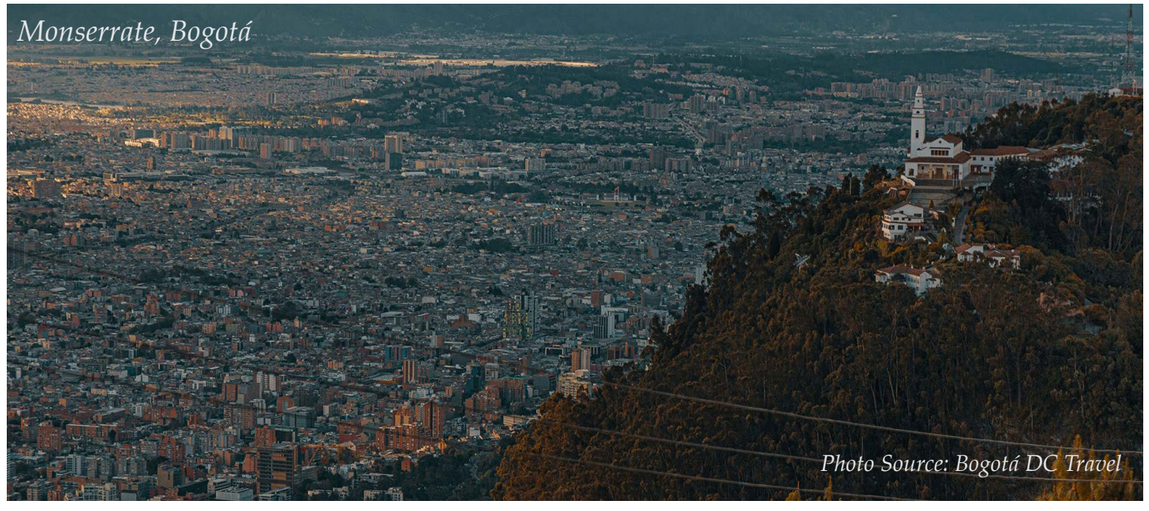
Bogotá, or Bogotá Distrito Capital (Bogotá D.C.), is the capital city of Colombia, one of the largest and rapidly growing cities in the world, and a regional political, economic and cultural center since the Spanish colonial times. The city is located on Bogotá Savannah in the middle of the country, which brings the city high elevation, mountainous topography, and cool and rainy weather all year round. Given the city's importance in the country and region, over the past few decades, it has been experiencing a huge influx of population migrating from surrounding municipalities or countries, which results in rapid urban expansion and puts pressure on existing civic infrastructure.

Given the ongoing urban expansion, this studio looks at two critically important interconnected segments – public transportation and housing. On the one hand, Bogotá has been world renowned for its multi-modal public transportation system – from the high-capacity BRT system, TransMilenio, as a part of the larger integrated transportation system (SITP), to Ciclovia, the city's move to close down all lanes every Sunday for only biking and walking. The city's cool climate encourages and invigorates citizens to bike and walk. However, due to natural constraints and other socio-economic factors, the public transit system does not have an equal spatial distribution, putting some communities at disadvantage for accessing. On the other hand, like many other large rapidly growing capitals in emerging economies, Bogotá is experiencing a housing shortage and disparities. Living conditions, access to utilities, access to transit and amenities vary dramatically for those living in formal versus informal housing. Bogotá's Estrato (estratificacion, social stratification or social class) system [1] further complicates such disparities.

This studio aims to bridge public transit access and housing affordability in Bogotá through policy, planning, and design. This section offers a glance into the city, the people, and their experiences living in the city both on a macro-scale through identifying city-wide trends, and on a micro-scale by zooming in onto five housing projects. Transportation and housing remain two key themes and focus of analysis for both city-wide trends and project-specific study.

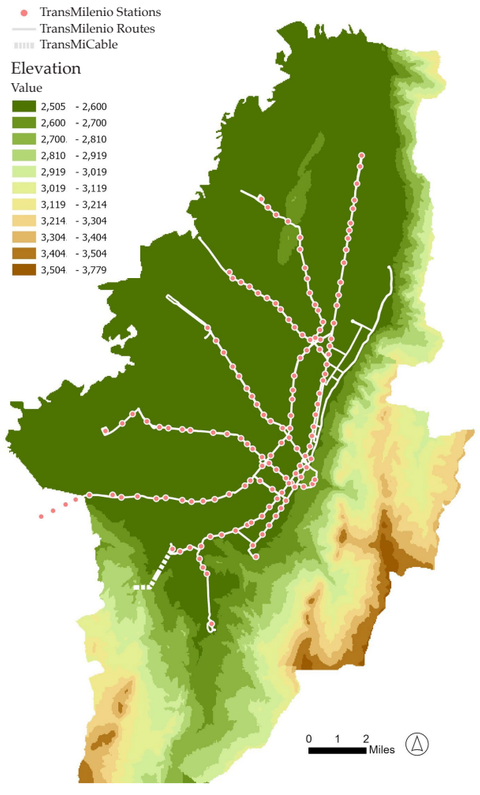
[1] Estratificacion is a social classification on the scale of 1-6 (1 being the lowest strata and 6 being the highest) assessed and determined by the government. It is an important indicator for utility pricing and social welfare programs. It does not incorporate household or individual income, as it is considered privacy that people refrain from sharing. Rather, it is a geographically-based classification (i.e. location is stratified, not households) based on criteria such as physical appearance of buildings in neighborhoods. Estrato brings nuance to housing and social disparities – on one hand, since it is geographically-based, stereotypes associated with the lowest and highest areas persists over time; on the other hand, some may choose to live in lower estrato neighborhood to avoid high utility costs, complicating the socio-economic profiles of many neighborhoods.

Topography

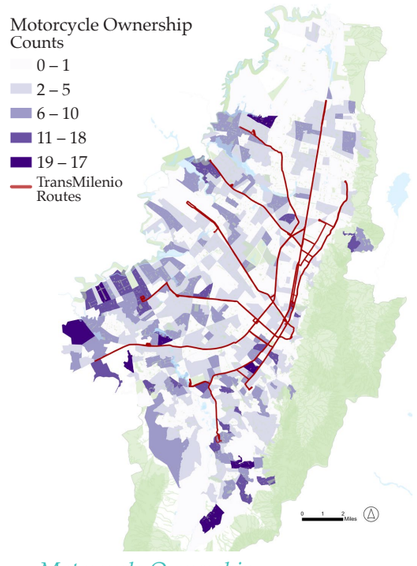


One distinct characteristic of Bogotá is the high elevation and mountainous topography. Located on the high plateau of Bogotá Savanna, a part of Cordillera Oriental of the Colombian Andes, the elevation in Bogotá starts from 2,505 meters (8,219 ft) and can reach 3,779 meters (12,398 ft) at highest. Elevation changes are mostly concentrated in southern and eastern parts of the city. While such change in elevation contributes to gorgeous scenic viewpoints such as Monserrate, it largely impacted and restrained urban development on the southern and eastern mountainous peripheries. The majority of TransMilenio BRT Bus Routes are reaching areas on the plateau, leaving the population living on slopes less accessible. TranMiCable, the cable car system that serves as a transit option complimentary to TransMilenio, was designed and implemented to tackle such transit inequity for the large population living in Ciudad Bolivar. Opened in 2018, TransMiCable has been a meaningful and successful attempt to enhance public transit accessibility and a solution to the mountainous cities like Bogotá.

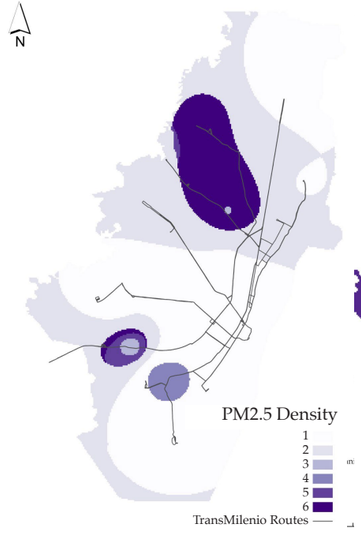
Topography of Bogotá



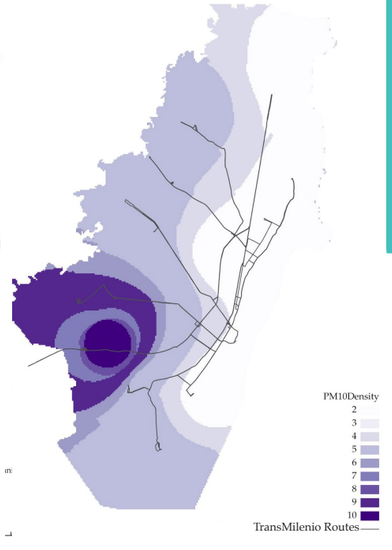
Air Quality



Motorcycle Ownership



PM2.5 Pollutant Desnity



PM10 Pollutant Desnity

Bogotá's air quality levels have been affected by the mass movements of large volumes of people and cargo. Although the average reading of PM 2.5 is 13.1 μg/m³ in 2019, which falls into the moderate classification of air quality, achieving the WHO target of 0 to 10 μg/m³ is still an essential goal to pursue. While the high elevation and high wind speed can help blow away pollutants and keep the air clean, the mass of vehicles using extremely outdated engines running on diesel fuels, along with their dire exhaust fume output, would be spewing out higher amounts of pollutants and noxious fumes. Moreover, highly congested roadways are often elevated, exposing pedestrians and cyclists to gases and particulate matter.

Looking closer, as we can see in the following maps, different air pollutants are actually concentrated in different areas of Bogotá. The highest concentration of PM 10 is in the southeast region, where the lowest socio-economic status block groups are located, posing a threat to the most vulnerable communities with poor air quality and higher rates of death related to air pollution. we can also observe the highest concentratedareas clustered in the northwest area and some in the southwest area where the industrial area is located. Numerous brick factories located in the far south, running on their fossil fuels such as coal, would be another cause of it. PM 2.5 shows a higher trend concentrating in the northwest region, which mostly consists of the highest socio-economic status block groups (estrato 6), and gradually lowers when it goes to the southeast, potentially due to higher vehicle ownership.

The highest motorcycle ownership area is clustered in the southern area of Bogotá, leading to that communities with lower socio-economic status may rely more on motorcycles, making the area much more polluted and posing themselves and vulnerable communities to a higher risk of air pollution-related diseases. These air pollutants can lead to higher death rates, lung developmental issues for the young population, increased instances of cancer, and lower fertility rates.

Transportation & Housing History

1960s – 1990s:

Guerra del centavo ('The Penny War')

The Penny War emerged approximately in the 60s and started to die down with the implementation of TransMilenio in 2000 and SITP in 2012, though there is no consensus on the exact start or end date. The war started with privatization of bus operations, as the profit-driven bus companies and drivers were fiercely fighting for more passengers and more profits, even one cent. There were three major problems associated with the Penny War – 1) passengers can request stops anywhere on the route causing traffic disturbance, 2) buses racing on the streets for boarding more passengers and larger market share, and 3) over-supply of buses that causes unnecessary competition and extra air pollution.

Informal Urban Growth

Ciudad Bolivar exemplifies how informal settlements have been developed widely during this period, Ciudad Bolivar is an good example. Ciudad Bolivar, located in the southern hilly part of Bogotá, represents a unique case in urban development and transportation. This informal mountainous settlement is home to approximately 592,123 people and is characterized by its distinctive use of the TransMiCable transportation mode. The area's topography and informal urban structure significantly influence the travel patterns and mobility challenges faced by its residents.

Intensifying Traffic Congestion

With the large inflow of population into the capital city, the existing informal public transit buses run by private operators and drivers started to fall in predicament. Lack of regulation and fierce competition on the road led to over-supply of buses regardless of existing demand, which eventually evolved into Guerra del centavo, or 'The Penny/Cent War'. Traffic congestion and passenger safety continued to worsen with population growing from 1 million to 5 million and urban area growing from 8,000 hectares to 30,000 hectares.

1999 – 2000

Proactive Planning Begins

To alleviate congestion of privately owned buses and vehicles, and to create a public transportation system that is comfortable, safe, and affordable, the project of TransMilenio, a publicly funded but privately operated Bus Rapid Transit (BRT) system, was passed in 1999 by Bogotá Council. Upon the start of operation of the first route in December of 2000, TransMilenio has undergone three phases of construction and expansion into today's size of 12 lines/zones and 138 stations that covers a large area of the city.

2012

Consolidation of Transportation

SITP, or Sistema Integrado de Transporte Público de Bogotá (Integrated Public Transit System of Bogotá) was proposed in decree in 2006 as a part of Plan Maestro de Movilidad (Mobility Master Plan). The system aims to integrate TransMilenio Troncal (BRT buses in red), Alimentador (feeder bus in green), Urbano (Urban buses in blue), and Complementario (Complimentary buses in orange) through zonal operations, integrated fare system, and corporations across different types of buses to make transfers smoother and trips safer.

Mega Social Housing Projects

With the transportation consolidation, the housing projects started to move to the city periphery. **Ciudad Verde** is one typical example as public developed housing project. Ciudad Verde stands out as a fully public, social housing triumph in Soacha, designed as a 'City within the City.' This development has successfully transformed into a self-sustaining enclave that provides shelter to over 100,000 residents in 53,000 homes, demonstrating an exceptional commitment to public welfare and urban planning. The project is distinguished by its expansive green spaces, which make up 20% of the area, and its comprehensive public amenities, including shopping centers, a community hospital, schools, and future university plans. Ciudad Verde's growth, marked by the addition of 14 towers and 448 apartments, exemplifies a 100% publicly funded response to the demand for affordable housing, embodying the ideals of community-centric urban expansion while enhancing the living standards of its residents.

Sustainability in Private Housing

Lagos de Torca is another example standing out as a private developed housing project located in the north periphery. Lagos de Torca, a visionary housing project spanning 18,000 hectares, is located in the north of Bogotá. With 34 meticulously planned parcels, it also addresses the pressing need for housing by developing the periphery rather than congesting the middle. What makes Lagos de Torca unique is that this project not only enhances environmental livability but also prioritizes the conservation of wetlands near the Bogotá River, necessitating thoughtful reconfiguration.

2018

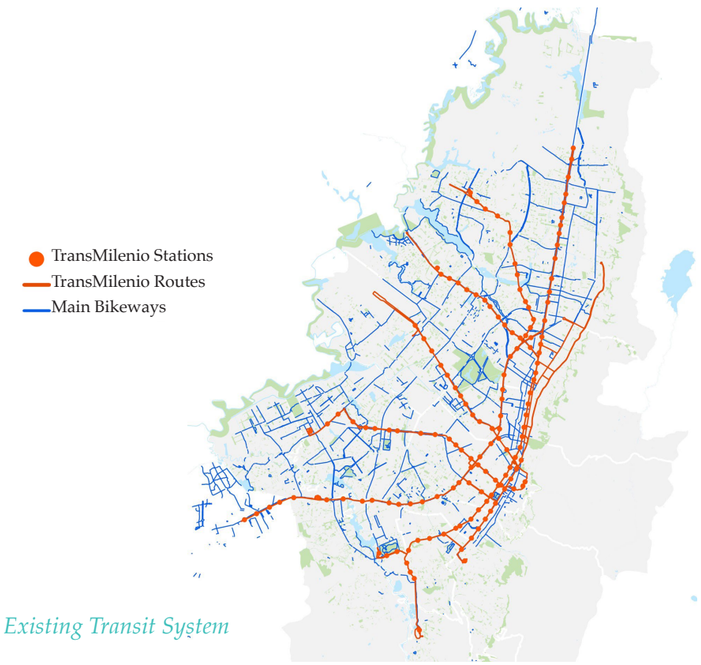
TransMiCable Opens

Inaugurated in December, 2018, TransMiCable offers a new transit mode of cable car for more than 700,000 residents living on the mountainous terrains in Ciudad Bolivar on the southern periphery, who had been suffering from transit inaccessibility due to topographic constraints. The route consists of 4 stations that connect the terminal station of Transmilenio bus, Portal del Tunal, with the majority of Ciudad Bolivar at the time. According to staff from Transmilenio during our visit and IFC reports, TransMiCable can shorten an average trip from 1 hour 20 minutes to just 15 minutes via gondolas.

Present Day, 2023

Existing Transit System

Currently, the Transmi system mainly operates 3 types of buses – Troncal (red bus, usually referred to as the 'Transmilenio' buses), Alimentacion (green feeder buses), and Urbano (also referred to as Componente Zonal, blue urban buses) – along with TransMicable. Complementarios (Orange Complementary buses) and Especial (small burgundy special buses) serve as linkage between less accessible periphery areas and BRT stations.



Existing Transit System

The Future of Bogotá

Parque de las Americas

This new residential development, comprising an impressive 3,451 units, strategically situates itself within the central core, offering residents not only a contemporary living space but also the convenience of multiple TransMilenio lines within walking distance. This accessibility to high-capacity transit systems enhances the site's connectivity, facilitating seamless travel for its inhabitants throughout the urban landscape. Furthermore, the site is integral to a broader urban renewal initiative known as Triangulo Bavari, emphasizing a comprehensive approach to rejuvenating the surrounding urban fabric.

Future (Planned for 2028): Bogotá Metro

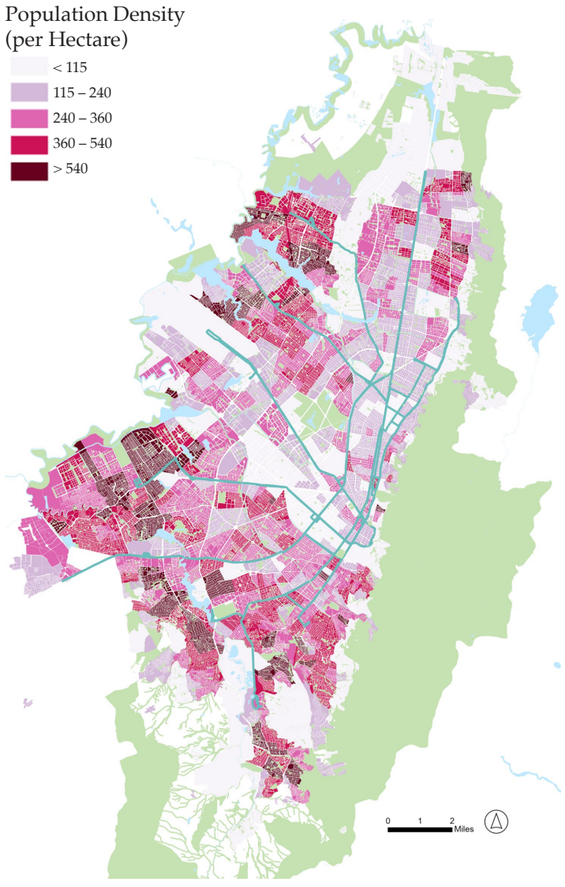
After years of debate, technical examinations, and financial planning, the construction of Bogotá's first metro line started in October of 2020. The metro is expected to be fully opeational by 2028. The metro line is expected to enhance high capacity transit, to alleviate current pressure on the Avenida Caracas corridor where Transmilenio is running on, and to connect and serve the south-western area of Bogotá. While the impact of the metro on local economy, community, and public transportation remains uncertain, the construction of metro undoubtedly brings excitement and potential opportunities for transit-oriented development to the city and its people.

Citywide Trends

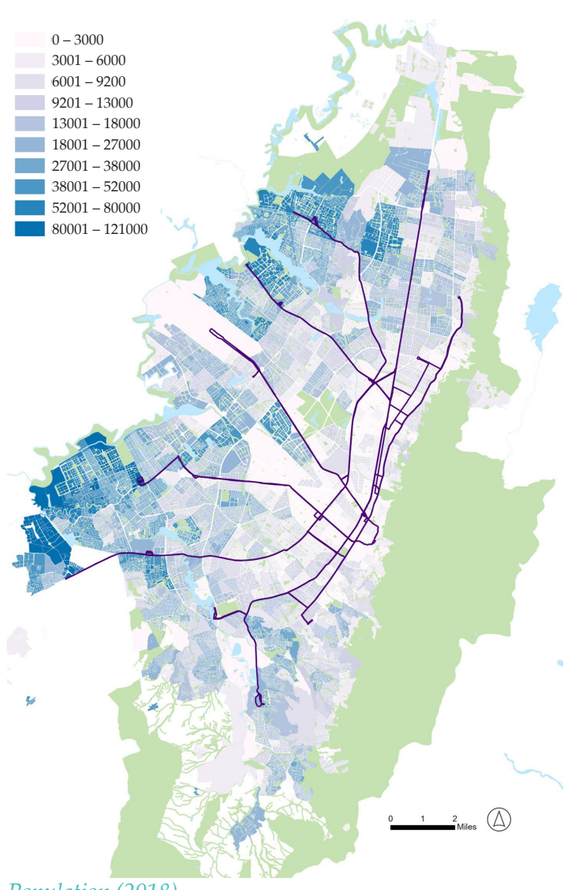
Disparities exist in both public transit accessibility and housing affordability across the city. On the one hand, the topographic constraints led to uneven development on the urban peripheries (especially southern and eastern mountainous areas), as opposed to the city center located on the plateau. Residents living on hills are encountering lower accessibility to public transportation and experiencing longer trips. On the other hand, the existing Estrato system creates interesting yet complicated dynamics in land and affordable housing development.

To better understand the complex and reciprocal relationship between public transit and affordable housing, we have proposed four key questions that we aim to explore with data analysis, namely – 1) where are people living, 2) where are they going (including work commutes and non-work trips), 3) by what means are they getting to their intended destination, and 4) what are their experiences with mobility. We queried data primarily from three credible sources – the national census data (2018, DANE), Household Travel Survey (2019), and Bogotá Datos Abiertos (or Open Data Bogotá, the city's open data portal) that provides more recent data on the city. For the purpose of identifying and inferring reasonable trends, we have aggregated block-level datasets into urban sectors, a geographic unit that is smaller than municipality but larger than blocks.

Where are people living?



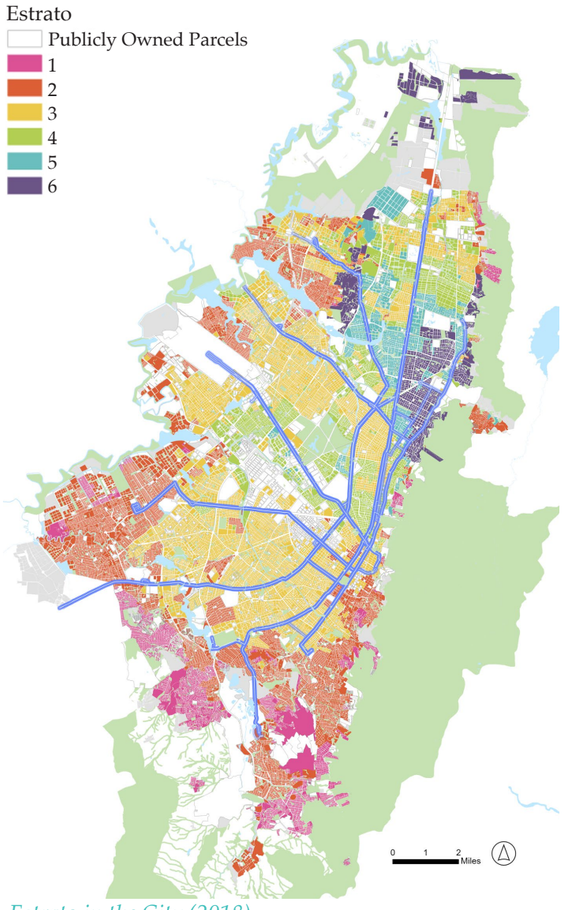
Population Density (2018)



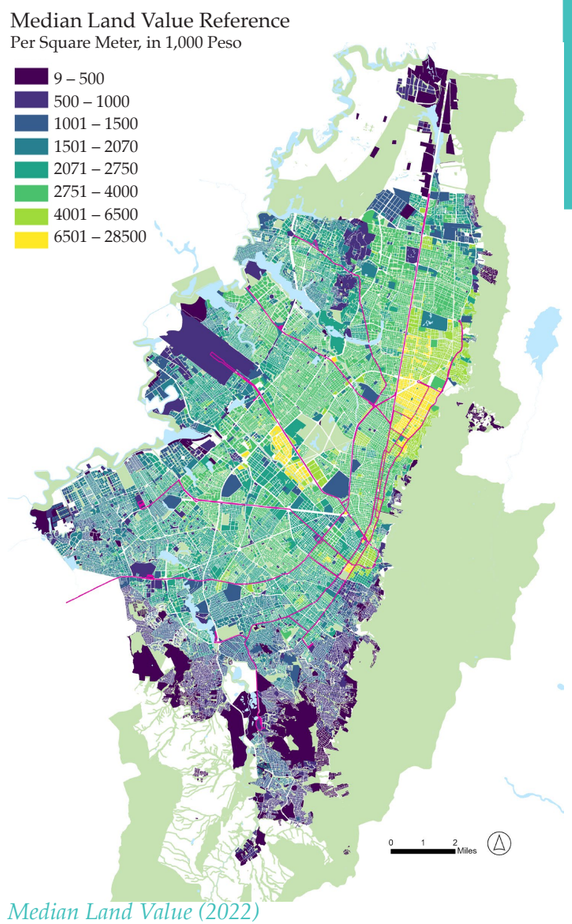
Population (2018)

A large proportion of the city's population lives on the verge of municipal boundaries, mostly in the west side. Through examining population distribution and density in contrast with existing BRT system routes, we reach two inferences. First, a majority of residents live on the urban periphery, which takes up a large portion of total population, are less accessible to existing BRT systems, and are putting the BRT stations on the periphery under high pressure. Second, that a large number of people living in south-western and southern areas are experiencing high density in their neighborhoods, potentially resulting in tight and worse housing conditions, in comparison to those living in city centers.

Where are people living?



Estrato in the City (2018)



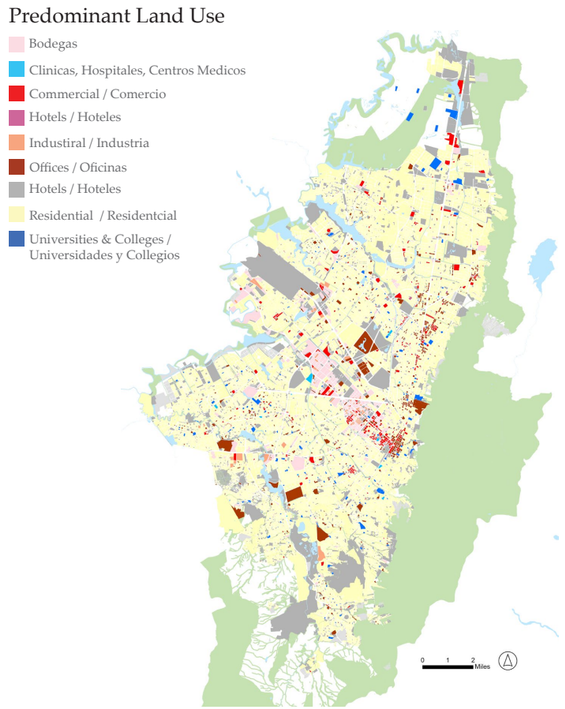
Median Land Value (2022)

Similar to the spatial distribution of population, there is an interior-periphery difference in median land value. Median land value is significantly higher in commercial hubs in the city center, while land on the western and southern periphery is on the lower end. When we compare this map with the spatial distribution of different estrato classes, we notice a geospatial connection between higher median land value and higher estrato class in the city center, where public transportation is relatively more accessible than periphery areas.

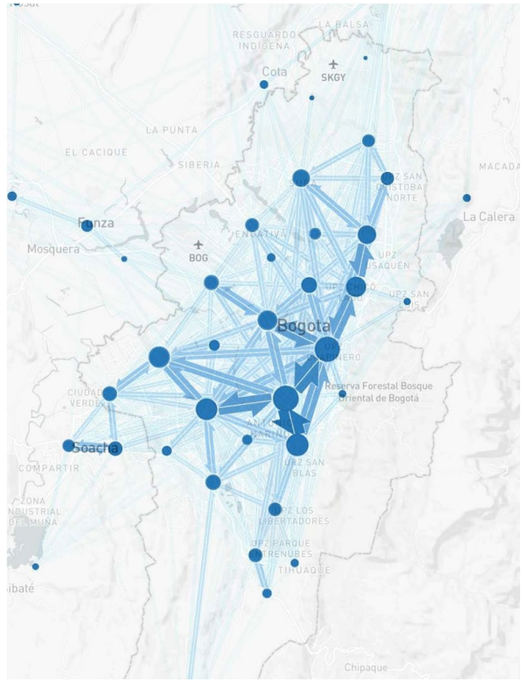
However, most citizens of Bogotá reside in areas of estrato 2 and 3, where it mostly falls in south-western and southern parts of the city with less accessibility to existing high-capacity BRT system.

To summarize, more population in the city lives on the urban periphery, particularly the southwestern and southern areas, where the land is at lower estrato and where they are experiencing less accessibility to high-capacity transit, and potentially worse housing condition.

Where are people going?



Predominant Land Use by Block (2022)

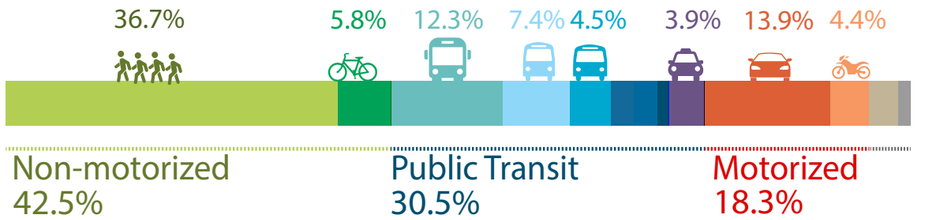


Origin-Destination Flow

Trips within Bogotá can be categorized into two types, internal trips which mainly take place within the community and external trips which is on a city level. For external trips, people predominantly travel between the outskirts of the city, where large populations reside, and the city center, which serves as the hub for employment opportunities, recreational activities, and educational institutions.

Both the north-south travel trends and the distinctive travel patterns between the outskirts and the city center due to these spatial disparities in resources.

How are they getting there?

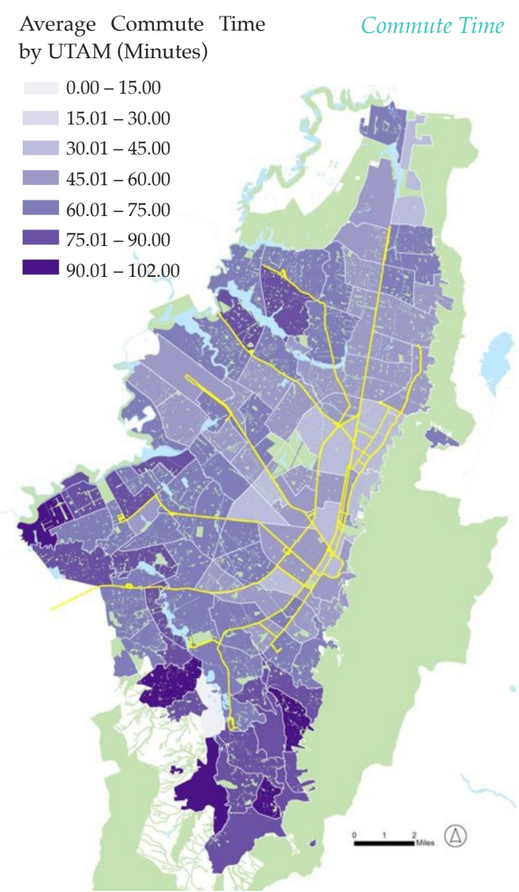


Transportation Modal Split

A similar pattern can be observed in commute trips within Bogotá. The center area experience a substantial influx of incoming trips, indicating that commuters residing in the city peripheries embark on extended journeys to reach these central areas, where employment opportunities abound. The extensive commute distances from the city outskirts to the center are mirrored in the commute time variations between the peripheries and interiors of the city. Residents in outlying areas endure significantly longer commute durations, with daily commute trips lasting over an hour and a half. This trend is particularly pronounced in the southernmost neighborhoods, where a significant proportion of the city's economically disadvantaged residents reside.

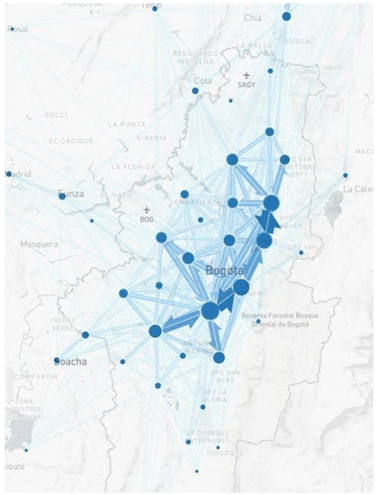
Bogotá is a city where non-motorized and transit trips take up large proportions of people's daily travels. Breaking down on the city level mode choices, the most chosen modes of transportation are non-motorized, with walking trips and biking trips taking up around 36.7% and 5.8% of total trips respectively. Public transit represents a substantial share of 30.5%, with TransMilenio accounting for 12.3% of the overall trips. Motorized trips, which mainly consists of driving private vehicles (13.9%) and motorcycles (4.4%), together takes up 18.3% of all trips. This composition puts infrastructure for walking, biking, and public transit at particularly critical role in the city's transportation planning.

Commute Time

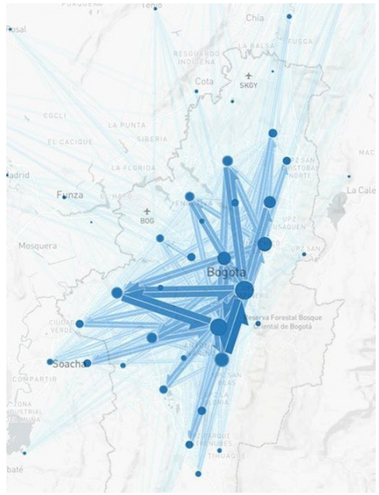


How are they getting there?

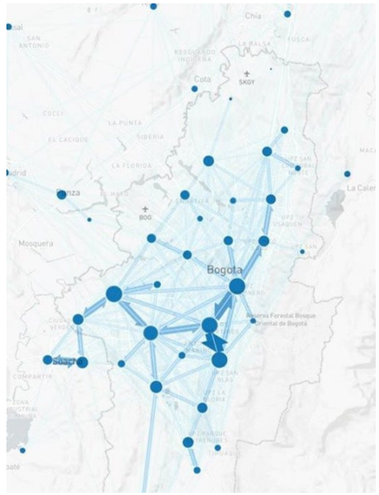
TransMilenio



Motor Vehicles



Walking / Biking

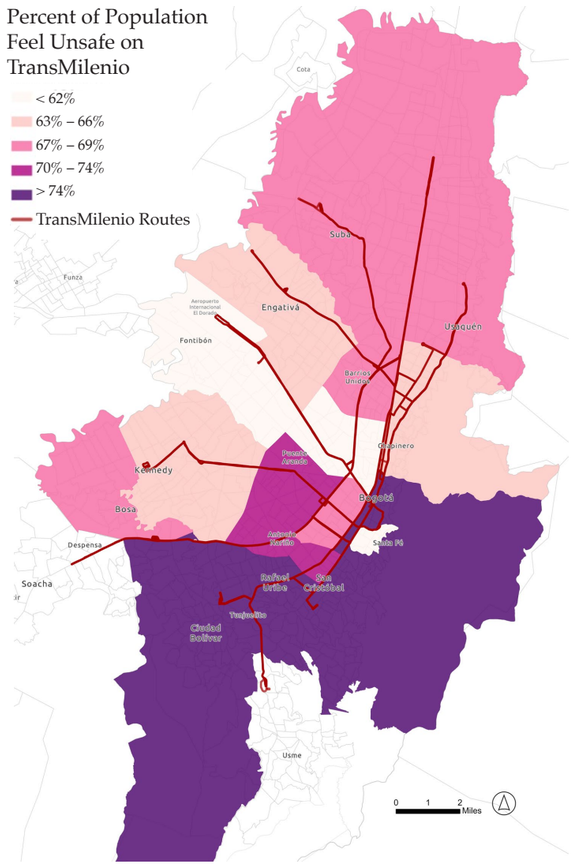


Origin-Destination Flow (by TransMilenio, Motor Vehicles, and Walking/Bikings Trips.

Zooming in on the mode split, mode choices for trip takers vary based on their origins and desired destinations. Significant differences emerge in the distribution and patterns of trips by TransMilenio, motor vehicles, and walking/biking. Trips by TransMilenio tend to be very long distanced, with trip takers traveling from outskirts to interiors, illustrating a radiating pattern.

Conversely, motor vehicle trips predominantly occur in the city interior regions, likely attributed to limited access to private vehicles in economically disadvantaged households, which primarily reside in the city peripheries. The travel patterns of motor vehicles also reveal distinct north-south trends, possibly linked to the higher car ownership among residents of higher estrato in the north. Biking and walking trips, on the other hand, tend to be much shorter in distance and are primarily concentrated in the city peripheries, including hilly regions like Ciudad Bolivar, which could be indicative of limited access to both public transit and private vehicles in these areas.

What are people's experiences with mobility?



Perception of Safety on TransMilenio

Walking and biking trips make up 42.5% of all modes of transportation, indicating that people in Bogotá heavily rely on walking and biking in their everyday lives. Despite this, many pedestrians and cyclists face challenges such as highly polluted corridors, bike accidents, and safety issues, particularly for women.

- In Bogotá, many motor vehicles use extremely outdated engines running on diesel fuels, emitting higher amounts of pollutants and noxious fumes. Additionally, the highly congested roadways are often elevated, exposing pedestrians and cyclists to dangerous gases and particulate matter.

- Cyclists face roadway safety issues, and we can observe that the bike crash incidents are highly concentrated in the peripheries. Additionally, 16% of bike crashes occur near BRT stations.

- Pedestrians don't feel safe walking on specific streets. The following example illustrates how some poorly lit streets, located next to a main corridor in the CBD, look like. From 2019 to 2022, the number of victims of sexual crimes increased, especially in the periphery region. More than 63% of assaults happened against women.

On the other hand, public transit trips also account for a substantial 30.5% of all trips. Although people rely on these services, they also face issues such as sexual harassment on TransMilenio, insufficient frequency of rides, and delays in TransMilenio, which are mainly criticized by riders. Specifically, over 70% of people consider TransMilenio unsafe or very unsafe, especially in southern localities like Ciudad Bolivar and Santa Fe.

Addressing these challenges requires comprehensive strategies, including updated infrastructure, improved safety measures, and a focus on sustainable transportation alternatives. Our proposed projects conduct further research to fully understand the complexities and develop effective solutions for fostering a cleaner, safer, and healthier transportation environment for people in Bogotá.

Framework

Our Approach to Housing & Transportation

Planning for Sustainability, Equity, and Growth

The relationship between transportation access and affordable housing are essential to understanding not only mobility and development across the city, but also how it impacts the city's most vulnerable residents. High-capacity transportation is the lifeblood to Bogotá's population, yet it remains inaccessible to southern and western peripheral areas with the highest population density and poorest communities. While Bogotá is frequently seen as a leader in transportation planning and land use planning, the city has struggled to integrate them into a single, shared cohesive vision. Transportation and housing relationships frame conversations on a wide variety of issues in Bogotá, from sustainability to equity, gender to job access, safety to mobility. Interweaving the conversation and connection between transportation and housing are thus essential to solving these problems and making Bogotá a more equitable place for its most vulnerable residents.

Understanding the spatial distribution and typologies of transportation and affordable housing reveals a gaping equity issue. For poorer residents, women, cyclists & pedestrians experience higher commutes, traffic violence, air pollution because of long commutes from the urban periphery and inadequate infrastructure. This is central to how we frame our goals and proposed interventions.

Within this context of spatial inequities of transportation and affordable housing, we are analyzing how the selected housing sites as sites through which to focus our recommendations. How can mega-developments on the city outskirts like Ciudad Verde or Lagos de Torca better incorporate planning that integrates planning for transportation with high density affordable housing? What opportunities are there around high-capacity transit - existing and planned – to provide new affordable housing?

Sustainability, equity, and safety are shared goals of all of our recommendations

We envision a Bogotá where its most vulnerable residents are able to access transportation, job opportunities, social housing, and community development. Within this planning framework, we have developed the following goals:

- Integrate housing and transportation planning into sustainable and equitable solutions
- Develop housing strategies that provide reliable access to high-capacity transit
- Improve equitable and safety outcomes for the most vulnerable transit users

Interventions

Interventions

A Collection of Interventions for an Equitable, Sustainable & Safe Bogotá

As we have laid out so far, Bogotá is a city with high hopes and a slate of projects it thinks will get it there. These range from the simple but monumental megadevelopments housing millions to the innovative and progressive care blocks which aim to lift the burden of care off of Bogotá's women. One piece that is missing, however, are overarching plans that tie these individual projects in a cohesive and marketable vision. The interventions we propose all center on looking holistically at a topic and addressing multiple problems at once.

There are four components to our plan.

1. Inclusive Futures
2.Transit Oriented Growth
3. Low Emisison Corridor
4. Safety

Each project addresses housing & transportation issues to make Bogotá a more sustainble, equitable, and prosperous place.

Inclusive Futures: A Housing Evaluation Toolkit

Transit Oriented Growth

Low Emission Corridors

Safety

Inclusive Futures

4

Criteria

A comprehensive lens to assess mid to large-scale housing developments.

Issue

- Increasing population
- Housing developments located in periphery of city

Goals

- Influence future policies
- Score current and future formally planned housing developments
- Apply criteria to all interventions to showcase toolkit in action

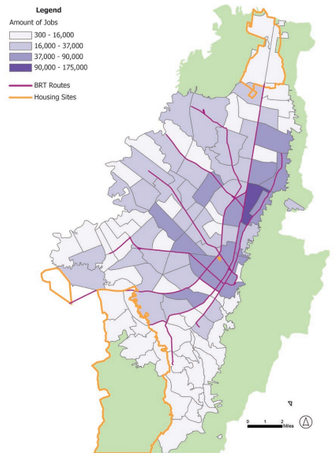
Inclusive Futures:

A Housing Evaluation Toolkit

In embarking on the ambitious endeavor of crafting the "Inclusive Futures", a Housing Evaluation Toolkit, our journey was catalyzed by recognizing the need for a comprehensive lens to assess mid to large-scale housing developments in Bogotá. Inspired by the distinguished BRT Gold Standards toolkit, celebrated for its prowess in transit-oriented development, and the widely embraced LEED rating system, a beacon for sustainable building practices, we aimed to create an evaluation toolkit that meets industry standards, setting a precedent for inclusivity. Our toolkit finds its guiding definition in Oregon Metro's vision — a vision that envisions housing as diverse, quality, physically accessible, affordable housing choices with access to opportunities, services, and amenities.

To holistically apply the toolkit in diverse scenarios, we have identified three key capacities for the toolkit. Firstly, we will employ the toolkit to evaluate the four sites discussed in the context section of this book. Beyond site evaluation, the toolkit's potential extends to influencing future housing and transportation policy and development. We hope that governments leverage this evaluation toolkit, offering incentives to developers for its widespread use. Lastly, the toolkit will serve as a practical tool for our classmates, enabling them to evaluate their interventions and demonstrating how this evaluation can inform future developments.

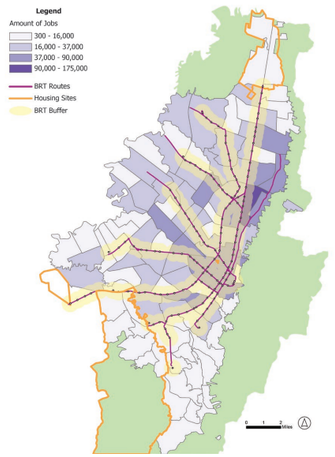
We will now present an overview of the four evaluation criteria. Beginning with transit equity, we explore the intersection of high-capacity transit and affordable housing, considering the proximity to job hubs, particularly relevant given the peripheral locations of the sites that were discussed in the previous sections. Subsequently, we delve into the relationship between job and transit equity. The third criterion, social services focuses on the CARE system, which will be discussed in more detail. Lastly, we introduce a community aspect to the evaluation, recognizing the inherent challenges in directly measuring this criterion. For the evaluation, we adopt a pragmatic approach, using the Social Services criterion as a proxy. This collective framework positions the "Inclusive Futures" Housing Evaluation Toolkit as a comprehensive guide and catalyst for transformative change in the landscape of urban development.



Employment

TRANSIT EQUITY

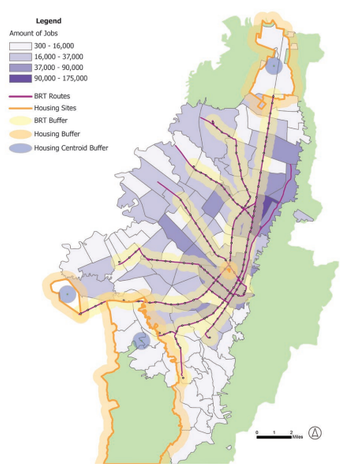
JOBS



Transportation

TRANSIT EQUITY

JOBS



Accessibility

TRANSIT EQUITY

JOBS

Transit Equity

In framing our analytical approach for these two criteria, we examined transportation and jobs in tandem. This strategic pairing is driven by a fundamental query that unfolds through our data analysis: How can we effectively connect people to jobs, and conversely, how can we strategically position jobs within reach of the people?

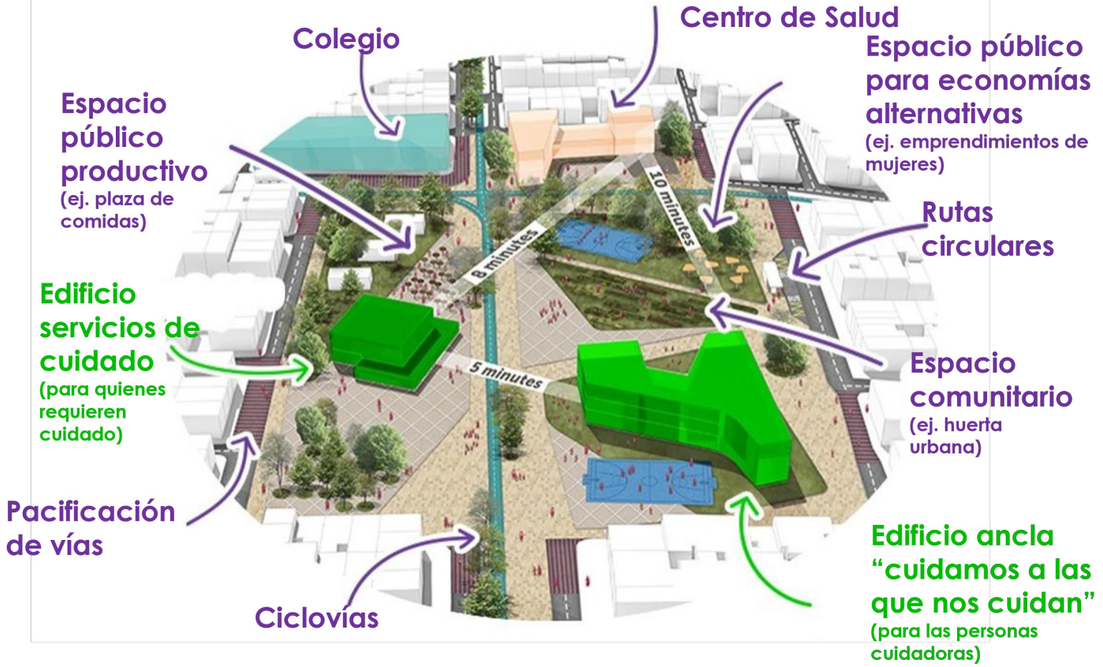
Commencing with the employment aspect, there are a concentration of jobs within the city center of Bogotá. This spatial reality unveils a critical consideration: when housing is situated on the periphery, residents heavily depend on public transit for commuting to and from these central job hubs. This underscores the challenge of bringing people to jobs.

Looking further into transit, this criterion is measured by residents' access to high-capacity transit within an 800m distance. The first map shows an 800m buffer from all the BRT stations and as you can see – when looking at the sites on the periphery – there is minimal overlap between the buffer and the housing sites, apart from a few small portions on the boundary of the sites.

The next map shows an 800m buffer from the boundary of the sites and the center of the sites. This allows for better visualization and understanding of how few people can easily access high-capacity transit that is essential for their daily lives – for both getting to work and accessing services and amenities located within the city center

Jobs

Conversely, the flip side of this equation is equally imperative: How can housing and employment synchronize, cultivating collaborative ecosystems on the periphery that foster job sectors and opportunities? This strategic alignment seeks to address the dynamic of bringing jobs closer to where people reside, satisfying the crucial "jobs to people" component. The nuanced interplay between housing, employment, and transportation forms a pivotal aspect of our evaluative framework, striving to craft urban environments that seamlessly integrate these elements for the overall benefit of the community.



Social Services

Care work is rarely paid or properly recognized as productive work. The burden of unpaid care also disproportionally affects women. So, to free up women's time, Bogotá developed the CARE System to bring the city and its services to caregivers.

At the center of the CARE system are CARE Blocks. These are areas where caregivers and those they care for can access city services. The CARE System's main innovations are its ease of access and its provision of services for caregivers and care receivers. These services for caregivers are professional and skills training, wellness promotion, and income-generating activities. Services for care receivers include professional care and recreational activities

In what the City of Bogotá depicts as the "ideal CARE block", all the services, including schools or healthcare and recreational facilities, are within a 10-minute walk.

The choice of CARE Blocks as the measurement for the Social Services criterion is rooted in a strategic and impactful approach to address the often-overlooked challenges faced by caregivers, particularly women, in the realm of unpaid care work.

For example, CARE Blocks serve as tangible manifestations of inclusivity and accessibility. Placing these areas near communities, especially in low-income neighborhoods, ensures that caregivers and care receivers can easily access the services they need. This strategic placement is crucial in addressing the barriers that many low-income residents face, such as limited transportation options.

Criteria

For the evaluation, the sites will be given a score of 1-3

For Transit Equity, we're looking for access to high-capacity transit within an 800-meter walking distance and scored each site based on the following:

Transit Equity

Poor (1): Limited or no access to high-capacity transit (800m walk), resulting in inadequate mobility options for residents.
Fair (2): Moderate access to high-capacity transit, but there are notable gaps or challenges that hinder equitable transportation for all community members.
Good (3): Excellent access to high-capacity transit (800m walk), ensuring convenient and inclusive mobility options for residents, promoting transit equity.

For Jobs, proximity to job centers and opportunities or job opportunities created by the development and scored each site based on the following:

Jobs

Poor (1): Limited proximity to job centers and opportunities, resulting in inadequate access to employment for residents.
Fair (2): Moderate proximity to job centers, but there are notable gaps or challenges that hinder equitable access to employment opportunities for all community members.
Good (3): Excellent proximity to job centers and opportunities, ensuring convenient access to diverse employment options for residents, and promoting job equity.

Social services are looking at CARE blocks in or near the development and scored each site based on the following:

Social Services

Poor (1): Limited proximity to CARE blocks in or near the development, impacting the well-being of residents.
Fair (2): Moderate proximity to CARE blocks, but there are notable gaps or challenges in providing essential social services for all community members.
Good (3): Excellent proximity to CARE blocks in or near the development, ensuring residents have convenient access to essential social services.

Community

Social Services will be used as a proxy for Community due to limitations for measurement of this criterion, and consequently, we have assigned the community the same scores as those derived from social services. Although we faced limitations in measuring community, we decided to keep it as a part of the criteria because we realize that it is an integral part of creating and sustaining an equitable mid to large-scale housing development. At that magnitude of residents, ensuring they can organize and make decisions is important.

Score	
1	Poor
2	Fair
3	Good

Criteria	Description
Transit Equity	Evaluate the developments **access to high-capacity transit within an 800-meter walking distance.** High-capacity transit includes services like buses, trains, or other efficient public transportation modes. This criterion focuses on ensuring equitable mobility for all residents, considering proximity and ease of access to public transportation options.
Jobs	This criterion focuses on the **proximity to job centers and opportunities**, ensuring that residents have convenient access to employment options. Consider the diversity and inclusivity of **job opportunities created by the development.**
Social Services	Examine the project's integration of **CARE blocks in or near the development.** This criterion focuses on ensuring that the housing project provides convenient access to CARE blocks which include professional and skills training, wellness promotion, and income-generating activities, contributing to the overall well-being of residents. .
Community	Using Social Services as a proxy due to limitations for measurement of Community criterion.

Ciudad Bolivar

Transit Equity: Fair (2)

Moderate access to high-capacity transit, but there are notable gaps or challenges that hinder equitable transportation for all community members.

Jobs: Poor (1)

Limited proximity to job centers and opportunities, resulting in inadequate access to employment for residents.

Social Services + Community Fair (2)

Moderate proximity to CARE blocks, but there are notable gaps or challenges in providing essential social services for all community members.

Rating

TRANSIT EQUITY	JOBS	SOCIAL SERVICES	COMMUNITY
2	1	2	2

Ciudad Verde

Transit Equity: Fair (2)

Moderate access to high-capacity transit, but there are notable gaps or challenges that hinder equitable transportation for all community members.

Jobs: Fair (2)

Moderate proximity to job centers, but there are notable gaps or challenges that hinder equitable access to employment opportunities for all community members.

Social Services + Community Poor (1)

Limited proximity to CARE blocks in or near the development, impacting the well-being of residents.

Rating

TRANSIT EQUITY	JOBS	SOCIAL SERVICES	COMMUNITY
2	2	1	1

Lagos de Torca

Transit Equity: Good (3)

Excellent access to high-capacity transit (800m walk), ensuring convenient and inclusive mobility options for residents, promoting transit equity.

Jobs: Fair (2)

Moderate proximity to job centers, but there are notable gaps or challenges that hinder equitable access to employment opportunities for all community members.

Social Services + Community: Fair (2)

Moderate proximity to CARE blocks, but there are notable gaps or challenges in providing essential social services for all community members.

Rating

TRANSIT EQUITY	JOBS	SOCIAL SERVICES	COMMUNITY
3	2	2	2

Parque de las Americas

Transit Equity: Good (3)

Excellent access to high-capacity transit (800m walk), ensuring convenient and inclusive mobility options for residents, promoting transit equity.

Jobs: Good (3)

Excellent proximity to job centers and opportunities, ensuring convenient access to diverse employment options for residents, and promoting job equity.

Social Services + Community: Good (3)

Excellent proximity to CARE blocks in or near the development, ensuring residents have convenient access to essential social services, and promoting community well-being.

Rating

TRANSIT EQUITY	JOBS	SOCIAL SERVICES	COMMUNITY
3	3	3	3

Maximizing the Metro

5 million people

Growth in Bogotá's population since the year 2000.

Issue

- Housing an ever-growing Bogotá
- Where people live and where they work are not in balance

Goals

- Create development strategies for each metro station
- Produce social housing without continue to expand Bogotá's extent
- Use central Bogotá's development demand to fund public priorities

Maximizing the Metro:

A Strategy for Transit-Oriented Development

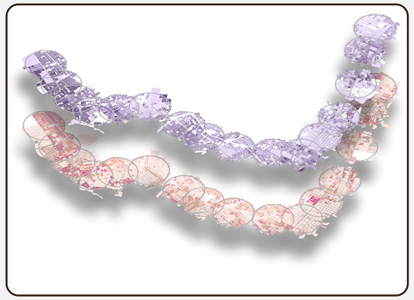
Bogotá is the epicenter of factors which mean that the city faces many obstacles to its population growth in the present and near future. An influx of residents combined with the typical household size shrinking will result in continued demand for more housing units.

While projects we have examined such as Ciudad Verde and Lagos de Torca promise space for hundreds of thousands of people, they are located at the periphery of the city. These communities, while great steps towards meeting demand, do not improve on the inequity of travel times between strata.

One of the largest investments Bogotá will be making to address its overcrowded transportation network is building a metro system. With Line 1 on its way to becoming reality, we determined that it is crucial that the city align its housing plan with this generational investment.

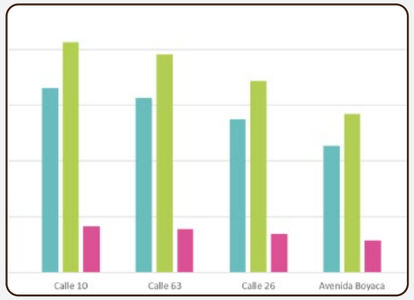
In a city with growth as high as it is, it is clear that almost any land opened up for development near the metro will be in high demand. Therefore, we have created a multi-layered plan for how Bogotá can create synergy between its transportation and housing goals.

Aligning Metro Stations with Development Strategies



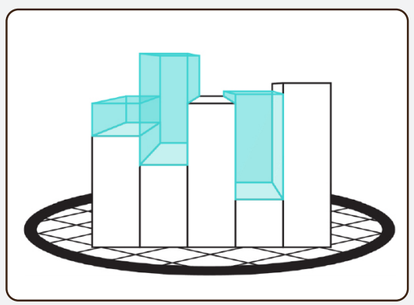
Using the World Bank's 3 V's framework, we analyze each station location to group them by development strategy. These categories allow each station to use its strengths to guide optimal development for the line as a whole.

Leveraging TOD for Funding Affordable Housing



Uncommon in Latin America currently, we propose a tax incremental finance district for the metro. This captures value from central stations to finance more than 8,000 units of affordable housing, making room for more than 20,000 residents in transit-rich areas.

Quantifying Potential Growth at Transportation Hubs



With development strategies and funding in place, we design development scenarios to show how this plan could become reality at four Line 1 stations, with massing for housing, retail, employment, and parks.

16 New Stations

that need to work together for the success of Bogotá.

Issue

- Managing development around metro stations
- Too much housing far from job centers
- Making up for the lack of integration of the city with the TransMilenio

Goals

- Assess the TOD readiness of each future metro station
- Highlight each's strengths and weaknesses
- Recommend locations to capture value to finance housing

Aligning Metro Stations with Development Strategies

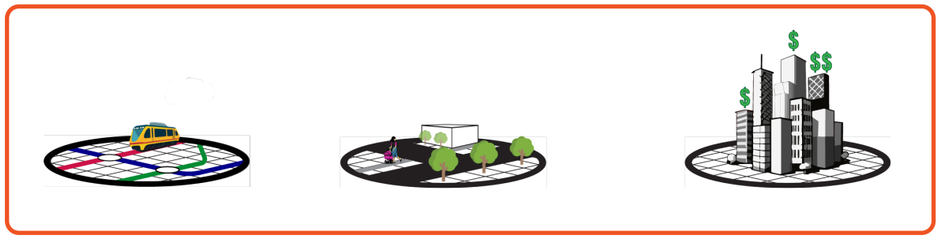
With development spilling over the boundaries of Bogotá, there is clearly demand for new space to build. Metro Line 1 will enable decreases in transportation costs that mean that density can, and should, increase in proximity to its stations.

However, demand is likely present for most types of development near most of the line's stations. Using the 3 V's framework from the World Bank, this section makes a large-scale analysis of each station, looking at their importance to city's transportation network, their local urban design, and their latent development demand.

This analysis will flesh out each station's strengths and weaknesses, and aligns them with ideal development strategies.

Some stations, like those with the most demand from private sector developers, can be hubs of innovative projects where value is captured for the public good. Other stations, like those towards the edge of the city, can be locations for public investment in social housing, helping citizens live closer to their jobs.

What are the 3 V's?



Node Value

The goal of calculating node value is determing the station's value as a transportation link in the city's system.

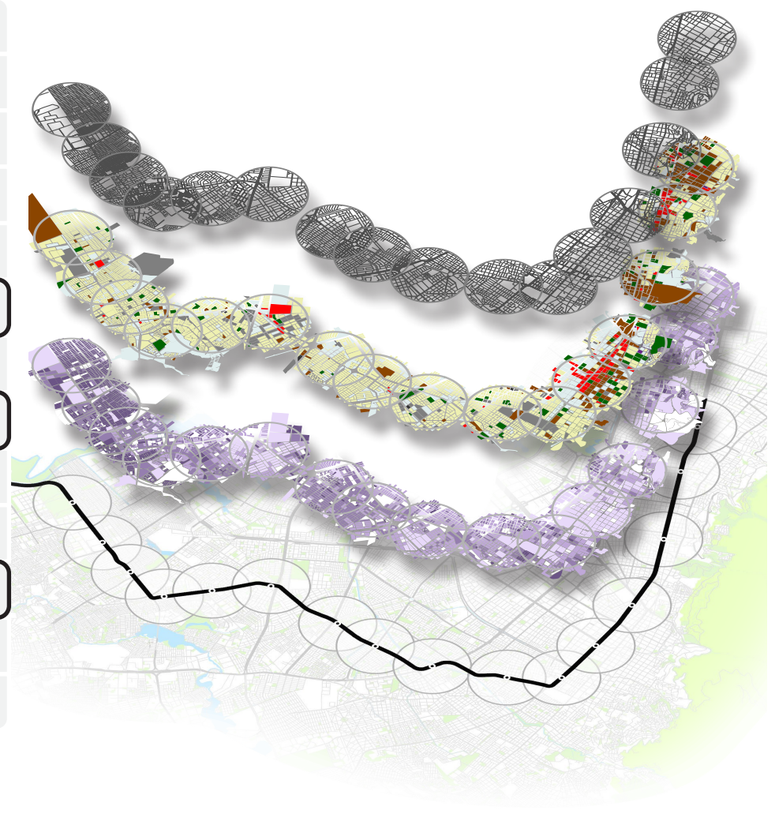
Place Value

Place value attempts to capture the nuances of good urban design through quantitative measures.

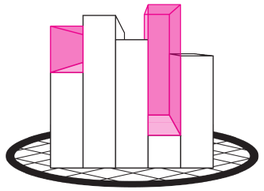
Market Value

By calculating market value, you can tell how likely private development will be interested in a station area.

- Node Value
- Network centrality
- Ridership
- Modal diversity
- Place Value
- **Intersection density**
- Pedestrian accessibility
- **Land use diversity**
- Social infrastructure
- Market Value
- **Residential density**
- Employment density
- Built form density potential



What happens with all of this data?
After each criteria is calculated, they are summed into a single TOD readiness index score. Then each station is separated into three TOD development strategies?

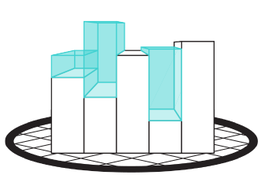


Transformation

True hubs of the transportation system and city as a whole.

These stations are the places for the city to demand innovation because of existing demand from the private sector. The city should also demand high-density, restrictions on private automobiles, and high-quality urban design.

Because of these stations' prime locations, the city must carefully allocate space to continuing its job agglomeration while allowing residential developments to provide short commutes to high-quality jobs. Any development here will also be an opportunity to capture increased values to finance affordable housing elsewhere.



Intensification

Prime balance between existing market demand and having room to develop.

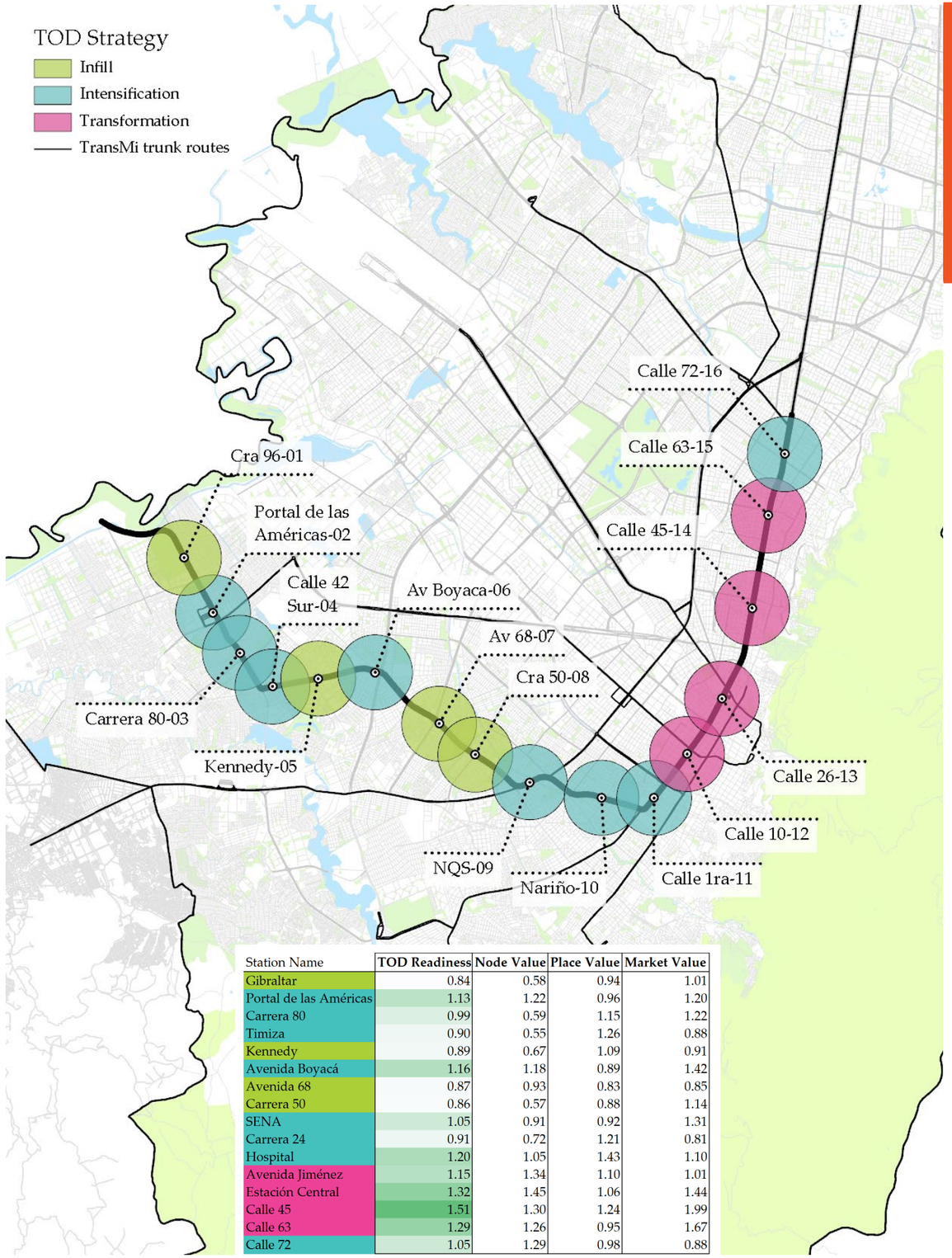
Intensification stations are in areas with private sector interest as well as room for densification. The city should support this private development interest to grow its tax base, encourage increased density near this transportation asset, and take advantage of marginally lower land costs to provide new housing in close proximity to job centers.

Infill

Areas to leverage existing low density and low costs to make large improvements.

This group represents stations at the periphery of the line. They have lower densities and lower land costs. These are great benefits as development here can densify, add new housing in a transit-rich area, and all with lower land costs to make financing affordable housing more efficient.

These stations are closest to the suburban megadevelopments such as Ciudad Verde, and will provide a contrasting development approach to accommodating demand for housing while providing easy commutes to job centers.



Station Name	TOD Readiness	Node Value	Place Value	Market Value
Gibraltar	0.84	0.58	0.94	1.01
Portal de las Américas	1.13	1.22	0.96	1.20
Carrera 80	0.99	0.59	1.15	1.22
Timiza	0.90	0.55	1.26	0.88
Kennedy	0.89	0.67	1.09	0.91
Avenida Boyacá	1.16	1.18	0.89	1.42
Avenida 68	0.87	0.93	0.83	0.85
Carrera 50	0.86	0.57	0.88	1.14
SENA	1.05	0.91	0.92	1.31
Carrera 24	0.91	0.72	1.21	0.81
Hospital	1.20	1.05	1.43	1.10
Avenida Jiménez	1.15	1.34	1.10	1.01
Estación Central	1.32	1.45	1.06	1.44
Calle 45	1.51	1.30	1.24	1.99
Calle 63	1.29	1.26	0.95	1.67
Calle 72	1.05	1.29	0.98	0.88

8 TIF Districts

Eight of the sixteen proposed stations will be used as indiviual TIF Districts.

Issue

- Bogotá's core faces a shortage of social housing amid rapid growth, requiring a coordinated strategy integrating housing plans with the upcoming metro system

Goals

- Identify centrally located stations along the Metro corridor with high pre-existing land value
- Form TIF Districts surounding these stations

Funding Social Housing: Tax Increment Financing Districts

In addressing the critical shortage of social housing in Bogotá's core, an innovative strategy involves leveraging Tax Increment Financing (TIF) to fund the construction of affordable housing along key metro corridors.

The selected areas, including Calle 72, Calle 10, Calle 63, Calle 26, Avenida Boyaca, Kennedy, Calle 45, and Avenida 68, are strategically positioned to benefit from both the expected rise in land values post-metro construction and an anticipated increase in Floor Area Ratio (FAR).

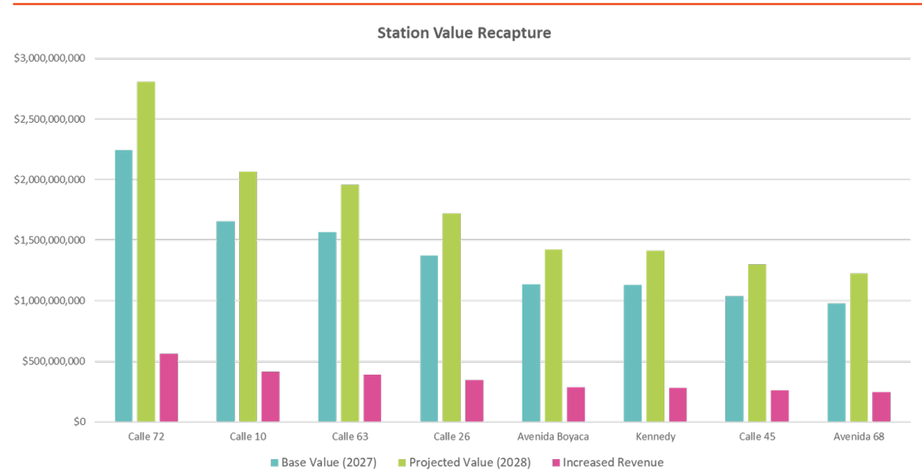
This dual appreciation in property values is pivotal for generating additional revenue through TIF districts, not only for housing initiatives but also for comprehensive infrastructure development in the surrounding areas.
By harnessing the financial gains from heightened land values and FAR, the TIF districts become a mechanism to finance not just housing projects but also the necessary infrastructure.

The synchronized development of both housing and infrastructure ensures a holistic approach to urban growth, fostering inclusive communities and optimizing the benefits derived from Bogotá's upcoming metro system. This innovative funding model aligns economic incentives with social development, creating a blueprint for a more resilient and equitable urban landscape in the face of the city's dynamic growth challenges.

Proposed TIF Districts

Prospoed TIF Districts

Station	Station Classification	Station Value	Location
Calle 72	Intensification	2,244,606,280	North Bogota
Calle 10	Transformation	1,652,831,037	Downtown
Calle 63	Transformation	1,564,541,428	Downtown
Calle 26	Transformation	1,375,206,468	Downtown
Avenida Boyaca	Intensification	1,136,808,718	West Bogota
Kennedy	Infill	1,129,923,453	West Bogota
Calle 45	Transformation	1,038,909,250	Downtown
Avenida 68	Infill	978,068,616	West Bogota



Illustrated in the accompanying graph are three crucial metrics: the base value of the stations, the projected value with an anticipated 25% increase in land value, and the resultant increased tax revenue between 2027 and 2028. The base value represents the initial station land value within an 800 meter radius of the selected metro stations, providing a benchmark for evaluating subsequent changes. Projected values reflect the expected surge in land values driven by the construction and operation of the metro system and increased FAR, a pivotal factor in the TIF mechanism. The graph depicts the increased revenue resulting from the rising land values during the one-year period from 2027 to 2028. This increased revenue serves as the financial backbone for the TIF districts, specifically to fund social housing initiatives and complementary infrastructure projects.

Where and How to Develop Social Housing

Around the Metro Stations

Issue

- Long Commute Time
- Unequal Spatial Distribution of Housing and Employment Resources
- Limited Access to Transportation

Goals

- Promote Affordable Housing
- Reduce Commuting Time
- Enhances Metro Ridership and Elevates Property Values
- Boosts Employment Opportunities

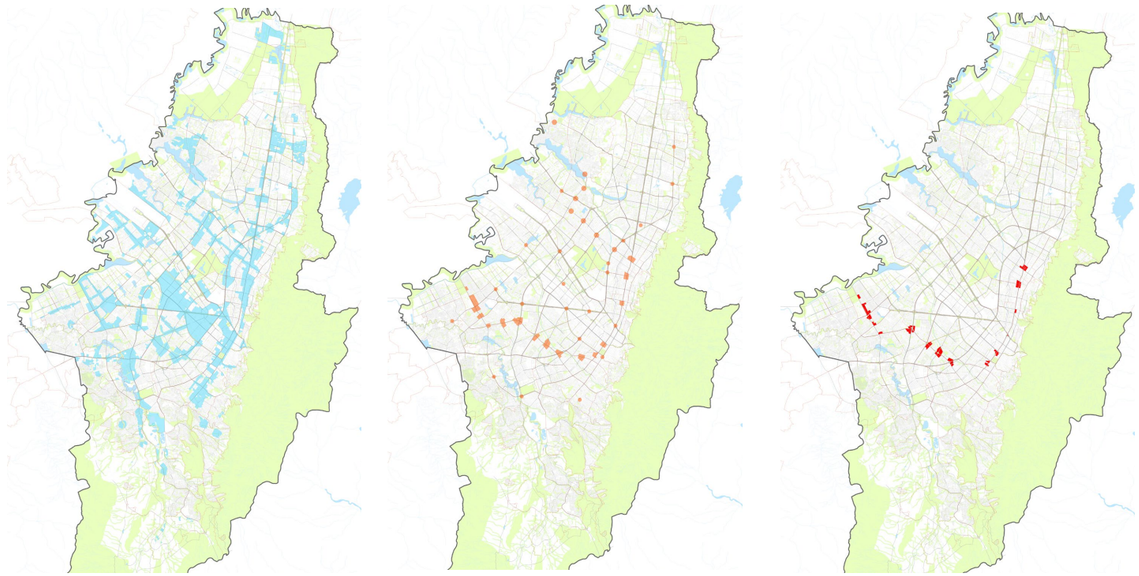
Housing Along the Metro

Following a comprehensive assessment of metro stations and a thorough financial analysis, our focus now shifts towards the strategic development of social housing in proximity to these key metro stations. The overarching objective of this phase is to formulate a comprehensive massing reference for our project areas, coupled with an estimation of revenue generated based on the massing to fund the development of social housing units around the metro stations.

This integration project of housing and transportation development not only addresses the critical need for social housing but also significantly reduces commute times by densifying the surrounding areas, thereby contributing to a more efficient urban transportation system. Moreover, this initiative creates a ripple effect, boosting employment opportunities and elevating property values through increased metro ridership. This approach is a deliberate effort to alleviate the observed uneven distribution of transportation, housing, employment, and public resources, ultimately striving to shape a more inclusive, equitable, and resilient urban environment.

Defining Project Areas

In identifying the project areas around the stations, we applied two criteria specified by the Bogotá planning department: the urban renewal area and the multimodal integration area. Through a cross-filtering process of these criteria, we pinpointed potential project areas that strategically capitalize on the benefits of both urban renewal and multimodal integration.



Urban Renewal Area

- Seeking the transformation of developed areas of the city;
- Possessing underused existing physical structures;
- Providing opportunities to densifying urban areas and other activities.

Multimodal Intergration Area

- Promoting Transit Oriented Developments;
- Improving bike and pedestrian mobility;
- Contributing to the consolidation of the care blocks and social services.

Potential Project Area

- Potential project areas that leverage the advantages of both urban renewal and multimodal integration.

Defining Project Areas

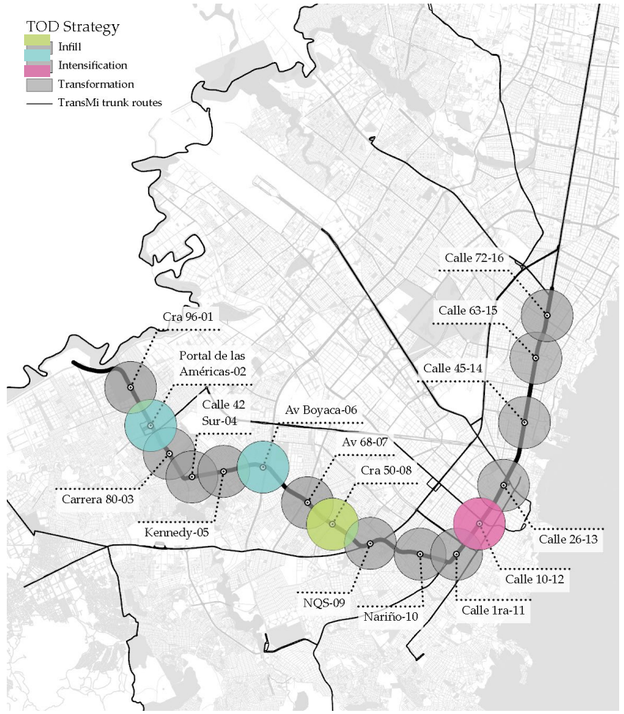
Expanding on the size of the potential areas calculated and taking into account the three station typologies identified in the metro evaluation project, we opted to designate specific sites for each station category to provide reference.

Calle 10 has been selected for transformation stations, which represent the true hubs of the transportation system and city as a whole.

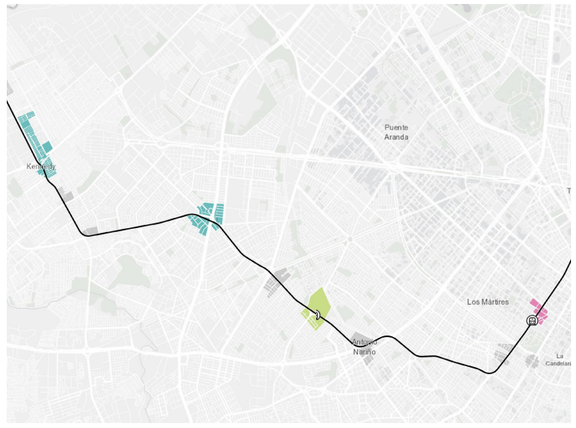
For infill stations which emphasize leveraging existing low density and low costs to make large improvements, Carrera 50 is chosen.

For intensification stations, which emphasize balance between existing market demand and having room to develop, we have identified two distinct sites: Portal de las Americas as a housing-centric location and Avenida Boyca as an employment-focused site.

Station Name	Total Lots	Potential Project Area	Station Type
Carrera 96	485	36,216	Infill Station
Portal de las Américas	2045	217,682	Intensification Station
Carrera 80	446	40,848	Intensification Station
Calle 42 Sur	224	38,424	Intensification Station
Kennedy	0	0	Infill Station
Avenida Boyacá	643	167,211	Intensification Station
Avenida 68	580	107,459	Infill Station
Carrera 50	986	209,045	Infill Station
NQS	442	121,933	Intensification Station
Nariño	0	0	Intensification Station
Calle 1ra	295	58,837	Intensification Station
Calle 10	219	63,630	Transformation Station
Calle 26	5	2,885	Transformation Station
Calle 45	48	23,817	Transformation Station
Calle 63	428	118,085	Transformation Station
Calle 72	282	110,892	Intensification Station



Map Station Typologies



Project Areas

Portal de las Américas

Intensification Station

Avenida Boyaca

Intensification Station

Carrera 50

Infill Station

Calle 10

Transformation Station

Here are the final chosen project areas and their locations along the metro line.

These four sites represent our chosen project areas which we will provide massing and revenue estimation for, and which can serve as a reference/case study for other areas under each of their station typology.

Massing Prerequisite

The critical elements for the success of this project lies in these three key components. These elements are more than operational tools; they constitute a strategic framework essential for achieving sustainable, inclusive, and efficient urban transformation.

1

TIF funding for social housing program

The TIF funding program is crucial for this project, channeling a portion of the value from metro development back into social housing. This approach supports sustainable, inclusive densification around key transit areas, ensuring that urban growth benefits the community.

2

Relax FAR allowance and maximum height for TOD development

Relaxing FAR and height restrictions for TOD developments along metro lines is essential. This policy change allows for greater density and efficient use of urban space, paving the way for more effective TOD projects that align with the goals of a compact, connected urban environment.

3

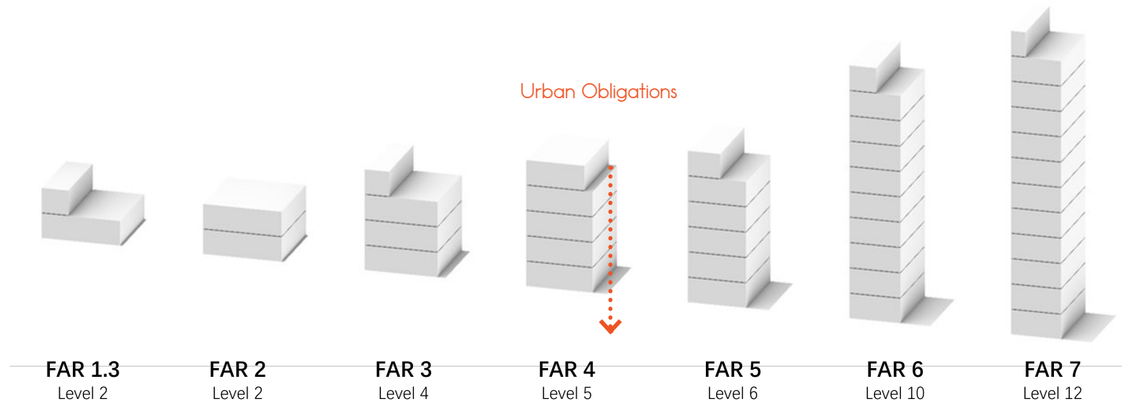
Twenty-year project implementation period

The project's twenty-year implementation period reflects its nature as a gradual, continuous transformation. This timeframe allows for detailed planning and execution, ensuring that each phase contributes effectively to the overall vision and sustainable urban development.

In identifying the project areas around the stations, we applied two criteria specified by the Bogotá planning department: the urban renewal area and the multimodal integration area. Through a cross-filtering process of these criteria, we pinpointed potential project areas that strategically capitalize on the benefits of both urban renewal and multimodal integration.

Construction Index	Public Transportation	Public Facilities	Obligation Percentage	Buildable Percentage
ICe ⩽ 1,3	0	0.03	0.03	**0.97**
1.3 < **ICe** ⩽ 2	0	0.03	0.03	**0.97**
2 < **ICe** ⩽ 3	0.07	0.03	0.10	**0.90**
3 < **ICe** ⩽ 4	0.15	0.03	0.18	**0.82**
4 < **ICe** ⩽ 5	0.25	0.03	0.28	**0.72**
5 < **ICe** ⩽ 6	0.34	0.03	0.37	**0.63**
6 < **ICe** ⩽ 7	0.35	0.03	0.38	**0.62**

FAR based Urban Planning Obligations



Urban Planning Obligations for Different FAR

Urban Planning Terminology

Construction Index: Floor Area Ratio (ICe), the effective floor area to lot area ratio

Urban Planning Obligations: A mechanism that aims to generate the balance between the benefits of the developments and the needs of urban supports represented in land or its equivalence in built area or in compensatory payments.

Avenida Boyacá

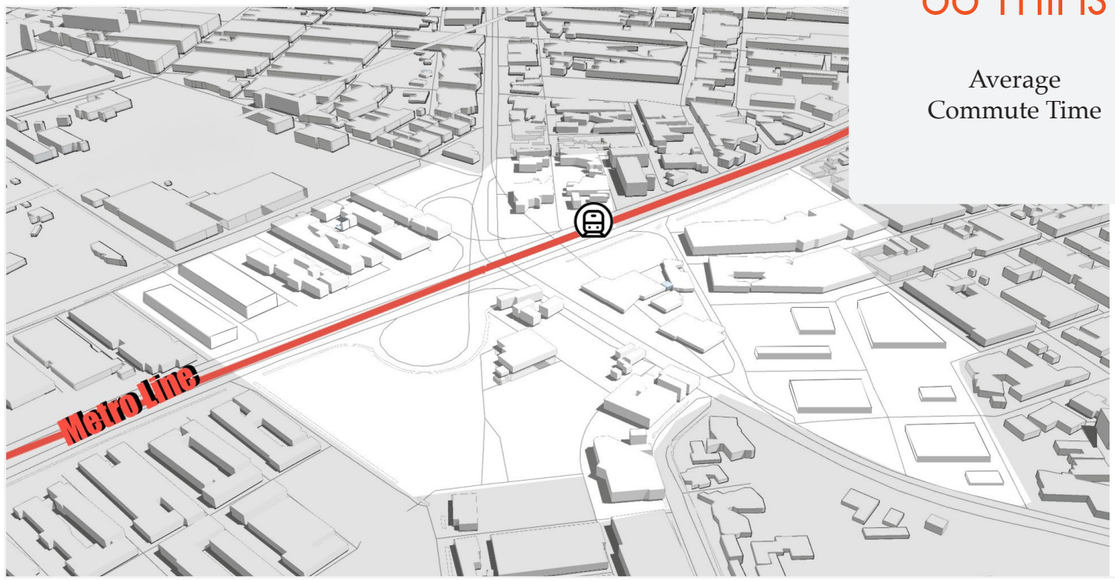
26,613

People living within 800 m near the metro Station

66 mins

Average Commute Time

Existing Condition



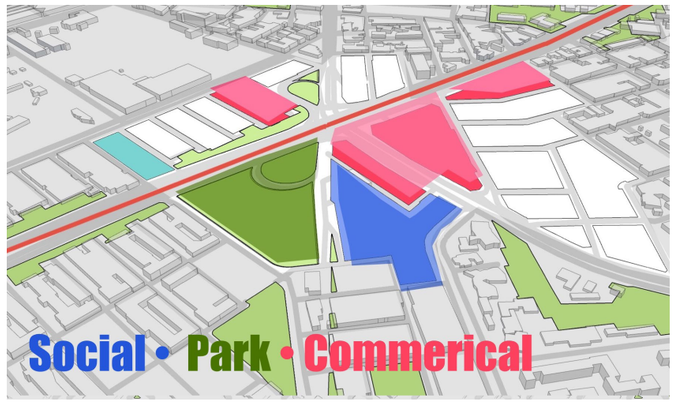
Portal de las Américas presents an opportunity for urban densification and improved transit connectivity, shorter commute time and lower congestion in the city's southwest periphery.

Avenida Boyacá is one of the proposed metro station located towards the Southwest of Bogotá. Situated in the center of the locality Kennedy, it has low to moderate population density around the station (refer to population density map).

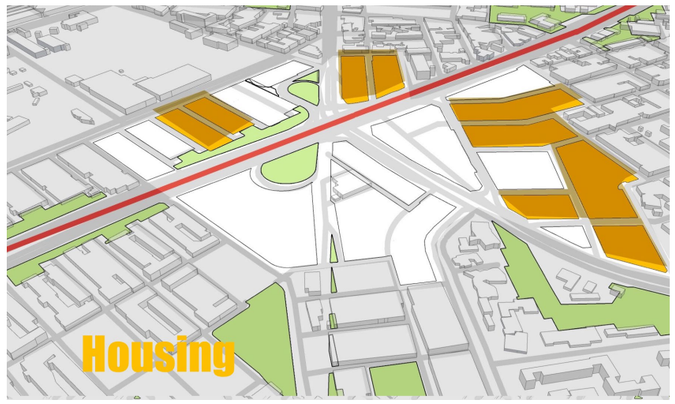
Central to the concept of the UPL (Local Planning Unit), Avenida Boyacá plays a pivotal role in the city's 30-minute city initiative, , where essential services are accessible within a short travel time. This initiative is crucial in fostering a more connected and efficient urban environment.

This area is planned for a 'care block', a dedicated zone that will provide essential services to the population in need. This aspect of the plan underscores a commitment to social welfare and accessibility to vital services.

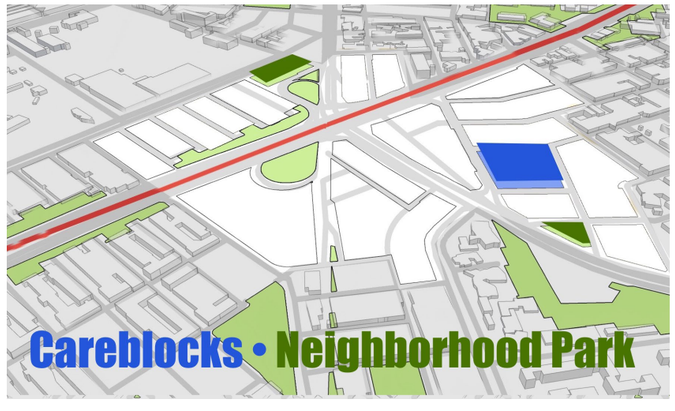
The existing amusement park and shopping center near project area serve as a solid foundation for further growth and development. These amenities provide a groundwork upon which future expansions and improvements can be built, ensuring the avenue's continued relevance and vibrancy in the urban landscape of Bogotá.



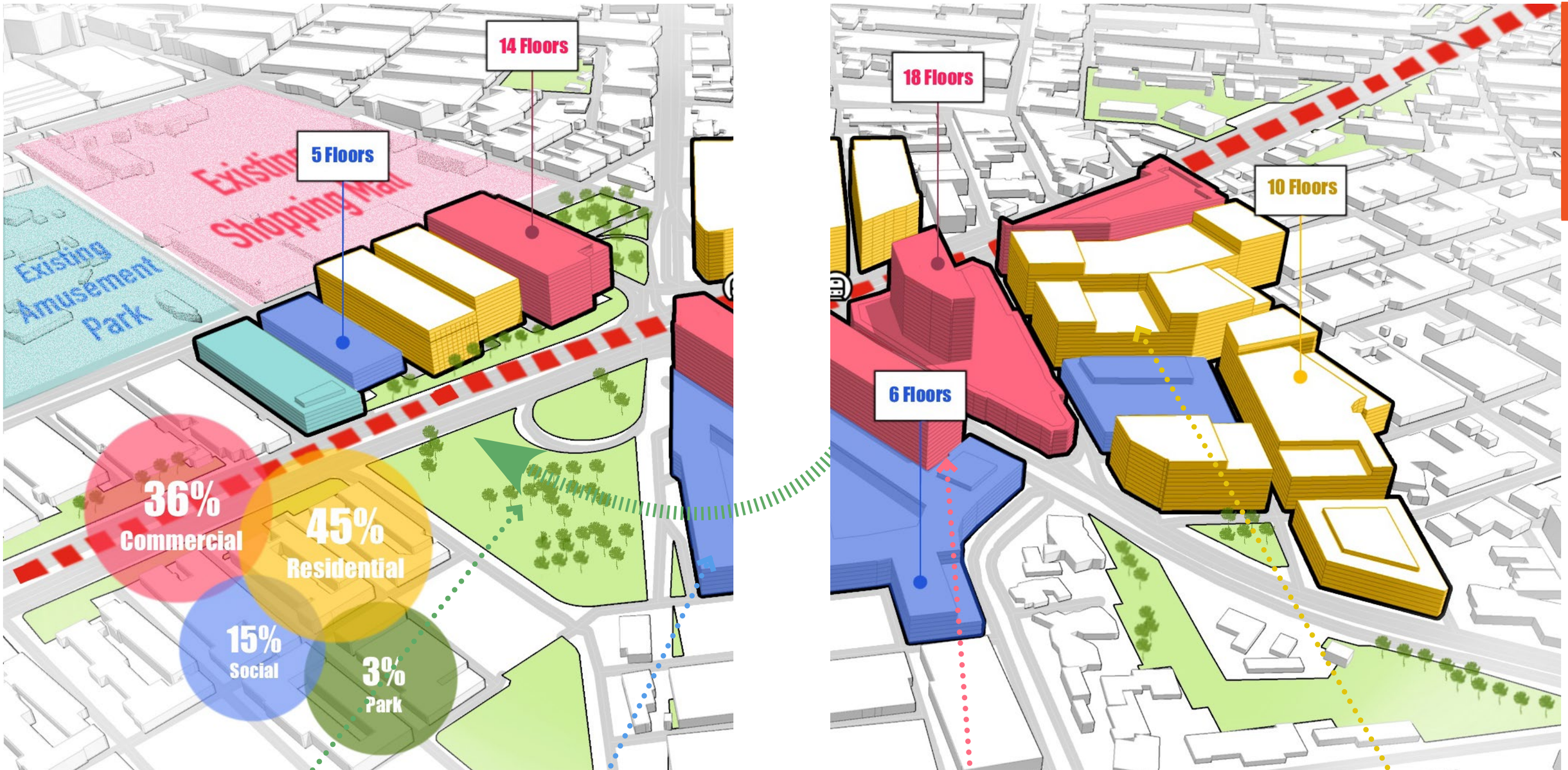
A key aspect of the proposal is transforming the area into a dynamic, multifaceted urban space, replete with a variety of attractions and amenities that elevate it beyond a transit station to a major local destination. The design incorporates a mix of shopping, leisure, and public spaces, aiming to foster economic growth and vibrant community interactions while creating ample job opportunities for local residents.



Design around the metro station incorporates moderate to high-density housing, thoughtfully blending social and commercial housing to foster a sense of cohesion. This approach is geared towards crafting an inclusive urban landscape that not only supports diverse social interactions but also nurtures a strong sense of community belonging.



Plan includes providing care services for local residents, including caretakers, children, and the elderly, aiming to enrich the community's well-being. Complementing this, the design proposes neighborhood parks that not only enhance the area's aesthetics but also serve as peaceful buffers between busy traffic and residential spaces, thereby ensuring tranquility and improving the quality of life for local residents.



Massing of Potential Build-out

The central strip provides a strong core consists of public space, social services such as school, clinics, library, civic facilities, office and commercial buildings.

The remaining 15% is dedicated to social and public areas, which will be providing services to not just residents living around the station, but also within the UPL

Commercial spaces are a key component, constituting 36% of the area. These commercial zones are designed to stimulate economic growth and provide ample employment opportunities.

Our plan introduces over 6,600 new housing units. This growth reflects our commitment to meeting the housing needs of our growing population, while building a vibrant, diverse local destination center.

Portal de las Américas

85,499

People living within 800 m near the metro Station

71 mins

Average Commute Time

Existing Condition

Portal de las Américas presents an opportunity for urban densification and improved transit connectivity, shorter commute time and lower congestion in the city's southwest periphery.

Portal de las Américas, a proposed metro station located on Bogotá's periphery, boasts a substantial area of developable land, presenting unique opportunities for urban densification.

This site's strategic position near both a TransMilenio portal and the penultimate station of the metro line positions it as a key node in the city's public transportation network, ensuring excellent transit access. Furthermore, the presence of numerous feeder buses, extending services to the city's outskirts, makes this location particularly suitable for residents commuting from outside Bogotá. This thoughtful integration of transportation options is poised to significantly ease commute times and alleviate congestion in the southwest periphery of Bogotá, enhancing the overall livability and accessibility of the area.

Portal de las Américas (Source: El Nuevo Siglo)

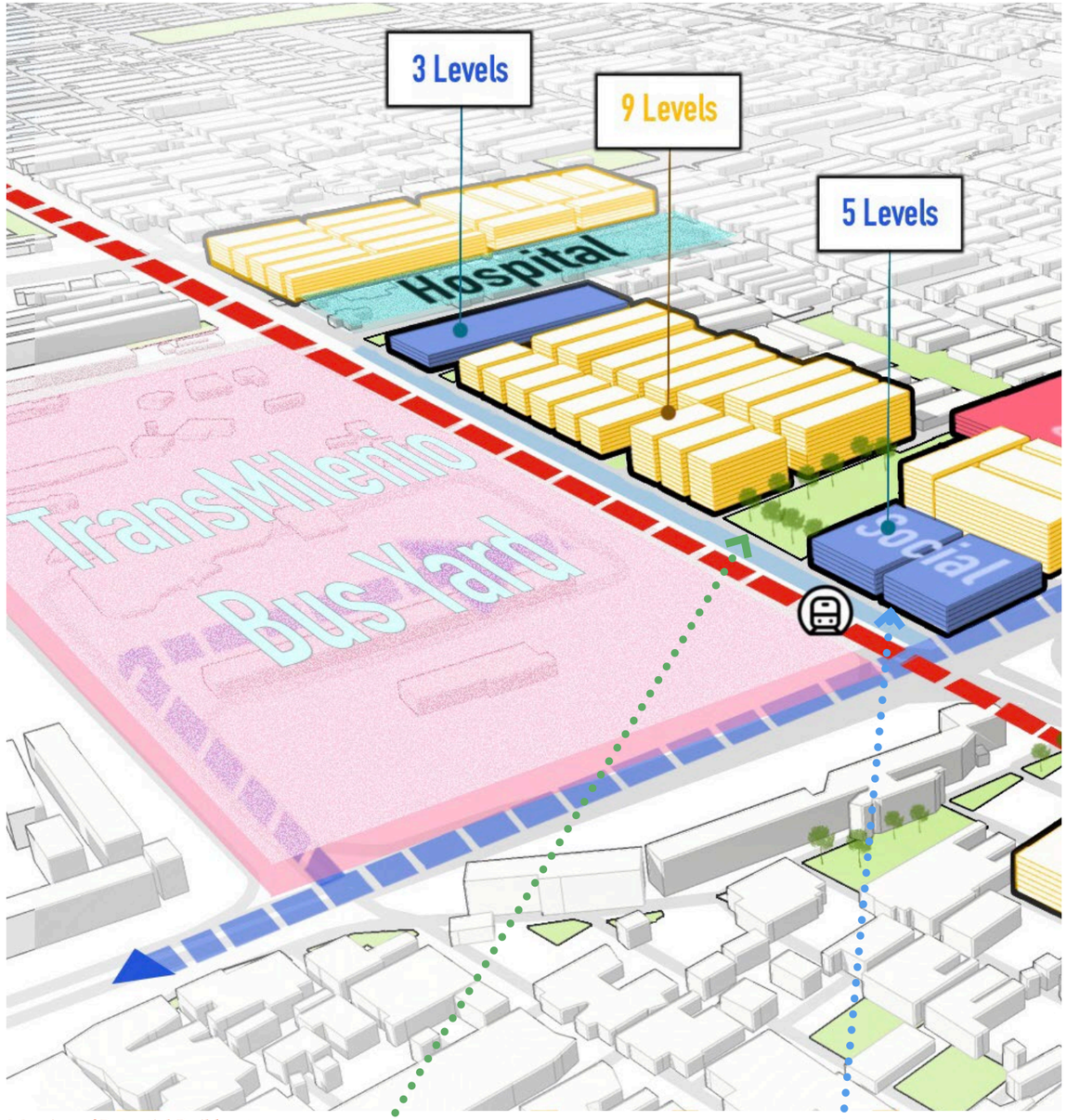
Typical Street (Source: Google Street View)

Centro Comercial Milenio Plaza (Source: Ospinas)

Portal de las Américas Station, is a vital TransMilenio portal station, enhancing the city's public transport network. It not only connects southwest part of the city but also serves as a key access point for commuters from outside Bogotá, with feeder buses bringing them here to use the BRT for city center access. This setup significantly boosts urban mobility and is a key infrastructure of Bogotá's commuters.

The housing typology in the vicinity is characterized by low-rise residentials, typically spanning up to four floors. The area is also known for its tendency towards informal growth This pattern of development reflects both the city's housing shortage and the economic realities of the region, contributing to a unique urban fabric that blends planned structures with more spontaneous, grassroots forms of habitation.

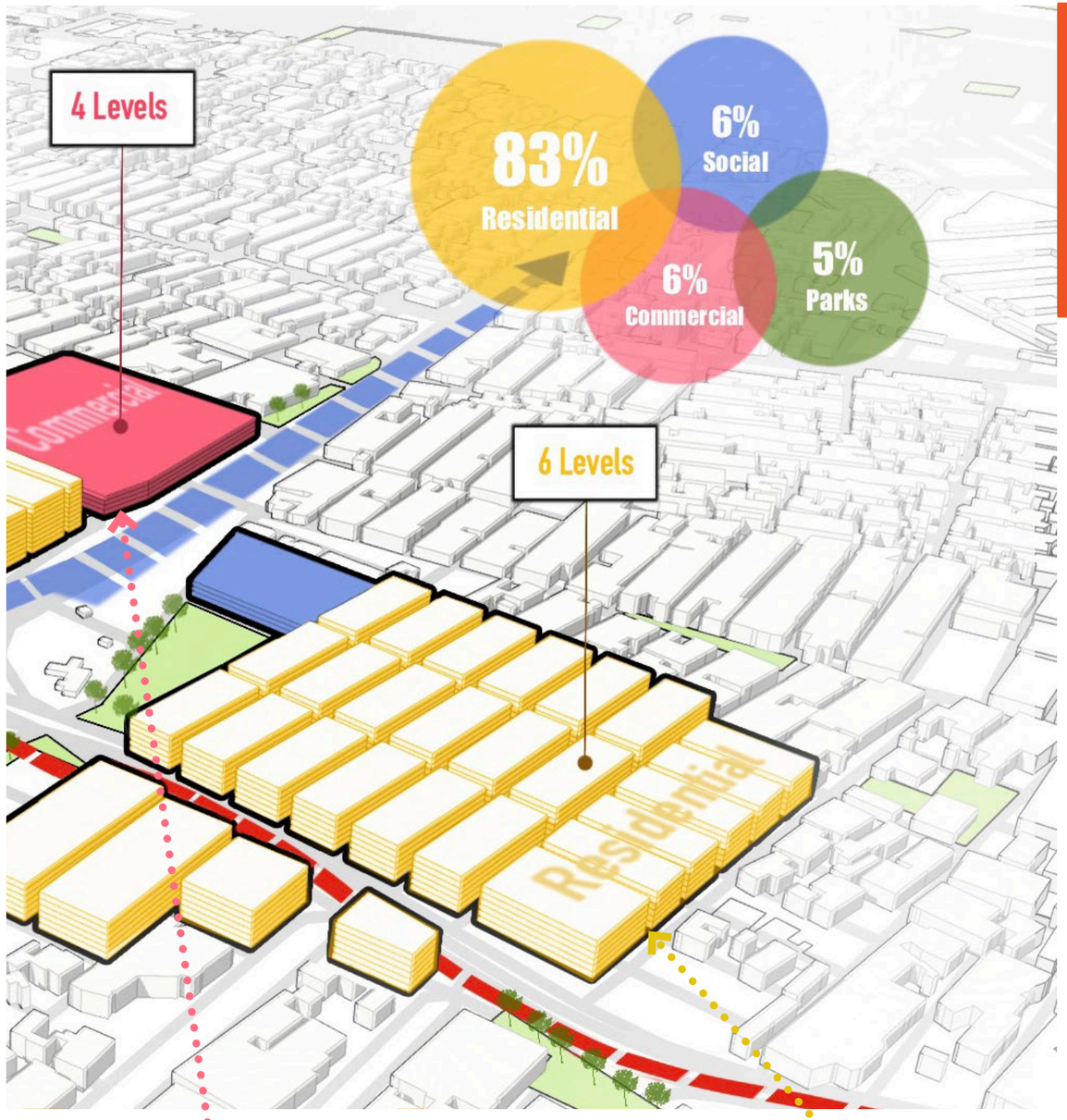
Centro Comercial Milenio Plaza, a low-rise shopping mall near Portal de las Américas, benefits from its proximity to the BRT portal, attracting customers from both local and broader regions. With the upcoming metro completion and increasing population density, there is a clear potential to boost the commercial density around the metro station area.



Massing of Potential Build-out

Key neighborhood green spaces are placed through out the project and connected to the waterways. This aims to create an immersion of nature into daily living.

The social spaces, including schools, clinics, and sports facilities, are strategically situated adjacent to the proposed metro station, ensuring easy mobility and accessibility for the community. All social areas are conveniently located near residential zones and parks, supporting a seamless integration of living, leisure, and community services.



Commercial spaces are crucial towards the success of the project, the increase in density of the existing commericial plaze is in anticipation of the increased housing density and other activities

The core is the creation of around 8,200 new housing units, which makes up a substantial 83%,of total building floor area. This prioritization reflects our commitment to address the urban sprawl of Bogotá to nearby municipalities.

Carrera 50

46,462

People living within 800 m near the metro Station

62 mins

Average Commute Time

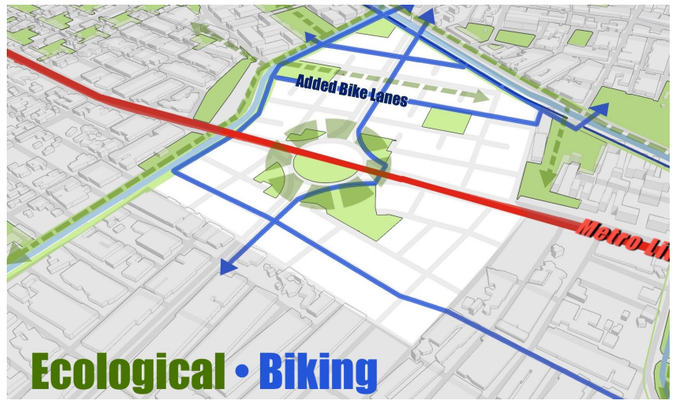
Existing Condition

Carrera 50 presents a unique opportunity for densification and development, poised to enhance employment prospects, reduce commute times, and promote sustainable living.

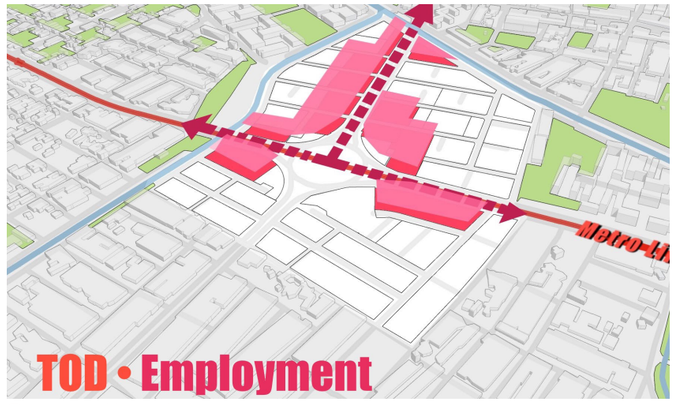
Carrera 50, located close to Bogotá's city center, is an area ripe with potential, particularly in terms of attracting employment opportunities. Its strategic proximity to downtown Bogotá means that it can significantly reduce commuting times for its residents.

Currently, the area is moderately populated, presenting an excellent opportunity for densification, especially near the metro station. Such strategic development is key to enhancing the living experience in Carrera 50, while also meeting the increasing needs of the city's growing population.

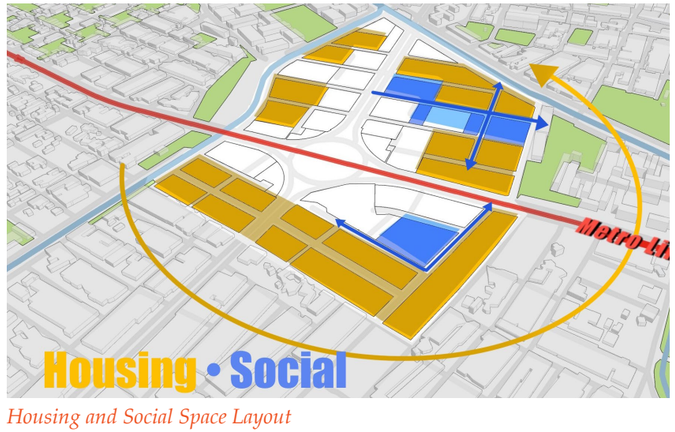
Additionally, the adjacency of Carrera 50 to a major bike corridor is an aspect that is poised to be capitalized upon. This feature opens up avenues to more seamlessly integrate the area into the broader urban infrastructure, while also promoting sustainable transportation methods and contributing to a healthier lifestyle for the residents.



Ecology and Bike Paths Layout



Commerical Layout

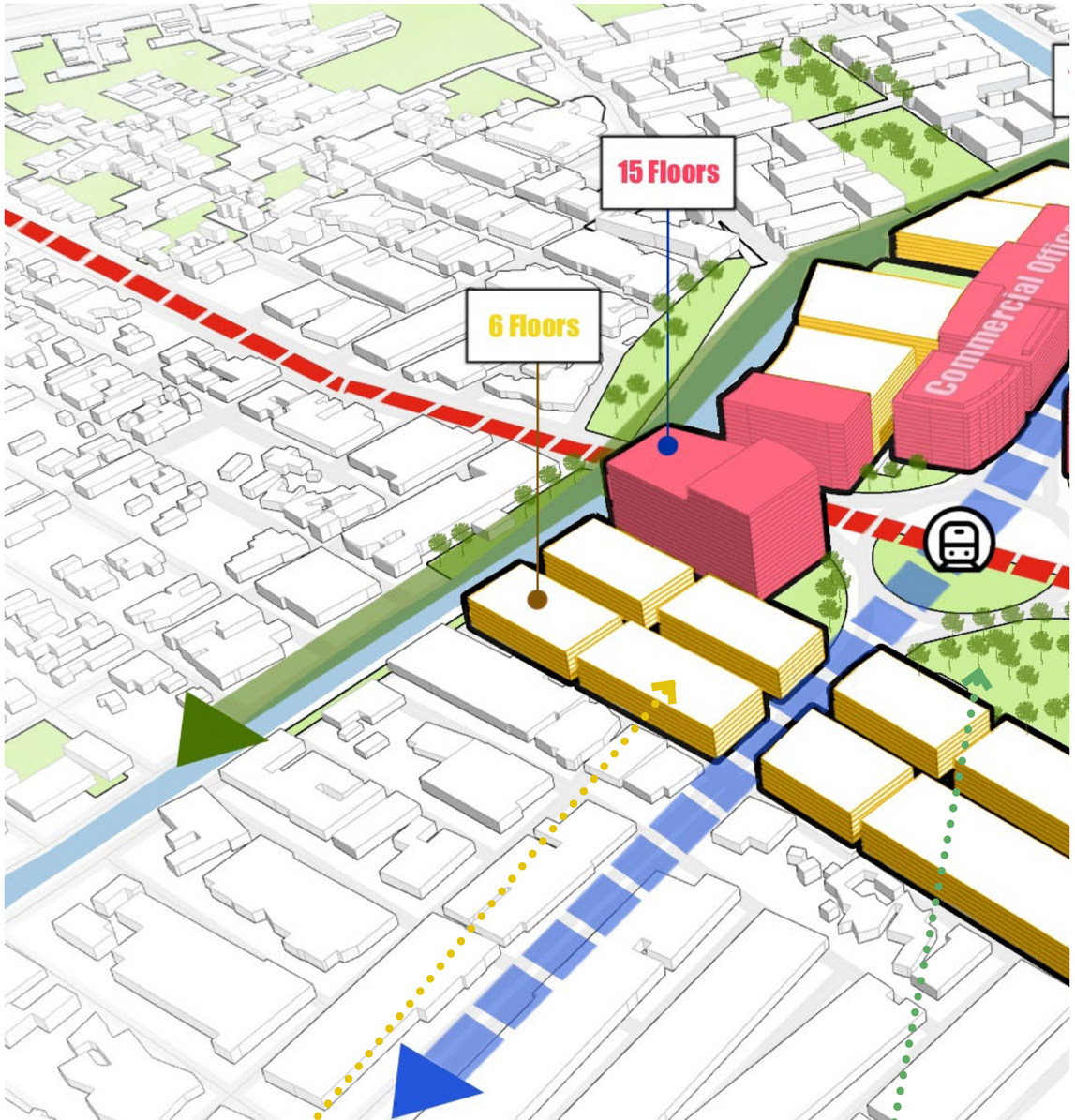


Housing and Social Space Layout

This proposal emphasizes integrating parks and nature, especially alone the waterways. Bike paths are planned to run through these parks and along major corridors, enhancing both local and broader connectivity. Additionally, parks at roundabouts will serve as green buffers, separating residential activities from heavy traffic, underlining our commitment to a sustainable, serene urban living environment.

Another aspect of the proposal focuses on employment and commercial activities along major arterial roads, utilizing theproximity to metro station to stimulate business growth. Density variations are aligned with proximity to intersections, with higher density near the intersection; and lower-density commercial near the convergence of waterways to minimize the affect of built density on nature.

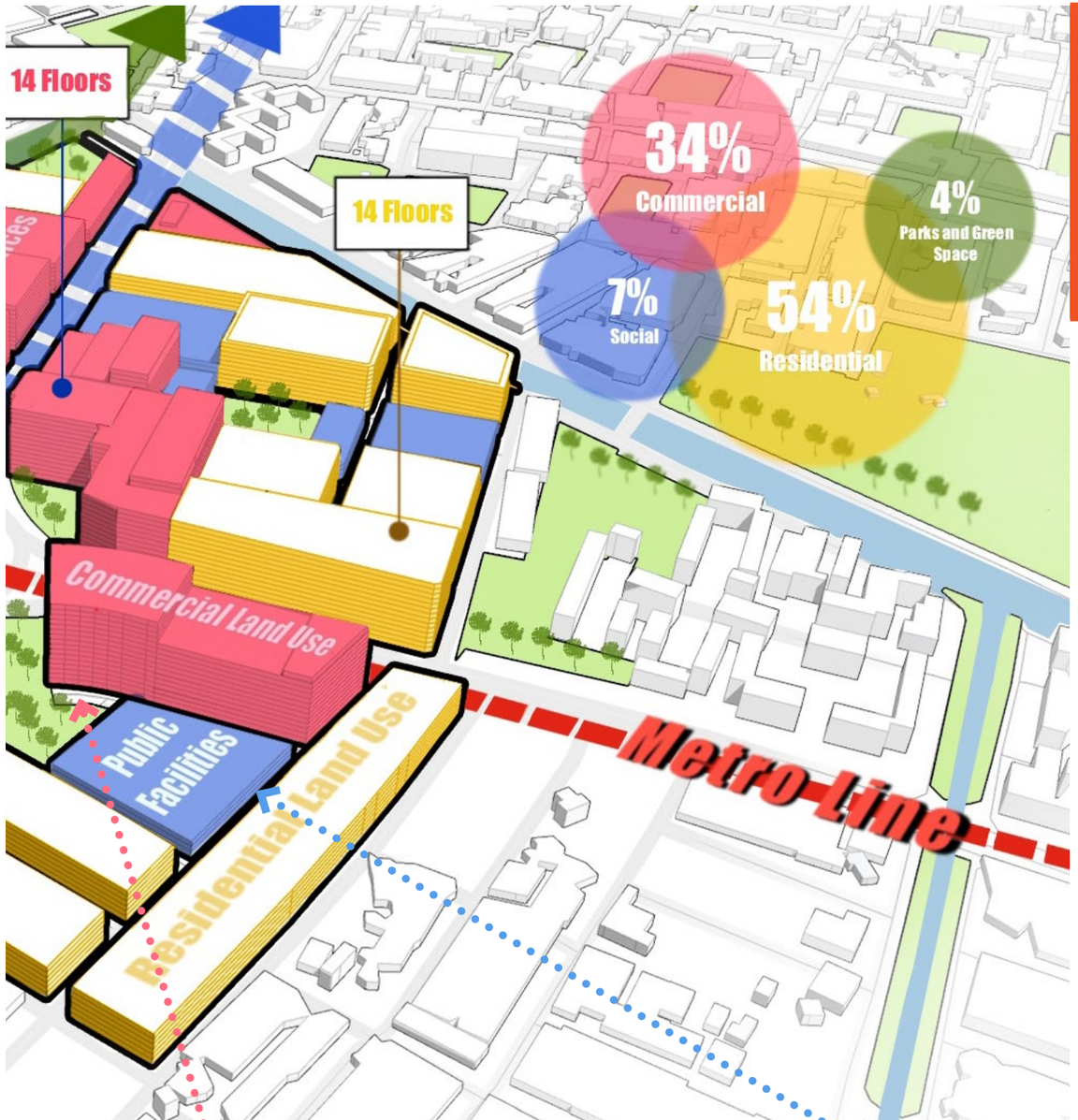
The proposed residential areas are strategically located near social spaces which are locally governed and will become the backbone of neighborhood activities, fostering a sense of community engagement. These areas work closely with parks and bike paths. This aims to create a community, where residential life is connected with accessible social amenities, green spaces, and sustainable transportation options.



Massing of Potential Build-out

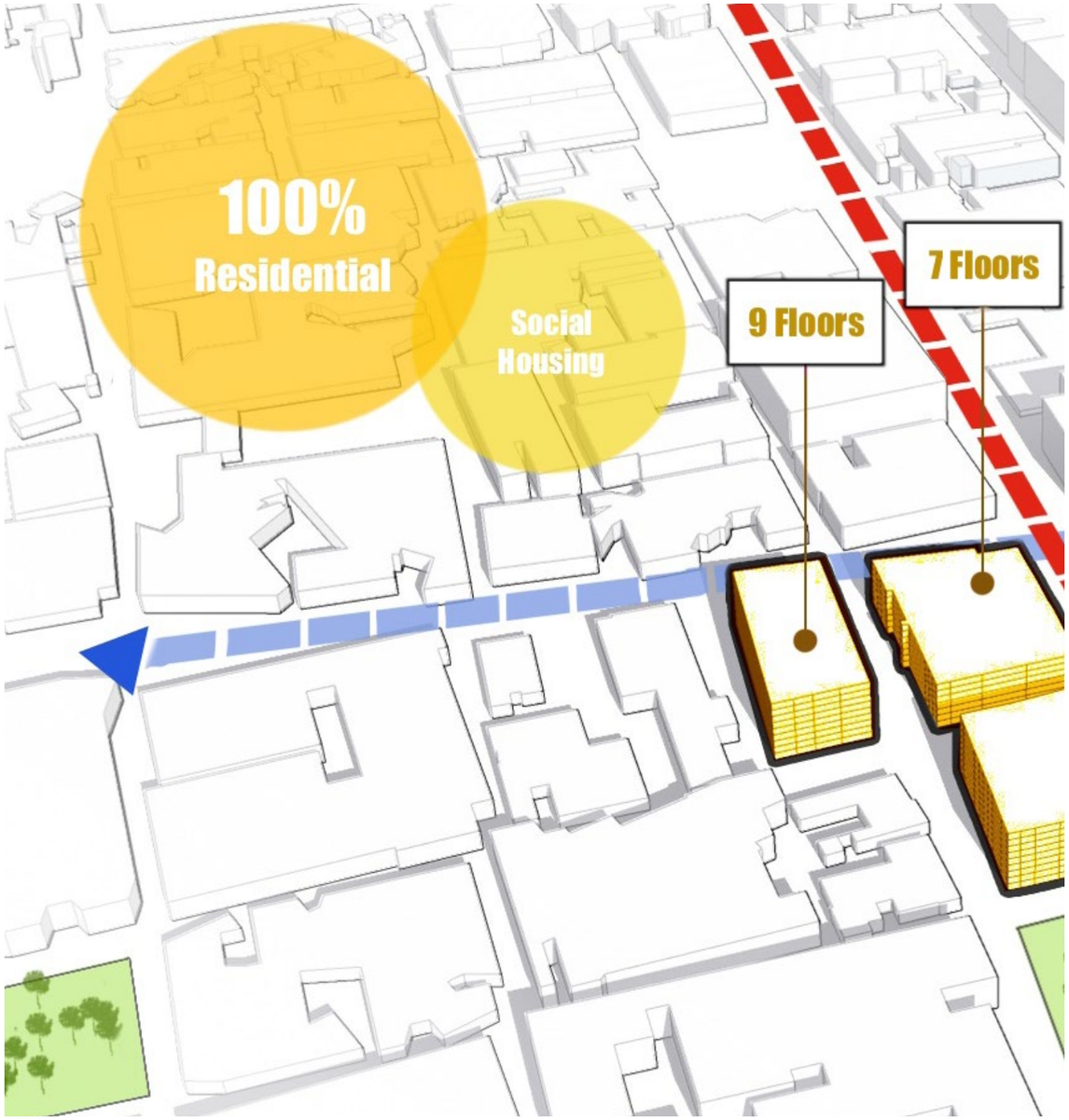
The proposal also includes the introduction of over 6,000 housing units, which is a significant addition and will bring approximately 18,000 new residents to the area. This expansion reflects our commitment to addressing the growing housing demand.

Parks are integrated to the natural setting to encourage ecological preservations. These green spaces also provide important open spaces and public retreats from the high-paced urban living.

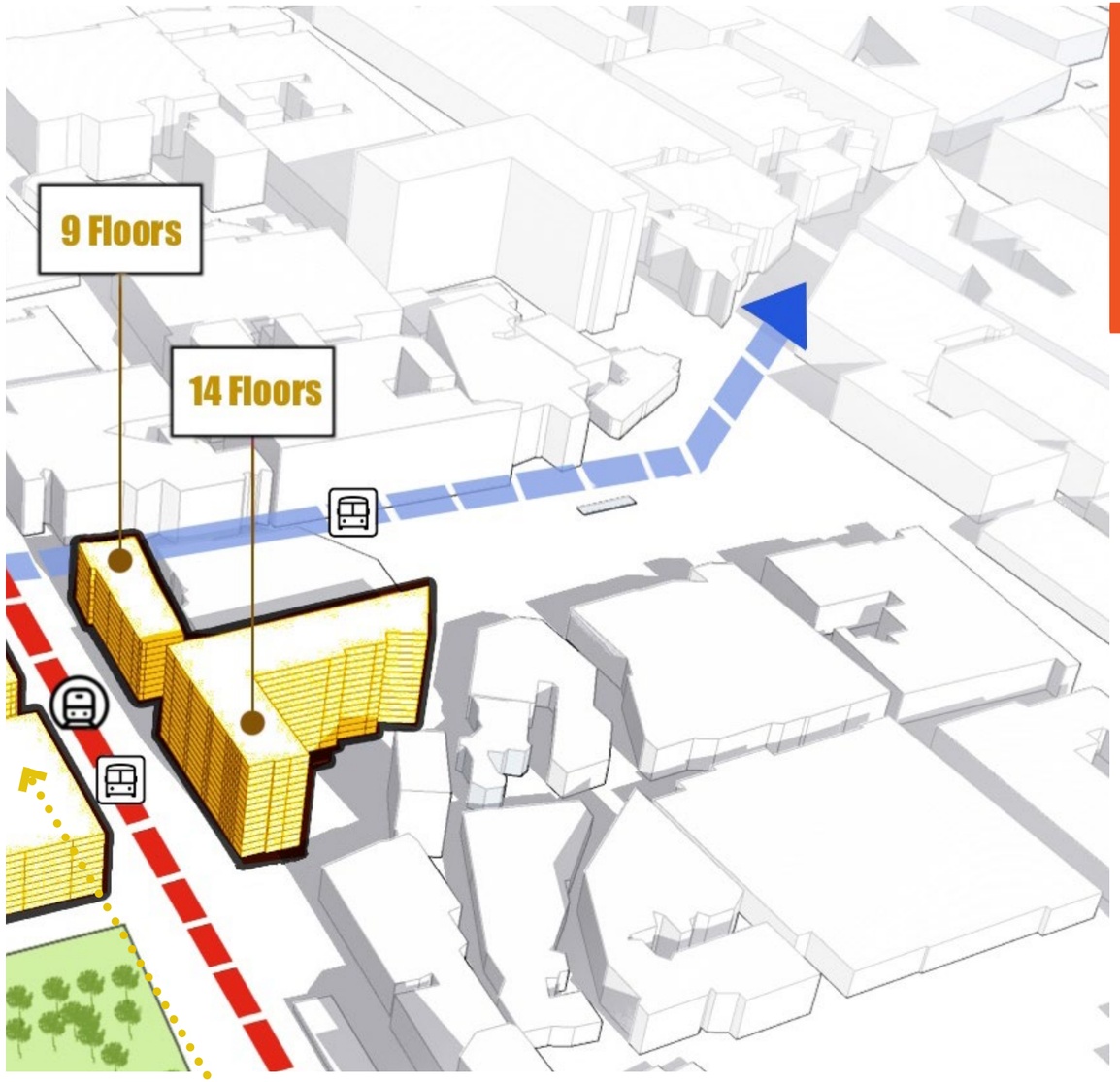


One key aspect in the proposal is the 34% of land dedicated to commercial spaces. This substantial portion underscores our goal to foster economic growth and job creation, ensuring a thriving local business environment and offload employment and traffic burden from city center.

Social spaces provice key public facilities to nearby residents and office employees. They will provide crucial support for future urban densifications.



Massing of Potential Build-out



Suitable lots were determined in this proposal. Presenting here is the introduction of 2,872 social housing units, adding about 8,000 new individuals to the neighborhood. This growth reflects the commitment to meeting the pressing need for affordable housing in the city. The design and allocation of these units are driven by the goal of providing high-quality, accessible living spaces for individuals and families.

Social Housing

The social housing section of the project proposes a focus on two main types of units: two-bedroom and three-bedroom, with an equal distribution between them. This approach is tailored to meet various family requirements, offering both adaptability and comfort. The financial structure of these units is a key aspect of the project's economic strategy. Revenue from Tax Increment Financing (TIF) funding programs introduced earlier is expected to play a crucial role in determining the total number of housing units that can be developed, guiding the project's scale and feasibility.

2 Unit Plan

3 Unit Plan

2-bedroom unit is containing 50 square meters, with a construction cost of $54,287. This unit is designed with versatility in mind, offering the possibility of conversion into a 3-bedroom space to adapt to changing family needs or preferences.

3-bedroom unit, covers 70 square meters and has a construction cost of $81,304. This larger unit is tailored to comfortably accommodate three-generation households, providing ample space for families seeking a more expansive living environment.

Revenue Generated: $333,626,858 / 60% = $556,044,763

	Residential Area	Budget Allocated	Social Housing Units	Social Residents
Portal de las Américas	519,655 m2	$139,195,853	2,053	5,749
Avenida Boyacá	419,976 m2	$112,495,612	1,659	4,646
Carrera 50	409,409 m2	$109,665,150	1,618	4,529
Calle 10	172,301 m2	$194,688,148	2,872	8,041
Total	1,349,041 m2	$556,044,763	8,202	22,965

Taking into account the construction costs of each unit, the project utilizes revenue generated from the Tax Increment Financing (TIF) funding mechanism, which is then allocated across each project area. Through a conservative estimation, this financial approach is anticipated to enable the funding of over 8,200 units of social housing, thereby accommodating over 22,000 residents across the total project area. This strategy underscores the project's commitment to maximizing the impact of available resources to meet the substantial housing needs within the community.

Private Sector Feasibility

TIF generated covered 60% of social housing construction

The inclusion of Tax Increment Financing (TIF) in the proposal, covering 60% of the social housing construction costs, makes it an attractive venture for the private sector. This significant financial backing reduces the burden of investment for private entities, enhancing the project's viability and appeal.

Budget used on land acquisitions, lowering land costs

A considerable portion of the project's budget can also be allocated for this purpose, effectively lowering the overall high land costs, which is currently a outstanding concern for developers. This strategic approach is particularly appealing to private sector investors, as it translates into lower initial investment costs and potentially higher margins of profitability.

Metro-induced land value appreciation

The expected increase in land value due to the development of metro infrastructure is an enticing aspect for private sector involvement. This metro-induced appreciation in land value will translate to long-term profitablity of the project which aligns with the interests of private developers and investors.

Conclusion

Maximizing the Metro

The project presents several key benefits, each contributing significantly to its overall success and feasibility. The station evaluation aspect is pivotal, involving a comprehensive study of the context and setup of each metro station. This deep understanding of the stations is essential for developing effective Transit-Oriented Development (TOD) strategies tailored to each specific location.

Leveraging TOD for Funding Affordable Housing

From the funding aspect, the project designed a TIF (Tax Increment Financing) mechanism, assessing the potential for development based on the incremental value of land post-metro completion. This approach provides a well-structured financial plan, crucial for both financing the project and understanding the funding sources for public housing. It ensures a transparent and viable process in the development.

Housing Along the Metro

The TOD developments component synthesizes insights from the initial stages, focusing on the practical aspects of place-making and design. This phase aims to actualize the vision, demonstrating the project's potential in terms of housing unit numbers, buildout massing, and total resident capacity. By addressing these factors, the project integrates housing and transportation development to alleviate the uneven and inequitable distribution of transportation, housing, employment and public resources.

Key Benefits

- Promotes affordable housing by integrating residential developments with transportation infrastructure, enhancing accessibility.
- Significantly reduces commuting times by strategically locating housing near transit hubs, streamlining daily travel.
- Boosts employment opportunities through the creation of new commercial and residential spaces around transit areas.
- Increases metro ridership, a direct result of the project, concurrently elevates property values in surrounding areas.
- Emphasizes improving pedestrian and cyclist infrastructure, promoting sustainable and healthy urban living.
- Strengthens community bonds and encourages engagement by combining housing and transportation development.

Low Emission Corridors

5 million people

Issue

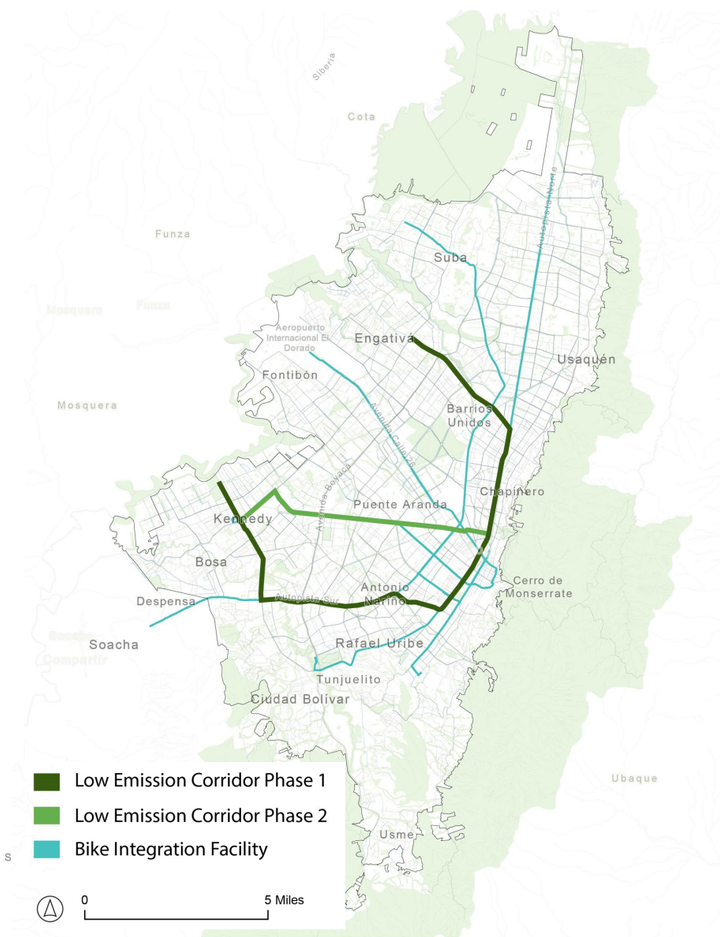
- Air Pollution
- Long bike & walk times
- Traffic congestion

Goals

- Limited Pollution
- Better travel & living environment
- Accelerate the Electric Vehicle Transition

Low Emission Corridors

A corridor with no-gas powered vehicles for limited pollution

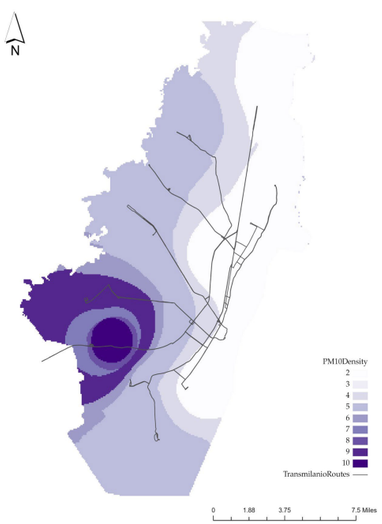


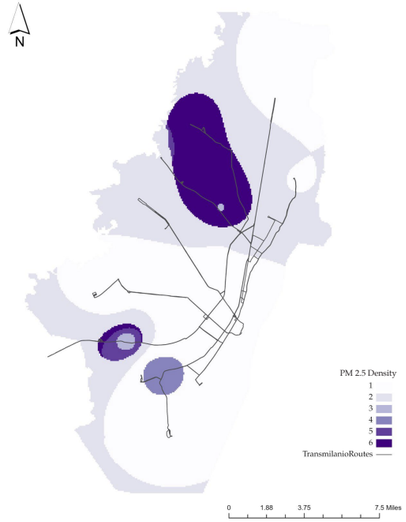
Traffic & Air Pollution

Motorcycle Crowding the Road

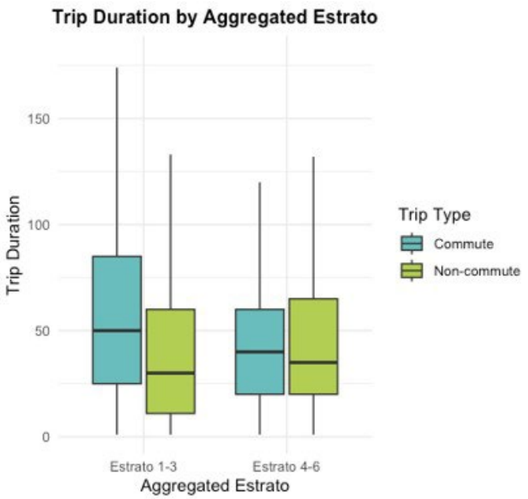
Emission from Cargo

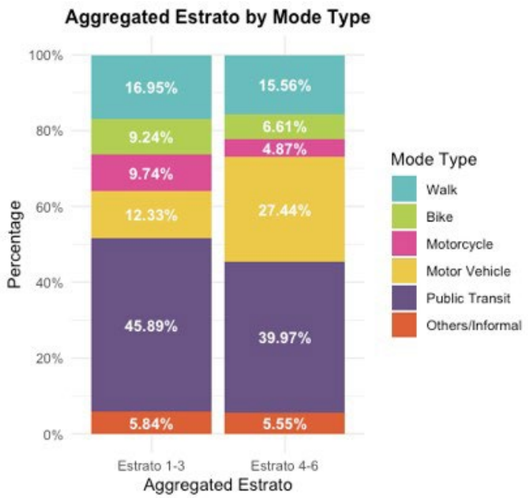
During our visit to Bogotá, the prevalence of motorcycles crowding the roads was striking, a mode of transport commonly used by lower income groups due to its affordability. This observation was coupled with the noticeable emissions emanating from cargo vehicles. Such conditions prompted a closer investigation into the city's air quality, specifically focusing on PM10 and PM2.5 data. Analyzing these two indicators revealed that areas with higher levels of air pollution were predominantly concentrated closer to the city's periphery. This insight was crucial in understanding the environmental challenges faced by Bogotá and informed our project.





Who Bears the Cost?





However, when we explore who is under highly effected by the air pollution, we found that the residents living in lower estrato areas experience longer commute time taking trasit, walking, biking and motorcycling, which are more vulnerable to air pollution.

As shown in the upper graph, commute times for lower estratos are consistently higher across all modes of transportation compared to those in higher estratos (4 to 6). This prolonged exposure during transit not only increases their vulnerability to air pollution but also impacts their daily quality of life. The lower graph, further illustrates the transportation preferences within these estratos, highlighting a significant reliance on public transit among lower estratos at 45.89%, compared to 39.97% in higher estratos. Additionally, the use of informal or other modes of transportation is marginally higher in lower estratos. These insights underscore the need for targeted environmental and transportation policies that address the unique challenges faced by residents in lower estratos.

Methodology

Criteria

1 Air Pollution

- PM2.5 Concentration
- PM10 Concentration
- Ozone Concentration
- Tree Density
- Proximity to Cargo Routes

2 Vulnerable Trips

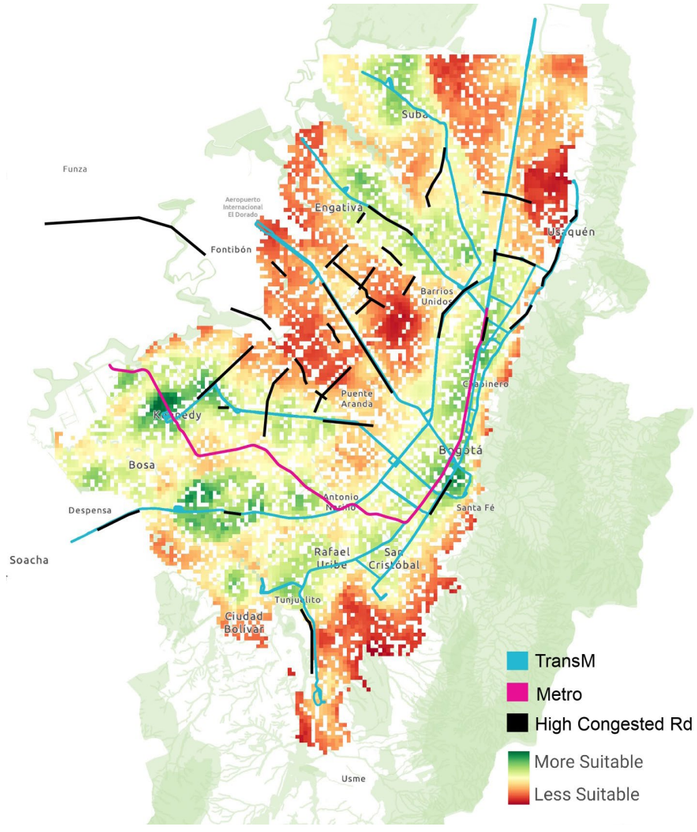
- Bike and Scooter Trip Density
- Walk Trip Density
- Motorcycle Trip Density

3 Amenity Proximity

- Care Block Proximity
- School Proximity Density
- Park Proximity Density
- TransMilenio Station Bike and Walk Isochrone
- Residential Block

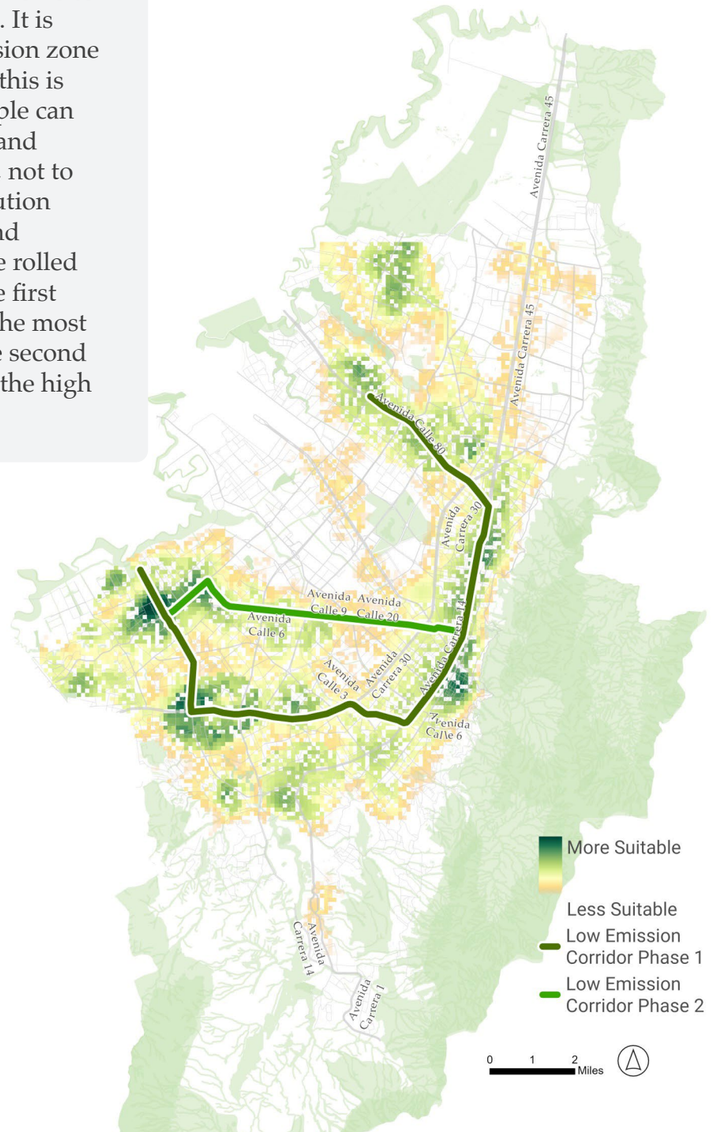
4 Transportation

- Proximity to TransMilenio
- Congestion
- Future Metro

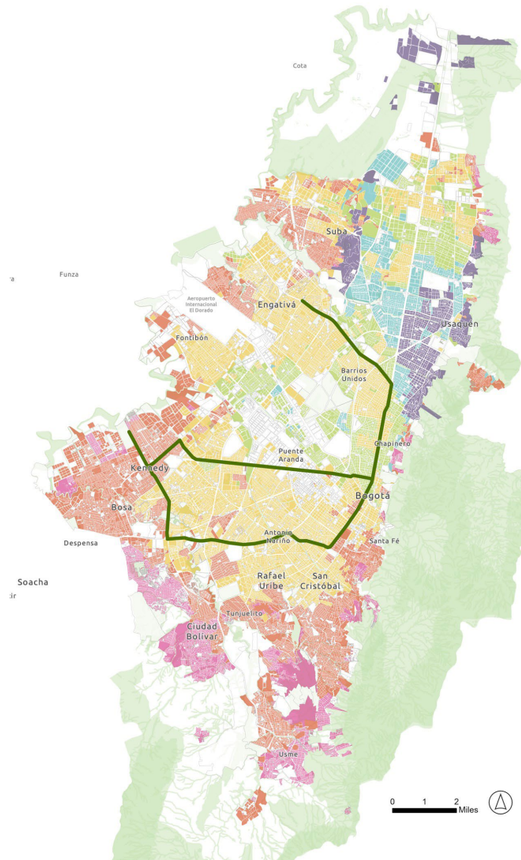


Low Emission Corridor

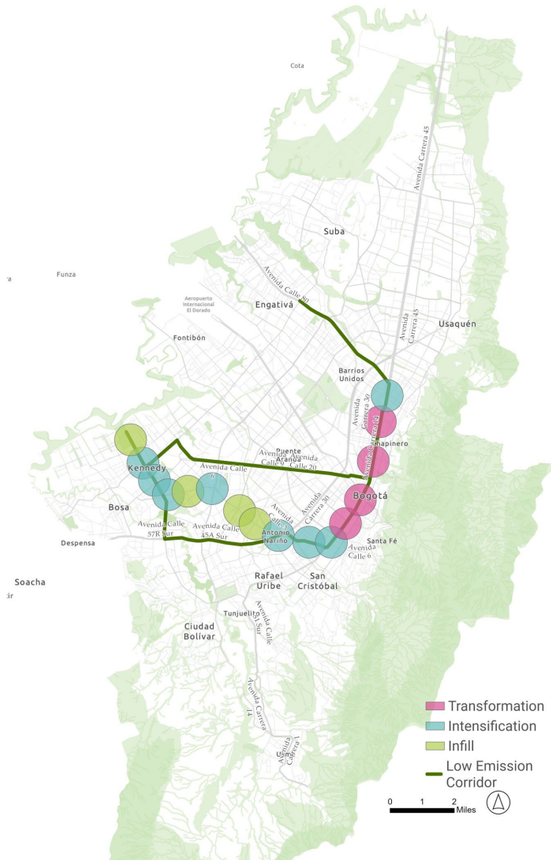
This will become a corridor with no gas-powered vehicles and limited pollution. It is similar to a low emission zone in London, however, this is a corridor where people can travel with healthier and greener environment, not to worry about the pollution created by gas cars and motorcycles. It will be rolled out in two phases, the first phase will priotitize the most suitable areas and the second has an emphasize on the high congested area.



Sustainable Housing



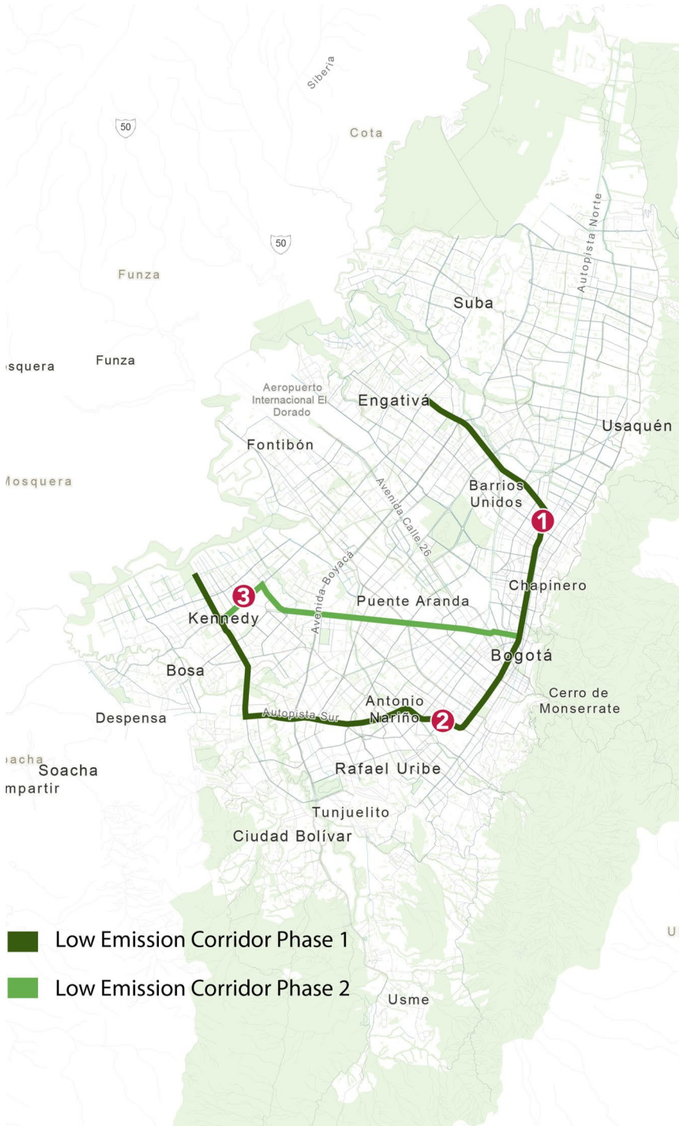
Estrato with Low-Emission Corridor



Metro Station Typology with Low-Emission Corridor

The corridor is designed to encompass areas across all estratos, fostering a healthier environment from the peripheries to the city center. In line with the Transit-Oriented Development (TOD) proposal, this plan also includes the provision of new social housing along the metro line, offering significant benefits to lower-estrato communities along the corridor.

Placemaking



To attain our objectives, we approach from two key perspectives - place making and modal shift. Place making aims to redesign. We focus on place-making, aiming to redesign streets for enhanced accommodation of electric vehicles (EVs) and creating a more comfortable environment for pedestrians. We have identified three distinct typologies along the corridor:

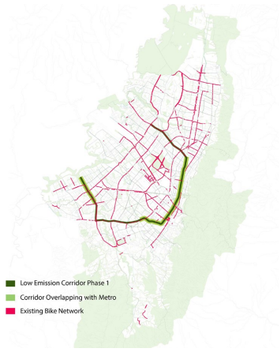
- TransMileno Designated Lanes Area
- Metro Station Intersecvtion
- Motorcycle-Dominant Areas

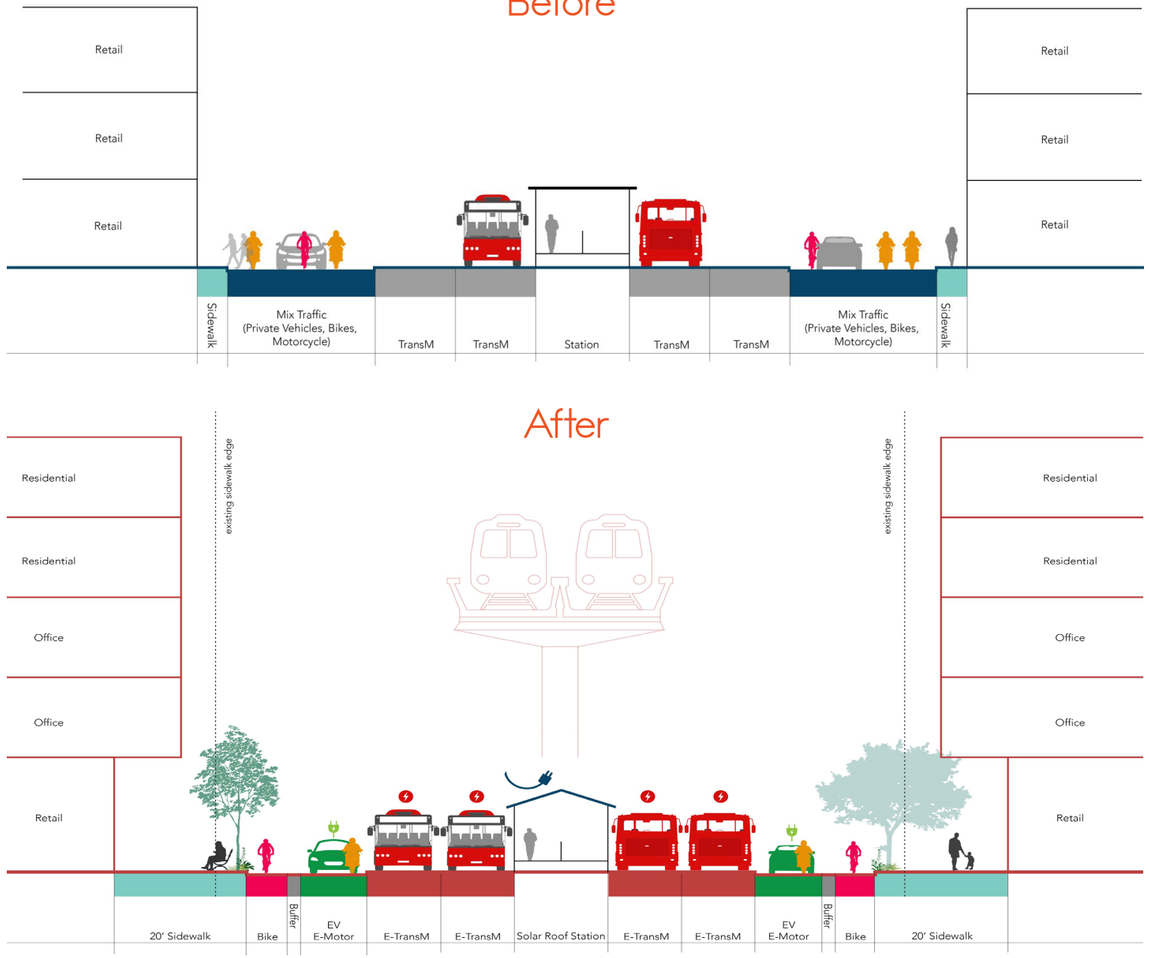
These typologies aim to seamlessly blend sustainable transport with improved pysical environment, tailored to the unique characteristics of each area.

Placemaking: with TransMilenio

The first typology centers on the intersection of Calle 75 and Carrera 20, which currently houses a Transmilenio station and two dedicated Transmilenio lanes, leaving limited space for other traffic. The sidewalks are extremely narrow, approximately 6 feet, and there's a noticeable gap in the bike network when compared to city-wide patterns.

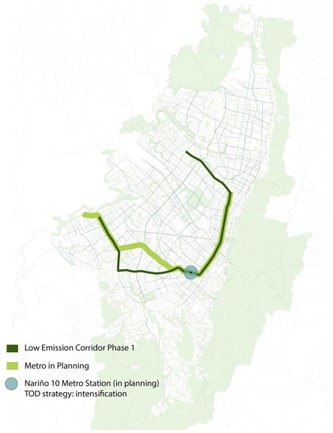
To address these issues, we propose eliminating one Transmilenio lane to create buffered bike lanes and expand the sidewalks. Additionally, we plan to convert the remaining lane into a shared lane for electric vehicles and e-motorcycles.



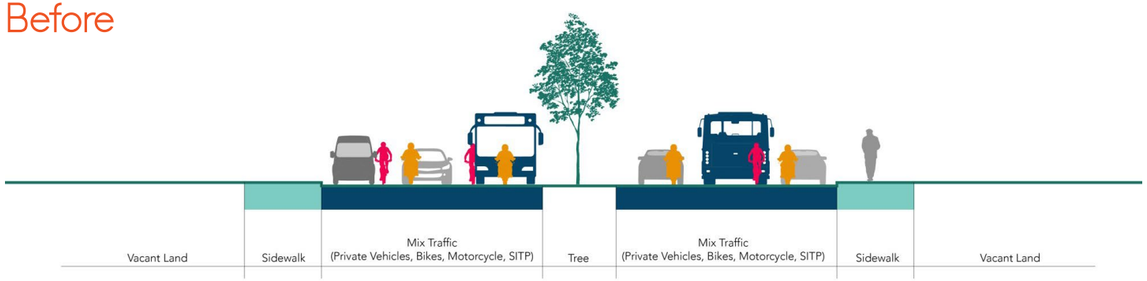


Placemaking: with Metro Station

Current Street View of Narino 10 station



Before



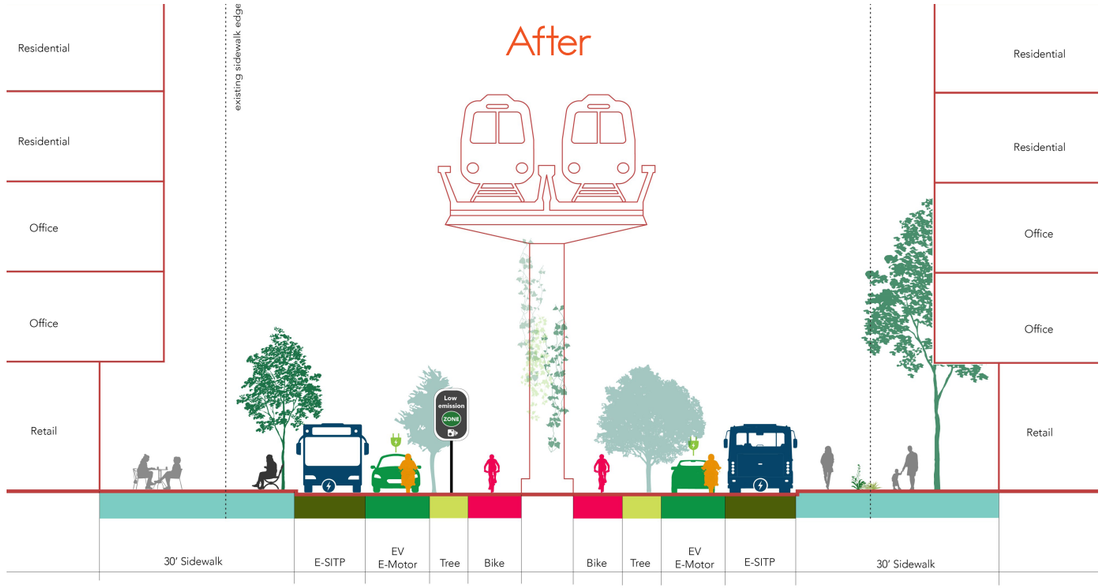
The second typology is at the intersection of a planned metro station, characterized by high vacancy rates. In line with the TOD strategy, this area is marked for intensification.

Our proposal aims to optimize the space beneath the metro, ensuring a comfortable distance between the metro lines and adjacent buildings to mitigate noise pollution. We envision bike paths under the metro, enhanced with tree canopies and vertical gardens. The sidewalk will be expanded to 30 feet, accommodating outdoor cafes and street furniture.

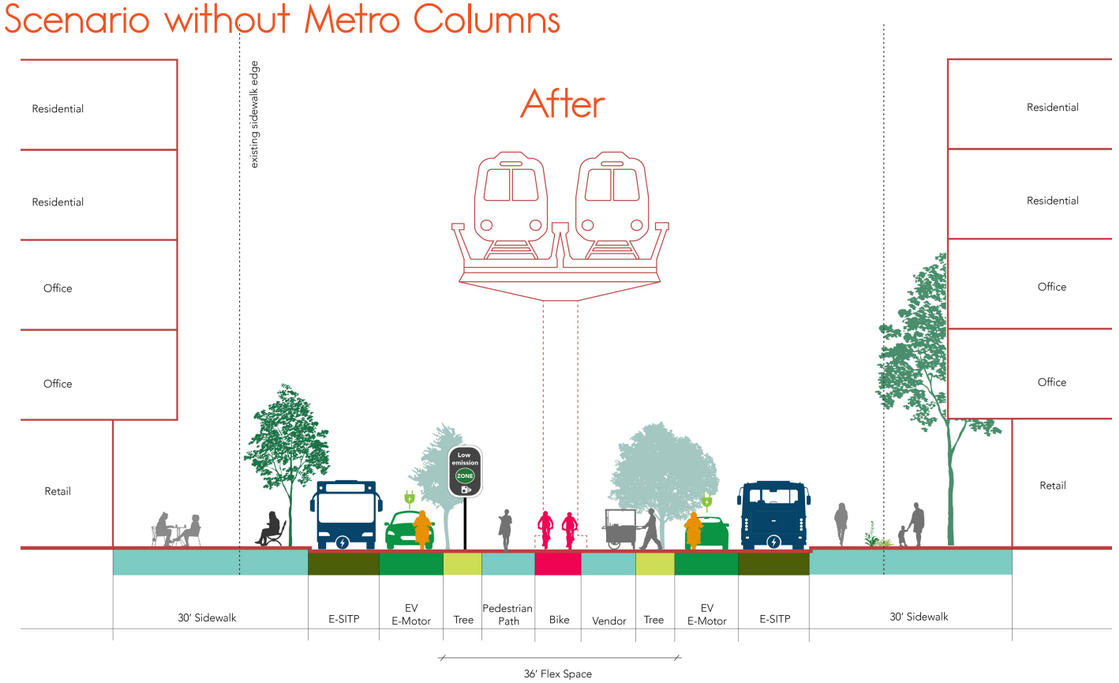
In the scenario without metro columns, a 36-foot wide flexible space emerges. This area can support a two-way bike path, a pedestrian walkway, and vendor spaces. Overhead, the metro serves as a protective canopy, shielding pedestrians and cyclists from rain.

Placemaking: with Metro Station

Scenario with Metro Columns



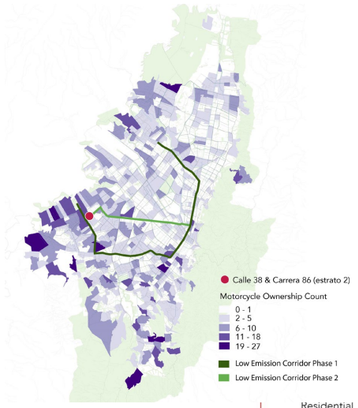
Scenario without Metro Columns

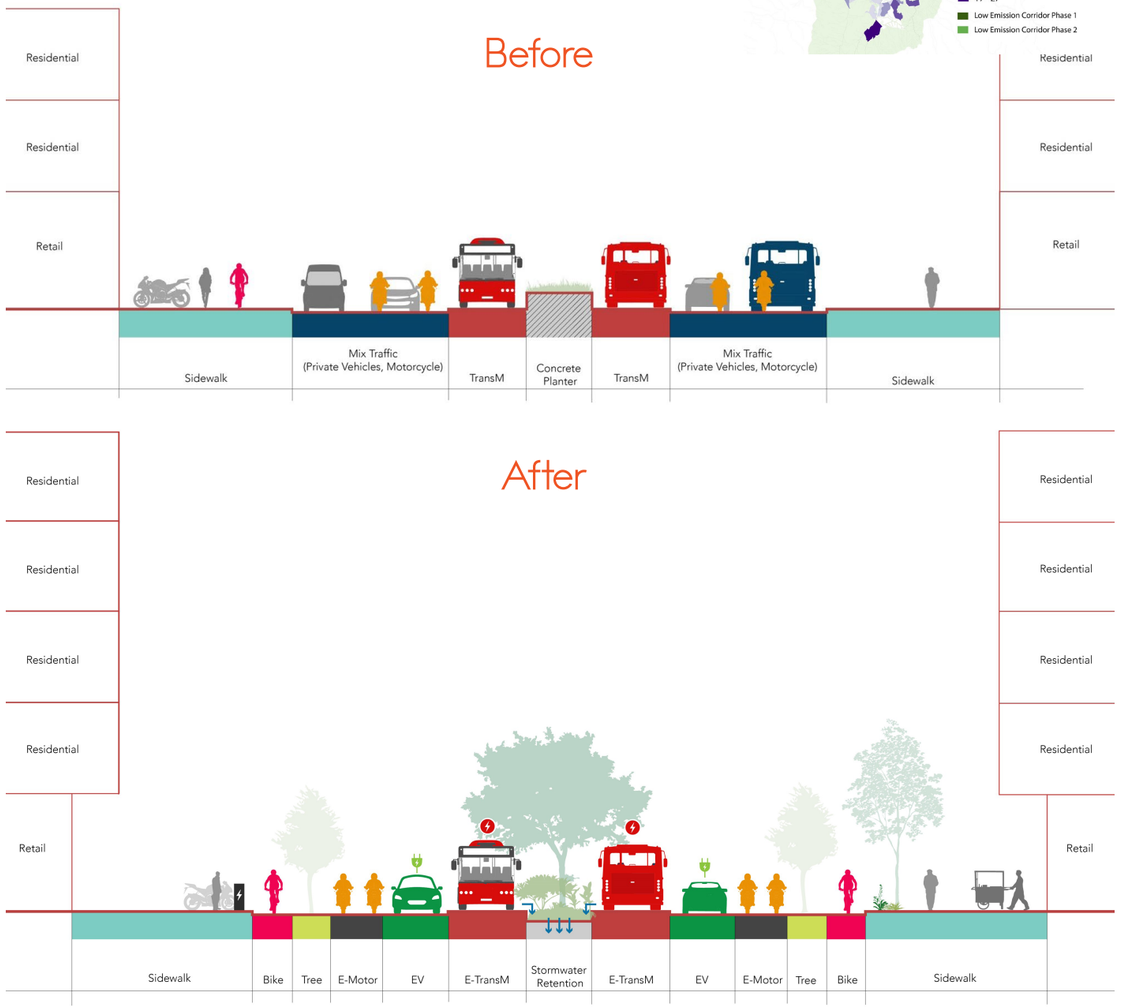


Placemaking: with E-Motorcycle

The third typology targets areas with high motorcycle ownership and lower socio-economic levels. It features a distinct lane for TransMilenio, divided by an elevated planter. Here, cyclists and pedestrians share the sidewalk.

To support the transition to e-motorcycles, we propose a dedicated e-motorcycle lane, equipped with battery swapping stations. Additionally, the central median is redesigned as a sunken, permeable structure for efficient stormwater collection during heavy rainfall.



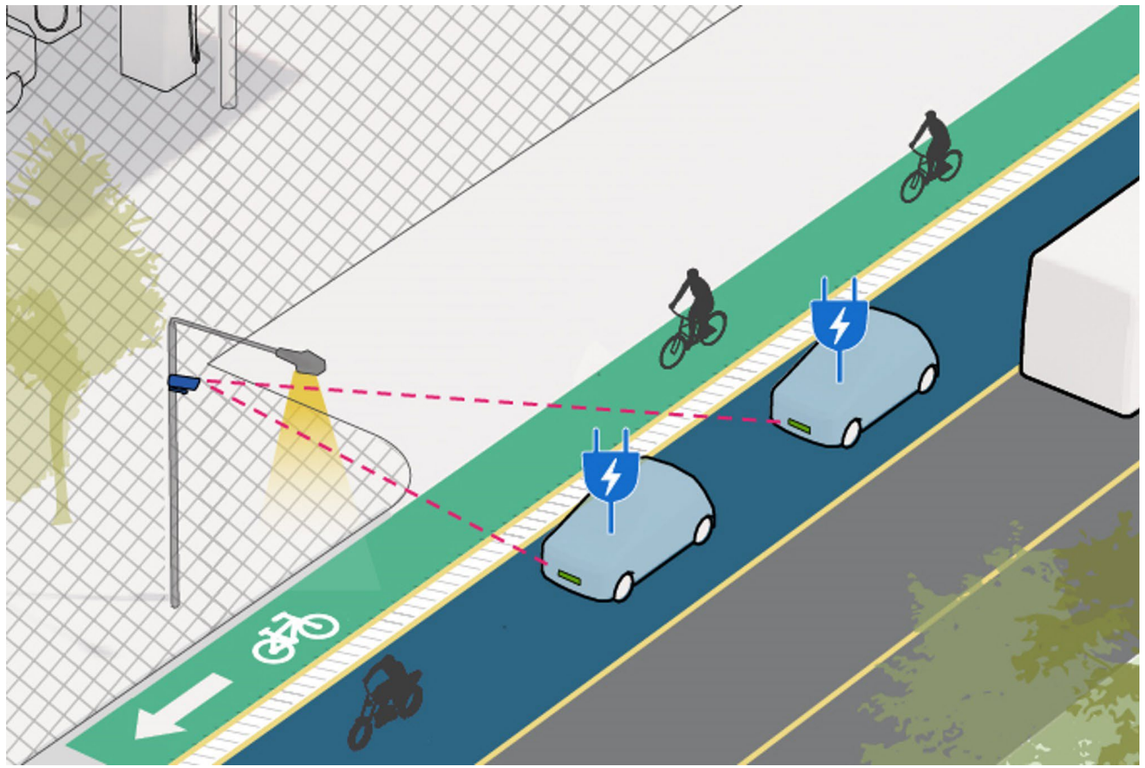


Modal Shift: Monitoring

To support the new street design for the low emission corridor, we propose a set of strategies aimed at encouraging a shift towards sustainable travel modes and vehicles. This shift is essential to achieve our goal of reducing gas-powered vehicles, thereby improving air quality and creating a healthier environment.

Our proposal includes the implementation of an EV-only lane within the low emission corridor. This lane's enforcement will be facilitated by detection cameras installed at strategic points. These cameras will identify EVs based on specific characteristics such as the presence of a charging port, the absence of an exhaust pipe, and a distinct license plate exclusive to registered EVs. The unique design of these license plates will also assist the community and the public in recognizing EVs in the designated lane.

To ensure compliance, a system of sequential camera detection will be employed. Any motor vehicle that is not an EV and is captured by two consecutive cameras within the EV-only lane will be subject to a fine. This measure is not only a deterrent against non-compliance but also a step towards fostering a culture of environmental responsibility and promoting the adoption of electric vehicles.



Modal Shift:
E-Motorcycle Sharing System

While we advocate for a shift towards sustainable transportation, it's crucial to clarify that our goal isn't to compel everyone to switch to electric vehicles (EVs). Instead, our strategy is designed to provide incentives for adopting various sustainable travel modes, such as biking, walking, or using public transit.

To support this diversity in transportation choices, we propose the introduction of an E-motorcycle sharing system. This model, akin to the bike-sharing system, has gained popularity in cities with high motorcycle usage, as evidenced by the success of Revel in New York and GoShare in Taiwan. Users can conveniently rent and park E-motorcycles at various locations along the corridor. Additionally, a battery swapping system will be available, allowing for easy exchange of batteries.

This initiative aims to reduce overall motor vehicle ownership, facilitating a smoother and more economical transition to e-motorcycles. Motorcycles are generally more affordable, and the shared battery swapping system serves both shared and privately owned E-motorcycles. By providing accessible and cost-effective options, we hope to encourage a gradual shift towards more sustainable transportation choices, contributing to a healthier, less congested urban environment.

Modal Shift:
EV Transition Incentives

In addressing the need for larger private vehicles, our focus is on enhancing EV purchase and usage incentives in Bogotá. With Colombia leading Latin America in EV fleet size, comprising 31% of the region's total in 2020, the ambition is to transition to 100% EVs by 2035. The city's existing EV incentives are robust, offering exemptions from import taxes, a 60% reduction in motor vehicle tax, and a 10% discount on both insurance and technical reviews for EVs. These measures substantially reduce the cost of owning an EV compared to traditional motor vehicles. Additionally, EV owners benefit from exemptions from peak-hour restrictions, license plate regulations, and participation in car-free days.

To further these efforts, we propose a comprehensive policy framework:

Firstly, encouraging manufacturers to reach an annual sales goal of 15,000 EVs in Bogotá. This initiative aims to increase market availability and consumer choice.

Secondly, implementing parking and toll incentives for EV owners. This includes free parking and toll exemptions until 2030, followed by a maximum fee of 50% of the standard rates for EVs thereafter, maintaining financial benefits for EV usage.

Thirdly, a policy that requires all public service vehicles to transition to electric models by 2025. This move sets a precedent in sustainable public transportation.

Lastly, the provision of passes for alternative, sustainable transportation modes to residents in lower estratos. This approach ensures equitable access to environmentally friendly travel options, promoting inclusivity.

These policy initiatives are designed to not just facilitate the shift towards electric vehicles but also to make sustainable transportation accessible and appealing to all sectors of Bogotá's population, contributing to a cleaner, more sustainable urban environment.

Existing

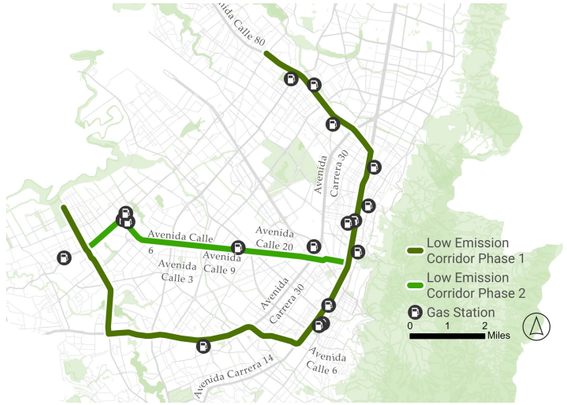
- Import tax exemption, and 60% discount on the Motor Vehicle Tax
- 10% discount on Soat insurance premiums, 30% discount on EV technical-mechanical review
- Minimum 2% of the total parking spaces for EV
- Exemption for the peak, license plate and car-free day

Proposing

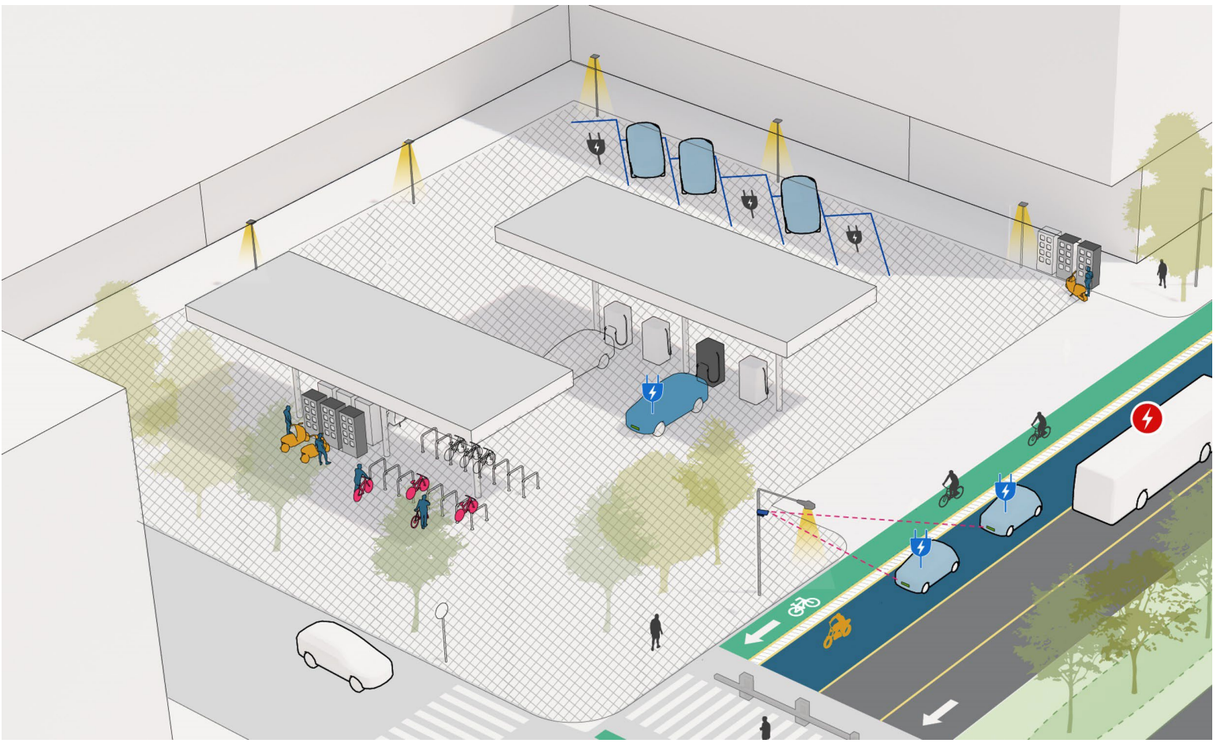
- Encourage manufacturers to sell at least 15,000 of EV in Bogota each year
- Exemption from parking fee and toll till 2030; from 2031, pay a maximum of 50% of the fees
- All new cars for public use (e.g. police car, utility truck, etc.) need to be EV from 2025
- Provide passes for low estrato residents to use alternative transportation mode

Modal Shift: Mobility Hub

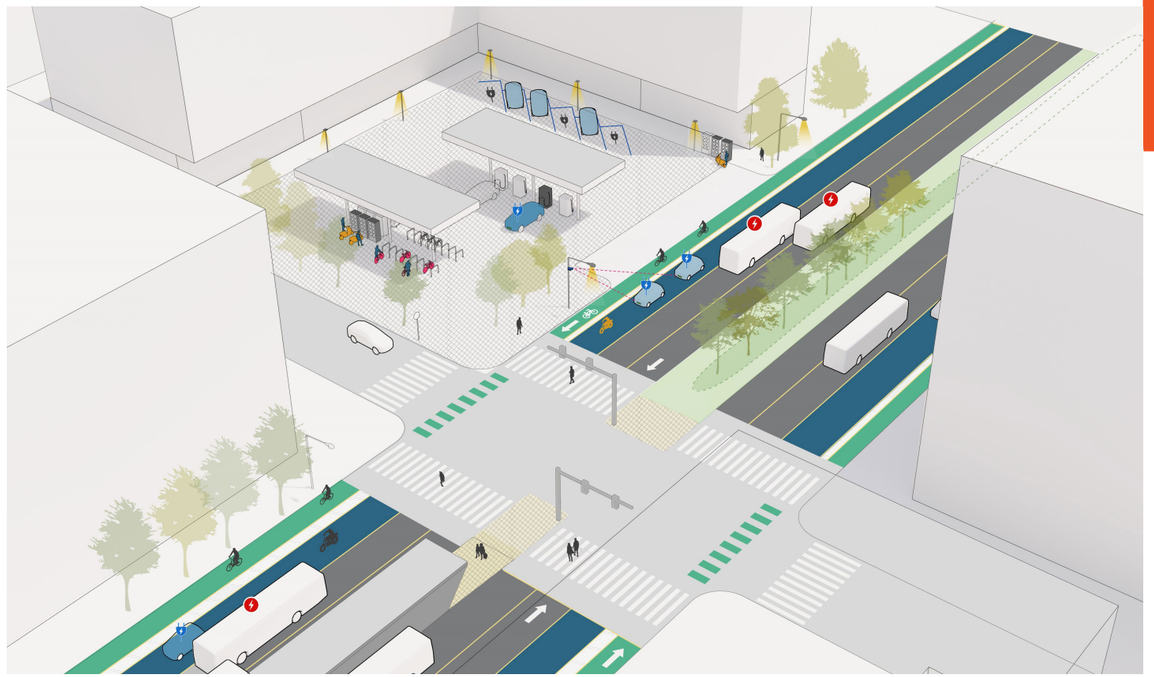
Pulling all the new street interventions and the alternatives of sustainable mode, we are introducing the mobility hubs that retrofits the existing gas stations along the corridor and newly developed metro terminal stations. Mobility hubs would provide all multimodal transport systems, including bike share stations, private bicycle parking boxes, E-motorcycle sharing station, battery swapping system, EV charging station. The hubs would be nearby the TransMilenio and metro station, serving as a middle point for people to park their private vehicle, rent the shared system, transit to public transit to travel along the corridor. The mobility hub would also have sufficient lighting to provide a sense of safety and surrounded by social housing, which can also provide the residents more affordable choices for commute.



Current gas stations along the corridor



Low Emission Corridor As Future



As we look back at the remarkable journey of TransMilenio, which evolved from a modest single line into the world's largest Bus Rapid Transit (BRT) system, it serves as a testament to Bogotá's commitment to innovative and sustainable urban transport. This evolution highlights the critical importance of creating healthy environments for both travel and living for all of Bogotá's residents. The proposed implementation of low emission corridors represents a pivotal element in the future development of TransMilenio, offering a blueprint for urban progress that is environmentally conscious and people-centric.

Integrating these corridors into the city's fabric is more than an enhancement; it's an essential step towards a future where sustainable mobility is seamlessly woven into everyday life. This initiative not only aims to reduce environmental impact but also to elevate the quality of urban life, making cities more livable, accessible, and equitable. As Bogotá continues to grow and evolve, embracing low emission corridors in the expansion of TransMilenio will not only benefit the current generation but also pave the way for a healthier, more sustainable future for generations to come. This vision of urban development, where environmental sustainability and human well-being are intrinsically linked, is what drives our commitment to this transformative project.

MiCicleta

Integrating Bicycle Infrastructure with High Capacity Corridors

7%

of all commutes are by bike

50%

Bogotá's Long Term Goal

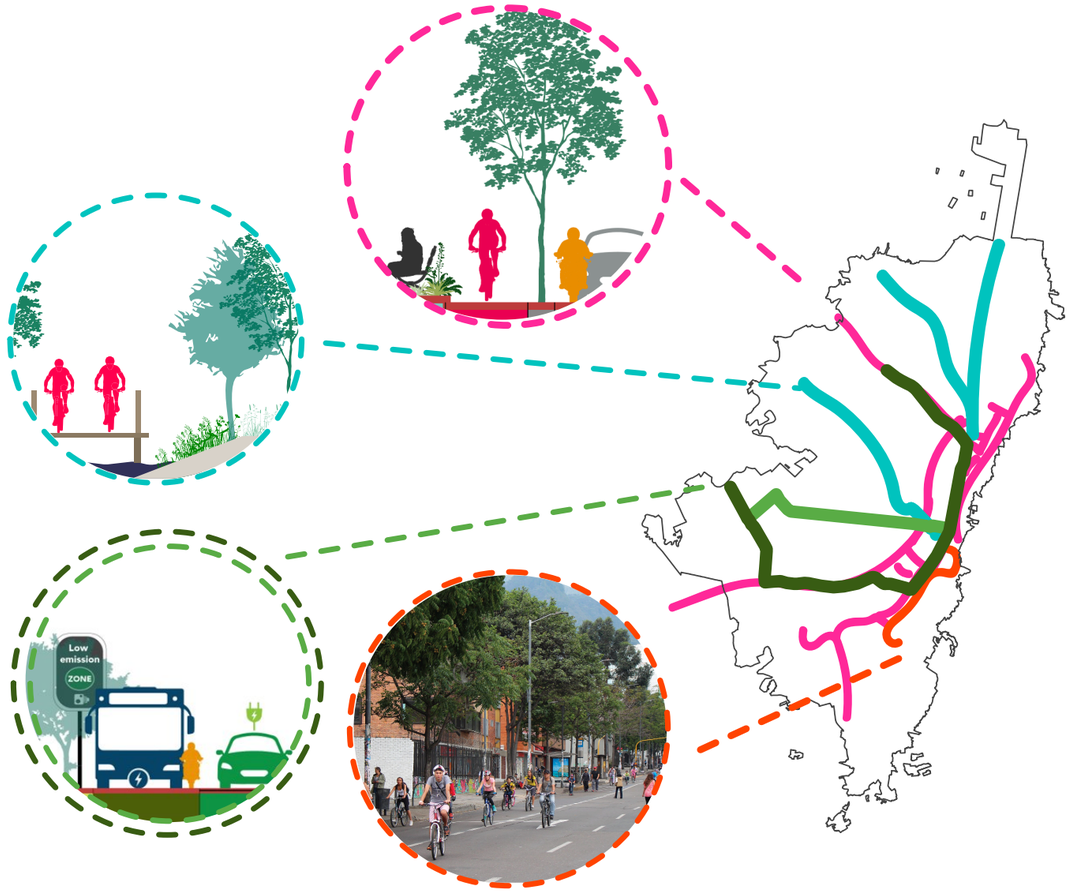
Issue

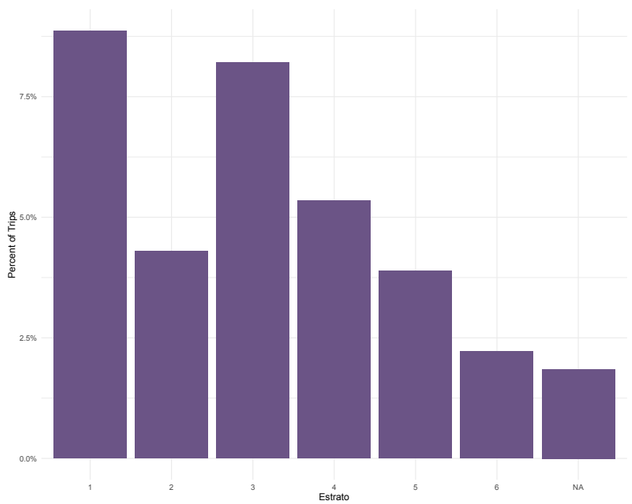
- Most cyclists are in estratos 1 & 3
- Disproportionate hotspots of crashes involving cyclists are in lower estrato areas
- The city aims to promote sustainable transportation

Goals

- Provide safe infrastructure for cyclists to access TransMilenio corridors either for cycling or for easy transfers
- Accelerate Bogotá's mode-share goal and get more people biking
- Improve cyclist experience to attract all users

Beyond the identified low-emission corridors, we have developed a long-term city-wide vision for high capacity corridors to provide better infrastructure for some of the lowest emission modes - bicyclists. A high quality bicycle network can connect high capacity corridors to affordable housing on the urban periphery and lower income residents to safe, affordable, and sustaiable transit city-wide. Bogotá has been lauded as a leader in bicycle infrastructure, but safety and access disparities persist across socioeconomic divides.





Cyclists by Estrato

There are four strategies to more cohesively integrate bicycle & bus rapid transit infrastructure.

1. **Develop** low emission corridors to foster the cleanest possible air quality

2. **Retrofit** existing corridors to accomodate buffered, comfortable space for cycling

3. **Expand** and making more **permanent** the incredibly popular Ciclovía program

4. **Establish** greenways along underutilized center medians

24%

of cyclists are women

1.8

Meters to be minimum space for cyclists as required by a newly adopted Complete Streets Policy & Public Space Manual

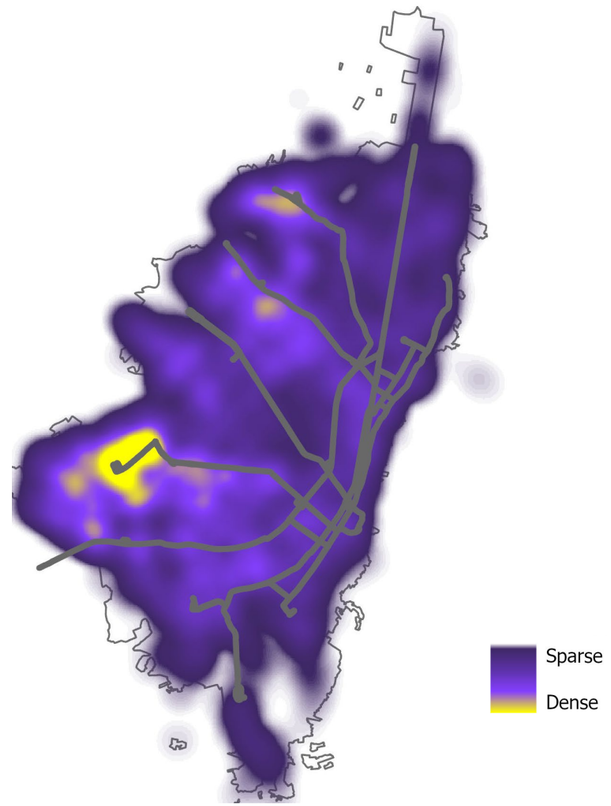
16%

of all crashes involving cyclists are on just 3% of Bogotá's roads, along TransMilenio corridors

Focusing on bicycle infrastructure along bus rapid transit corridors offers a variety of opportunities centered on equity & safety.

Bogotá has ambitious mode share goals to expand bicycle mode share of commutes from its current 6 - 7% to 50%.
The city also has plans and complete street policies to allocate more roadway space to bicycle citywide.

Expanding bicycle infrastructure can benefit lower income residents living on the outskirts of the city, since most cyclists are residents in estratos 1 and 3. By providing an integrated network, cyclists can access more jobs, services, and amenities in the rest of the city. Cycling infrastructure can be a **vehicle for economic mobility,** especially for women who make up a smaller proportion of cyclists and experience harassment on public transportation.



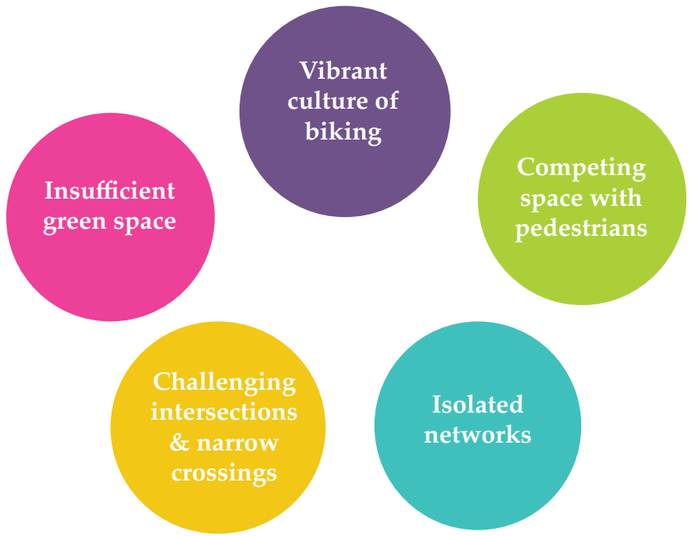
Concentration of Crashes Involving Cyclists (2015 - 2023)

Lower estrato cyclists living on the outer areas of Bogotá face a disproportionate share of traffic violence. Many of these crashes take place near TransMilenio terminals, especially near Portal de las Americas. A concentration of crashes near terminals may indicate that a wide variety of road users are trying to access TransMilenio and facing higher conflict rates.

From our site visit, we observed disparities in bicycle infrastructure along high capacity corridors. Although there are many cyclists using these corridors, facilities vary in quality and vary among estrato areas, likely resulting in inequitable crash outcomes.

Existing Infrastructure

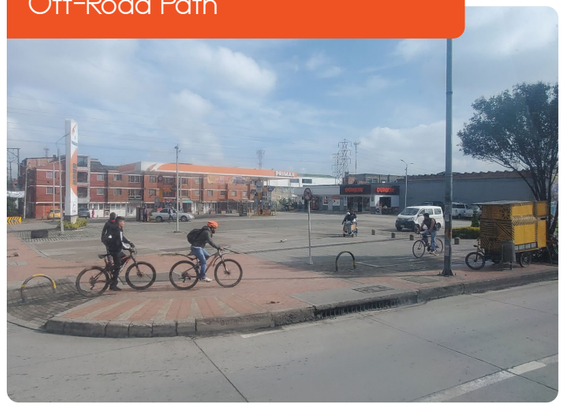
The State of Bicycle Infrastructure Today



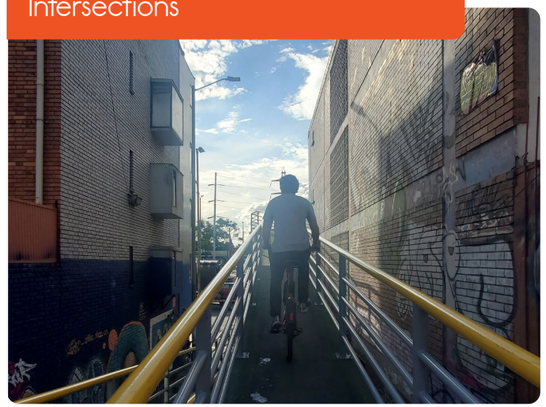
A majority of TransMilenio corridors have off-road paths at level with pedestrians. Along other corridors, there are no designated facilities and cyclists mix with regular vehicle traffic. Cyclists trying to cross the wide roads have to share narrow pedestrian ramps intended to access median transmilenio stations. There are very few on-road cycle tracks or greenways.

While some of the mega developments have implemented bicycle infrastructure, many of them are islanded networks without city-wide connectivity. At the same time, Ciclovía is one of the most successful street closure programs in the world. On Sundays, hundreds of thousands of people take to the streets along BRT corridors.

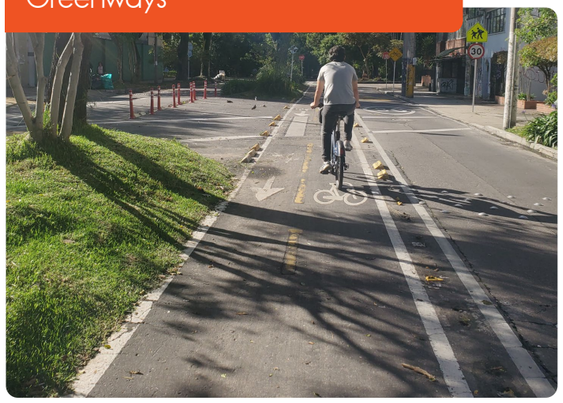
Off-Road Path



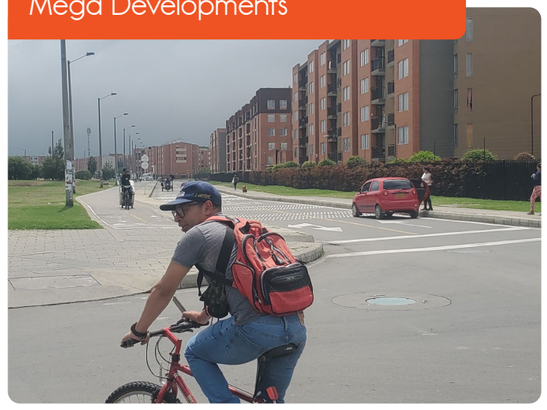
Intersections



Greenways

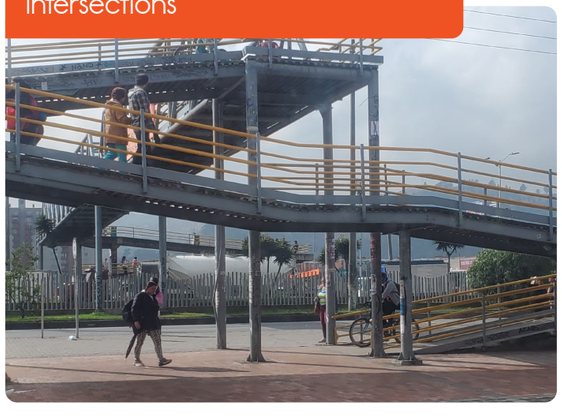


Mega Developments

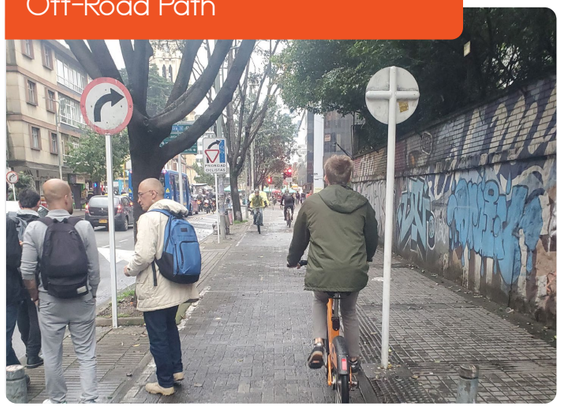


No Facility

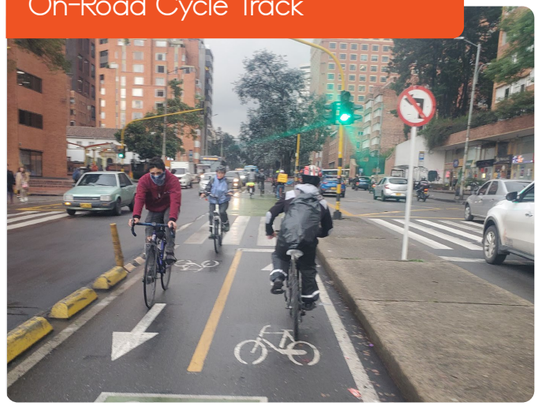
Intersections



Off-Road Path



On-Road Cycle Track

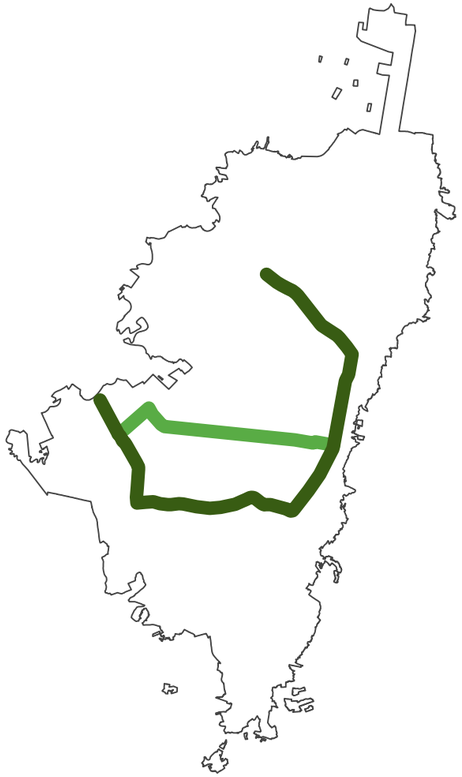


Typology 1: Low Emission Corridor

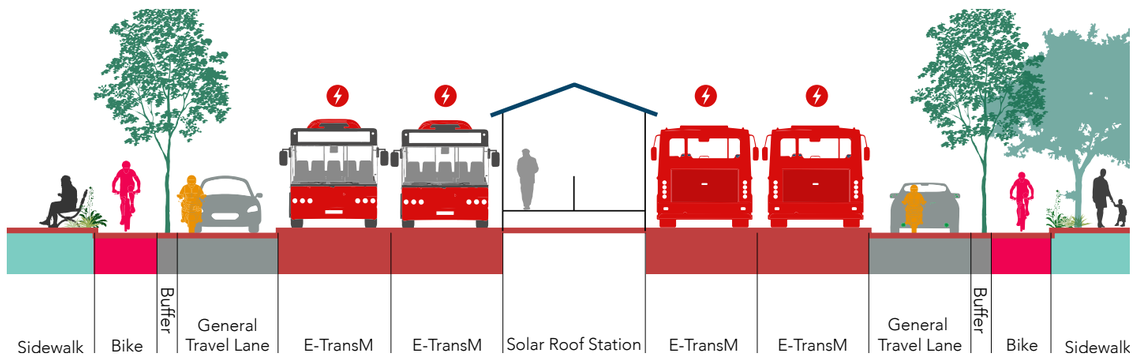
A low emission corridor offers the following benefits to cyclists:

- Better air quality and improved health outcomes
- Less noise pollution & more pleasant experience for all ages of cyclists

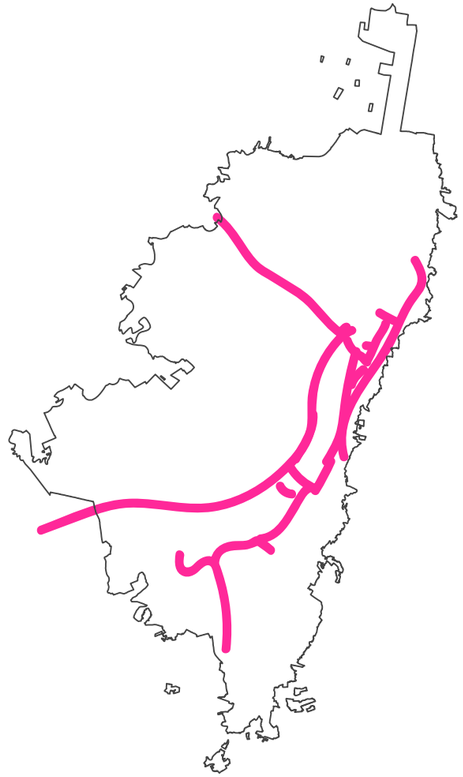
Restrictions for gas-powered vehicles has a directly positive impact on cyclists by allowing them to enjoy reduced air polluted corridors. It is not feasible that every household in Bogotá will have access to a private vehicle, electric or gas-powered. Therefore, ensuring that these low emission corridors are not exclusively for EVs but for the lowest emitting modes of travel like biking, walking, and public transit will make it an equitable low emission corridor.



Typology 2: Retrofit Corridor



A simple retrofit of a majority of corridors reclaiming a genetral travel lane for cycling infrastructure can provide a basic level of service across the network where none currently exists. Reallocating more space to biking & walking can reduce conflicts while improving access to businesses. Additionally, the inclusion of a planted bike buffer as standard on BRT facilities is critical to improve not just the air quality, but provide a physical protection to cyclists. An analysis of crashes involving cyclists reveals that overtaking closely and failure to maintain safe distances are the top two causes of crashes involving cyclists. Therefore, physical barriers can reduce these outcomes while improving overall cycling confidence. A safe experience makes biking a dignified mode of transportation for all people of all socioeconomic backgrounds.



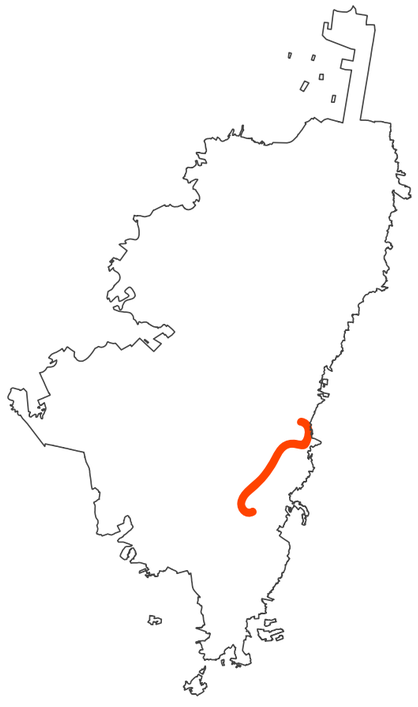
Typology 3: Permanent Ciclovía

Ciclovía is an incredibly successful program that has been replicated worldwide where every Sunday & holidays, major TransMilenio corridors are transformed into vibrant spaces where hundreds of thousands of people walk or bike. This program should become **permanent** in the densest parts of the city where single-occupancy vehicles are moving a small portion of people.

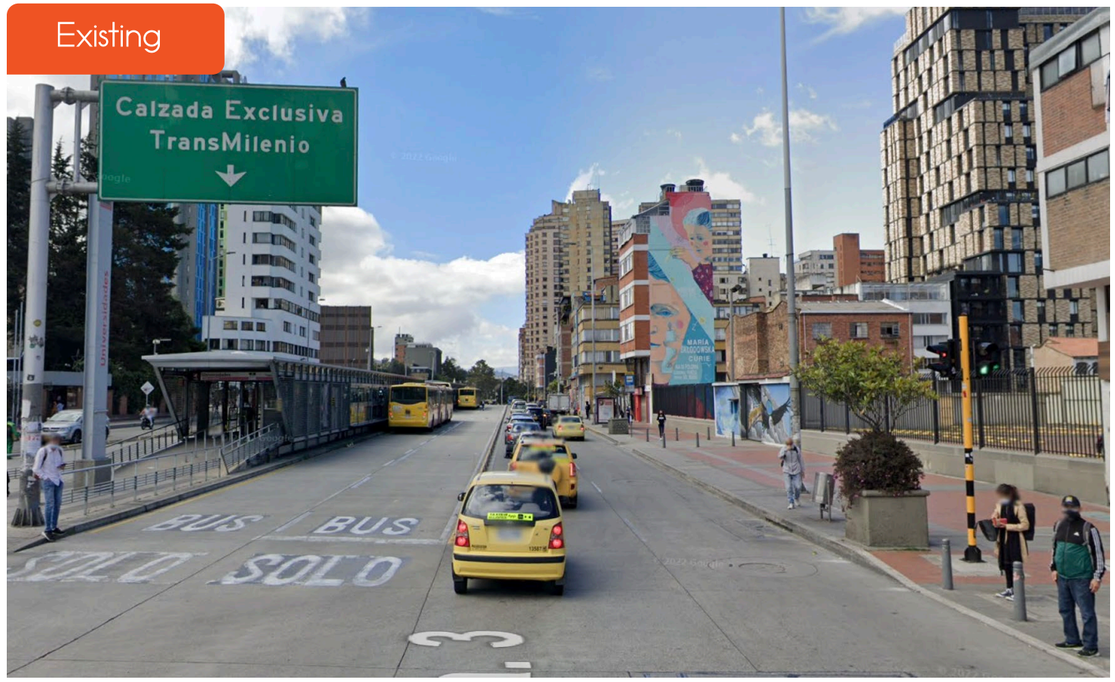
With this intervention, the streetscape will be improved and circulation will be maintained via the TransMilenio, walking, biking, and the future Metro. The ciclovía program can be alternated on every other block to keep some vehicular traffic accessing businesses as a phase-in plan.

University of Pennsylvania, Fall 2023

Up to 1.4 million people participate in Ciclovía weekly



Existing

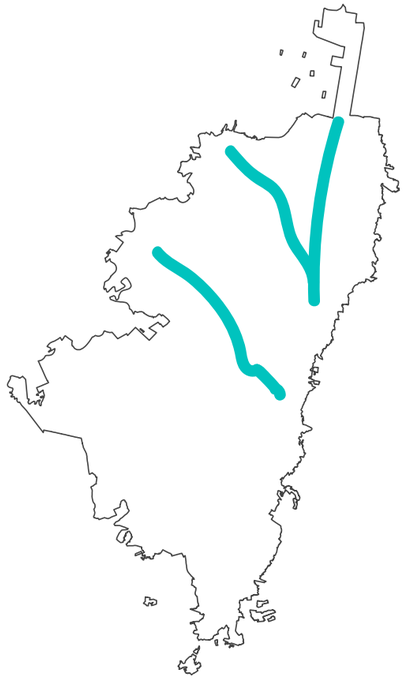


Proposed

Typology 4: Greenway

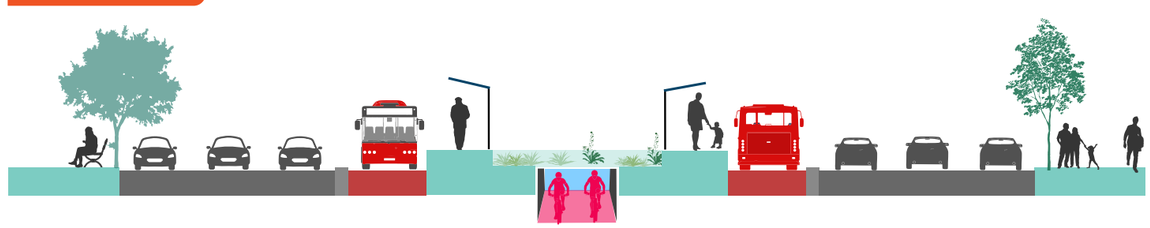
Finally, an inventory of the corridors revealed that that there are three major corridors with underutilized green space or channelized rivers. These spaces can be reclaimed from unused space into public amenities while providing eco-cobenefits. A path like this already exists along the corridor to the airport, but it could be expanded and provide improved station access.

Providing separate entrances to TransMilenio for pedestrians and cyclists is a model that should be built upon and expanded, improving bicycle circulation & speed, access to TransMilenio, and reducing conflicts with pedestrians. By routing the path under the stations but providing dedicated access points, cyclists can accecss transportation and a city-wide cycling network.

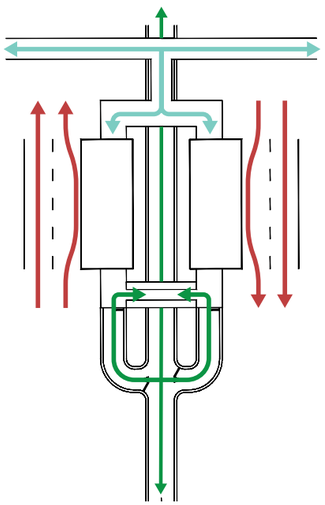


Typical Section

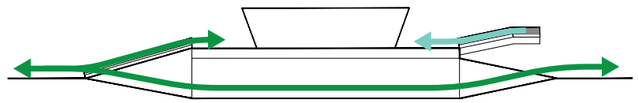
Station Section



Station Plan



Station Section



Pedestrian Flow

TransMilenio Flow

Bicycle Flow

Safety


Las Mujeres somos No de Bolín de Guerra
¿Cambiamos
EL FINAL
de nuestra
HISTORIA?
DIVERSIDAD
Colectiva Lentes Morados

More than

63%

of assaults happened against women*

Issue

- More incidents, assults, and robberies happening on street or in public transportation
- More women encounter assults on public transit
- General Perception of TransMilenio as unsafe

Goals

To enhance both physical safety and subjective perception of safeness on streets and public transit, primarily for women but also for all.

* Data Source: Movilidata Bogotá (https://transport.opendatasoft.com/pages/crimen-seguridad/)

Viaje a Gusto

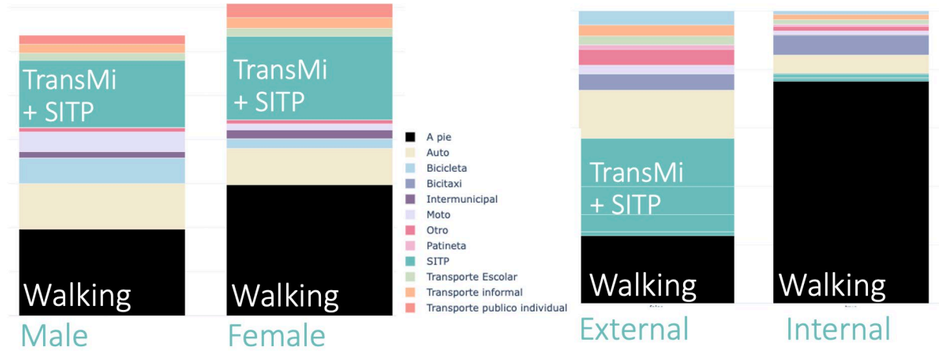
Safer Travel, Better Experience

With the rapid urban expansion and growth of TransMilenio and SITP as a whole, more population than ever are traveling in Bogotá every day, whether on foot or via public transportation. One primary concern with traveling, however, is safety – both physical and perception of safety. In particular, women are facing higher percentage of assaults, especially sexual assaults, when traveling. The word cloud below shows that women, abuse, and grabbing are some keywords associated with TransMilenio.

Perception of TransMilenio: Keywords: Mujer (Women), Abuso (Abuse), Agarraron (Grab)

Complementing the previous projects on infrastructural changes, Viaje a Gusto is designed to shape a safer and better experience in Bogotá, particularly for women passengers and pedestrians. As the caretakers of most households, women deserve to be taken care at home, at workplace, and when traveling. Though the program prioritize women's experience, the program is designed not only for women, but those whose safety may be potentially at threat when traveling, and eventually everyone traveling in the city.

Modal Breakdown



According to the Household Travel Survey (2019), walking is the primary mode for trips made by females. Walking is also the primary mode for internal trips, while SITP (including the TransMisystem) is the primary mode for external trips. (Note: internal vs. external refers to travel within UTAM (Unidad Territorial de Análisis de Movilidad, or Territorial Mobility Analysis Unit, a unit similar to neighborhood) or across multiple UTAM). Therefore, Viaje a Gusto is designed to revolve around walking as the key mode to internal trips and public transit to external trips.

A Bipartite Program

Internal Trips

Viaje sin Peligro

(Travel w/o Danger)
Sidewalk and **Streetlight**
Enhancement and Redesign

External Trips

Viaje sin Miedo

(Travel w/o Fear)
Safety on Transit, Less Sexual Harassment Initiative

To enhance the safety of traveling during both internal and external trips, ***Viaje a Gusto*** is designed to be a bipartite program involving two complementary projects. ***Viaje sin Peligro*** ('Travel without Danger') targets internal walking trips through sidewalk enhancement and streetlight redesign. ***Viaje sin Miedo*** ('Travel without Fear') aims to tackle safety on public transportation (mainly SITP), particularly the prevalent issue of sexual harassment. Each project engages three key strategies.

Viaje sin Peligro

Sidewalk and Streetlight Enhancement and Redesign

Viaje sin Peligro focuses on improving pedestrians' walking experience through sidewalk enhancement and streetlight redesign. As data suggests, walking is one of the predominant modes of traveling, particularly for internal short trips, and many pedestrians are women running errands or going to take care of family members.

The existing condition of the sidewalk, however, is not always ideal for pedestrian safety. As shown in the pictures on the right side, some areas, especially those on the urban peripheries, are lacking in pedestrian infrastructure such as safe, wide, protected sidewalks and sufficient lighting. In addition, many sidewalks that are not located in lively city centers tend to have lower permeability and transparency, which means the storefront facade is closed off. The absence of fellow pedestrians, insufficient lighting, and low transparency together create a sense of insecurity for those walking in periphery neighborhoods at night. With more population living in those periphery neighborhoods, some sidewalks need to be transformed to ensure that pedestrians feel safe when walking at night.

To achieve this goal, we are proposing three design strategies: 1) general sidewalk enhancement that involves basic paving and widening of sidewalks, 2) streetlight enhancement to ensure there is sufficient lighting and decent visibility, and 3) increase permeability to achieve 'natural surveillance', which allows more passive interaction between interior and exterior. The geographical focus for implementing the strategies should be communities on the urban peripheries that do not currently have consistent pedestrian infrastructure.

Existing Conditions

Lack of Safe Sidewalk

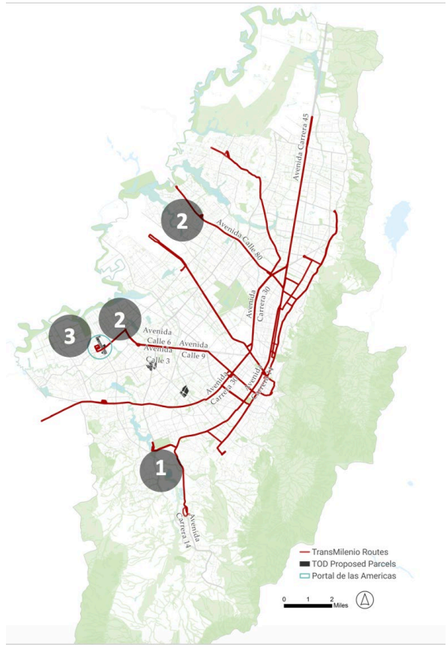
Narrow Sidewalk & Insufficient Lighting

Low Permeability & Insufficient Liighting

Strategies & Case

1. General Sidewalk Enhancement
2. Streetlight Enhancement
3. Permeability - 'Natural Surveillance'

All three strategies are targeting the urban peripheries. Given more population are living in those areas, as previously introduced, it is critical to improve their walking experience when making internal trips. Each strategy is demonstrated through a case at a potential site for implementation, though the case sites are not the only places for deploying the strategies. They can also guide sidewalk design in mega affordable housing projects such as Lagos de Torca or Ciudad Verde, given the importance of internal connections in those large communities.



Case sites for implementing Viaje sin Peligro Strategies

1 General Sidewalk Enhancement

Current

Proposed

Ciudad Bolivar: Sidewalk Paving

General sidewalk enhancement typically includes basic paving and widening. This is particularly important in Ciudad Bolivar, where the topography is mountainous and sidewalks tend to be narrower and closer to car traffic. Many sidewalks in the area are lacking continous paving. For instance, the section shown above is a turning slope in Ciudad Bolivar. Pedestrians, especially students from nearby schools, have to walk on the driveway due to the absence of continuous paving. Given it is also a U-turn, pedestrians may walk in blind zones of drivers and are exposed to danger. Basic paving can keep pedestrians on sidewalk and significant lower chance of car accidents.

2 Streetlight Enhancement

Streetlight Upgrade (Since 2014)

The Streetlight Upgrade Program has been planned and executed since 2014. Entities and organizations including Unidad Administrativa Espeecial de Servicios Publico (UAESP), Enel-Codensa (Colombian Utility), and Bloomberg Associates have been involved in the process of upgrading streetlights to brighter LED lights that are more energy efficient.

Streetlight Upgrade Program

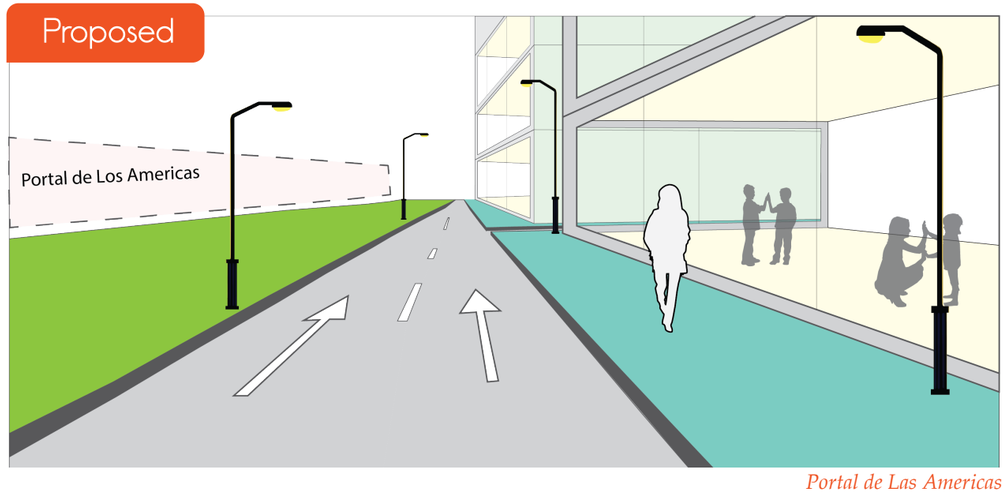
Photo of Dark Alleyway Taken in 2019

Insufficient Lighting Remain as a Problem in 2019

Despite the continuous effort to upgrade existing street lamps, many smaller alleyways remain relatively dark at night in 2019. The map on the right shows hotspots or clusters of more points with poor lighting -- unsurprisingly, many of the dark clusters are located on the peripheries. While streetlight enhancement programs frequently prioritizes driveway and overlook pedestrian lighting, sidewalk lighting is particularly important for large communities on the peripheries.

Currently in 2023, some of the poor lighting points reported in 2019 is experiencing transformation with new street lights installed in place. The government should continue the effort of installing more streetlights and ensure sufficient lighting in periphery areas. Brighter street lamps, higher density of them, and more energy efficient lights translate to higher night visibility, less traffic accidents, safer walks, better pedstrian experience, and less energy cost.

3 Permeability - 'Natural Surveillance'



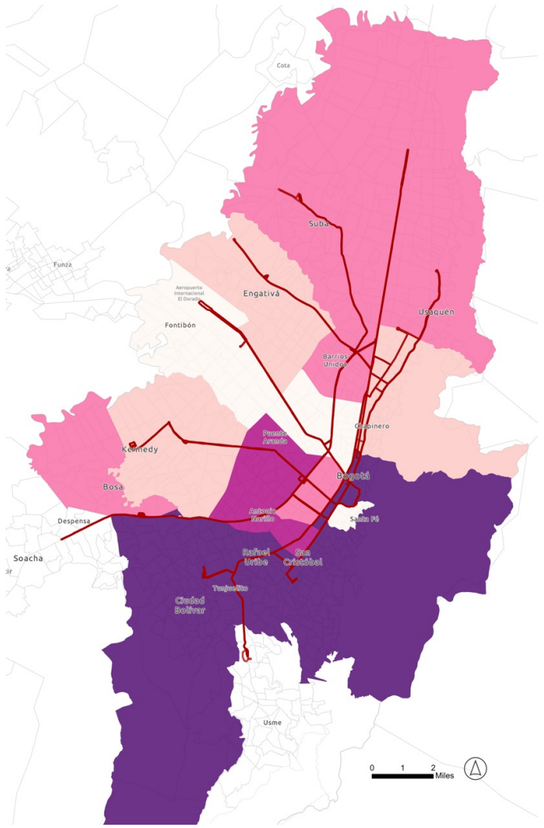
Portal de Las Americas

The third strategy is to improve permeability by opening up the storefront façade. Increasing permeability and transparency allows more passive interaction between activities in the indoor space and pedestrians on the sidewalk. This also encourages 'Natural Surveillance', meaning people indoors can 'watch' the street and will be aware of any incidents happening on the street, which in turn can make pedestrians feel safer to walk.

We chose a section adjacent to Portal de Las Americas, a TransMilenio terminal as a case study to test our intervention. Previously, we have proposed a TOD project near the site, with community centers, commercial retail space, and residential buildings. Given community centers and retail space are located on lower levels, we are imagining the façade to be all glass and transparent, visually opening up to pedestrians. Additional streetlights light up the whole space at night, especially after the operating hours of the storefront spaces.

Viaje sin Miedo

Less Harassment, Better Experience
On Public Transportation



More than
60%
of Population consider TransMilenio unsafe

Percent of Population Feel Unsafe on TransMilenio
- < 62%
- 63% - 66%
- 67% - 69%
- 70% - 74%
- > 74%
- TransMilenio Routes

According to data presented on *Bogotá Como Vamos*, despite improvement in security over the past years, more than 60% of the total population still consider TransMilenio unsafe or very unsafe in 2022. The word cloud presented earlier also shows a preception of TransMilenio associating with abuse and harassment, particularly targeting women. Viaje sin Miedo, therefore, hopes to change such conditions and perceptions through a set of strategies and interventions that both amplify women's voices and foster social change.

Existing/Past Women-Oriented Programs

Women-Only Buses Pilot

In 2014, Women-only TransMilenio bus pilot program was introduced to the city. However, its operation stopped not long after, potentially due to its very limited routes, which was not sufficient to satisfy large demand during rush hour.

La Rolita Trains Female Drivers

La Rolita is a women-led electric bus fleet that aims to bring gender equity into the transportation sector. Their training program allows many females to be employed as drivers. It is a big step forward, yet many more steps ahead to change the predominantly male culture.

Surveillance Facial Recognition Camera

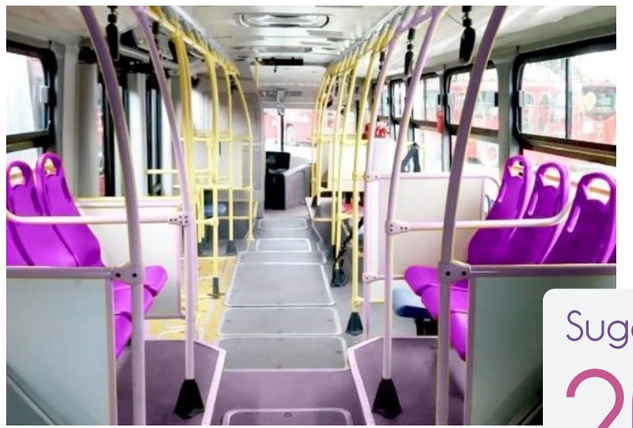
Facial recognition cameras for surveillance have been recently installed on TransMilenio buses. The cameras can detach facial expressions and identify potential cases of assault. The recognition technology needs time to be trained and efficacy is yet to be verified.

Strategies & Case

The strategies we are proposing aim to learn from the past pilot programs and fill in the gaps of existing programs as listed above. The strategies include 1) women's priority seating and waiting area, 2) a social campaign to raise awareness of sexual harassment and encourage more victims to step up and speak out, and 3) a text reporting system for reporting harassment onboard. The strategies are designed to not separate women but to protect them from crowded buses, to not further 'victim shaming' but to publicly shame the offenders. We believe those human-oriented human-enforced interventions can fill in gaps of surveillance technology and foster a culture that collectively fights against harassment on public transit.

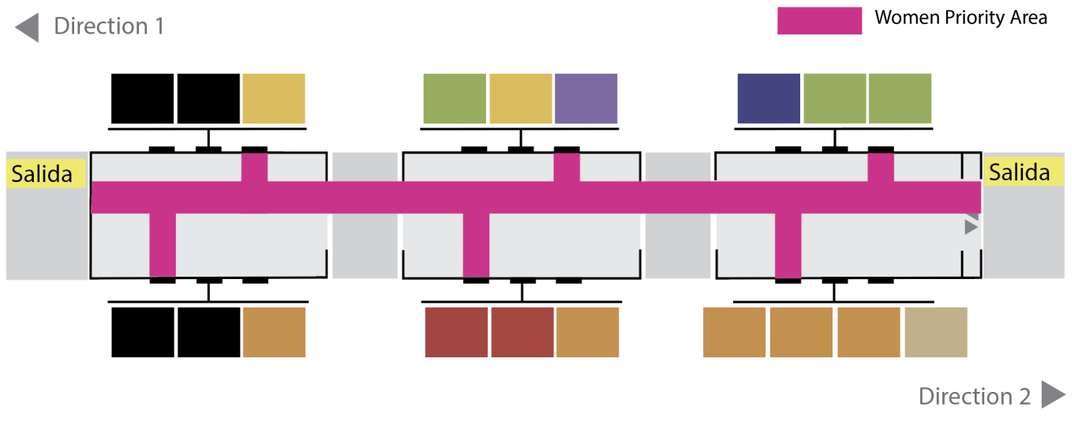
1. Priority Seating and Waiting Area
2. Social Campaign
3. Text Reporting System

1 Priority Seating and Waiting Area



Suggested Priority Seating:
20% of Total Seats

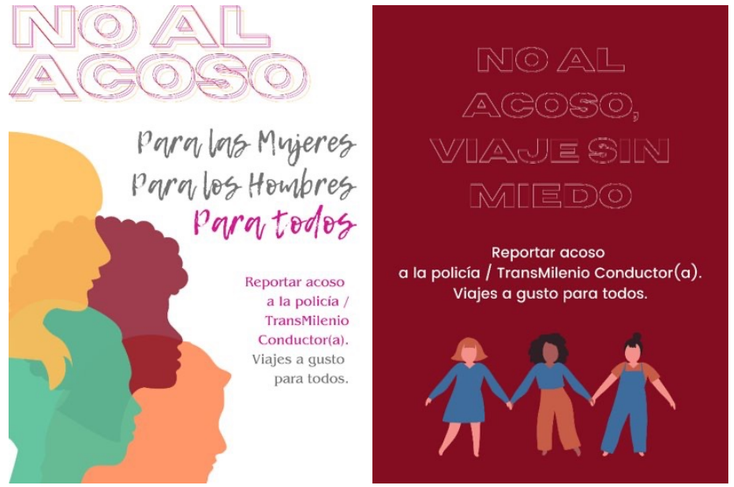
Given the halt of the previous women-only bus pilot program, we learned that running a completely women-only bus can be both costly and limiting. Hence, we are proposing women's priority seating (shown above) and waiting areas at stations (shown below). After referencing other types of priority seating in other countries, we are proposing a higher-than-average 20% of total seating to be women's priority seating. The seating should be located near the driver and should be implemented not only on TransMilenio but also on SITP buses. While one may argue that 20% is too high for current female ridership, it is possible that females choose not to ride right now due to safety concerns. The priority waiting area and seats may help boost female ridership and alleviate their safety concern and burden of choosing alternative ways of transportation, allowing for better mobility for females.



Proposal for Women Priority Waiting Area

2 Social Campaign

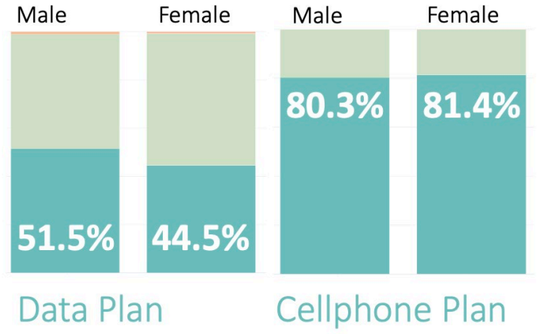
A social campaign can be helpful for fostering a culture of speak up. The sample posters on the right calls for 'protecting women/men/all' by reporting harassment to police or bus drivers. The posters can be put up on buses, at stations, and any public or community shared space. When the text reporting system (Strategy 3, details described below) is implemented, an instruction to the system can also be informed to passengers through posters and other forms of social campaign (e.g., websites or commercials).

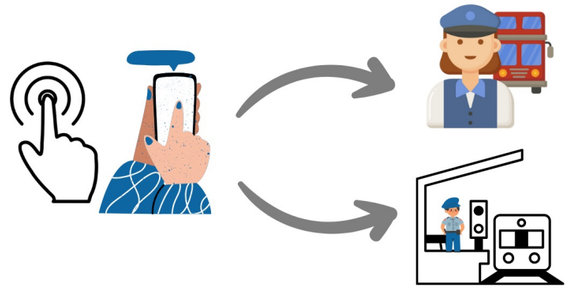


Sample Design for Posters

3 Text Reporting System

Harassment report system is not uncommon in Latin American countries. For instance, Quito, Ecuador has implemented a 'Stop the Harassment' hotline that allows passengers to report sexual harassment onboard via text. Using the Quito system as a model, we are proposing a similar report system on TransMilenio buses. Passengers can report harassment cases either using buttons on bus or through texting a hotline, and both the driver and police officers at the next stop will be notified. Given more than 80% of total population owns cellphone plan yet less than half owns data plan, text system allows most passengers to report cases.





Conclusion

Conclusion

This plan envisions Bogotá, Colombia as an expanding and transit-oriented city that is equitable for all residents by integrating affordable housing developments with accessible, high-capacity transportation systems. This overarching vision is enacted by addressing the city's current challenges of lack of accessible affordable housing, how to plan for the future of the metro, and safety and connectivity of the existing BRT. By addressing the lack of accessible affordable housing and setting guidelines for future housing developments, Bogotá will be able to create sustainable, long-term housing further into the periphery as the city continues to expand and grow. Through addressing transit-oriented development around the future metro stops, the city has the ability to capitalize on capital investments by densifying and developing the land to meet affordable housing demands. The low emission corridor and bike connectivity network help to make the city more sustainable for a greener future and provide additional comfort and connectivity to residents. The safety interventions help to address concerns, enable the transit system to be more user friendly, and work to support the beforementioned initiatives. By enacting these plans, Bogotá can become a more affordable, equitable, and accessible city with the tools to successfully continue their urban growth.

Appendix

References

Baker, Flora. “Bogota’s Female-Only Bus Carriage Expands to Peak Hour Services.” Colombia News | Colombia Reports, April 8, 2014. https://colombiareports.com/amp/bogotas-female-bus-carriage-continue-another-month/.

The Bogotá Care System, September 2022. https://www.brookings.edu/wp-content/uploads/2021/12/City-playbook_Bogota.pdf.

Ciudad Verde. https://ciudadverde.com.co/.

Como Vamos. https://escomovamos.org/.

Datos Abiertos Bogotá. https://datosabiertos.bogota.gov.co/.

“Datos Abiertos Colombia: Datos Abiertos Colombia.” la plataforma de datos abiertos del gobierno colombiano. https://www.datos.gov.co/en/.

“Departamento Administrativo Nacional de Estadística.” Departamento Administrativo Nacional de Estadística DANE. https://www.dane.gov.co/index.php/estadisticas-por-tema/demografia-y-poblacion/censo-nacional-de-poblacion-y-vivenda-2018.

“Descubre Ciudad Verde, Soacha.” Portal Ciudad Verde, October 28, 2023. https://miciudadverde.com/.

“Encuesta de Movilidad 2019.” Secretaría Distrital de Movilidad, August 27, 2022. https://www.movilidadbogota.gov.co/web/encuesta_de_movilidad_2019.

Lagos de Torca. https://lagosdetorca.co/web/.

“Lagos de Torca.” Inicio. https://www.habitatbogota.gov.co/proyectos-estrategicos/lagos-de-torca.

Localidad de Ciudad Bolívar. https://bogota.gov.co/mi-ciudad/localidades/ciudad-bolivar.

“Manual de Espacio Público 2023_.” Secretaría Distrital de Planeación. https://www.sdp.gov.co/content/manual-de-espacio-publico-2023.

Ministry of Foreign Affairs, Republic of China (Taiwan). “Taiwan Zips toward a Green Future with E-Scooters.” Taiwan Today, April 30, 2021. https://taiwantoday.tw/news.php?unit=3%2C7%2C11%2C16%2C19&post=199024.

“Mobility Hubs: Steering the Shift towards Integrated Sustainable Mobility.” UITP. https://www.uitp.org/news/mobility-hubs-steering-the-shift-towards-integrated-sustainable-mobility/.

Norway’s long-term low-emission strategy for 2050 - UNFCCC, October 2020. https://unfccc.int/sites/default/files/resource/LTS1_Norway_Oct2020.pdf.

“The Opportunity of Low Emission Zones: A Taming Traffic Deep Dive Report - Institute for Transportation and Development Policy.” Institute for Transportation and Development Policy - Promoting sustainable and equitable transportation worldwide, August 22, 2023. https://www.itdp.org/publication/the-opportunity-of-low-emission-zones-a-taming-traffic-deep-dive-report/.

Orozco, Jose. “La Rolita Electric Bus Company Prioritizes Gender Equity.” Bloomberg.com, May 8, 2023. https://www.bloomberg.com/news/features/2023-05-08/la-rolita-electric-bus-company-prioritizes-gender-equity.

“Primera Línea Del Metro de Bogotá (PLMB).” Metro de Bogotá | Inicia el proceso de contratación de la Línea 2 del Metro. https://www.metrodebogota.gov.co/?q=que-es-metro.

Using Transit-Oriented Development Interventions to Support Sustainable Territorial Developement in the Bogotá - Cundinamarca Region, October 2020. https://www.thegpsc.org/sites/gpsc/files/todknowdoc/final_version_technical_note_tod_and_lvc_in_bogota_-_cundinamarca_in_english_0.pdf.

“What Is Tax Increment Financing (TIF)? - The New School SCEPA.” Scepa. https://www.economicpolicyresearch.org/insights-blog/what-is-tax-increment-financing-tif.