

## **Building the World's Highest Subway:**

An Analysis of the Development and Financing of Line One of the Metro De Quito



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<sup>1</sup> Natalia Rivas and Pamela Ramón, “El Metro Está Pasando y Solanda Se Está Hundiendo,” La Barra Espaciadora, December 24, 2018, <https://www.labarraespaciadora.com/ddhh/el-metro-de-quito/>.

## **Abstract:**

Line One of the Metro de Quito (PLMQ) is nearing completion after more than a decade of planning and construction. When it is done, it will be the first subway system in the country as well as the highest in the world. Quito faces a unique set of mobility challenges that necessitate this massive undertaking. Mountains to the east and west of the city constrain growth to a dense north-south corridor as the population and automobile ownership rates continue to rise and traffic continues to worsen. Currently, the city has a fairly comprehensive bus and bus rapid transit (BRT) system but these too fall victim to traffic across the city. In the early 2010's, the city decided to take the next step in developing its public transit infrastructure by beginning to construct an underground metro system. The PLMQ will allow end to end travel in the city in under a half hour. However, the PLMQ would not have been possible for Quito to complete on its own. The PLMQ benefitted from a series of partnerships that addressed shortcomings of the current institutions in the city and country. Local groups conducted social and environmental impact surveys that guided how multilateral banks like the IDB, World Bank, EIB, and CAF helped fund the massive undertaking. Quito also benefited from knowledge sharing and technical support from the Metro de Madrid and other private contractors. The PLMQ, which is scheduled to open in February of 2022, is poised to reduce traffic, lessen pollution, and improve city life overall. This case is a great example of how multilateral finance can be a powerful force for good beyond just providing financial assistance. Multilateral financial institutions can also provide important environmental and social safeguards as well as technical expertise that makes projects like the PLMQ beneficial for residents.

## **Acknowledgements:**

I would like to take this opportunity to thank a number of people who are not cited or mentioned throughout this paper. First, I'd like to thank Janine Ferretti for guiding me through this process, providing advice and ideas, and constantly pushing me to dig deeper into this topic. I'd also like to thank Jorje and Maria Antoineta Zalles, not only for their help connecting me to stakeholders in Quito, but also for their endless hospitality during my time in Quito during the spring of 2019. Those months were formative to my interest in this project specifically, but more broadly in urban and transportation planning. Finally, I'd like to thank my partner, Margot, as well as my family and friends for their support through this past year. This would not have been possible without everyone above and I'm incredibly thankful for their help and support.

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## List of Acronyms and Abbreviations

- BRT: Bus Rapid Transit  
CAF: Corporación Andina de Fomento or Andean Development Bank  
DMPT: Dirección Metropolitana de Planificación Territorial  
EIB: European Investment Bank  
EPMMQ: Empresa Pública Metropolitana Metro de Quito  
IBRD: International Bank for Reconstruction and Development  
IDA: International Development Association  
IDB: Inter-American Development Bank  
IMF: International Monetary Fund  
MDB: Multilateral Development Bank  
PLMQ: Primera Línea del Metro de Quito  
SITP: Sistema Integrado de Transporte de Pasajeros  
UNFCCC: United Nations Framework Convention on Climate Change

## Introduction:

The city of Quito, capital of Ecuador, sits in the shadow of Volcán Pichincha 2850 meters above sea level. Once a hub of the Spanish Empire in the region, today the city is a hub for business, tourism, and culture as it houses one of the best-preserved historic city centers in the world. The city's population has grown at a rapid pace since the country's oil boom in the late 1970's and early 1980's. Along with the population, car ownership in the city has also grown at an incredibly fast rate. But spatially, the city's growth has been constrained to a tight north-south corridor due to the surrounding mountains. This has created immense issues surrounding traffic and mobility. The city has a bus and bus rapid transit (BRT) system, but these modes compete with private automobiles on heavily congested roads. The city faces mobility issues, traffic congestion, and air pollution due to overcrowded roads. In 2009, to respond to these mounting problems, the city decided to build a metro line.

Construction began in December 2012 and the service is expected to begin in February 2022.<sup>2</sup> The line will go from Terminal Quitumbe, a local and regional bus hub on the south end of the city to El Labrador, a smaller bus terminal in the north. The 15 stations on the line span 22 km of the city, covering population centers and



Fig. 1: Satellite Image of Quito, Credit: Google Maps

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<sup>2</sup> Metro De Quito. 2020. "Inicio." Metro De Quito. <https://www.metrodequito.gob.ec/>.

promising end to end travel in a little over a half hour, about a third of the current average travel time.<sup>3,4</sup> The PLMQ has been a massive undertaking for the city and after nearly a decade, it is finally nearing completion.

However, Quito has not been alone in its efforts with the PLMQ. It has benefited greatly from the support of multilateral finance and international partnerships sharing knowledge on how to build and operate a metro system. The PLMQ was necessary to address mobility challenges in Quito, but would not have been possible without collaboration in key areas such as technical capacity and financial support between the government, multilateral institutions, and other international partnerships. The success of the multilateral model in Quito is an important model for future projects that include lessons for both Multilateral Development Banks (MDBs) and countries taking money from these institutions. The PLMQ is a perfect example of what is possible when local ambitions and national priorities are in accord with the policy goals, environmental and social safeguards, and funding capabilities of MDBs.



## Why A Metro?

Quito's first Metro proposal came in 1972 from then-Mayor Sixto Durán Ballen.<sup>5</sup> He claimed traffic congestion was at a critical point and wanted to implement an underground rail system to connect the city longitudinally in a similar manner to the project that

Fig. 2: 1972 Plan for Metro de Ouito, Credit: Gamble

<sup>3</sup> See Appendix 1 for List of Stations and Parameters

<sup>4</sup> “Environmental Impact Study of the Metro de Quito First Line.” *Gesambconsult Consultores*. 71-72

<sup>5</sup> Gamble, Julie Catherine. "Visioning a Transit City: Citizen Participation and Transit Planning in Quito, Ecuador." <https://escholarship.org/uc/item/6qx4b0tc>. Pg. 54.

would eventually come to fruition nearly four decades later. However, at that time the city had other priorities and the metro was set aside.<sup>6</sup> Since that time, Quito has grown rapidly, traffic has worsened as car ownership rates rose faster than population growth, and it has implemented a number of public transit upgrades like BRT. However, the city has continued to face major mobility challenges.

Quito is challenged by a unique set of geographic constraints that make growth and mobility especially tough. The city has to contend with Volcán Pichincha looming over the

western side of the city and a number of smaller hills to the east that drop off to form the Inter-Andean Valley. The geographic constraints have forced urban growth in Quito to fill a narrow north-south corridor. The city has only recently begun expanding east, into the valley, as its population has rapidly grown over the past 60 years.<sup>7</sup> The urbanized area is nearly 50km from end to end but only averages 4 to 5km in width. Currently, there are a number of ways to get around in Quito and all of them are heavily

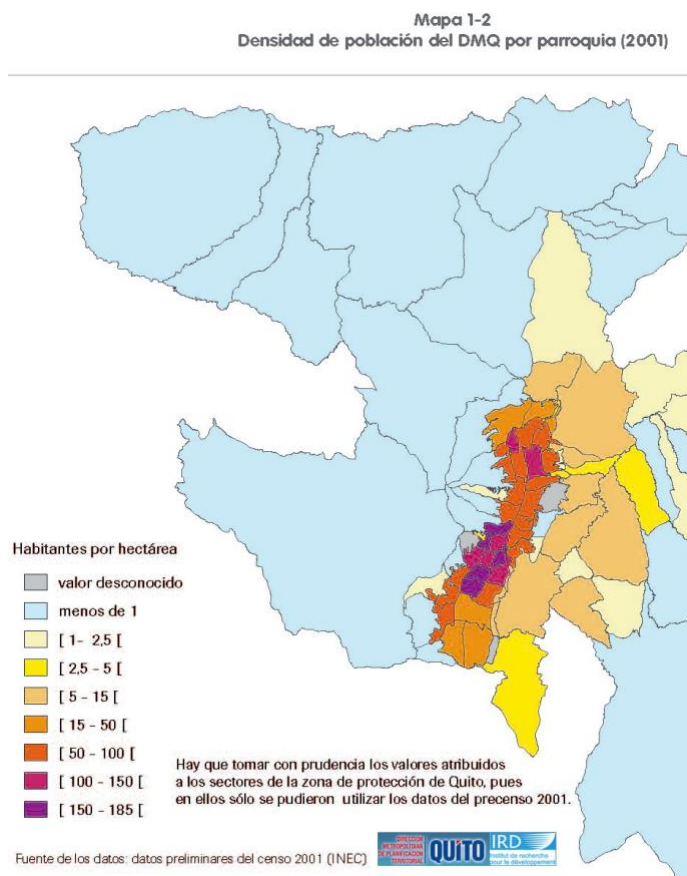


Fig. 3: Population Density of Quito, Credit Demoraes

<sup>6</sup> Gamble, Julie Catherine. "Visioning a Transit City: Citizen Participation and Transit Planning in Quito, Ecuador." <https://escholarship.org/uc/item/6qx4b0tc>. Pg. 55.

<sup>7</sup> "Environmental Impact Study" *Gesambconsult Consultores*. Pg. 71.



influenced by the geography that has shaped the city as a whole.

## Private Car Usage and Traffic:

One mode of transportation dominates the city streets: private automobiles. Reliance on private automobiles comes with a whole set of issues that are tough to deal with in any city, let alone a city without the room to continually expand roads to accommodate more car traffic. According to the Environmental Impact Survey completed in advance of the PLMQ, car ownership rates are outpacing population growth in the city; traffic congestion has become one of the biggest problems in the city.<sup>8</sup> The current road system is serving a volume of traffic beyond its capacity which brings the average travel velocity under 10km/h on many major roads residents rely on to move around the city.<sup>9</sup> The root of traffic issues in the city come from a seemingly low car ownership rate of 13% and a 27% share of overall trips made by car in the city.<sup>10</sup>

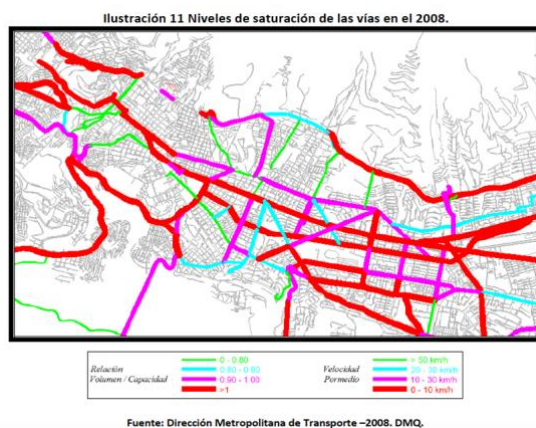


Fig. 4: Avg. Speed on Arterial Roads in Quito, Credit UNFCCC

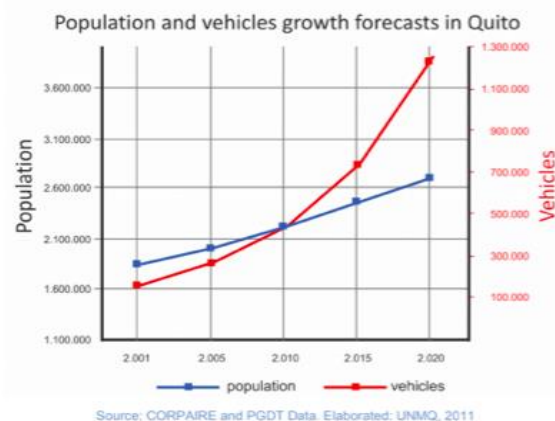


Fig. 5: Credit EPMMQ

<sup>8</sup> “Environmental Impact Study” *Gesambconsult Consultores*. Pg. 1.

<sup>9</sup> “New Mass Public Transportation System to Reduce the Use of Fossil Fuels.” UNFCCC. Pg. 31.

<sup>10</sup> “New Mass Public Transportation System” UNFCCC. Pg. 13.

In spite of the small percentage of car owners and lower percentage of trips in the city, private cars cause issues because they are incredibly inefficient from a spatial perspective. At full capacity, 5 passengers, the average compact car uses about 1.43m<sup>2</sup> of road space per passenger, by comparison the conventional bus uses 0.29m<sup>2</sup> per passenger and the articulated busses the city uses for BRT use 0.28m<sup>2</sup> per passenger. However, more often than not private cars are carrying a much lower percentage of their full capacity than busses and BRT which means the gap in spatial efficiency is only wider than it appears in this statistic. This data reflects the reality that widespread use of private cars in Quito is incredibly unsustainable from a mobility standpoint, and the continued growth of automobile ownership and share of overall travel are quite concerning for Quito's mobility prospects in the long term.

### Air Pollution:

Aside from time wasted sitting in traffic congestion, the amount of air pollution caused by cars is another issue prevalent in the lives of Quiteños. Pollution from combusted gasoline and diesel hangs over the city, and does not disperse like it would in a typical city. The nearby mountains cause atmospheric temperature inversions which keeps air pollution contained within the valley. An atmospheric temperature inversion occurs when warmer, less dense air moves over a colder, denser air mass.<sup>11</sup> The resulting structure means cold air in the valley is unable to mix with other cold air above and outside the valley, dispersing the pollution. This leaves the pollution trapped over the city as it becomes increasingly dense from motor vehicle emissions. A study of air pollution in Quito that took place in 2000 identified acute respiratory illness

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<sup>11</sup> Megan V. Brachtel et al., "Spatial and Temporal Variations and Mobile Source Emissions of Polycyclic Aromatic Hydrocarbons in Quito, Ecuador," *Environmental Pollution* 157, no. 2 (2009): pp. 528-536, <https://doi.org/10.1016/j.envpol.2008.09.041>, Pg. 529.

symptoms in 30% of children in the city overall, that number climbed to 70% when examining children in areas with high automobile traffic.<sup>12</sup> Quito has the worst air quality in Ecuador and faces major challenges with all kinds of air pollution and particulate matter.<sup>13</sup> For comparison, IQ Air ranks Quito's air quality about the same as it ranks Los Angeles' air quality.<sup>14</sup> Los Angeles is a city that has some of the worst air pollution in the US and is also partially due to a temperature inversion like in Quito.<sup>15</sup>

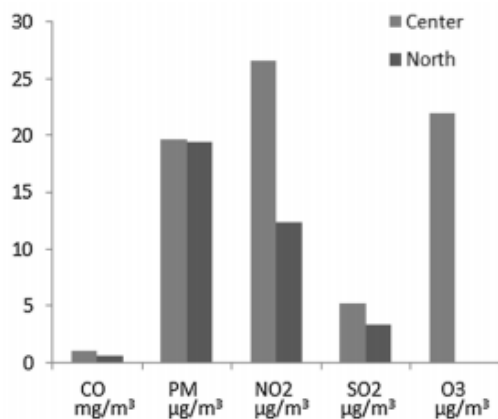


Fig. 6: Particulate Matter Concentrations across Quito, Credit: Estrella et. al.



Fig. 7: Low hanging clouds over Quito seen from Volcán Pichincha demonstrating a temperature inversion, Original Photo

The vast majority of Quito's air pollution is from motor vehicles, like privately owned cars, trucks and busses. 65% of nitrogen oxides, 28% of volatile organic compounds, and 98% of

<sup>12</sup> Bertha Estrella et al., "Air Pollution Control and the Occurrence of Acute Respiratory Illness in School Children of Quito, Ecuador," *Journal of Public Health Policy* 40, no. 1 (2018): pp. 17-34, <https://doi.org/10.1057/s41271-018-0148-6>, Pg. 18.

<sup>13</sup> Megan V. Bracht et al., "Spatial and Temporal Variations and Mobile Source Emissions of Polycyclic Aromatic Hydrocarbons in Quito, Ecuador," *Environmental Pollution* 157, no. 2 (2009): pp. 528-536, <https://doi.org/10.1016/j.envpol.2008.09.041>, Pg. 528.

<sup>14</sup> "Live Animated Air Quality Map (AQI, PM2.5...): AirVisual," Empowering the World to Breathe Cleaner Air, accessed March 31, 2021, <https://www.iqair.com/us/air-quality-map>.

<sup>15</sup> "Los Angeles Air Quality Index (AQI) and California Air Pollution: AirVisual," Los Angeles Air Quality Index (AQI) and California Air Pollution | AirVisual, accessed March 31, 2021, <https://www.iqair.com/us/usa/california/los-angeles>.

carbon monoxide emitted in the city originates from motor vehicles.<sup>16</sup> Private cars account for a disproportionate share of the pollution because they are generally much less efficient on a per passenger mile basis.<sup>17</sup> They have tried to reduce air pollution in a number of ways, most notably being the *Pico y Placa* Program. This program has successfully restricted certain cars from driving in the city center during peak hours. This program has been effective in reducing air pollution in the city by 9-11%.<sup>18</sup> This is a significant amount, but even greater reductions are possible if greater alternatives to driving are provided. Quito's unique geographic circumstances require a solution that drastically reduces air pollution and it makes sense to target the biggest contributors to the problem: motor vehicles.

## Noise Pollution:

Another consequence of the high volume of automobile traffic in the city is the high level of noise pollution. Chronic exposure to noises louder than 65dB can cause major psychological and physiological disturbances like hearing loss, sleep disturbances, stress, and

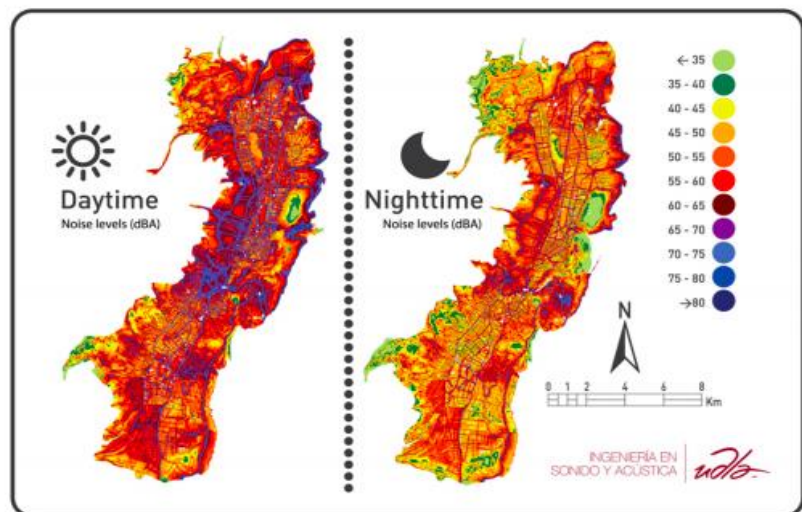


Fig. 8: Ambient Noise Level in Quito, Credit Bravo Moncayo et. al.

<sup>16</sup> "Environmental Impact Study" *Gesambconsult Consultores*. Pg. 66.

<sup>17</sup> Megan V. Brachtel et al., "Spatial and Temporal Variations and Mobile Source Emissions of Polycyclic Aromatic Hydrocarbons in Quito, Ecuador," *Environmental Pollution*, Pg. 528

<sup>18</sup> Paul E. Carrillo, Arun S. Malik, and Yiseon Yoo, "Driving Restrictions That Work? Quito's Pico y Placa Program," *SSRN Electronic Journal*, 2013, <https://doi.org/10.2139/ssrn.2240327>, 1539.

cardiovascular disease.<sup>19</sup> In cities, the main source of noise pollution is traffic. It averages around 80-90dB, well above the levels that are considered safe. In Quito, a quarter of residents live in areas with noise that exceeds 65dB during the day.<sup>20</sup> The areas that are most impacted are those along with major roads in the city center.

Automobiles dominate the city spatially and bring a whole host of issues along with them. From obvious impacts like traffic congestion, to more abstract ones like respiratory illnesses as a result of excessive air pollution and disturbed sleep stemming from noise pollution. It is clear cars cannot continue to be the dominant mode of transportation in the city. Their growing use in the city threatens resident's health and livelihoods, but the city does have a number of alternatives to address this reality.

## Non-Motorized Transportation

In addition to private automobiles, a number of residents use non-motorized modes to get around the city. Non-Motorized modes comprise about 15.6% of all trips in the city and include things like walking, which makes up 98% of non-motorized travel, and cycling, which is the other 2%.<sup>21</sup> Walking is critical to the function of any city. In Ecuador as a whole, there is a favorable mix of land use development and high access to shopping centers, meaning people generally can walk to access things they need in their neighborhoods like food, public transit,

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<sup>19</sup> Jake Hays, Michael McCawley, and Seth B.C. Shonkoff, "Public Health Implications of Environmental Noise Associated with Unconventional Oil and Gas Development," *Science of The Total Environment* 580 (December 9, 2017): pp. 448-456, <https://doi.org/10.1016/j.scitotenv.2016.11.118>, 449.

<sup>20</sup> Luis Bravo-Moncayo et al., "A Cost-Effective Approach to the Evaluation of Traffic Noise Exposure in the City of Quito, Ecuador," *Case Studies on Transport Policy* 7, no. 1 (2019): pp. 128-137, <https://doi.org/10.1016/j.cstp.2018.12.006>, 134.

<sup>21</sup> "New Mass Public Transportation System" UNFCCC. 13, 72.

and other services.<sup>22</sup> However, Ecuador did score lower than other Latin American countries on walking/cycling facilities and aesthetics.<sup>23</sup> This means that even though walking is feasible, it is not always a desirable or even safe option. Additionally, when needs are beyond the neighborhood, walking is a much less feasible option due to the city's elongated configuration, along with challenges related to air pollution and elevation.

Cycling is one of the most sustainable and efficient modes of transportation, both environmentally and spatially, yet it only makes up 0.31% of trips overall in the city.<sup>24</sup> Cycling is heavily concentrated in the city center, partially due to smaller streets with less car traffic.<sup>25</sup> These conditions are ideal for cycling even without infrastructure like bike lanes present. The city does have a bike lane system, but outside of the city center cyclist experiences are much more negative. The bike lane system is not comprehensive and there are a number of large, busy intersections across the city that are frequently cited by cyclists as a danger in spite of the presence of proper zebra crossings and bike lanes.<sup>26</sup> This reveals a larger design failure as roads in the city have generally been designed primarily for cars and cyclists have been an afterthought.

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<sup>22</sup> Gerson Ferrari et al., "Association between Perceived Neighborhood Built Environment and Walking and Cycling for Transport among Inhabitants from Latin America: The ELANS Study," *International Journal of Environmental Research and Public Health* 17, no. 18 (2020): p. 6858, <https://doi.org/10.3390/ijerph17186858>, 8.

<sup>23</sup> Gerson Ferrari et al., "Association between Perceived Neighborhood Built Environment and Walking and Cycling for Transport among Inhabitants from Latin America: The ELANS Study," *International Journal of Environmental Research and Public Health*, 8.

<sup>24</sup> "New Mass Public Transportation System" UNFCCC. 72.

<sup>25</sup> Julie Gamble, Bernhard Snizek, and Thomas Sick Nielsen, "From People to Cycling Indicators: Documenting and Understanding the Urban Context of Cyclists' Experiences in Quito, Ecuador," *Journal of Transport Geography* 60 (March 16, 2017): pp. 167-177, <https://doi.org/10.1016/j.jtrangeo.2017.03.004>, 173.

<sup>26</sup> Julie Gamble et al, "From People to Cycling Indicators: Documenting and Understanding the Urban Context of Cyclists' Experiences in Quito, Ecuador," *Journal of Transport Geography* 60 (March 16, 2017): pp. 167-177, <https://doi.org/10.1016/j.jtrangeo.2017.03.004>, 176.

## Public Transit Options:

Most notably, the city has developed a robust public transit system that serves a large percentage of city residents. The public transit options include and BRT corridors that run the length of the city and a bus system designed to feed into and supplement the BRT system. While Quito's public transit efforts are steps in the right direction, they do have their own shortcomings. Understanding Quito's public transit system is key to understanding mobility as a whole in the city.

The city's conventional bus network plays a vital role in the transportation ecosystem. Conventional busses operate in the same rights of way as other cars and trucks on the road, stopping to pick up passengers at stops along set routes. There are 146 bus routes in the urbanized area run by 44 different operators.<sup>27</sup> This bus system accounts for 74% of all public transit trips in the city, and 46% of all trips.<sup>28</sup>

While many residents rely on the bus system, it faces some serious challenges. The bus system lacks uniformity and integration stemming from the high number of different operators across the city. This makes it harder for passengers to access the information necessary to use the



Fig. 9: Conventional Busses in Quito, Credit UNFCCC

<sup>27</sup> See Appendix 2 for Full List of Bus Operators

<sup>28</sup> "New Mass Public Transportation System" UNFCCC. 13-14.

system. In the past, there have been problems with consistent timetables and consistent stops leaving many residents without the knowledge they need to get around. In addition to that, the conventional bus system does not have dedicated rights of way, leaving many busses stuck in the same traffic private cars are creating. With frequent stops to let passengers board and exit factored in, this makes the bus one of the slowest motorized modes of transportation in the city. In certain, older parts of the city the busses also have to contend with streets that are too narrow for them. The issues with conventional busses have a disproportionate impact on residents in the poorer, southern half of the city. In turn, Quito's most vulnerable residents face the longest commutes in the city.

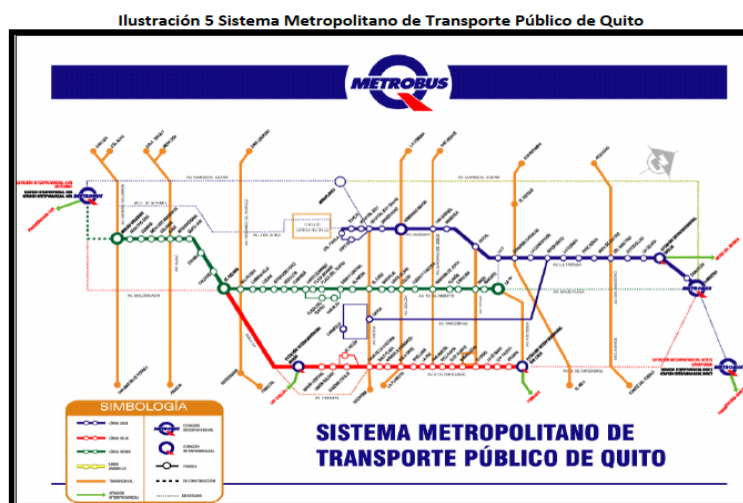


Fig. 10: Map of MetrobusQ BRT System, Credit, UNFCCC

To address the shortcomings of the conventional bus network, a BRT network was developed in the late 1990's. The BRT consists of 3 main lines: The Occidental, The Trolebus, and the Ecovía. These routes follow high density street corridors and allow for high volume rapid transit in dedicated rights of way reserved for these busses only.

Quito began its BRT system in 1995 at a time when the mode was especially popular in Latin America because of its relatively low cost and high efficiency.<sup>29</sup> It was originally under private operation but the government was quick to take over the system, lower fares, and expand service

<sup>29</sup> Laurel Paget-Seekins, "Bus Rapid Transit as a Neoliberal Contradiction," *Journal of Transport Geography* 48 (2015): pp. 115-120, <https://doi.org/10.1016/j.jtrangeo.2015.08.015>, 116.



which now makes up 16% of all trips in the city.<sup>30, 31</sup> The BRT succeeds in areas the conventional bus does not, it is much faster, more reliable, and a unified system. The city has given the BRT dedicated rights of way in the middle of main roadways, this means it does not have to sit in traffic with the rest of the motorized vehicles. The main challenge the BRT faces is that too many passengers take advantage of its fast and reliable service. According to the World Bank, during peak times each BRT bus carries 175 passengers, well over the maximum capacity of 165.<sup>32</sup> This overcrowding can cause its own delays, lengthen wait times, and lessen the quality of service for all riders.

The transportation ecosystem in Quito faces a number of challenges on all fronts. The overuse of cars clogs city streets and the public transit options are not sufficient to meet the demand of city residents. The city surface itself is saturated, adding another BRT corridor or expanding roadways would not be a viable option.

In 2009, Dr. Augusto Barrera ran for mayor of Quito, promising a Metro. Barrera, a member of Rafael Correa's Alianza País party, was heavily invested in the *Buen Vivir* policies being pushed at the federal level. Part of this policy included a number of large infrastructure projects.<sup>33</sup> Barrera saw his election as a mandate to fulfill the promises he made on the campaign trail, including an underground metro. These conditions, combined with a new focus on sustainability from multilateral institutions created the necessary conditions for the PLMQ to finally become a reality. In 2012, after years of planning, construction began on a metro line between two major transportation hubs on opposite ends of the city. Terminal Quitumbe in the

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<sup>30</sup> Laurel Paget-Seekins, "Bus Rapid Transit as a Neoliberal Contradiction," *Journal of Transport Geography*, 116.

<sup>31</sup> "New Mass Public Transportation System" UNFCCC. 13.

<sup>32</sup> Sameh Wabah and Grace Muhimpundu, "Visiting Ecuador's Very First Metro," World Bank Blogs, November 23, 2016, <https://blogs.worldbank.org/transport/visiting-ecuador-s-very-first-metro>.

<sup>33</sup> Gamble, Julie Catherine. "Visioning a Transit City". 36.

south, the southern terminus of the BRT system and the largest bus station in the city serving routes across the country, is one hub. The other is El Labrador, a hub in the north that serves two BRT lines as well as regional bus service. The PLMQ will wind its way across the city, serving high density zones and integrating with existing public transit infrastructure. It is set to be completed later this year and will completely alter the mobility structure of the city.

## Benefits of the PLMQ:

### Increased Mobility:

The most obvious benefit of the PLMQ is its speed and unimpeded right of way directly through the densest parts of the city. The PLMQ is expected to have an average speed of 37.5km/h, much faster than the speed of busses, private cars, and BRT.<sup>34,35</sup> It will complete trips across the entire city in a little under a half hour, about a third of what it would be travelling on other modes. This speed will have huge benefits for all city residents, it will shorten commutes, and make

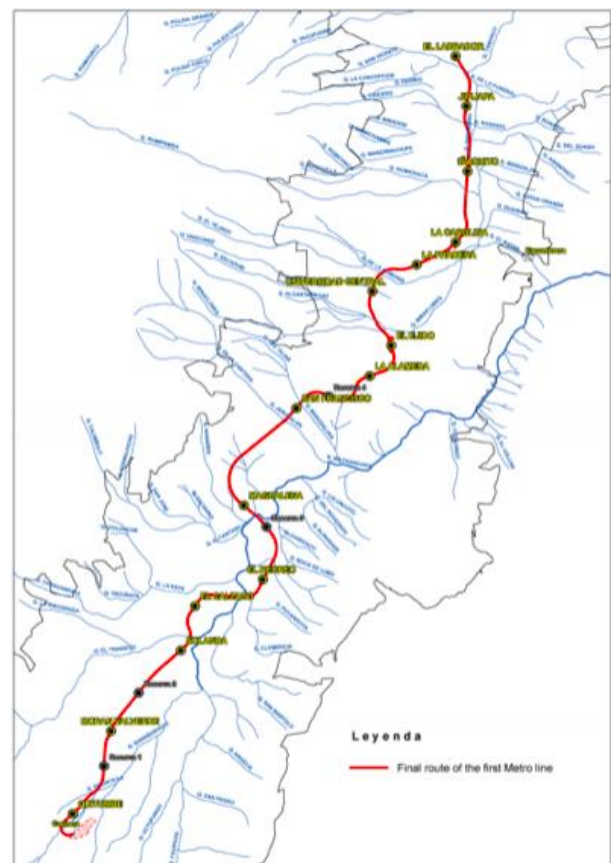


Fig. 11: Finalized Map of Line One of the Quito Metro, Credit EMMPQ

<sup>34</sup> World Bank. "Project Appraisal Document on a Proposed Loan in the Amount of US\$ 205 Million to the Municipality of the Metropolitan District of Quito with Guarantee of the Republic of Ecuador for a Quito Metro Line One Project." The World Bank Group. 27.

<sup>35</sup> "New Mass Public Transportation System" UNFCCC. 31-32.

all parts of the city more connected. This speed will not just benefit Metro riders, its impacts will be felt across all modes. Drivers who switch to the metro will help reduce traffic in the city and allow for faster trips by car. The PLMQ will also attract BRT riders and help alleviate overcrowding.

In addition to speed, Quito's spatial constraints demanded a solution that did not further congest surface level transportation. By going underground, the PLMQ avoids disrupting an entire corridor of the city. Quito has a fairly high population density and any above ground construction on a city-wide scale would need to displace countless residents and businesses. The PLMQ's only above ground footprint are the newly constructed stations, some of which integrate into existing BRT and Bus infrastructure. This means that the PLMQ can work in concert with the current transportation system and provide riders with a premium alternative to other modes.

### Sustainability and Environmental Benefits:

The PLMQ also presents a number of benefits for the city external to transportation as well. It also will contribute to lessening the carbon footprint of the city at large. The PLMQ itself will run on electricity, meaning that it will not contribute emissions directly into the city's air like most other vehicles, public and private, do.<sup>36</sup> In fact, the PLMQ is projected to remove 163,942 tons of CO<sub>2</sub> from Quito's air annually as drivers make the switch to faster public transit options like the PLMQ.<sup>37</sup> While much of Ecuador's electricity is currently generated by oil, the PLMQ uses energy in a more efficient manner than gasoline and diesel motor vehicles. In

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<sup>36</sup> "Environmental Impact Study" *Gesambconsult Consultores*. 66.

<sup>37</sup> "Environmental Impact Study" *Gesambconsult Consultores*. 100.

addition to this, the PLMQ is projected to compete with and reduce motor vehicle traffic in the city. This will further decrease the air pollution in the city.

The PLMQ will also lessen noise pollution in the city as well. As discussed, much of Quito's noise pollution is caused by cars, so the reduction in car trips will bring relief from the noise pollution.<sup>38</sup> In addition, since the PLMQ is completely underground, the soil surrounding Metro tunnels will dampen the noise from the trains to a nearly imperceptible level on the surface.<sup>39</sup>

### Long Term Urban Policy:

The PLMQ will also allow the implementation of SITP or *Sistema Integrado de Transporte de Pasajeros*. Since 2012, Quito has developed a plan alongside the PLMQ to integrate public transit options in the city, making it easier for passengers to transfer between modes of transport without redundant fares. Due to the overlapping layout of the BRT and Metro along with the intersecting bus

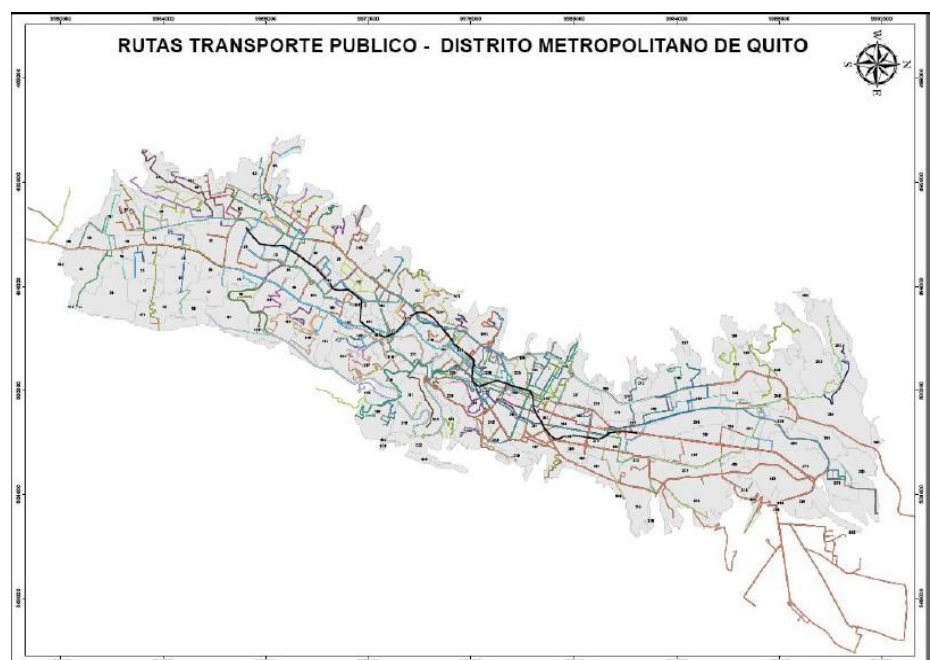


Fig. 12: Public Transit Routes in Quito, Credit: UNFCCC

<sup>38</sup> Luis Bravo-Moncayo et al., "A Cost-Effective Approach to the Evaluation of Traffic Noise Exposure in the City of Quito, Ecuador," *Case Studies on Transport Policy* 128.

<sup>39</sup> "Environmental Impact Study" *Gesambconsult Consultores*. 67.

network, transfers between modes are not only expected, but in many cases necessary.<sup>40</sup> In most cases, metro stations are in areas near one or more BRT stops, making transfers relatively easy from a logistical standpoint.<sup>41</sup> This plan seeks to create a unified fare payment system for the PLMQ, the BRT, and conventional busses to bring that level of ease to the financial side of the system. The PLMQ is set to serve as the backbone of this system, as it serves the highest density of riders with the greatest speed.<sup>42</sup>

Finally, the PLMQ is a very prestigious undertaking. Multiple sources contacted for this paper discussed how the PLMQ can be seen as a status symbol for the city and the country.<sup>43,44</sup> Metro systems are a larger investment than public transit modes like BRT and conventional bus networks; they demonstrate a commitment to mobility and sustainability. They are an opportunity for further development as areas around Metro stations become revitalized centers for economic opportunities. In Quito's case, the PLMQ is focused on bettering the lives of those at the bottom end of the city's income distribution.<sup>45</sup>

The PLMQ itself has created over 2200 construction jobs and over 1100 permanent jobs for residents, and its development will have spillover effects into the city's economy as a whole.<sup>46</sup> A study conducted by the American Public Transit Association concluded that investment in public transit not only provides short term stimulus to the local economy, but also

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<sup>40</sup> Efrain Bastidas Zelaya, "Analysis of Multistage Chains in Public Transport: The Case of Quito, Ecuador," *Libro De Actas CIT2016. XII Congreso De Ingeniería Del Transporte*, June 7, 2016, <https://doi.org/10.4995/cit2016.2016.3530>, 187.

<sup>41</sup> See Appendix 3 for Metro/BRT walkability map

<sup>42</sup> "Environmental Impact Study" *Gesambconsult Consultores*. Pg. 4.

<sup>43</sup> Interview with John Renshaw, 10/5/2020

<sup>44</sup> Interview with Carlos Perez Brito, 10/9/2020

<sup>45</sup> Interview with Mauricio Anderson, 12/17/2020

<sup>46</sup> "Environmental Impact Study" *Gesambconsult Consultores*. Pg. 72.

a long term positive impact on economic productivity.<sup>47</sup> In fact, public transit investment has been shown to have a five-fold impact in the larger economy, this means Quito could see as much as a \$10 billion increase in economic activity from this \$2 billion investment.<sup>48</sup> This could take a number of forms such as new businesses, the possibility of increased density in the city center, more free time for residents to take part in leisure activities, and cleaner air to make those activities more enjoyable. But one thing remains certain: increased mobility will improve economic prospects for the city.

## Capabilities of Ecuadorian Institutions Surrounding the PLMQ:

To successfully plan, build, and operate a metro system is no small undertaking. It requires a massive amount of financial resources and specific institutional knowledge. This was the first project of its kind in Ecuador, there was no domestic expertise on underground Metro systems. For a number of reasons, the capabilities to complete this project on its own were not present in Quito's and Ecuador's institutions before the development of the PLMQ. However, when they could, Ecuador's institutions did play a vital role in the development and analysis of the project in its early stages.

### Ecuador's Financial Status:

One of the biggest shortcomings was Ecuador's ability to pay for the project. Underground metro rail is one of the most expensive modes of transportation, about 5 times

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<sup>47</sup> "Economic Impact of Public Transportation Investment 2020 Update" (American Public Transit Association, April 2020), Pg. 1.

<sup>48</sup> "Economic Impact of Public Transportation Investment 2020 Update" (American Public Transit Association, April 2020), Pg. 1.

more expensive than BRT over time.<sup>49</sup> This is a huge barrier for any city considering building new underground rail in spite of its massive benefits. However, as discussed, the PLMQ was the best transit solution for the city in the long term considering its current needs and potential for growth. Any city would have trouble paying for such a large undertaking, in Quito's case, the total cost was around \$2 Billion USD. However, Ecuador faces a number of economic challenges that further constrict its ability to pay for large infrastructure projects like the PLMQ.

In the modern era, Ecuador's economy has been based on the export of natural resources, specifically oil. Ecuador saw a massive increase in economic activity during the late 1960's as oil reserves were opened up and the country began to export.<sup>50</sup> Much of the early exports were controlled by foreign capital, meaning that most of the profits left the country along with the oil. However, this period did mark the beginning of substantial economic growth for the country. During the 1970's the economy grew tenfold as the country continued to export oil and the economy was relatively stable through the 1980's and 1990's.<sup>51</sup>

In 1998, Ecuador faced its worst financial crisis ever. Falling oil prices triggered by crises in Asia; rising inflation, and a particularly damaging El Niño cycle caused both a banking and currency crisis that brought the country's economy to a grinding halt. GDP fell nearly 30% in 1998 as multiple banks closed.<sup>52</sup> The crisis spiraled out of control and eventually the government's only option was to switch the national currency to U.S. Dollars. After dollarization

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<sup>49</sup> Schabas, Michael. "Review of Metrolinx's Big Move." Neptis Foundation, 147.

<sup>50</sup> Dennis Michael Hanratty and Thomas E. Weil. *Ecuador: a Country Study*. Washington, DC: Federal Research Division, Library of Congress, 1991. 148.

<sup>51</sup> "GDP (Current US\$) - Ecuador," Data (The World Bank, 2020), <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?end=2019&locations=EC&start=1970>.

<sup>52</sup> Luis Ignacio Jácome, "The Late 1990's Financial Crisis in Ecuador: Institutional Weaknesses, Fiscal Rigidities, and Financial Dollarization At Work," *IMF Working Papers* 04, no. 12 (2004): pp. 1-43, <https://doi.org/10.5089/9781451842937.001>, Pg. 6.

the economy did stabilize and began to grow. However, the economy has remained reliant on exports, mainly oil and agricultural goods. While the country's economy has grown substantially since the crisis, it did not have the ability to fund a large, expensive infrastructure project like the PLMQ.

### Domestic Technical Knowledge:

In addition to insufficient financial resources, Quito and Ecuador did not possess the technical knowledge on the design, construction, and implementation of an underground Metro. In the past, Quito has implemented innovative solutions to combat its unique and challenging mobility circumstances. The city's BRT and conventional bus service mitigate a massive amount of traffic congestion and pollution and similar systems have been implemented in other cities in Ecuador like Guayaquil. There is plenty of domestic experience with bus and BRT systems. But, Quito's size and density have increasingly demanded higher volume solutions for which there was no domestic experience. In underground rail projects around the world, it is normal to bring in experts from the outside to share knowledge and help develop a successful plan and a successful system. One example of this is the DC Metro. When the DC Metro was in its early stages of development, they brought experts from New York, Boston, and Cleveland to share their expertise in the process of developing a new metro system for Washington D.C.<sup>53</sup> In the case of Quito and Ecuador as a whole, the knowledge required to plan, construct, and operate a Metro system was not present in domestic institutions. Therefore, outside help would be necessary in the development and implementation of this project.

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<sup>53</sup> Zachary M. Schrag, *The Great Society Subway: a History of the Washington Metro* (Baltimore, MD: Johns Hopkins Univ. Press, 2014), 35.



## Environmental and Social Impact Surveys:

There is one area where the city's and other domestic institutions were fully prepared and capable to execute: assessing and forecasting the effects of construction and implementation of the PLMQ. There are a number of fronts on which the impacts of projects are evaluated, and these lenses of analysis are assembled in reports and assessments. The Empresa Pública Metropolitana Metro de Quito (EPMMQ) conducted an environmental impact study in partnership with Gesambconsult, a local consulting firm, that looked at the environmental impacts of mobility in Quito before the PLMQ, of the construction process, and the expected results after the PLMQ is completed. In addition to the environmental study, there was a social impact survey conducted by the Ekos Corporation, another local consulting firm. Both of these studies show the strongest aspect of local and domestic institutions: evaluating the current situation. These reports were vital in the planning and implementation of the PLMQ and were a necessary prerequisite for acquiring funding from MDBs.

The Environmental Impact Study covers a broad range of issues pertaining to mobility and the environment in Quito. The study opens with a justification for the PLMQ and an analysis of the goals the city wants to fulfill through the implementation of the project. The objectives of the study itself consist of the following points:

- a. Analyze and describe the area where the project will be carried out.
- b. Identify the significant impacts.
- c. Evaluate the environmental impacts.



Fig. 13: Diagram of Quitumbe Garage and Workshop as shown in the Environmental Impact Survey, Credit EPMMQ

- d. Establish measures in order to take advantage of positive impacts and mitigate the negative ones.
- e. Design a set of management plans that enable the monitoring and following up on the main impacts <sup>54</sup>

The study goes on to provide a comprehensive analysis of the environmental state of the city and the land it occupies. It contains sections on general climate, hydrogeology, geology, built environment, as well as seismology and anticipated vibrations from the PLMQ itself.<sup>55</sup> The study then analyzes the civil works aspects of the project: the route and locations of stops, the types of structures to be built, electrical infrastructure, and passenger amenities among other items.

With a full picture of the PLMQ, the study then moves to identify the negative impacts in the environmental and social of the construction process and introduces strategies for mitigation during this period. In addition, it explores the longer-term positive outcomes that will be realized the operation phase that ultimately justify the project. The survey features a comprehensive set of plans for the mitigation of climate change, air contamination, biological and water contamination, and mobility deterioration during the construction process along with a number of other factors.<sup>56</sup> In addition to the mitigation measures, the PLMQ also outlines plans for occupational safety, emergency management, community outreach, waste management, cultural preservation, rehabilitation of affected areas, and closing/abandonment. The study concludes that

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<sup>54</sup> “Environmental Impact Study” *Gesambconsult Consultores*. 2-3.

<sup>55</sup> “Environmental Impact Study” *Gesambconsult Consultores*. I-II.

<sup>56</sup> “Environmental Impact Study” *Gesambconsult Consultores*. II.

despite potential negative outcomes, with the proper safeguards the PLMQ will be of great benefit to the city of Quito.<sup>57</sup>

The social impact study was done by Ekos Corporation, another local consulting firm.<sup>58</sup> The main goal of this study was to identify relevant stakeholders and analyze the social and economic impacts the PLMQ would have across the city. They identified stakeholders by looking at major groups within the city like public and private transport, non-motorized transport, public services, civil society, political actors, habitants of the city, and commercial interests. They looked at the levels of interest and influence as well as support for the project among different groups within the city. Upon identifying stakeholders, Ekos conducted both a quantitative analysis and qualitative analysis of each actor in the process.

The quantitative process used telephone surveys with closed questions about socioeconomic status, mobility characteristics, and the PLMQ itself. The surveys were targeted toward areas surrounding Metro stations and a representative sample was calculated. They conducted interviews with nearly 7,000 interlocutors from groups like bus drivers, public transit users, taxi drivers and riders, parking attendants, pedestrians, cyclists, as well as the general public.<sup>59</sup> Through their surveys, they discovered the project had broad support as the best option to solve mobility issues in the city across different groups. Most groups demonstrated between 60 and 75% support for the project.<sup>60</sup>

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<sup>57</sup> “Environmental Impact Study” *Gesambconsult Consultores*. 99-100

<sup>58</sup> “Estudio de Caracterización Social, Económica Y Análisis de Evaluación de Medios de Transporte de la Población Del Distrito Metropolitano de Quito en Referencia Al Proyecto Del Metro de la Ciudad de Quito” (Quito, EC: Spectrum Opinión y Mercado, 2012), pp. 8-284, 1.

<sup>59</sup> “Estudio de Caracterización Social, Económica Y Análisis de Evaluación de Medios de Transporte”, pg. 59.

<sup>60</sup> “Estudio de Caracterización Social, Económica Y Análisis de Evaluación de Medios de Transporte”, pg. 62-105.

The qualitative analysis was conducted with people in positions of influence like political figures, heads of bus and taxi cooperatives, local employers, nearby businesses, local organizations focused on mobility, local opinions leaders, and street vendors among other stakeholders. This section includes

interview-style questions on perceptions of the public transit system, perceptions of cities with a metro, knowledge of the proposed Metro project, and anticipated impacts from construction and implementation.<sup>61</sup> This section also found a broad base of support for the PLMQ. The interviews are then used to extrapolate a matrix of strengths and weaknesses as well as opportunities and threats for different stakeholders. These matrices are intended to be a tool to help the PLMQ reach out to the community, address concerns, and highlight future benefits.

Through its comprehensive analysis of stakeholders across the city, the social impact survey works not only to anticipate impacts on the community, but provides a framework for the PLMQ to reconcile concerns and build consensus where it is not present. That being said, the study does reveal incredibly broad-based support across income, level of influence, and role in the community.<sup>62</sup> This study successfully and convincingly shows how the residents feel about

Gráfico 5.1. Posición vs Influencia de los Actores Sociales cuantitativos relacionados al proyecto METRO de Quito.

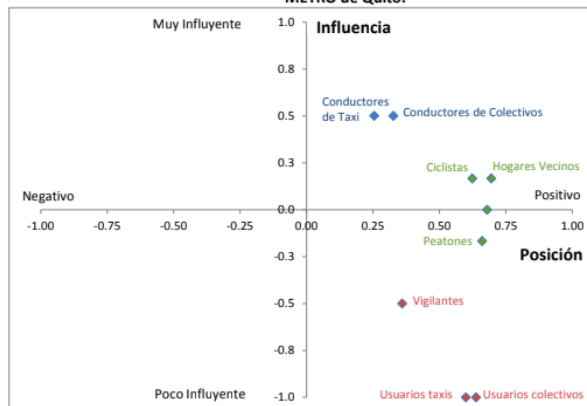


Fig. 14: Graph showing Stakeholder Influence and Opinion of the Metro, Credit EKOS Corporation

<sup>61</sup> “Estudio de Caracterización Social, Económica Y Análisis de Evaluación de Medios de Transporte”, pg. 106-174.

<sup>62</sup> “Estudio de Caracterización Social, Económica Y Análisis de Evaluación de Medios de Transporte”, pg. 196.

the PLMQ and it shows how to streamline public outreach to make the project even more effective and popular.

Despite not having the financial and technical capacity to carry out this project on its own, Quito and Ecuador demonstrated that they possess vital capabilities surrounding localized knowledge and connections to make the project successful. PLMQ has been an incredibly expensive and technically complex project, but it would not have been possible without the initial analyses conducted by local firms in partnership with the PLMQ. In these firms, experts used localized knowledge of the natural and built environment as well as social and economic dynamics to lay the groundwork for the PLMQ once funding and technical knowledge was secured.

## Partnerships that Addressed Shortcomings:

In starting to seek funding for the PLMQ from MDBs, Quito first had to conduct the above analyses of the project to be in compliance with the environmental and social safeguard regimes present with each MDB involved in the funding of the PLMQ. By making these kinds of studies a necessary precondition, MDBs can ensure projects they decide to fund fall in line with their own agendas. In addition, these requirements provide the space for local entities to invest in thoroughly analyzing potential impacts as a sort of down payment on the access to capital and technical expertise provided by MDBs

While the knowledge possessed by locals was vital to formulate and direct the project, outside help in the forms of financial support and technical knowledge sharing were vital in the realization of the PLMQ. Quito was able to take advantage of outside resources through its relationship to multilateral institutions like the IDB, World Bank, Andean Development Bank

(CAF), and the European Investment Bank (EIB) as well as a technical partnership with the Madrid Metro.

### Financial Partnerships:

The initial budget for the project was \$1.5 billion USD, and Ecuador's contribution toward that cost was to be divided between a number of domestic institutions: \$200 million USD from the Banco del Estado, \$153 million USD from the Bank of the Ecuadorian Social Security Institute, \$53 million USD from the federal government, and \$200 million USD from the municipal district, with much of that funding coming from revenues from the new airport.<sup>63</sup> In addition to these sources, the rolling stock was purchased with \$188 million USD of supplier credit.<sup>64</sup> The sum of domestic financing was nearly \$800 million USD, leaving an initial budgetary gap of around \$700 million.

This left a large gap in funding to be filled by a number of multilateral partners from which the PLMQ received an unprecedented amount of support. Those institutions included The IDB, The World Bank, the EIB, and CAF. Not only did these organizations work with the city on this project, but with each other to ensure the process met all of the environmental and social standards put forth by each institution. This required the implementation of protocols for cooperation between organizations that usually work on projects alone. In addition to the financial support, the PLMQ also benefited from technical knowledge sharing from the Madrid

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<sup>63</sup> World Bank. "Project Appraisal Document on a Proposed Loan in the Amount of US\$ 205 Million to the Municipality of the Metropolitan District of Quito with Guarantee of the Republic of Ecuador for a Quito Metro Line One Project." The World Bank Group. Pg. 63.

<sup>64</sup> World Bank. "Project Appraisal Document on a Proposed Loan in the Amount of US\$ 205 Million to the Municipality of the Metropolitan District of Quito with Guarantee of the Republic of Ecuador for a Quito Metro Line One Project." The World Bank Group. Pg. 6.

Metro among other foreign contractors with underground metro experience. These partnerships were incredibly important in the development and execution of the PLMQ.

The IDB serves Latin America and the Caribbean. It was founded in 1959 under the framework of the Organization of American States. It is the largest source of multilateral finance for the region and is made up of 48 member states.<sup>65</sup> It includes the vast majority of countries in the region as well as the U.S., Canada, much of the EU, China, Japan, and South Korea. They lend to governments and governmental entities to support projects related to economic and social development. In the past the bank has prioritized infrastructure development and combating climate change, making the Quito Metro Line One a fitting project for the bank to take on.

In total the IDB contributed \$450 Million USD toward building the PLMQ, and an additional \$1.5 million USD went toward organizational and institutional strengthening of the EPMMQ.<sup>66</sup> The first \$200 million was approved in 2012 and an additional \$250 million was approved in 2018. The bulk of the money was designated to go toward three components of the project: civil works, rolling stock, and technical assistance. The IDB sought to coordinate funding between multilateral institutions as well as ensure adherence to its own environmental and social safeguards as well as policy goals. This project ties in to the bank's larger Regional Environmental Sustainable Transport action plan, a framework that mainstreams climate change mitigation in the bank's transportation projects.<sup>67</sup> The bank also became involved as the lead institution to procure funding from the EIB and CAF, making full funding of this project possible. The terms of the loan agreement with the IDB specify the project had to meet a number of special conditions for the money to be disbursed. These include securing the EIB and CAF

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<sup>65</sup> "Overview," IADB, 2020, <https://www.iadb.org/en/about-us/overview>.

<sup>66</sup> "Projects Search," IADB, accessed September 15, 2020, <https://www.iadb.org/en/projects-search?country=EC&or=TR&status=&query=>.

<sup>67</sup> "Transportation," IADB, 2020, <https://www.iadb.org/en/topics/transport/transportation>.

loans, investments from public institutions in Ecuador (Bank of the Ecuadorian Social Security Institute, Banco del Estado, national government, and the municipal government), submitting to IDB operating regulations such as audits and reporting, submitting a draft of the SITP plan, evidence that the Bank's environmental and social terms are met, and submitting the plan for the organizational structure of the EPMMQ.<sup>68</sup> All of these terms were met and the IDB disbursed the full amount promised. With all of these terms, the bank could ensure the money was being used in ways that not only benefited Quito and its residents, but also furthered the policy goals of the bank itself.

The World Bank was formed after World War Two as a partner to the International Monetary Fund in the Bretton Woods Agreement. It works to provide grants and loans to middle- and low-income countries to pursue projects they would not be able to fund on their own. The bank's main mission is to reduce poverty, but it also works toward fulfilling the UN's millennium development goals. The World Bank has two main branches, The International Bank for Reconstruction and Development (IBRD) which has 189 member countries, and the International Development Association (IDA) which has 173 member countries. The section of the bank involved with the project in Quito was the IBRD.

The World Bank initially loaned \$205 million USD in 2013, due to the collaborative nature of the involvement of multilateral institutions the terms of this loan are very similar.<sup>69</sup> The World Bank did specify a five-part plan for the project:

- i. Construction of Two Metro Stations (La Magdalena and El Labrador)

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<sup>68</sup> "EC-L1111 : Quito Metropolitan Urban Transport System." IADB. [www.iadb.org/en/project/EC-L1111](http://www.iadb.org/en/project/EC-L1111). Pg. IV.

<sup>69</sup> World Bank. "Project Appraisal Document on a Proposed Loan in the Amount of US\$ 205 Million to the Municipality of the Metropolitan District of Quito with Guarantee of the Republic of Ecuador for a Quito Metro Line One Project." The World Bank Group. Pg. i.



- ii. Infrastructure and Equipment Investment (13 metro stations, 23km of tunnels, a rail yard, and system-wide facilities)
- iii. Provision of Train Sets (Eighteen six-car sets, auxiliary vehicles for yard work and track maintenance)
- iv. Project Management,
- v. Technical Studies (Implementation of Metro, Implementation of SITP)<sup>70</sup>

However, this was not the only loan disbursed by the World Bank. In 2018, they disbursed another \$230 million USD in additional financing to cover a gap in funding.<sup>71</sup>

The European Investment Bank (EIB) is a publicly owned, multilateral financial institution made up of EU member states. It was founded in 1958 when the Treaty of Rome came into effect, and it now oversees over \$230 Billion USD in funds making it the largest publicly owned multilateral bank in the world. It is a “policy-driven bank” meaning that its goal is to use financial power to further the EU’s policy goals at home and abroad.<sup>72</sup> When lending outside of the EU, the bank focuses on projects that will develop new infrastructure and promote environmental sustainability and EU presence. The bank also seeks to promote public-private partnerships.

The PLMQ fits all of these categories so the bank loaned €200 million in 2013.<sup>73</sup> In its own documentation, the EIB stressed that the project should not just adhere to Ecuadorian

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<sup>70</sup> World Bank. "Project Appraisal Document on a Proposed Loan in the Amount of US\$ 205 Million to the Municipality of the Metropolitan District of Quito with Guarantee of the Republic of Ecuador for a Quito Metro Line One Project." The World Bank Group. Pg. i.

<sup>71</sup> World Bank. "Project Paper on a Proposed Additional Loan in the Amount of US\$230 Million to the Municipality of the Metropolitan District of Quito with Guarantee of the Republic of Ecuador for the Quito Metro Line One Project" The World Bank Group. Pg. 15.

<sup>72</sup> Eib. "METRO DE QUITO." Homepage. European Investment Bank, [www.eib.org/en/projects/pipelines/all/20110297](http://www.eib.org/en/projects/pipelines/all/20110297).

<sup>73</sup> Eib. "METRO DE QUITO." Homepage. European Investment Bank, [www.eib.org/en/projects/pipelines/all/20110297](http://www.eib.org/en/projects/pipelines/all/20110297).

standards, but also EU standards surrounding public consultation and stakeholder engagement. In addition to those points, the EIB also required a resettlement framework and action plan to address the residents who will be displaced by construction. The EIB also noted that their participation in the project was in part to open the way for EU based contractors in a competitive bidding process. In 2016, the bank loaned an additional €40 million to cover additional costs.<sup>74</sup>

The CAF comprises many Latin American countries and Spain. It was founded in 1970 and comprises 17 member countries and 15 private banks.<sup>75</sup> The bank seeks to promote sustainable development and regional integration in Latin America and is one of the main sources of multilateral funding for the region.<sup>76</sup> In addition to financing, the bank also works to provide technical assistance to support the implementation of its projects.

The CAF initially loaned \$250 million USD for the project in 2012 and an additional \$152 million USD in 2018 for the second phase of construction.<sup>77</sup> CAF documentation is notoriously hard to find, they do not have the same level of transparency as the other financiers involved in this project. What is known is their contributions were made within the harmonized set of standards put forth by the IDB under the cooperation agreement between the financial institutions.

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<sup>74</sup> Eib. "METRO DE QUITO." Homepage. European Investment Bank, [www.eib.org/en/projects/pipelines/all/20110297](http://www.eib.org/en/projects/pipelines/all/20110297).

<sup>75</sup> "About CAF - Brief History," About CAF - Brief History, 2011, <https://web.archive.org/web/20071024194507/http://www.caf.com/view/index.asp?pageMS=41245&ms=17#>.

<sup>76</sup> "About CAF - Brief History," About CAF - Brief History, 2011, <https://web.archive.org/web/20071024194507/http://www.caf.com/view/index.asp?pageMS=41245&ms=17#>.

<sup>77</sup> "CAF Projects," CAF (CAF, 2020), <https://www.caf.com/en/projects/?kw=Metro%2Bde%2BQuito&parent=0&sd=&ed=&reset=true>.

In total the project has cost around \$2 billion, about \$500 million more than the original budget.<sup>78</sup> In addition to the increased overall cost, multilateral finance spent an additional \$632 million than originally estimated due to shortfalls in domestic funding sources. Without the flexibility and capacity of these multilateral institutions, the PLMQ could not have been funded.

### Multilateral Bank Coordination:

One of the most remarkable aspects of this project was the collaboration between multilateral finance institutions. Typically, even though many institutions work alongside each other, working together on the same project is much less common. To ensure efficient cooperation, the institutions had to create a framework for collaboration.<sup>79</sup> The IDB was designated as the lead for all matters related to procurement, social and environmental safeguards, and financial management for the project. This is because the IDB was the first finance institution working on the project and had guidelines set before other institutions came into the picture. The institutions also created a coordination committee with one representative from each financier. They were tasked with overseeing the project implementation as well as reporting back to the institutions on the status of the project.<sup>80</sup>

As stated above, the IDB was designated the lead and the procurement was set to their policies. However, the procurement policies of the World Bank were set to apply in cases of involvement from firms, and the procurement of goods, works, and non-consulting services from

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<sup>78</sup> World Bank. "Project Paper on a Proposed Additional Loan in the Amount of US\$230 Million to the Municipality of the Metropolitan District of Quito with Guarantee of the Republic of Ecuador for the Quito Metro Line One Project" The World Bank Group. 15.

<sup>79</sup> "Principles of Collaboration: Quito Metro Line One Project." Washington, DC: The World Bank, December 6, 2013.

<sup>80</sup> "Principles of Collaboration: Quito Metro Line One Project." Washington, DC: The World Bank, December 6, 2013. Pg. 3.

countries outside the scope of the IDB. In turn, the IDB agreed to apply the World Bank's debarment and suspension list to ensure firms sanctioned by the World Bank for fraud and corruption were not awarded contracts.<sup>81</sup> The institutions agreed to harmonize their bidding requirements and have full inter-institution transparency on matters related to procurement.

Despite taking the lead on environmental and social safeguards, the IDB was not necessarily in control of all of the standards set forth for the project. According to the Principles of Collaboration, "[T]he Project shall be carried out pursuant to, and in compliance with, the environmental and social policies, practices, procedures and guidelines of each financier."<sup>82</sup> The goal was for the financiers to reach a mutually acceptable position. The IDB's leadership role meant organizing meetings to discuss safeguards, chairing those meetings, attempting to coordinate safeguard supervision, and reporting joint communications to the Borrower, in this case being the EPMMQ. If a mutually acceptable position was unable to be met, it would be turned over to the Coordination Committee and later the management of each financier if a mutually acceptable position could still not be reached.

Through the development of these principles of coordination, the IDB, World Bank, CAF, and EIB were able to successfully fund the development and construction of the PLMQ. Without this collaboration, the project would not have received the necessary funding and Quito would be facing a worsening mobility reality. In addition, the participation and collaboration between these institutions created a web of social safeguards, environmental safeguards, and best practices for occupational health and cultural patrimony that proved to be an asset for all involved with and impacted by the project.

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<sup>81</sup> "Principles of Collaboration: Quito Metro Line One Project." Washington, DC: The World Bank, December 6, 2013. Pg. 4.

<sup>82</sup> "Principles of Collaboration: Quito Metro Line One Project." Washington, DC: The World Bank, December 6, 2013. Pg. 6.

## Technical Knowledge Sharing Process:

Another area where international cooperation has proven to be vital has been with the Madrid Metro's involvement in technical knowledge sharing and organizational development. The Madrid Metro opened in 1919 and now operates a nearly 300km network.<sup>83</sup> Representatives in Quito had been working with the Madrid Metro as far back as 2009 to receive technical assistance and advisory support on matters related to design, technical specifications, financial and economic feasibility studies, and the development of a finance structure for Quito's planned metro.<sup>84</sup> As such, the IDB included a provision in its loan contract with Quito that the Madrid Metro will run Quito's Metro for the first three years as a form of financial risk mitigation. During that time, there will be a gradual handover to the EPMMQ. By taking advantage of Madrid's experience, Quito receives a well-managed metro and the knowledge to continue its success after their partners from Madrid leave.

## Outcomes for Quito:

While the expected opening of the PLMQ has been pushed back a number of times, at this time it is expected to open in February of 2022.<sup>85</sup> According to the Metro's website, the project is 98% complete and they are currently testing the trains on the tracks. Despite not having served a single passenger yet, stakeholders across the board are interested in the outcomes of the project and want to figure out its exact impact on mobility and life in Quito.

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<sup>83</sup> "Metro in Figures," Metro de Madrid (Metro de Madrid, 2020), <https://www.metromadrid.es/en/who-we-are/metro-in-figures>.

<sup>84</sup> Interview with Mauricio Anderson, 12/17/2020

<sup>85</sup> Metro De Quito. 2020. "Inicio." Metro De Quito. <https://www.metrodequito.gob.ec/>.



Fig. 15: Tunnel Boring Machines at work in Quito, Credit EPMMQ

One way stakeholders have tried to evaluate the outcomes is by setting up a quantitative set of goals for the PLMQ to fulfill. The World Bank compiled a set of quantitative goals that have been updated as the PLMQ progresses toward service. Many of these goals reflect no status currently simply because the PLMQ is not open yet. Goals like passengers per day, Greenhouse Gas Emissions in the city, and percentage of satisfied users cannot be quantified until the PLMQ begins operations.<sup>86</sup> However, once the PLMQ does begin operations, the goals are very reasonable. The passengers per day goal is 295,999, this is well within the EPMMQ's own capacity projections for metro systems.<sup>87</sup> The GHG emissions goal is for the PLMQ to remove 58,170 tons of GHG emissions from the transport sector, this is also within reach based on the EPMMQ's own projections.

There are some intermediate goals that the World Bank included to ensure the project stayed on track. Goals like percentage of civil works completed, rolling stock completed, and stations completed are all nearly done.<sup>88</sup> The civil works and stations were both over 99%

<sup>86</sup> "World Bank Project : Quito Metro Line One - P144489." World Bank. [projects.worldbank.org/en/projects-operations/project-detail/P144489](https://projects.worldbank.org/en/projects-operations/project-detail/P144489).

<sup>87</sup> "Environmental Impact Study" *Gesambconsult Consultores*. 4.

<sup>88</sup> "World Bank Project : Quito Metro Line One - P144489." World Bank. [projects.worldbank.org/en/projects-operations/project-detail/P144489](https://projects.worldbank.org/en/projects-operations/project-detail/P144489).

complete and the rolling stock was 80% as of Nov. 10th, 2020 when the goals were last updated. Aside from these, they also are tracking goals related to the SITP, like the percentage of Bus Fleet under a unified fare system, and feeder routes completed. The EPMMQ has yet to make progress on these goals; when they were last updated were still at 0%. In addition to the easily quantifiable infrastructure goals, the World Bank is tracking the implementation of social safeguards, specifically related to gender protections. The goals put forth were to implement a reporting mechanism for gender-based violence taking place in the PLMQ and hiring a 20% female staff directly employed by the EPMMQ. As of November 10th, both of these goals remain incomplete.<sup>89</sup>

However, there is more to evaluate than quantitative standards and the implementation of programs in the progress and expected impacts of the PLMQ. One other metric is the opinions of those involved with the implementation of the project. Over the course of this project, I spoke with a number of people involved with the PLMQ and the financiers to understand their perspective and to obtain their opinion on whether or not the project was successful during its development and implementation and will be successful as it begins operations.

John Renshaw is an independent social development contractor who was involved with the IDB's social safeguards program for the project. He is an expert on poverty reduction and social aspects of large-scale infrastructure projects. In my discussion with him, he outlined what he thought set Quito up for success in this endeavor. First, by choosing an underground metro, the city began with a blank slate and did not have to work around existing transportation networks. In Renshaw's view, this made the planning and implementation much simpler.<sup>90</sup> In

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<sup>89</sup> See Appendix 4 for WB Status as of 3/29/2021

<sup>90</sup> Interview with John Renshaw, 10/5/2020

addition to this, he noted the city's existing BRT network was a great asset as planners could naturally integrate the two systems to make a more comprehensive and faster network across the city. Renshaw believes the project has been successful, and will continue to provide long term economic and environmental benefits to the city. In addition to these benefits the PLMQ also grants an element of prestige over Guayaquil, the largest city in the country which does not have a metro system.<sup>91</sup>

Carlos Perez Brito is another social specialist who has worked for both the IDB and World Bank. He agrees the PLMQ is a good investment for the city and especially stressed the reductions in travel time. He talked about how some workers in the south of the city wake up before 5am to be on time for a job that starts at 8am in the north of the city.<sup>92</sup> However, according to him, these benefits did not come without substantial costs. While the PLMQ could generally tunnel where it pleased, stations and other above ground construction were a different matter. For the entire construction period, Quito has had to deal with construction traffic, road closures, and detours that only worsen the existing transit ecosystem. Beyond that, neighbors of stations had concerns about gentrification in the future as the PLMQ opens and the city reorganizes itself to fit the new transit reality.<sup>93</sup> In spite of these concerns, he believes that the project has been successful thus far for both the city and the financial institutions involved.

Finally, Mauricio Anderson, former general manager of the EPMMQ, offered his thoughts with me on the outcomes of the project and his hopes for the future. He emphasized that the PLMQ will help the 73% of city residents who use public transit get around much quicker. He noted that these benefits will especially help those in middle- and lower-class neighborhoods

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<sup>91</sup> Interview with John Renshaw, 10/5/2020

<sup>92</sup> Interview with Carlos Perez Brito, 10/9/2020

<sup>93</sup> Interview with Carlos Perez Brito, 10/9/2020



as they are much more dependent on transit and typically face the longest commutes in the city.<sup>94</sup> He hopes the PLMQ will contribute to longer term goals the city has like SITP, greenhouse gas reduction, and lowering private car use.<sup>95</sup> He celebrated the fact that the project was carried out in a very safe and efficient manner. Only one worker died on site during the tunneling process, giving the project a fatality rate far below many other large underground infrastructure projects.<sup>96,97</sup> In addition, the project broke a world record for tunneling speed as one of the tunnel boring machines tunneled 1489.5m in just 30 days.<sup>98</sup> He also discussed how the EPMMQ employed a massive communications and public relations effort to consult experts on issues like the environment and archaeological heritage as well as everyday citizens who were critical of the project.<sup>99</sup> Looking forward to the future, Anderson hopes that the PLMQ is just the beginning of a reorganization of the city's mobility priorities as it moves to integrate its network and expand into other modes of transportation. He mentioned the possibility of aerial cable cars similar to systems in Medellin, Colombia and La Paz, Bolivia as next steps for the city.<sup>100</sup>

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<sup>94</sup> Interview with Mauricio Anderson, 12/17/2020

<sup>95</sup> Interview with Mauricio Anderson, 12/17/2020

<sup>96</sup> Interview with Mauricio Anderson, 12/17/2020

<sup>97</sup> Kimberly Hegeman, "Looking Back on the World's Deadliest Construction Projects," For Construction Pros (AC Business Media, August 28, 2020), <https://www.forconstructionpros.com/blogs/construction-toolbox/blog/12096401/looking-back-on-the-worlds-deadliest-construction-projects>.

<sup>98</sup> David Burroughs, "Tunnelling for Quito Metro Completed," International Railway Journal (Simmons Boardman Publishing, October 24, 2018), <https://www.railjournal.com/passenger/metros/tunnelling-for-quito-metro-completed/>.

<sup>99</sup> Interview with Mauricio Anderson, 12/17/2020

<sup>100</sup> Interview with Mauricio Anderson, 12/17/2020

## Implications for Multilateral Finance:

This project was much more than a success for Quito and its residents who receive all the benefits of the PLMQ. It also represents a huge success for the multilateral banks involved. This project is a vindication of the sustainability minded policies promoted by multilaterals and can be used as a demonstration of their abilities surrounding urban infrastructure and a knowledge sharing framework that benefits all parties involved. This can be seen throughout the project in aspects like an effective public outreach campaign encouraged by stakeholder engagement policies, the high degree of worker safety achieved by occupational health safeguards, and the protection of historic sites through a plan to prevent damages to cultural patrimony among other important assets. Through their work, a number of lessons can be learned.



Fig. 16: Public Viewing of a New Metro Train, Credit EPMMQ

## What Success Means for the City and Banks:

The success of this project brings tangible benefits for the multilateral banks involved in a number of ways. This project not only raises Quito's profile as a growing metropolis but also gives the banks a success to show off not only to their stakeholders, but also to interested countries. This project involved immense complexity on all fronts and the banks get to take some credit to bolster their credentials in the sphere of urban development and sustainability as they

executed it in a safe and successful manner while ensuring environmental and social safeguards were adhered to.

In addition to bolstering the banks as capable institutions, it also helps the relationship with recipient countries. It wasn't that long ago that the streets of Quito were filled with protests spurred by changes in fuel subsidies at the behest of the International Monetary Fund (IMF).<sup>101</sup> After weeks of protest and the temporary relocation of the government, President Moreno had no choice but to keep the subsidy and not go along with the IMF's structural readjustment.<sup>102</sup> These kinds of policies have historically created mistrust for Bretton Woods institutions including the World Bank and other multilateral financial institutions as they have proven disastrous for domestic economies.<sup>103</sup>

However, in this instance, the banks can attach their name to the PLMQ which is incredibly popular.<sup>104</sup> This in turn, creates an environment where multilateral investment is welcome and even encouraged by local people. Collaboration with MDBs can become much less politically volatile and the people will in turn benefit from increased investment in vital infrastructure across sectors like transit, energy, and housing among others.

It is clear that the PLMQ's success will be a huge benefit to the banks. However, none of this was guaranteed from the start. Ecuador didn't have to turn to MDBs when they needed funding on this project; it was a deliberate decision made for a number of reasons.

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<sup>101</sup> José María León, "Deal Struck in Ecuador to Cancel Austerity Package and End Protests," *The New York Times* (The New York Times, October 13, 2019), <https://www.nytimes.com/2019/10/13/world/americas/ecuador-protests-lenin-moreno.html>.

<sup>102</sup> José María León, "Deal Struck in Ecuador to Cancel Austerity Package and End Protests," *The New York Times* (The New York Times, October 13, 2019), <https://www.nytimes.com/2019/10/13/world/americas/ecuador-protests-lenin-moreno.html>.

<sup>103</sup> Beate Jahn, "Kant, Mill, and Illiberal Legacies in International Affairs," *International Organization* 59, no. 01 (February 15, 2005), <https://doi.org/10.1017/s0020818305050046>.

<sup>104</sup> "Estudio de Caracterización Social, Económica Y Análisis de Evaluación de Medios de Transporte", pp. 8-284, 196.

## Why Multilateral Finance was Chosen Over Chinese Investment:

Perhaps most critical for the MDBs success was the fact that Ecuador sought their help for this project at all. This project came at a time when Ecuador did not have a good economic relationship with many countries, particularly the US, and a bulk of their external development financing was from the Chinese government through their Development Bank and their Export Import Bank.<sup>105</sup> Despite this, Ecuador decided to go with MDB funding due to the MDBs experience with this kind of construction as well as their environmental and social safeguard regimes.<sup>106</sup>

The chart on the right shows the financial commitments of a number of development finance partners involved in Ecuador around when the PLMQ was being planned and constructed. Nearly half of Ecuador's

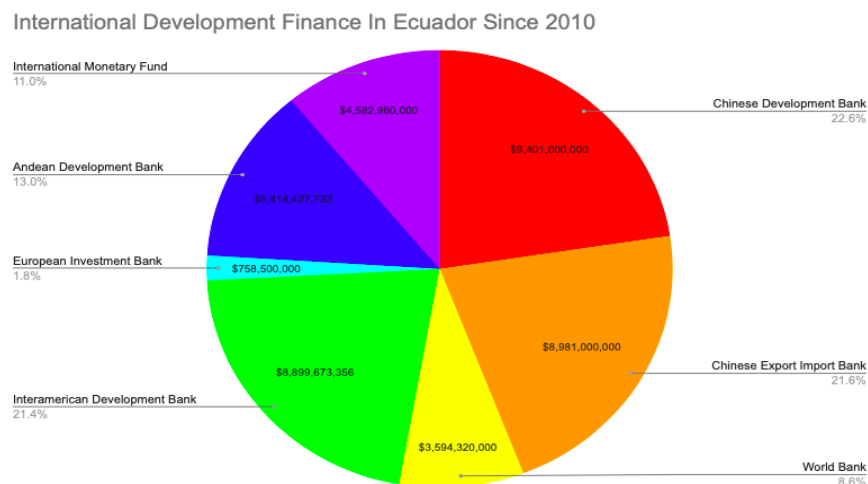


Fig. 17. Sum of International Development Finance in Ecuador since 2010

financing came from the Chinese Development Bank and Export Import Bank.<sup>107</sup> China's involvement in Ecuador spans across multiple sectors including energy, transportation, and

<sup>105</sup> Rebecca Ray, et al. "Geolocated Dataset of Chinese Overseas Development Finance." Boston, MA: Boston University Global Development Policy Center. Online database. doi: 10.17605/OSF.IO/7WUXV.

<sup>106</sup> Interview with Mauricio Anderson, 12/17/2020

<sup>107</sup> Rebecca Ray, et al. "Geolocated Dataset of Chinese Overseas Development Finance." Boston, MA: Boston University Global Development Policy Center. Online database. doi: 10.17605/OSF.IO/7WUXV.

disaster relief among other things.<sup>108</sup> The rest was from MDBs like the ones involved in the PLMQ as well as the IMF which is also heavily involved in the country.<sup>109, 110, 111, 112, 113</sup> Not only did these groups fund the PLMQ, but also worked across sectors completing projects around the country. This chart shows the scope of competition and involvement between these organizations.

This project came to a head with the ascension of Alianza Pais at the local level shortly after Rafael Correa was elected at the federal level. Part of Correa's economic policy included an audit of odious debt taken on illegitimately by the prior military government. The audit concluded that much of the odious debt should be cancelled as the money would be better spent on domestic programs to better the lives of Ecuadorians. So far, only Ecuador has seriously pursued this and in doing so strained economic relationships with partners like the U.S. and Europe.<sup>114</sup> As a result, Ecuador was prohibited by these partners from issuing sovereign debt. This left it with few options to fund large infrastructure projects deemed necessary for the wellbeing of the Ecuadorian people.

Despite strained ties with the U.S. and Europe, China still provided bilateral assistance to Ecuador. China did this because ideologically, both countries subscribe to left wing politics and

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<sup>108</sup> Rebecca Ray, et al. "Geolocated Dataset of Chinese Overseas Development Finance." Boston, MA: Boston University Global Development Policy Center. Online database. doi: 10.17605/OSF.IO/7WUXV.

<sup>109</sup> "Projects," World Bank (World Bank, 2021), [https://projects.worldbank.org/en/projects-operations/projects-list?countryshortname\\_exact=Ecuador](https://projects.worldbank.org/en/projects-operations/projects-list?countryshortname_exact=Ecuador).

<sup>110</sup> "Projects Search," IADB (IADB, 2021), <https://www.iadb.org/en/projects-search?country=EC&or=TR&status=&query=>.

<sup>111</sup> "Global Financing Map," Global financing map (European Investment Bank, 2021), <https://www.eib.org/en/projects/map.htm>.

<sup>112</sup> "CAF | Ecuador," CAF (CAF, 2021), <https://www.caf.com/en/countries/ecuador/>.

<sup>113</sup> "Transactions with the Fund, Ecuador," International Monetary Fund (IMF, 2021), [https://www.imf.org/external/np/fin/tad/extrans1.aspx?memberKey1=270&endDate=2099-12-31&finposition\\_flag=YES](https://www.imf.org/external/np/fin/tad/extrans1.aspx?memberKey1=270&endDate=2099-12-31&finposition_flag=YES).

<sup>114</sup> Interview with Rebecca Ray, 3/2/2021

China tacitly approved of Ecuador's debt policy.<sup>115</sup> In addition to political camaraderie, this can also be seen as a part of China's larger geopolitical strategy, funding infrastructure and development to gain influence in areas that have traditionally been in the western sphere of influence.<sup>116</sup> China had both the financial capacity and technical knowledge to act as the funding source for the PLMQ. China has had immense success with rail projects domestically, building thousands of kilometers of urban and high-speed rail in the past decade, and they've spent over USD\$13 billion in the country since work on the PLMQ started.<sup>117,118</sup> But the country decided to go with another funding source altogether. In fact, between November 2014 and February 2015, the Ecuadorian government was approached by a few Chinese state railway companies to cover the additional financing needs when it was clear Ecuador could not meet its original financial commitment. However, they were dismissed as the government decided it was satisfied with the MDBs work and their safeguard regime and continued to work exclusively with them on the PLMQ.<sup>119</sup>

### MDB Assets and Advantages:

Using funding from MDB's brought a number of benefits to the project which is why they were ultimately the funding source chosen for the PLMQ. MDBs are an important economic interface for smaller countries focused on infrastructure development like Ecuador and larger

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<sup>115</sup> Interview with Rebecca Ray, 3/2/2021

<sup>116</sup> Rebecca Ray, et al. "Geolocated Dataset of Chinese Overseas Development Finance." Boston, MA: Boston University Global Development Policy Center.

<sup>117</sup> "China's High-Speed Rail Lines Top 37,900 Km at End of 2020," The State Council (The People's Republic of China, January 10, 2021), [http://english.www.gov.cn/archive/statistics/202101/10/content\\_WS5ffa36f3c6d0f725769438ad.html](http://english.www.gov.cn/archive/statistics/202101/10/content_WS5ffa36f3c6d0f725769438ad.html).

<sup>118</sup> Rebecca Ray, et al. "Geolocated Dataset of Chinese Overseas Development Finance." Boston, MA: Boston University Global Development Policy Center.

<sup>119</sup> Interview with Mauricio Anderson, 12/17/2020

economies like the United States and Europe. In addition, MDB's bring expertise in environmental and social safeguards that help ensure projects like this one don't come with any unintended negative consequences in the natural or social realms. Finally, the MDB's were able to foster technical partnerships that were critical in the development and implementation of the infrastructure itself.

MDBs serve as a critical economic interface, and this was especially true for Ecuador when they sought funding for this project. As a dollarized country, they have no control over their monetary policy. Therefore, it's important for them to maintain economic ties with the U.S. since the U.S.'s monetary decisions directly impact Ecuador in a way few other countries have experienced.<sup>120</sup> Due to the structure of the MDBs Ecuador was seeking funding from, these loans had to be approved by the U.S. at a time when they could've easily worked against them as retribution for Ecuador's action against odious debt.<sup>121, 122</sup> The fact they did not demonstrates how MDBs can be a space for economic cooperation outside of politics. The goal of MDBs is to fund projects that improve people's lives, whether it's through infrastructure improvements like the PLMQ or any number of projects across sectors. This is a goal that goes beyond any political differences between countries and the decision to fund the PLMQ at a time when Ecuador was largely considered an economic pariah, especially in the eyes of the United States, shows this to be substantively true.

In addition to the maintenance of critical economic ties, the MDBs also provided a number of assets that proved vital in the development and implementation of the PLMQ. One important realm is the social impact sensitivity policies championed by MDBs and their

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<sup>120</sup> Luis Ignacio Jácome, "The Late 1990's Financial Crisis in Ecuador," *IMF Working Papers*, Pg. 25.

<sup>121</sup> "Capital Stock and Voting Power," IADB, 2020, <https://www.iadb.org/en/about-us/capital-stock-and-voting-power>.

<sup>122</sup> "Voting Powers," World Bank, 2020, <https://www.worldbank.org/en/about/leadership/votingpowers>.

alignment with Ecuador's domestic policies. Sumak Kawsay or Buen Vivir is a critical tenet of governmental policy in Ecuador implemented in 2008 with the new constitution.<sup>123</sup> It translates literally to good life and encompasses all kinds of rights of both people and the environment in which they live. Central to this idea is community solidarity, reciprocity, and harmony with nature. The PLMQ fits into this idea as it not only improves economic conditions in the city for residents, but also contributes to cleaner air, a healthier environment, and stronger communities. It is a holistic investment toward bettering the lives of all residents in the city. While the PLMQ did not go through a formal Sumak Kawsay/Buen Vivir policy screening, it was reviewed by the Ecuadorian National Planning Secretariat. They ensured the project fulfilled social and economic requirements which in part are influenced by Sumak Kawsay/Buen Vivir policies.<sup>124</sup>

The involvement of MDBs brought a strong social safeguards protocol that ensured communities were protected and their concerns were heard throughout the development and implementation of the PLMQ. The MDBs all have their own social safeguards requirements and this project had to abide by not just one, but all four sets. These safeguards are evident across banks, for example: the EIB's and World Bank's requirement of a resettlement framework for those displaced by construction, the larger SITP plan and regular audits necessitated through the IDB's conditions, and the development of a social program within the EMMPQ to communicate with affected communities and provide non-monetary compensation as required under

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<sup>123</sup> Beth Williford, "Buen Vivir as Policy: Challenging Neoliberalism or Consolidating State Power in Ecuador," *Journal of World-Systems Research* 24, no. 1 (2018): pp. 96-122, <https://doi.org/10.5195/jwsr.2018.629>, 103.

<sup>124</sup> Interview with Mauricio Anderson, 12/17/2020



Ecuadorian law.<sup>125,126,127,128</sup> The convergence of a desire to provide benefits to and protect communities was a great asset for all stakeholders surrounding the PLMQ.

In addition to social safeguards, the MDBs also have other broader policies aligned with the environmental sustainability side of Ecuador's Buen Vivir policy. Since around 2015, in the wake of the Paris Climate Accords, MDBs identified sustainable transport as a critical investment due to its outsize impact on humanity's carbon footprint.<sup>129</sup> Enrique Garcia, president and CEO of CAF even said "Transport plays a key role in the climate change agenda worldwide, but Latin America's engagement becomes a more critical factor in developing sustainable solutions given the high motorization rates the region is facing. Today, Latin America is suffering the most challenging impacts of climate effects; today not 2050 or 2100."<sup>130</sup> Quito is a perfect example of the high motorization rates Garcia mentioned, making this investment an easy decision for the banks based on their environmental policy goals.

MDBs have been increasingly pushed by governments and civil society to become more involved in financing projects that will help mitigate the impacts of climate change. The policies developed as a result of this pressure are an asset for the MDBs because the problem of climate change grows more serious with each passing day. Increasingly, policymakers are looking for ways to implement more sustainable infrastructure and policy but many countries need external

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<sup>125</sup> Eib, "METRO DE QUITO." Homepage. European Investment Bank, [www.eib.org/en/projects/pipelines/all/20110297](http://www.eib.org/en/projects/pipelines/all/20110297).

<sup>126</sup> World Bank. "Project Appraisal Document on a Proposed Loan in the Amount of US\$ 205 Million to the Municipality of the Metropolitan District of Quito with Guarantee of the Republic of Ecuador for a Quito Metro Line One Project." The World Bank Group. Pg. 38.

<sup>127</sup> "EC-L1111 : Quito Metropolitan Urban Transport System." IADB. [www.iadb.org/en/project/EC-L1111](http://www.iadb.org/en/project/EC-L1111). Pg. IV.

<sup>128</sup> Interview with Mauricio Anderson, 12/17/2020

<sup>129</sup> "Multilateral Development Banks Join Forces to Ramp up Climate Action in Transport," World Bank (World Bank, December 3, 2015), [https://www.worldbank.org/en/news/press-release/2015/12/02/multilateral-development-banks-join-forces-to-ramp-up-climate-action-in-transport?cid=EXT\\_WBEmailShare\\_EXT](https://www.worldbank.org/en/news/press-release/2015/12/02/multilateral-development-banks-join-forces-to-ramp-up-climate-action-in-transport?cid=EXT_WBEmailShare_EXT).

<sup>130</sup> "Multilateral Development Banks Join Forces to Ramp up Climate Action in Transport," World Bank (World Bank, December 3, 2015), [https://www.worldbank.org/en/news/press-release/2015/12/02/multilateral-development-banks-join-forces-to-ramp-up-climate-action-in-transport?cid=EXT\\_WBEmailShare\\_EXT](https://www.worldbank.org/en/news/press-release/2015/12/02/multilateral-development-banks-join-forces-to-ramp-up-climate-action-in-transport?cid=EXT_WBEmailShare_EXT).

investment to transition to sustainable alternatives. MDBs have the resources to back up these policymakers and make these kinds of projects happen, making them a huge asset to the policymakers who want to see an increased focus on sustainability in their own country.

Along with the resources, MDBs can help coordinate the kinds of technical knowledge sharing that makes projects like the PLMQ, where there was no domestic experience with underground rail, possible. Mauricio Anderson discussed the importance of the involvement from Metro Madrid with their design capabilities and operational knowledge.<sup>131</sup> This kind of knowledge sharing is customary, and even has precedent in other underground rail construction projects.<sup>132</sup> The cooperation between Madrid and Quito, in part, was a result of the involvement of the MDBs like the IDB and World Bank, in which Ecuador and Spain are both members.

MDBs have a number of assets outside of capital that worked in their favor when Ecuador was deciding where they would seek funding on this project. From their desire to maintain an economic relationship with partners like the United States, to environmental and social safeguards, and the coordination of technical knowledge sharing, the MDBs were the clear choice to fund this project.

### Lessons Learned from Quito For Multilateral Finance:

The experience of MDBs in Quito provides a number of lessons as MDBs face increased competition from other development entities. By learning from Quito, MDBs can better position themselves as the default for development finance and serve both their own interests as financial entities and serve the interests of those who seek funds from them.

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<sup>131</sup> Interview with Mauricio Anderson, 12/17/2020

<sup>132</sup> Zachary M. Schrag, *The Great Society Subway: a History of the Washington Metro*, 35.

One unique aspect of the PLMQ is that some version of underground rail had been in the public consciousness of the city dating as far back as 1972.<sup>133</sup> This project benefitted from already having been litigated in the public sphere for nearly half a century. In addition, it addressed a need familiar to everyone in the city: traffic congestion. By solving a problem the whole city struggled with, the EPMMQ and the MDBs were able to be on the side of the people. This is reflected in the surveys conducted on the social impacts of the PLMQ.<sup>134</sup> Deciding to fund projects with high levels of local support is a great way for MDBs to build rapport with communities where their reputations might previously have been negative due to unpopular projects or harsh structural adjustment conditions imposed to access funding.

Additionally, MDBs need to continue to fund projects that serve their sustainability policies. Funding sustainable infrastructure benefits everyone, not just the residents of the Quito or the MDBs. By continuing to fund these kinds of projects, MDBs are actively contributing to a smaller carbon footprint and a greater chance of meeting climate goals set forth by a number of international organizations.<sup>135</sup> If they continue to demonstrate their effectiveness on this front, they will only gain influence and resources to put back into projects like the PLMQ that help further mitigate climate change.

MDBs can take the success of Quito and use it as an example for other cities interested in sustainable public transport and carbon negative living. By providing concrete examples of the resources available, the technical support, and the array of environmental and social safeguards

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<sup>133</sup> Gamble, Julie Catherine. "Visioning a Transit City". 55.

<sup>134</sup> "Estudio de Caracterización Social, Económica Y Análisis de Evaluación de Medios de Transporte", pp. 8-284, 196.

<sup>135</sup> Nancy Birdsall and Scott Morris, "Multilateral Development Banking for This Century's Development Challenges: Five Recommendations to Shareholders of the Old and New Multilateral Development Banks" (Center for Global Development, October 5, 2016), <https://www.cgdev.org/publication/multilateral-development-banking-for-this-centurys-development-challenges>.

MDBs can provide, the case of the PLMQ is a great asset for MDBs as they move forward with more sustainable infrastructure projects. It demonstrates how MDB involvement can be used as a tool to increase local capacity across industries and create a sustainable and prosperous future for recipients of multilateral finance.

## Conclusion

It is clear that the PLMQ is set to become an incredible asset for Quito and vastly improve the lives of residents. The PLMQ will have huge impacts in the mobility ecosystem of the city as well as a number of adjacent issues like environment, public health, and economic benefits that are incredibly important to residents. This success is a result of a series of strategic decisions and international collaboration that came together around this project.

The development of the PLMQ was conducted in a manner which considered wide-ranging impacts in the environmental and social spheres. By working in collaboration with communities and completing comprehensive studies, the EPMMQ was able to identify negative outcomes ahead of time and work with MDBs to plan mitigation strategies to ensure communities were not too adversely affected by the process of construction. This marks a departure from projects in the past where there were not in-depth studies and mitigation strategies implemented beforehand. In instances where these protocols were not followed, there was a much higher potential for inflicting harm onto surrounding communities and to the environment. However, in this case, a web of social and environmental protocols put in place at the behest the four MDBs were followed and the surroundings were protected.

In addition to the careful consideration put into the development of the PLMQ, this project demonstrates a successful model of complex international cooperation that stands to

benefit all parties. A web of multilateral financiers, national actors in Ecuador, and a number of local consultants, professionals, and other actors came together, developing channels of communication and frameworks for cooperation that allowed for the accumulation of resources and technical expertise to make this project possible.

The PLMQ is an important case for MDBs as they can take important lessons from the project as well. This project is a clear demonstration of the value MDBs can bring outside of capital investments into projects. MDBs can serve as a vital economic interface outside of politics for countries that are otherwise on bad terms. Through MDBs, investments can be made to better the lives of everyday people who have no part in political squabbles between federal governments. In addition, the combination of social and environmental safeguards, along with technical expertise, are a great asset to countries with less experience in large infrastructure projects like this one and proved decisive in the local decision-making process.

Overall, The PLMQ was the best solution for Quito's mobility issues. All surface-level options had been exhausted and therefore, the move underground was necessary. The PLMQ reflected the long-term interests and goals of the city government, and at that moment those goals were in harmony with federal policy and the sustainability goals of MDBs. By implementing the PLMQ, the city is emphasizing the need for more sustainable, more efficient transportation and it is committing to realizing those goals in the long term. Through leveraging international partnerships, the city is making the PLMQ a reality that will vastly improve quality of life for all residents and MDBs can take the lessons from this project to help more cities accomplish the same for their residents.

## References

About CAF - Brief History, 2011.

<https://web.archive.org/web/20071024194507/http://www.caf.com/view/index.asp?pageMS=41245&ms=17#>.

Atha, Simeon, and Carlos Perez Brito. Interview with Carlos Perez Brito. Personal, October 9, 2020.

Atha, Simeon, and John Renshaw. Interview with John Renshaw. Personal, October 5, 2020.

Atha, Simeon, and Mauricio Anderson. Interview with Mauricio Anderson, December 17, 2020

Atha, Simeon, and Mauricio Anderson. Interview with Mauricio Anderson, March 23, 2021

Atha, Simeon, and Dr. Rebecca Ray. Interview with Carlos Perez Brito. Personal, March 2, 2021.

Bastidas Zelaya, Efrain. "Analysis of Multistage Chains in Public Transport: The Case of Quito, Ecuador." *Libro de Actas CIT2016. XII Congreso de Ingeniería del Transporte*, June 7, 2016. <https://doi.org/10.4995/cit2016.2016.3530>.

Birdsall, Nancy, and Scott Morris. Rep. *Multilateral Development Banking for This Century's Development Challenges: Five Recommendations to Shareholders of the Old and New Multilateral Development Banks*. Center for Global Development, October 5, 2016. [www.cgdev.org/publication/multilateral-development-banking-for-this-century-s-development-challenges](http://www.cgdev.org/publication/multilateral-development-banking-for-this-century-s-development-challenges).

- Brachtl, Megan V., John L. Durant, Carlos Paez Perez, Jorge Oviedo, Fernando Sempertegui, Elena N. Naumova, and Jeffrey K. Griffiths. "Spatial and Temporal Variations and Mobile Source Emissions of Polycyclic Aromatic Hydrocarbons in Quito, Ecuador." *Environmental Pollution* 157, no. 2 (2009): 528–36.  
<https://doi.org/10.1016/j.envpol.2008.09.041>.
- Bravo-Moncayo, Luis, Miguel Chávez, Virginia Puyana, José Lucio-Naranjo, Christiam Garzón, and Ignacio Pavón-García. "A Cost-Effective Approach to the Evaluation of Traffic Noise Exposure in the City of Quito, Ecuador." *Case Studies on Transport Policy* 7, no. 1 (December 16, 2019): 128–37. <https://doi.org/10.1016/j.cstp.2018.12.006>.
- Burroughs, David. "Tunnelling for Quito Metro Completed." *International Railway Journal*. Simmons Boardman Publishing, October 24, 2018.  
<https://www.railjournal.com/passenger/metros/tunnelling-for-quito-metro-completed/>.
- "CAF | Ecuador." CAF. CAF, 2021. <https://www.caf.com/en/countries/ecuador/>.
- "CAF Provides Financing for Quito Metro Construction." CAF. Accessed December 14, 2020.  
[www.caf.com/en/currently/news/2012/11/caf-provides-financing-for-quito-metro-construction/](https://www.caf.com/en/currently/news/2012/11/caf-provides-financing-for-quito-metro-construction/).
- "Capital Stock and Voting Power." IADB, 2020. [www.iadb.org/en/about-us/capital-stock-and-voting-power](http://www.iadb.org/en/about-us/capital-stock-and-voting-power).
- Carrillo, Paul E., Arun S. Malik, and Yiseon Yoo. "Driving Restrictions That Work? Quito's Pico y Placa Program." *SSRN Electronic Journal*, November 26, 2013.  
[doi.org/10.2139/ssrn.2240327](https://doi.org/10.2139/ssrn.2240327).

- “China's High-Speed Rail Lines Top 37,900 Km at End of 2020.” The State Council. The People's Republic of China, January 10, 2021.  
english.www.gov.cn/archive/statistics/202101/10/content\_WS5ffa36f3c6d0f725769438ad.html.
- Correa, Felipe, and Ramiro Almieda, eds. 2013. *A Line in the Andes*. Boston: Applied Research & Design.
- Demoraes, Florent. “Elementos Esenciales Del Funcionamiento Del Sistema De Movilidad Metropolitana.” *Dirección Metropolitana de Planificación Territorial*, November 2005, 89. <https://doi.org/10.4000/books.ifea.7073>.
- “EC-L1111 : Quito Metropolitan Urban Transport System.” IADB. Accessed December 14, 2020. [www.iadb.org/en/project/EC-L1111](http://www.iadb.org/en/project/EC-L1111).
- Eib. “METRO DE QUITO.” Homepage. European Investment Bank, June 20, 2020. [www.eib.org/en/projects/pipelines/all/20110297](http://www.eib.org/en/projects/pipelines/all/20110297).
- Estrella, Bertha, Fernando Sempértégui, Oscar H. Franco, Magda Cepeda, and Elena N. Naumova. “Air Pollution Control and the Occurrence of Acute Respiratory Illness in School Children of Quito, Ecuador.” *Journal of Public Health Policy* 40, no. 1 (2018): 17–34. [doi.org/10.1057/s41271-018-0148-6](https://doi.org/10.1057/s41271-018-0148-6).
- Ferrari, Gerson, Oliveira Werneck, André, Rodrigues Da Silva, Danilo, Kovalskys, Irina, Gómez, Georgina, Rigotti, Attilio, Yadira Cortés Sanabria, Lilia, García, Martha Cecilia Yépez, Pareja, Rossina G, Herrera-Cuenca, Marianella, Zimberg, Ioná Zalcman, Guajardo, Viviana, Pratt, Michael, Cofre Bolados, Cristian, Saldía, Emilio Jofré, Pires,



Carlos, Marques, Adilson, Peralta, Miguel, Rossato De Victo, Eduardo, Fisberg, Mauro, and On Behalf Of The Elans Study Group. "Association between Perceived Neighborhood Built Environment and Walking and Cycling for Transport among Inhabitants from Latin America: The ELANS Study." *International Journal of Environmental Research and Public Health* 17, no. 18 (2020): 6858.

Gamble, Julie, Bernhard Snizek, and Thomas Sick Nielsen. "From People to Cycling Indicators: Documenting and Understanding the Urban Context of Cyclists' Experiences in Quito, Ecuador." *Journal of Transport Geography* 60 (March 16, 2017): 167–77.  
<https://doi.org/10.1016/j.jtrangeo.2017.03.004>.

Gamble, Julie Catherine. "Visioning a Transit City: Citizen Participation and Transit Planning in Quito, Ecuador," 2015. <https://escholarship.org/uc/item/6qx4b0tc>.

"GDP (Current US\$) - Ecuador." Data. The World Bank, 2020.  
<https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?end=2019&locations=EC&start=1970>.

Gesambconsult Consultores. Rep. *Environmental Impact Study of the Metro de Quito First Line*. Quito: Metro de Quito, n.d.

Global financing map. European Investment Bank, 2021.  
<https://www.eib.org/en/projects/map.htm>.

Hanratty, Dennis Michael, and Thomas E. Weil. *Ecuador: a Country Study*. Washington, DC: Federal Research Division, Library of Congress, 1991.

- Hays, Jake, Michael McCawley, and Seth B.C. Shonkoff. “Public Health Implications of Environmental Noise Associated with Unconventional Oil and Gas Development.” *Science of The Total Environment* 580 (December 9, 2017): 448–56.  
doi.org/10.1016/j.scitotenv.2016.11.118.
- Hegeman, Kimberly. “Looking Back on the World's Deadliest Construction Projects.” For Construction Pros, August 28, 2020. [www.forconstructionpros.com/blogs/construction-toolbox/blog/12096401/looking-back-on-the-worlds-deadliest-construction-projects](http://www.forconstructionpros.com/blogs/construction-toolbox/blog/12096401/looking-back-on-the-worlds-deadliest-construction-projects).
- IADB. “Transportation.” IADB, 2020. [www.iadb.org/en/topics/transport/transportation](http://www.iadb.org/en/topics/transport/transportation).
- Jahn, Beate. “Kant, Mill, and Illiberal Legacies in International Affairs.” *International Organization* 59, no. 01 (February 15, 2005). <https://doi.org/10.1017/s0020818305050046>.
- Jácome, Luis Ignacio. “The Late 1990's Financial Crisis in Ecuador: Institutional Weaknesses, Fiscal Rigidities, and Financial Dollarization At Work.” *IMF Working Papers* 04, no. 12 (2004): 1–43. <https://doi.org/10.5089/9781451842937.001>.
- León, José María. “Deal Struck in Ecuador to Cancel Austerity Package and End Protests.” The New York Times. The New York Times, October 13, 2019.  
<https://www.nytimes.com/2019/10/13/world/americas/ecuador-protests-lenin-moreno.html>.
- “Live Animated Air Quality Map (AQI, PM2.5...): AirVisual.” Empowering the World to Breathe Cleaner Air. Accessed March 31, 2021. <https://www.iqair.com/us/air-quality-map>.

“Los Angeles Air Quality Index (AQI) and California Air Pollution: AirVisual.” Los Angeles Air Quality Index (AQI) and California Air Pollution | AirVisual. Accessed March 31, 2021. <https://www.iqair.com/us/usa/california/los-angeles>.

Metro De Quito. 2020. “Inicio.” Metro De Quito. <https://www.metrodequito.gob.ec/>.

“Overview.” IADB, 2020. <https://www.iadb.org/en/about-us/overview>.

Paget-Seekins, Laurel. “Bus Rapid Transit as a Neoliberal Contradiction.” *Journal of Transport Geography* 48 (2015): 115–20. [doi.org/10.1016/j.jtrangeo.2015.08.015](https://doi.org/10.1016/j.jtrangeo.2015.08.015).

“Principles of Collaboration: Quito Metro Line One Project.” Washington, DC: The World Bank, December 6, 2013.

“Projects.” World Bank. World Bank, 2021. [https://projects.worldbank.org/en/projects-operations/projects-list?countryshortname\\_exact=Ecuador](https://projects.worldbank.org/en/projects-operations/projects-list?countryshortname_exact=Ecuador).

“Projects Search.” IADB. Accessed September 15, 2020. <https://www.iadb.org/en/projects-search?country=EC&or=TR&status=&query=>.

Ray, Rebecca, Kevin P. Gallagher, William Kring, Joshua Pitts, and B. Alexander Simmons.

“Geolocated Dataset of Chinese Overseas Development Finance.” Boston, MA: Boston University Global Development Policy Center. Online database. doi: 10.17605/OSF.IO/7WUXV.

Rep. *Economic Impact of Public Transportation Investment 2020 Update*. American Public Transit Association, April 2020. <https://www.apta.com/research-technical-resources/research-reports/economic-impact-of-public-transportation-investment/>.

Rep. *ESTUDIO DE CARACTERIZACIÓN SOCIAL, ECONÓMICA Y ANALISIS DE EVALUACION DE MEDIOS DE TRANSPORTE DE LA POBLACIÓN DEL DISTRITO METROPOLITANO DE QUITO EN REFERENCIA AL PROYECTO DEL METRO DE LA CIUDAD DE QUITO*. Quito, EC: Spectrum Opinión y Mercado, 2012.

Rivas, Natalia, and Pamela Ramón. “El Metro Está Pasando y Solanda Se Está Hundiendo.” La Barra Espaciadora, December 24, 2018. <https://www.labarraespaciadora.com/ddhh/el-metro-de-quito/>.

Schabas, Michael. “Review of Metrolinx's Big Move.” Neptis Foundation, n.d. [www.neptis.org/sites/default/files/metrolinx\\_review\\_2013/neptis\\_schabas\\_report\\_dec\\_2013\\_finaljuly23.pdf](http://www.neptis.org/sites/default/files/metrolinx_review_2013/neptis_schabas_report_dec_2013_finaljuly23.pdf).

Schrag, Zachary M. *The Great Society Subway: a History of the Washington Metro*. Baltimore, MD: Johns Hopkins Univ. Press, 2014.

“Transactions with the Fund, Ecuador.” International Monetary Fund. IMF, 2021. [https://www.imf.org/external/np/fin/tad/extrans1.aspx?memberKey1=270&endDate=2099-12-31&finposition\\_flag=YES](https://www.imf.org/external/np/fin/tad/extrans1.aspx?memberKey1=270&endDate=2099-12-31&finposition_flag=YES).

“Transportation.” IADB, 2020. <https://www.iadb.org/en/topics/transport/transportation>.

United Nations, Framework Convention on Climate Change. New Mass Public Transportation System to Reduce the Use of Fossil Fuels. Quito, EC. UNFCCC 2013.

“Voting Powers.” World Bank, 2020. [www.worldbank.org/en/about/leadership/votingpowers](http://www.worldbank.org/en/about/leadership/votingpowers).

Wabah, Sameh, and Grace Muhimpundu. "Visiting Ecuador's Very First Metro." World Bank Blogs, November 23, 2016. [blogs.worldbank.org/transport/visiting-ecuador-s-very-first-metro](https://blogs.worldbank.org/transport/visiting-ecuador-s-very-first-metro).

World Bank. "Project Appraisal Document on a Proposed Loan in the Amount of US\$ 205 Million to the Municipality of the Metropolitan District of Quito with Guarantee of the Republic of Ecuador for a Quito Metro Line One Project." The World Bank Group. Accessed January 28, 2021.

World Bank. "Project Paper on a Proposed Additional Loan in the Amount of US\$230 Million to the Municipality of the Metropolitan District of Quito with Guarantee of the Republic of Ecuador for the Quito Metro Line One Project" The World Bank Group. Accessed January 29, 2021.

"World Bank Project : Quito Metro Line One - P144489." World Bank. Accessed December 14, 2020. [projects.worldbank.org/en/projects-operations/project-detail/P144489](https://projects.worldbank.org/en/projects-operations/project-detail/P144489).

Zelaya, Efrain Bastidas. "Analysis of Multistage Chains in Public Transport: The Case of Quito, Ecuador." *Libro de Actas CIT 2016. XII Congreso de Ingeniería del Transporte*, 2016. [doi.org/10.4995/cit2016.2016.3530](https://doi.org/10.4995/cit2016.2016.3530).

# Appendices

Appendix 1: List of Metro Stations and Route Parameters, Credit: EPMMQ

Station N°	NAME	Initial station coordinate	final station coordinate	Central platform coordinate	ROUTE TUNNEL PLAN	
E-01	QUITUMBE	10+000,000	10+140,770	10+059,350	Width of the path (measured between active boarders)	1.435 mm
E-01b	FUTURE STATION (RESERVE 1)			11+303,157	Distance between the axis of the lane	1.505 mm (lane 54E1)
E-02	MORÁN VALVERDE	11+920,352	12+102,270	12+033,247	Type of transition curves	Clotoide
E-02b	FUTURE STATION (RESERVE 2)			13+106,488	Maximum speed	100 Km/h
E-03	SOLANDA	14+094,194	14+257,379	14+185,979	Maximum superelevation	150 mm
E-04	EL CALZADO	15+158,950	15+315,138	15+242,341	Minimum radius	300 m
E-05	EL RECREO	16+834,012	16+964,094	16+894,797	Non-compensated maximum acceleration	0,65 m/s <sup>2</sup>
E-05b	FUTURE STATION (RESERVE 3)			18+107,088	Maximum acceleration uncompensated traveler	1 m/s <sup>2</sup>
E-06	LA MAGDALENA	18+695,191	18+829,379	18+759,179	Maximum superelevation ramp	Normal: 1,5 mm/m Exceptional: 2,0 mm/m
E-06b	FUTURE STATION (RESERVE 4)			20+047,373	Superelevation deficiency	100 mm
E-07	SAN FRANCISCO	21+397,154	21+518,054	21+456,354	Maximum Superelevation variation in time (mm / s)	Normal: 30 mm/s Exceptional: 50 mm/s
E-07b	PLAZA DEL TEATRO (RESERVE 5)			22+275,586	Maximum variation of uncompensated lateral acceleration (m/s <sup>3</sup> )	0,02 g
E-08	LA ALAMEDA	23+310,633	23+469,233	23+398,083	Minimum length of straight between circular curves (m)	0,4 V
E-09	EL EJIDO	24+202,887	24+409,087	24+303,187	Minimum length of constant curvature alignments (m)	0,4 V
E-10	UNIVERSIDAD CENTRAL	25+456,246	25+589,187	25+525,265	Useful length of platform (straight)	115 m
E-11	LA PRADERA	26+631,158	26+771,658	26+706,108	ROUTE IN ELEVATION OF LINE TUNNEL	
E-12	LA CAROLINA	27+559,261	27+699,011	27+624,061	Type of vertical alignment	Parabolic
E-13	IÑAQUITO	29+085,470	29+222,570	29+160,421	Slope (maximum)	Maximum: 35 mils (exceptional Machángara River crossing 37 mils) Low: 0 mils (stations) 5 mils (tunnel)
E-14	JIPIJAPA	30+452,735	30+591,432	30+527,885	Vertical alignment setting minimum	3.500 (exceptional 2.000 Machángara river crossing)
E-15	EL LABRADOR	31+557,853	31+698,903	31+626,902	Maximum permissible acceleration in vertical alignments	Normal: 0,15 Exceptional: 0,30

Appendix 2: Bus Operators in Quito, Credit: UNFCCC

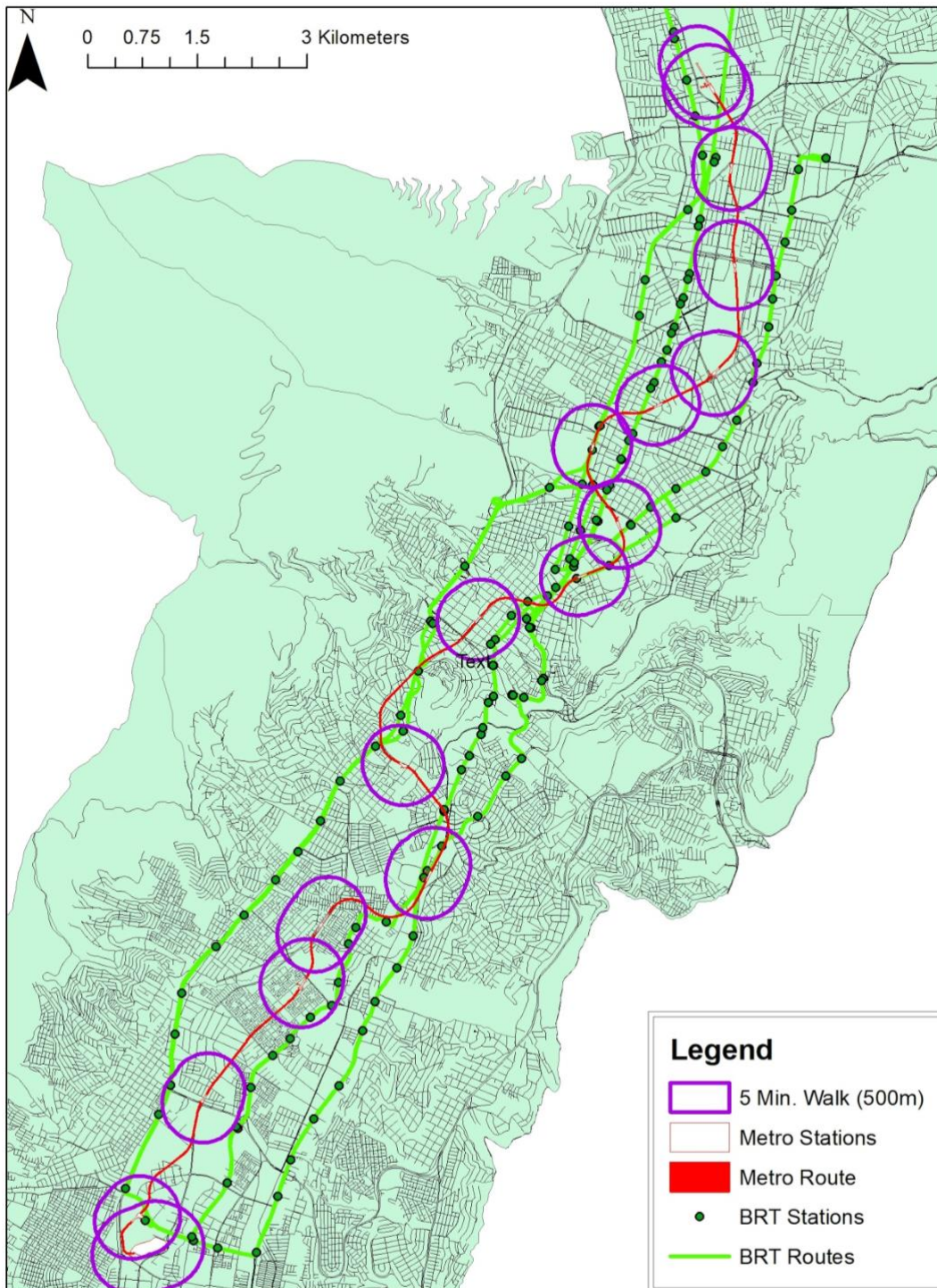
**Tabla 16 Operadoras del Sistema Convencional Urbano**

No.	Nombre Operadora	Tipo	Flota Operadora
1	BELLAVISTA	COOP.	30
2	ATAHUALPA	CÍA.	15
3	VENCEDORES DE PICHINCHA	CÍA.	106
4	QUITUMBE	CÍA.	72
5	GUADALAJARA	CÍA.	34
6	SAN CRISTOBAL	CÍA.	61
7	6 DE DICIEMBRE	CÍA.	44
8	SAN FRANCISCO DE CHILLOGALLO	COOP.	80
9	VICTORIA	CÍA.	66
10	QUITO	COOP.	40
11	ALBORADA	CÍA.	56
12	PICHINCHA	CÍA.	38
13	NACIONAL TRANSPORTES	CÍA.	43
14	MONSERRAT	COOP.	20
15	DISUTRANS	CÍA.	80
16	7 DE MAYO	COOP.	17
17	JUAN PABLO II	COOP.	87
18	TRANSPLANETA	CÍA.	145
19	ECUATORIANA TRANS HEROICA	CÍA.	57
20	SAN CARLOS	CÍA.	28
21	TESUR	CÍA.	66
22	CATAR	CÍA.	23
23	LATINA	CÍA.	87
24	LUJOTURISSA	CÍA.	24
25	TRANSMETRÓPOLI	CÍA.	20
26	MARISCAL SUCRE	COOP.	83
27	REINO DE QUITO	CÍA.	58
28	TRANSPORSEL	CÍA.	62
29	21 DE JULIO	CÍA.	26
30	QUITENO LIBRE	CÍA.	57
31	TRANSLATINOS	CÍA.	116
32	TRANSALFA	CÍA.	50
33	COLECTRANS	CÍA.	23
34	SERVIAGOSTO	CÍA.	72
35	METROTRANS	CÍA.	27
36	TRANSZETA	CÍA.	33
37	AGUILA DORADA	CÍA.	15
38	SECUATRANS	CÍA.	17
39	RAPITRANS	CÍA.	23
40	TRANSPACOMI	CÍA.	8
41	TRANSHemisfericos	CÍA.	29
42	TRANSPORTE SAN JUAN DE CALDERON	COOP.	24
43	TRANSPORTE LLANO GRANDE	COOP.	22
44	TRANSPORTES CALDERON	COOP.	46
TOTAL			2.130

Fuente: Equipo consultor, Octubre 2013

### Appendix 3: Metro/BRT Walkability

## Area within a 5 Minute Walk From a Metro Station



Map Source: Simeon Atha, May 26, 2020.

Shapefile Source: Quito Gobierno Abierto Retrieved May 24, 2020, from <http://gobiernoabierto.quito.gob.ec>

Data Source: Quito Gobierno Abierto Retrieved May 24, 2020, from <http://gobiernoabierto.quito.gob.ec/>

Projection: Transverse Mercator Complex

Coordinate System: WGS84TMQ



## Appendix 4: World Bank Status Indicators

# Results Framework

## PROJECT DEVELOPMENT OBJECTIVE INDICATORS

INDICATOR		BASELINE	CURRENT	TARGET
Passengers per day in PLMQ	Value	0	0	295999
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Travel time for public transportation users	Value	38.5	38.5	23.1
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Operating costs of Quito's vehicle fleet	Value	0	0	-59400000
	Date	November 11, 2013	November 10, 2020	January 1, 2021
GHG emissions from transport in DMQ	Value	0	0	-58170
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Adequate passenger capacity provided by PLMQ	Value	No	No	Yes
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Percentage of users satisfied with overall metro service, its security and comfort (differentiated by gender and income)	Value	0	0	65
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Percentage of female users satisfied with overall metro service, its security and comfort	Value	0	0	65
	Date	Invalid date	Invalid date	Invalid date
Percentage of low-income users satisfied with overall metro service, its security and comfort	Value	0	0	65
	Date	Invalid date	Invalid date	Invalid date
Percentage of jobs accessible in 60 minutes of travel time	Value	45.3	45.3	50.8
	Date	November 11, 2013	November 10, 2020	January 1, 2021

## INTERMEDIATE RESULTS INDICATORS

INDICATOR		BASELINE	CURRENT	TARGET
Percentage of physical work progress in civil works other than stations	Value	0	99.96	100
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Percentage of rolling stock completed	Value	0	80	100
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Percentage of metro feeder routes in operation	Value	0	0	15
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Percentage of physical work progress in stations and universal access	Value	0	99.54	100
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Percentage of bus fleet under unified fare-collection system	Value	0	0	25
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Percentage of physical work progress in rail yard	Value	0	100	100
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Implementation of a reporting mechanism for cases of violence against women and girls in the PLMQ	Value	No	No	Yes
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Percentage of progress in installation of power supply, auxiliary, signaling and telecom systems	Value	0	82	100
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Percentage of technical and professional staff, directly employed by the operator of PLMQ, that is female	Value	0	0	20
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Percentage of fare-collection system installed	Value	0	0	100
	Date	November 11, 2013	November 10, 2020	January 1, 2021
Percentage of progress in installation of permanent way	Value	0	99.9	100
	Date	November 11, 2013	November 10, 2020	January 1, 2021