



TRANSPORT SOLUTIONS AND URBAN REGENERATION IN LATIN AMERICAN CITIES.

A PROPOSAL FOR MEXICO CITY.

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ABSTRACT (ITALIANO)

Oggi ci sono delle città congestionate. Le strade sono piene di auto che non sembrano muoversi a velocità elevate. Ci sono delle città che sembra la loro qualità di vita sta peggiorando. E ci sono città in cui la distribuzione della ricchezza non sembra del tutto giusta. Ci sarà per caso un rapporto tra questi fattori?

Questo documento illustra come diverse città dell'America Latina stanno combattendo la congestione del traffico in contemporaneo di tentare di migliorare le economie delle loro città e dei loro abitanti. Discute in primo luogo il rapporto tra trasporto pubblico e della qualità di vita, i benefici di investire nelle città e il loro trasporto pubblico come mezzo per collegare i potenziali utenti e mercati. Che cose succedrebbero quando si elude tali connessioni in città.

Di seguito è riportato uno studio dettagliato di Città del Messico, il suo stato attuale, le statistiche, la morfologia, una cronologia della sua crescita, così come una descrizione del proprio sistema di trasporto pubblico. Si descrive come, quando, dove e perché si verificano i movimenti di persone all'interno di questa città. Dopo c'è una dettagliata analisi dei benefici attuali e che cosa potrebbe essere migliorata con i mezzi pubblici a Città del Messico.

Poi si presenta una ricerca delle città di Bogotá, Curitiba e Rio de Janeiro per sapere che cosa stanno facendo per evitare il traffico. Questa sezione cerca di esaminare le tre città su pari condizioni di morfologia, economia, peculiarità e caratteristiche dei mezzi di trasporto pubblico, come le infrastrutture e di come si fa il movimento delle persone. In seguito si riassume i loro problemi attuali e il modo in cui li stanno affrontando.

La parte successiva è una proposta per migliorare la mobilità a Città del Messico, fatta in tre scale: metropolitana, locali, e di quartiere. Il suo scopo è quello di raccogliere le esperienze di altre città e implementare qui. La strategia si propone di affrontare entrambe i campi di uso del territorio e della mobilità. Alla fine vengono presentate alcune considerazioni finali.

ABSTRACT (ENGLISH)

Today there are cities that are congested. The streets are full of cars that do not seem to move or travel at fast speeds. There are cities that seems their quality of life is getting worse. And there are cities where the distribution of wealth does not seem entirely fair. Is there any relationship between these factors?

This paper discusses how several Latin American cities are battling traffic congestion while trying to improve the economies of their cities and their inhabitants. Firstly discusses the relationship between public transport and quality of life, the benefits of investing in cities and their public transport as a means to connect potential users and markets. What would happen when avoiding such connections in cities.

Following is a detailed study of the City of Mexico, its current status, statistics, morphology, a chronology of its growth, as well as a description of its public transport system. It details how, when, where and why occur the movements of people within this City. After there's a detailed analysis of the current benefits and what could be improved with the public transport in Mexico City.

Then it's presented a research of the cities of Bogotá, Curitiba and Rio de Janeiro to know what they are currently doing to prevent traffic. This section tries to examine the three cities on equal terms of morphology, economy, distinctive features and characteristics of public transport such as infrastructure and how is done the movement of people. Later is summed their current problems and how they're tackling them.

The next part is a proposal to improve mobility in Mexico City, done in three scales: metropolitan, local, and neighborhood. It's purpose is to pick up the experience of other cities and implement it here. The strategy aims to address both areas of land use and mobility. Finally are presented some final thoughts.

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1. WORLD CITY REGIONS, REGIONAL DEVELOPMENT CITIES AND MOBILITY

1.1. THE PHENOMENON OF WORLD CITY REGIONS

Webster defines the city as “a place where people live that is larger or more important than a town: an area where many people live and work”¹, a definition too brief, since, in a city we do many more activities than just working or studying. As it is so true, as the fact that cities are a great investment because they are centers of economic, social and creative development, all placed in a compact area, getting the most of the soil, and therefore much more profitable (and not just economically).

However in recent years, cities have undergone changes that have greatly decrease this profitability. Several factors have come together to decrease the levels of productivity that once had the cities, mostly in the decades of the 50's to the 70's. Cities have grown exponentially, especially by the arrival and settlement of immigrants eager to be included within the dynamics of cities. Cities are becoming increasingly fragmented, spatially speaking, socially dividing and environmentally destructive.

The cities still have (and is not expected to decrease in a long time) growth. The World Bank has estimated that while the population in the cities belonging to developed countries grew only 5%, its built area increased by 30% in the period 1990-2000; and the population living in cities of developing countries grew by 20%, bringing an increase of 50% of constructed area². This puts pressure on the government, which has a population to attend, and especially towards the disadvantaged, the poor.

But it is also generated a need, though most of the time is speculative, for housing and infrastructure manufacture for the city. Therefore, cities are generating a much larger urban footprint than in the past, with an exponential growth rate, which is not defined and can be as dispersed as the city itself required or permitted.

Regardless of the conditions of the city, they have been designed in such a way that transport is a fundamental requirement for operation. Many people have a need to be transported from one place to another, for the activities performed in a single day (usually) are not found in the same place. But it is in these times where the condition of transport are making our eyebrows to lift, as the decrease of the conditions under which it takes place, in addition to increasing transport times, and the increase in product distances of the phenomenon of sprawl that we are currently living, makes us think about our current transport modes.

All these conditions, and some others present in different cities, that have the same generalizing effect that makes decrease the quality of life, makes us wonder if we have the right formula for cities. Could it be that cities have their own mind and they decide their own destiny? Or is it perhaps that cities are simply uncontrollable?

If we consider the followings:

- That cities continue to grow, given its proven success bringing people and goods, and information and ideas,
- In addition to the use of the soil, which is much larger, hence best used, due to the quantity of people who use it,
- Although cities have higher population densities relative to the rest of its territories, the property of self-compaction of the city makes their amounts of CO2 emissions lower compared to national levels³,
- Just like the persistent and almost magnetic connection between the increase in quality of life in cities with opportunities, social interaction and their own wealth⁴,
- And the millions of dollars that will be invested in the cities in the coming years,
- Bringing as a cause (or effect) the increase of world's population living in cities from 50% to 75% by 2050,

We could say that then it's worth a little to rethink our definition of city as well as how to design these spaces, so that cities can pick up a new meaning. One that comes closest to the actual needs of responsible resource management, security, sustainable economic development use, but also fun and quality of life for all. Rem Koolhaas,

[1] <http://www.merriam-webster.com/dictionary/city>

[2] Burdett, Richard et al. *Living in the endless city: the Urban Age project by the London School of Economics and Deutsche Bank's Alfred Herrhausen Society*. New York; London, Phaidon Press, 2011. P. 11.

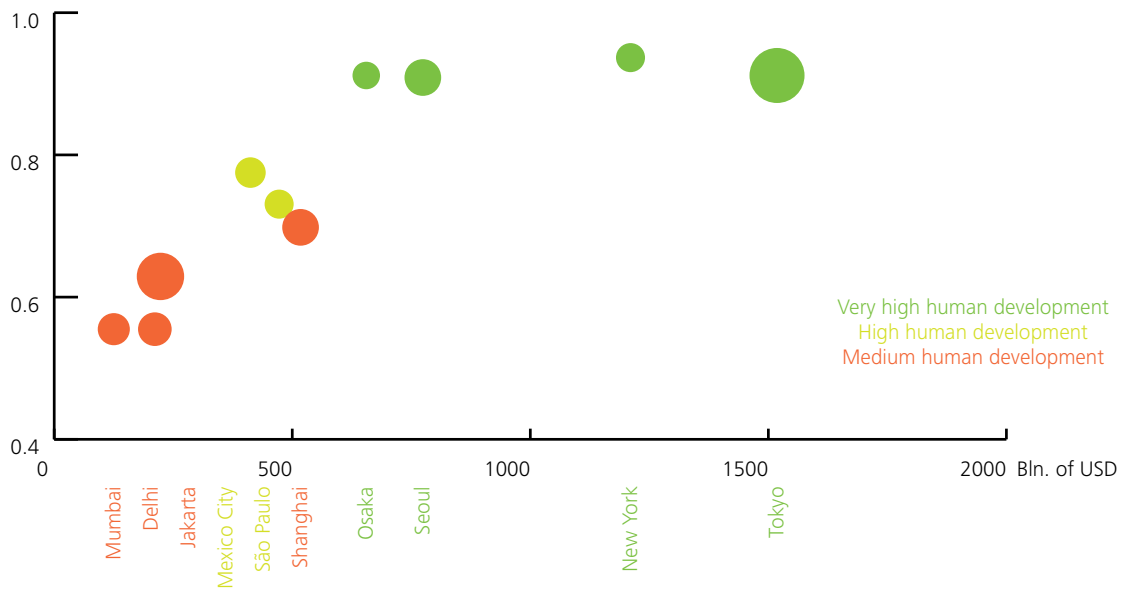
[3] Idem. P. 304.

[4] Idem. P. 304

architect and theorist of contemporary architecture could not have said this better when he said that the problem of the contemporary city is no city in the way that was understood, but the attitude of these users, the citizens, and the attitude the planet has toward them⁵.

But how is it possible to increase the level of life of the citizens? If we go back to the relationship that we did mention, which is the level of quality of life directly related to the wealth of the city, we can conclude that the most significant increase in the very richness of the city could benefit in so directly to the population.

Graph 1.1 World Gross Domestic Product / Human Development Index comparison.



N.B. The size of the circle represents the population of their metropolitan area compared to the rest.

Sources: The Brookings Institution. *Global MetroMonitor*. <http://www.brookings.edu/research/interactives/global-metro-monitor-3>
 United Nations Development Programme. *2013 Human Development Report*. <http://hdr.undp.org/en/2013-report>

Now let's consider that in a certain period of time nations are born and die, while cities remain. This is because their own material property. While nations have their different processes of evolution, so they have their own economies. These are nothing but the product of his entire economic history accumulated throughout the time that the city itself has existed.

But a recent phenomenon presented in cities is the forgetfulness of its economic history, the historical past. When it's a lucky happening to be remembered, in the best case is understood as an obstacle to enter to the new knowledge economy, and in the worst case is seen as an obstacle toward progress. One consequence is, the forgetfulness of history and specialized differences, and that the "old" sectors can potentially serve to "new and advanced". We are talking about a link between the advanced sectors and a many years ago link: manufacturing-services. A concrete example of this would be the Urban Manufacturing⁶.

In many cities it's possible to see several areas of "Architectural glamour" whose brightness obscures stories of urban specialization. It's necessary to recover these joints to see those trends. Recognizing the links between material economies or "old" and the new economy of "knowledge."

At certain stages of history, various production capacities as agriculture, manufacturing, commerce, etc., managed to jump one way or another, or switch to a different mode of organization. This shift was then seen as a new and "not material." Work as performed by financial services or creative people was considered "new" and therefore overvalued. In turn, this over-valuation of this new sector took another consequence, the devaluation of material economies. From this we can deduce two missing links: the link between economies of knowledge with material or older economies, and the link with the city, since some types of material economies as urban manufacturing, are a critical component of the sectors economies of "knowledge".⁷

[5] Idem. P. 51.
 [6] Idem. P. 56.
 [7] Idem. P. 58

Urban manufacturing has the potential to create a better distribution of the economy through the creation of middle-class jobs that entails the creation of specialized middle class firms; as opposed to hyper profits corporate companies. To make this, its necessary to develop it in an urban settlement, given the multiple benefits it has: the existence of a vast network of suppliers, contractors, and direct deal with customers.

It is therefore necessary to give value to the older material practices. This leads to the following first two of many benefits: return the value to this economy, and decreased competition between cities, given their degree of specialization.

There are two aspects of urban manufacturing that are unnoticed; one (as already mentioned) are multiple joints between old and new sectors, and another is the fact that a particular type of manufacturing is integral to service economies. Urban manufacturing is linked to sectors such as design, cultural industries, trade buildings, among other sectors that are integral to the already advanced services economy.

The characteristics of urban manufacturing are the following:

- Need an urban location, as there are contractors.
- It is entirely customizable, hence needs to be in close proximity to its customers and to a diverse pool of first-rate craft workers
- And reverts the service-manufacture relationship.

Today its possible to see a new type of urban manufacturing, one with much more dynamic, and that has been a mixture of standardized manufacturing and urban manufacturing, unlike the one seen during the period between 1980 and 1990. During this period the government did not recognize the field of urban manufacturing, plus they tried to retain large factories in cities since they were much more visible and felt much more their economic impact, and the fact that the government listened better the financial and services sector.

The urban economy is related with two aspects: urban manufacturing (as previously described) and informal economies, as could be the various artists, architects, designers, software developers, among others. Perhaps is not possible to see at a glance the links between them, but with a close examination to the "circuits" that cross each of the activities, and connections available to each circuit, will make us see that even the financial sectors are connected to the urban manufacturing. Once then noticed this large network of "informal economy", we'll realize that various cities have the potential to have a sector of small-scale urban manufacturing.

Now, how to generate the demand for urban manufacturing? To strengthen this demand is necessary the presence of advanced services sector in growth, along with what would be a resultant growth in high-income workers with a preference for urban life⁸. This results in demands for services such as restaurants, shops , cultural events , furniture , trade, and their architectural works required for these activities , whether those are new buildings or old refurbishments. Should be careful planned, as this demand can easily be eradicated due to factors such as lack of support from the agencies responsible for the creation of local and / or national, as well as the privileging of certain advanced services, or any given sectors because those difficult the articulation of strong and effective urban economies. It is then created the effect of a stone wall, when a stone is removed, or in our case a firm or small business , the wall / this complex of dynamic network is compromised, forcing businesses to stay in town and take this network to the fullest. Whenever there is a demand for urban manufacturing, the city generates a win-win situation, because a sector of advanced and dynamic services is strengthened with a dynamic urban manufacturing sector.

The almost widespread architectural context, and its own language today makes us think that cities that take advantage of this are pretty similar. This can not be any more false. Similar scenarios can contain various types of economic transactions. A recognition of the skill levels of activities inside the city can make us notice that in cities could be presented less competition and greater specialization of activities. In turn, the recognition of its various activities would make us note the trend of new economic activities within a building having a highly specialized staff dedicated to professional activities, while the rest of the staff is located elsewhere. The link between them is due to new channels of information, from the telephone to the Internet among others. Similar to this, and assuming that the architecture and space planning serves human activities, we may assume that the infrastructure of a city must have two characteristics: it is necessary, but in turn is indeterminate. The new standard of the urban manufacturing would then be a surrounding of convergence and homogenization of the built environment, leading as a result the

[8] Idem . P. 63.

logical shift of thought in building planning, from the famous “ who or what “ occupies the spaces to “how” are those used.

1.2. A NEED FOR (URBAN) MOBILITY

The city overtook several decades, its rational dimension. This in terms of its geographical location, its size and the number of inhabitants; but also in relation to their impact on the environment of the region in which it has been established, the decline and degradation of natural resources, both in quantity and quality, reaching in many cases to their destruction or extinction by overexploitation or mismanagement.

The fact is that Mexico City, with over 8,700,000 inhabitants, lives with great energy, overcoming the daily challenges through the efforts of its people. It is part of a metropolitan conglomerate with over 18,000,000 people and so far, while recognizing extraordinary economic and political costs and gaps, the large metropolitan area of Mexico City works⁹.

Among the most important factors to take into account to explain the growth of the City, is the one relative with mobility of the population, IE transportation from place of residence to their operation centers: school, work, shopping and other activities. The more the city has grown and its metropolitan area, transport demand has forced the increase of both public and private vehicle fleet, recording a higher density of vehicles on the road and parked on the streets; saturation of roads at various times of the day; parking demand and longer commuting times with higher economic costs and impact on quality of life of the population, taking time away from family life and other activities¹⁰.

Recent data from the Ministry of Transportation and Highways of the Federal District indicates that there is a record of more than 4,600,000 motor vehicles¹¹, which do not always reflect the need transportation but other acquired cultural habits¹².

Meanwhile, the main streets in Mexico City have an area of 930km, with over 18,000,000 square meters of road surface; secondary roads totaling 12,500 km in length¹³. Maintenance implies an ongoing effort to keep them under satisfactory conditions. The traffic lights, and synchronization systems with adaptive or intelligent electronic instrumentation with sensors for traffic flow, helps to give greater fluidity. But all these programs will not be sufficient to continue the growth trend of the urban area¹⁴.

Although one could imply the existence of a belief that the road network of the city is enough for its size to enable mobility of its population satisfactorily, are probably right. However this is not possible given the disparity between public transport and private citizens. There is increasing traffic density and congestion of roadways in greater numbers and more hours a day. The average velocity continues to decrease.

Give priority to the promotion and improvement to public transport solution is required, without prejudice to the need to improve in parallel the private transportation, and to solve in the best way the saturation of the roads. In this city, like many others in the world, the advantages of having private transportation that allows great mobility, cease when the public transport presents comparative benefits in time, money, comfort and security. Unfortunately, in Mexico City, public transport is not sufficiently satisfactory, either for comfort, convenience, time private transfers, multiple payments, among others.

It's noted that from long time ago, the city authorities have conducted programs and built works to improve mobility and transportation of people. However, the dimension of the metropolis and its suburbs, as well as the concentration of the population living in it, in both cases beyond what is rationally desirable, makes necessary to concert national, regional and local review policies development. The goal should be greater harmony in the

[9] Márquez Ayala, David. *El Reto del Transporte en la Ciudad de México. Voces, Ideas y Propuestas*. México D.F., Libros para Todos, 2005. Pp. 13.

[10] Idem. Pp. 14.

[11] National Institute of Statistics and Geography. *Motor vehicles registered in circulation*. http://www.inegi.org.mx/sistemas/olap/Proyectos/bd/continuas/transporte/vehiculos.asp?s=est&c=13158&proy=vmrc_vehiculos

[12] Márquez Ayala, David. *El Reto del Transporte en la Ciudad de México. Voces, Ideas y Propuestas*. México D.F., Libros para Todos, 2005. Pp. 14.

[13] Ministry of Road and Transport of the Federal District. *Estadísticas*. <http://www.setravi.df.gob.mx/wb/stv/estadisticas>

[14] Márquez Ayala, David. *El Reto del Transporte en la Ciudad de México. Voces, Ideas y Propuestas*. México D.F., Libros para Todos, 2005. Pp. 15.

development of the regions, based on creating real incentives to the creation of conditions for the establishment in other territories, thus following decentralization.

The problems and solutions of the city must be addressed in concert; unilateral decisions often affect the other entity and all people. Hence the need to create a real political vision towards medium and long term, a metropolitan coordination with sufficient powers to carry out the plans, programs and projects requiring the metropolitan area, respecting the sovereignty of each state.

With the roads full of cars to many hours of the day, we reflect on what the City would be if there was not a mass transit system such as the Subway and BRT. The continuation of the construction of a more efficient mass transit network, is for many specialists a solution that should still be carried on.

According to a study done by UITP (International Association of Public Transport), those cities with exclusive tracks and well-developed public transport are the ones with more fluidity in urban transportation than the automobile¹⁵.

The subway and suburban rail compete favorably in terms of speed. In Mexico City, the average speed is 33 kilometers per hour, while the car is 22.5. What we can deduct is that an efficient public transport system can play an important role in reducing the time spent in commuting, allowing citizens to have more free time for their professional activities or leisure¹⁶.

The city is a human space that facilitates the exchange of all types of goods, services and information. But gradually the streets are becoming a road network, whose main function is to accommodate the automobile. Meanwhile people and their needs are being relegated by the movement of the machinery.

A quality public transport system can be faster than the car. A "sustainable mobility" implies forms of mobility that are not only just from a social point of view but also economically visible and environmentally friendly. Public transport plays an important role in these three aspects¹⁷.

The urban space is the site of encounter, games, trade, walking and movement, and is the character of the city and its inhabitants. Urban roads should be a part of life. It is necessary, therefore, a more democratic distribution of the space that prioritizes pedestrian mobility. At the end of the day, we all are pedestrians.

1.3. TRAFFIC AS A CONSTRAINT

1.3.1. Economic constraints

Let us now examine what happens with the economic cycles. Let's start with the assumption that anyone, regardless of where they live, requires capital for survival. But there are others who seek capital for other purposes, mainly to get more capital. And for that they are willing to issue it. This has been true since the eighteenth century, where the capitalist simply had to choose a technology and organizational form to begin operations, through the purchase of labor power and means of production. The final product was the capital, which split into two, one part to reinvest and a backup. An important constant in this capitalist cycle is continuity. So if it does not exist, there's risk of loss. The simple cycle arrest threatens to devalue capital already acquired.

Now, all this movement of capital is done on a place in physical space. The capital has the tendency to pass any barrier, even if it takes time. This trend, along with the one to speed the transactions so that the exchange of capital is done much faster, have always existed. Without these barriers, the capitalist has the need to expand. To do this, more capital is generated and then look for new fields to absorb the reinvested capital, beginning the cycle again. It is with this endless cycle that highlights the problem of absorption of surplus capital.

When capital meets an insurmountable barrier, is said to be in a crisis. From here there are two possibilities: that the barrier is passed, in this case the growth continues; or that the barrier can not be passed, initiating a cycle of crisis. This can start with the decrement of growth, after which is continued a surplus capital, and ultimately leads to the

[15] Márquez Ayala, David. *El Reto del Transporte en la Ciudad de México. Voces, Ideas y Propuestas*. México D.F., Libros para Todos, 2005. Pp. 18.

[16] Idem. Pp. 18.

[17] Idem. Pp. 36.

devaluation and / or destruction of the already acquired capital¹⁸.

To reproduce the capital, it has to overcome six barriers¹⁹:

- The initial money-capital impairment.
- The shortage of labor (or policies for those).
- Inadequate means of production.
- Inadequate technologies and organizational forms.
- Resistance / inefficient work process.
- Lack of demand backed by money to pay on the market.

Unlike the old system of savings, where capital is concentrated in fewer and fewer hands, the credit system has enabled a relatively rapid attainment of capital. This, along with some other financial instruments have permitted a much more dynamic movement of capital. New connections between places exceeding in capital and those with a shortage of this have been done. This mechanism is needed to overcome blocking movement of capital within a physical space.

Neither the population nor capital are fixed, despite restrictions imposed by the State. Although there are millions of people who are not integrated in the game of capitalism, human landscapes with social relations, production styles, lifestyles, technologies, organizational forms, relationships with nature are created around. All of them mixed with institutions. It seems that they are not related, but the truth is they are.

The capital, despite the clutter that might appear in their distribution seems to follow some basic principles, some geographical principles. The first is that capital must overcome its geographic boundaries for its accumulation. This improvement is achieved over time. This improvement is not only driven by capital itself, the capitalist has to do with it too. With mobility in the space of capital and greater control of it, the capitalist is able to maintain its power. This is as well motivated by the pressure of the competition. When pursuing the control over the space, time and technological advances, the capitalist seeks to have superiority over its competition. This imposes the fetishistic belief that every economic problem can be solved with a technological breakthrough or temporal space. Once these beliefs converge, what we then get is a whole frenzy of innovations²⁰.

The second principle is that the circulation of capital is given in one place, a geographical location, where a concentration of money, means of production, labor, and production of goods are. There is an ideal location to locate economic activities, and is close to the means of production, market consumption and labor. This reduces production costs and increases profits. Once all these conditions come together, it is when the laws of capital accumulation works, and not backwards²¹.

One of the pillars of capitalism is the geographical differentiation, and this is only achieved by two factors: a dominant ideology and a minimum of individual freedom. Companies strive to do this, and therefore care for infrastructural developments (which make the company more profitable) and many restructures, usually driven by competition and crisis.

These developments can encourage the creation of external economies, or the advantages that a capitalist has just by being near to each other, also known as geographical agglomerations of capitalist activities or industrial districts.

However, the same location of activities in physical space determines the fact of dependence of flows, whether of cash, goods and / or people. It is therefore also necessary an effective transport system. Therefore we can deduce that the slightest friction in the transport flow causes restriction of cash, goods and / or people²².

This was already fully known by the capitalists and it's seen in the creation of vast networks of market connections.

[18] Harvey, David. *The Enigma of Capital: and the Crises of Capitalism*. Madrid, Akal, 2012. Pp. 41-45.

[19] Idem. P. 47.

[20] Idem. Pp. 131-134.

[21] Idem. Pp. 134-135

[22] Idem. P. 136.

This knowledge allowed better absorption of surplus capital. Wherever there's a place that offers lower costs, capitalist will move there.

This location done by capitalists, in turn leads to a particular type of competition, as two companies can not occupy the same place. This gives rise to a monopolistic competition that has implications for transport, such as high transport costs which provide protection to local producers; or its opposite, low transportation costs, causing a weakening of monopolies²³.

1.3.2. Environmental constraints

Transport is one of the main sources of greenhouse gases. Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulfur dioxide (SO₂), carbon monoxide (CO), lead, volatile organic compounds (VOCs), solid particles and some hydrocarbons are the main compounds burning fossil fuels - such as gasoline and diesel - expel into the atmosphere. Despite the improvement in engine efficiency and fuel quality - relative progress due to the inefficient characteristics of the internal combustion engine - given the increasing number of vehicles and displacement, the introduction of more powerful engines and a lower vehicle occupancy, continuous emissions volume increase.

Specifically, CO₂ (a gas without which life on the planet would not be possible, but at concentrations above the ones presented on early twentieth century) is causing an increase in the average temperature of the Earth and, therefore, increased greenhouse conducive climate change. Emissions from transport in the EU increased by 15% between 1990 and 1998.

Currently, transport is responsible for 25% of global CO₂ emissions, and 85% of this figure corresponds to surface transport modes. A 2% increase in annual distance traveled also increases CO₂ emissions 35,000 tonnes, despite the comprehensive emission control by the administration. In this sense, public transport accounts for only 2.1% of total emissions²⁴.

In urban areas, transport is by far the main cause of pollution, mainly due to the large number of vehicles that travel daily on the inhabited areas. The emissions from the tailpipes of motor vehicles generate most of the air pollution, and more than a quarter of the emissions of greenhouse gases, affecting the health of people, especially newborns, the elderly and people with respiratory diseases.

According to the European Environment Agency, although urban air quality improves slightly, pollution levels continue to pose a risk to health.

Another aspect to consider in relation to vehicle pollution is noise, since, mainly in urban areas, vehicular traffic is 80% of ambient noise.

Noise pollution is related to cardiovascular disease and hearing loss, as well as nervous system disorders (stress, irritability, tension), fatigue, chronic insomnia, feeling bad generated, impaired concentration, abnormal processes of learning and communication difficulties and social relationship. It is estimated that over 30% of the world's population is exposed to noise levels that may be harmful to health.

Mexico City has one of the highest concentrations of automobiles in the world. Of this we can realize compared with 142 private vehicles in Los Angeles and 256 in Madrid. No wonder, therefore, that the flow of traffic in the Mexican metropolis is far smaller than in other cities.

The average vehicle speed on the road network of Mexico City, at all hours of the day and throughout the year, is 22.5 kilometers per hour, compared to 47.4 kilometers per hour from Los Angeles and 35.1 kilometers per hour from Madrid. Only three cities in the world have worse indexes: Bangkok, Taipei and Caracas²⁵.

Mexico City has one of the highest levels of toxic air emissions in the world, mainly due to the exhaust of private vehicles. The total emissions of carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO₂) and volatile hydrocarbons in Mexico City summed a staggering 29,909 kilograms per urban hectare. This figure can be compared with the level of 2,648 kg in Rio de Janeiro, 2,916 kg in Los Angeles, 3,509 kg and 1,483 kg in Berlin in Tokyo.

[23] Idem. P. 138-139.

[24] Márquez Ayala, David. *El Reto del Transporte en la Ciudad de México. Voces, Ideas y Propuestas*. México D.F., Libros para Todos, 2005. Pp. 138.

[25] Idem. Pp. 18.

According to the World Health Organization, the concentrations of suspended particles in Mexico City reached 179 milligrams per cubic meter, almost double the maximum level recommended by the WHO, which is 90 mg / m³.

Moreover, the WHO estimated that just by reducing atmospheric levels of carbon monoxide, lead and suspended particles in developing countries could be avoided, almost around 700,000 deaths annually.

Every year in Mexico City die from traffic accidents, an average of 151 people per million inhabitants, while the figures for other cities are, for example, 142 in Los Angeles, 74 in Madrid and 26 in London. In some cities in the world, traffic accidents account for 40% of all fatal accidents and are the leading cause of deaths in the group between 15 and 30 years old. Meanwhile, public transport is 5 to 10 times safer than private transport. In Europe, for example, is between 20 and 25 times safer to travel by rail than by road²⁶.

1.4. BOOSTING REGIONAL DEVELOPMENT WITH URBAN REGENERATION

Cities, as we have seen, have the potential to generate global changes. They have all the ability to pressure and influence to support the global changes that the planet urgently needs. Environmentally speaking, they are much more sustainable than the urban sprawl, since their emissions are considerably much less due to their ability of compaction. Besides the fact that they have everything inside well conjoined and necessary to maintain a sustainable economy assembly.

We have seen that one of the factors that can help is to encourage urban manufacturing. This has the potential to create a better distribution of the economy through the creation of middle-class jobs, which leads to the creation of specialized middle class firms. And we have seen that this can occur only in urban settlements, as these conjoined the necessary features to make this industry work: the existence of a vast network of suppliers, contractors, and dealing directly with customers. According to the second principle of geographic capital, we are talking about there are ideal conditions to have not only one but several ideal locations for the creation and incentive of business in a city.

We have also seen that one of the factors that may jeopardize the economic, social and environmental development is the lack of efficient transport. Public transport is possibly the most important provision of the cities to promote economic development while reducing air pollution and improving the quality of life²⁷.

A good method to get the most of the absorption of capital has been the production of spaces and urbanization, financed through debt. Examples are seen from the Napoleon III era (when there was the urge to absorb surplus capital at the time) to the seventies in the US²⁸. Unfortunately after the late seventies began to generalize the problem of traffic. Absorption of capital, coupled with population growth generated that the simple construction of urbanization ceased to be the necessary response to capital flows. Having raised various configurations and traffic solutions, such as satellite towns, toll roads, dormitory towns, rich areas, etc., all based on policies to stimulate car purchase, generated the situation where we are today.

Then a question raises: is it possible to attack the city traffic while improving their economy, in an environmentally sustainable framework? The answer is quite positive. One way to reduce environmental emissions, and therefore traffic would be an integrated urban transport system. According to Hoornweg, emission reduction is possible in dense cities with an effective system of transport and, preferably, environmentally friendly ones, as well as distances reduce operating costs per household²⁹. The economic benefits are many depending on the point of view:

- Reduction of greenhouse gases: stimulation of innovation in creating new technologies to address the problem, in addition to the benefit of small economies of scale.
- Environmental policies: project an image of an attractive city, an issue that can attract investors. Reduce the costs of the health system, promotes competitiveness and limited dependence on imported materials and/or energy.
- From implemented measures: promotes creation of jobs for the creation of new policies on the use of cars,

[26] Idem. Pp. 19.

[27] Burdett, Richard et al. *Living in the endless city: the Urban Age project by the London School of Economics and Deutsche Bank's Alfred Herrhausen Society*. New York; London, Phaidon Press, 2011. P. 318.

[28] Harvey, David. *The Enigma of Capital: and the Crises of Capitalism*. Madrid, Akal, 2012. Pp. 140-145.

[29] Burdett, Richard et al. *Living in the endless city: the Urban Age project by the London School of Economics and Deutsche Bank's Alfred Herrhausen Society*. New York; London, Phaidon Press, 2011. P. 344.

public transport, infrastructure, etc.

If the benefits are pretty obvious, then why are we living in a situation of lack of support for the solution to this problem? There are several reasons for this: the fact that the results are not achieved in short-terms, gains provided by energy efficiency can not be easily recognized or monetized, plus to achieve it, strong investment and skilled personnel is required in the field, which is currently lacking.

How to plan a city where traffic is not a issue? An answer to this would be to attack the problem of automobile dependency. This can be achieved by creating urban amenities close to transport. This immediately encourages polycentric urban growth, which helps prevent the formless development, or the phenomenon of sprawl. An extensive and well-integrated transport network can reduce the need to purchase a vehicle. Now, what will draw people to use public transport will be those amenities, or "mobility magnets". They should be perfectly localized. You can tell when the magnet itself is used. Shouldn't be pursued to locate them based on the provision of land for a specific place or on the basis of profitability that can result . Should seek the location of various uses and nearby projects to each other, as when used regularly can drastically reduce the need for private transportation system³⁰.

A city that claims to be both accessible and democratic has urban "mobility magnets" near to the nodes of public transportation system. The role of government is to identify urban amenities, knowing how will the city develop, its destiny, and its trend of development of the population. The final goal would be to reach in a given case the point where it ceases to rely not only on private transport, but as well in the public transport system, consequently resulting in the need for a short, low-impact mobility (IE walking and cycling). In the end this will determine how livable and enjoyable the city is³¹.

[30] Idem, Pp. 380, 383, 386.

[31] Idem, Pp. 386-3





2. URBAN GROWTH OF MEXICO CITY

The Valley of Mexico is located in 19° 20' North Latitude and 99° 05' West Longitude, being part of a basin, which has an average elevation of 2,240 meters and an area of 9,560 km². It has mountain ranges, plateaus and ravines, as well as half-planes land in what were once the lakes of Texcoco, Xochimilco and Chalco. The valley is composed of a part of the State of Mexico, the southern state of Hidalgo, Southeast Tlaxcala and almost the entire Federal district.¹

Within the Valley is located the Mexico City Metropolitan Area. It is conformed of 3 states, with some or all of their municipalities. These states are: the Federal District (capital of the country), the State of Mexico and the State of Hidalgo.

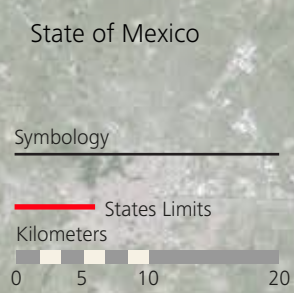
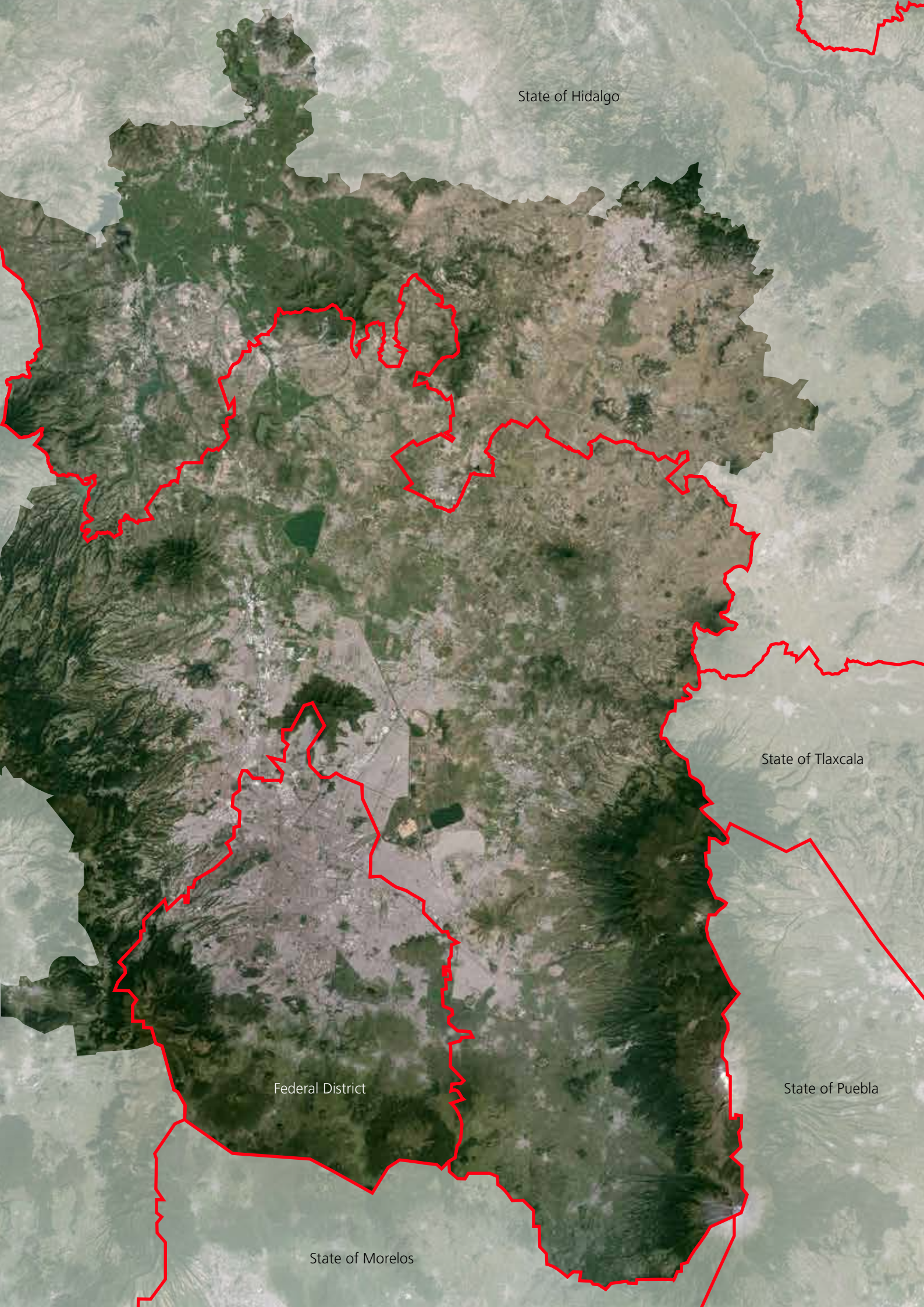


Fig. 2.1 Mexico City Metropolitan Area.

Source: Secretariat of Social Development; Federal District Government; State of Mexico Government; State of Hidalgo Government. http://www.puec.unam.mx/pdf_cont/pozmvm_digital.pdf

[1] Secretariat of Environment and Natural Resources, State of Mexico Government, Federal District Government and Secretariat of Health. *Program for the air quality improvement in the Metropolitan Area of the Valley of Mexico 2002 - 2010*. P. 2-3.



State of Hidalgo

State of Tlaxcala

Federal District

State of Puebla

State of Morelos

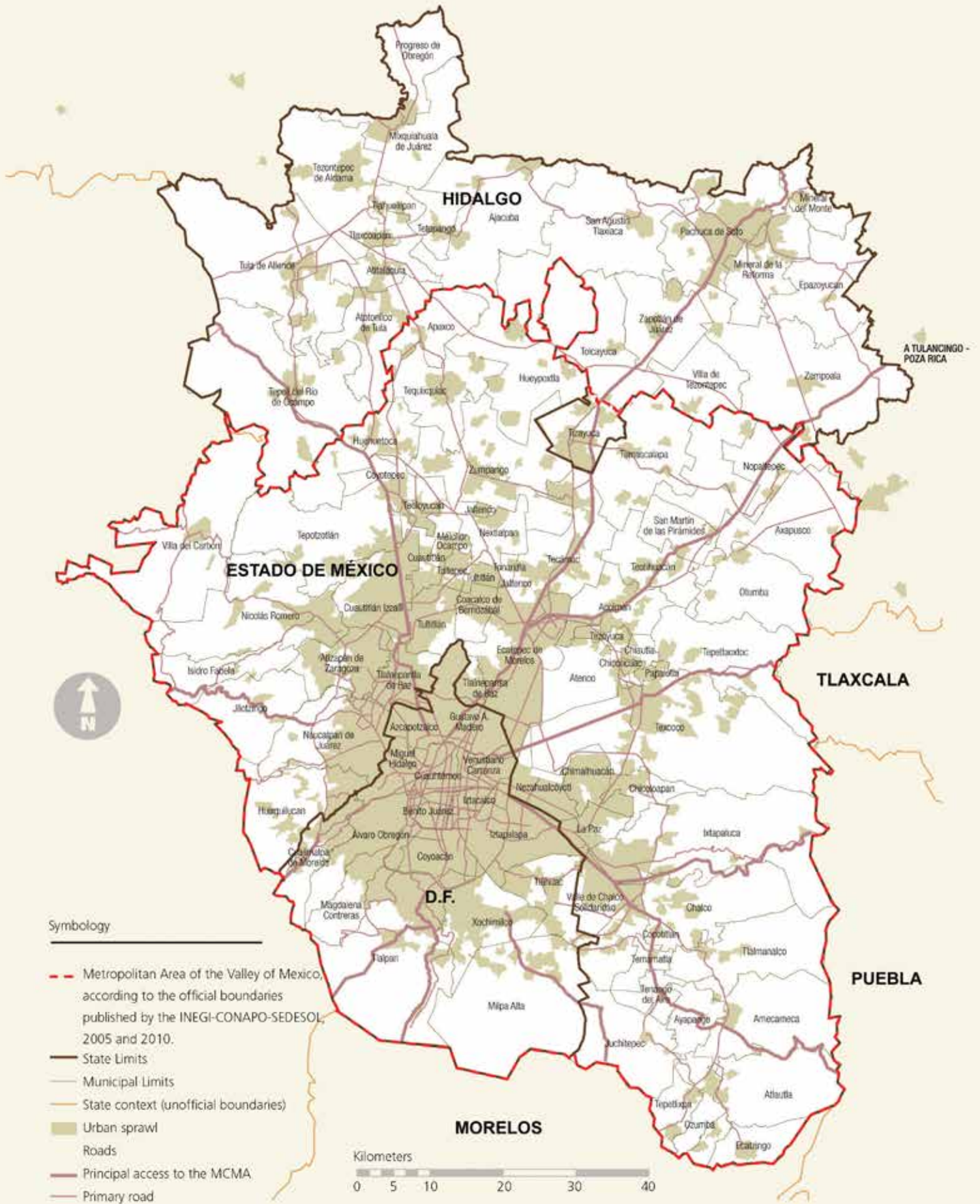


Fig. 2.2 Delegations (in the Federal District) and Municipalities comprising Mexico City Metropolitan Area. Source: Secretariat of Social Development, Federal District Government, State of Mexico Government, State of Hidalgo Government. *Programa de ordenación de la Zona Metropolitana del Valle de México. Actualización 2012.* Mexico, 2012. P. 11.

2.1. POPULATION²

Inside Mexico City Metropolitan Area (MCMA) lives 21 million people of which 53 % live in the 59 suburban municipalities of the State of Mexico, 42% in the Federal District and 5% in the 21 municipalities of Hidalgo. The largest concentrations of population in the MCMA is located in the central delegations of DF and municipalities located in the State of Mexico to the east and north of Mexico City.

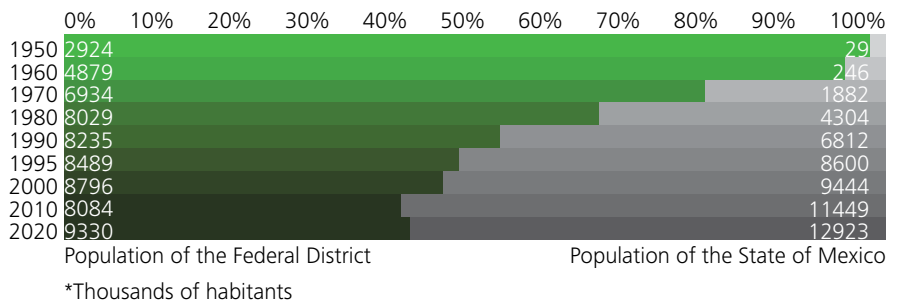
Between 2000 and 2010 the annual growth rate of the total population of the MCMA was 0.85%. Each of the three entities that make up the MCMA show variations in their population dynamics. In Mexico City the annual growth rate of the total population was 0.27%. For it surrounding State of Mexico municipalities, the total annual rate amounted to 1.33 % and for the Hidalgo State rated to 2.84% per annum.

The absolute decrease or increase in population in these political administrative units respond to a prevailing pattern of urbanization in Mexican metropolitan areas, characterized by loss or stagnation of the population in the central city and peripheral growth in the municipalities of entities neighbors.

Migration is the main factor that modifies the metropolitan population

[2] Secretariat of Social Development, Federal District Government, State of Mexico Government, State of Hidalgo Government. *Programa de Ordenación de la Zona Metropolitana del Valle de México. Actualización 2012. Síntesis Ejecutiva.* Mexico, 2012. Pp. 14-18.

Graph 2.1 MCMA Growth distribution between the Federal District and the State of Mexico.



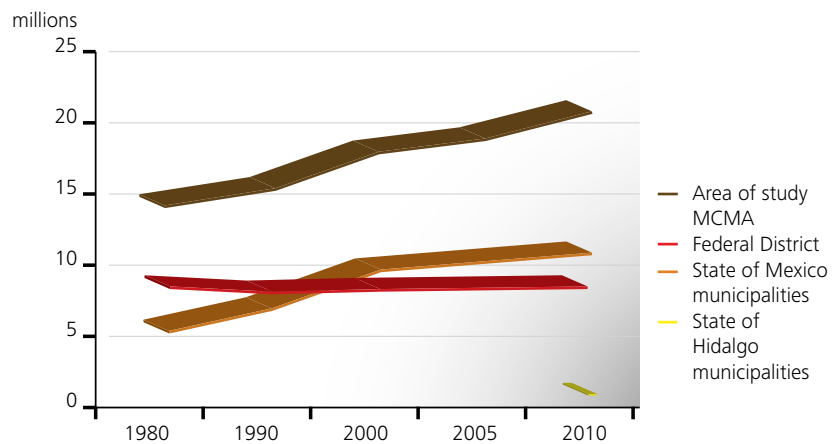
Source: Secretariat of Health, Secretary of the Environment and Natural Sources, Secretariat of Ecology of the Government of the State of Mexico, Secretary of the Environment of the Government of the Federal District. *Programa para mejorar la calidad del aire de la Zona Metropolitana del Valle de México. 2002-2010.*

Chart 2.1 MCMA Growth rate, 1980-2010

	1980-1990	1990-2000	2000-2005	2005-2010	2000-2010
MCMA	0.76	1.70	0.79	0.92	0.85
Federal District	-0.71	0.44	0.04	0.32	0.27
State of Mexico	2.73	2.96	1.25	1.41	1.33
State of Hidalgo					2.84

Source: National Institute of Statistics and Geography (INEGI), *Census of Population and Housing 1980-2010, II Census of Population and Housing 2005.*

Graph 2.2 MCMA Population Growth. 1980-2010.



Source: Secretariat of Social Development, Federal District Government, State of Mexico Government, State of Hidalgo Government. *Programa de ordenación de la Zona Metropolitana del Valle de México. Actualización 2012.* Mexico, 2012. P. 15.

Chart 2.2 Migration in the MCMA

MCMA	Migration	Immigration	Net balance
MCMA total	680 540	891 307	210 767
Federal District	281 569	203 529	-78 040
59 Municipalities of the State of México	364 813	599 365	234 552
21 Municipalities of the State of Hidalgo	34 158	88 413	54 225

Source: University Programme of City Studies - National Autonomous University of Mexico, based on the INEGI Census of Population and Housing 2010.

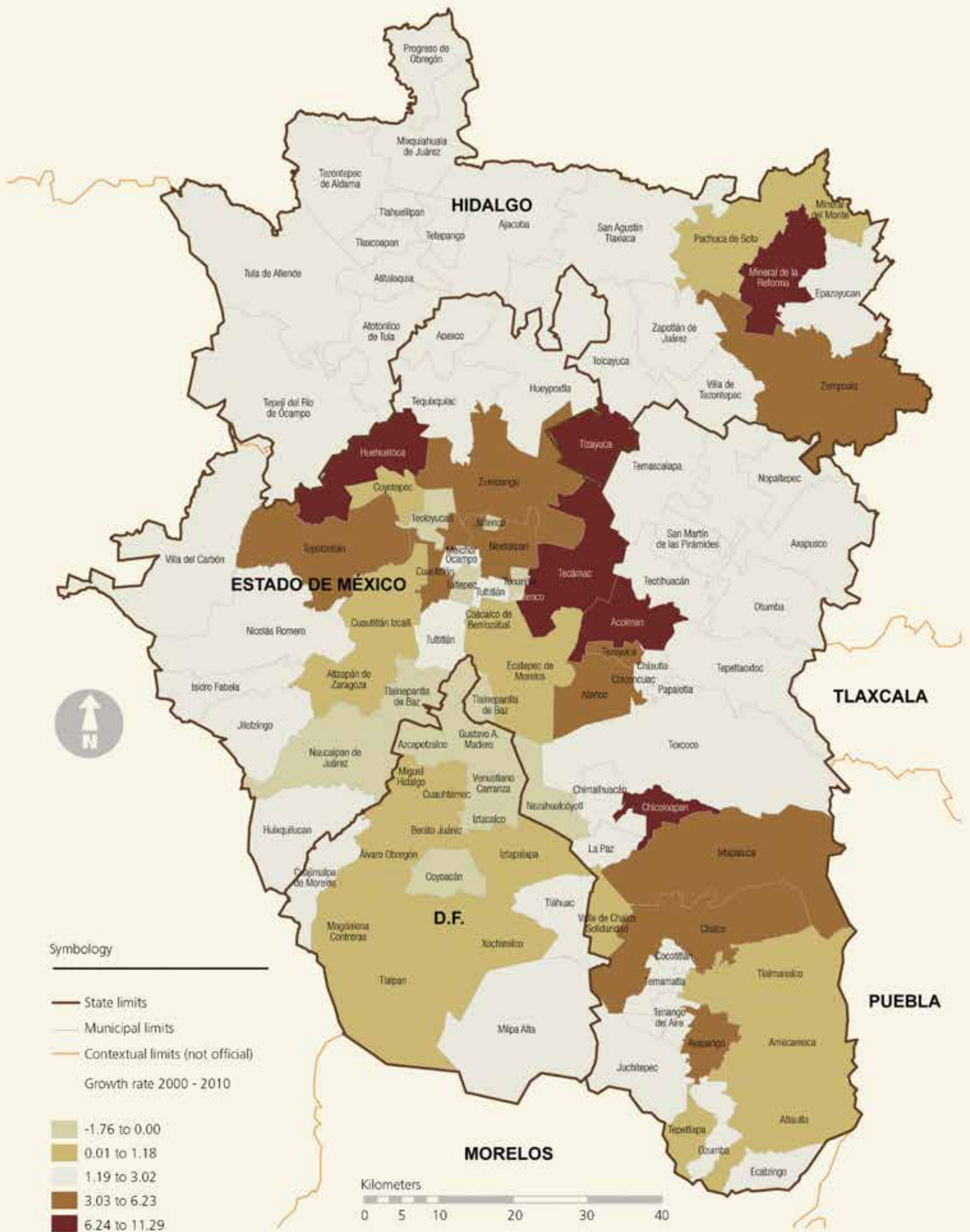


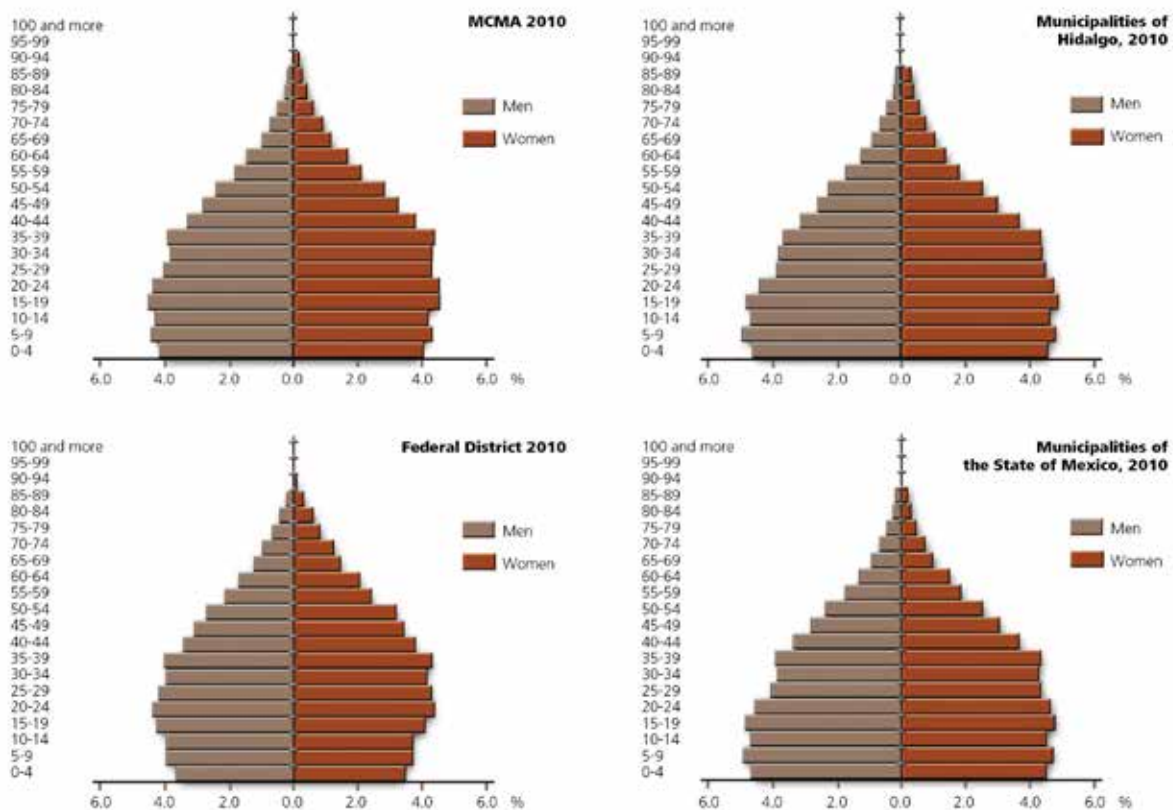
Fig. 2.3 Population growth rates 2000-2010. Source: Secretariat of Social Development, Federal District Government, State of Mexico Government, State of Hidalgo Government. *Programa de ordenación de la Zona Metropolitana del Valle de México. Actualización 2012.* Mexico, 2012. P. 17.

dynamics since the MCMA is one of the major magnet zones of the country, particularly for the neighboring municipalities in the State of Mexico. Between 2005 and 2010, the Federal District has a net negative migration balance of -78,040 people. The 59 neighboring municipalities in the State of Mexico have 234,552 additional residents and the State of Hidalgo municipalities continue to receive population, whether they're from the State of Mexico or the Federal District, with a positive net migration of 54,255 people. Overall, the MCMA had an increase of 210 767 people in the reference period.

The demographic transition in the MCMA, as the age pyramid shows, recorded a considerable reduction in the base, an expansion in the middle ages and an increasing trend of the elderly population. This population structure generates, on one hand, a large public demand for education and employment, and on the other, demand for services for the elderly population and a heavy burden on the current labor force. In this matter, in 2010, the average age of the population in the MCMA was 27, which expresses the weight of the young population and potential workforce has this urban region to join the productive activities.

Also, in 2010 the percentage of children under 15 represents a quarter of the population, while people between 15 and 64 years are 68.2% and 6.2 over 65%. Regarding the population distribution within the MCMA as age group, children under 15 are most representative in the neighboring municipalities of the State of Mexico and Hidalgo (63.3%) than in the DF (36.7%), although they can access services in the central city. Meanwhile, people 15 to 64 years old also have greater weight in the suburban municipalities than the ones living in the Federal District (57.1 % and 42.9 % respectively). Finally, those over age 65 are concentrated in the core of the MCMA, mainly in the central municipalities of the FD, but also those closest to Mexico City and oldest conurbation municipalities.

Graph 2.3 MCMA Population Pyramids, 2010.



Source: Secretariat of Social Development, Federal District Government, State of Mexico Government, State of Hidalgo Government. *Programa de ordenación de la Zona Metropolitana del Valle de México. Actualización 2012*. Mexico, 2012. P. 18.

2.2. URBAN EXPANSION³

Throughout the twentieth century, the area occupied by the metropolitan area has expanded dramatically on par with the population growth.

[3] Idem. Pp. 18-21.

Around the thirties, the population of the MCMA increased with higher rates than in the rest of the country. In the fifties there was the spatial expansion of the metropolis, almost within the limits of the Federal District, where then lived 99% of the population of the region. This is the time when population growth had the highest growth rates in history. In the seventies, the metropolitan area exceeded the limits of the Federal District and spread to the State of Mexico.

The nineties marked a major shift in urban growth trends in the MCMA, thereafter, the metropolitan growth occurred more in the territory of the State of Mexico. In fact, migration to this also comes from Mexico City.

Also in that decade, metropolitan growth begins to push ecological conservation areas, mainly in Iztapalapa, Tláhuac, Xochimilco, Tlalpan, Magdalena Contreras and Milpa Alta. In the State of Mexico, the urban area expands discontinuously segregated in many cases.

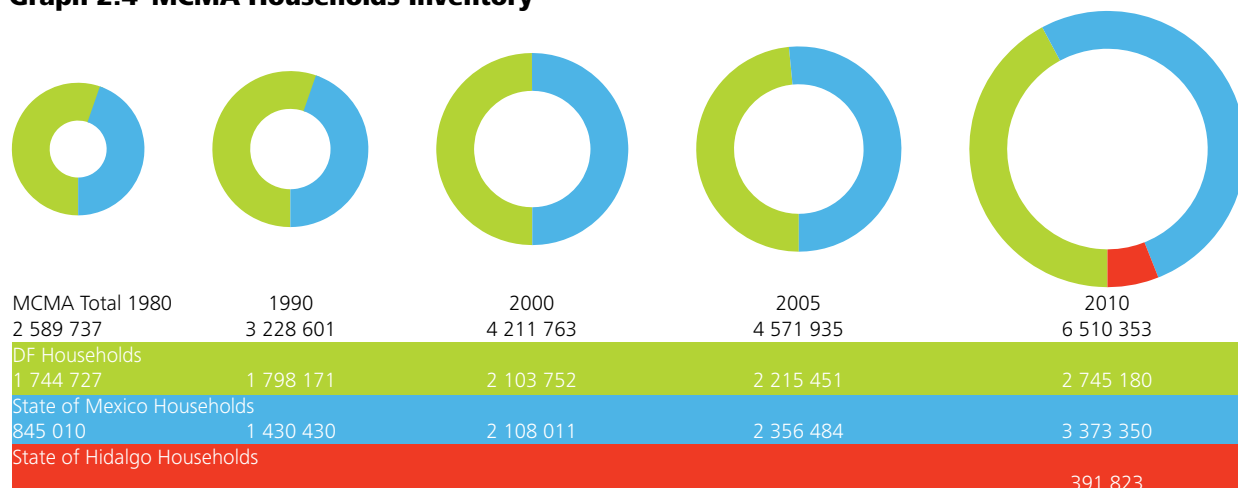
The total growth of the surface of the MCMA urban area between 2005 and 2010 was almost 18 800 hectares, with a total area of 146,032 hectares in 2010. 68% of the total growth in this area occurred in the municipalities of the State of Mexico and 31% in the municipalities of Hidalgo. Only 1% of the growth of the urban area corresponded to the Federal District.

Inside the MCMA coexist various processes of different nature and intensity, in the occupation of the territory. On one side is the Federal District, which virtually isn't expanding its urban boundary and, by contrast, has initiated a process of recovery of some central areas. Coexist in this case peripheral consolidation processes (areas that gain population without growing horizontally) with recovery processes and depopulation in central and intermediate areas. In contrast, urban areas of the municipalities of the State of Mexico and Hidalgo are characterized by a strong expansion in peripheral and discontinuous modes combined with the depopulation of the consolidated central areas. Only the conurbation in the State of Mexico are present some peripheral consolidation processes (Ecatepec, Valle de Chalco and Ixtapaluca, etc.). It can be said that while in the municipalities of the State of Mexico and Hidalgo dispersion forces are present, in the Federal District the concentration predominate.

The dispersion is not primarily driven by irregular settlements as in previous decades. The main causes are the new projects (sets) of housing located at increasing distances from urban centers, leaving large gaps between them and the continuous urban territories (Tecámac, Zumpango and Huehuetoca). The land inventory owned by housing developers enables them to secure the land for new developments, thus a more intensive use of previous investments. This combination of circumstances has created new expectations for economic performance in the landowners, while leading to a more scarce and expensive land situation. In this context, popular groups have found new option of settlement in the old towns of the metropolitan area, which usually have the basic urban services. The discontinuous expansion by way of this housing complexes and popular settlement of ancient villages reduces the average density. Isolation conditions difficulting the daily flow of their inhabitants are created, hindering the creation of proximities economies, considered a fundamental step to improve the welfare. This is particularly serious in the case of housing projects, where it is common to find vacant homes.

The number of dwellings in the MCMA in 2010 was 6,510,353. In the period 2005-2010 the increase was 1,716,269 households, representing 26.3% of all households. Its territorial distribution in 2010 corresponds to 51.8% in the

Graph 2.4 MCMA Households Inventory



Source: National Institute of Statistics and Geography (INEGI), *Census of Population and Housing 1990-2010, I and II. Census of Population and Housing 1995 and 2005.*

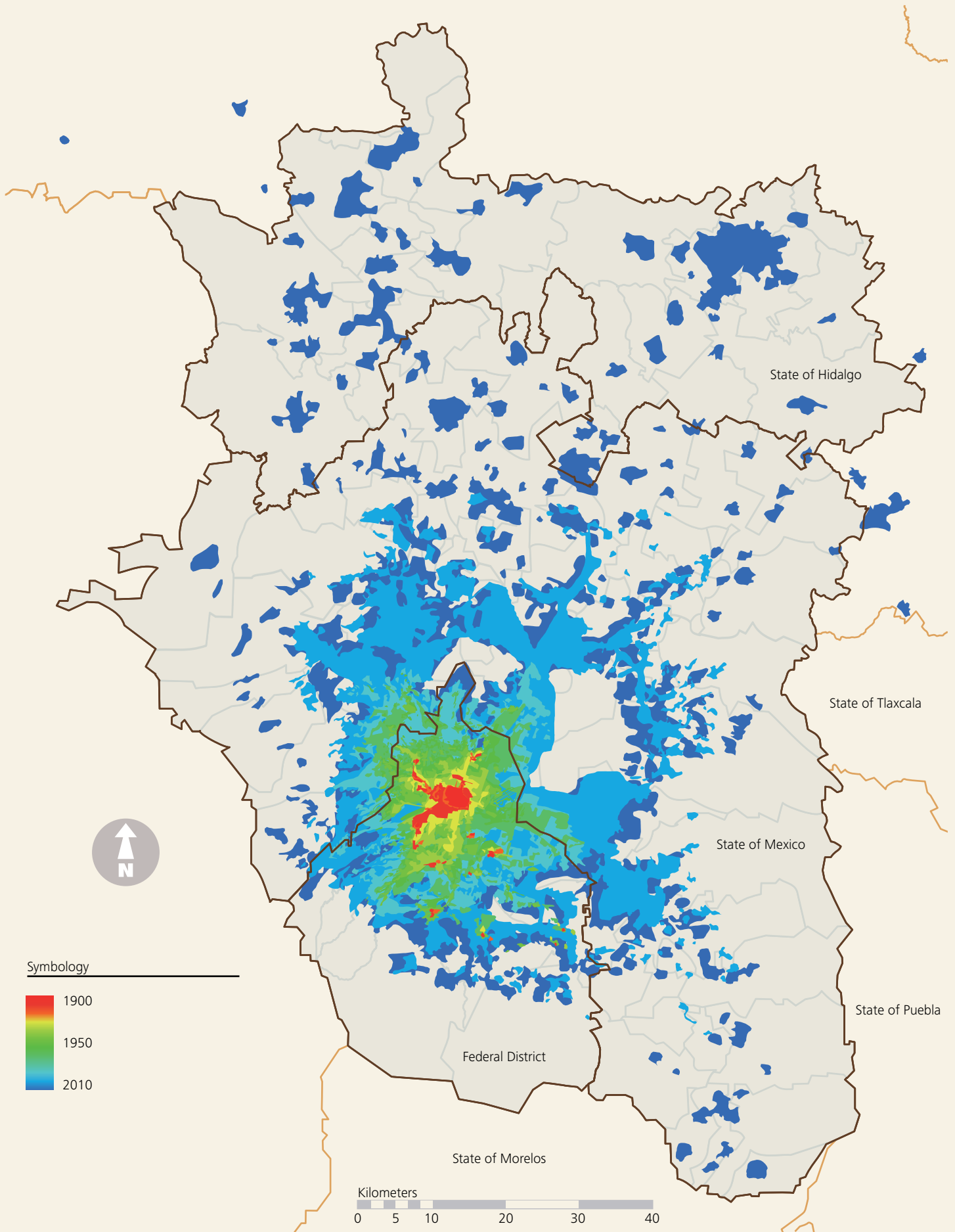


Fig. 2.4 Territorial expansion of the MCMA (1900-2010). Source: Espinosa López, Enrique. *Ciudad de México : Compendio Cronológico de su Desarrollo Urbano, 1521-2000*. México, National Polytechnic Institute, c2003.

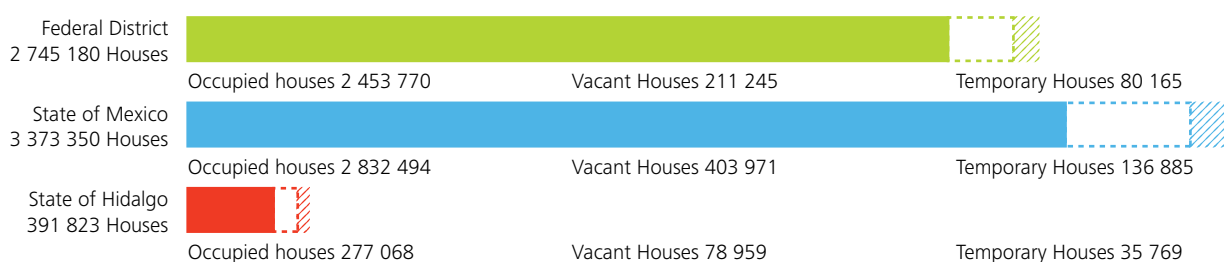
metropolitan municipalities of the State of Mexico, 42.2% in the DF and 6% in the metropolitan municipalities of the state of Hidalgo.

The increase in the number of households in Mexico City between 2005 and 2010 was 529,729 homes, while in the metropolitan municipalities of the State of Mexico was 1,016,866 and the metropolitan municipalities of Hidalgo, to 169,674 homes.

In the MCMA, according to the 2010 Census there is a very high number of vacant homes. Currently the INEGI estimates a vacancy in the MCMA of the order of 10%, equivalent to 694,175 households, of which 403,971 (58.2%) are located in the municipalities of the State of Mexico, 211 245 (30.4%) in the municipalities of DF and 78,959 (11.4%) in the municipalities of Hidalgo.

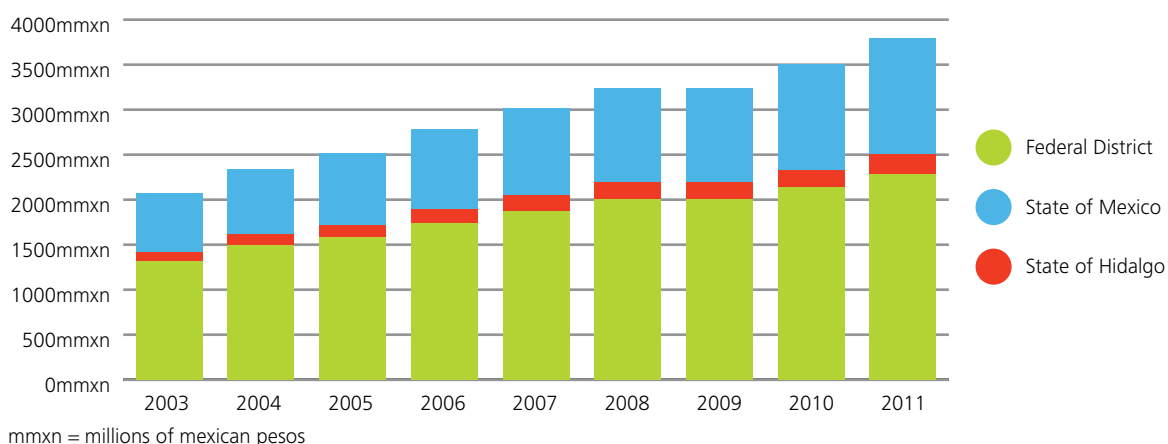
2.3. ECONOMIC DEVELOPMENT⁴

Graph 2.5 MCMA Households and Vacant Houses Inventory



Source: National Institute of Statistics and Geography (INEGI), *Census of Population and Housing 2010*.

Graph 2.6 MCMA Gross Domestic Product per Entity 2003-2011



Source: National Institute of Statistics and Geography (INEGI). *Gross Domestic Product. State GDP 2003 Standard*. <http://www.inegi.org.mx/sistemas/olap/proyectos/bd/consulta.asp?p=16859&c=17383&s=est&cl=3#>

The MCMA provides 27.2% of the Gross Domestic Product (GDP) of the country and concentrates most of the services, even if it has declined in recent decades.

The primary activity of the MCMA has changed, following the trend in all major cities of the world from the eighties, moving from a city of heavy and polluting industry to one with services centers and light industries.

The spatial distribution of industry, trade and services in the MCMA presents differential patterns. The modern sector of the economy, including advanced services, linked to the global economy, is located in municipalities of central and west of the MCMA.

As for trades, big businesses are concentrated in Cuauhtémoc, Miguel Hidalgo, Benito Juárez, Iztapalapa and Álvaro Obregón delegations of the Federal District, and municipalities of Naucalpan and Tlalnepantla, where large

[4] Idem. Pp. 21-22.

shopping centers are located, as well as areas with high concentration of commercial establishments such as the Historic Center of Mexico City and Polanco. There are as well major urban corridors with significant trade intensity as the Paseo de la Reforma, Insurgentes. Meanwhile, in Mexico City's main Groceries Supply Center, located in Iztapalapa, records the most perishable goods transaction in the whole country.

In 2008, 22% of industrial production in the MCMA is concentrated in ten political administrative units. The most significant unit was the municipality of Hidalgo Atitalaquia as a result of the operation of industrial parks of great significance that are located in the municipality. Secondly Atzacapotzalco is located in the Federal District, next largest municipalities Tlalnepantla, Ecatepec, Cuautitlan Izcalli, Naucalpan and Tultitlán and delegations Miguel Hidalgo, Coyoacán and Iztapalapa.

Moreover, the traditional sector of the local economy is characterized by technological backwardness, and illegal employment with low wages.

A pattern of metropolitan spatial distribution is noted, where the commercial and service activities in the modern sector show a concentric pattern associated with the location of the high-income population in an axis going from the center to the west.

The activities of the traditional sector, however, are scattered throughout the territory and correspond to the location of residential areas and mixed use, as well as traditional industrial corridors, both DF and the neighboring municipalities. The territorial disconnection of the main economic activities and sources of employment with respect to the residential areas are the main factors in the generation of large number of intra-urban commutes, which generates social, economic and environmental negative effects.

Regarding to employment, between 2003 and 2008, the personnel

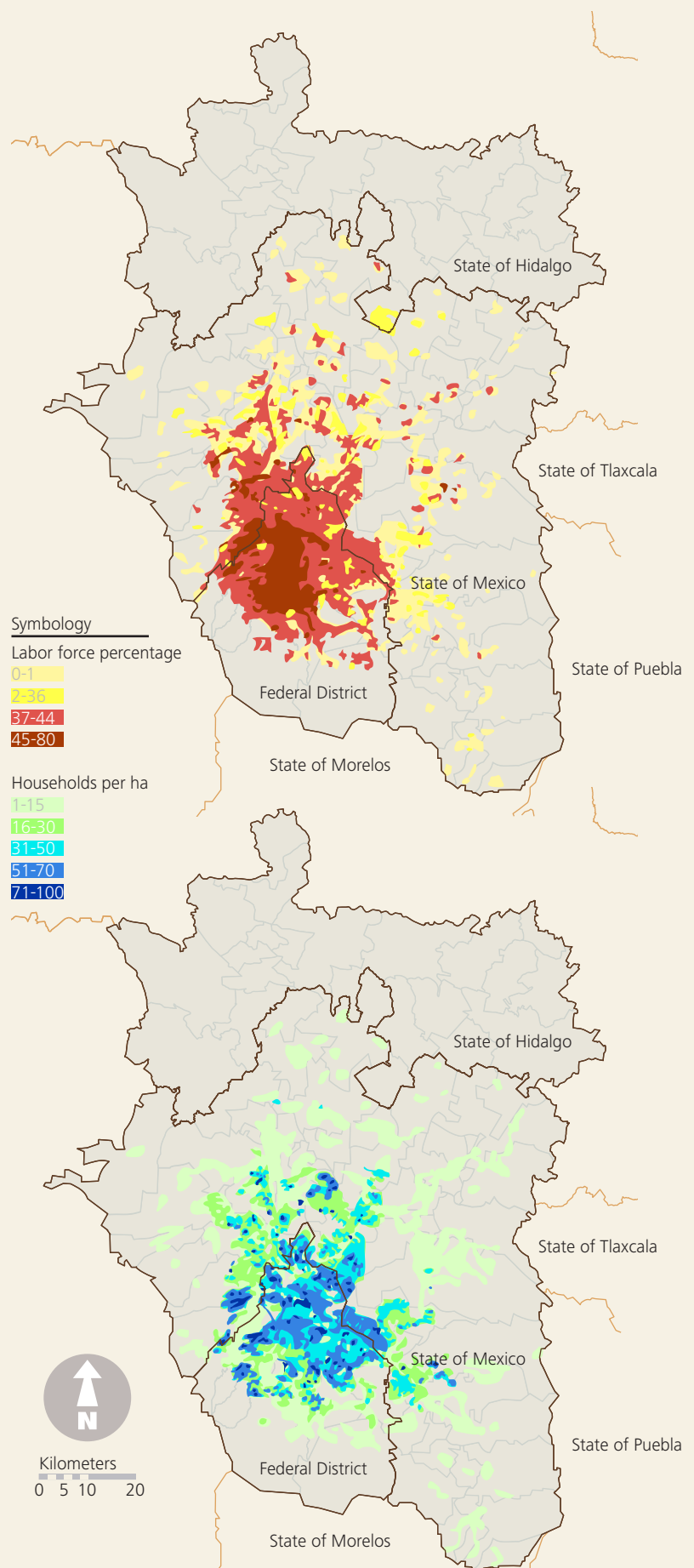


Fig. 2.5 MCMA Relationship between Labor Force and Households locations. Source: Center for Sustainable Mobility Mexico. *Atlas de Accesibilidad y Conectividad de la Zona Metropolitana del Valle de México*. México, D.F., Center for Sustainable Mobility Mexico. Mm.: 19, 29.

employed in the MCMA showed an absolute increase in about 1.3 million jobs, with average annual growth rate of nearly 7%. The most significant absolute and relative increase occurred in private services which almost doubled, while manufacturing declined in absolute terms by 40 000 jobs.

The five municipalities in the MCMA which recorded the largest absolute growth in occupational supply between 2003 and 2008 were: Ixtapaluca, Ecatepec, Chimalhuacán, Nezahualcoyotl and Tultitlán that together, concentrated 15.7% of the new jobs. Moreover, Atzacapotzalco virtually generated 32.6% of the new jobs in the City. Another important record is the town of Pachuca de Soto that concentrated 38% of new jobs created in the municipalities of Hidalgo from 2003 to 2008.

2.4. POVERTY AND MARGINALIZATION⁵

The National Council of Evaluation for the Social Development Policies (CONEVAL) notes that in 2010, 34.71% of the population of the MCMA was living in poverty. The highest percentages of population in poverty by income (between 57.3% and 72.1%) were concentrated in five areas: a) in the southeast of the State of Mexico, the Atlautla, Ecatingo, Juchitepec, Ozumba and Tepetlapa municipalities; b) in the northeast of the same state, the municipalities of Temascalapa Axapusco, and in the Hidalgo State, the municipalities of Villa Juarez, Zapotlán, Tezontepec; c) in the northwest Hidalgo the municipalities: Tezontepec of Aldama, Tlaxcoapan, Tetepango, Tlahuelilpan; d) in the east of the State of Mexico: Valle de Chalco, Chimalhuacán, Atenco and Nextlalpan; and finally e) in the north State of Mexico, the two municipalities with the highest poverty are Tequiquiac and Hueyoxtlá.

In contrast, the municipalities and delegations with the lowest levels of poverty (8.7% and 25.6% of its population) are: a) the delegations Benito Juárez, Coyoacán, Azcapotzalco, Cuauhtémoc, Miguel Hidalgo and Cuajimalpa in Mexico City; and b) the municipalities of Cuautitlan and Cuautitlan Izcalli in the State of Mexico.

The population in extreme poverty is 4.8% of the total population of the MCMA. The two municipalities with the highest extreme levels, Ecatingo and Atlautla, express the high rate of urban segregation seen in the MCMA, as well as eleven municipalities with percentages of people living in extreme poverty between 11% and 18.4% which are located on the periphery of the urban area: in the north Apaxco, Hueyoxtlá and Nextlalpan, in the northwest of Tezontepec, Aldama, and in the east, Atenco, Chimalhuacán, Villa de Chalco Solidaridad, Chalco, Juchitepec, Ozumba and Tepetlapa.

In the opposite situation, the lowest percentages of people living in extreme poverty are found in: 1) the central area comprising most of the delegations in the Federal District with the exception of Milpa Alta, 2) the municipalities of Cuautitlan Izcalli, Atizapan and Coacalco in the State of Mexico and 3) in the Northeast, the municipalities of Pachuca de Soto and Mineral de la Reforma in the State of Hidalgo.

Moreover, according to the National Population Council (2010), 48% of the localities in the MCMA have a degree of high and very high marginalization, but highly marginalized population represents only 2% of the total. At the middle level of marginalization is 6.34% of the population living in 463 localities. Meanwhile, the low and very low levels cover 30.6% of the towns of the MCMA, or a total of 678 localities.

A significant concentration of localities with high and very high marginalization in southern delegations is observed in DF on the edge of the conservation land, mostly in the delegations Milpa Alta, Tláhuac, Tlalpan and Xochimilco. Also, a number of localities with the highest levels of marginalization are located in the municipalities of the State of Mexico within the boundaries of the conservation areas of the Sierra Nevada and the Sierra de las Cruces.

2.5. INSECURITY AND URBAN VIOLENCE⁶

Between 2005 and 2010, like the rest of the country, the MCMA observed a general increase in crime which is reflected in an average annual crime growth rate of 4.61%. The total number of crimes recorded by the agencies of the Public Ministry of Common Law Offenses increased from 351,000 in 2005 to 440,000 in 2010, higher than the national average increase which was 3.8%. The main crimes were homicides, assaults, injuries, theft and abuse that threaten the physical and emotional integrity and property of individuals and businesses.

[5] Idem. Pp. 24-25.

[6] Idem. P. 26.

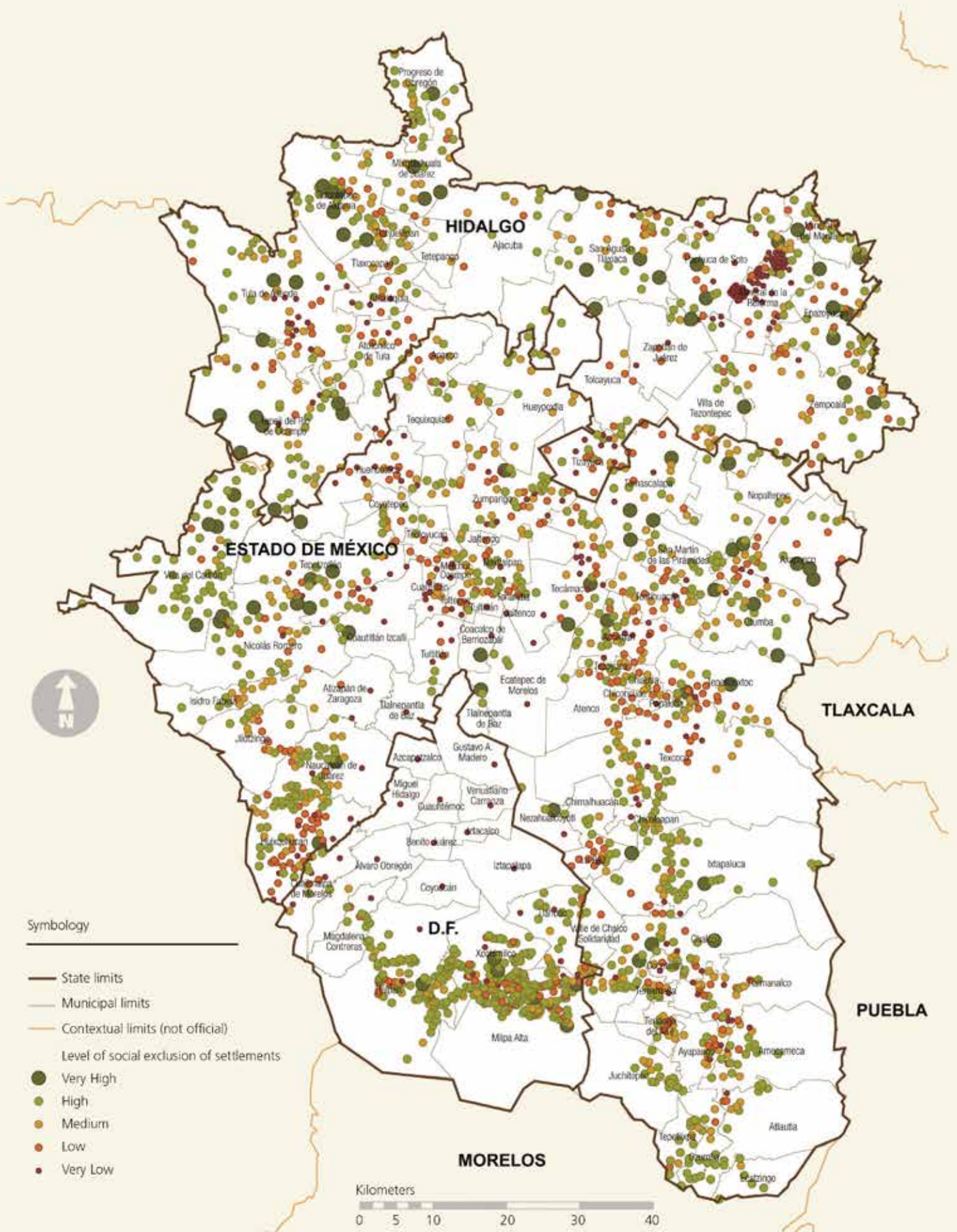


Fig. 2.6 Level of Social Exclusion. Source: Secretariat of Social Development, Federal District Government, State of Mexico Government, State of Hidalgo Government. *Programa de ordenación de la Zona Metropolitana del Valle de México. Actualización 2012.* Mexico, 2012. P. 25.

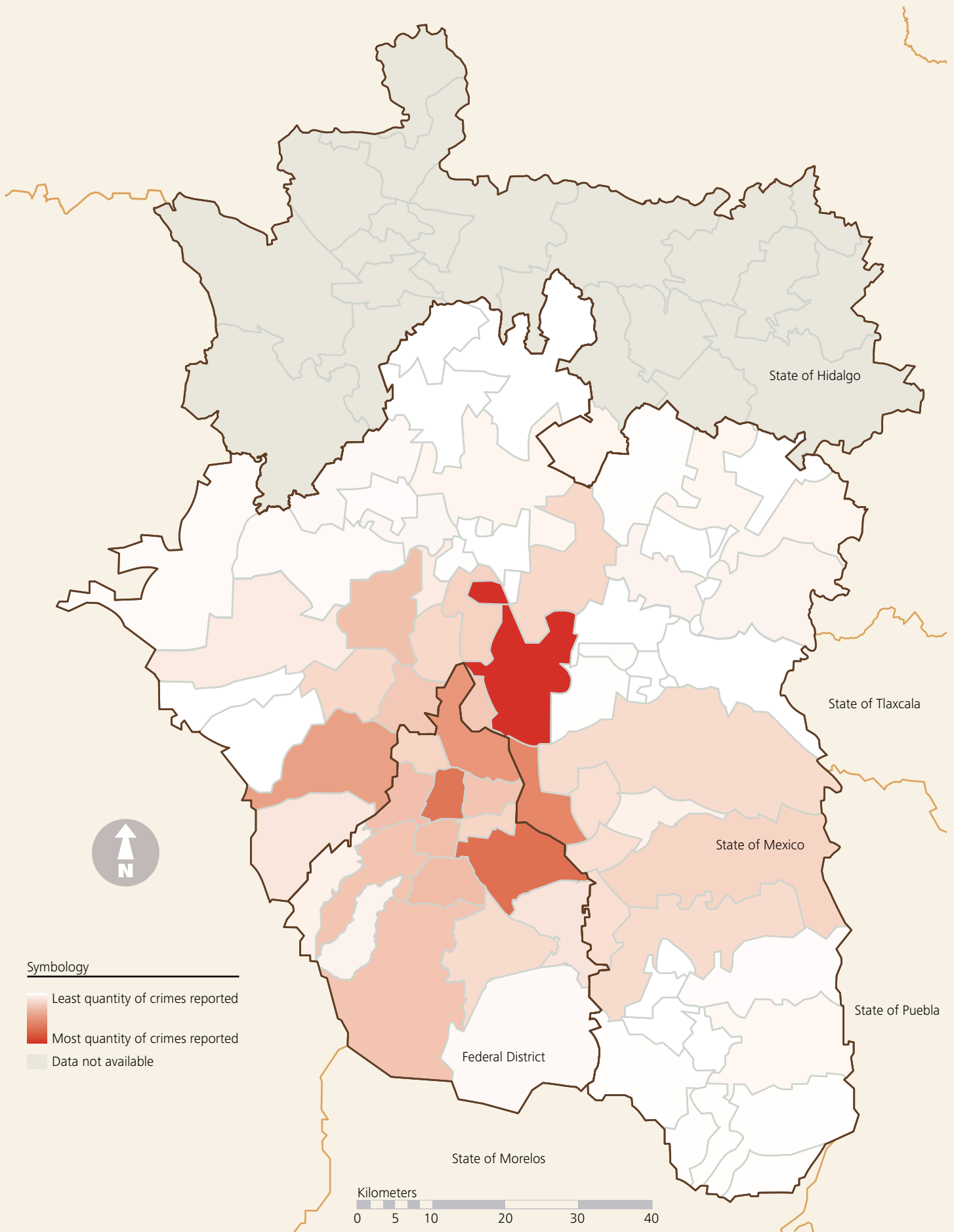
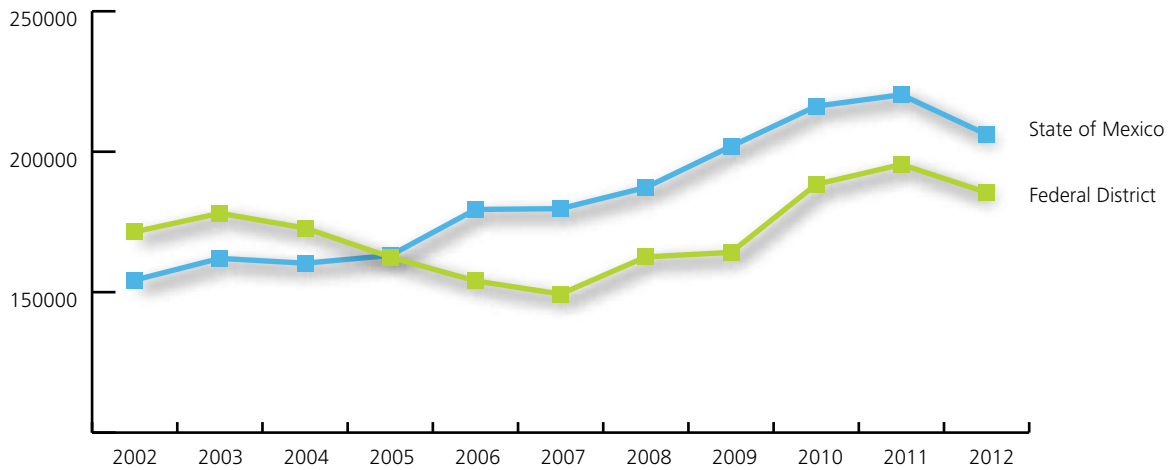


Fig. 2.7 Reported Crimes Rates. Source: National Institute of Statistics and Geography. *Cuaderno estadístico de la zona metropolitana del Valle de México 2012*. Mexico, Inegi, 2012. <http://www.inegi.org.mx/est/contenidos/espanol/sistemas/CEZM12/estatal/default.htm>

Graph 2.7 MCMA Crime Rate Evolution 2002-2012



Source: National Institute of Statistics and Geography (INEGI). *Cuaderno estadístico de la zona metropolitana del Valle de México*. Mexico, Inegi, Editions 2002 thru 2012. <http://www3.inegi.org.mx/sistemas/productos/default.aspx?c=265&s=inegi&upc=702825001082&pf=Prod&ef=&f=2&cl=0&tg=80&pg=0&ct=106020000>

It has also as well increased the expressions of domestic violence whose main victims are women and children, as well as the risks of road accidents in a metropolis whose composition and structure requires multiple trips through a system of motorized transport. In 2011 this negative trend reversed and the number of crimes decreased by 12.53% compared to the level reached in 2010.

The increase in crime in the last five years and the demands of society prompted changes in the areas responsible for public safety to strengthen and innovate strategies and actions to address it. In 2011 a series of successive increments breaks in the crime rate in the MCMA and the number of crimes decreased to approach the levels it had in 2008. It's noted the case of Hidalgo, since achieves 30.61% decrease in the number of crimes compared to 2010. Virtually all towns in the MCMA have decreased their crime rates, except for a few located in the State of Mexico, mainly: Nezahualcoyotl, Chalco, Chicoloapan, Teotihuacan, Texcoco and Valle de Chalco Solidaridad.

The significant decrease in the absolute and relative number of recorded crimes is explained largely by the implementation of a security strategy that integrated social and situational crime prevention, to which policies and actions of social development areas are added. In 2011 the average crime rate in the MCMA was 19.6 crimes per 1000 inhabitants (20.9 in Mexico City, Hidalgo 15.7 and 19 in the State of Mexico), which decreased compared to 2010, but remains a concern as these data refer to offenses that have been reported and registered.

Most urban crime rate is presented in the central delegations of Mexico City and the border towns, mainly located in the northeast and northwest of the central area, which have absorbed both population growth and displacement of productive activities (industrial and tertiary). The areas with a high crime rate are urban delegations of DF and municipalities of the State of Mexico and Hidalgo.

The predominant crime is theft representing 45.98% of recorded crime. It's noted the case of Cuauhtemoc delegation in the center of the City, which for decades ranked first in terms of crime rate.

2.6. SOCIETY AND CULTURE

In 2005, in the MCMA 95.4% of the population were literate, 4.3% are illiterate, and there was a 56.5% of the total population 15 years and over lacking secondary education. The population with higher education reached 18.1%⁷.

The MCMA currently has 15 of the top 50 universities in the country, both private and public, including the National Autonomous University of Mexico, center of education with the biggest quantity of research done in the country⁸.

[7] López Pérez, Sócrates. *Diagnóstico Sociodemográfico De La Megalópolis Del Centro Del País*. Pachuca, Hgo., Universidad Autónoma del Estado de Hidalgo. Instituto de Ciencias Sociales y Humanidades, August 2008. Pp. 118. http://poblacion.hidalgo.gob.mx/index.php?option=com_content&task=view&id=25&Itemid=33

[8] "Las Mejores Universidades de México - Ranking 2012" on America Económica.com. <http://rankings.americaeconomia.com/2012/ranking-universidades-mexico/ranking.php>

This makes the MCMA, the metropolitan area with the most amount of knowledge generated. The Scientific Production Ranking of Mexican universities cites 8 out of 20 MCMA universities as the ones with the most amount of published scientific articles⁹.

According to the Census of Population and Housing, 2000, in the states of Mexico, Hidalgo and Mexico City currently are living 1,041,610 indigenous people, of which only 37.84% lives in Greater Mexico City. This indicates that the vast majority, almost two thirds of these Indians prefer living in rural municipalities, relatively close to the MCMA or other cities (Pachuca, Queretaro, Puebla, Toluca, Cuernavaca, Tlaxcala, etc). The big cities do not seem to be attractive for these indigenous languages speakers, but probably interact with them in search of certain services (eg, medical or educational). The Indians are relatively few, since they represent only 2.14% of the metropolitan population, 2.01% of the population of the Federal District, 2.26% of the suburban municipalities of Mexico State and 2.38% of the population of Tizayuca¹⁰.

2.7. ENVIRONMENTAL CONDITIONS¹¹

Urbanization puts pressure on the protected areas, soil conservation and agricultural areas, which affects and threatens the environmental services they provide to the city. A horseshoe metropolitan level biotic corridor surrounding the urban area is identified and should be a clear limit to their expansion.

The supply and management of water consumption remains one of the main problems and demand approach with a regional vision. Local sources of supply consist of four underground aquifers of which more water is extracted than its natural recharge capacity: aquifers Mexico City, Chalco-Amecameca, Texcoco and Cuautitlán-Pachuca. The distant sources consist of two aquifers in the Upper Lerma and a system of seven dams located in the basin of Cutzamala.

According to the National Water Commission (2010) the MCMA is supplied with a flow rate of 81.9 m³/s coming from: 62.2 m³/s of the Valley of Mexico (76%), 4.8 m³/s of Lerma (6 %) and 14.9 m³/s Cutzamala basin (18%).

The total flow in the basin of the Valley of Mexico is used as follows : 64.7 m³/s for urban use (79 %), 4.6 m³/s for industrial use (6 %) and 12.6 m³/s for agricultural use (15 %). From the urban use flow is estimated that 38 % is lost in the primary and secondary networks.

Contamination of surface water and groundwater, and drainage overload are related to the limited capacity for treating wastewater. The existing treatment plants, though numerous and relatively well distributed treat only reach 7% of the sewage of the metropolis. Virtually all of the wastewater are expelled from the Valley of Mexico and exploited for irrigation in the Mezquital Valley. Notably, currently being built in Atotonilco de Tula, Hidalgo, is located a wastewater treatment plant building site with a capacity of 35 m³/s, aiming to mitigate the problems of pollution and health risks in the region.

Therefore, the water supply to the MCMA and general drainage system must fit into a regional perspective that includes the four watersheds linked artificially with the hydraulic infrastructure: Valley of Mexico Basin, Lerma, and Tula Cutzamala. Sustainable planning of this resource must consider its regional dimension as water management and drainage of the MCMA also has environmental impacts outside the basin of the Valley of Mexico.

The generation and management of solid wastes represent a source of severe environmental, social and economic problems. MCMA generates 21,000 tons of garbage a day. The largest fraction of municipal solid waste is organic. The remaining fraction is composed mainly of the following products : pet, paper, cardboard, transparent glass, rigid plastic, tin, colored glass, aluminum and iron. An estimated 40% of municipal solid waste has a potential recyclable (Metropolitan Environmental Commission, 2010).

In addition to the need to reduce waste generation, it's highlighted the problem of collection and transfer of this wastes. The few places of final disposal of garbage provokes long truck distances with negative effects on air quality

[9] *Ranking de Producción Científica Mexicana. Ranking 2011*. México, D.F., Foro Consultivo Científico y Tecnológico, A.C., November 2011. Pp. 13. http://www.foroconsultivo.org.mx/libros_editados/ranking_por_institucion_2011.pdf

[10] Hernández Bringas, Héctor Hiram et al. "La población indígena en la Zona Metropolitana del Valle de México, 2000" in *Papeles de Población*, vol. 12, núm. 47. Universidad Autónoma del Estado de México, January- March 2006. Pp. 160-161. <http://www.redalyc.org/pdf/112/11204707.pdf>

[11] Secretariat of Social Development, Federal District Government, State of Mexico Government, State of Hidalgo Government. *Programa de Ordenación de la Zona Metropolitana del Valle de México. Actualización 2012. Síntesis Ejecutiva*. Mexico, 2012. Pp. 30-34.

and vehicular traffic. This suggests the desirability of decentralizing and distributing a greater number of spaces available throughout the metropolitan area.

The urban area extends in a semi-enclosed basin in the southwestern portion of the Valley of Mexico, which is naturally subject to conditions that does not allow proper cooling of the atmosphere. Among the major physiographic and climatic factors that affect air quality include the following:

The hilly surroundings of the basin is a natural barrier to the free movement of wind and dispersion of pollutants . Therefore, it is suitable for the accumulation of air pollutants medium.

Frequent temperature inversions occurring in the valley, more than 70 % of the days of the year, are a natural phenomenon that causes a temporary stagnation of air masses in the atmosphere. This inhibits the ability of self-purification and it favors the accumulation of contaminants.

Anticyclonic systems are often recorded in the central region of the country, and have the ability to generate still capsules of air in areas that can cover much larger ones than the Valley of Mexico.

The intense and constant solar radiation is recorded in the Valley of Mexico along all year, favoring the formation of ozone.

The altitude at which the Valley of Mexico (2,240 MASL), determines that the oxygen content is 23% less than at sea level.

2.8. TOWARDS A MEGALOPOLIS¹²

The process of emergence of megacities has arisen since the sixties worldwide. In Mexico arose between 1950 and 1995 given to significant changes in the urbanization throughout the country. This development was continued and accelerated but concentrated in certain regions and cities.

Several authors agree on the existence of a network of cities in the center of the country, which have shaped a great city, a megalopolis in the central region of the country. However, the departure point is the MCMA, which has joined other Metropolitan Areas in various functional relationships that are relatively close and connected to wide roads and roads networks. These are the Metropolitan Areas of Toluca, Queretaro, Pachuca, Tulancingo, Tula, Cuernavaca, Cuautla, Puebla-Tlaxcala, Tlaxcala, and San Martin Texmelucan Apizaco. Each features highly integrated subsystems cities, which account structures and complex relationships, arises from the union or overlap of two or more metropolitan areas. By 2005 concentrated a population of 35 million people, or 33% of the national total.

That's why it is defined as the Country Centre Conurbation Region (RCCP), which refers to a megalopolitan phenomenon that occurs in the central region and formed by the Federal District and the states of Hidalgo, Mexico, Morelos, Puebla and Tlaxcala.

The central region of the country has had a historical process of regional integration. It is considered that the composition of the development has been through the integration of several cores and energized by a central one (DF) and the accompanying reduction of the primary activities of 3.38% to 0.59% in the period 1970-2000; significant changes in the secondary sector of 42.53% to 21.85% and the increase in tertiary activities, from 54.08% to 77.55%. The Human Development Index for the area was 0.8913 for the Federal District and the State of Mexico 0.7954, which compared to the national average (0.8014) the central city is above, ie the quality of life is one of the best in the country.

So far we can say that the only thing that has been missing is a megalopolitan administration that achieves a comprehensive and sustainable development of metropolitan areas and that as a single unit conceives the best way to live and living for its citizens. Definitely it is the secure future of millions of people and we must prepare to ensure they have a decent life, and these cities are a real alternative of life for its inhabitants.

[12] López Pérez, Sócrates. *Diagnóstico Sociodemográfico De La Megalópolis Del Centro Del País*. Pachuca, Hgo., Universidad Autónoma del Estado de Hidalgo. Instituto de Ciencias Sociales y Humanidades, August 2008. Pp. 37, 42, 45, 70, 234, 235. http://poblacion.hidalgo.gob.mx/index.php?option=com_content&task=view&id=25&Itemid=33

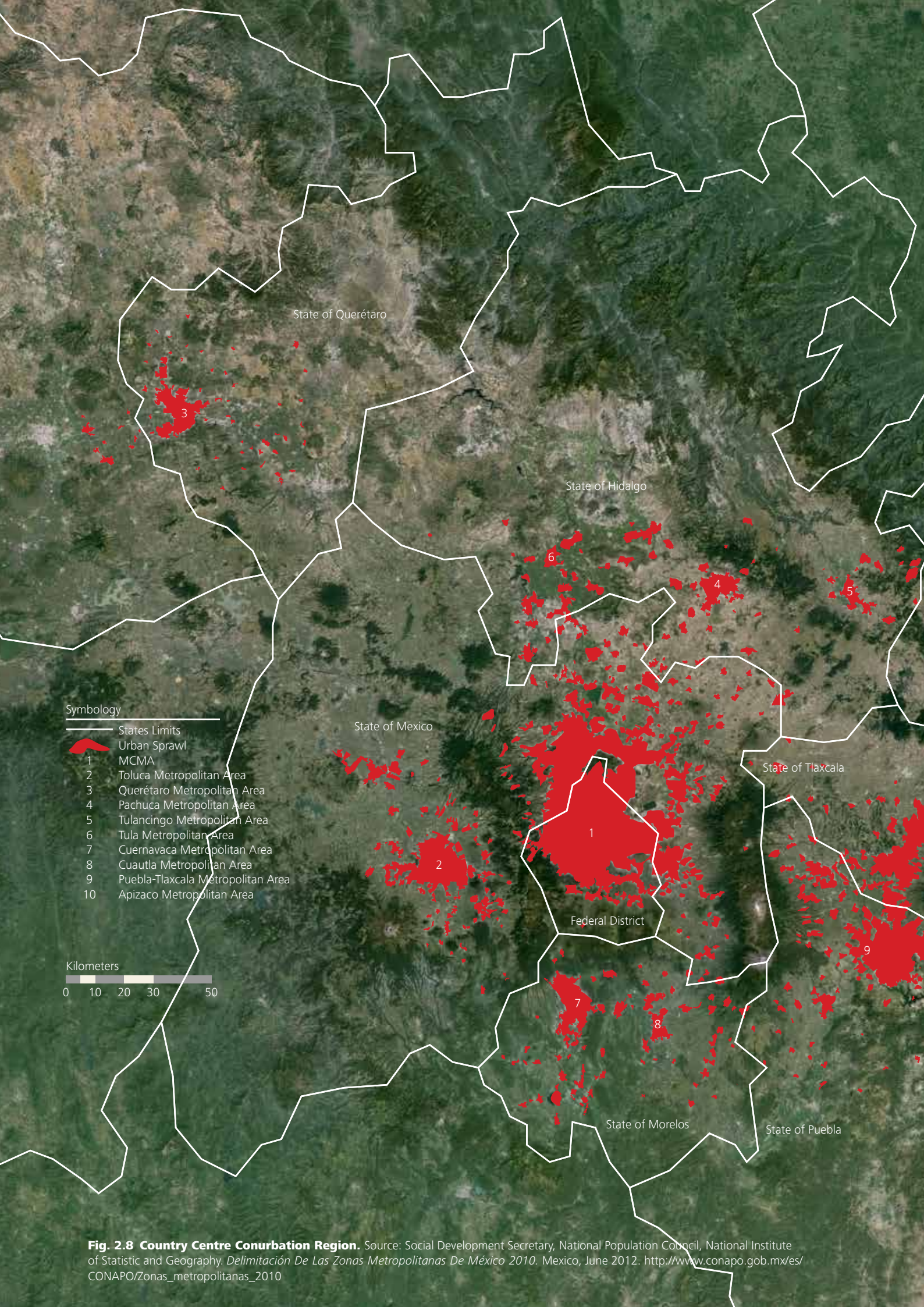


Fig. 2.8 Country Centre Conurbation Region. Source: Social Development Secretary, National Population Council, National Institute of Statistic and Geography. *Delimitación De Las Zonas Metropolitanas De México 2010*. Mexico, June 2012. http://www.conapo.gob.mx/es/CONAPO/Zonas_metropolitanas_2010



Fig. 2.9 Mexico City's Shape and Survey. 1628. Gomez de Transmonte, Juan.

2.9. HISTORICAL BACKGROUND

2.9.1. Mexico City in the early seventeenth century¹³

The capital was already one of great contrasts. While inside the trace were seen large doorways guarding elegant palaces, vast courtyards and long corridors, outside the trace was observed in neighborhoods and suburbs overcrowded rooms where humble native Indians lived. These were located in the area around the city center and houses were scattered without forming streets. The city had a layout based on the orthogonal primitive traces of what was once the center of the Aztec empire.

2.9.2. The mid-eighteenth century¹⁴

The appearance of the city had improved. Its streets were paved and had potable water. It had several squares that gave life to the city. Trade flourished till the point that the merchants did not fit in the main market and began to spread in the main square. Building construction kept arising with the appearance of new convents, schools and other buildings.

2.9.3. The mid-nineteenth century¹⁵

In 1824 with the promulgation of the first constitution of the country, is decreed the creation of the Federal District. Within its definition was also specified its radio, which was two leagues from the Main Square (Constitution Square). Two years later was released a better one, where their limits were specified.

By then the 114 thousand inhabitants would expand the boundaries of the Federal District, reaching 1482km², with 7 surrounding districts with the State of Mexico. In the last decades of the century, public transport was organized in the following way:

- Site carriages, which varied by condition, presentation and printing of horses.
- Carriages, for vast distances, could accommodate 20 persons, with destinations to San Angel, Tacubaya, Tacuba and La Villa.

[13] Espinosa López, Enrique. *Ciudad de México : compendio cronológico de su desarrollo urbano, 1521-2000*. México, National Polytechnic Institute, c2003. Pp. 58-60.

[14] Idem. Pp. 83-84.

[15] Idem. Pp. 99-102, 116-121.



Fig. 2.10 Juarez Avenue in Mexico City. 1895. Photograph. A. Briquet. <http://1.bp.blogspot.com/-Yosh9QkSkpA/UWzXJ6yonxI/AAAAAAAAACxQ/wJwZG1ycdLU/s1600/800px-MexicoCityc1890.jpg>

- Animals pulled railways, or trams, with destinations to conurbations closer to the center of the Federal District . Those were by then 37 first class, 179 second and 315 third class units. By 1900 comes into operation the first electrified tram in Mexico City.

In the interurban level, in 1873 the Mexican railroad facilities were opened with Veracruz as destination. In 1884 would be added Puebla and Jalapa as stops. In 1884 would be inaugurated a Mexican railroad route to Queretaro, Celaya, León, Aguascalientes, Zacatecas, Torreon, Chihuahua and Ciudad Juarez.

By 1895 Mexico City had a population of 331,000 inhabitants spreaded in six prefectures, an amount that would increase to 367 thousand by 1900. This year the city had a density of 432 inhabitants/hectare. In the rest of DF the number of inhabitants was 171 thousand inhabitants, giving a total of 539 thousand inhabitants and 1200 hectare of urban area with population density of 449 inhabitants / hectare. The expansion of the city in the late nineteenth century remained almost static for an era of peace and progress imposed by then dictator General Porfirio Diaz. Therefore, only people with middle-income and high could create good colonies towards the west part of the city.

2.9.4. 1900 - 1910¹⁶

Federal District Urban Surface: 350ha
 Mexico City Urban Surface: 850ha
 Urban area: 1200ha

By 1910, the city had already 962 hectares of urban area, growing 112 hectares more than in 1900, or 13.18%. In the rest of the Federal District, there was an increase of 58 hectares, reaching an area of 408 hectares in total grew to 1370, an increase of 14.17% compared to urban areas in 1900. Until March 1903, the Federal District was divided into the City of Mexico and 6 districts, which became 13 municipalities. In this first decade, the trend of urban growth was westward.

In the 1910 census, the Federal District and had a population of 716 862 inhabitants, and 1370 hectares of urban area, having an average density of 523 inhabitants per hectare; for the Mexico City it accounted for 471 016 inhabitants and 962 hectares of urban area, a density of 490 people per hectare while for the remaining 12 municipalities had a population of 245,846 inhabitants.

Despite this growth, the city was dragging a series of problems, as the limited supply of housing, which was already of low quality. Some neighborhoods housed 600 to 800 people. According to the 1900 census, 18 199 were families who did not have a specific home. In addition to the household income of the middle class was 80 to 100 pesos per month and the previously rented houses which were rented between 30 and 50 monthly pesos, rose to 100 and 120, the homes of 10 to 20 pesos monthly rent which actually had conditions deplorable.

[16] Idem. Pp. 131-137.

The city's pavements stretched more on the west part of the city than in the east, due to the initiative of individuals who were those who requested it, supporting it's costs or constructing new suburban infrastructure facilities (water, electricity, sidewalks and even sometimes the phone). Unlike the Eastern part, where asphalt pavements spread slowly replacing cobbled, given that the suburbs could afford this "luxury", resulting in some poor suburbs that did not benefit of the asphalt pavement. Also, and as slowly as the asphalt pavements, were the works of fading channels infesting this part of the capital.

While the roads were based on the old layout, they had an average acceptable width for the common traffic of 1905. However, on the outskirts of the city, ie the part inhabited by the natives, the streets did not always follow the alignment of the central streets, but sometimes had to undergo the tortuous directions given by ditches and canals. Not even after several civil works (whose origin was not on benefits or hygiene monitoring, but on the health and traffic engineering), it was possible to continue the trace 100%, resulting in a few streets in diagonals.

Within the Federal District, Public Transportation was made as follows:

- In most of the Federal District (Delegations Atzacapotzalco, Guadalupe Hidalgo, Tacuba, Tacubaya, Mixcoac, San Angel, Coyoacan and Tlalpan) electric streetcars were used.
- While in the east, Iztapalapa, trams were horse-drawn.
- To reach Cuajimalpa, a road was used, just like Xochimilco.
- And to get to Milpa Alta was required to travel to a country road.

In the east, the electric tram services were very limited since, at first, was the agenda of offering the service to others in the city, plus this was not a government service, it was offered by a private company operating under their interests. However, in 1902 were already 112 miles of electrified track around the Federal District.

With the arrival of the new century, also came to the capital a new transport system, the automobile. It was in 1896 when the first cars appeared in Mexico, going from 136 that were in 1903 to 800 in 1906.

2.9.5. 1910 - 1920¹⁷

Federal District Urban Surface: 408ha
Mexico City Urban Surface: 950ha

[17] Idem. Pp. 144-148.

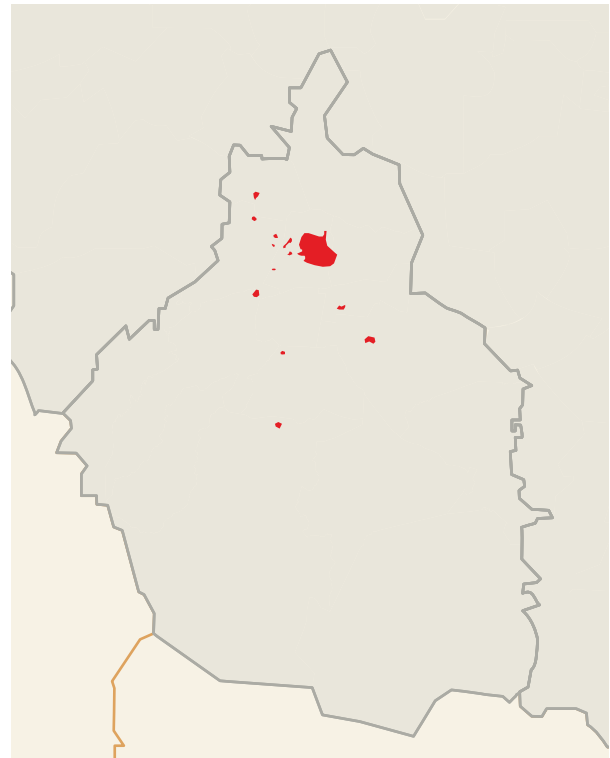


Fig. 2.11 Mexico City Metropolitan Area Footprint, 1900. Source: Espinosa López, Enrique. *Ciudad de México : compendio cronológico de su desarrollo urbano, 1521-2000.* México, National Polytechnic Institute, c2003. Map 6.



Fig. 2.12 Electric Tram Inauguration. January 15th, 1900. Unknown Newspaper.

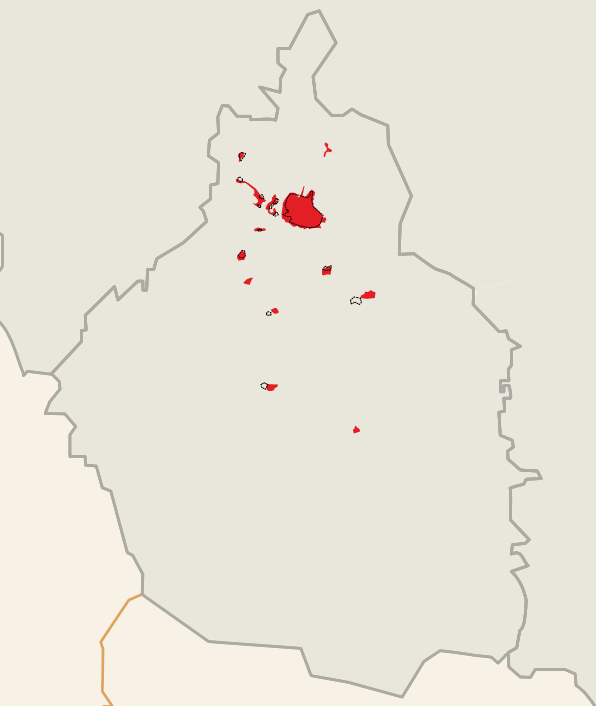


Fig. 2.13 Mexico City Metropolitan Area Footprint, 1910. Source: Espinosa López, Enrique. *Ciudad de México : compendio cronológico de su desarrollo urbano, 1521-2000.* México, National Polytechnic Institute, c2003. Map 7.

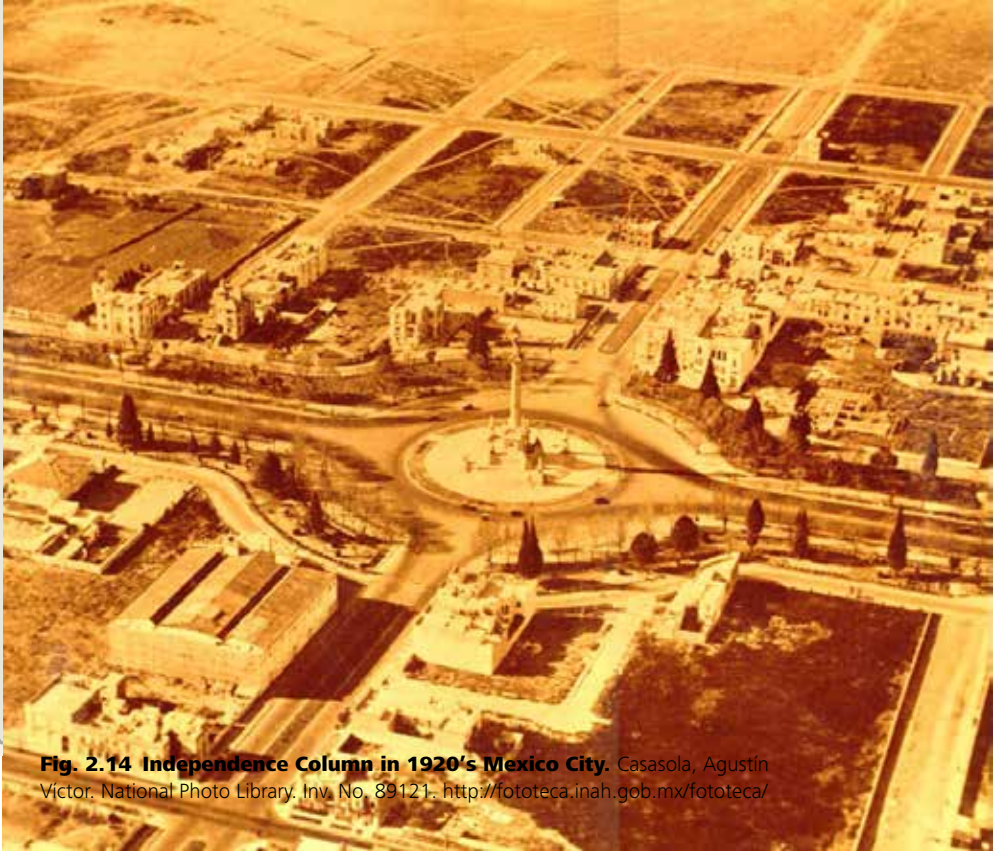


Fig. 2.14 Independence Column in 1920's Mexico City. Casasola, Agustín Víctor. National Photo Library. Inv. No. 89121. <http://fototeca.inah.gob.mx/fototeca/>

Urban area: 1370ha

According to the 1921 census, the Federal District had a population of 906,063 inhabitants, and inside Mexico City were 615 367.

During the historical movement called "Mexican Revolution" between 1910 and 1918, Mexico City was divided into eight zones whose limits were exceeded in 1918 by urban sprawl of 3250 hectares; together the Federal District had increased 2847 ha of urban area compared with 1910. This development was caused by immigration from surrounding villages and other states caused by the various revolutionary groups, seeking safety in the big city.

The growth trend was mainly to the west and southwest. Especially the western developed since it is the high side and it was withdrawn from Lake Texcoco, therefore was not subject to the danger of flooding and because the vegetation was more abundant was possible to build houses with vegetation.

Meanwhile the Eastern part of the city remained almost without developments. The topography of the land and the environment made this unattractive for the founding of new neighborhoods, as this side of the former Lake Texcoco was more susceptible to flooding and brackish water that made almost impossible the development of vegetation, and resulting in the presence of arid plains with winds dragged the odor of putrefaction of the city towards this area.

During the "Mexican Revolution" happened in a common way suspension of transportation services. The authorities were not able to continue working in the works that required the city. It took six years after the armed conflict to restored peace and reactivate the economy necessary to restart the services and works.

As to the particular transport modes from 1911 and in nine months, 242 cars were imported at a cost of 272,268 pesos, a total of 2400 cars traveling in the city since March 1912.

Meanwhile workers trams were in the habit of promoting strikes to improve working conditions, to the point of calling one in 1917 that forced the authorities to improvise transportation. As a result came the firsts "passenger trucks", with wooden beams, tables and sailclothes accommodating a few people. After finished the strikes, operators of these trucks continued to serve especially in places far from trams.

At the regional level since late 1921, communication of Mexico City with the rest of the country was with the main railway companies. While the electric tram reached almost all the municipalities of the Federal District.



Fig. 2.15 1930's Constitution Square with Trams and the National Palace on Background. <http://www.mexicomaxico.org/Tranvias/images/zocalo1930.jpg>

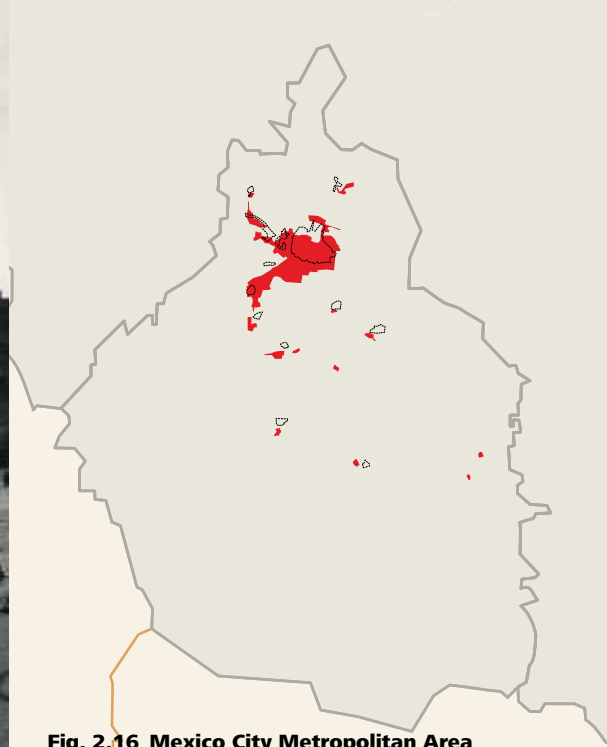


Fig. 2.16 Mexico City Metropolitan Area Footprint, 1918. Source: Espinosa López, Enrique. *Ciudad de México : compendio cronológico de su desarrollo urbano, 1521-2000.* México, National Polytechnic Institute, c2003. Map 8.

2.9.6. 1920 - 1930¹⁸

Federal District Urban Surface: 1096ha
 Mexico City Urban Surface: 2154ha
 Urban area: 3250ha

By 1929, the total urban area of Mexico City grew to 6262 hectares, increasing 76.40% over the 1918 expansion. Within the limits of the city, the urban area was 5462 hectares, this does not mean that the city grew 3308 hectares more than in 1918, only that its limits were extended, covering almost the entire urban area and leaving only 800 urban hectares for other delegations. The growth trend of the city was to the north, while the east of the town began to grow on the former Lake Texcoco. But its greatest displacement was to the south.

The existing passengers trucks in mid-1923 (1722 trucks) had no organization in its routes, yet had become very important in their activities, so the government conducted a plan to fix their schedules and avoid congestion inside the downtown streets.

By 1925 the tramway lines covered over 350 kilometers, and reached all the municipalities of the Federal District. Animal-drawn cars continued to serve until this year, although to a lesser proportion, for the 2060 that existed in 1926 were reduced to 788 cars.

By 1929 there were already within the federal District the following railway stations: Buenavista, Cologne, Monte Alto, San Rafael, Hidalgo and San Lazaro. Of those departed trains to various parts of the republic, arriving to the border with the United States. In addition there was the railroad that ran all around these stations.

2.9.7. 1930 - 1940¹⁹

Federal District Urban Surface: 800ha
 Mexico City Urban Surface: 5462ha
 Urban area: 6262ha

By getting its present limits in December 1899, the Federal District reached approximately 150 thousand hectares. By 1941, the total urban area was 9928 hectares, which represented 6.62% of the territory and an increase of 58.4% in relation to the surface of the urban area in 1929. Mexico City consisted of 12 barracks, having a total area of 14,129 hectares and an urban area of 7138 hectares, which represented an increase of 30.68 relative to 1929.

[18] Idem. Pp. 156-163.
 [19] Idem. Pp. 197-207.

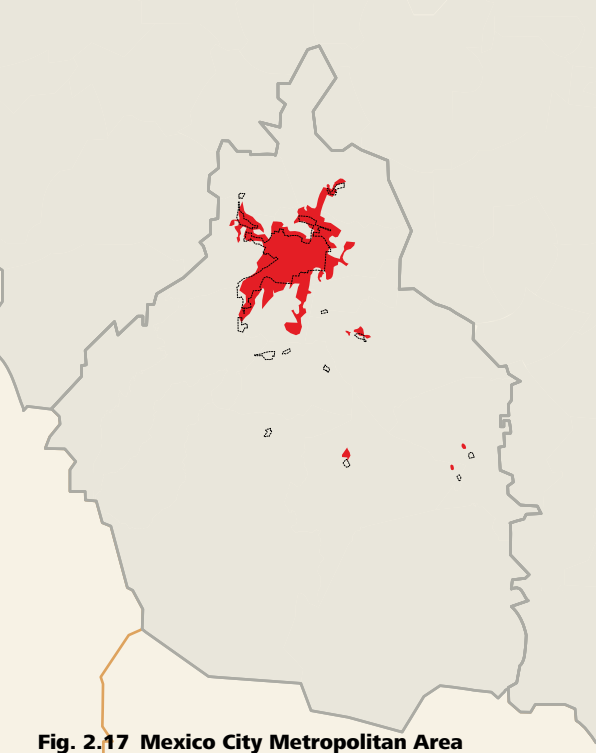


Fig. 2.17 Mexico City Metropolitan Area Footprint, 1929. Source: Espinosa López, Enrique. *Ciudad de México: compendio cronológico de su desarrollo urbano, 1521-2000.* México, National Polytechnic Institute, c2003. Map 9.



Fig. 2.18 "La Nacional" Building in 1930. http://1.bp.blogspot.com/-T6f1NBwYmVs/U6h8jNTR0gI/AAAAAAAAAFZY/N4ujnyvTNsY/s1600/SAM_5236.compr+-+copia.jpg

The growth trend developed towards the north and east. To the west, the urban area did not grow because the Chapultepec Forest served as a limit, the Daniel Garza neighborhood was created.

2.9.8. 1940 - 1950²⁰

Federal District Urban Surface: 2790ha
 Mexico City Urban Surface: 7138ha
 Urban area: 9928ha

In 1950 the Federal District occupied an urban area of 14 650 hectares, meaning an increase of 57.63% compared to 1941, covering 10.43% of the territory. The urban area of Mexico City, located within the Federal District, had by those years 1352 hectares, increasing 31% compared to 1941.

[20] Idem. Pp. 214-218.

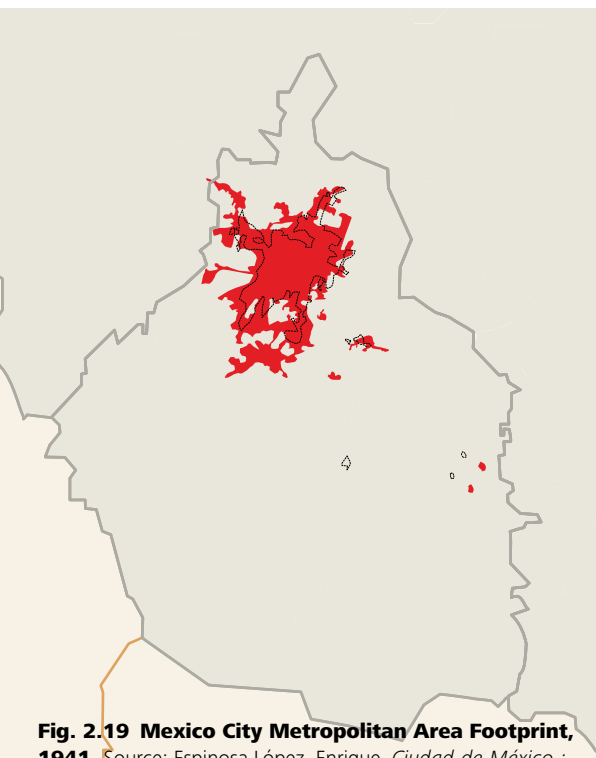


Fig. 2.19 Mexico City Metropolitan Area Footprint, 1941. Source: Espinosa López, Enrique. *Ciudad de México : compendio cronológico de su desarrollo urbano, 1521-2000.* México, National Polytechnic Institute, c2003. Map 10.



Fig. 2.20 1940/1950's Aerial View of the Reforma Avenue.

It is during these years that the conurbation with the State of Mexico is started, with an approximate 1500 hectares, appearing mostly on the north side of the Federal District and the southern boundary of the State of Mexico. Meanwhile, the north side of the city was declared industrial uses, a fact which led to the proliferation of industry. The current international airport was already on its current location. While the south would grow in rectangular pattern, in the west of the city increased by the appearance of residential neighborhoods.

Private transport in these times see a substantial growth, moving from 41 263 units in 1941 to 55 014 in 1950, or an increase of 33.32%, unlike the passengers trucks, which saw an increase in the same period from 2 183 units to 4282, or 96.06%. This speaks of a serious traffic problem that already existed in the city, for which had two almost insurmountable barriers: the narrow downtown streets, and subsurface aqueous lands preventing the construction of underground parking.

2.9.9. 1950 - 1960²¹

Federal District Urban Surface: 6298ha

Mexico City Urban Surface: 9352ha

Nearby State of Mexico Municipalities Surface: 1502ha

Urban expansion: 17152ha

The constant influx of people towards the city of Mexico in these years, from the province, created an urgent demand of low cost housing, emerging areas of very poor housing on vacant plots. About 300 proletarian neighborhoods passed to an incessant growth process because of a working population increase in the city. In early 1952, the neighborhoods surface represented 23.5% of the total area of the city of Mexico, at the end of 1955 increased to 30% and by 1958 it was 35%. The dismal situation of these areas made room for a poor urban structure, making a hazard in almost all lines of urban life. To beautify the city between 1953 and 1964 were built 14 parks and gardens with a total area of 5 727 819m².

During this decade were built about 346 miles of new streets, avenues, roads and continuous circulation pathways, including a part of nowadays's Peripheral Ring Road on the west side.

[21] Idem. Pp. 232-233.



Fig. 2.21 Mexico City Centre in 1954. <http://www.mexicomaxico.org/Tenoch/Mexico1954.htm>

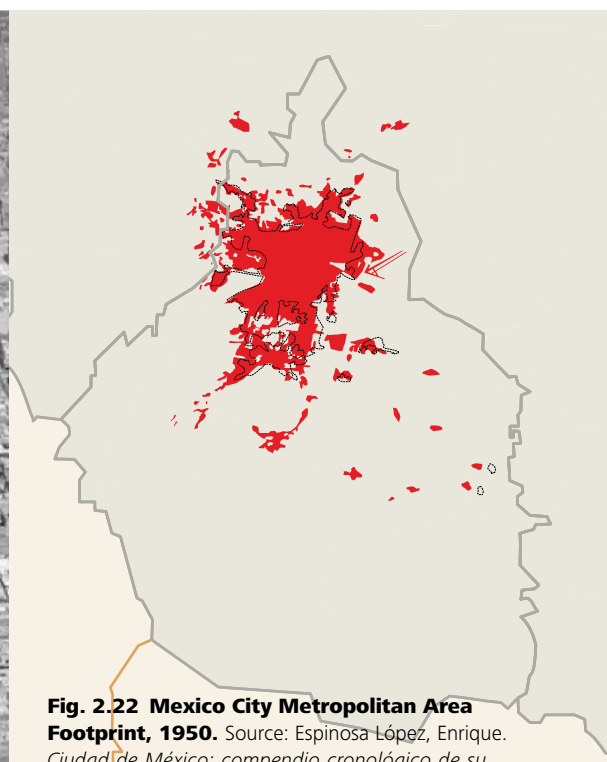


Fig. 2.22 Mexico City Metropolitan Area Footprint, 1950. Source: Espinosa López, Enrique. *Ciudad de México: compendio cronológico de su desarrollo urbano, 1521-2000*. México, National Polytechnic Institute, c2003. Map 11.

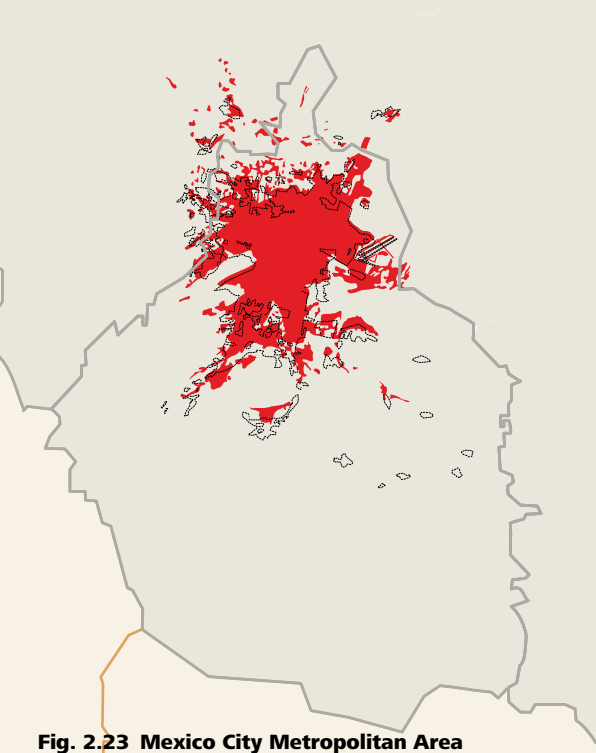


Fig. 2.23 Mexico City Metropolitan Area Footprint, 1959. Source: Espinosa López, Enrique. *Ciudad de México: compendio cronológico de su desarrollo urbano, 1521-2000*. México, National Polytechnic Institute, c2003. Map 12.



Fig. 2.24 1962 Aerial View of Mexico City Airport. <http://3.bp.blogspot.com/-349A-VbqdvM/VAVALHZVrsl/AAAAAAAAAAHe0/BGPOmMmjXoc/s1600/aicm62.jpg>

2.9.10. 1960 - 1970²²

Federal District Urban Surface: 10419ha
 Mexico City Urban Surface: 11960ha
 Nearby State of Mexico Municipalities Surface: 4191ha
 Urban expansion: 26570ha

In 1959 the urban area of Mexico City reached 22 379 hectares, an increase of 51.75% in nine years, occupying 15% of its territory. Mexico City comes to have 11 500 hectares of urban area, an increase of 27.5% over 1950. While in the north, in the Atzacapozcalco Delegation observed that industries occupied 40% of its surface. However, most of the development still is in the south, while in the west continue developing neighborhoods ranging from social interest housing to residential. In the State of Mexico is beginning to develop in the same way residential areas.

This decade saw the openings of various roads of urban transport such as the Mexico - Puebla Highway and the Miguel Aleman Viaduct (1962), the extension of Paseo de la Reforma (1964), the southeast part of the Peripheral Ring Road and the northern part of the same, reaching the Mexico - Querétaro Highway, and the intersection with the Cuernavaca Highway (1967).

In this period about five million people had to move inside the city, and for that the city had 15 thousand taxis, 6000 buses and 400 electrical units (including trolleybuses and trams) operating in disorganized ways. Of these, 90% were inadequate and traveling in poor hygiene and comfort.

Taxis represented an unaffordable transport modes because, although public transport had serious defects, this did not mean that it was found in fair conditions. The increasing vial congestion led to unaffordable taximeter rates due to the loss of time on every trip and to the average speed which almost never exceeded 20km/hr, giving a high coefficient man-hours and hours-lost vehicles.

The shared bus system consisted of many trucking companies and urban lines and had equally, managers, timekeepers, inspectors and other staff, resulting in high operating costs. The authorities tried to attack the problem of traffic congestion with the opening of major avenues, but given the already explained disorganization, resulted in the increased number of buses congesting existing arteries and lowering the average speed on the roads .

As for the electrical transport, trams and trolleybuses composed the main means. While the trams were abundant at higher rates than trolleybuses, were of limited flexibility, with high maintenance costs and equipment in the process. Trolleybuses proved ideal for the city, despite its small number of units, as well as few routes and infrequent

[22] Idem. 237-249.

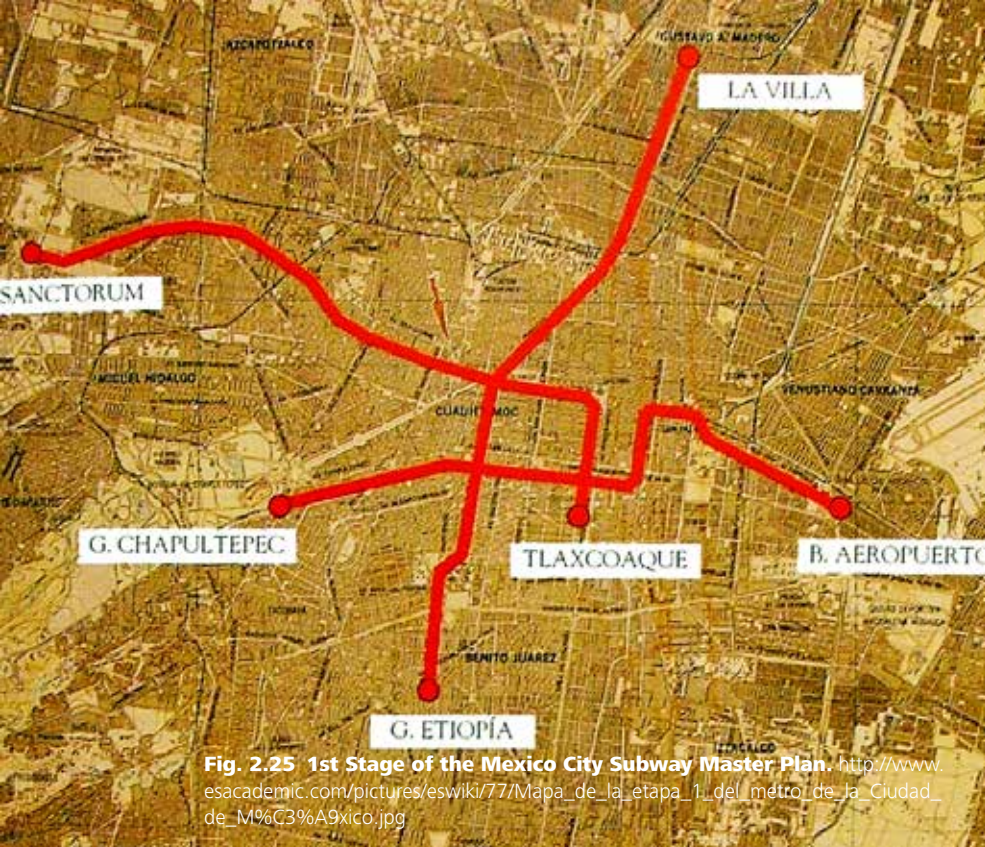


Fig. 2.25 1st Stage of the Mexico City Subway Master Plan. http://www.esacademic.com/pictures/eswiki/77/Mapa_de_la_etapa_1_del_metro_de_la_Ciudad_de_M%C3%A9xico.jpg

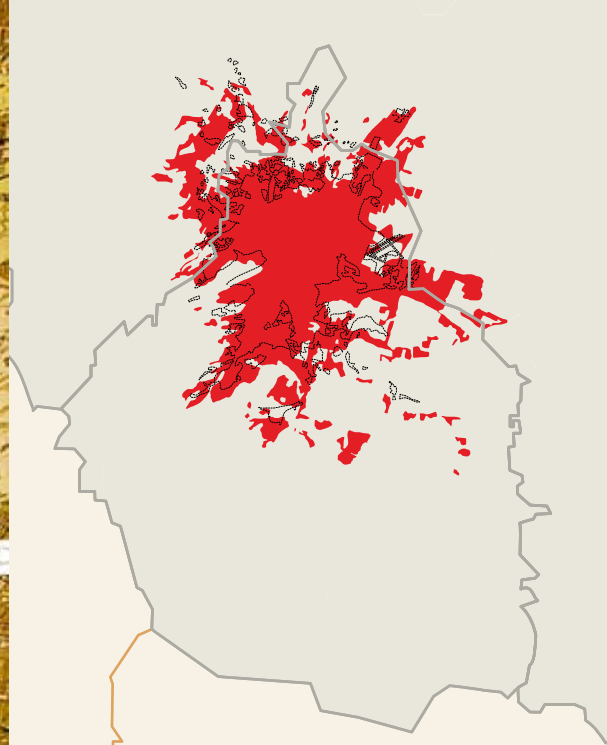


Fig. 2.26 Mexico City Metropolitan Area Footprint, 1970. Source: Espinosa López, Enrique. *Ciudad de México : compendio cronológico de su desarrollo urbano, 1521-2000.* México, National Polytechnic Institute, c2003. Map 15.

transiting. In 1964 carried about five hundred thousand users in this environment.

The particular transport saw an increase of 178% of the vehicle fleet, with 211,587 cars in the early 60's that came to the amount of 589 615 vehicles in 1970.

In 1967 increased the problems of urban transportation due to the excessive passenger demand, given the lack of transportation in large urban areas (mostly downtown). Given all these problems, the government raised the urgent need to build a massive public transportation system, or Metro. This subway would connect densely populated colonies to the city center, where usually converged most of the population due to the concentration in this area of shops and offices. The result of this project was seen in 1969 with the opening of the line one, with 16 stations. It is with this fact that a new era of modernization is inaugurated in the capital, benefiting millions of people.

2.9.11. 1970 - 1980²³

Federal District Urban Surface: 20498ha
 Mexico City Urban Surface: 13090ha
 Nearby State of Mexico Municipalities Surface: 13265ha
 Urban expansion: 46853ha

During these years the total urban area of Mexico City was 33,588 hectares, increasing 50.09% with regard to the 1959 expansion, occupying 22.65% of its territory. Mexico City reaches an area of 12 090 hectares of urban area, increasing 13.83%. This reduced growth was sufficient to saturate its territory which was 14,129 hectares, while the remaining was already occupied by urban forests and the international airport. The trend of urban growth for these years starts from the north of the city of Mexico, while in the east part the city is expanded so that it covers the major urban wastelands. The State of Mexico also sees development in its southeastern part, where the municipality of Nezahualcóyotl is located, both in an organized layout and aggressive way. Also the southern part of the City manages to see growth with housing developments. The west side is the least one growing in this period.

By this time derived several problems of urban growth from the previous decade. This was reflected in the poor articulation between transport systems and roads, since the behavior caused traffic congestion and slow circulation, the relationship between businesses and living areas, giving rise to the tendency to prefer certain avenues. These facts anticipated a work to organize the urban movement and the foundation for a rational structure of roads and transport. The answer was the Inner Circuit(1972), supporting several avenues and roads distributors, meeting more than 50% of conflicting intersections.

[23] Idem. Pp. 257-277.

Moreover, in most of the roads one or sometimes two lanes were used only for parking, a fact that diminished circulation road capacity . This problem of suffocation, among others, began the construction of the "Road Axis" project (1978-1979), starting with the area bounded by the Inner Circuit, since this was the most densely populated area. This work consists of 19 main roads and avenues running 8 northbound and eleven going to the east west direction. Most are one-way traffic and two lanes for public transport, one of which is in the opposite sense. Indeed, this work reduced time and increased the capacity of the roads.

Even so, with all these plans, the main roads were unfinished in 1980, with 60% missing in the Peripheral Ring Road project, 74% for the Inner Circuit and 23% missing of the "Road Axis" projects. While the secondary streets were characterized mostly by a lack of continuity, preventing vehicular movement and causing frequent jams.

By 1980, the Federal District was an urban area of 56,655 hectares, with 8,831,079 inhabitants and with a circulation of 1,869,808 vehicles generated 21,441,708 daily trips.

The total units of mass transport represents only 3.51%, generating 61.90% of trips. Instead private cars accounting for 96.49% of the units they made only 38.1% of the trips. Its rapid growth, about 11% per year, or more than three times the annual rate of population growth, sharpened congestion situations since cars occupied 70% of the roads for driving and parking, and only carrying an average of 1.5 passengers per trip . This disproportion caused traffic problems and transportation, which would grow on the following decades.

The public bus service, 534 routes, had remained the basic support of surface transport, and attending about half of all trips that were generated. However the service was still insufficient given agglomeration at all times, unreliable service, slow performance and mechanical failures of several units.

By this time the Subway was already well established as the backbone of transport in the city with 3 lines operating a network of 41.52km, carrying two million 555,000 passengers daily. Trolleybuses and trams operating in a network of 320km, transported 588,000 passengers. Moreover taxis complement mass transit, moving to 2 million 392 thousand passengers, but it was still insufficient supply of transport. Therefore is seen in this period the appearance of buses operated by private groups, or commonly known as "peseros" (since was paid back then 1 peso for the service).

2.9.12. 1980 - 1990²⁴

Federal District Urban Surface: 56655ha
Nearby State of Mexico Municipalities Surface: 34471ha

[24] Idem. Pp. 284-289.

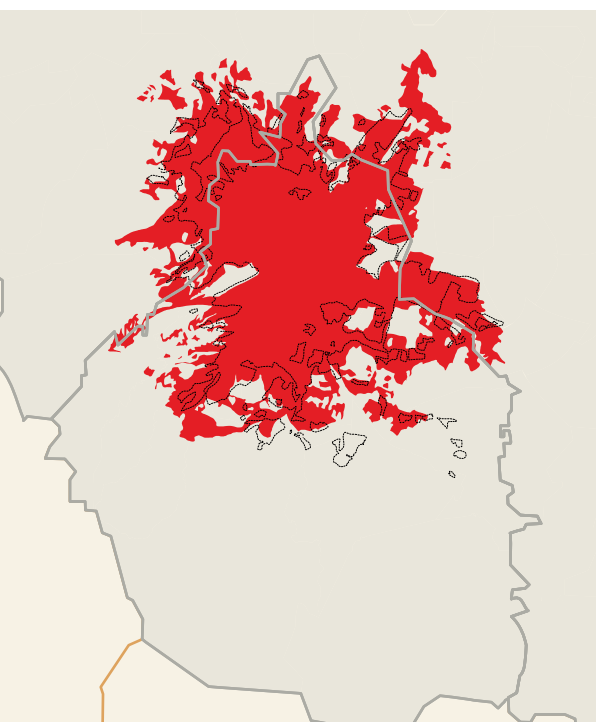


Fig. 2.27 Mexico City Metropolitan Area Footprint, 1980. Source: Espinosa López, Enrique. *Ciudad de México : compendio cronológico de su desarrollo urbano, 1521-2000.* México, National Polytechnic Institute, c2003. Map 16.



Fig. 2.28 Talismán Metro Station of Line 4. <http://bit.ly/1Aipvfy>

Urban expansion: 91126ha

In 1980 Mexico City acquires an urban area of 56,655 hectares, giving an increase of 40.48% in relation to the expansion occurred between 1961 and 1970 and occupied 76.25% of the developable area. The trend of urban growth in the Federal District and metropolitan area in the State of Mexico between 1971 and 1980 spread in all directions, but not with the same intensity, especially in the western area, because in part it was limited by ravines. In the Federal District were used the large urban voids, while in the State of Mexico large neighborhoods are created populating the neighboring towns of the Federal District, as well as urban voids get saturated.

As from the early 50's were given a series of restrictions for the industry to prevent it's development inside the Federal District. This was seen as an opportunity for businessmen who wanted to settle in the metropolitan area and finding as a viable choice to establish in the neighbouring municipalities of the State of Mexico. It is then in 1980 when 17 State of Mexico municipalities were already conurbation of the Federal District: Atizapán, Coacalco, Cuautitlan Romero Rubio, Chimalhuacán, Ecatepec, Huixquilucan, Naucalpan, Nezahualcoyotl, La Paz, Tlalnepantla, Tultitlan, Cuautitlan Izcalli, Chalco, Chichester, Ixtapaluca Nicolas Romero and Tecámac. The growth rate of these municipalities between 1960 and 1970 was 5.6%, 3.4% consists of natural growth and 2.2% of social growth.

The rapid population growth led to a situation of housing in informal settlements with a high degree of overcrowding and lack of services, localized without any technical standard location and construction. This metropolitan area arrives in 1980 to a surface close to 34,471 hectares, compared to the urban expansion in 1970, the increase is 163.34%, with a population of 4,523,192 inhabitants and a density of 131 inhabitants per hectare.

The subway showed a significant development, with the construction of lines 4, 5, 6, 7 and 9, with 68 stations and a length of over 87 kilometers, carrying an average of 4,466,399 daily users.

2.9.13. 1990 - 2000²⁵

Federal District Urban Surface: 71365ha
Nearby State of Mexico Municipalities Surface: 91040ha
Urban expansion: 162405ha

The city and the suburbs are still growing and developing road infrastructure adapted to the requirements of mass transportation, transforming the streets to avenues, highways, main roads, and the Peripheral Ring Road. The main roads had commercial properties, lodging, cultural, entertainment, and other types of businesses. In total there were then 35 roads summing 216km. The main roads are characterized by one-way, with overpasses and exclusive lanes for public transport passengers. Of these there are 514km, for which 4.6km are controlled access .

Problems with public transport continue to present due to unsuitable and insufficient transfers mainly because the system was entrusted to private companies operating with various problems, mainly related with wages. It is then when the Government of the Federal District assumes control of the company "Servicio de Autobuses Urbanos" (City Buses Service). The reorganization is tailored specifically to the moment that is lived and backed by the subway, causing long lines for users who wanted to use the service.

Of the vehicles registered in 1998 in the Federal District, 3,455,228 were private cars, while buses accounted for 16,649 units, 23,489 minibuses and 4000 vans were present. Taxis totaled 89,236 units and freight trailers were 274,879 units. Other vehicles such as motorcycles and antique cars accounted for 61,772 units. The total recorded in Mexico City were 3,925,253 vehicles.

By mid 1991, the A line of the subway opened, connecting the eastern part of the Federal District in Mexico, with 17km and 10 stations. Continued, in 1994 the line 8 that goes from downtown to the southeastern part of the Federal District, with 19 stations and a length of 20km. Then came the B line in 2000 running from downtown to the northeast of the metropolitan area in the State of Mexico, with 21 stations and 22km in length. By the end of this period the Subway had eleven lines and a length of 202km with 175 stations.

[25] Idem. Pp. 310-312.

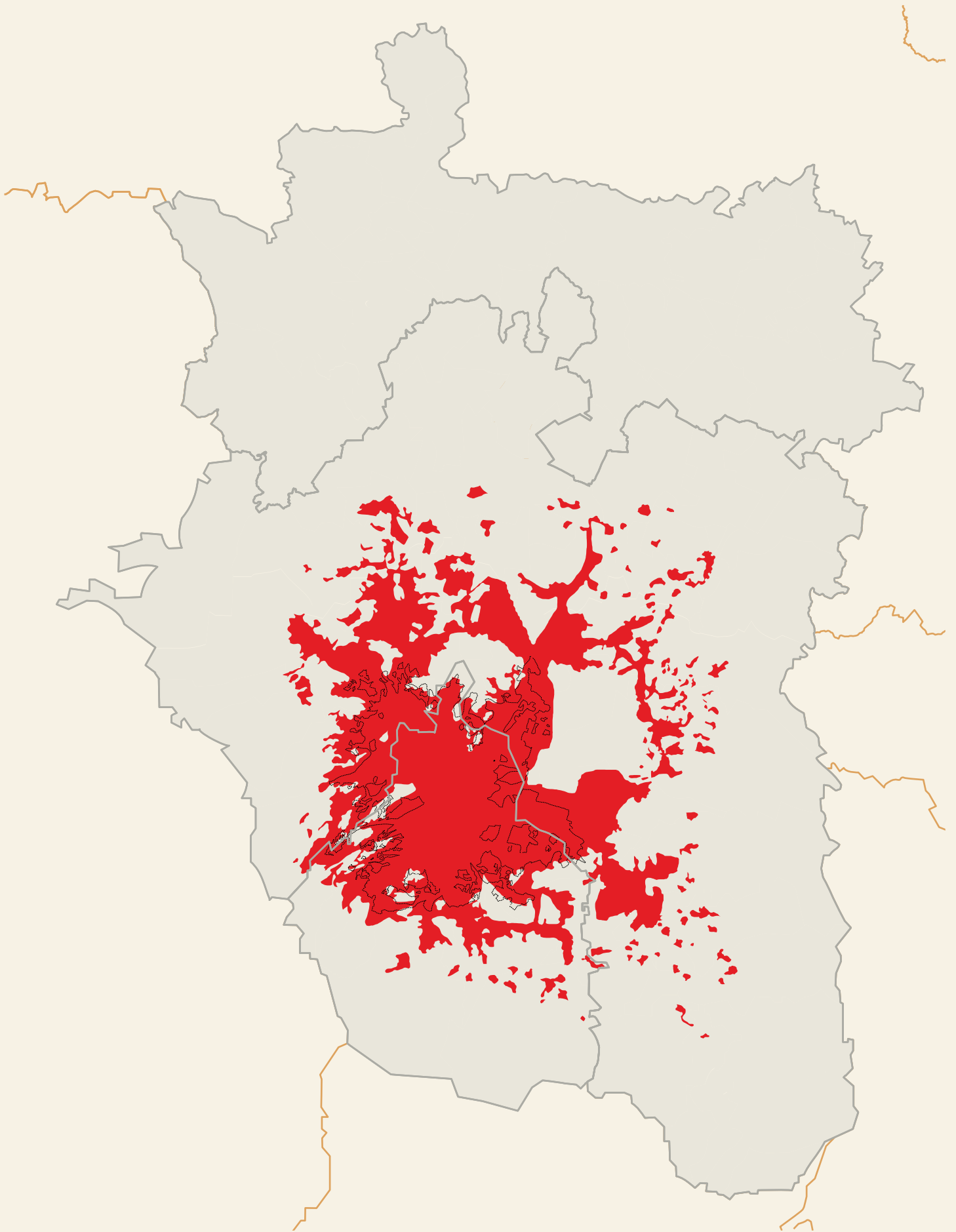
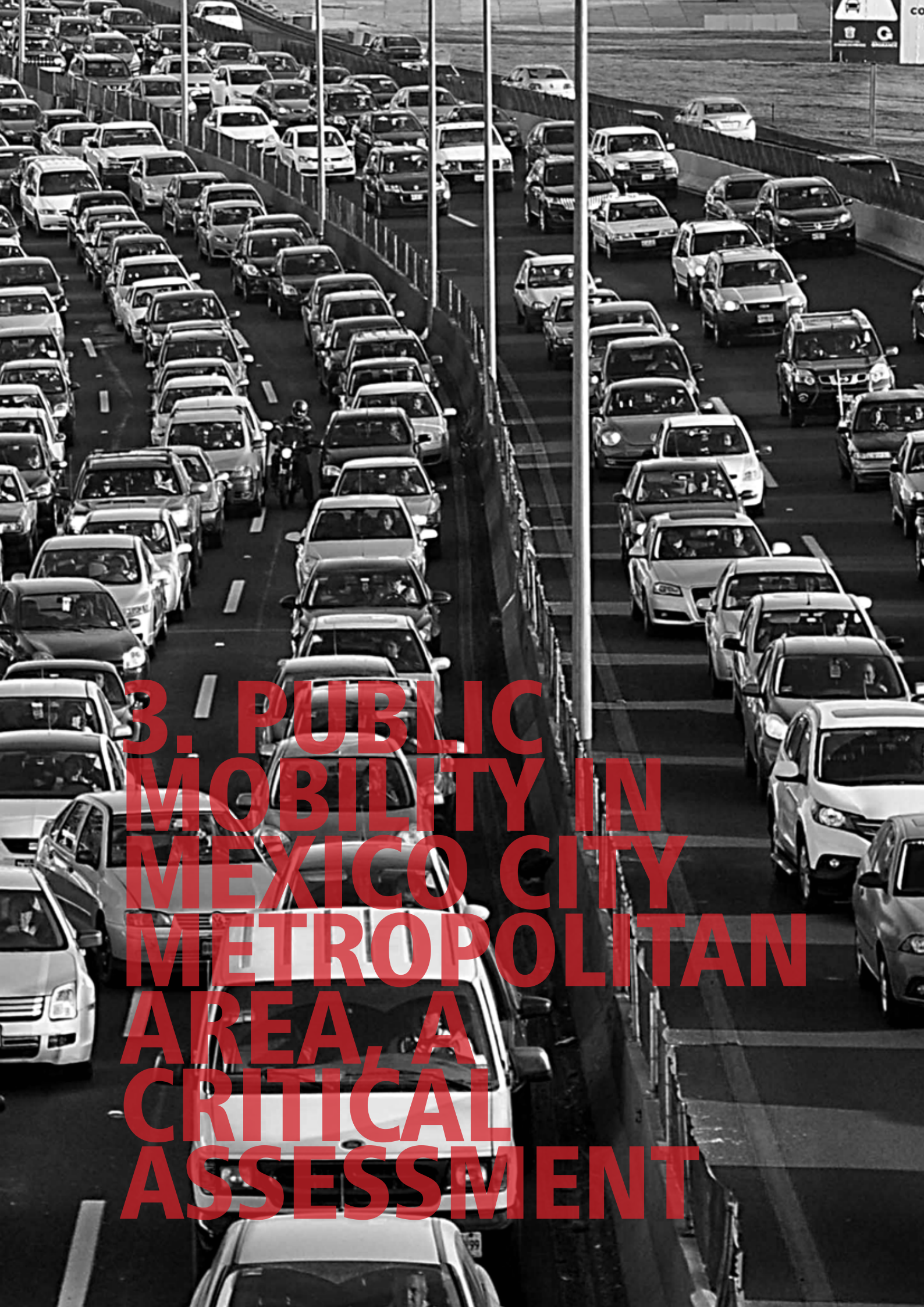


Fig. 2.29 Mexico City Metropolitan Area Footprint, 2000. Source: Espinosa López, Enrique. *Ciudad de México : compendio cronológico de su desarrollo urbano, 1521-2000*. México, National Polytechnic Institute, c2003. Map 18.





**3. PUBLIC
MOBILITY IN
MEXICO CITY
METROPOLITAN
AREA, A
CRITICAL
ASSESSMENT**

3.1. PUBLIC MOBILITY: HOW IS IT DONE

Being one of the largest and most complex cities on this planet, the MCMA has an extensive transport network, which depends heavily on the location and / or socioeconomic status of where you are.

The public transport system is the transport mode used to move a certain amount of people in the same vehicle by charging a fee. Usually this transport mode has a defined route and in some cases has defined route stops. It may be confined to a federal entity or not.

The existing public transport in MCMA are the following:

3.1.1. Massive public transport

A) Metropolitan train

The subway, commonly known as Mexico City "Metro" is a train type public transportation system that serves large areas of the Federal District and the State of Mexico. Operation and use is in charge of decentralized public body called "Sistema de Transporte Colectivo" (Public Transport System, STC). Currently the network of the Metro has 12 lines composed by 226 km of tracks and 195 stations lines, of which 44 are multi modal transfer stations, as well as 12 transfer terminals stations listed as capture nodes or breaking bulk. Having a large number of terminal stations with maps and multi modal transfer stations, speeds up the transfer of passengers and integrates journeys between the Federal District and Municipalities of the conurbation of the State of Mexico, mainly. The network has 115 underground stations, 26 elevated and 54 on the surface. The Public Transport System currently carries over 1,600 million users per year, or 5.1 million users on weekdays and 7.6 million of journeys per day, considering transfers, making it undoubtedly due to its characteristics of infrastructure and service, the most important transport system of Mexico City and its Metropolitan Area. Its operations carries net economic and social benefits by savings in man-hours used for transport, contributes to the reduction of pollution of the environment and improves the quality of life of the inhabitants of the city.¹

Lines 1, 2 and 3 carry approximately 49% of total users, highlighting the incorporation of the line 12 that is involved with more than 5% of the flow in the Network.²

The infrastructure of the STC has 4,909 properties, with an infrastructure of 1,334 buildings and grounds, formed by 926 buildings, stations and interstations; 322 buildings that are integrated into the workshops Zaragoza, Tasqueña, Ticomán, Ciudad Azteca, La Paz, El Rosario, Constitución de 1917 and Tláhuac. 84 properties for administrative or commercial purposes. Among the buildings mentioned are the 195 stations, three high voltage substations, 174 substations rectification, 357 substations and lighting, 2 central control checkpoint and 2 line control checkpoints.³

[1] Sistema de Transporte Colectivo. *Informe a la Comisión de Movilidad, Transporte y Vialidad VI Legislatura de la ALDF*. México, 2013. Pp. 5-8. <http://www.metro.df.gob.mx/organismo2/informes.html>

[2] Idem. P.9.

[3] Idem. P. 11.

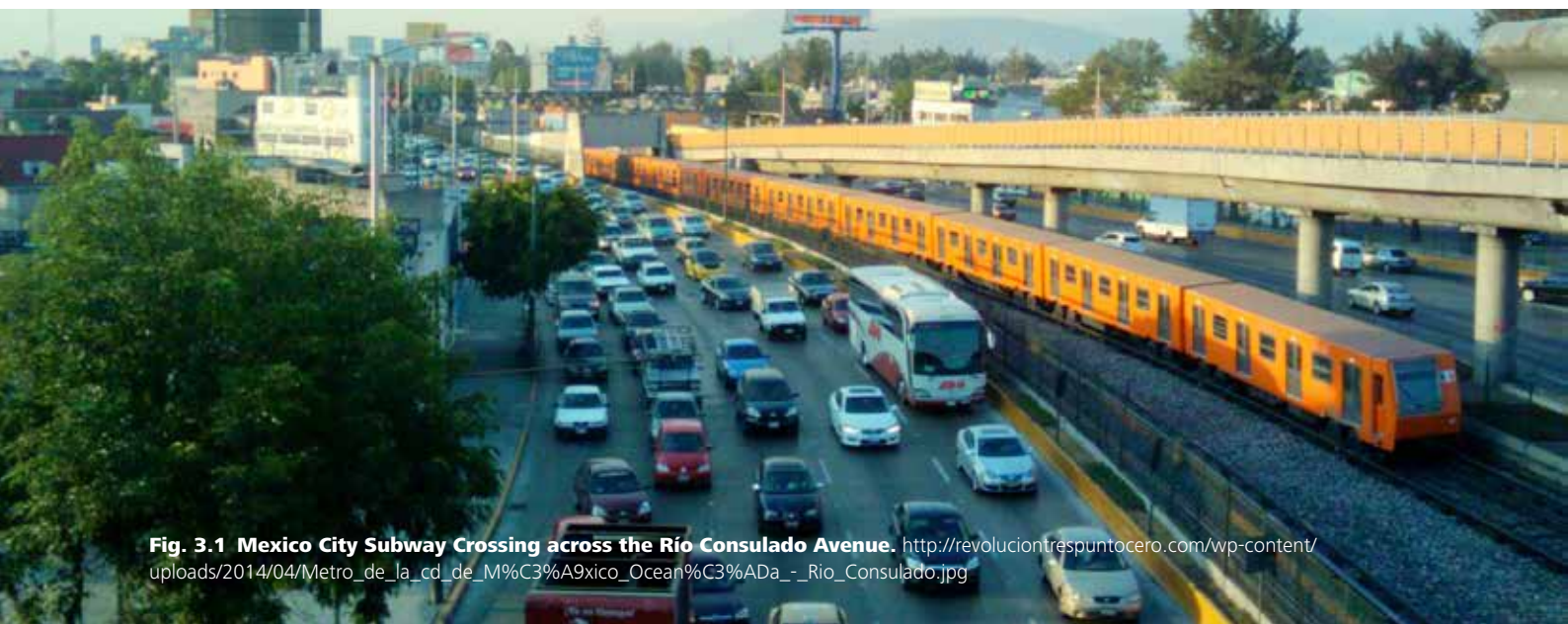


Fig. 3.1 Mexico City Subway Crossing across the Río Consulado Avenue. http://revoluciontrespuntocero.com/wp-content/uploads/2014/04/Metro_de_la_cd_de_M%C3%A9xico_Ocean%C3%ADa_-_R%C3%ADo_Consulado.jpg

Background⁴

The Public Transport System (STC), better known as Metro, started operations in the year 1969; from then to now, it has grown and evolved to become one of the leading transport companies in the country. The metro, in its development, has gone through seven main different stages:

In this first phase of construction were present 48,000 workers, 4000 technicians and, approximately 3000 managers. This enabled an average of one kilometer of construction per month. Interdisciplinary groups made the final layouts of the Metro lines, so that during its construction a minimum of contingencies were presented. One of them occurred during the construction of the Pino Suarez station, where a Mexica shrine apparently dedicated to Ehécatl, god of wind, was found, joining the station design. This first stage consists of three lines: the one that runs from west to east, from Zaragoza to Chapultepec; Tacuba 2 to 3 Taxqueña Tlatelolco and the General Hospital. The total length of this first network was 42.4 km with 48 stations for the ascent, descent and transfer of users.

We can identify two phases in the second stage. The first is the extension of Line 3: from the northern part of Tlatelolco to La Raza, and to the south, from General Hospital to Zapata. During the second phase, the Government prepared a Master Plan and a Transportation Plan for the Federal District, and later, in 1980, the first Master Plan of Metro. As a start of this second phase, the construction of lines 4 and 5 began. With the completion of the second stage, in late 1982, the Metro network reached a length of 79.5 kilometers (almost double what built in the first stage) the number of stations increased to 80.

The third stage consists of the extensions to lines 1,2 and 3, plus it's started the construction of two new lines, 6 and 7. The network length is increased by 35.2 kilometers and the number of stations increased to 105. The line 3 was extended from Zapata to Universidad, line 1 from Zaragoza to Pantitlán, and line 2 from Tacuba to Cuatro Caminos, on the border with the State of Mexico; latter two extensions were opened on August 22, 1984. With these extensions, lines 1, 2 and 3 reach its current path. The line 6 has 9.3 kilometers long and seven stations, two of which correspond: Rosario, in line 7, and Instituto del Petróleo, in line 5. Meanwhile the line 7 runs at the foothills of the Sierra de las Cruces, which encloses the Valley of Mexico to the west; the plan is outside the lake area and communicating points are at higher altitudes

[4] Sistema de Transporte Colectivo. *Etapas de construcción*. México D.F., <http://www.metro.df.gob.mx/organismo2/construccion.html>



Fig. 3.2 First stage of the Metro with 70's MCMA Footprint. Source: Sistema de Transporte Colectivo. *Etapas de construcción*. México D.F., <http://www.metro.df.gob.mx/organismo2/construccion.html>

Fig. 3.3 Second stage of the Metro with 80's MCMA Footprint. Source: Sistema de Transporte Colectivo. *Etapas de construcción*. México D.F., <http://www.metro.df.gob.mx/organismo2/construccion.html>

than previously ones linked by the network. Therefore, the solution used for construction was the deep tunnel type. Its conclusion was an increase to the network of 13.1 km and ten stations.

The fourth stage consists of extensions to the lines 6 (of Martin Petroleum Institute Carrera) and 7 (Tacuba El Rosario), and the start of a new line, 9, from Pantitlán to Tacubaya. The enlargement of the line 6 was opened on July 8, 1988; adding 4.7 kilometers and four stations to the network, the extension of line 7 was completed on



Fig. 3.4 Third stage of the Metro with 90's MCMA Footprint. Source: Sistema de Transporte Colectivo. *Etapas de construcción*. México D.F., <http://www.metro.df.gob.mx/organismo2/construccion.html>

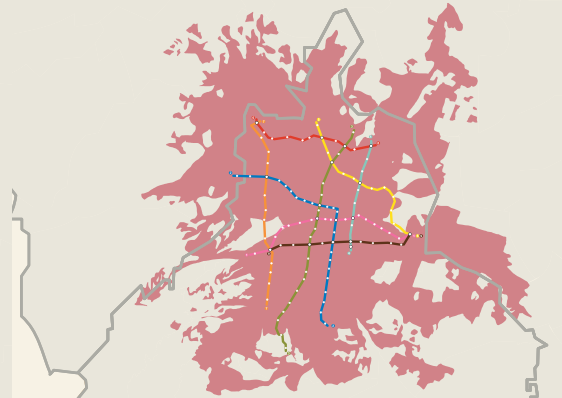


Fig. 3.5 Fourth stage of the Metro with 90's MCMA Footprint. Source: Sistema de Transporte Colectivo. *Etapas de construcción*. México D.F., <http://www.metro.df.gob.mx/organismo2/construccion.html>

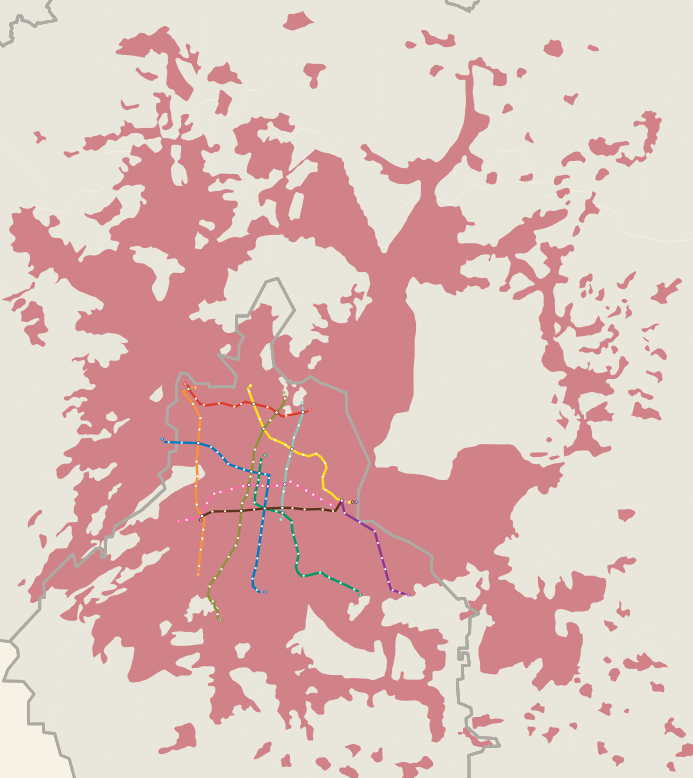


Fig. 3.6 Fifth stage of the Metro with 2000's MCMA Footprint. Source: Sistema de Transporte Colectivo. *Etapas de construcción*. México D.F., <http://www.metro.df.gob.mx/organismo2/construccion.html>

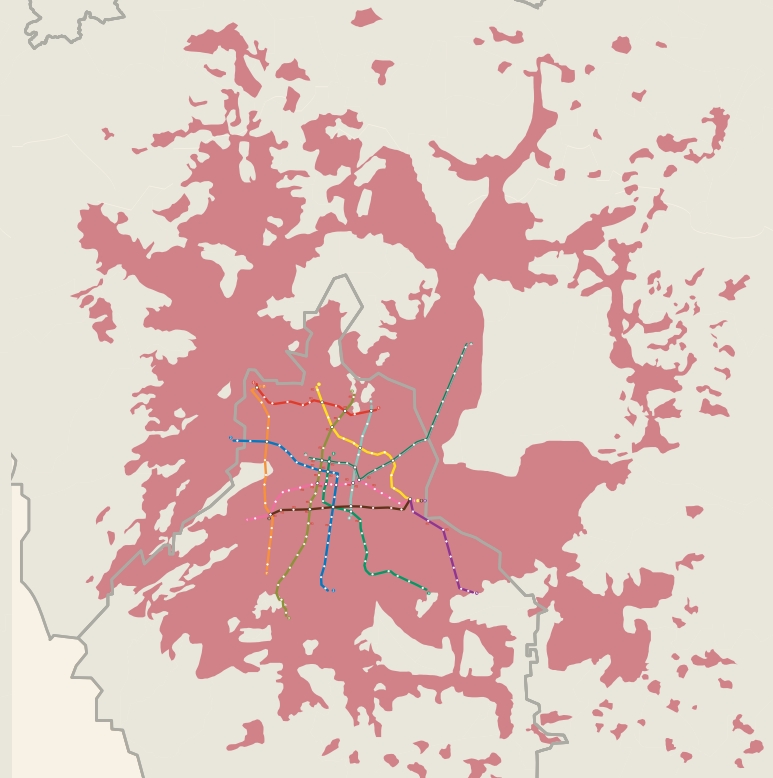


Fig. 3.7 Sixth stage of the Metro with 2000's MCMA Footprint. Source: Sistema de Transporte Colectivo. *Etapas de construcción*. México D.F., <http://www.metro.df.gob.mx/organismo2/construccion.html>

November 29, 1988 and increased the net with 5.7 kilometers and four more seasons. The line 9 was opened a year later. The new line added to the network 12 stations and 15.3 kilometers; has a similar journey to the line 1, in order to decrease its congestion at peak times.

In the fifth stage, the first extension of the subway network to the State of Mexico began with the construction of the line A of Pantitlán to La Paz. It was chosen for this line a surface solution and rail trains wheels instead of tires, since the costs of construction and maintenance were reduced. A checkpoint and exclusive workshops for line A were built. The line was inaugurated on August 12, 1991, adding ten stations and 17 kilometers long to the current network. The Pantitlán station connects it with lines 1, 5 and 9. On the other hand, the original layout of the line 8 was also changed, as it was considered that its crossing thru the Historic Downtown and a connection with the Zócalo station would threaten the structural stability of several colonial buildings and the remains of pre-Hispanic city that lies below the first square would be damaged. The first section of the line 8, Constitution of 1917 - Garibaldi, was inaugurated on July 20, 1994. Upon completion of the fifth stage of construction of the Metro, the length of the network had increased by 37.1 kilometers, adding two new lines and 29 stations. That is, at the end of 1994, the Metro network already had 178.1 kilometers, 154 stations and ten lines.

On the sixth stage, the studies and projects of the Metropolitan Line B began in late 1993 and in October 29, 1994 construction began on the underground section between Buenavista and Garibaldi Square. The line B, from Buenavista to Ciudad Azteca is 23.7 kilometers long with 13.5 kilometers in the Federal District, crossing the Cuauhtémoc, Venustiano Carranza and Gustavo A. Madero delegations and 10.2 kilometers in the territory of the State of Mexico, in the Ecatepec and Nezahualcoyotl municipalities; with 21 stations: 13 in the capital and eight in the state of Mexico. Once operational the line B, the metro network as a whole increased 13% to reach 201.7 kilometers.

Fig. 3.8 Seventh stage of the Metro with 2010 MCMA Footprint. Source: Sistema de Transporte Colectivo. *Etapas de construcción.* México D.F., <http://www.metro.df.gob.mx/organismo2/construccion.html>

The seventh stage started with the announce of the possible construction of a new metro line. On July 2007 a statistic was implemented in the Federal District to determine the possible path of a new metro line. Finally was chosen the one going from Iztapalapa delegation to Tláhuac. On June 2008 began its constructions, and its inauguration was in October 2012. The line runs in the southern part of Mexico City, from the western part to the southeastern of it, reaching the State of Mexico. The line is 26km length and has 20 stations.

B) Metrobús

With 9 years of life, is the younger transport system the MCMA has seen. Metrobús is a Bus Rapid Transit transportation system that operates buses with rubber wheels which circulate on confined and exclusive lanes. They have certain established stops and access to them is via a payment with an electronic card. The administration is the responsibility of the company Sistema de Corredores de Transporte Público de Pasajeros del D.F., Metrobús. It is noteworthy that the connection between various lines has no cost. The Bus has five lines that run throughout the Federal District, connecting 171 stations.⁵

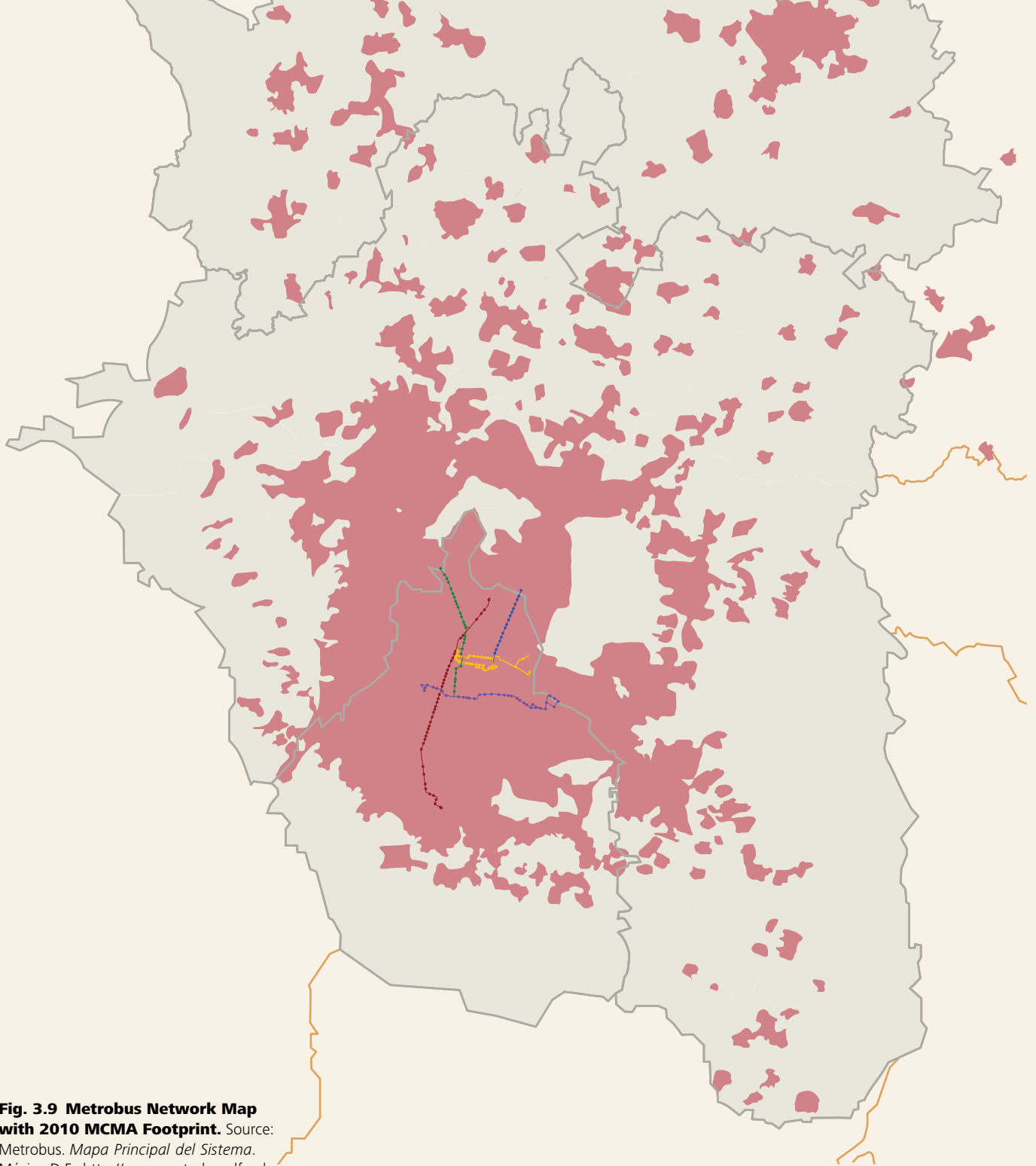


Fig. 3.9 Metrobus Network Map with 2010 MCMA Footprint. Source: Metrobus. *Mapa Principal del Sistema*. México D.F., <http://www.metrobus.df.gov.mx/mapa.html>

[5] Sistema de Corredores de Transporte Público de Pasajeros del Distrito Federal Metrobús. Metrobus - Ciudad de México - ¿Qué es Metrobús?. http://www.metrobus.df.gov.mx/que_es_metrobus.html



Fig. 3.10 Mexico City Metrobús in Front of the “La Bombilla” Station. <https://flic.kr/p/5D91pr>

Background

In 2002, the Embarq-World Resources Institute Center for Sustainable Transport and the government of Mexico City signed a cooperation agreement for five years to implement the Programme for Sustainable Transport in Mexico City, giving as a result the creation of the Center Sustainable Transport in Mexico City. In the same year is disclosed to the press the start of talks between the authorities of the Federal District and the State of Mexico for the construction of a Bus Rapid Transit corridors, similar to those implemented in Bogotá.

In 2003 the government of the Federal District, with the Centre for Sustainable Transport in Mexico City, begin to design the master plan for the Bus Rapid Transit corridors, envisioning 6 routes confined lanes in various avenues. It was called “Metrobus” and would have stations approximately every 400 meters. The first road where this measure was implemented was on Avenida Insurgentes. It would be in late 2004 when the construction of the first line of the Metrobus would start.⁶

In March 2005 the first line of the Metrobus was inaugurated in the City of Mexico, with 36 stations and 18.7km, running from north to south of the city. Subsequently would be extended its length to 28.1km and 46 stations.⁷

Then in December 2008, is inaugurated the second line: line 2. It crosses from east to west of Mexico City, with a length of 20km with 36 stations.⁸

The third line to be built was Line 3, with a length of 17km with 33 stations⁹, crossing from the north of the city to the south, but ending at the center of the city. It was opened in February 2011.¹⁰

It's continued the fourth Metrobus line, line 4. It was commissioned in April 2012. Runs in an east west and has 40 stations on 28km of route, divided into two routes, the northern route (17 stations) and the southern route (with 23 stations). The two characteristics of this line are that as we have seen, has two routes, and it is the only line connecting the International Airport of Mexico City with historic center, offering an additional way to reach the airport.¹¹

The latest line to be built is line 5, running from northeast to southwest of the city to the limit with State of Mexico It has a length of 10km which has spread 18 stations. ¹² It was inaugurated on November 2013.¹³

[6] Sosa, Iván (5 de diciembre de 2004). “Arrancan las obras de primer Metrobús”. Distrito Federal, México: Reforma.

[7] Sistema de Corredores de Transporte Público de Pasajeros del Distrito Federal Metrobús. *Metrobus - Ciudad de México - Mapa Línea 1*. http://www.metrobus.df.gob.mx/mapa_L1.html

[8] Sistema de Corredores de Transporte Público de Pasajeros del Distrito Federal Metrobús. *Metrobus - Ciudad de México - Mapa Línea 2*. http://www.metrobus.df.gob.mx/mapa_L2.html

[9] Sistema de Corredores de Transporte Público de Pasajeros del Distrito Federal Metrobús. *Metrobus - Ciudad de México - Mapa Línea 3*. http://www.metrobus.df.gob.mx/mapa_L3.html

[10] Pazos, Francisco. «Inaugurarán mañana la Línea 3 del Metrobús». Distrito Federal, México: Excélsior, 7 de febrero de 2011. <http://www.excelsior.com.mx/node/711814>.

[11] Sistema de Corredores de Transporte Público de Pasajeros del Distrito Federal Metrobús. *Metrobus - Ciudad de México - Mapa Línea 4*. http://www.metrobus.df.gob.mx/mapa_L4.html

[12] Sistema de Corredores de Transporte Público de Pasajeros del Distrito Federal Metrobús. *Metrobus - Ciudad de México - Información Línea 5*. http://www.metrobus.df.gob.mx/L5_resultados.html

[13] Belmont, José Antonio et al. “Inauguran L5 del Metrobús”. México, D.F., Milenio.com, 5 de noviembre de 2013. http://www.milenio.com/df/Inauguran-L5-Metrobus_0_184781854.html



Fig. 3.11 State of México's Mexibus. http://upload.wikimedia.org/wikipedia/commons/3/39/Mexibus_Jardines_de_Morelos_05.jpg

C) Mexibús

The Mexibus is a Bus Rapid Transit system located in the State of Mexico and reaching the Federal District. Its control and management is the responsibility of the companies Transmasivo S.A.¹⁴(Operating the "Mexibus I" line) and Red de Transporte de Oriente S.A. de C.V.¹⁵ (operating line "Mexibus III"). It has 2 lines. It has a total length of 31 km and has 53 stations. The stations are located in the State of Mexico, in the municipalities of Ecatepec, Tecámac, Nezahualcoyotl, Chimalhuacán, and the Federal District, in Venustiano Carranza Delegation.

Background

The first line to be opened was the Line 1, which runs from the northeast to the Federal District, State of Mexico in the town of Tecámac. It has a length of 16km in which it has 24 stations spread. It has an influx of 128,000 people per day.¹⁶

The next line to be opened was Line 3, which was opened in May 2013. Runs from the eastern part of the Federal District from east west to the town of Chimalhuacán in the State of Mexico, passing through the town of Nezahualcoyotl of same state. It has 27 stations spreaded on a line of 18km, in which are moved over 75,000 people a day.¹⁷

[14] Transmasivo, S.A. Transmasivo. <http://www.transmasivo.com.mx/interna.html>

[15] Redacción. "Mexibús Línea 3 dará servicio gratuito". México, D.F., El Universal, 1 de mayo de 2013. <http://www.eluniversaledomex.mx/otros/mexibus-linea-3-dara-servicio-gratuito-.html>

[16] Gobierno del Estado de México. Secretaria de Comunicaciones - GEM. Estado de México, 2011. http://portal2.edomex.gob.mx/secom/transporte_masivo/sistema_transporte_masivo/ciudad_azteca_tecamac/index.htm

[17] Gobierno del Estado de México. Secretaria de Comunicaciones - GEM. Estado de México, 2011. http://portal2.edomex.gob.mx/secom/transporte_masivo/sistema_transporte_masivo/chimalhuacan_nezahualcoyotl_pantitlan/index.htm

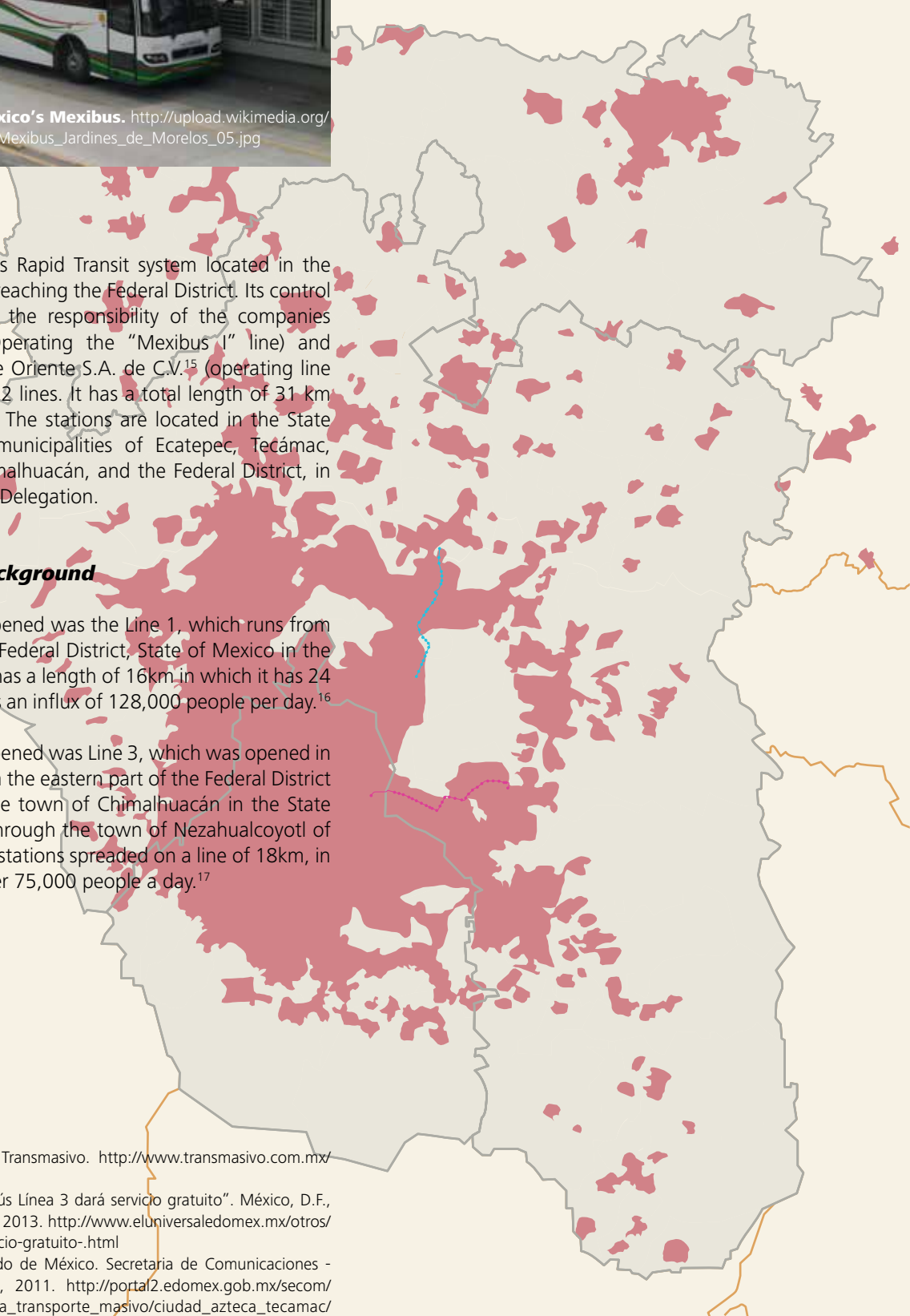


Fig. 3.12 Mexibus Network Map with 2010 MCMA Footprint. Source: Transmasivo Mexibus. *Ruta*. Estado de México, <http://www.transmasivo.com.mx/ruta.html>



Fig. 3.13 Rendering of the State of Hidalgo's Tuzobús. Tuzobus.mx

D) Tuzobús¹⁸

The Tuzobús is (currently) an unbuilt project for a Bus Rapid Transit system for the city of Pachuca and the Metropolitan Area of the State of Hidalgo. In 2008, as part of a Regional Project on Urban Mobility in the Metropolitan Area of Pachuca, a Bus Rapid Transit system arises. It was not until 2013 that construction started. At the end of its execution will have six main routes, and is expected to improve the mobility of about 330 thousand users of public transport in ten municipalities in the metropolitan area.

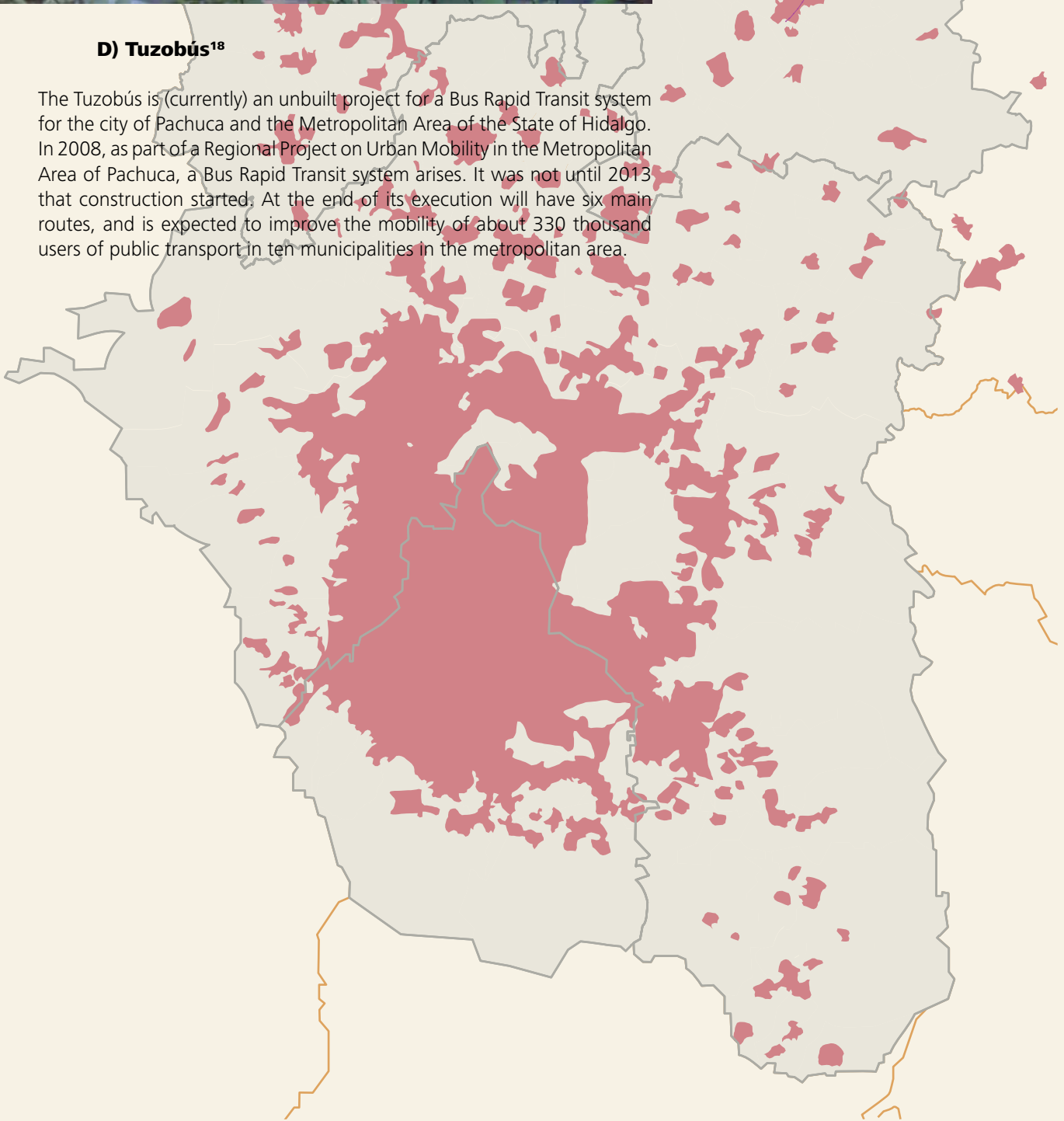


Fig. 3.14 Tuzobús Network Map with 2010 MCMA Footprint. Source: Tuzobús. Tuzobús. Estado de Hidalgo, <http://www.portalinf.net/tuzobus/>

[18] Chávez, Axel. "Arranca la construcción del Tuzobús". México, D.F., Milenio.com, 30 de diciembre de 2014. http://www.milenio.com/hidalgo/Arranca-construccion-Tuzobus_0_181182378.html

E) Trolleybus

The trolleybus is an electric bus system, powered by two upper electrical cords. The trolley does not use any special tracks or rails on the road, making it a more flexible system to implement in the Federal District. It is administered by the company "Servicio de Transportes Eléctricos del Distrito Federal".

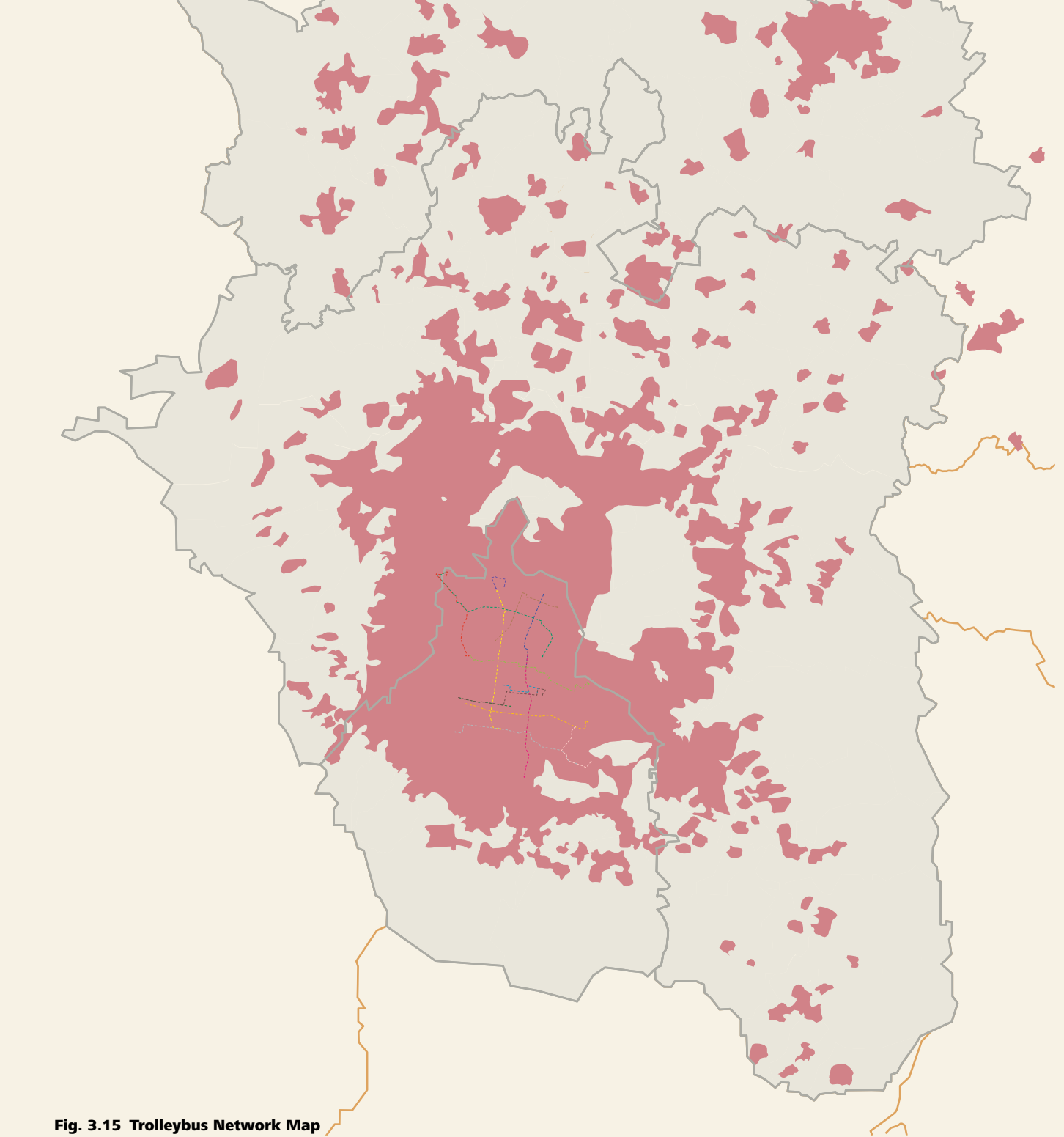


Fig. 3.15 Trolleybus Network Map with 2010 MCMA Footprint. Source: Servicio de Transportes Eléctricos del Distrito Federal. *Red del Servicio*. México, D.F., <http://www.ste.df.gob.mx/index.html?page=1&content=1/>



Fig. 3.16 Federal District's Trolley. <http://lametelpasajero.files.wordpress.com/2012/03/transporte-d-f-trolebc3bas2.jpg>

Background¹⁹

From the mid-nineteenth century the system of horse-powered tramways was already used in the city. It is not until the end of that century that comes the shift to electric traction. By the early 1900's the first electric tram line was inaugurated (from Tacubaya to Chapultepec). The right to use and exploit this mobility system belonged to the company "Compañía Limitada de Tranvías Eléctricos de México". This company received funding from the Federal Government.

By 1909 the network of electric trams had 225km length of roads, and various lines in different cities. In 1922 the service was the most widespread for the transfer of passengers, cargo, funeral, plus an efficient service of rental of advertising space, since several companies promoted them. However by 1945 the picture was different, as different employer-employee conflicts caused the current government to dissolved the "Compañía de Tranvías de México" (Trams Company of Mexico), giving rise to the Institución Descentralizada del Transporte Eléctrico del Distrito Federal (Decentralized Institution of Electrical Transport of the Federal District). Then, by 1952, the Federal District acquires all the assets of the above companies located in Mexico City. Upon completion of the action is created a company which is in charge nowadays of the administration of electric transport in Mexico City: "Servicio de Transportes Eléctricos del Distrito Federal" (Electric Transport Service of the Federal District).

Then it is carried out a modernization of the units. U.S. origin PCC trams models are introduced, although the basis for renewal was the introduction of the Westram model trolleybus. Soon the trolley demonstrated its many advantages: more freedom of movement, since railways were not necessary; its tires did a silent, plus those were fast and reliable vehicle. During the 50s and 60s different trolleybuses were acquired.

In 1965 the Electric Transport Service DF had a vehicle fleet of 173 trolleybuses and 170 km high line cables.

By the year 1970 the Company had a vehicle fleet of 577 trolleybuses, of which only 230 units were providing the service. It was necessary at the beginning of 1971, to perform a program of rehabilitation, restoration and maintenance of 550 trolleybuses, which finished in the middle of the decade.

The number of available trolleybus units continuously increasing in the 80's, having at the beginning of the decade 758 units. By the mid-decade its increased by 27%, reaching 1045 units (345 units however were in detention for lack of spare parts).

In the early 90's it is necessary to rehabilitate the vehicle fleet acquired in previous years, in addition to the acquisition of new units. Arriving at the beginning of the new century the trolleybus fleet reached 489 units. Their network of 16 lines with a length of 399km and 380 colonies benefiting 9 of the Federal District.

[19] Servicio de Transportes Eléctricos del Distrito Federal. *Antecedentes*. <http://www.ste.df.gob.mx/antecedentes/index.html>

F) RTP²⁰

The Passenger Transport Network (RTP) is a bus service and maintains an articulator and radial service along its 3220 kilometer network of routes, transporting 607,000 passengers on an average weekday and 208 thousand during non-working days.

The RTP connects with 127 stations of the Metro 175, which represents 72.5%; 14 Metrobus stations, 5 stations of the Light Rail and 5 stops from the Zero Emissions Corridor.

At the end of December 2009, the RTP operated a total of 91 routes over 3,279 kilometers, assisting users of the 16 delegations that make up the Federal District; in service hours from 5:00 to 22:30 and emphasizing areas of scarce resources. The RTP, had at the end of December 2009 an operable vehicle fleet of 1,268 buses.

Among the various services offered by the company include²¹:

- Ecobus or "Green Route"
- Express Service
- Athena Service (only for women)
- School service
- Service to people with disabilities
- Service to children and older adults
- Buses rental to government agencies.

Fig. 3.17 RTP Service Map with 2010 MCMA Footprint. Source: Red de Transporte de Pasajeros. *Red de Rutas*. Mexico, 2014. <http://www.rtp.gob.mx/pdf/RED%20DE%20RUTAS.pdf>

[20] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad. *Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal*. México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf pp. 32, 33, 61, 62.

[21] Red de Transporte de Pasajeros de Distrito Federal. "Servicios". <http://www.rtp.gob.mx/servicios.html>



Fig. 3.18 Federal Districts' RTP Service Buses. <http://aristeguinoticias.com/wp-content/uploads/2014/03/metro-03.jpg> <http://1.bp.blogspot.com/-dQy6thE0r3c/VBB8cNdBOTI/AAAAAAAAAMmg/c39ZxAWs4LU/s1600/DSC04502.JPG>

Background

In early 2000 its created the RTP, consisting of buses belonging to the old organization “Urban Passenger Motor Carrier Route 100”. As in other modes of transport, demand always exceeds capacity, and in this case the capacity of the Government to meet it. That’s why in September 2000 the local government decided to purchase new units in addition to repairing existing ones. This trend would continue until 2009.²²

In 2010 the service is modernized, with the acquisition of new units based on natural gas, creating the “Green Route” that runs from the center to the Business western part of the city.²³

[22] Alcántara, Liliana. “Adquirirá RTP 500 Unidades mas”. México, D.F., El Universal, 22 de Diciembre de 2000. <http://www.eluniversal.com.mx/ciudad/21247.html>

[23] Robles, Johana. “Nuevas unidades de RTP circularán a Santa Fe”. México, D.F. El Universal” 14 de febrero de 2011. <http://www.eluniversal.mx/notas/744674.html>



Fig. 3.19 Federal District's Light Rail. <https://jorgalbrtotranseunte.files.wordpress.com/2011/05/dsc01134.jpg>

G) Light Rail²⁴

The light rail is a transport mean similar to the subway. It runs on a rail system and works with electricity. It has a single line that runs on the south of the city. This system runs at the same level with the cars, making it at certain points subject to traffic conditions. Their service and administration is in charge of the company "Servicio de Transportes Eléctricos del Distrito Federal", the same in charge of the administration of the trolleybuses.

The only light rail line is located in the south of the city, providing a clean transport service to the people of Coyoacán, Tlalpan and Xochimilco delegations, with its 16 stations distributed over 13km. Currently, with 11 vehicles crossings, the journey between terminals is 37 minutes circa.

Background

As seen in the history of the trolley and the actual development of the City of Mexico, in the early 70's are introduced the "Main Axes" to combat traffic problems that were flooding the city. This made the tram network (then 156km throughout the City) gradually decreased to only 3 tram lines. In turn this led to the construction of the first Light Rail line, made with parts of old PCC streetcars. In the early 90's, several components of the trains had to be modernized to ensure its operation.

Fig. 3.21 Light Rail Service Map with 2010 MCMA Footprint. Source: Servicio de Transportes Eléctricos del Distrito Federal. *Servicios*. Mexico, 2014. <http://www.ste.df.gob.mx/servicios/trenligero.html>

[24] Servicio de Transportes Eléctricos del Distrito Federal. *Servicios*. <http://www.ste.df.gob.mx/servicios/trenligero.html>



Fig. 3.20 Suburban Rail. <http://media.impacto.mx/imagenes/large/5311130978873f3113bdc0f3.jpg>

H) Suburban Rail²⁵

The Suburban Rail is a newly implemented project at the metropolitan level. It consists of a confined train system of metal rails that make trips both in the central and northern area of Mexico City and the surrounding area of the State of Mexico. Currently the project consists of a 27km line with 7 stations. It uses the existing road infrastructure belonging to the Federal Government, serving 320,000 passengers per day.

Background

In 1978 the Federal Government through the Ministry of Communications proposes the construction of a Mexican electric double track railway. After studied the issue, it is determined that the route Mexico City - Queretaro, is the most viable to electrify, especially because of its strategic location between these two important cities. Although in the early 80's the project is stopped, is taken up in 1986²⁶. By 1994 regular trips between these cities are opened. However these trips did not last long, because in 1996 the Federal Government closed the company in charge of train operations.

In 1997 the Federal Government proposes the creation of a commuter train on the existing old railroad track property of the Government in Mexico City. The network would have three main tracks and corresponding branches systems for a better connection²⁷. It was until 2001 when the Federal Government signed an agreement with the Federal District and the State of Mexico for the realization of a suburban train²⁸. In 2008 the first part is opened,²⁹ and from early 2009 the current line is fully operational³⁰.

[25] Secretaría de Comunicaciones y Transportes. *Portal SCT - Beneficios*. <http://www.sct.gob.mx/transporte-y-medicina-preventiva/transporte-ferroviario-y-multimodal/tren-suburbano/beneficios/>

[26] Delgado, Javier; Blanca Rebeca Ramírez Velázquez. *Ciudad-región y transporte en el México Central: Un largo camino de rupturas y continuidades (Colección Ciudad y Región) (en español)*. México: Plaza y Valdés Editores, Universidad Nacional Autónoma de México, 1998. Pp. 142-143.

[27] Majoral Moliné, Roser. «¿Planeación del transporte a gestión fragmentada de la movilidad en la Ciudad de México?». *Territorios y sociedades: diferentes dimensiones de análisis (Actas del III Simposio de planificación y desarrollo del territorio, una mirada a América Latina y Europa) (en español)*. Barcelona, Spain: Edicions Universitat Barcelona, 2007. P. 99.

[28] Cobos González, Carmen. *Proyecto del Ferrocarril Suburbano de la Zona Metropolitana del Valle de México*. Distrito Federal, México: Presidencia de la República Mexicana 2000-2006, 11 de junio de 2003. <http://fox.presidencia.gob.mx/actividades/?contenido=5534>

[29] Notimex. «Probarán tren suburbano por un mes». Ciudad de México, México: Noticieros Televisa. 23 de abril de 2008. <http://www.esmas.com/noticierostelevisa/mexico/726228.html>

[30] Rebeca Jiménez. «Suburbano por fin llega a Cuautitlán». Ciudad de México, México: El Universal. 6 de enero de 2009. <http://www.eluniversal.com.mx/ciudad/93526.html>

Fig. 3.22 Suburban Rail Map with 2010 MCMA Footprint. Source: Ferrocarriles Suburbanos. *Estaciones*. Mexico, 2014. <http://www.fsurbanos.com/secciones/operacion/recorrido.php>



Fig. 3.23 MCMAs' Concessioned Busses and Mini Buses.

3.1.2. Concessioned public transport

A) Buses, minibuses and minivans

The public transport concession (like mini vans, minibuses and buses) represents one of the most important services for its large volume of journeys undertaken. In 2007, 30,170 units (20,000 of those were minibuses), covering 9.6 million daily trips which represented 60.1 percent of all journeys were made on 104 routes and 1,150 branches in a journey of about 8000 kilometers. In the metropolitan zone enable a large proportion of the lengths of trips (46.2 percent). However, when considering only public transportation, this service represents up to 65% of metropolitan travel. In 2010 was seen a volume of 16 million 402 thousand travels in this type of concession transport, which represented 52.1 percent of total trips.³¹

Background³²

Prior to the buses and minibuses, the state public transport covered 71% of the journeys, while with the company "Route 100" (R-100) covered 40% of those trips on buses. The company "Route 100" became operational following the nationalization in 1981 of private buses services.

"Route 100" offered an organized and coordinated service with other state means of public transport and together constituted a multi-modal public transport. However were heavily subsidized (mostly often not recovering operating costs) and their performance was mediocre. In 1989 a series of budget cuts sparked a strike was declared illegal. The union of "Route 100" lost 7000 job positions and different routes were canceled. Henceforth service reduction would be obvious: in 1985 had up to 7,000 units while in 1989 something close to 3,500, and then in 1990, 2,500. In 1995 finally was declared final bankruptcy.

In 1986 the use of 20 passenger minibuses was authorized, while in 1987, 7,000 concessions were granted and in 1989 those concessions were increased to cover the routes that "Route 100" failed to attend. This was the beginning of the current chaos, as it shifted from a planned and orderly system of public transport, straight to one private, fragmented into different routes and branch lines, with low capacity, without planning and without institutional managers.

[31] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad. *Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal*. México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf pp. 33-34.

[32] Medina, Salvador. "Microbuses y colectivos, el origen del mal" on Letras libres.com. México, D.F., August 1st 2011. <http://www.letraslibres.com/blogs/blog-de-la-redaccion/microbuses-y-colectivos-el-origen-del-mal>



Fig. 3.24 MCMA's Taxis. https://farm1.staticflickr.com/36/82586567_949ca6700f.jpg <http://fuerza.com.mx/wp-content/uploads/2014/05/BLOQUEO-DE-TAXIS-3.jpg>

B) Taxis

Taxis in Mexico City are also a representative service, since it has a fleet of 108 thousand units, and another sum operating on illegal mode, constituting what is one of the larger transport fleets. This service mobilizes more than one million 250 thousand passengers daily and is a relevant job niche since it gives direct and indirect support to nearly one million Mexicans. In this way it's considered an option of continue demand due to the breadth of its fleet, affordable rates and needs of population displacement. However, the existence of irregular service and the problems that arise in the concessions of a large number of taxis, such as lack of ownership, due dates, lack of payment of vehicle inspection or lack of physical-mechanical controls and maintenances caused the development of insecurity practices towards users and citizens.³³

- In the city there are several types of taxi service³⁴: Regular taxis: This service is provided, generally in compact cars, green or white with red colored. Those are metered, and must have in the passenger view the permission of the driver with photo.
- Radio taxis: They are identified by the radio antenna. Radio taxi companies keep track of the car and driver that offers the service.
- Tourism type taxis: They are available to tourists at the door of the main hotels. They have higher rates when compared to other forms of taxi. The units are not metered, so a negotiation of the cost of the service is highly recommended before boarding the vehicle.
- Site taxis: Are red, and parked in special stops, usually at the corners. The cost of service is greater than those others types. They are not metered, so it is advisable to agree the price before you get to the unit. They provide services 24 hours a day.

Background³⁵

Rental cars began to serve in the city of Mexico in 1903, with 136 units. The first car rental site it established in the Alameda, American businessman M.C. Hurlle who applied a rate of eight pesos the hour and ten pesos on Sundays and holidays days. In 1922 the vehicle rental with no timeline started, lacking of an attachment to a "site", identified as "Yellow Yellow Taxi", hence constantly roamed the city streets seeking clients.

In 1971, with the first 500 units, large taxis were replaced by the popular "Vochos" or Beetle Type 1, giving birth to the "minicabs" which replaced the famous "crocodile" or large cabs of the fifties.

While trolleybuses remain practically without increasing its network or buses units since 1981, it was strengthened the expansion of collective taxis throughout the metropolitan area, with the worsening of air pollution levels.

[33] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad. *Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal*. México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf P. 34.

[34] Fernández Ruiz, Jorge et al. *Régimen Jurídico del Urbanismo*. México, D.F., Universidad Nacional Autónoma de México., 2009. Pp. 270-271.

[35] Fernández Ruiz, Jorge et al. *Régimen Jurídico del Urbanismo*. México, D.F., Universidad Nacional Autónoma de México., 2009. Pp. 270-271.



Fig. 3.25 Federal District Bike Sharing System. <http://metropolihoy.com/v1/multimedia/notas/1362962131-36.jpg> <https://flic.kr/p/aETmz9>

3.1.3. Alternative mobility³⁶

Regarding alternative mobility linked to the promotion of a new urban order, it's highlighted in 2010 the introduction of an alternative service "Ciclotaxis" in the Historic Center of Mexico City assisted with hybrid technology. Similarly, the creation of a bike sharing system, giving a fundamental sustainable transportation infrastructure to the centre of the city. Currently the bike sharing system "Ecobici" has 273 stations in six neighborhoods.

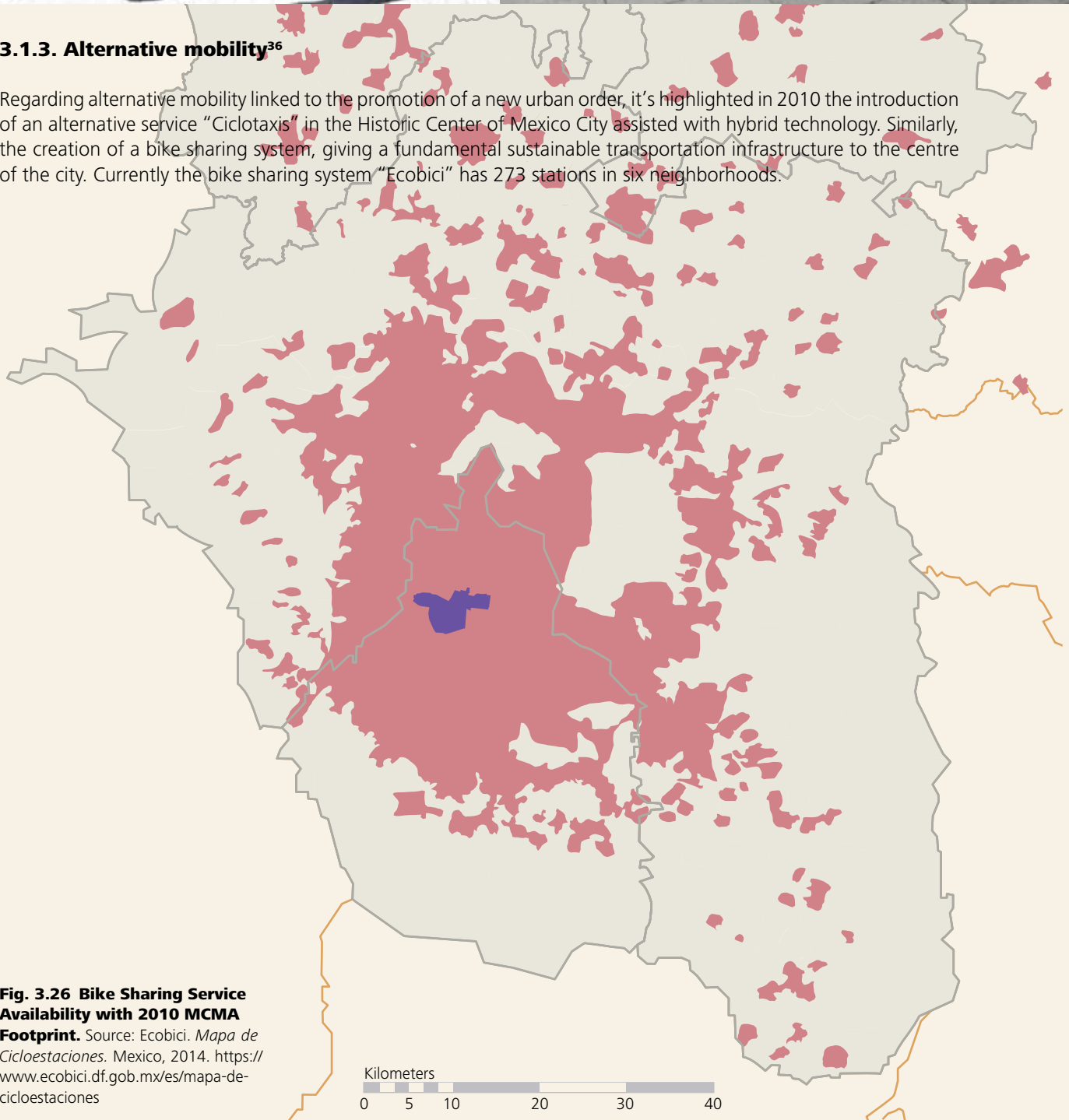


Fig. 3.26 Bike Sharing Service Availability with 2010 MCMA Footprint. Source: Ecobici. *Mapa de Cicloestaciones*. Mexico, 2014. <https://www.ecobici.df.gob.mx/es/mapa-de-cicloestaciones>

[36] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad. *Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal*. México, D.F., 25 de febrero de 2011. http://www.evaluacion.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf. P. 34.

3.2. MOBILITY: WHERE, WHEN AND WHY

3.2.1. How many?

A) Percentage of Trips per Entity

Of the 21.9 million of trips made by residents of the MCMA along a business day, 58.4% originate in the Federal District and 41.3% in the selected municipalities of the State of Mexico.

Of the Trips occurring in the DF, 83% stay there; as for travel originating in the municipalities of the State of Mexico, 75.7% stay within the same area.

About one in six trips generated in the Federal District has by some destination the State of Mexico municipalities, while one in four trips generated in such municipalities going to Mexico City³⁷.

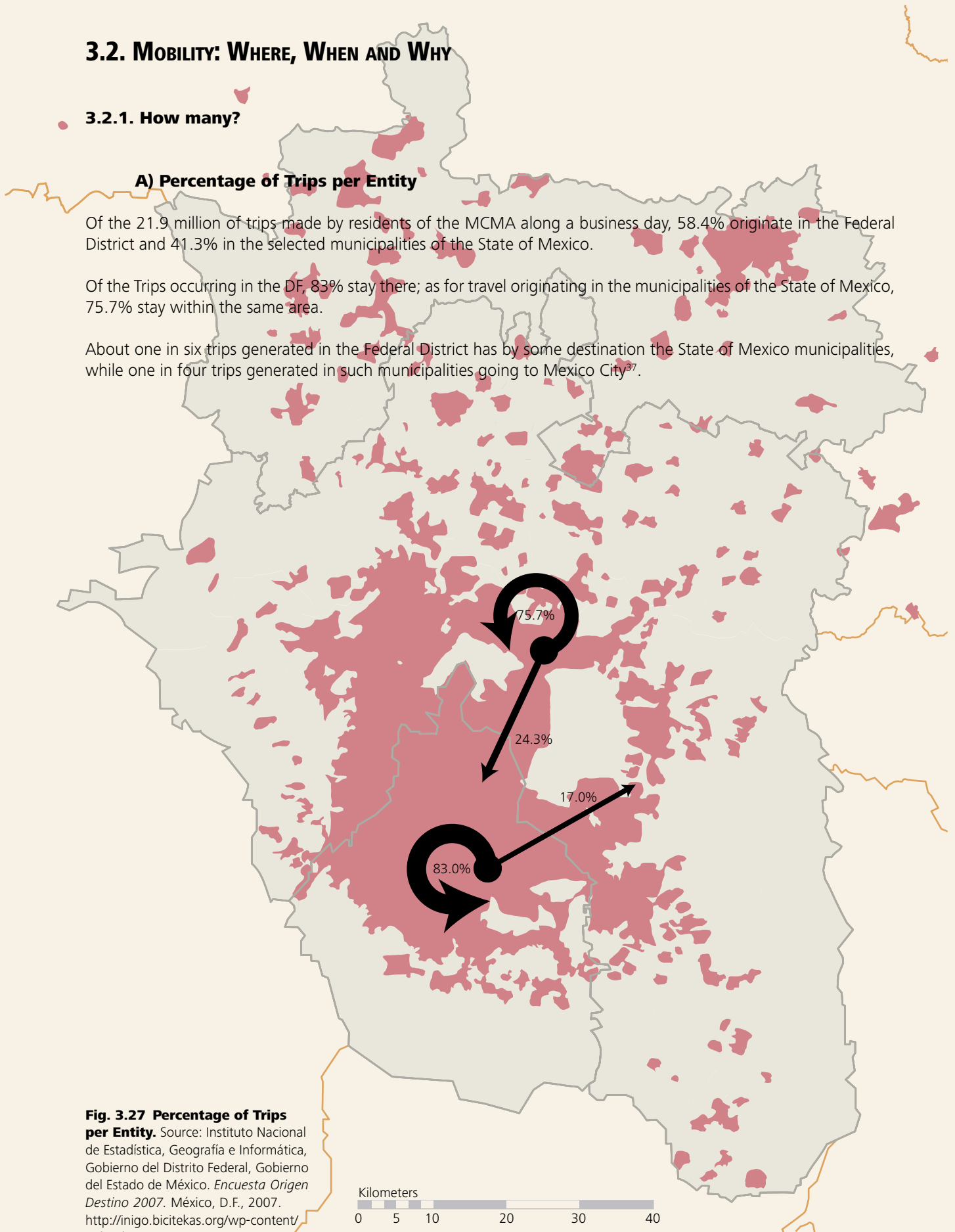
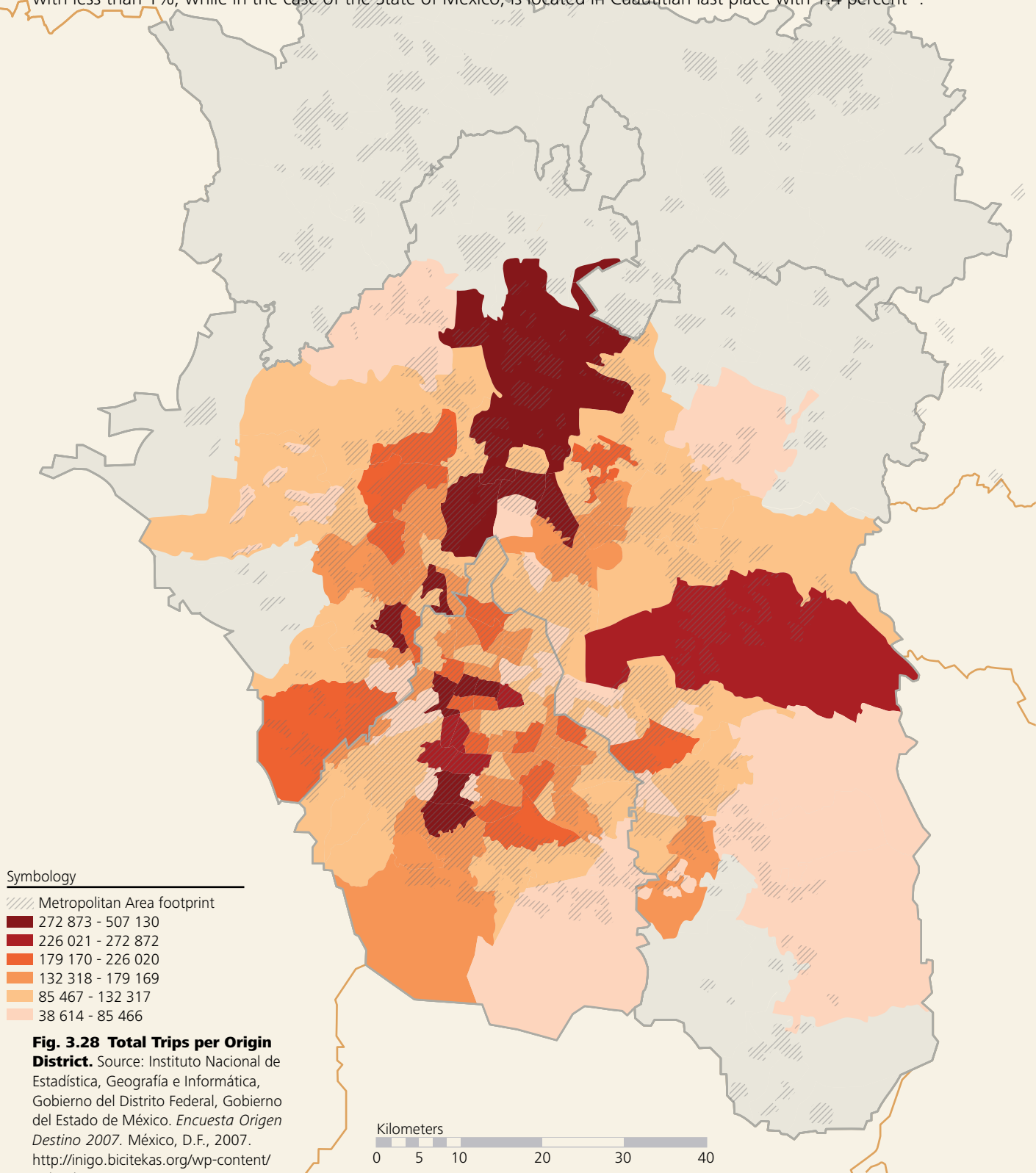


Fig. 3.27 Percentage of Trips per Entity. Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 103.

[37] Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 47.

B) Total Trips per Origin District

In the Federal District, the delegation which produces the highest number of trips is Iztapalapa with 14.2%, followed by 13.2% with the delegation Cuauhtémoc. Among the selected municipalities in the State of Mexico Ecatepec de Morelos stands, with 15.9% of total trips produced in the municipalities of the State of Mexico, Naucalpan followed with 10.4%. At the opposite end, the delegation produced fewer trips reported in the Federal District is Milpa Alta, with less than 1%, while in the case of the State of Mexico, is located in Cuautitlan last place with 1.4 percent³⁸.



[38] Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 49.

C) Total Trips per Drawn District

As for drawn trips -journeys arriving at a different predetermined geographical area where it originated - similar to those produced travel behavior was observed; as delegations with increased travel are Iztapalapa and Cuauhtemoc over quarter of the drawn trips the Federal District. For the State of Mexico, municipalities attracting more trips are Ecatepec de Morelos and Naucalpan, with 15.9% and 10.4% respectively. The delegation and the municipality with fewer trips is Milpa Alta, with less than 1.0%, and Cuautitlan, with 1.4%. The areas of neighboring municipalities concentrated 9.0% of trips attracted, implying that the total of the 40 municipalities of the State of Mexico selected 21 of these attract less than 9.0% of the trips³⁹.

Symbology








-  Metropolitan Area footprint
-  276 013 - 509 586
-  229 298 - 276 012
-  182 583 - 229 297
-  135 868 - 182 582
-  89 153 - 135 867
-  42 437 - 89 152

Fig. 3.29 Total Trips per Drawn District. Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 105.



[39] Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 49.

3.2.2. How?

A) Road and Railroad Infrastructure in MCMA

In terms of road infrastructure, the Federal District has 10,200 kilometers of road network, being 930km long their primary roads, 9,557 kilometers of secondary roads, 421.16 km of road axes, 320.57 kilometers of primary branches, and 9,229km of secondary roads. It also has 31 main roads, totaling a length of 328.60 kilometers⁴⁰.

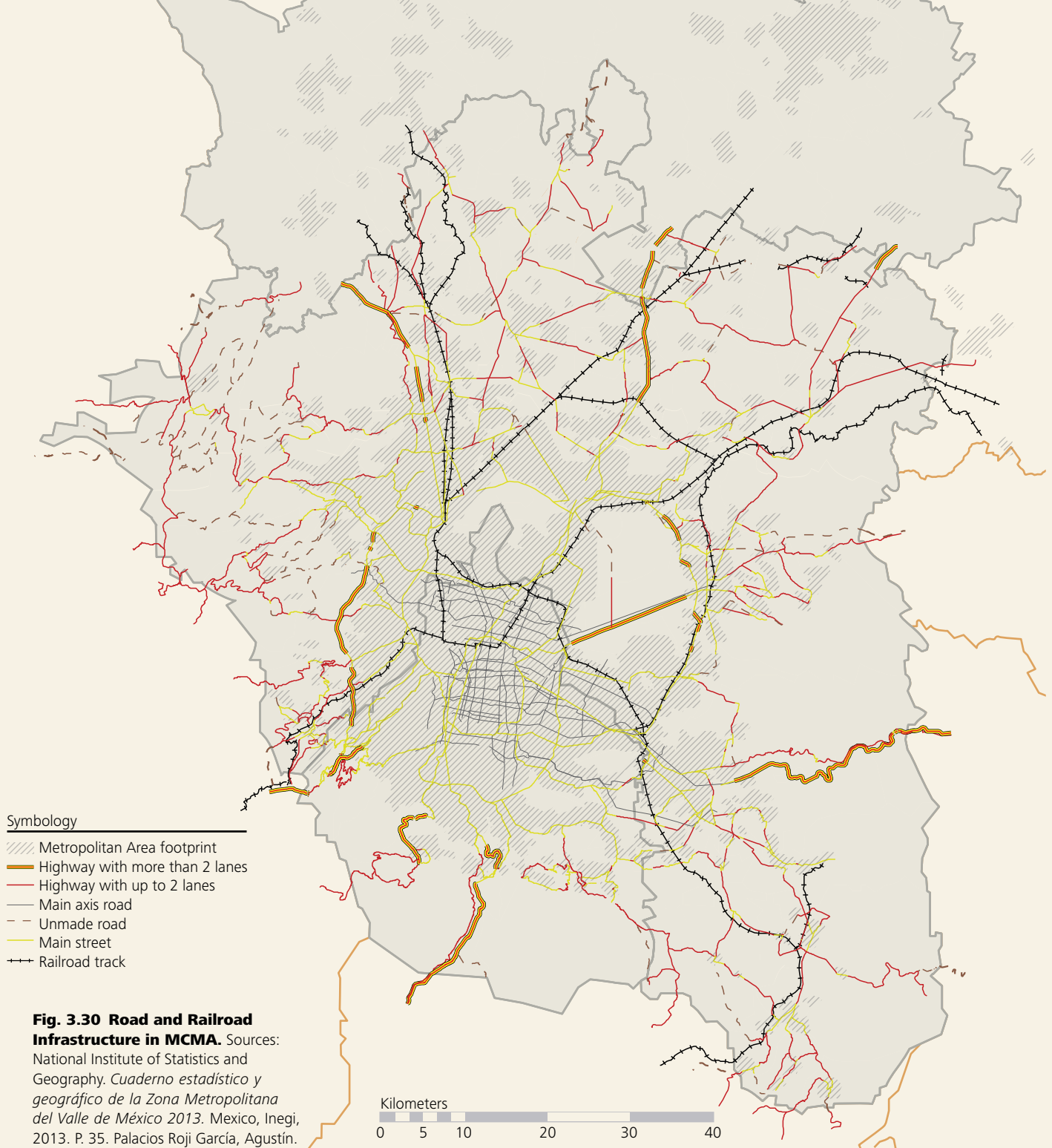


Fig. 3.30 Road and Railroad Infrastructure in MCMA. Sources: National Institute of Statistics and Geography. *Cuaderno estadístico y geográfico de la Zona Metropolitana del Valle de México 2013*. Mexico, Inegi, 2013. P. 35. Palacios Roji García, Agustín. *Guía Roji de la Ciudad de México, Área Metropolitana y alrededores 2009*. México, D. F., Guía Roji, 2009.

[40] Fernández Ruiz, Jorge et al. *Régimen Jurídico del Urbanismo*. México, D.F., Universidad Nacional Autónoma de México., 2009. P. 279.

B) Total Journeys per District done solely with the Subway

The trips solely done with the subway present a concentration in the Historic Centre of Mexico City. It is from there where these trips branch out towards the eastern part of the MCMA (whether it's the north or south part of it). In the Federal District, this concentration branches out, as said, in the eastern part, reaching again a concentration of journeys in the south. Meanwhile the western part has almost no journeys registered due to the lack of infrastructure. In the State of Mexico there's a visible concentration of journeys in the municipality of Ecatepec due to the line B of the Subway.

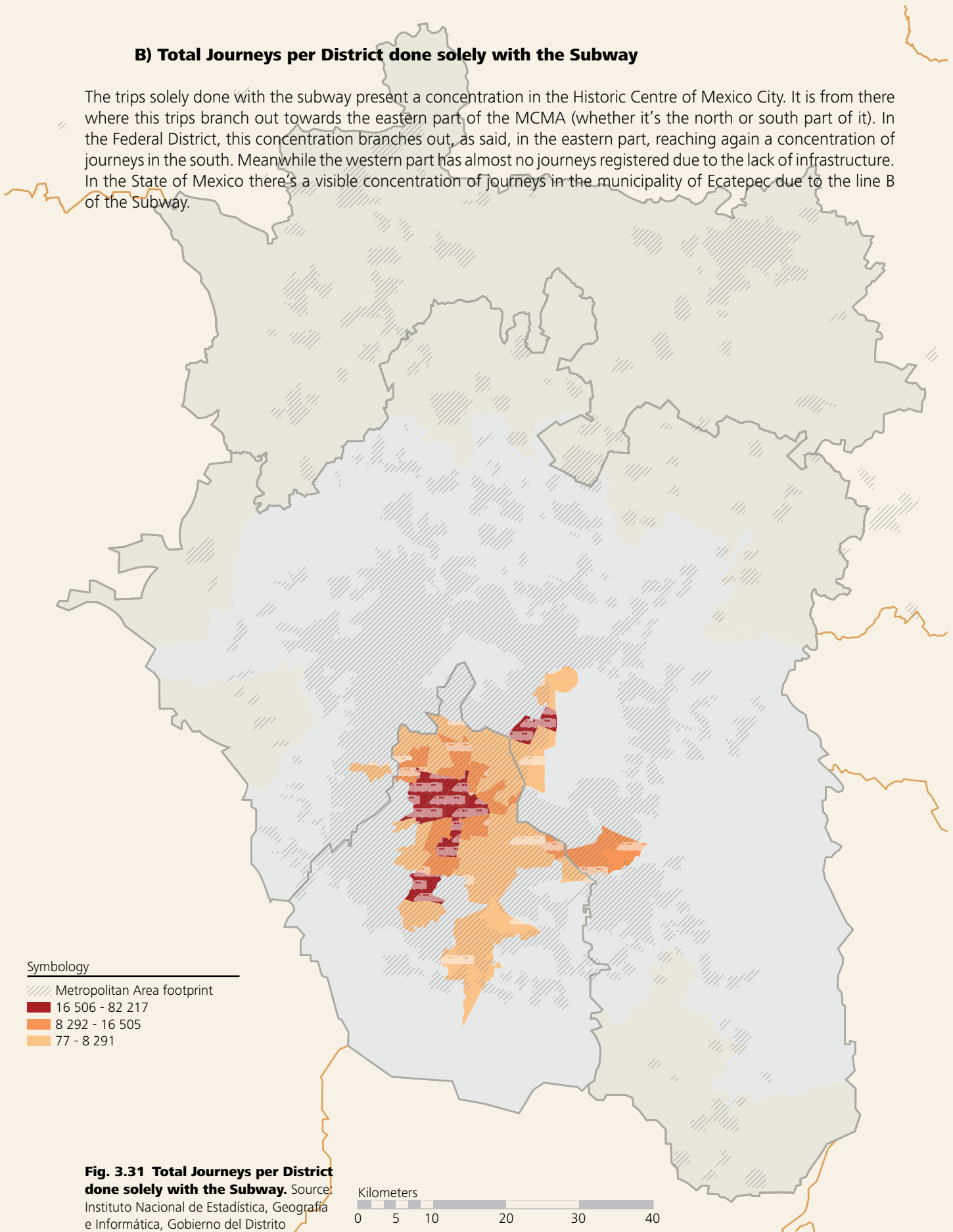


Fig. 3.31 Total Journeys per District done solely with the Subway. Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 105.

C) Total Journeys per District done solely with the RTP Network

Since RTP network is much more extensive, it covers almost all of the Federal District, with a tendency to focus on the extreme west, central and northern part of it. Since the coverage of the system is only in the Federal District, it disappears in the State of Mexico.

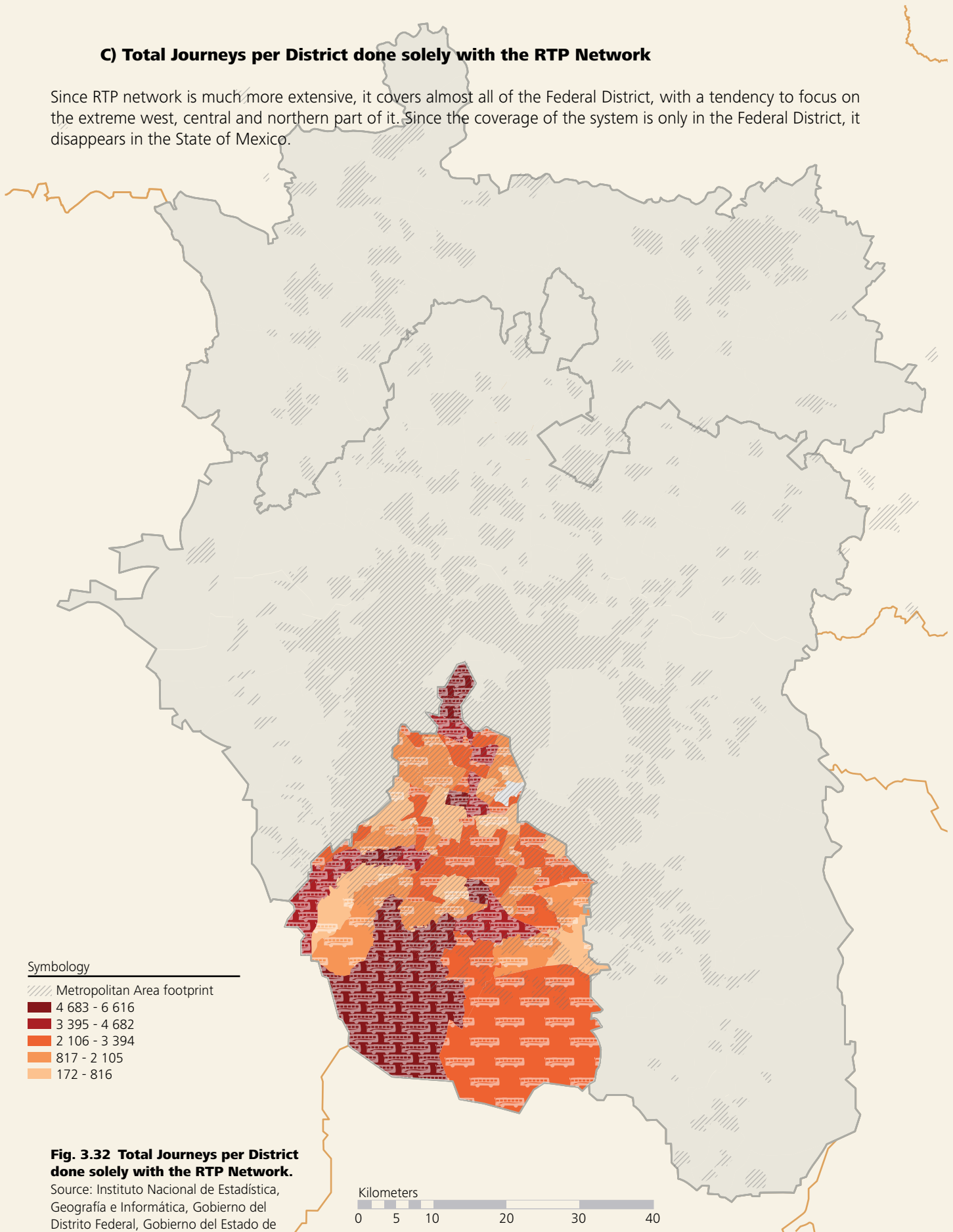


Fig. 3.32 Total Journeys per District done solely with the RTP Network.

Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 108.

D) Total Journeys per District done solely with Suburban Buses and other transport modes

The main feature of the suburban bus is that transport people from one state to another, thus creating much greater communication nodes and, in turn, much greater distances. There is a proliferation of these trips in the northern part of the State of Mexico, which spreads to the south of it, coming to the west and east of the State of Mexico. Meanwhile in Mexico City, these trips are very few, except those generated in the Historic Center.

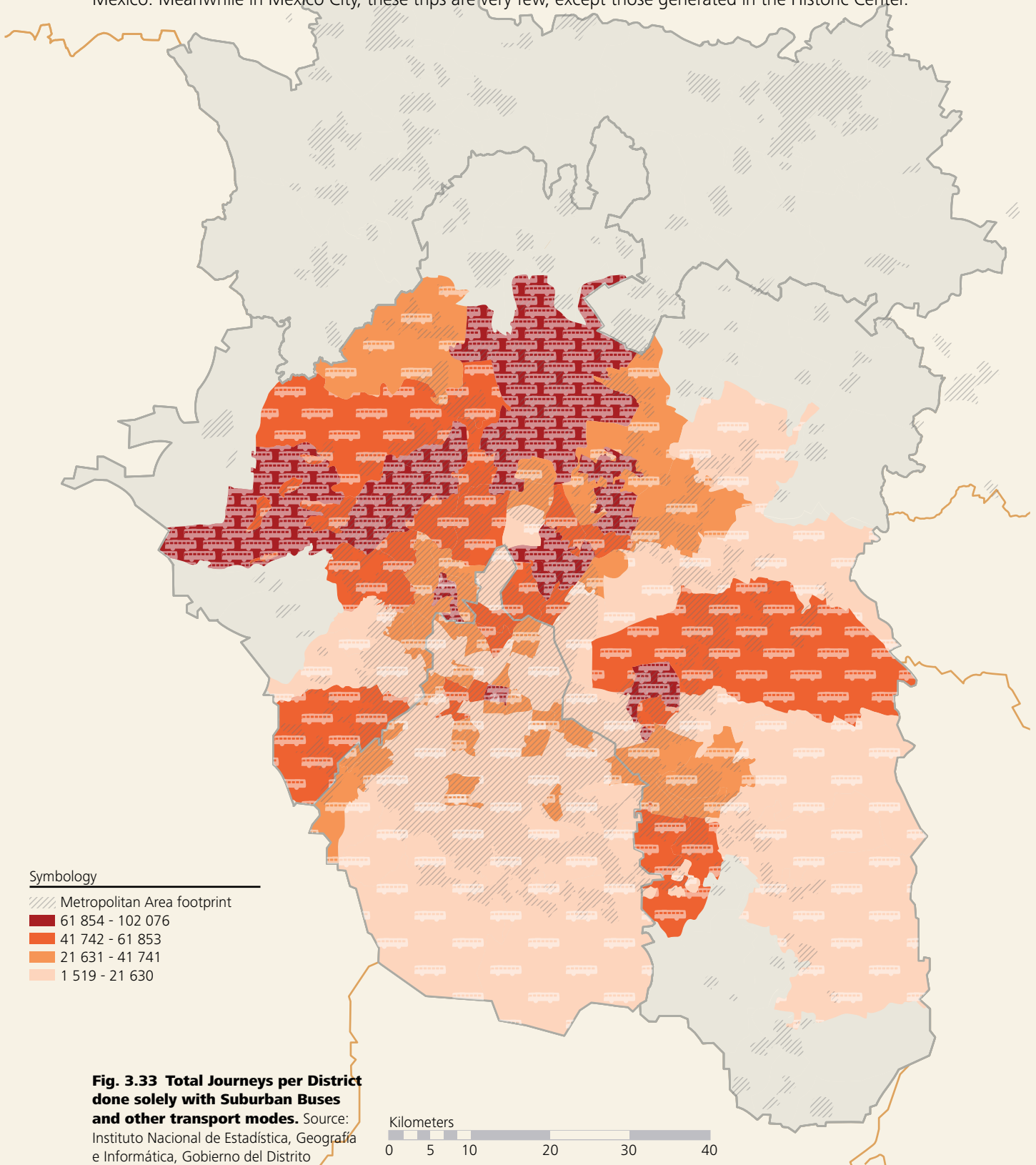


Fig. 3.33 Total Journeys per District done solely with Suburban Buses and other transport modes. Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 110.

E) Total Journeys per District done solely with Buses, Minibuses and Minivans

In contrast to the extent seen covered with the Subway and the RTP network, this means of public transport has the greatest number of trips on the outskirts of the MCMA, and its tendency to disappear increases as it approaches the Historical Center of Mexico City.

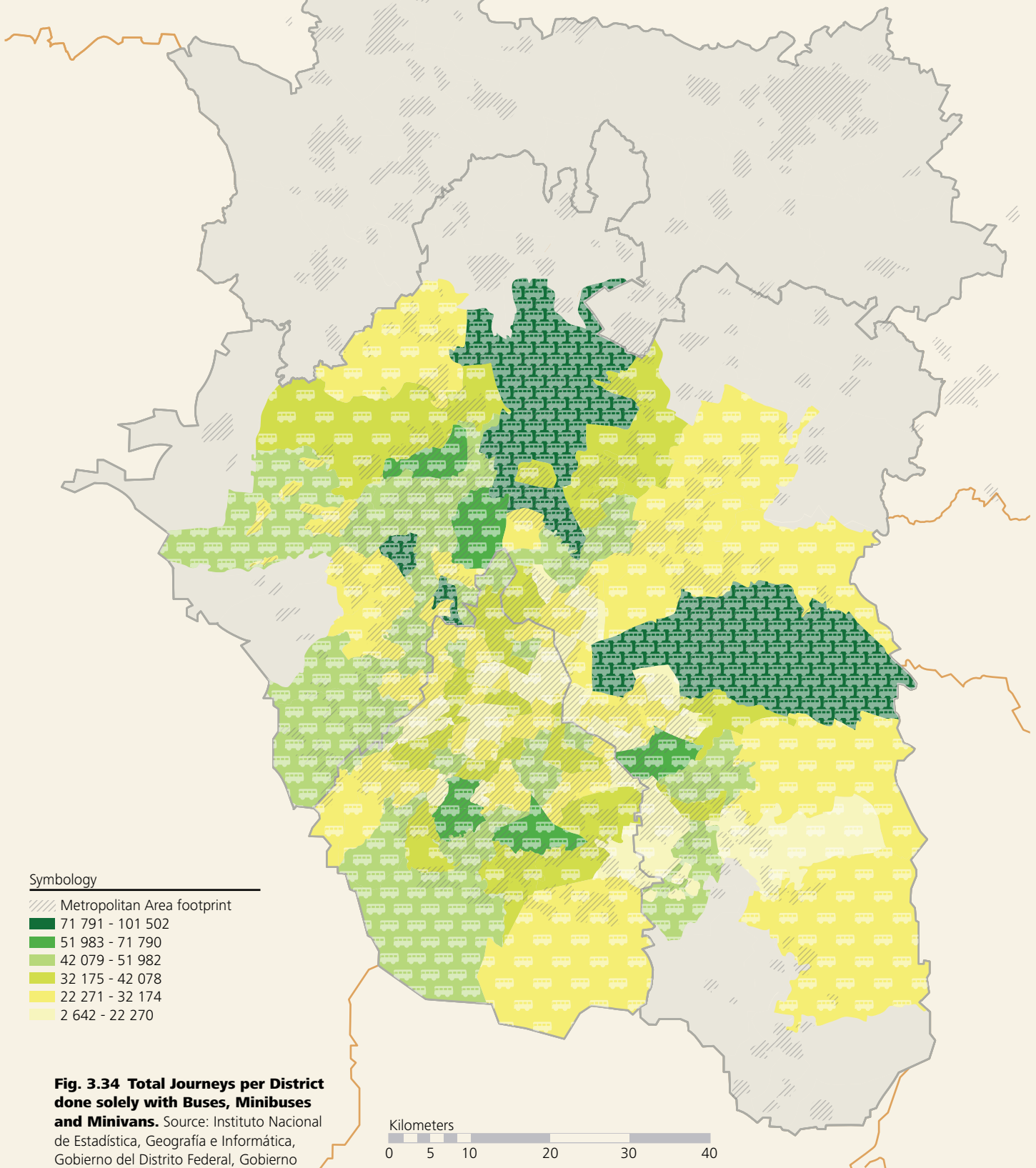
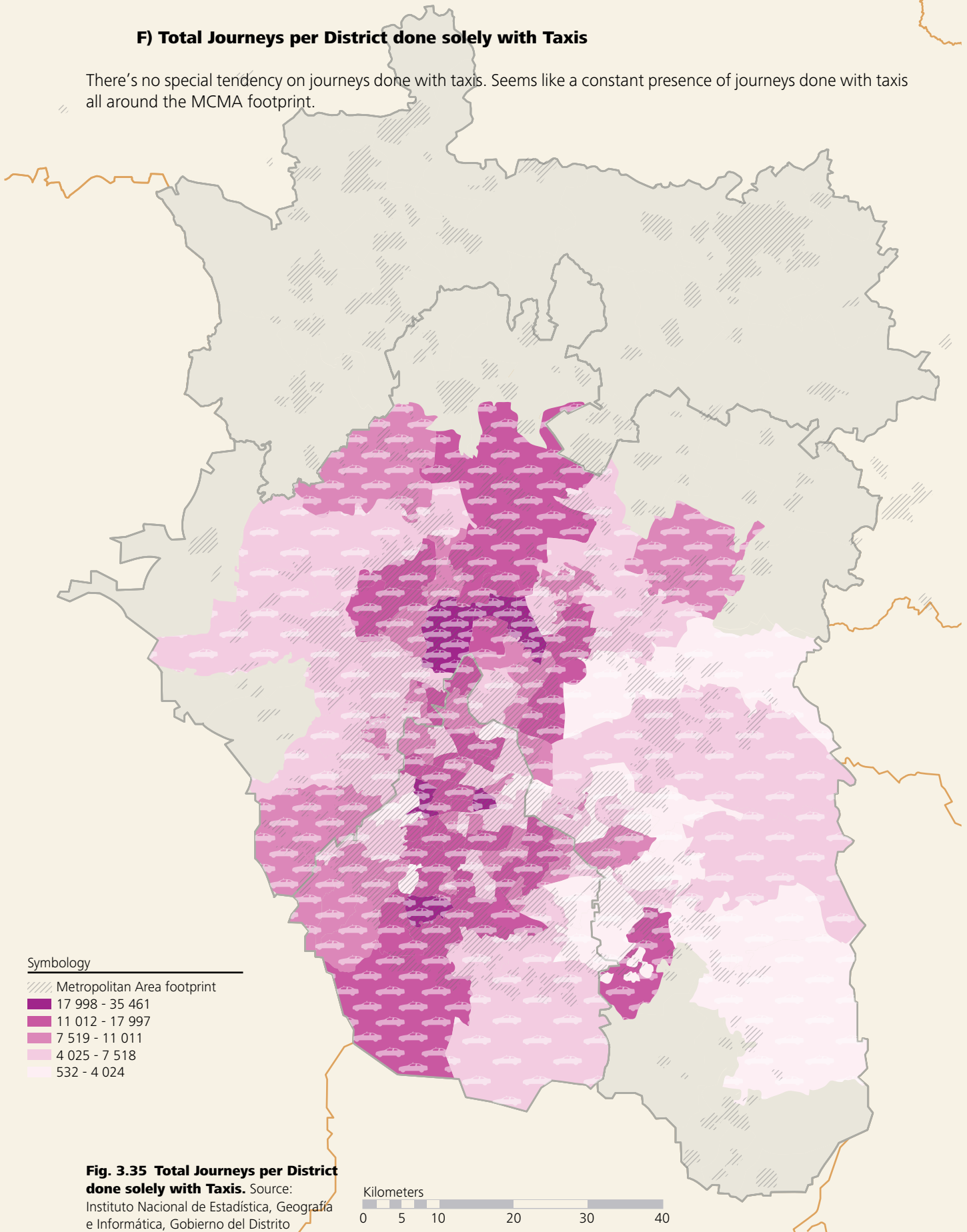


Fig. 3.34 Total Journeys per District done solely with Buses, Minibuses and Minivans. Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 111.

F) Total Journeys per District done solely with Taxis

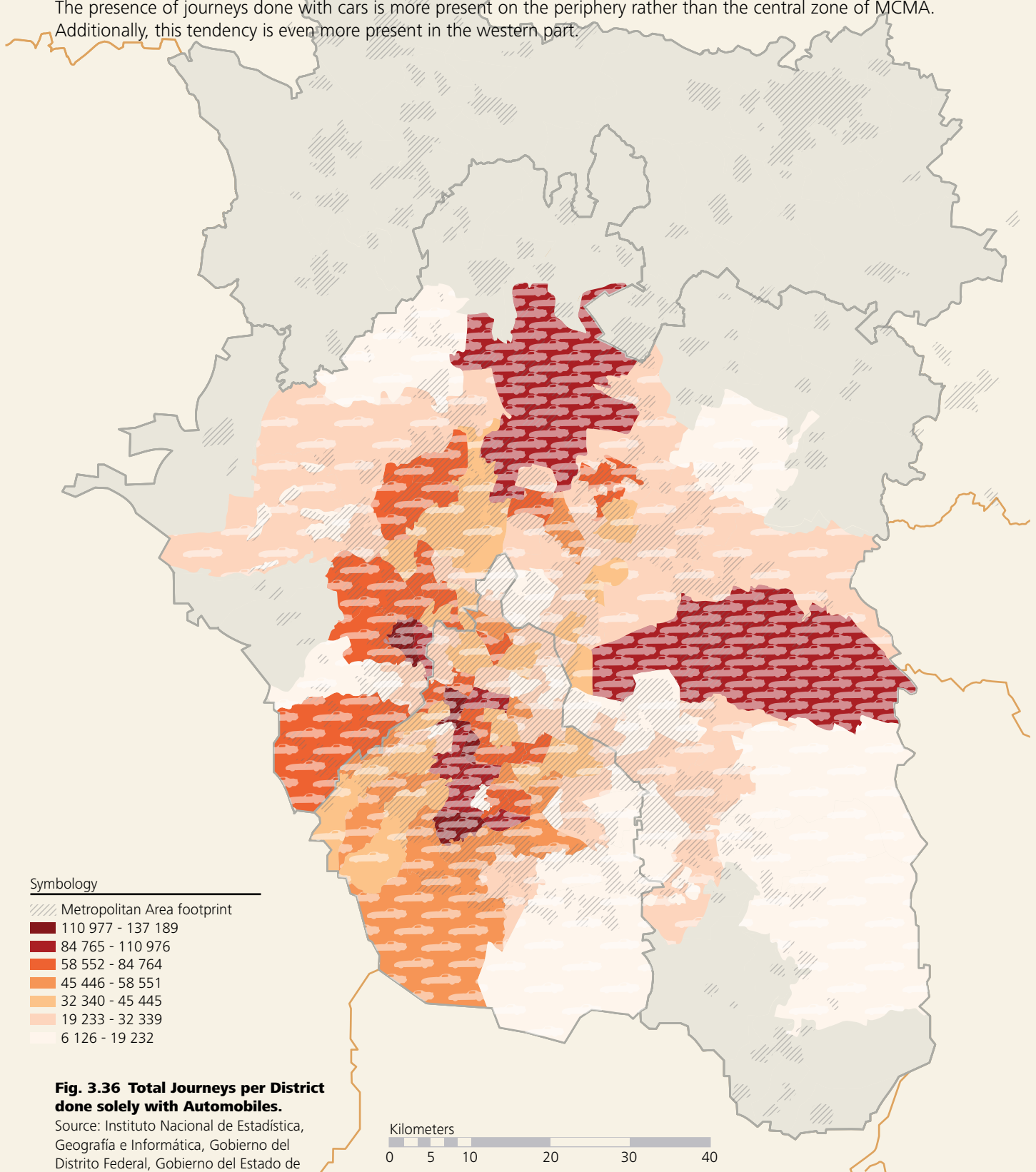
There's no special tendency on journeys done with taxis. Seems like a constant presence of journeys done with taxis all around the MCMA footprint.



G) Total Journeys per District done solely with Automobiles

In the MCMA a bit more of 15.1 million trips are made by a single mode, for which the car is the most widely used transport by quantifying little more than 6.2 million trips, ie 41.5% of the total.

The presence of journeys done with cars is more present on the periphery rather than the central zone of MCMA. Additionally, this tendency is even more present in the western part.



H) Total Journeys per District done solely with Bicycles

In this case, the biggest quantity of journeys done with the bicycle is done in the “opposite” part of MCMA, the eastern part, not seen dominated by cars as in the last map.

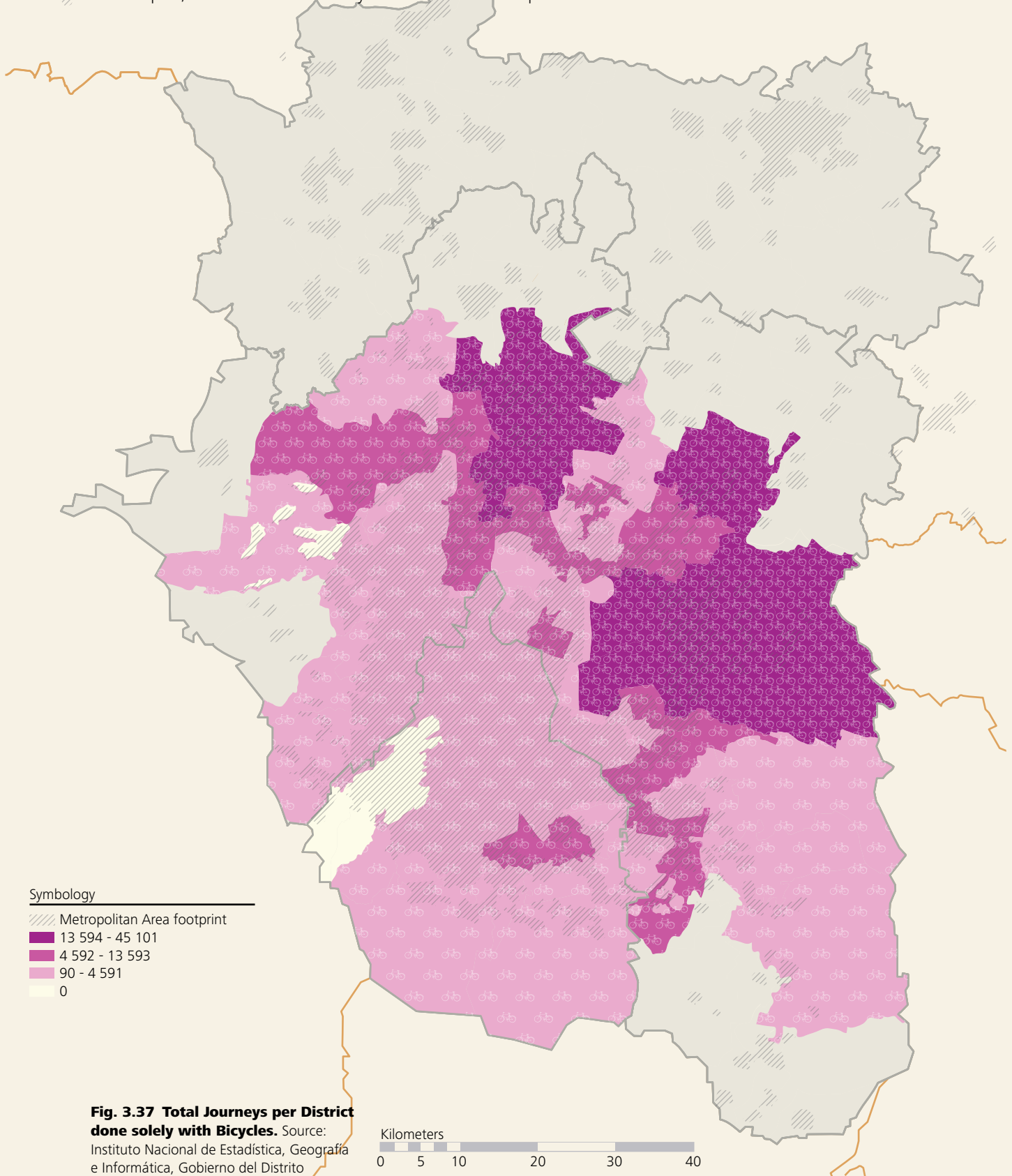


Fig. 3.37 Total Journeys per District done solely with Bicycles. Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 115.

3.2.3. Where?

A) Main Journey Paths done solely with the Subway

The Subway present quite a complicated and extensive combination of journey paths, highlighting the ones done on the north-south direction and the west-east direction.

Should be noted that for the case of the subway, most of its users use it as an important connection with other transport options.



Symbology

- Metropolitan Area footprint
- 12 659 - 15 905
- 10 495 - 12 658
- 8 331 - 10 494
- 6 166 - 8 330
- 5 083 - 6 165

Fig. 3.38 Main Journey Paths done solely with the Subway. Source:

Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 123.

Kilometers
0 5 10 20 30 40

B) Main Journey Paths done solely with Buses, Minibuses and Minivans

The main journeys done with Buses, Minibuses and Minivans are mostly present in the Municipalities of the State of Mexico, as well the southern part of the Federal District. Seems the negative picture of the journey paths done with the Subway.

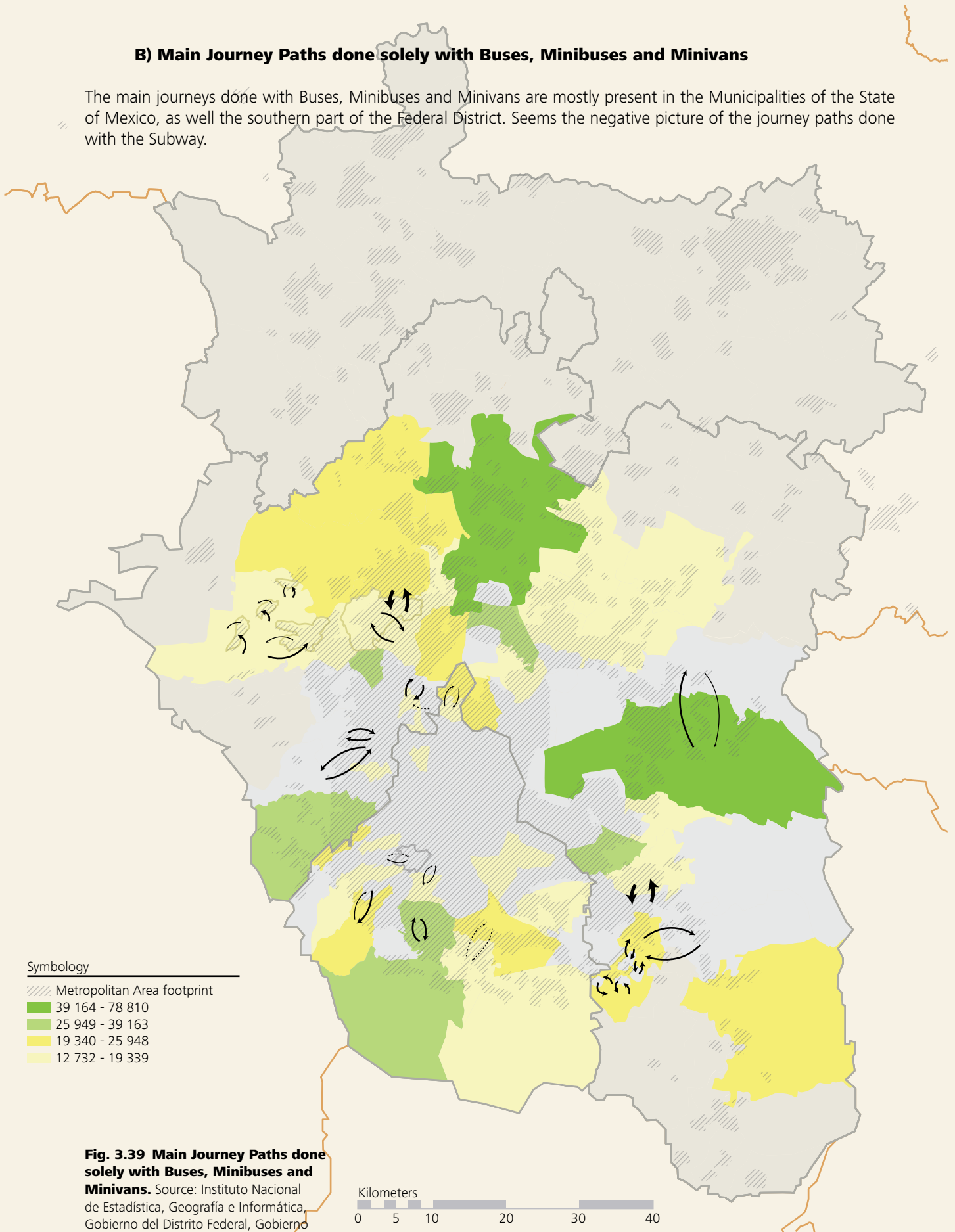
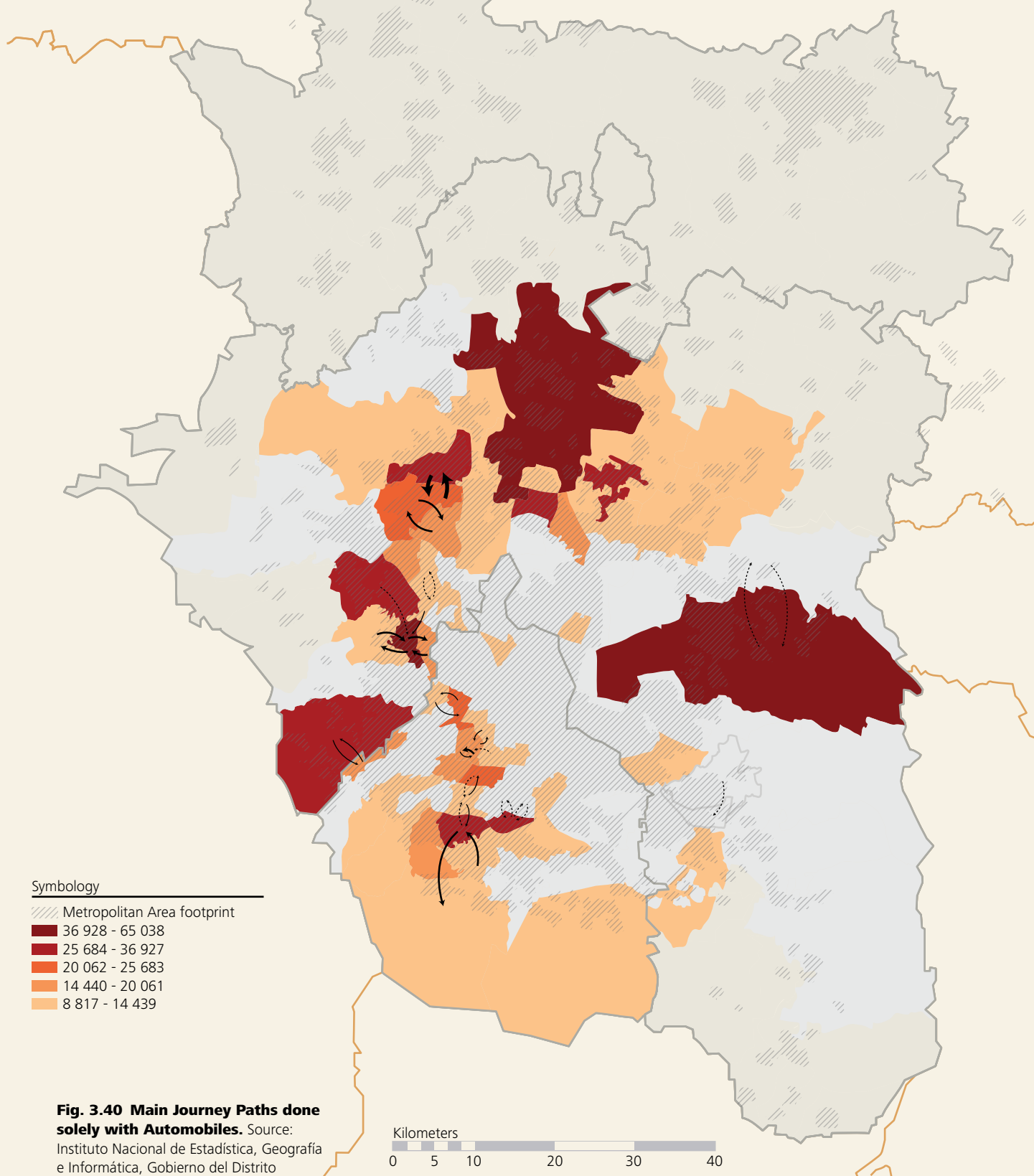


Fig. 3.39 Main Journey Paths done solely with Buses, Minibuses and Minivans. Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 127.

C) Major Journey Paths done solely with Automobiles

The main journeys done solely with automobiles are mostly present in the western part of the MCMA. There's as well the intense presence of journeys in the northern and eastern part of the State of Mexico, following the most segregated parts of the MCMA sprawl.



D) Major Journey Paths done solely with Bicycles

And in contrast with the Major Journey Paths done solely with Automobiles (on page 102), the journey paths done with bicycles are mostly present in the eastern part of MCMA.

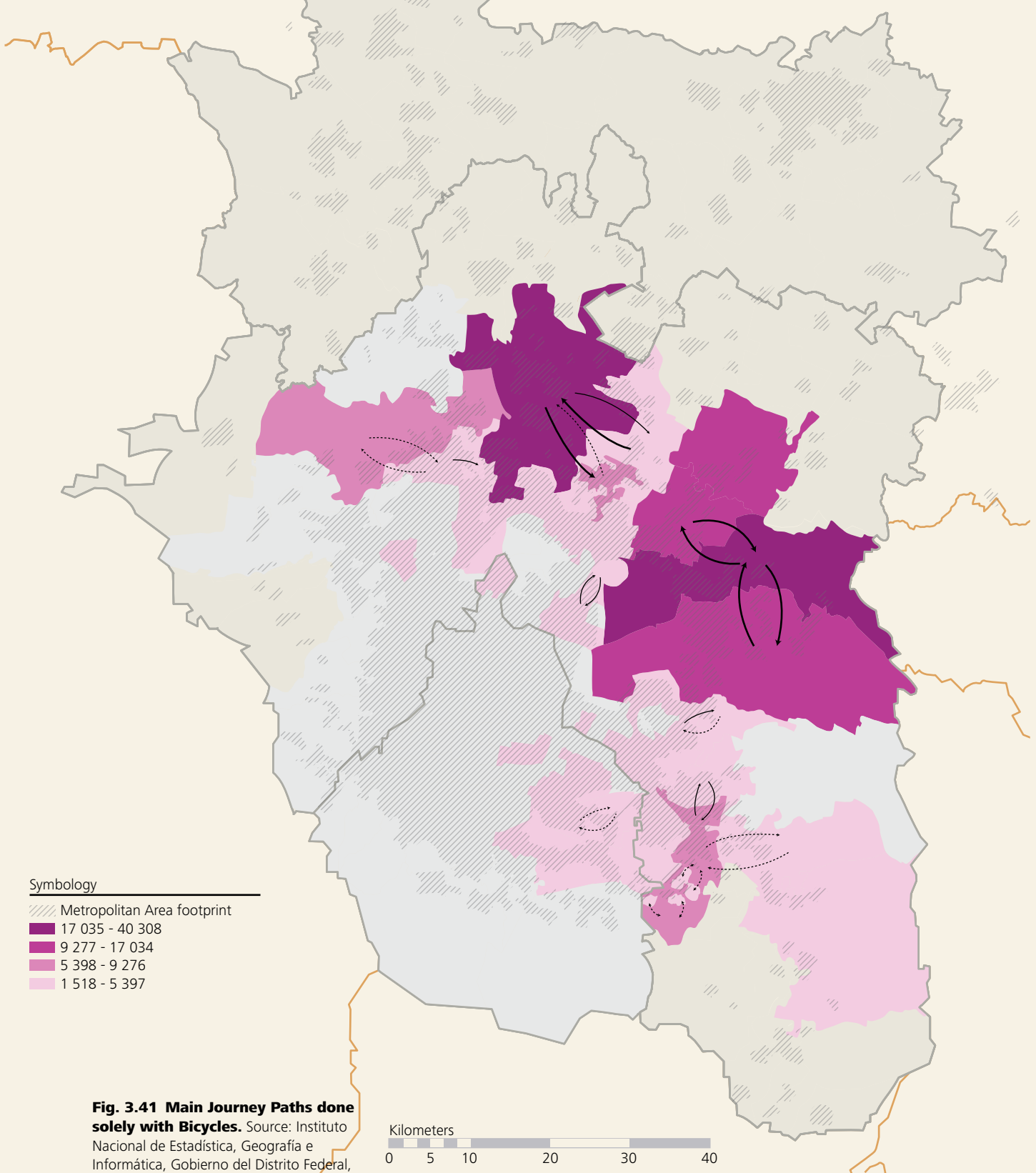
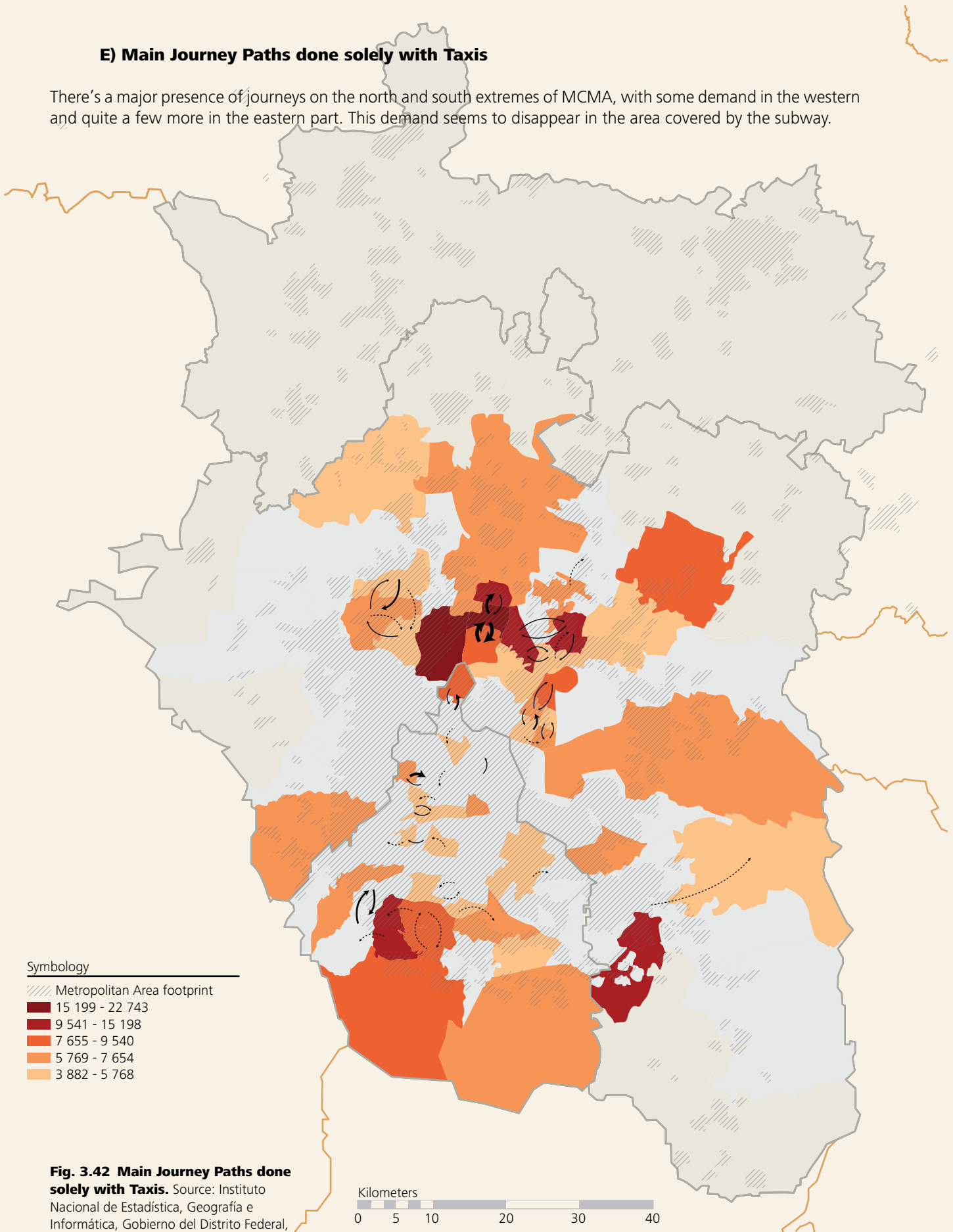


Fig. 3.41 Main Journey Paths done solely with Bicycles. Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 129.

E) Main Journey Paths done solely with Taxis

There's a major presence of journeys on the north and south extremes of MCMA, with some demand in the western and quite a few more in the eastern part. This demand seems to disappear in the area covered by the subway.

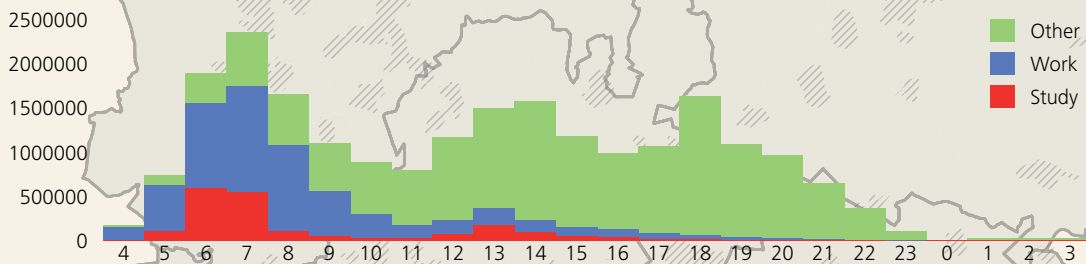


3.2.4. Why?

A) Main Purpose of the Journey per Origin and Destination⁴¹

Of the trips made between the municipalities of the State of Mexico and the Federal District, 53.7% are for the purpose of going to work. The largest proportion of trips with the purpose to go to work is performed within the limits of the Federal District or within the municipalities of the State of Mexico; followed in order of importance those that take place between the municipalities of the State of Mexico and the Federal District.

Graph 3.1 Journeys per Start time and Purpose.



Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 72, 75, 76.

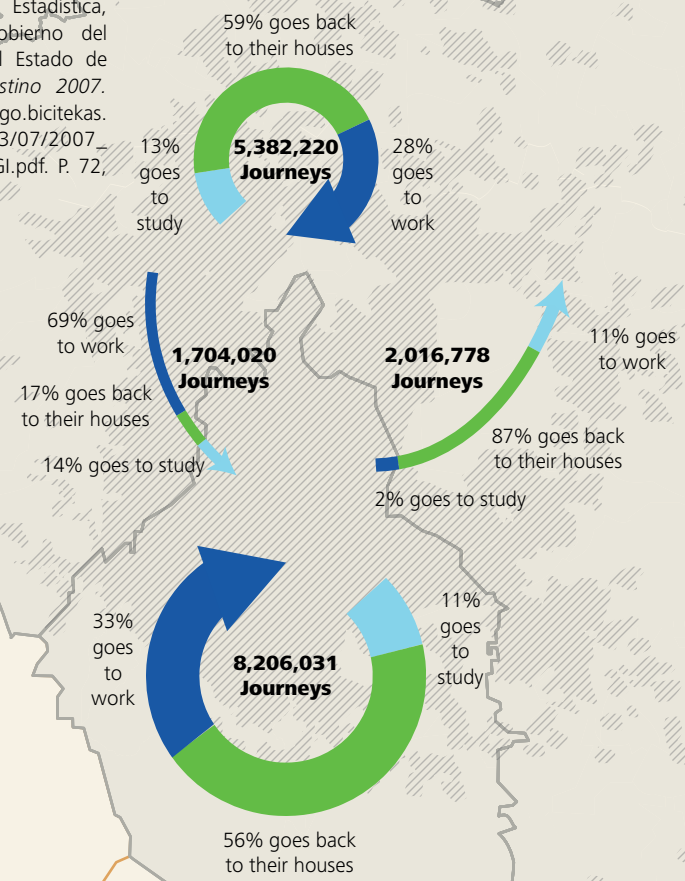
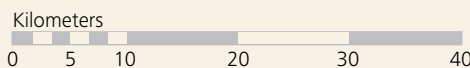


Fig. 3.43 Main Purpose of the Journey per Origin and Destination.

Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 72.



[41] Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 72.

B) Total Trips whose sole purpose is to go to work

Of the trips made between selected municipalities of Mexico State and the Federal District, 53.7% are for the purpose to get to work.

The largest proportion of trips with the purpose to go to work are performed within the limits of the Federal District, or those done within the municipalities of the State of Mexico; followed in order of importance by those that take place between the municipalities of the State of Mexico and the DF.

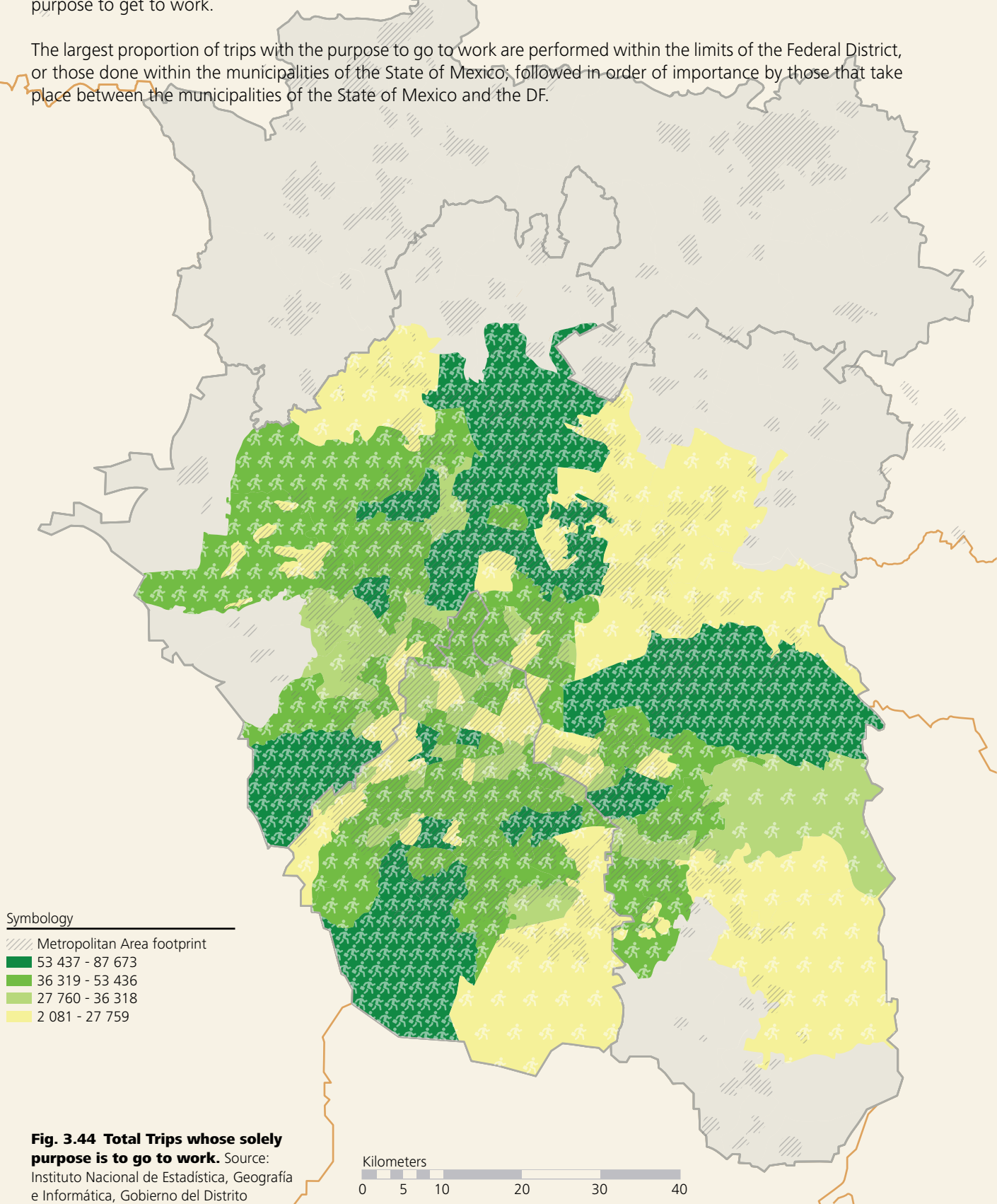


Fig. 3.44 Total Trips whose sole purpose is to go to work. Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 117.

C) Total Trips whose solely purpose is to go to the school

There seems to be a similitude with the previous map, since the districts with most trips done for work purposes are as well (almost) the ones with the most quantities of trips done for education purposes. Should be noted that these districts are the ones surrounding the central area of the Federal District.

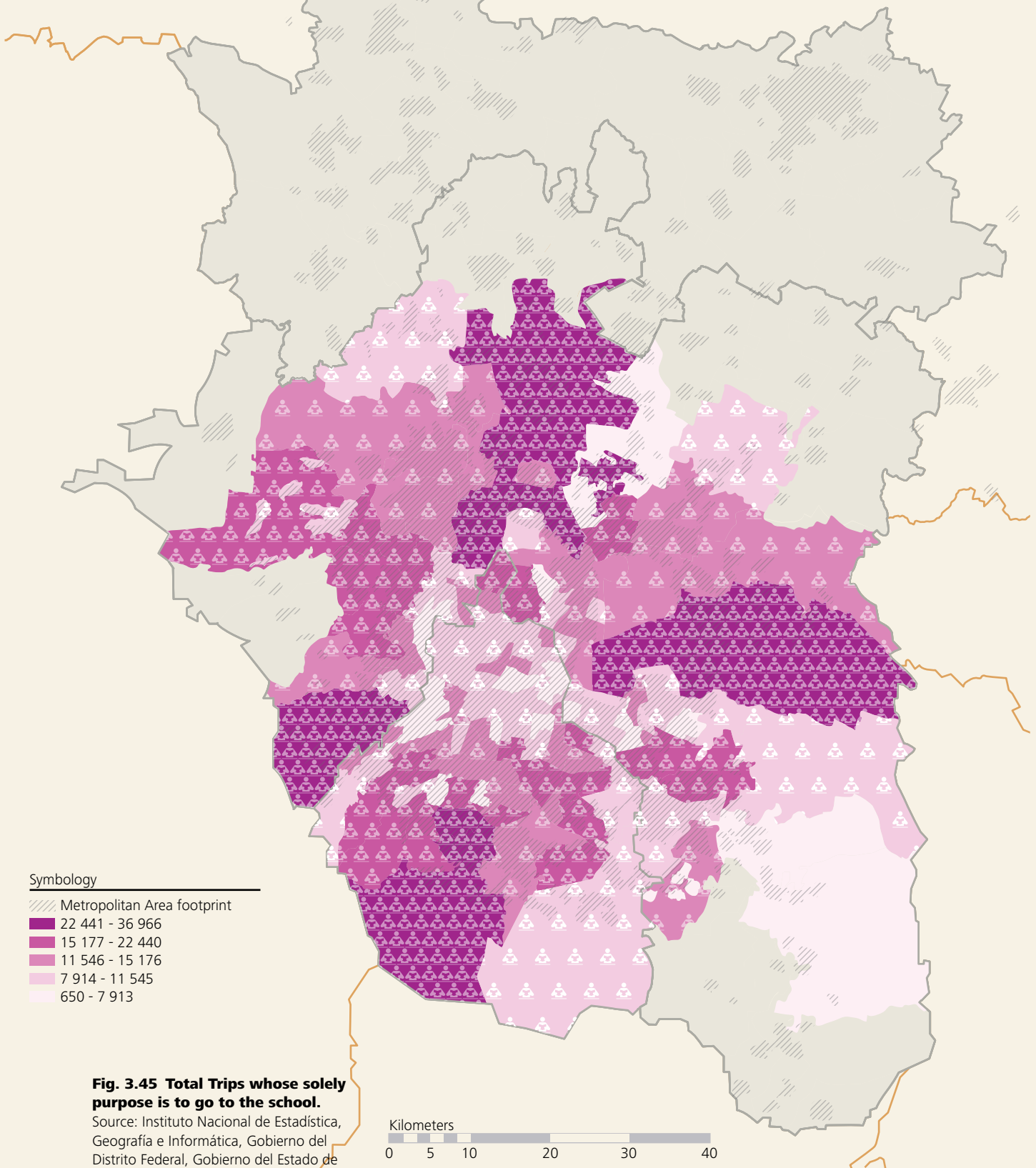


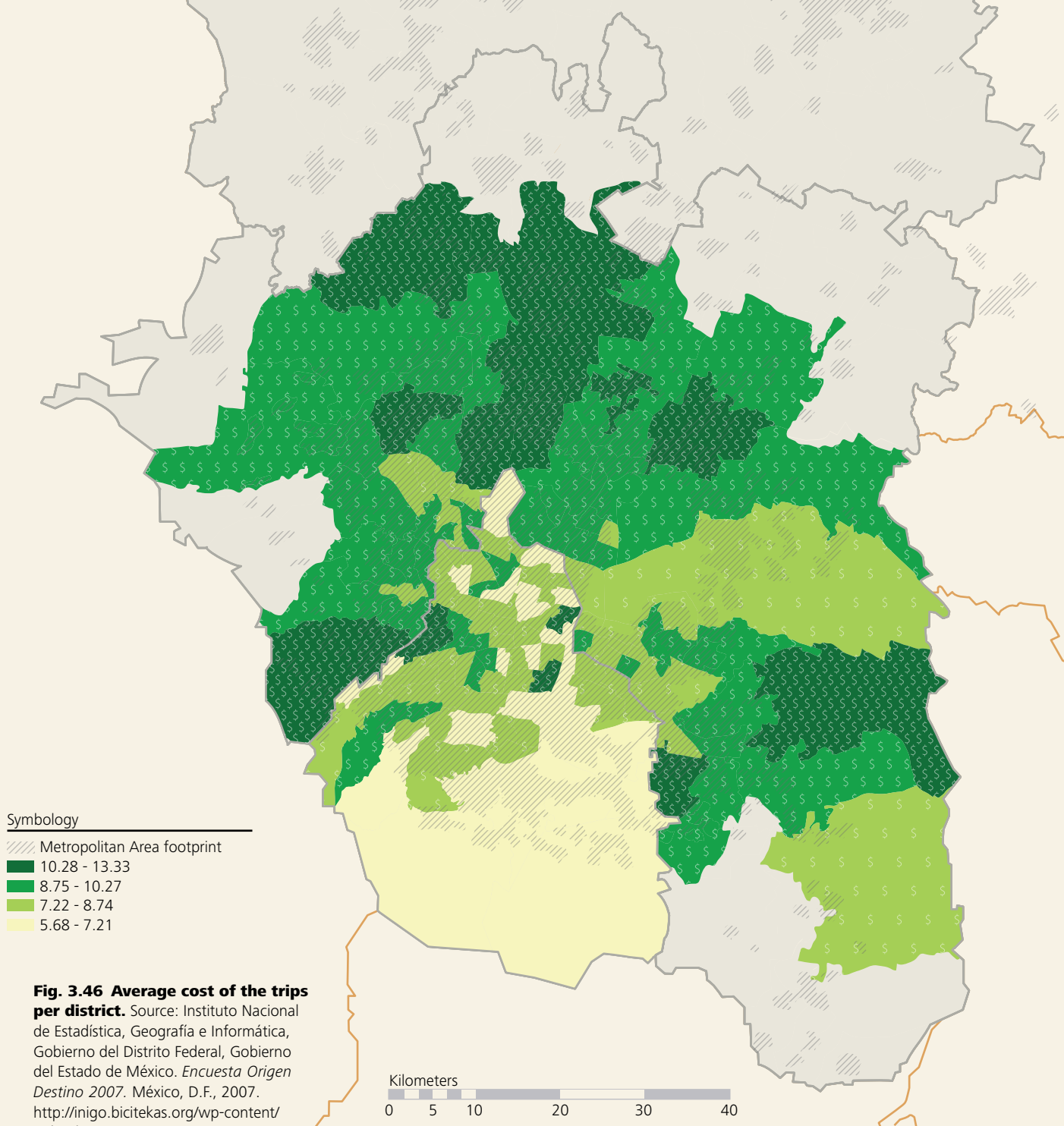
Fig. 3.45 Total Trips whose solely purpose is to go to the school.

Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 118.

3.2.5. How much?⁴²

The travel cost in public transport depends on the distance of the routes, so the higher average cost is to move from the Federal District to the municipalities of the State of Mexico, with an average cost of \$ 11.00 per trip. Similarly, people who move from one suburban municipality to somewhere within the Federal District spend on average \$ 10.81.

When the source and destination involves distances within the same geographical area, ie, between the municipalities of the State of Mexico and between the delegations of the Federal District, the average cost does not exceed \$ 9.00 per trip; the lowest cost are incurred within the capital.



Symbology

- Metropolitan Area footprint
- 10.28 - 13.33
- 8.75 - 10.27
- 7.22 - 8.74
- 5.68 - 7.21

Fig. 3.46 Average cost of the trips per district. Source: Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 121.

[42] Instituto Nacional de Estadística, Geografía e Informática, Gobierno del Distrito Federal, Gobierno del Estado de México. *Encuesta Origen Destino 2007*. México, D.F., 2007. http://inigo.bicitekas.org/wp-content/uploads/2013/07/2007_Encuesta_Origen_Destino_INEGI.pdf. P. 89.

3.2.6. Transportation/Labor Force/Households Spatial Relationships

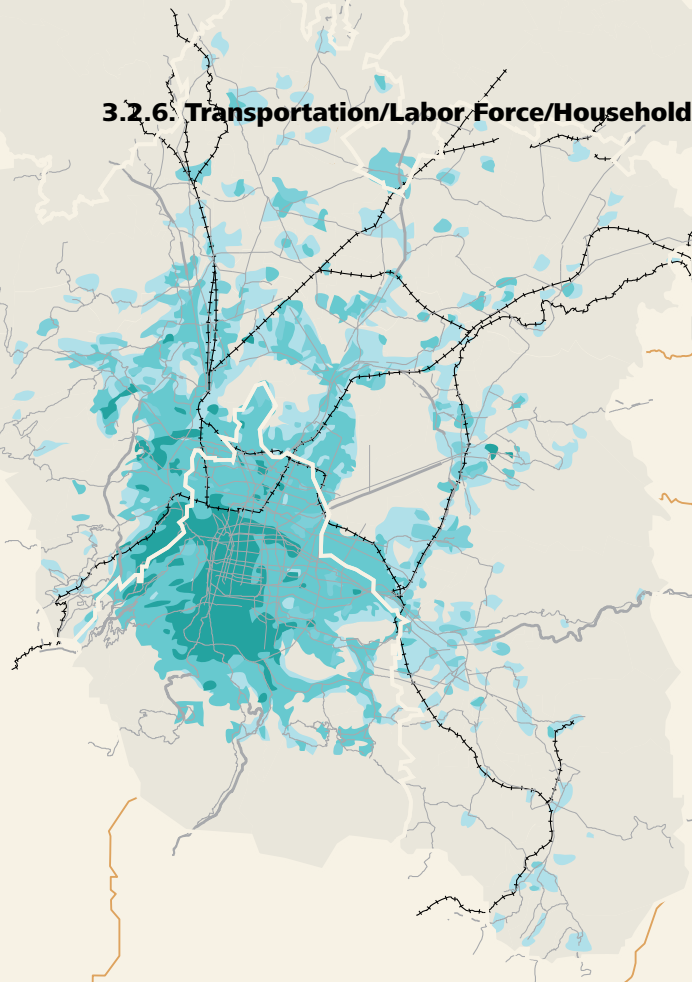


Fig. 3.47 MCMA Primary roads network with the labor force locations. Source: Fig. 2.5 on page 49 and Fig. 3.30 on page 92.

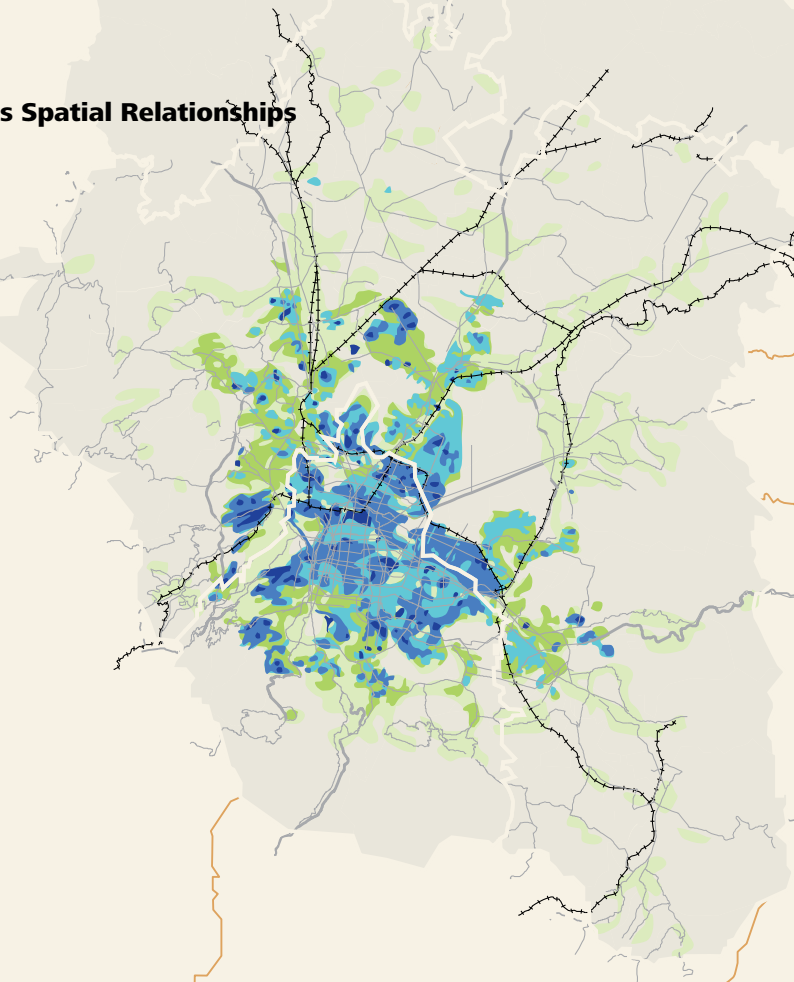


Fig. 3.48 MCMA Primary roads network with the households locations. Source: Fig. 2.5 on page 49 and Fig. 3.30 on page 92.

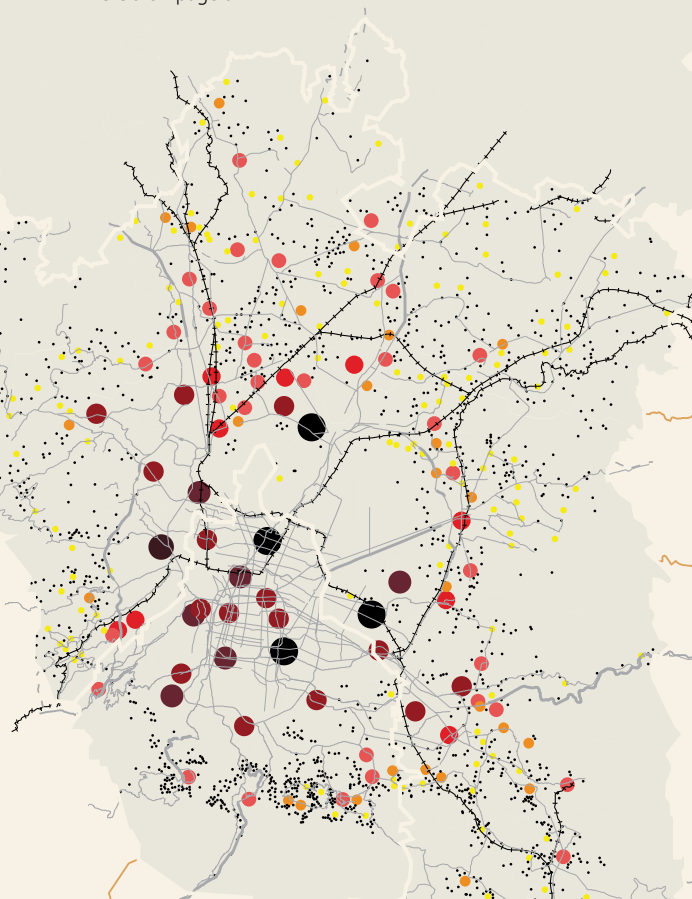


Fig. 3.49 MCMA Primary roads network with the center of populations locations. Source: Fig. 2.5 on page 49 and Center for Sustainable Mobility Mexico, *Atlas de Accesibilidad y Conectividad de la Zona Metropolitana del Valle de México*. México, D.F., Center for Sustainable Mobility Mexico. M. 46.

The road structure of the MCMA does not offer the same possibility of connection to the various places that are to be connected, that is, to go to the workplace (since there is a large concentration of them in the Federal District, see Fig. 3.47 it's possible to see a relatively optimal connectivity to major highways, roads and other roads axes. Unlike appreciated this in the State of Mexico, as there are many roads with lack of connectivity, in addition to the lack of a system of interconnected roadways (will be discussed later).

As for housing, a much more difficult situation is appreciated (Fig. 3.48, since the very tendency to sprawl of the MCMA makes residential areas are more remote from each other, and consequently the roads to connect them be much more scarce or inadequate.

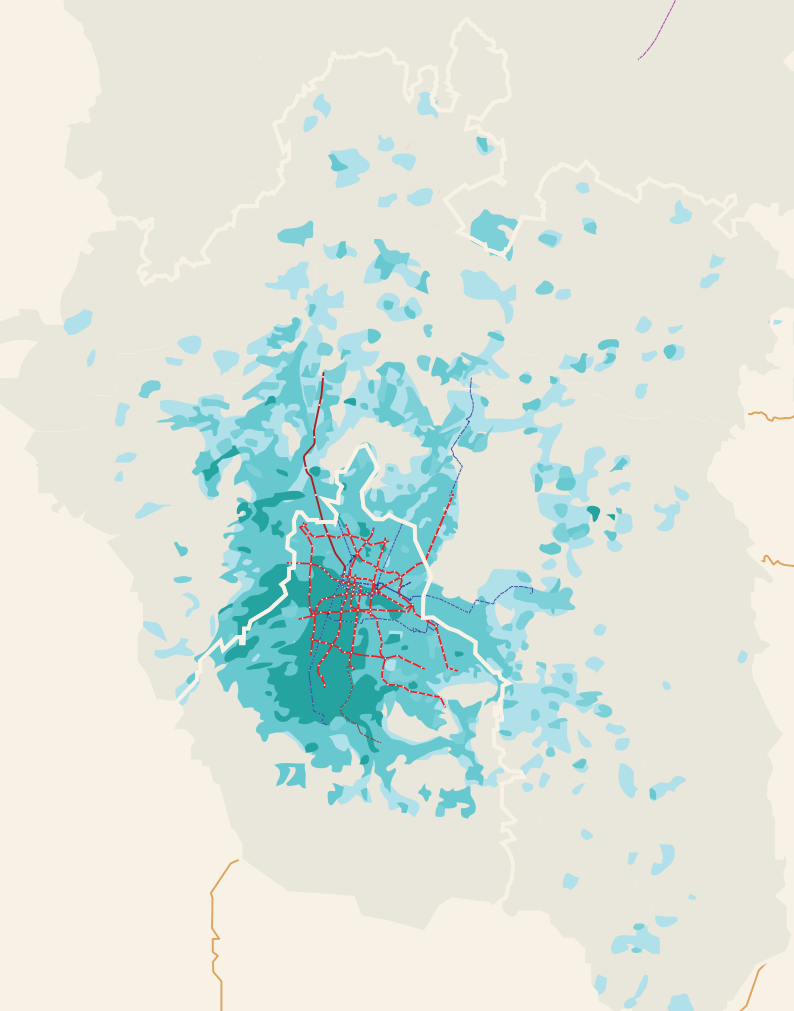


Fig. 3.50 MCMA Metro, Light Rail and Suburban Rail networks with the labor force locations. Source: Fig. 2.5 on page 49, Fig. 3.8 on page 75, Fig. 3.21 on page 84 and Fig. 3.5 on page 74.

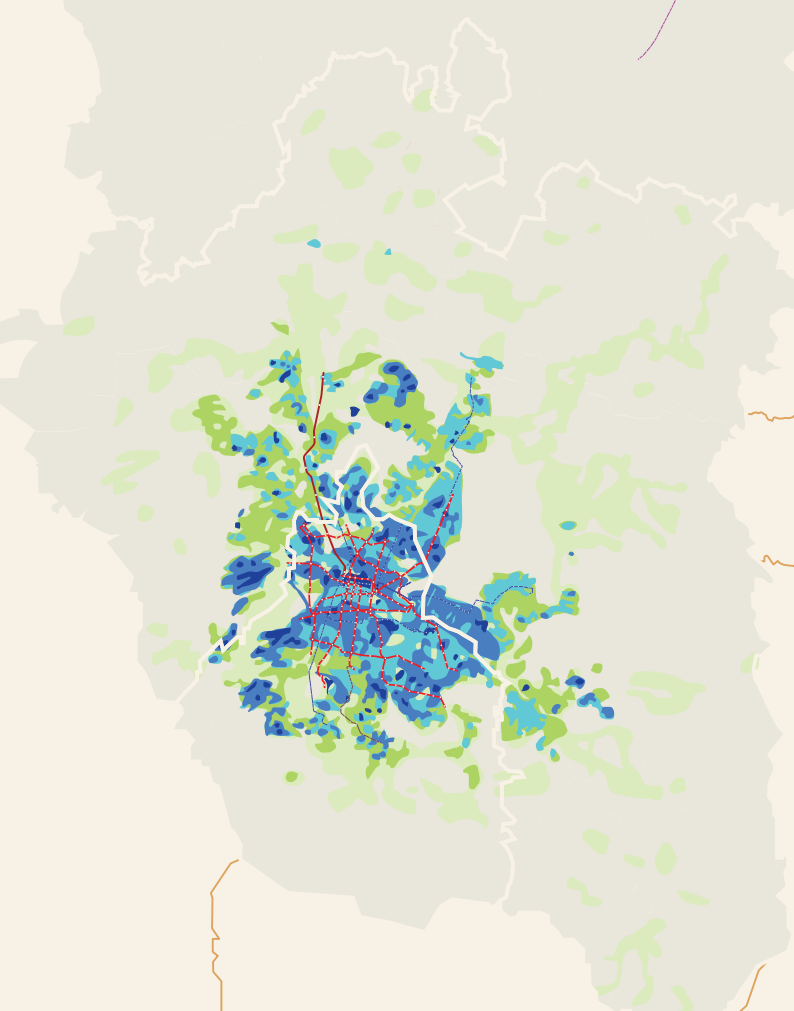


Fig. 3.51 MCMA Metro, Light Rail and Suburban Rail networks with the households locations. Source: Fig. 2.5 on page 49, Fig. 3.8 on page 75, Fig. 3.21 on page 84 and Fig. 3.5 on page 74.

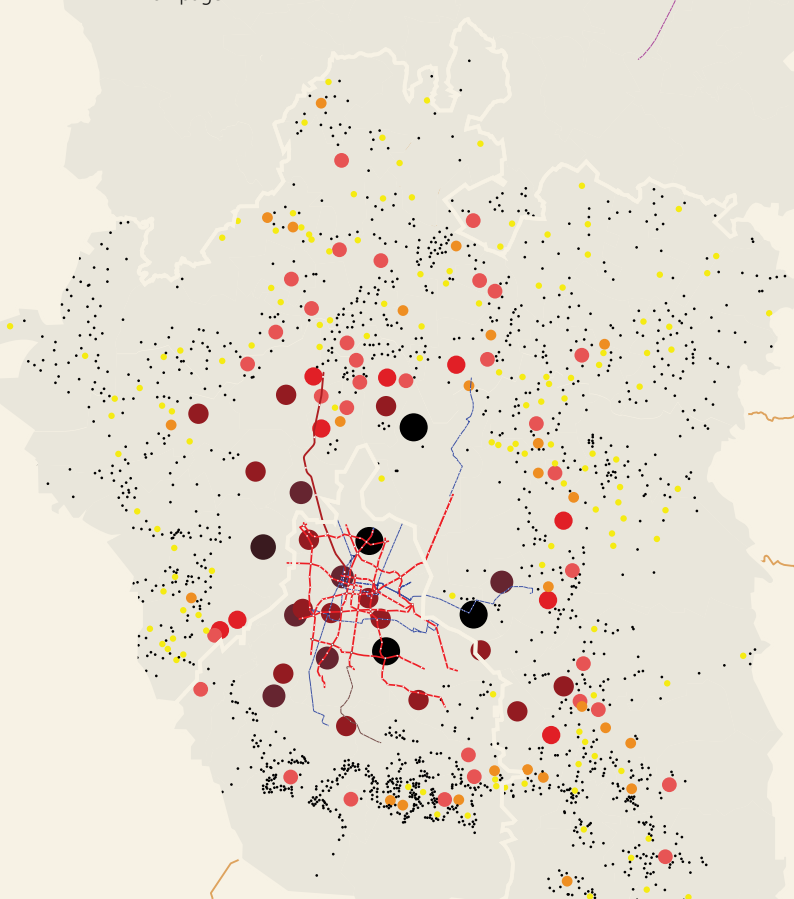


Fig. 3.52 MCMA Metro, Light Rail and Suburban Rail networks with the center of populations locations. Source: Fig. 3.8 on page 75, Fig. 3.21 on page 84 and Fig. 3.5 on page 74 and Center for Sustainable Mobility Mexico. *Atlas de Accesibilidad y Conectividad de la Zona Metropolitana del Valle de México*. México, D.F., Center for Sustainable Mobility Mexico. M. 46.

For the mass public transportation infrastructure, it's seen that most of the Federal District is covered by the Metro, as well with the Light Rail and the Suburban Rail. This coverage is in places where the terrain is mostly flat. It is as well located mostly in residential areas and densely populated working areas. However is noted that in the south and west of the Federal District this transport network doesn't arrive.

However, in the State of Mexico the situation is worse, because it presents an almost virtual disconnect with mass transit systems. In the northwest and northeast there's the introduction of the Suburban Rail and Metro, respectively. While there is the presence of this infrastructure, seems to cover only a few of the population centers in the State of Mexico. As it's seen in the center of populations map (Fig. 3.52) lower center of populations are disconnected from these means of mass transportation.

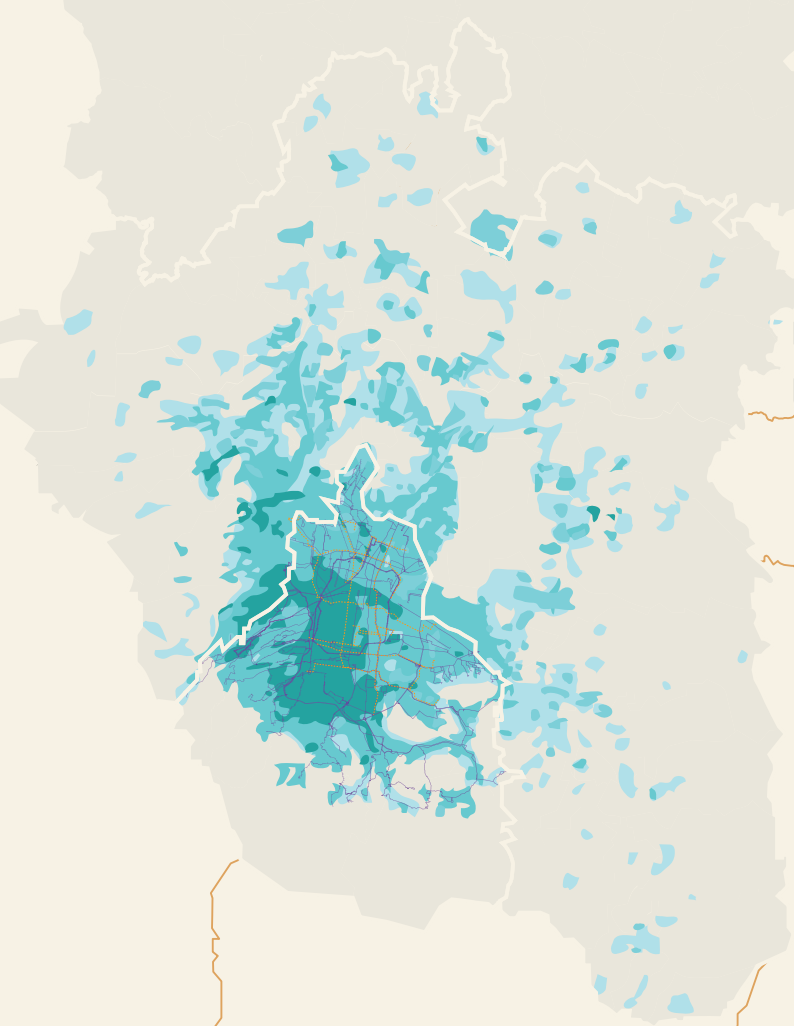


Fig. 3.53 RTP and Trolleybus network with the labor force locations. Source: Fig. 2.5 on page 49, Fig. 3.17 on page 82 and Fig. 3.15 on page 80.

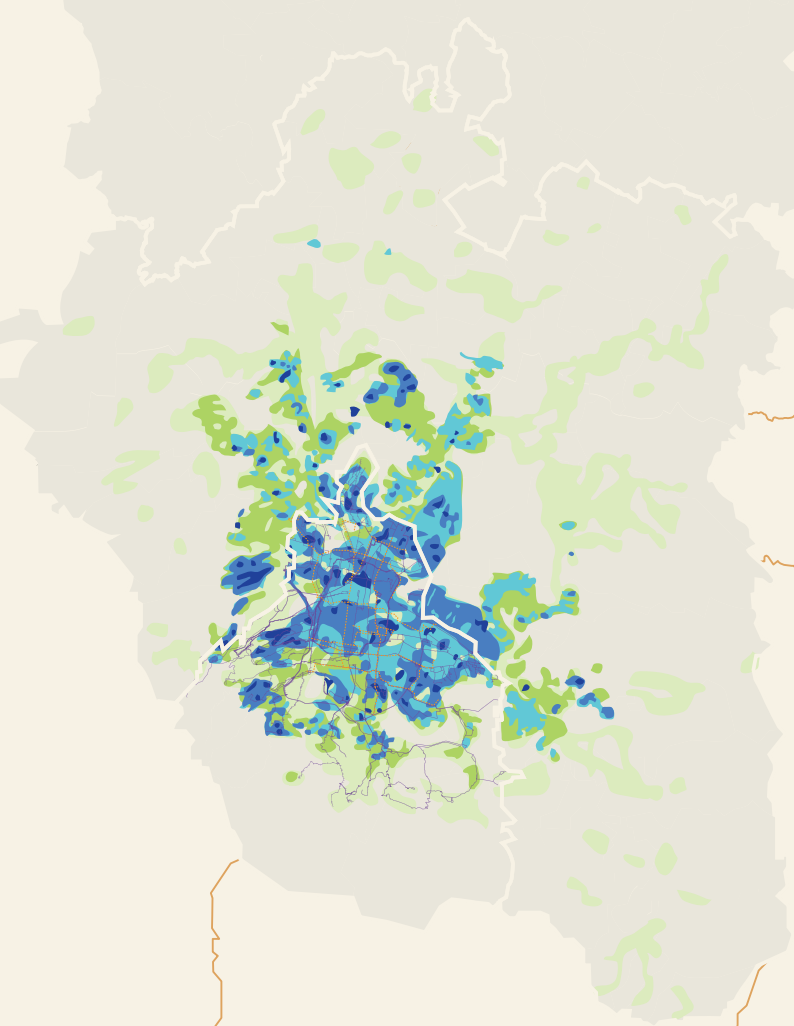


Fig. 3.54 RTP and Trolleybus network with the households locations. Source: Fig. 2.5 on page 49, Fig. 3.17 on page 82 and Fig. 3.15 on page 80.

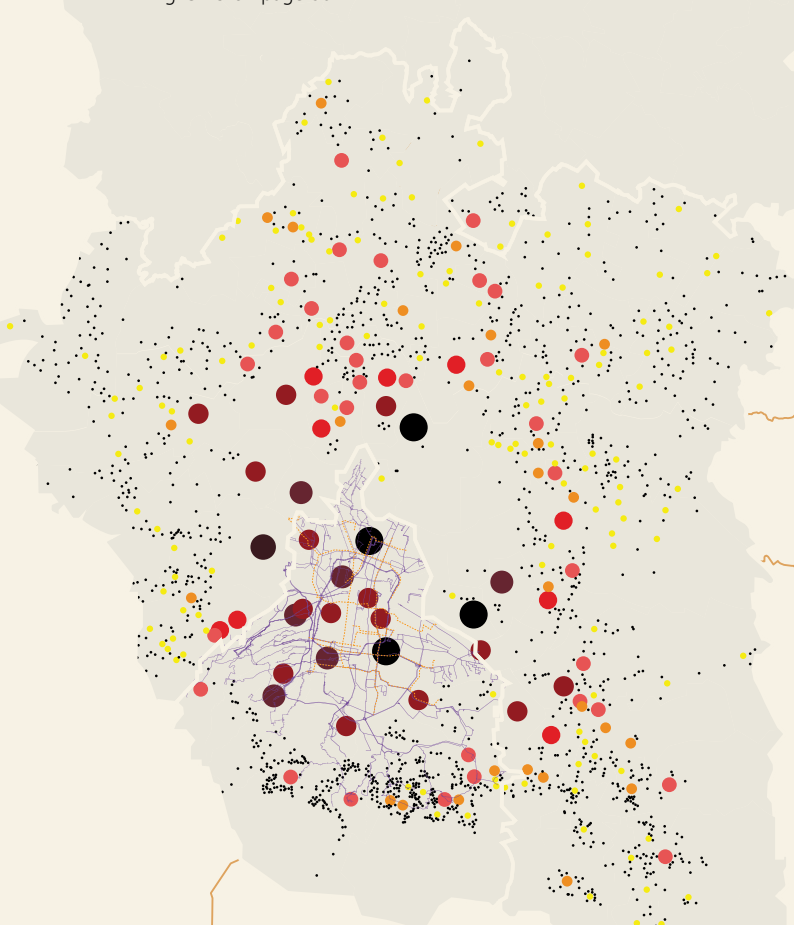


Fig. 3.55 RTP and Trolleybus network with the center of populations locations. Source: Fig. 3.17 on page 82, Fig. 3.15 on page 80 and Center for Sustainable Mobility Mexico. *Atlas de Accesibilidad y Conectividad de la Zona Metropolitana del Valle de México*. México, D.F., Center for Sustainable Mobility Mexico. M. 46.

The Passenger Transport Network and the Trolleybus network are located throughout the Federal District into a sort of grid layout, repeatedly following the existing road network. It is noted that the southern part and the western are less connected to the central part of the city.

But what stands in principle on the map is the complete disconnect between these transport systems and the State of Mexico, despite the proliferation of buses, minibuses and minivans.



Fig. 3.56 Federal Entities in charge of transportation and state controlled transport companies in Mexico City. Images. google.com.

3.3. MOBILITY: BENEFITS AND CURRENT ISSUES

3.3.1. Governance

Current issues⁴³

The mobility problems in the city and its solutions, have presented a cyclic behavior. Throughout the second half of the twentieth century, mobility crisis were resolved with short-term solutions and not visualized under a medium- and long-term projects, as has happened in other countries with higher mobility problems than Mexico City.

In general terms the modus operandi of the Government is: When it's reached a "limit" on mobility (roads and transport) and the city has been congested, there is (or have been) various interventions like those that at the time were the main axis. Over recent decades wrong decisions have been taken that have led to the excessive growth of low-capacity transport: the elimination of Route-100 and the lack of development of the Metro system.⁴⁴

[43] Márquez Ayala, David. *El Reto del Transporte en la Ciudad de México*. México, Libros Para Todos, 2005. Pp. 65-67.

[44] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad.

The task of ensuring the mobility of persons and goods within the capital territory is entrusted to the Semovi, the Ministry of Mobility, while in the State of Mexico it's in charge the Secretary of Transportation, and in the State of Hidalgo it is up to the Ministry of Public Works and Land Management. Like any organization, those have certain operating guidelines.

In turn, the Federal District has 3 decentralized agencies that directly provide the public transport of passengers, these agencies are: 1) Public Transport System (Metro), 2) Electric Transport Service (Electric buses and light rail) and 3) Passenger Transport Network (or RTP). Additionally, there's the Metrobus, having mixed participation of the Government of the Federal District and dealers shareholders.

However, the World Bank has identified some guidelines or modes of organization within the theme of urban transport that can prevent the improvement of efficient operation of roads, transport and vehicles in general. These are:

- The separation of infrastructure from operations,
- The separation of the different transport modes, and
- The separation of infrastructure financing with the establishment of rates and fees for the use of infrastructure.

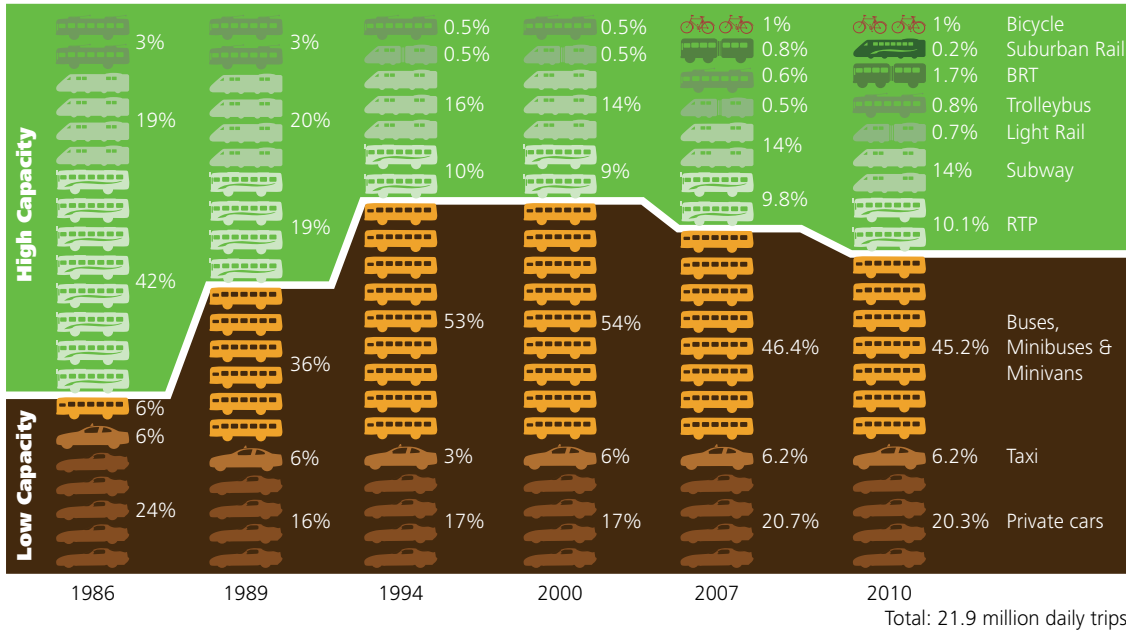
Unfortunately, we can state that these guidelines are present within the organizational structure of the various ministries involved in transportation. We can identify certain administrative obstacles that do not help improve the performance of the organizations. The first list would be the lack of balance between the law, the budget received and adequate resources, and the lack of adequate institutional coordination between them and within them.

One of the serious problems facing Mexico City is the predominance of private vehicles since the year 2000 when private cars represented 72 percent of low-capacity transport, although carrying only about 16 percent of passengers. Overall, more than 95 percent of these motor vehicles operating in the MCMA have captured only 20 percent of total travel sections. Nearly a decade after a significant increase in private vehicles was recorded, reaching 3.5 million units, which is associated with the economic growth, the urban sprawl, poor public transport, more credit facilities, among other factors. However, this transport accounted for 20.7 percent of the travel sections. Thus is observed an over-subscription of such low capacity transport on major roadways, becoming a factor that seriously affects the mobility in the MCMA.⁴⁵

Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal. México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf pp. 59.

[45] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad.

Graph 3.2 Evolution of MCMA'S transport modal split.



Source: Secretariat of Social Development, Federal District Government, State of Mexico Government, State of Hidalgo Government. *Programa de ordenación de la Zona Metropolitana del Valle de México. Actualización 2012.* Mexico, 2012. P. 29.



Fig. 3.57 Poor urban planning both in the streets and buses. https://zapateando2.files.wordpress.com/2009/09/100_7500.jpg
http://3.bp.blogspot.com/-q8_bh0IRShk/T67I9JFBjyI/AAAAAAAAACM8/6ors7qnWn34/s1600/Mercedes+Benz+Torino60.jpg

3.3.2. Public transport system issues

A) General

Benefits

Currently MCMA has several transport modes serving its population. Depending on the zone where the population resides will determine its availability.

Current issues

Service coverage of public transport of passengers (TCP) is another general problem as it does not cover the entire territory of the Federal District, nor its metropolitan area. Looking at a map of the location of the lines and stations of the Metro, Metrobus, RTP, trolleybus and light rail, we can conclude the coverage is limited and differentiated (see maps on Fig. 3.47 to Fig. 3.55, pages 109 to 111).

The public transport service with better quality, accessibility and efficiency, is concentrated in certain areas of the city. The center and the west are better served than other areas of the city, a situation aggravated in the east. There are still large areas where the population doesn't have motorized connection to stations and stops of public transport, meaning a commute is needed to do, whether it is walking or biking. To reach the boarding sites, some are forced to take other transport modes (taxi, minibus or van). The accessibility to non-motorized infrastructure of the public transport does not cover the entire City; the spaces left these stripes proximity become true "islands" or isolated areas that favor the use of private cars or transport concession. That means a greater expenditure of time and financial resources of the citizens.

This territorial inequality in access to public transport system for passengers is a vacuum that tends to be occupied by the private sector. In these areas, the concession transport (taxis, buses, minibuses and minivans) define routes, times and type of service, meaning the service is determined by the interests of carriers and private companies. This has resulted in competition for passage, the lack of replacement of units, excessive hours of drivers, insecurity and general dissatisfaction in terms of a basic need for citizens: accessible, affordable and quality mobility.⁴⁶

The deficient mobility, traffic congestion and high travel costs are related to ineffective urban planning and the proliferation of new housing developments located in ever more remote outlying areas from the workplace, education and trade (see maps in section "3.2.6. Transportation/Labor Force/Households Spatial Relationships" in page 109).

A phenomenon that has worsened in recent years is the construction of new housing complexes located on the periphery of the MCMA in the metropolitan municipalities (Tecámac Zumpango, Chicoloapan, Huehuetoca) that do

Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal. México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf pp. 35.
 [46] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad. *Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal.* México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf Pp. 195-196.



Fig. 3.58 Avenues turning into streets. Maps.google.com

not have the economic infrastructure, meaning employment, educational, health, trade, etc., to receive in a short term thousands of families.

The new inhabitants of these large and sometimes huge housing projects, work, study and shop, in most cases, in the Federal District, so they have to commute daily to the Metro, Metrobus, RTP and the concession transport stops, which involves moving long distances, many hours spent in transportation, a high spending in this area (up to 25% of their monthly income), social and family disintegration and in general a life quality important decrease. Due to these distances and high costs, many of the workers are left to sleep in the homes of relatives or friends during the work week and the weekend return to their homes. This represents a serious problem of family disintegration.

There is no physical or functional integration with the public transport system of the State of Mexico passengers, especially in regard to the State of Mexico municipalities of the MCMA. In the metropolitan context of the operation modes of public transport passengers is poor especially given the large and growing importance of metropolitan mobility, which is reflected in the number of intercity commutes, poor transfer mechanisms and the high cost of money and loss of man hours, both traveling from the Federal District to the State of Mexico and vice versa. Besides the discomfort, insecurity, and long journeys that lengthen the working day, users have to incur in high costs (over usd7.00 a day), and yet neither the Federal authorities, the Federal District or the State of Mexico, have been, or appears to have a willingness to create an operating mechanism to streamline the system. On the contrary seems to be a view that transport systems in both entities are independent and operate separately, which is completely detached from reality⁴⁷.

Urban expansion brought as a consequence the growth of travel demand, but not the improvement of transport infrastructure. Thus, the mobility in Mexico City has faced shortfalls in both modes of transport and the road network available. In particular highlights that mobility in the metropolitan area of Mexico City is currently based on a distorted modal structure, which has its greatest potential for transfer in low-capacity transport-buses, taxis and private cars with clutter-routes and unsafe for users. Furthermore, this mode of transport has limited integration with the large transport infrastructure, such as high capacity Metro, RTP, STE, Metrobus, and uses disadvantageously primary roads, which are also saturated by private cars⁴⁸.

The other problem of the mobility is a deficit road network, exceeded on its capacity with a faulty integration to facilitate transfers between transport modes and between primary and secondary roads, where to its saturation is added deficiencies in the administration, control and regulation of traffic and poor road culture that work to accentuate congestion. The result is a systematic saturation and the resulting reduction in speed with a greater environmental impact. Thus the increased travel trend throughout the metropolitan area faces deficits, weaknesses and distortions of the road network and the transport network.

The City does not have enough urban conditions that allow better performance of public transport system. One example is the lack of space to build bus stops where they can park, instead of the current conditions in which the fleet is permanently occupying the streets⁴⁹.

[47] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad. *Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal*. México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf P. 193.

[48] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad. *Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal*. México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf Pp. 29-31.

[49] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad. *Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal*. México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf P. 192.



Fig. 3.59 Obsolete equipment and overcrowding in the subway. <http://73cd07b1b31bbd553e61-bd8575762ff7dbcd3daf4f82a05feb34.r32.cf2.rackcdn.com/pictures/2011/04/11/230286.jpg> <https://m3m0x.files.wordpress.com/2009/11/dsc01647.jpg>

From 1986 to 2010, the outstanding features of the structural change in the type of transport are the reduction of use of private vehicles (from 24 to 20.3 percent from 1986 to 2009) even though the total number of vehicles increased; the increased use of collective transport, minibuses and vans, from 6 to 45 percent compared to the decrease in the in the share of the bus-related disappearance of "Route 100"- which went from 42 to 10.2 percent; the Metro share declined from 19 to 14 percent, despite the increased number of lines. Overall high capacity transport units were replaced with medium and low capacity transport ones, and the share of public transport was reduced. This has led to saturation of roads, insecurity for the user and a high environmental impact.

The average travel time increased from 46.9 to 53.2 minutes between 1994 and 2007. Overall, both trips done by public and private transport, saw a decrease in travel speed and an increase in average travel time .

Recently have intensified the metropolitan journeys and the primary destination remains the same Federal District which attracts, among others, nearly 70 percent of the metropolitan employment and 60 percent of the students⁵⁰.

B) Metro

Benefits

The Metro Public Transport System reaches almost the majority of the Federal District. According to polls, it has a service approval of above 7/10, meaning it is considered as an efficient transport system. With normal conditions, commuting times are drastically reduced. Pollution is as well drastically reduced thanks to the metro⁵¹.

But among all of the factors that have a direct impact in the population, the biggest one could be the price of the ticket, 0.35usd (5mxn). The total fare is 0.76usd(11.16mxn) but the population receive a direct non restricted subsidy from the government of 0.55usd(8.16mxn), meaning in 2012 the fare for an unlimited time inside the subway was of 0.20usd (3mxn). It should be noted that nowadays (2015) the fare has raised 2 more mexican pesos, to reach the 0.34usd (5mxn). In 2012 it was paid by 1457.30 million users. But special groups like elderly, personnel of the subway or handicapped (among others) have free access to the system, meaning a whole 151.40 million users were granted free access to the subway in 2012⁵².

Current Issues

Currently, the Metro Public Transport System (STC-M), is the service that carries the highest percentage of users by moving 4.5 million passengers daily. However this transport represents only 13.6 percent of the trips made in ten delegations of the Federal District and part of the four municipalities of the State of Mexico⁵³. Despite its

[50] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad. *Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal*. México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf Pp. 30-31.

[51] Cuevas, Gabriela. "Ventajas y Deficiencias del STC Metro" in El Universal.mx. Mexico City, April 23, 2012. <http://www.eluniversalmx.com.mx/editoriales/2012/04/58132.php>

[52] Sistema de Transporte Colectivo. *Informe a la Comisión de Movilidad, Transporte y Vialidad. VI Legislatura de la Asamblea Legislativa del Distrito Federal. 3. Ingresos y Subsidios*. <http://www.metro.df.gob.mx/imagenes/organismo/informes/2013/comparecencia3.pdf>

[53] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad. *Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal*. México, D.F., 25



Fig. 3.60 Construction of the metrobus and a crowded metrobus station. https://fotografiadeprensa.files.wordpress.com/2010/10/img_4486.jpg <https://tolentinotheboss.files.wordpress.com/2008/10/22102008111.jpg>

extraordinary growth and success in moving people inside Mexico City, the metro demand a coverage expansion into the growing urban areas⁵⁴.

The metro network lacks of balance, since the three oldest lines account for more than half of the passage of the whole system and more than half of the uptake of passengers per kilometer of line built.

The metro operates at a high technological level since at the time of its creation (relatively recent) was provisioned with the latest technology. However, today presents a major lag in some areas such as the computer and digitizing process.

The STC has been operating with a financial structure with a chronic deficit that is seen in all its magnitude in their statements. These mounting losses occur despite the Federal District Government has increased appreciably the subsidy for this transport system.

The STC-Metro also faces serious problems of intervals stabilization, modernization and upgrading of equipment and train especially in some of their lines. It also faces the need to make repairs and major maintenance⁵⁵.

Security is a major concern of the citizens of this city, and the Metro should respond to them. Operational risks, not only of this type of transport but in general all, requires paying special surveillance methods, evacuation and rescue attention. Among others, should pay attention to the need for regulation of informal business in the street.

There have been incidents and service interruptions arising from uneven settlements on the tracks. However, the rolling stock, pillar of the underground operation, presents the greatest challenges: the oldest trains have been rehabilitated, however still require modernization. Electronic systems for the rehabilitation of trains are not common to see, instead the present mechanical systems are obsolete for its function.

The metro network lacks of balance, since the first three lines capture more than half of the passengers of the entire system. Moreover lines 4, 5 6, 7 and "A" carry only 20% of the total passengers.

The quality of service is related to the real possibilities offered for the capital's population to be quickly transferred from a source to a destination. The metro has lost large groups of the population, which has opted for other transport modes to reduce travel times⁵⁶.

C) Metrobús

Benefits

The Metrobús system has gained a lot of popularity not only among Mexico City inhabitants, but as well inside the government. Being a cheaper system to build and easier to manage are two of their most appreciated qualities.

de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf Pp. 31-32.

[54] Fernández Ruiz, Jorge et al. *Régimen Jurídico del Urbanismo*. México, D.F., Universidad Nacional Autónoma de México., 2009. P. 263.

[55] Universidad Nacional Autónoma de México. Coordinación de Humanidades. Programa Universitario de Estudios sobre la Ciudad. *Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal*. México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf . Pp. 36-37.

[56] Márquez Ayala, David. *El Reto del Transporte en la Ciudad de México*. México, Libros Para Todos, 2005. Pp. 69-71.



Fig. 3.61 An empty Mexibus station and a trolleybus trying to reach the bus stop. <http://siempre889.com/wp-content/uploads/2013/08/Mexibus-2.jpg> <https://flic.kr/p/8rJMas>

That's why all three states (Federal District, State of Mexico and the State of Hidalgo) are investing on the BRT systems. The Federal District is planning to expand its network. Currently one line is under construction, and a second one is under planning. When both are finished, the network will have 7 lines of confined buses⁵⁷.

Current Issues

The main problem that has been found to the Metrobus system is the number of articulated buses put into service, which is insufficient for the number of passengers that nowadays exceeds more than 260,000 people per day, causing serious problems especially in the southern part of the route at certain times of day.

Despite being a popular system to build and manage (as described above), there aren't yet any signs of integration with the rest of the transport system.

D) Mexibus

Benefits

After the Suburban Railway, this is the second massive public transport system inside the entity, reaching sectors of the State of Mexico where massive public transport never was present. Following the successful trend from the Metrobús system, currently is under construction their 3rd line, "Line 2". Inauguration is expected in march 2015⁵⁸

Current Issues

Nevertheless the system is underused due to several factors, such as: a high accident rate, specially on Line 3, excessive traffic jams in the zone, missing or robbed lamps, missing or robbed sewer caps, damaged water pipes due to excessive buses transit, among others⁵⁹.

Another problem present is the phenomenon concerning a double or sometimes triple investment in transport due to the need of using (after the inauguration of the Mexibus) a second and sometimes third transport system such as another bus, the metro or the suburban rail⁶⁰.

E) Trolleybus

[57] Sistema de Corredores de Transporte Público de Pasajeros del D.F., Metrobús. January 2015. <http://www.metrobus.df.gob.mx/>

[58] Chávez González, Silvia and Dávila, Israel. "Aún sin funcionar, Línea 2 del Mexibus inaugurada ayer" in La Jornada.unam.mx. Mexico, D.F., January 13th, 2015. <http://www.jornada.unam.mx/ultimas/2015/01/13/linea-2-del-mexibus-aun-no-funciona-a-pesar-de-que-ayer-fue-inaugurada-2139.html>

[59] Campos, Gerardo. "Mexibús, grave problema para Neza" on El Sol de México. Mexico, D.F., August 5th, 2013. <http://www.oem.com.mx/elsoldemexico/notas/n3077263.htm>

[60] Barrera Aguirre, Juan Manuel. "Crítica Ex Edil de Ecatepec Línea 2 del Mexibus" on El Universal.mx. Mexico, D.F., December 11th, 2014. <http://www.eluniversal.com.mx/ciudad-metropoli/2014/critica-ex-edil-de-ecatepec-linea-2-del-mexibus-1061313.html>



Fig. 3.62 RTP Buses standing in the avenue and people rushing to get into the RTP bus. <https://www.flickr.com/photos/khristianlinarez/15289431491/sizes/k/> http://www.eluniversaldf.mx/fotos/linea12_camiones_face.jpg

Benefits⁶¹

The trolleybus has always been in the public transport network scene since its appearance. Nowadays it has more than 600km network laid out inside the Federal District. Its fare is still an accessible one, 0.13usd (2mxn) on regular journeys, while special ones such as the one running inside the center of the city has a cost of 0.27usd (4mxn). Several users are granted a subsidy if they're part of special groups such as children, elderly people, handicapped, among others.

The trolleybuses have a major cost benefit than the regular concessioned buses. While a regular bus unit has an useful life of about 4 years, a single trolleybus unit can surpass 15 years. There are other benefits for the environment thanks to their non pollution engineering. These units are as well soundless, meaning no acoustic pollution for the environment.

Current Issues

Among the main problems identified in the trolleybus network are:

At first would be the lack of units, which makes the service slow and unused. Also, the selected routes to operate compete with franchised buses⁶².

Also, there's the invasion of trolleybus network lanes with cars, which has consequences such as increased travel times, in addition to the risk of accidents by impeding the free passage of trolleys and corridors operating without local government authorization. It is also possible to list the taxis and minibuses stops obstruction: causing conflicts in traffic lane used by trolleybuses and invasion of spaces used for the ascent and descent of users.

Obstruction by the informal sector and parked cars is also a problem as it invades stops and parking of particular cars in primary roadways.

Finally, as to the problems in the multi modal transfer stations, stand out the obstruction of traffic routes entering the Federal District and excess of concessioned transport units⁶³.

F) RTP

Benefits

The Federal District Government, through the Passenger Transport Network (RTP) provides service to 500,000

[61] Quintero, Josefina. "Trolebus, transporte barato, seguro y limpio, en riesgo de desaparecer" in La Jornada. Mexico City, January 6, 2005. <http://www.jornada.unam.mx/2005/01/06/043n1cap.php>

[62] Fernández Ruiz, Jorge et al. *Régimen Jurídico del Urbanismo*. México, D.F., Universidad Nacional Autónoma de México., 2009. P. 266.

[63] Universidad Nacional Autónoma de México. Coordinación de Humanidades. *Programa Universitario de Estudios sobre la Ciudad. Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal*. México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf pp. 143.



Fig. 3.63 Cars overtaking the light rail crossing and a suburban rail station. Maps.google.com <https://mikesnotes.files.wordpress.com/2009/04/estacion-cuatitlan.jpg>

passengers on weekdays with a network operating 3,185 kilometers in length, the 16 delegations of Mexico City and particularly serves 135 low-income areas.

Most routes in the RTP are linked to metro stations, strong demand roads and all trips are subsidized for users, being fully exempted from payment the elderly, people with disabilities, and children under 5 years. This service provides a crucial tool for the regulation of public transport in the Federal District⁶⁴.

Current Issues⁶⁵

Currently there's a lack of investment in this company. This has seriously impacted in the vehicle fleet because nowadays 75% of its units have reached their useful life and must be either repaired or substituted. If considered as well the leases done to the Metro and other bus lines to fulfill their own services, the resulting is a company with a lack of buses, meaning a serious decrease in their productivity levels. It is normal to see in the city the RTP buses completely crowded.

About their operation, it is unclear where are the buses going. No clear information about their destination or routes were founded on their website. The closest information about their routes is the mere mention in their website. For a regular person could result difficult to know, and after to use this service if the mere route is unbeknownst.

G) Light rail

Benefits

The Light Rail offers a non pollution transport service for the south inhabitants of the Federal District. With their confined lanes, offers a connectivity with the Metro system⁶⁶.

Current issues⁶⁷.

The roads crossings infrastructure is practically nonexistent because there are 9 roads cruises, of which 3 have only automatized boom barriers for vehicular traffic.

As for the fare system, currently it is necessary to pay a ticket to access the system, since it isn't included in the Metro fare. Furthermore there is no audio system to inform the public user on the operating conditions. As for the infrastructure itself such as catenaries, pathways and substations, they're about to meet their expected lifetime.

[64] Universidad Nacional Autónoma de México. Coordinación de Humanidades. *Programa Universitario de Estudios sobre la Ciudad. Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal.* México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf pp. 32-33.

[65] Bolaños Sánchez, Ángel. "Cumplieron su vida útil el 75% de los autobuses de RTP: informe" in *La Jornada*. Mexico City, January 4th, 2015. <http://www.jornada.unam.mx/2015/01/04/capital/023n1cap>

[66] Servicios de Transportes Eléctricos del Distrito Federal. "Lineas del tren ligero". <http://www.ste.df.gob.mx/index.html?page=1&content=3>

[67] Universidad Nacional Autónoma de México. Coordinación de Humanidades. *Programa Universitario de Estudios sobre la Ciudad. Evaluación del diseño e instrumentación de la política de transporte público colectivo de pasajeros en el Distrito Federal.* México, D.F., 25 de febrero de 2011. http://www.evalua.df.gob.mx/files/recomendaciones/evaluaciones_finales/ev_transp.pdf pp. 143-144.



Fig. 3.64 Interior of a suburban rail wagon and a man getting an ecobici bike. <http://static.panoramio.com/photos/large/10707729.jpg> http://mexico.itdp.org/wp-content/uploads/121030_0471.jpg

H) Suburban Rail

Benefits⁶⁸

The suburban rail has had a serious impact in the northern zone of MCMA. The users have a massive transport system that connects them with the central part of the Federal District. There's an estimated time saving of about 2hr and 40min for each person using the suburban rail. The service delivers fastness and comfort on most of their journeys. On each of every station are present several bus stops with different neighboring routes. There's as well on every station a mall filled with business -such as convenience stores, fast foods, internet cafes- ready to serve the commuters.

There are in return some benefits as well for the environment such as traffic jams reductions, an estimated 14% reduction of pollution on the metropolitan area and a reduction on accident levels. Consumption of fossil fuels are decreased thanks to this non pollution transport system. Noise pollution is as well reduced thanks to this system.

But the system impacts as well on socioeconomic levels: by making a platform for the creation of more than 25,000 jobs.

Current issues⁶⁹

The suburban rail has currently some issues. The first one and most basic would be that is an underused system. One of the main reasons is the lack of neighboring buses lines, making harder for the population to reach the suburban rail stations. Once inside the suburban rail bus station there's the feeling of lacking buses due to the way these buses stops works: only allowing the carriage and discharge of passengers without the possibility to park inside. The measure is -said- to boost public transport journeys to and from the suburban rail station.

Unlike most of the Federal District transport companies, the suburban rail -being a private company- does not offer discounts or subsidies to vulnerable groups of the society⁷⁰.

I) Ecobici

Benefits⁷¹

The Federal District's bike sharing system, or *Ecobici*, has had a great acceptance from their users since its inauguration in 2010. The system has seen an incremental from 1% to 5% (in 2012) of their share from the total

[68] Secretaría de Comunicaciones y Transportes. "Beneficios Tren Suburbano" on sct.gob.mx. Mexico City, June 14th, 2013. <http://sct.gob.mx/en/transportation/transporte-ferroviario-y-multimodal/tren-suburbano/beneficios/>

[69] Cruz Serrano, Noe. "Suburbano enfrenta colapso financiero" in [El Universal.com.mx](http://www.eluniversal.com.mx/ciudad/114668.html). Mexico D.F., December 19th, 2012. <http://www.eluniversal.com.mx/ciudad/114668.html>

[70] Ferrocarriles Suburbanos, S.A. "Preguntas Frecuentes" on [fsuburbanos.com](http://www.fsuburbanos.com). http://www.fsuburbanos.com/secciones/atencion_usuario/faq.php?faq=8

[71] Gómez, Abigail. "Ecobici pedalea, pero no llega a la meta" on [El Universal.mx](http://www.eluniversal.com.mx/ciudad-metropoli/2014/impreso/ecobici-pedalea-125647.html). Mexico, D.F., August 16th, 2014. <http://www.eluniversal.com.mx/ciudad-metropoli/2014/impreso/ecobici-pedalea-125647.html>



Fig. 3.65 A concessioned minibus suffered an accident and buses at Pantitlán Station waiting for the arrival of people. <https://feiyi1.files.wordpress.com/2013/03/dsc04119.jpg> <http://www.panoramio.com/photo/4810835>

journeys done in the Federal District. Meanwhile, the subscriptions to the system has seen increments from 2011 with 41% to 2012 with 34%, even though a slight decrease.

Citizens living or working near the bike sharing system are the ones most benefited. They are “rediscovering” the joy and pleasure among with the benefits of the bike. That’s why society is increasingly putting pressure in the government to do regulations and laws in favor of cyclists.

The best benefit, as depicted by most of the users, is time, since statistics say that with a half hour commute is covered a 16km distance, while with the car for the same time is only covered a mere 12km. Plus there are the benefits to the environment. For the whole journeys done with the bike sharing system there’s a 2.4 million CO₂ emissions. And there’s of course the reported health improvement by their users.

Current issues

Currently, due to the success and an interest on sustainable mobility from the Federal District Government, there are plans to expand the bike sharing system. Yet, the speed rate of implementation is still low for the size of this city.

The *Ecobici* system has presented several logistic errors such as lack of bicycles on certain stations, malfunction of bicycles, electronic errors while taking or returning a bike on the station, among others⁷².

The company, being owned by the Federal District, until today operates only inside this entity. No bike sharing system is present in the State of Mexico nor Hidalgo.

3.3.3. Concessioned public transport issues

A) Buses, minibuses and minivans

Benefits⁷³

Despite most of their current issues, the concessioned public transport still has quite a few benefits, such as their transit frequency. This type of transport, due to the demand excess, usually has low transit frequencies. Bus after bus, minibus after minibus, minivans after minivans transit several times a day with low frequencies at most point of MCMA, sometimes carrying a single or two passengers, and sometimes completely full.

Current issues⁷⁴

[72] González, Juan Pablo. “Las quejas más frecuentes del servicio Ecobici” on El Universal DF.com.mx. Mexico, D.F., February 25th, 2011. <http://www.eluniversaldf.mx/cuauhtemoc/nota21084.html>

[73] Márquez Ayala, David. *El Reto del Transporte en la Ciudad de México*. México, Libros Para Todos, 2005. Pp. 92-93.

[74] Fernández Ruiz, Jorge et al. *Régimen Jurídico del Urbanismo*. México, D.F., Universidad Nacional Autónoma de México., 2009. P. 269,



Fig. 3.66 Bus stop invaded by informal businesses and a common image in MCMA avenues (Northern part of the city area). http://www.noticiasnet.mx/portal/sites/default/files/fotos/2014/03/23/3_2.jpg <http://www.comunicacion.naucaipangob.mx/wp-content/uploads/2014/03/DSC1785.jpg>

In Mexico City most public transport trips are made in passenger minibuses, buses and mini vans, whose routes besides tortuous, have dispersed origins and destinations, with the consequent loss of man-hours.

The concessioned public transport service operates with a variety of media, different levels of physical and administrative integration and heterogeneous vehicles, in some cases with a considerable degree of obsolescence and unsuitable for mass service.

This mode of transport is characterized by units with overload passage; their current routes were not planned properly, originating duplicity, unexplained self-competence and lack of administration routes, which results in the decrease in the speed, step frequency, bad driving, discomfort and risk to the users. The lack of control and monitoring of service promotes congestion upon passengers descent and ascent reaching the third row on major roads and threatening the integrity of the users; also create conflict points zones in modal interchange points like Metro stations.

In addition, the minibuses and taxis concession transport causes congestion, low speeds and a considerable amount of pollutant gases, whose contribution to total emissions is significant and growing.

3.3.4. Current infrastructure

A) Road infrastructure

Benefits

The actual road layout (see Fig. 3.30 on page 92) seems to suggest a soon to be network, linking several paths of MCMA.

Current issues²⁷⁵

Mexico City's road network has a length of about 9000 kilometers, of which only about 900km are classified as primary roads. Of these there are only 147 kilometers of controlled access. The 8,000km remaining correspond to secondary roads. The primary pathways include controlled access roads, major roads and road axes. The road structure as a whole has a number of deficiencies due to lack of maintenance as well as the emergence of conflicts caused by discontinuity and fragmentation.

Currently there is a clear disruption of road networks and public transport, and at a specific level, also the "road subnets", being particularly relevant in the case of the primary network and secondary subnets for articulation with

275.

[75] Fideicomiso para el Mejoramiento de las Vías de Comunicación del Distrito Federal. *Diagnóstico de la movilidad de las personas en la Ciudad de México. Una red llena de agujeros*. México, D.F., <http://www.fimevic.df.gob.mx/problemas/1diagnostico.htm#red>



Fig. 3.67 Metro station access invaded by informal businesses and Tacubaya Metro and Metrobus stations with buses stops, informal businesses and moving cars. <http://www.diariodemexico.com.mx/wp-content/uploads/2013/10/01-INSEGURIDAD-F01.jpg> <https://navegandolaarquitectura.files.wordpress.com/2012/11/4.jpg>

the controlled entry roads, and the secondary road network.

The saturation of the roads generates low speeds. In an analysis of traffic counts conducted in 1997 and 1998 for primary roads DF is concluded., 85% of primary roads will have poor fluency, which requires a speed between 20 and 21 km / hr, while vehicles groups moving at 17 km / hr. Only 15% of the remaining roads have stable fluidity.

This warns of a phenomenon where saturation invades the nearby roadways, whether primary or secondary. Analysis of traffic flow in peak hours indicate a low level of service that results in saturation of the roads, more travel time in commuting, in a great loss of man-hours in busy traffic, higher consumption of fuel and significant levels of pollution to the environment from low traffic speed.

The west side of the Mexico City generates one of the greatest conflicts in the city, because it is highly deficient of a primary road system that allows displacement with an appropriate level of services. Its topography constituted of hills separated by ravines has prevented the establishment of a road network to allow accessibility, to which is summed the excessive growth of human settlements and services in recent years.

B) Multi Modal Transfer Station

Benefits⁷⁶

Nowadays the Multi Modal Transfer Stations play a key role on MCMA, allowing: mobility and connectivity. Several journeys coming from the peripheries of MCMA requires a first commute with a bus. These buses depart and arrive as well in these transfer stations. Most of the transfer stations are connected with the subway system, allowing the commuters to either have the possibility to either continue their journey with the subway or to embark in another bus.

Moreover, several Multi Modal Transfer Stations have as well developed (or will develop) a series of services for the community such as shopping malls (mostly) or community centers⁷⁷.

Current Issues

Multi modal transfer centers serve approximately 4 million users a day. Nowadays they are currently saturated because in its design the increasing demand for public transport was not anticipated, so insufficient spaces for users and service providers is currently presented. Disordered public transport services with access to multi modal transfer stations, cause congestion in and out of the facility during peak hours, which contributes to increased pollution

[76] Martínez Vásquez, Juan. *Análisis de los Centros de Transferencia Estratégicas en el Distrito Federal*. Reviewed by Guadalupe González Díaz. Specialization Thesis. Instituto Politécnico Nacional. January 2010. <http://itzamna.bnct.ipn.mx/dspace/bitstream/123456789/8314/1/ANACENTROS.pdf>

[77] Castillo, Elia. "Concesionarán paraderos, entre ellos Indios Verdes" on Milenio.com. México, D.F., February 18th, 2014. http://www.milenio.com/df/Concesionaran-paraderos-Indios-Verdes-Centros_de_Transferencia_Modal_0_247775254.html



Fig. 3.68 Bicycle path invaded by cars and cyclist moving through the car lanes. <http://inigo.bicitekas.org/wp-content/uploads/2015/01/FOTO-NO-PRESUPUESTO.jpg> <https://bicigourmet.files.wordpress.com/2012/09/bg-sesion-4.jpg>

and accidents. In hours where no saturation is recorded, the problem is not only caused by excessive dwell times of the units within the multi modal transfer stations, but also by the invasion of the streets of the periphery units on hold for long periods, using spaces of public roads as shuttles, parking and a place to repair units, which affects users and citizens.

The lack of integration has physical, operational and pricing consequences that make difficult the transfer of passengers from one mode to another. Inside this network with different modes of passenger transport, the connection nodes present major deficiencies.

There is a link between modes of public transport of passengers, but obviously not the best one. Deficiencies of these inter modal transfer stations force passengers to walk long distances, often wait on the outdoors, to do long queues, to walk in unsafe conditions in unsanitary spaces with garbage and that in times of rains are generally swamped due to lack of maintenance.

C) Bicycle paths

Benefits

In 2013 there were a mere 55km of bicycle paths connected to the streets network. There are, however, plans to increment it⁷⁸.

Current issues

Yet, this incremental is still low and concentrated only in zones where the bike sharing system is present. This infrastructure is only available in the Federal District. No plans for bicycle infrastructure are undergoing in the State of Mexico.

3.4. MOBILITY: A CRITICAL ASSESSMENT

3.4.1. Strengths

A) Public Transport Network

- There's a diversity of transport modes inside MCMA.

[78] Gómez, Abigail. "Ecobici pedalea, pero no llega a la meta" on El Universal.mx. Mexico, D.F., August 16th, 2014. <http://www.eluniversal.com.mx/ciudad-metropoli/2014/impreso/ecobici-pedalea--125647.html>

- As well there are different public transport system scales depending the commutes necessities.
- The **subway** is considered efficient, and its fare is a low one thanks to the subsidy received from the government.
- The metrobus (**BRT**) has gained popularity due to its efficiency and its easy and economic implementation.
- There's a large deployed infrastructure of the **trolleybus** inside the Federal District, 600km circa.
- Plus, the **trolleybus** has an accessible fare and subsidies for vulnerable groups.
- The **trolleybus** present greater advantages in comparison with the concessioned public transport units, such as a longer service life and low pollution levels.
- The **RTP** buses service aims to work on vulnerable groups zones inside the Federal District, connecting them with the subway.
- The **RTP** gives as well a subsidy to vulnerable groups.
- The **light rail** offers connectivity to the south part of the Federal District with the rest of the city through a connection with the subway.
- The **suburban rail** offers a fast, effective and quality service by connecting the north of MCMA with the center.
- The **suburban rail** offers as well the possibility of a connection with their stations and its surroundings thanks to some buses lines.
- The **suburban rail** offers several services such as shopping, offices, fast foods among others on their malls inside their stations.
- The **suburban rail** reduces pollution and traffic.

B) Concessioned Public Transport

- There's a diversity on the concessioned public transport fleet.
- There's as well an increment on the concessioned public transport system.
- Their passing interval is high, but only due to its offer excess.

C) Infrastructure

- MCMA has the foundation for a streets network well connected and classified.
- The multi modal transfer stations allow mobility and connectivity between different transport modes and to different places along MCMA.

3.4.2. Weaknesses

A) Public Transport Network

- Lack of integration between transport companies.
- Lack of coverage, or a limited one.
- Concentration of public transport in certain zones (mostly the western part).

- There's a decrease on the use of the **subway**.
- Lack of coverage of the **subway**, mostly in the State of Mexico.
- Lack of technological improvements to the **subway**, their trains and infrastructure.
- The **subway**, as a company, is soon to go bankrupt.
- The metrobus (**BRT**) doesn't have enough buses to meet its demand.
- The mexibus (**BRT**) is underused due to their high accident rates, traffic jams, insecurity and damages to their and public infrastructure.
- The **trolleybus** is currently underutilized due to its high infrastructure deployed and low usage.
- The **trolleybus** has a low performance mostly due to their lane invasion done mostly by private cars.
- The **RTP** buses service lacks of public investment.
- The **RTP** buses service has a low performance, among several factors due to the lends done to other companies such as the subway.
- The **light rail** doesn't have enough preference in the street, making their journeys a bit longer than expected.
- Most of the infrastructure of the **light rail** is about to meet their service life.
- The **suburban rail** is underused due to the lack of connectivity to their stations.
- The **suburban rail** does not offer any subsidy or discount to vulnerable groups of the society.

B) Concessioned Public Transport

- There's an offer excess of the concessioned public transport.
- Deficiencies of the public transport network are covered mostly by the concessioned one.
- Most of their fleet is meeting their service life time.
- Drivers do long shifts.
- There's a high crime rate involved in this type of transport.
- And the satisfaction levels are extremely low.
- The transportation costs are high.
- There's a limited integration with massive transport.
- Most of their routes are spread all along MCMA.
- There's a total lack of control with the system.

C) Infrastructure

- There's a lack of connectivity, priority and control of the streets network.
- Existing connectivity infrastructure, or the multi modal transfer stations, do not facilitate connectivity between transport modes.

- There's a lack of dedicated space for the public transport.
- The streets network and the multi modal transfer stations lack of serious maintenance.
- Currently, both the street network and the multi modal transfer stations are saturated.

D) Government

- There's a complete lack of urban and metropolitan planning.
- This planning lack favors the phenomenon of urban sprawl.
- The state transport ministries don't have any coordination between each other.
- Existing planning do not match current transport conditions at all.
- There's a lack of vision of the future of MCMA public transport system.
- There's a lack of public funding and investment on the transport field.

3.5. FUTURE PROJECTIONS

It is well known that the MCMA mobility suffers a crisis right now. Infrastructure is poor, the private vehicle fleet and travel times are increased. Governments, though mostly the Federal District, are carrying out various actions to counteract this phenomenon that cost in 2011 about 55.4 billion pesos, or 0.5% of the national GDP⁷⁹. The phenomenon of city congestion also has unquantified health consequences for the inhabitants, as MCMA already holds the title of the city with the most uncomfortable mobility all along the planet⁸⁰.

That is why both the Federal Government and local governments are taking steps to counteract this effect:

The Federal Government is promoting actions to avoid the phenomenon of urban sprawl, including the enactment of a new National Urban Development Plan 2014-2018, focusing on compact and sustainable cities. This includes actions to contain the metropolitan areas, strengthen the mix of uses, promote sustainable development, strengthen policies for sustainable mobility, among others⁸¹. It is expected that all concerned agencies and parties to which this law suits to adapt at a period no longer than 24 months (from January 2015).

The Federal Government and local government (the Federal District and the State of Mexico) are already planning the expansion of two subway lines. To do this, tenders will be in this year (2015)⁸². Besides, there will be the construction of a railway that would link the western financial part of the city with the subway⁸³. However, these seem to be the only measures incorporated to promote mass mobility and combat trafficking in the MCMA.

The measures that the government is implementing are insufficient or late to attack the root problems, which are: excessive vehicle fleet, deficiency and public transport concession and the lack of urban planning.

[79] "Tráfico en el DF cuesta 55.4 mil mdp al año" on El Universal.mx. April 11th, 2011. <http://www.eluniversal.com.mx/notas/758414.html>

[80] International Business Machines Corp. "IBM Global Commuter Pain Survey: Traffic Congestion Down, Pain Way Up" on IBM.com. Armonk, N.Y., September 8th 2011. <http://www-03.ibm.com/press/us/en/pressrelease/35359.wss#release>

[81] *Programa Nacional de Desarrollo Urbano 2014-2018*. Diario Oficial de la Federación. México, D.F., April 30th, 2014. http://www.dof.gob.mx/nota_detalle.php?codigo=5342867&fecha=30/04/2014

[82] "Licitarán este año ampliación de las Líneas A y 12 del Metro" on Milenio.com. Mexico, D.F., February 9th, 2015. http://www.milenio.com/df/ampliacion_L12-ampliacion_linea_A-Joel_Ortega_STC_Metro_0_461354103.html

[83] "Van por el tercer piso: Construirán viaducto elevado de Santa Fe a Periférico" on Animal Politico.com. July 24th, 2014. <http://www.animalpolitico.com/2014/07/gdf-construira-viaducto-vehicular-santa-fe-periferico-para-apoyar-tren-toluca-df/>



EN TRANSITO

BUSSCAR

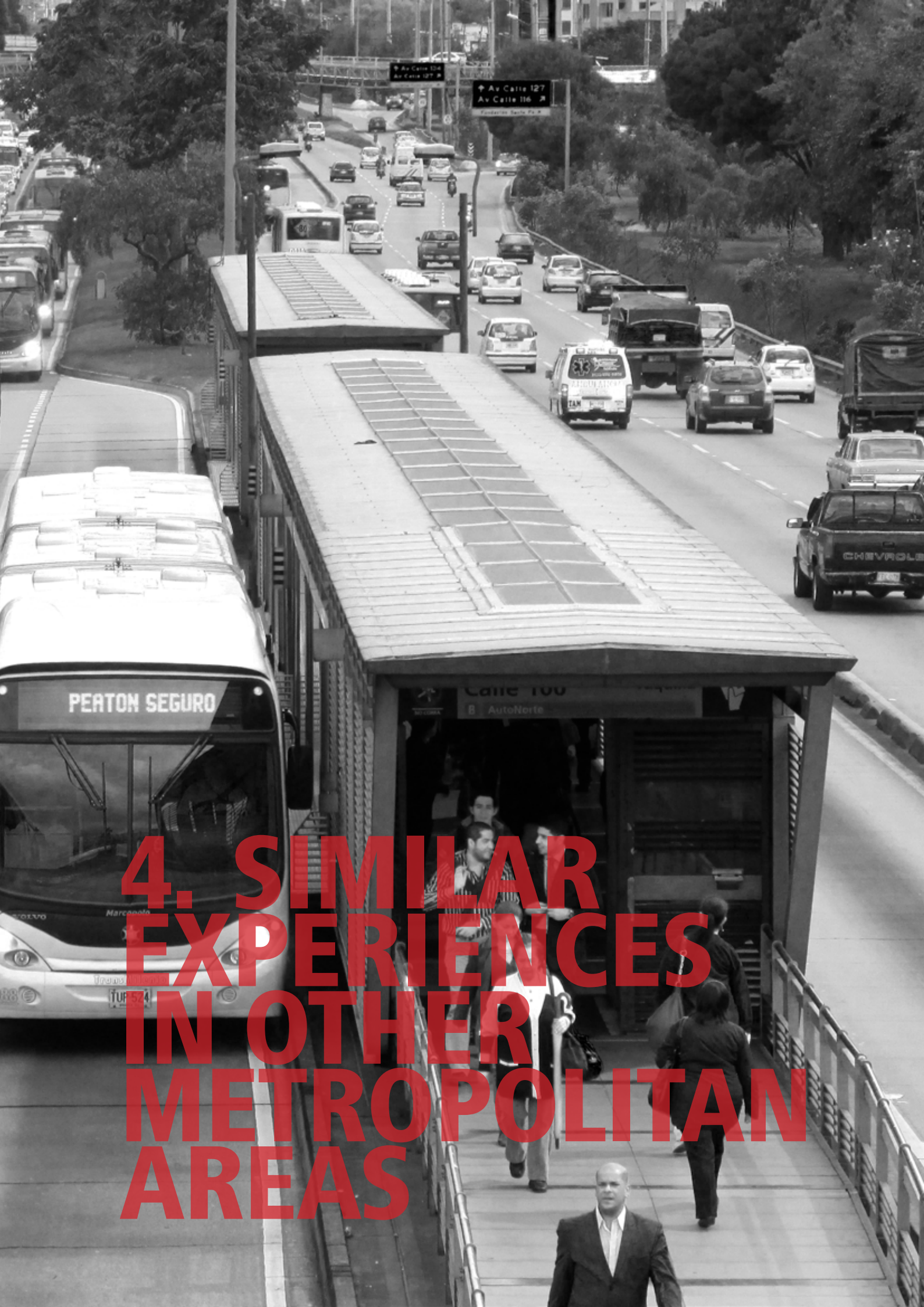
U189

TransMilenio

STE-04A

H51 PORTAL USNE

ED88



Av Calle 104
Av Calle 127

Av Calle 127
Av Calle 116

PEATON SEGURO

Calle 100
B AutoNorte

**4. SIMILAR
EXPERIENCES
IN OTHER
METROPOLITAN
AREAS**

4.1. BOGOTÁ



4.1.1. Brief description of the city

Bogotá is the Capital of Colombia, located relatively in the center of the country, in the natural region known as the Bogotá savanna¹. with an estimated 7.776.845 inhabitants as of 2014². The city has a length of 33km north to south and 16km from the east to the west³. As the Capital, host the highest organism of the Executive branch of the Government, as well as the Legislative and Judiciary branches.

On the economic level, Bogotá contributes with the biggest portion of Colombia's GDP:

[1] Instituto Colombiano de Antropología e Historia. *Sabana de Bogotá*. Bogotá, 2014. http://www.icanh.gov.co/ver_pagina_ingles/release/register_of_archaeological_sites/sabana_bogota

[2] Departamento Administrativo Nacional de Estadística. *Estimación y proyección de población nacional, departamental y municipal total por área 1985-2020*. Bogotá, 2013. http://www.dane.gov.co/files/investigaciones/poblacion/proyepobla06_20/Municipal_area_1985-2020.xls

[3] Alcaldía Mayor de Bogotá. *Bogotá una Metrópoli Latinoamericana*. Bogotá, 2012. <http://portel.bogota.gov.co/portel/libreria/php/01.270701.html>

Symbology

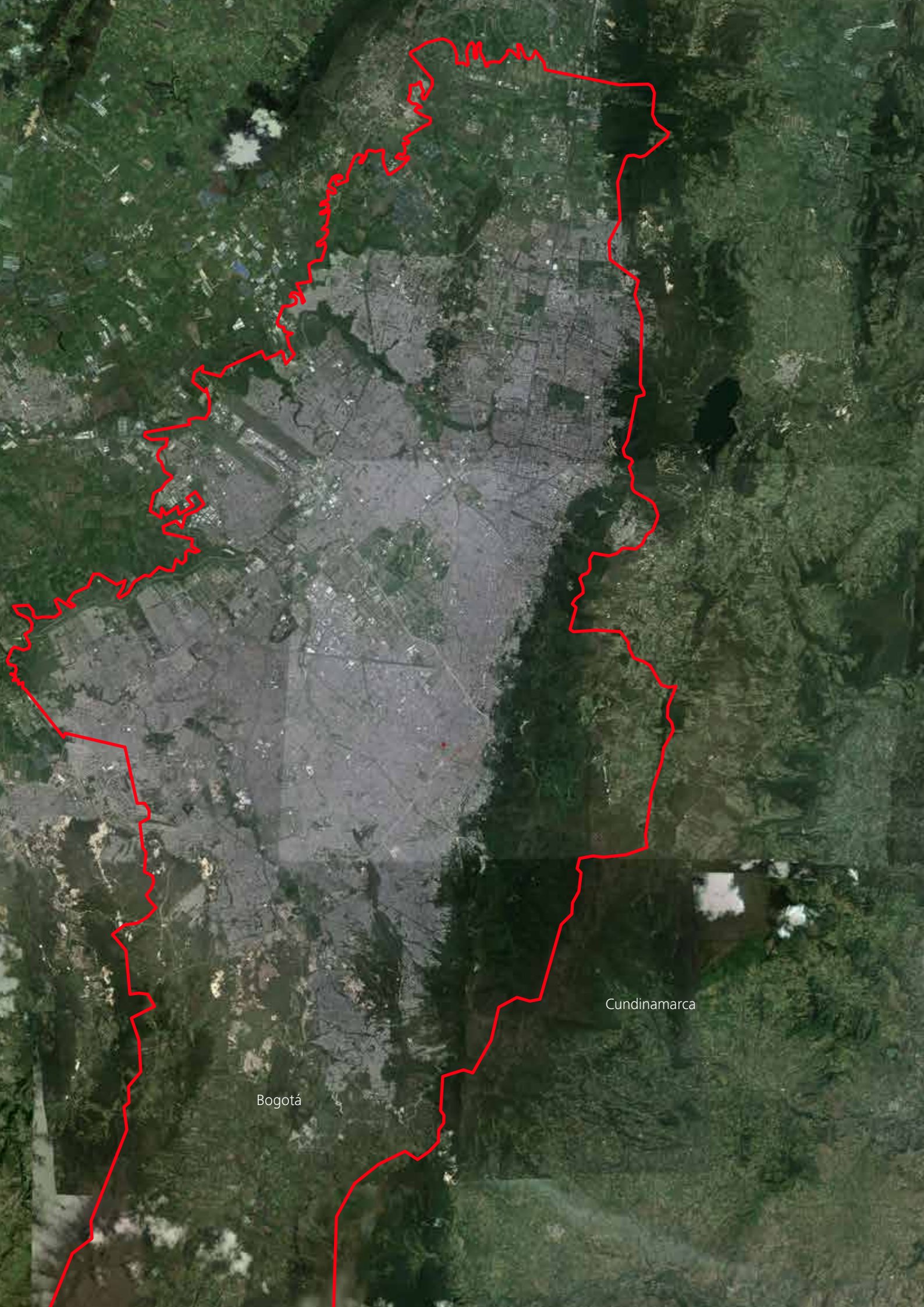
States Limits

Kilometers

0 1 2 5

Fig. 4.1 Bogotá Metropolitan Area.

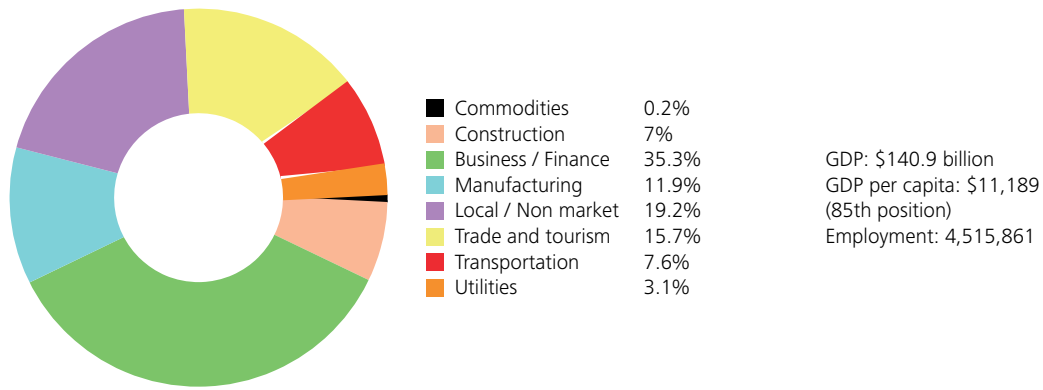
Source: Google, Inc. <http://maps.google.com>



Bogotá

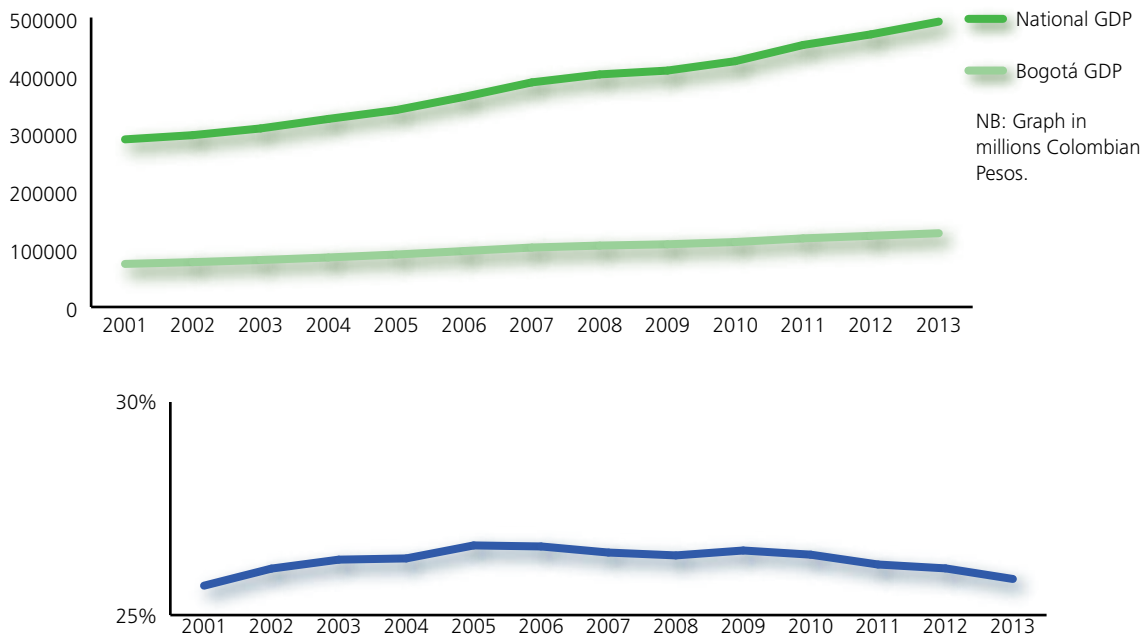
Cundinamarca

Graph 4.1 Bogota's Metropolitan Area Output by Industry.



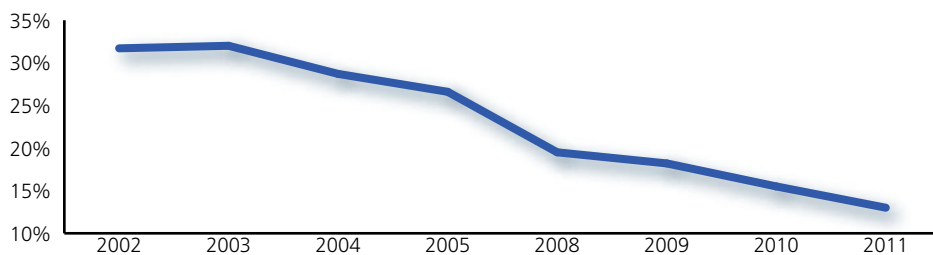
Source: The Brookings Institution. *Global MetroMonitor*. <http://www.brookings.edu/research/interactives/global-metro-monitor-3>

Graph 4.2 Colombia and Bogota's GDP Comparison with Annum Variation.



Source: Departamento Administrativo Nacional de Estadística. *Cuentas Trimestrales de Bogotá D.C. Producto Interno Bruto (PIB) Primer Trimestre 2014. Preliminar*. Bogotá, DANE, August 20th, 2014. http://www.dane.gov.co/files/investigaciones/boletines/pib/Bogota/Bol_PIB_Bta_1_trim_14.pdf

Graph 4.3 Poverty Percentage in Bogotá.



Source: Galvis, Luis Armando. "¿El triunfo de Bogotá?: desempeño reciente de la ciudad capital" on *Documentos de Trabajo sobre Economía Regional*. No. 182. Cartagena de Indias, Banco de la República - Centro de Estudios Económicos Regionales, February 2013. http://www.banrep.gov.co/sites/default/files/publicaciones/archivos/dtser_182.pdf

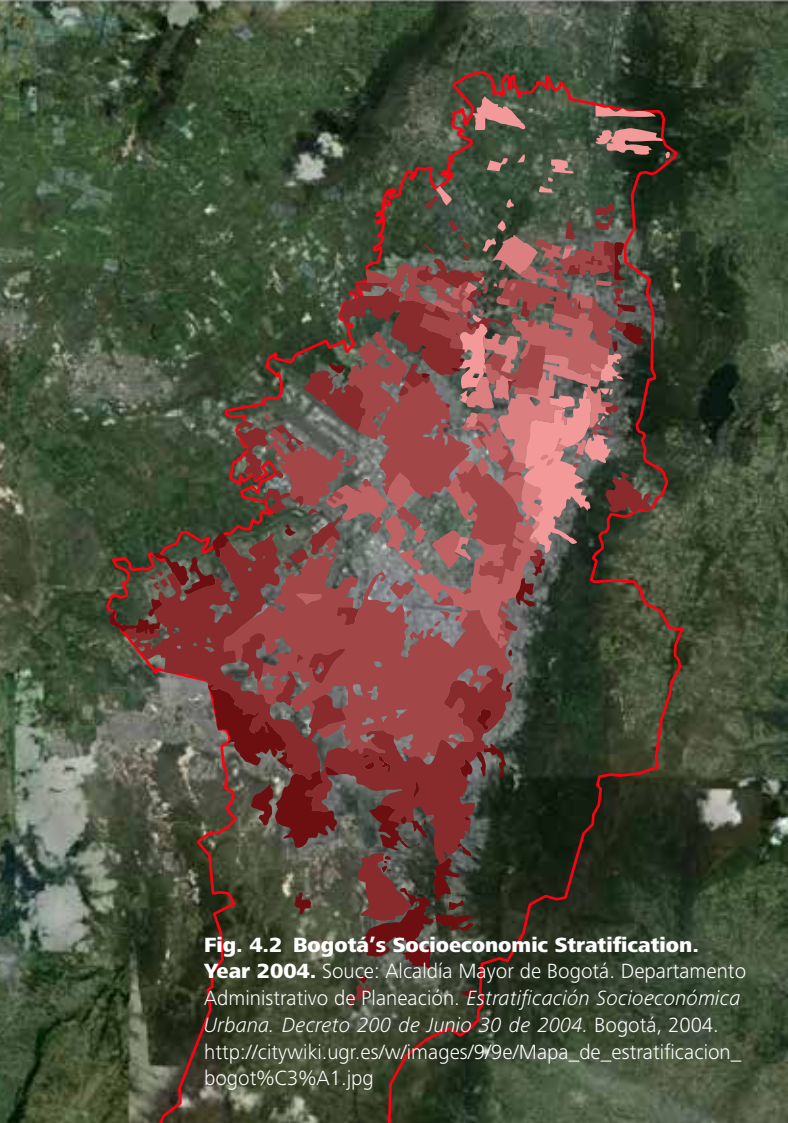


Fig. 4.2 Bogotá's Socioeconomic Stratification. Year 2004. Source: Alcaldía Mayor de Bogotá. Departamento Administrativo de Planeación. *Estratificación Socioeconómica Urbana. Decreto 200 de Junio 30 de 2004.* Bogotá, 2004. http://citywiki.ugr.es/w/images/9/9e/Mapa_de_estratificacion_bogot%C3%A11.jpg

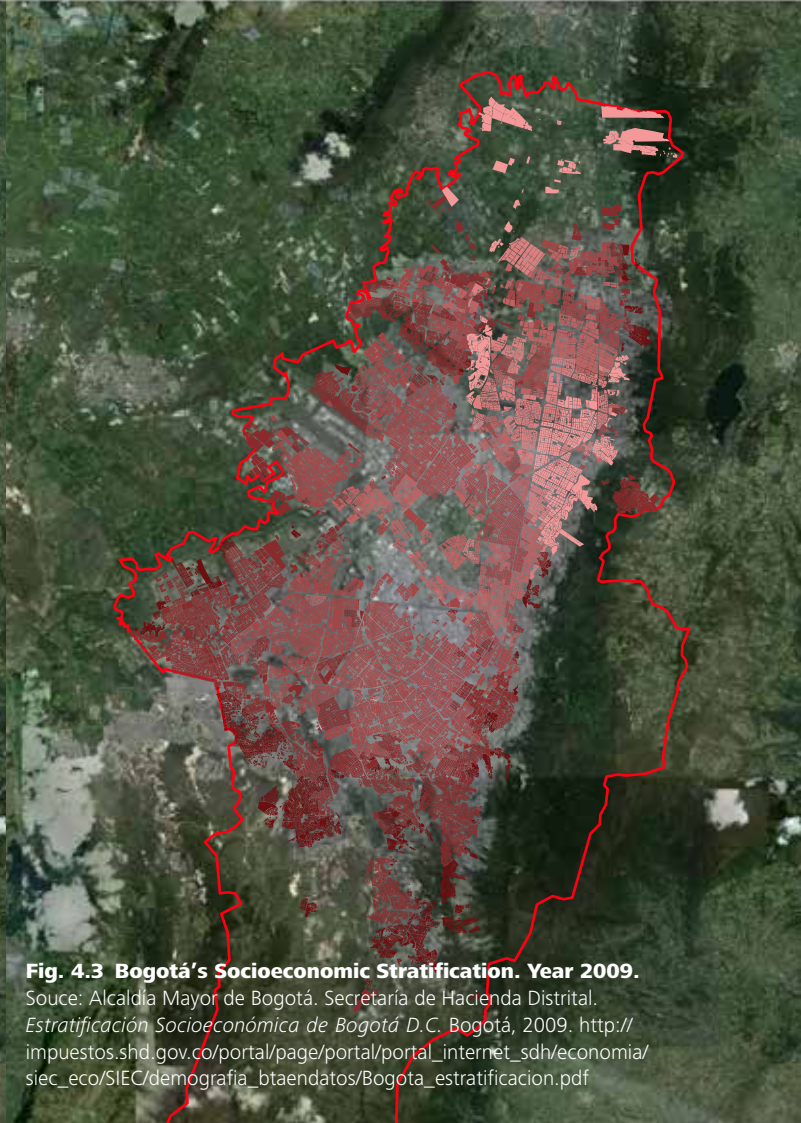


Fig. 4.3 Bogotá's Socioeconomic Stratification. Year 2009. Source: Alcaldía Mayor de Bogotá. Secretaría de Hacienda Distrital. *Estratificación Socioeconómica de Bogotá D.C. Bogotá, 2009.* http://impuestos.shd.gov.co/portal/page/portal/portal_internet_sdh/economia/siec_eco/SIEC/demografia_btaendatos/Bogota_estratificacion.pdf

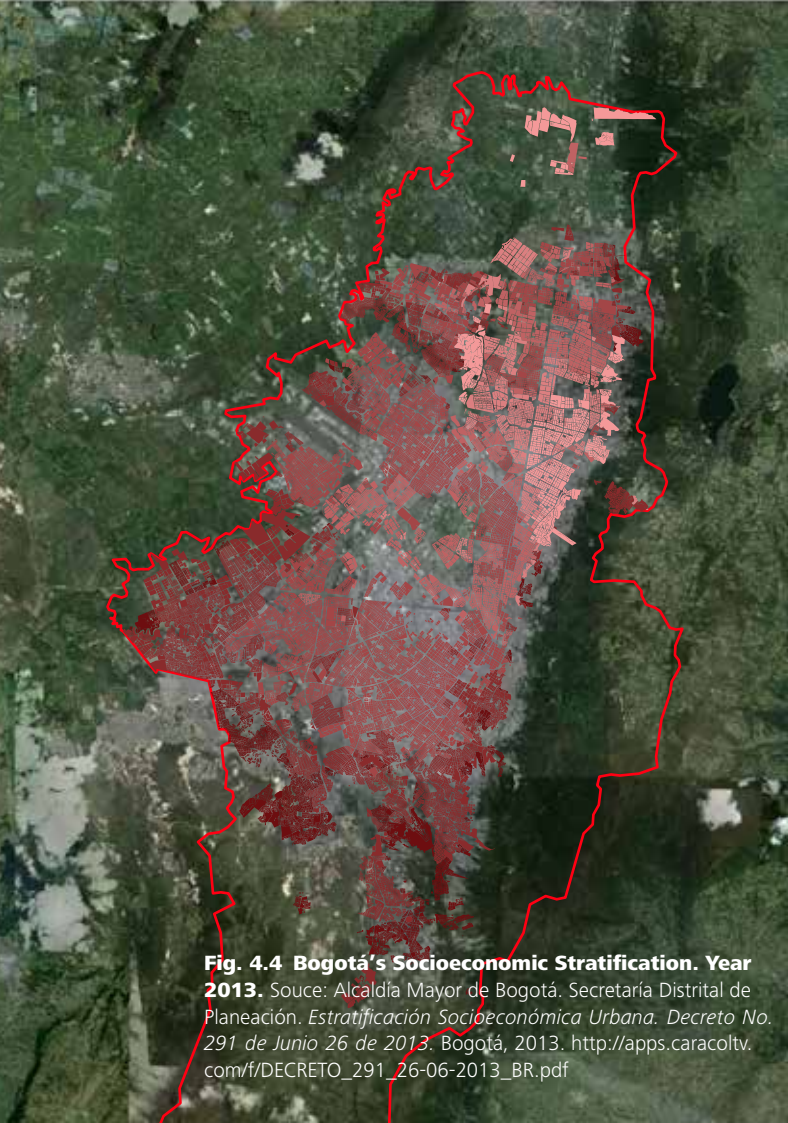


Fig. 4.4 Bogotá's Socioeconomic Stratification. Year 2013. Source: Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. *Estratificación Socioeconómica Urbana. Decreto No. 291 de Junio 26 de 2013.* Bogotá, 2013. http://apps.caracoltv.com/f/DECRETO_291_26-06-2013_BR.pdf

Symbology

- Bogotá D.C. Limit
- Strate 1 - Lowest Socioeconomic Level
- Strate 2
- Strate 3
- Strate 4
- Strate 5
- Strate 6 - Highest Socioeconomic Level

24.5%⁴, and it's the seventh city by the GDP's size in Latin America⁵. The important cultural offer is represented in many museums, theaters and libraries, which have given to Bogotá the recognition of the "Athens of South America"⁶ and the Ibero-American Capital of Culture 2007⁷, also is home to major festivals with broad experience and national and international recognition. Academic activities highlights as well, as most of the major Colombian

[4] Departamento Administrativo Nacional de Estadística. *Cuentas Departamentales - Base 2005.* Resultados año 2011pr. Bogotá, 2012. http://www.dane.gov.co/files/investigaciones/pib/departamentales/B_2005/Resultados_2011.pdf

[5] Universidad del Rosario. *Ranking de Ciudades Latinoamericanas para la Atracción de Inversiones. Informe Oficial - Mayo del 2012.* Bogotá, Universidad del Rosario, 2012. P. 9. <http://www.urosario.edu.co/competitividad/documentos/docuemntoranking2012.pdf>

[6] Rincon, Carlos. *Colombia: Beyond Armed Actors: A Look at Civil Society on "ReVista"*. Cambridge, David Rockefeller Center for Latin American Studies, Spring 2003. P. 35. <http://dev.drclas.harvard.edu/revista/articles/view/242>

[7] *Bogotá es elegida como capital iberoamericana de la cultura para el 2007* on "El Tiempo". Bogotá, October 12th, 2006. <http://www.eltiempo.com/archivo/documento/CMS-3283540>

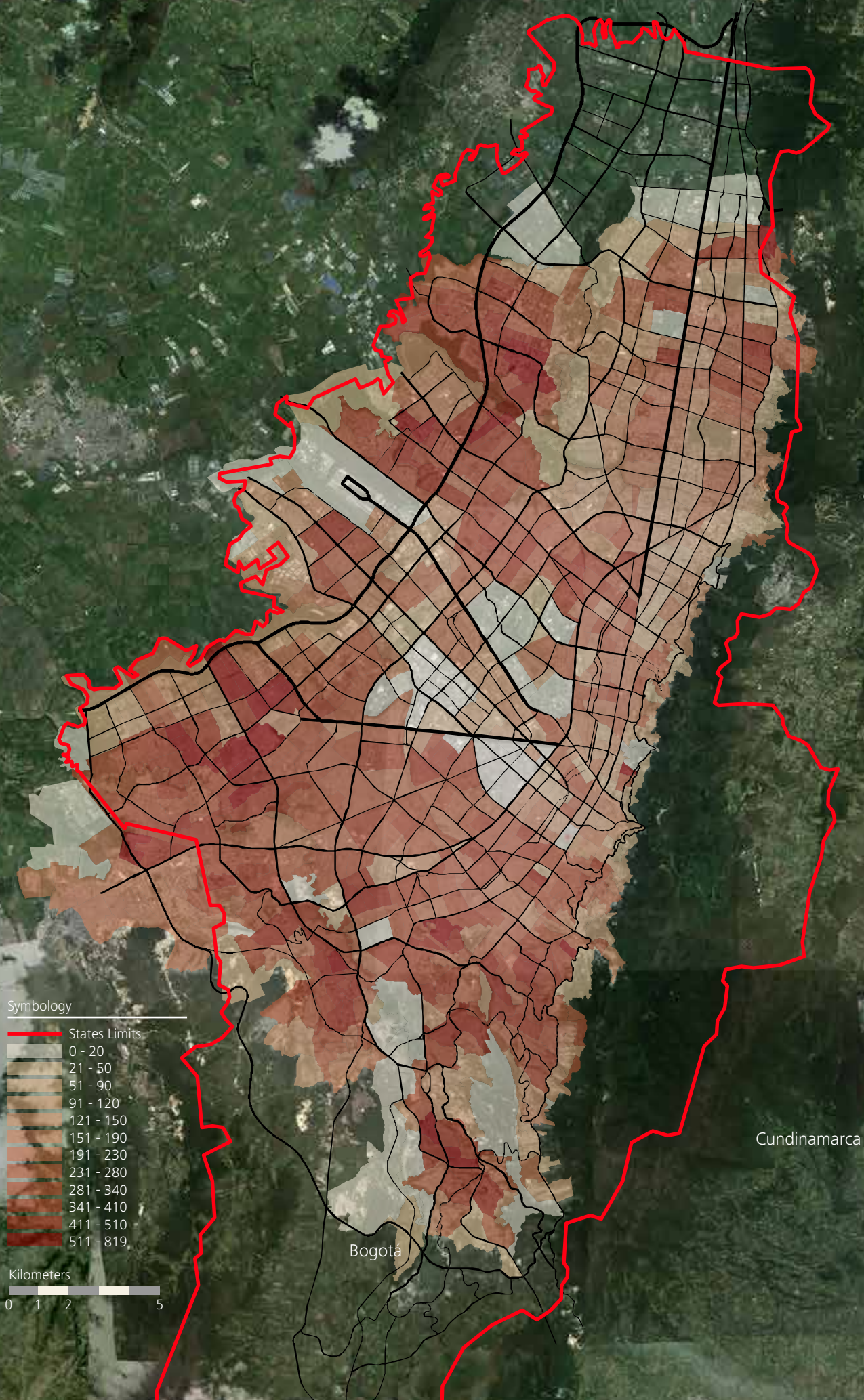


Fig. 4.5 Bogotá's Population Density in Pop/ha. Source: Steer Davis Gleave. *Revisión, Actualización y Calibración del Modelo de Transporte de Cuatro (4) Etapas de Bogotá y la Región Capital. Informe 3. Bogotá D.C., August 2011.* P. 17. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>

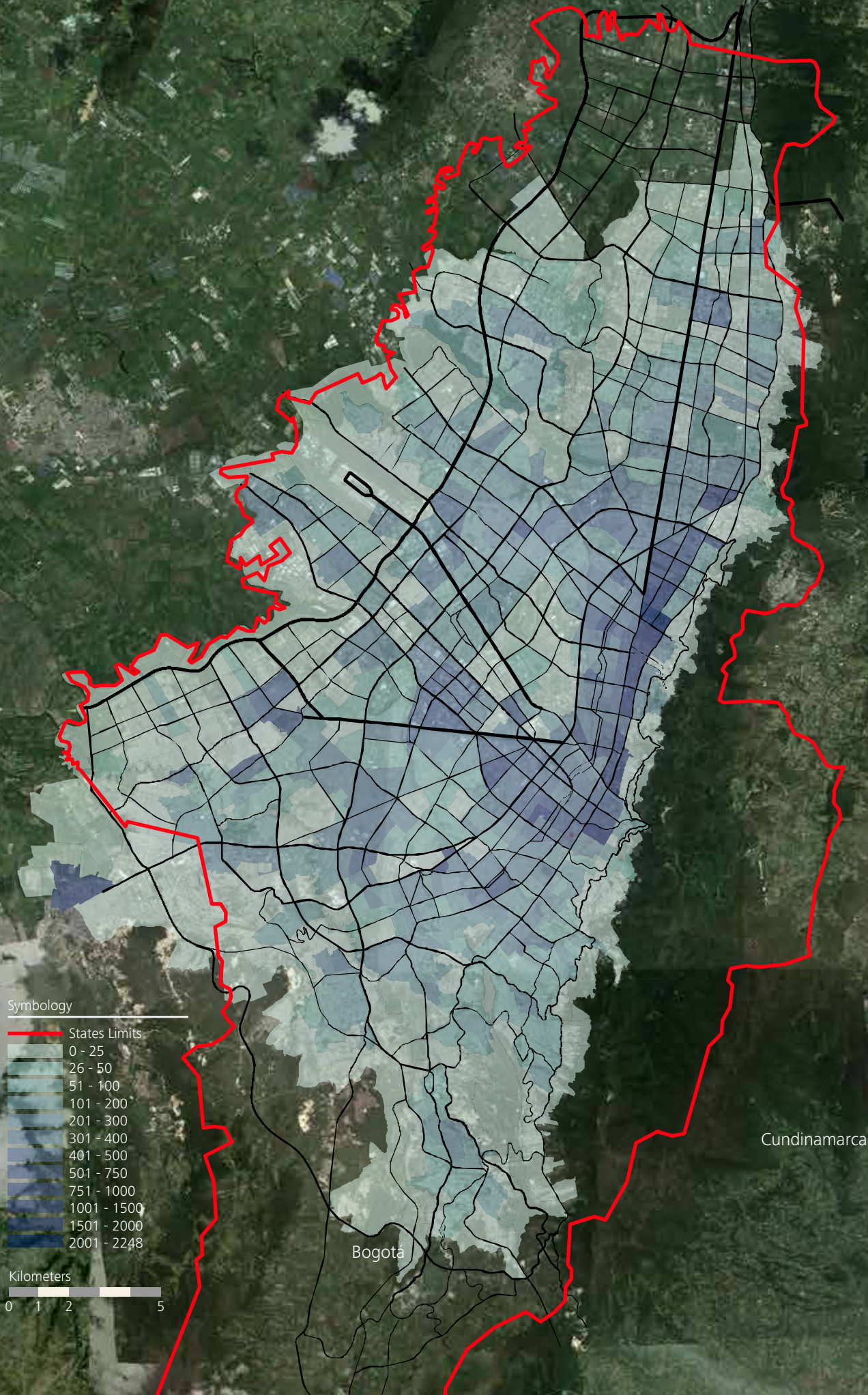
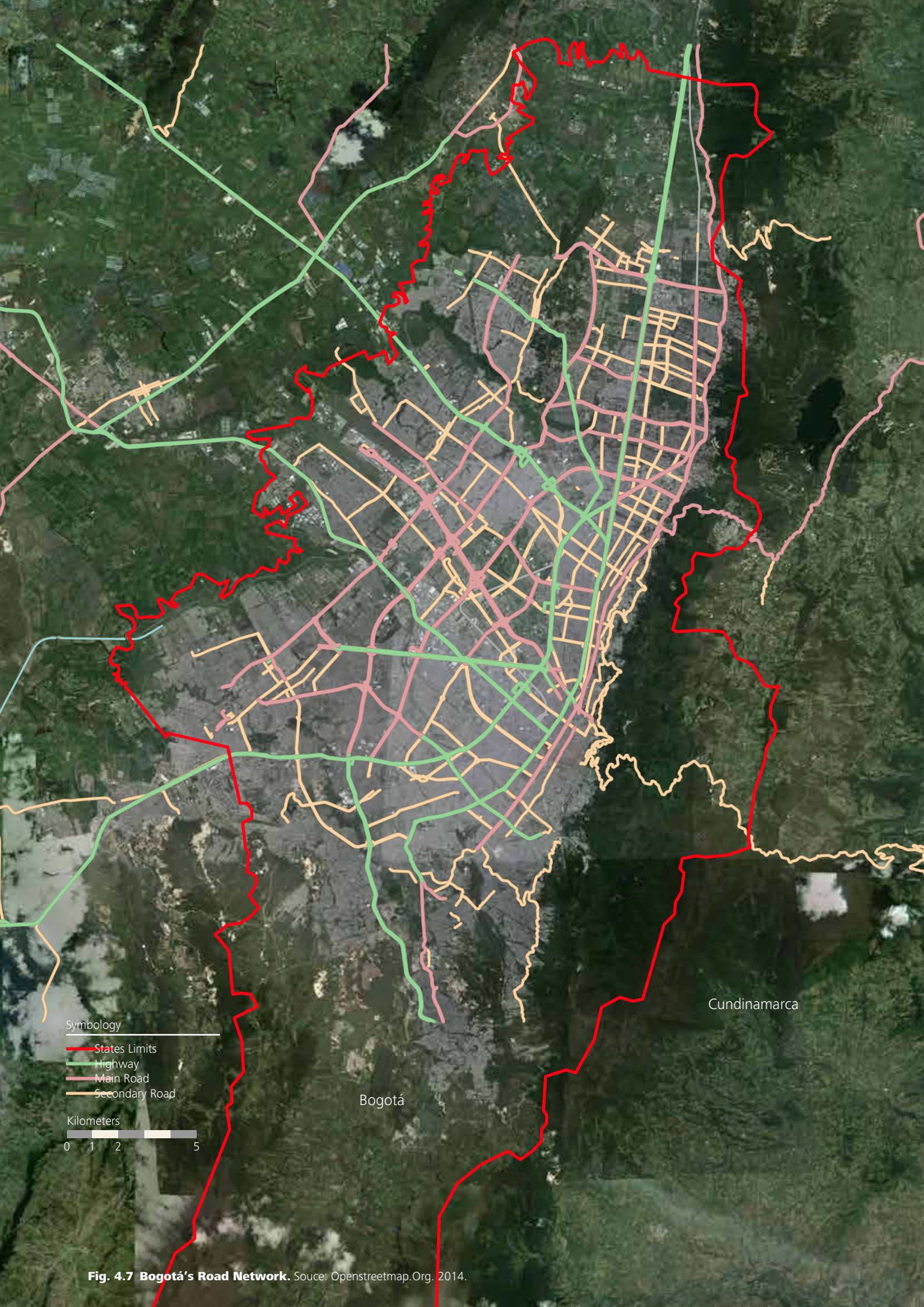


Fig. 4.6 Bogotá's Labor Force Location in Job/ha. Source: Steer Davis Gleave. *Revisión, Actualización y Calibración del Modelo de Transporte de Cuatro (4) Etapas de Bogotá y la Región Capital. Informe 3.* Bogotá D.C., August 2011. P. 22. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>



Symbology

- States Limits
- Highway
- Main Road
- Secondary Road

Kilometers



Fig. 4.7 Bogotá's Road Network. Source: Openstreetmap.Org, 2014.

Symbology

- States Limits
- Bicycle Path
- Bicycle Parking

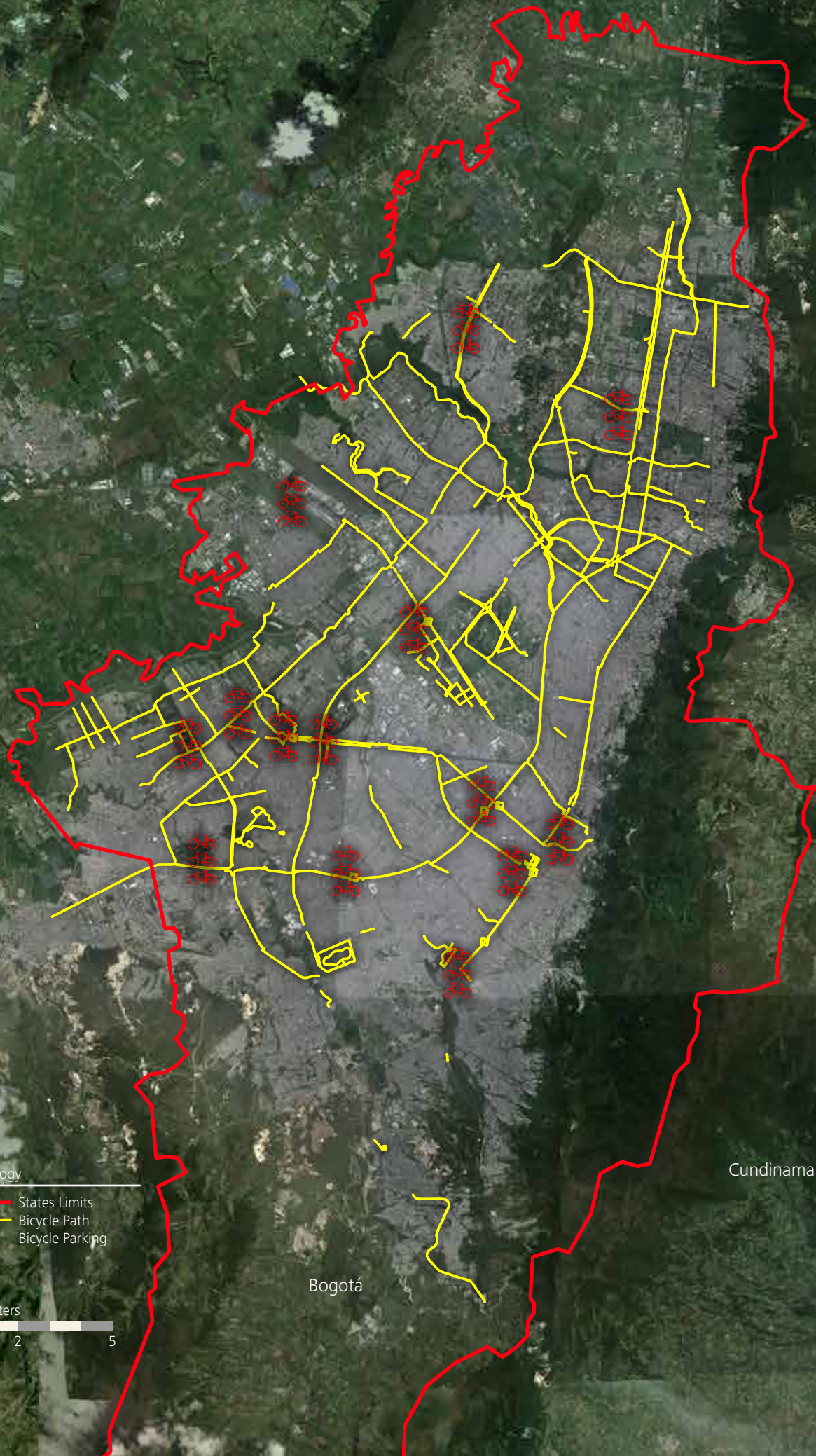
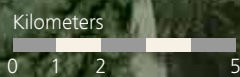


Fig. 4.8 Bogotá's Bicycle Paths Infrastructure. Source: Alcaldía Mayor de Bogotá. Secretaría Distrital de Movilidad. *Sistema de Ciclorrutas*. Bogotá, November 30th, 2012. <http://www.movilidadbogota.gov.co/?sec=8>

universities are based in the city.

Bogotá has 20 localities, or districts, forming an extensive network of neighborhoods. Areas of higher economic status tend to be located to the north and north-east, close to the foothills of the Eastern Cordillera. Poorer neighborhoods are located to the south and south-east, many of them squatter areas. The middle classes usually inhabit the central, western and north-western sections of the city.

The urban layout in the center of the city is based on the focal point of a square or plaza, typical of Spanish-founded settlements, but the layout gradually becomes more modern in outlying neighborhoods. The street arrangement of Bogotá is based on the Cartesian coordinate system. The current types of roads are classified as streets, which run perpendicular to the hills, with street numbers increasing towards the north, and also towards the south (with the suffix "South") from Street 1 on. *Carreras* or Avenues run parallel to the hills, with numbering increasing as one travels east or west of *Carrera* 1 (with the suffix "East" for roads east of *Carrera* 1). Other types of roads more common in newer parts of the city may be termed as *Eje* (Axis), Diagonal or Transverse⁸.

4.1.2. Bogota's transport system

The City of Bogotá has two different types of public transport, depending on their destinations:

- Interurban: Composed by buses arriving to their two terminals located one in the Eastern part of the City and the other in the Southern part.
- Urban: Composed by the Integrated System of Public Transportation, taxis

In addition to those systems, there's the presence of private mobility composed by: bicycles, automobiles and pedestrians.

A) Interurban transportation

As stated, the interurban transportation is done by buses arriving through several roads to the two buses stations located inside the City, one on the eastern part, colloquially called Salitre City, and a newer station known as the South Station due to its location. Departing from this stations leaves buses reaching several cities of Colombia. From the Southern Central departs buses to the southern part of the city, while on the Salitre City Station departs buses to over 600 destinations⁹.

(insertar mapa de localización de centrales camioneras)

B) Urban transportation

Bogotá's new Integrated System of Public Transportation groups the buses, the minibuses or collectives buses with the worldly renowned TransMilenio System. The main goals are:

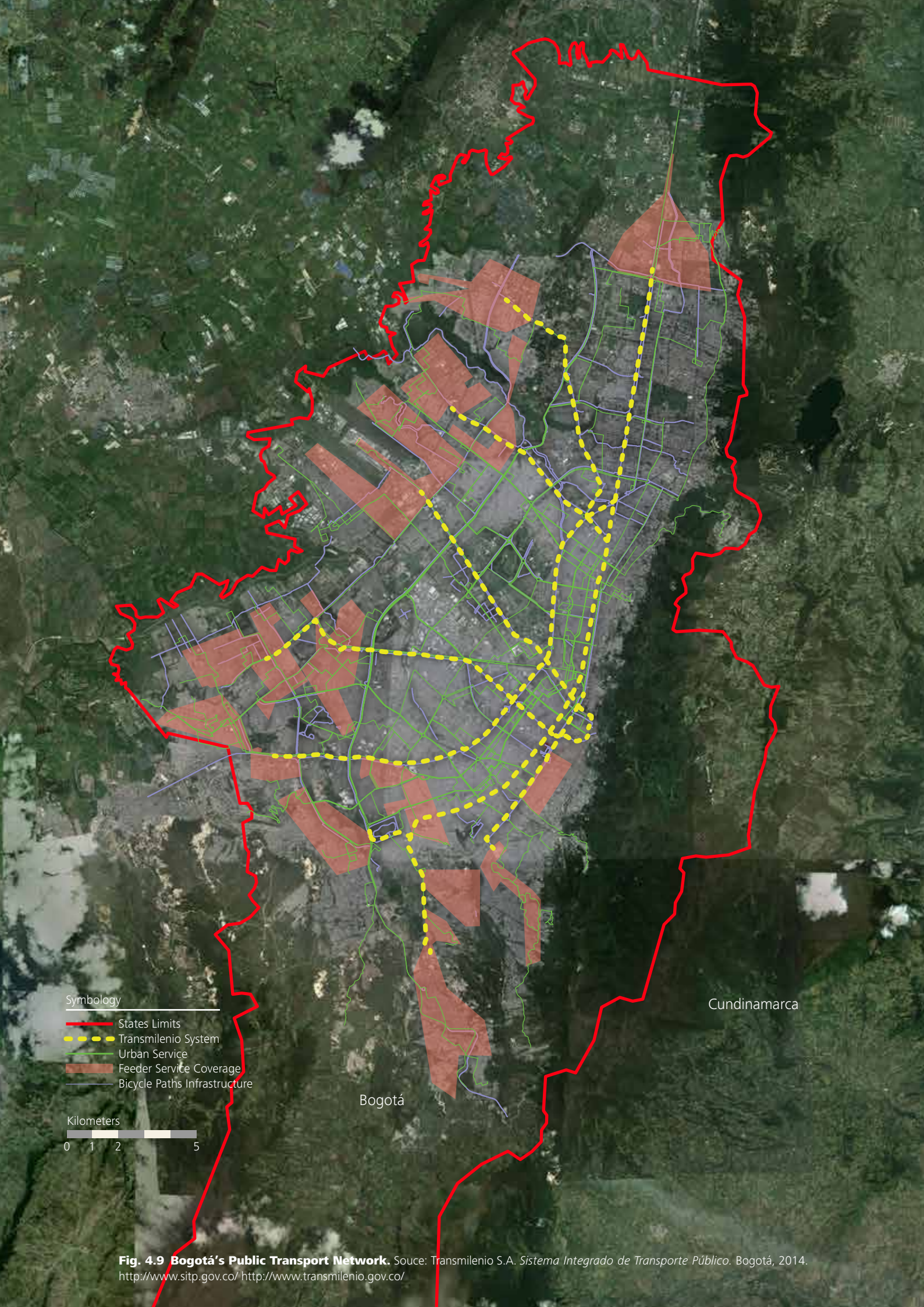
- Achieve a 100% range of services for public transportation in the city.
- Integrate the operation and fees, equaling the demand of buses in all the zones.
- Technological adjust of the current float, reducing the number of accidents and increasing accesibility.

The main characteristics of the System are:

- The (new) classification of the routes: main routes, urban, feeder routes, complimentary and special routes.
- Zoning operation: creation of 13 zones and a neutral zone

[8] Bartlett, John. *Urban Layout and Nomenclature*. Miami, 2011. <http://www.hk3c.ca/index.php/urban-layout>

[9] Terminal de Transporte, S.A. *Empresas que Operan en la Terminal Central y Destinos que Cubren*. Bogotá, 2013. http://www.terminaldetransporte.gov.co/home/index.php?option=com_content&task=view&id=353&Itemid=115



Symbology

- States Limits
- - - Transmilenio System
- Urban Service
- Feeder Service Coverage
- Bicycle Paths Infrastructure



Fig. 4.9 Bogotá's Public Transport Network. Souce: Transmilenio S.A. *Sistema Integrado de Transporte Público*. Bogotá, 2014. <http://www.sitp.gov.co/> <http://www.transmilenio.gov.co/>

- Fleet lifespan: 12 years.
- Fees equalization
- Payment centralization: an unique way of payment.
- Democratization of the System: active participation of the holders.

The Integrated System of Public transportation is composed by:

TransMilenio System

The TransMilenio System is a massive BRT system implemented in Bogota since 2001. The system started with red articulated (or double articulated) buses having two (or three) embodiments joined by a bellow. For their displacement, these have exclusive lanes through the city, connecting specific stops, or stations. Normally this type of system is known as Bus Rapid Transit. The articulated buses have a capacity of 180 passengers (46 sit and 114 standing up), while the bi-articulated buses have a capacity of 250 passengers. The cost of the ride is 1400cop (0.72usd) during off-peak hours and 1700cop (0.88usd) on rush hours. The exchange to feeder buses is included¹⁰.

This buses run through dedicated lanes specially built and conditioned for the transit of buses and physically separated from the mixed lanes, available for the private mobility, collective buses, taxis, etc.

The stations are the only authorized stop of the system, where the buses can pick up and leave passengers. These are enclosed and covered spaces, built in aluminum, concrete, steel and glass. They have ticket offices at the entrance, and a secure access for the passengers through semaphores, pedestrian bridges or tunnels. On the terminal stations there's the possibility of connection with the feeder buses, the intermunicipal routes and the bicycles. The fare fully covers the trip from the feeder buses, meaning there's no double payment. On this way, the TransMilenio covers not only the main avenues, but as well the system is extended to peripheral zones of the city

[10] Alcaldía Mayor de Bogotá. *Transporte Desde y Hacia Bogotá*. Bogotá, 2014. <http://www.bogota.gov.co/ciudad/transporte>



Fig. 4.10 Transmilenio System Running through Bogotá's Streets. http://blogpontodeonibus.files.wordpress.com/2012/08/120_transmilenio_1.jpg

and neighboring municipalities.

The bicycle parking is included on the system. This space is where cyclists leave their bicycles in safe and comfortable places, directly connected to the TransMilenio system. There's no fee for the use of the system. Currently there are 9 bicycle parkings¹¹.

The operation of the system has several modalities [TransMilenio, S.A. Operación. Bogotá, 2014. <http://www.TransMilenio.gov.co/es/articulos/operacion>]:

* Regular service: making a stop on each station of the lines. There's a schedule and a timetable established for the service.

* Super Express service: makes the journeys on the dedicated infrastructure, the difference is that the buses make a special journey previously identified by the company known as origin-destination pair, due to the high demand of the service, not following the original line. The service as well makes special stops on designated stations with an outstanding quantity of passengers. This service is only carried out during rush hours.

* Express service: Similar to the Super Express service, these buses don't do all the stops in the line, but only special ones with a high demand. The difference with the Super Express service is that these ones run through a single line.

Urban Service

The Urban Service runs through the main streets of the city, connecting stations of the TransMilenio System. The service is done with buses, minibuses or minivans. It runs on mixed lanes. The routes are similar to the current ones running in the city. The payment is done with the intelligent card.



Fig. 4.11 Bogotá's Sitp "Urbano" Buses. <http://bit.ly/1EN7uJ5> <http://bit.ly/1veCLOY>

Feeder Service

These buses help to transport from and to neighboring zones to the terminal or regular stations of the TransMilenio System. Their characteristic color is green. The trip is included in the TransMilenio fare. These buses are similar to the bi-articulated of the TransMilenio System (but lacking of the characteristic articulation of the TransMilenio BRT's), most of them having 3 doors, although of a smaller size and an electronic board with the route and destination. Their nominal capacity is 90 people.

Complementary Service

This service runs through one of the zones, connecting them to the nearest Transmilenium Station.

[11] TransMilenio, S.A. *Infraestructura*. Bogotá, 2014. <http://www.TransMilenio.gov.co/es/articulos/infraestructura>



Fig. 4.12 Bogotá's Sitp "Alimentadores" or Feeder Buses. <https://www.flickr.com/photos/dulyvillamizar/7236707234> https://www.flickr.com/photos/alimentador_victor/8007659373

Special Service

This service runs from and to the peripheral zones of the city. These zones are designed if the current transport system does not reach them yet. The journeys are done in minibuses.



Fig. 4.13 Bogotá's Complementary Service Buses. https://fbcdn-sphotos-a-a.akamaihd.net/hphotos-ak-frc3/468167_10201306724816107_35811980_o.jpg https://fbcdn-sphotos-g-a.akamaihd.net/hphotos-ak-ash3/943384_10200550569838093_1552490989_n.jpg

Bicycle System

Bogotá has a bike path system (see Fig. 4.8 on page 139) consisting of a growing network of exclusive lanes (over 300 kilometers) for bicycle traffic, supported by 14 bicycle parkings. An estimated 200,000 people use the system daily to transport. The travel time is always the same, regardless of the time. Unlike other transport modes, bike paths are not congested at peak hours¹².

The main reasons for a bike trip is to go to work, to the school and back home. The average travel time by bike is 25 minutes, while in the private vehicle is 33 minutes, on the traditional public transport is 56 minutes, 47 minutes using TransMilenio, 25 minutes for the taxi, and 30 minutes using a motor bike. The average speed of cyclists is around 17k /h, the average distance a typical cyclist travel is 7 kilometers¹³.

[12] Alcaldía Mayor de Bogotá. Secretaría Distrital de Movilidad. *Bogotá en Bici*. Bogotá, August 5, 2010. <http://www.movilidadbogota.gov.co/?pag=278>

[13] Alcaldía Mayor de Bogotá. Secretaría Distrital de Movilidad. *En Bicicleta*. <http://www.movilidadbogota.gov.co/?sec=8>

4.1.3. How, When, Where and Why

Bogotá's Integrated Public Transport System aims to work as a single transport system through the whole Bogota's Metropolitan area. Using the *Transmilenio* System as a vertebral column of it, transporting the users from one point of the city to another, and using the rest of the system as a support to the main one.

A) How

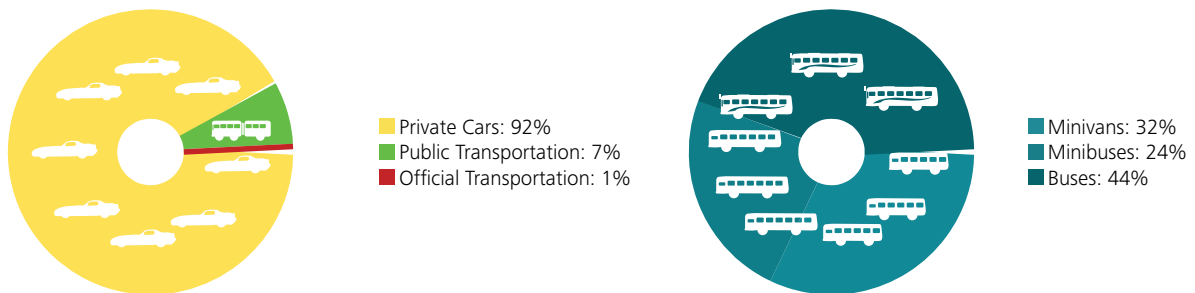
Graph 4.4 Bogota's Mobility modal split



Source: "La movilidad de Bogotá en Cifras" on *Caracol.com.co*. Bogotá, September 26, 2012. <http://www.caracol.com.co/noticias/bogota/la-movilidad-de-bogota-en-cifras/20120926/nota/1768489.aspx>

The most preferred way to move in Bogotá is by foot, and after that, most of the people move in buses. Followed are the cars, then the BRT's (Transmilenio) and at last the taxis.

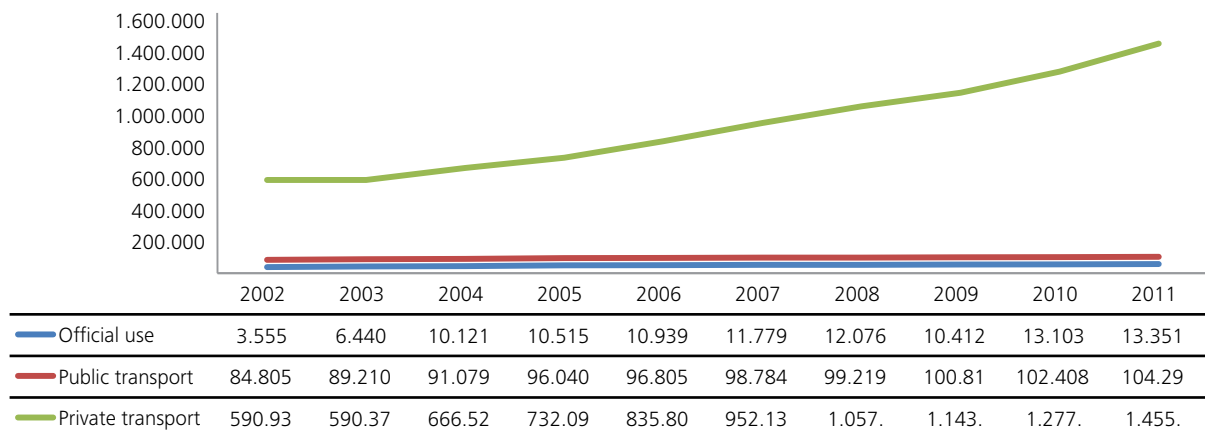
Graph 4.5 Bogota's Vehicle fleet split



Source: Alcaldía Mayor de Bogotá. Secretaría Distrital de Movilidad. *Movilidad en Cifras 2011*. Bogotá, 2011. Pp. 4,7. http://www.movilidadbogota.gov.co/habwebx_archivos/audio_y_video/boletin%20de%20cifras%2011-07-2012.pdf

But the vehicle fleet of Bogotá display different and almost inverse numbers, with private cars as the most quantity of vehicles moving in Bogotá.

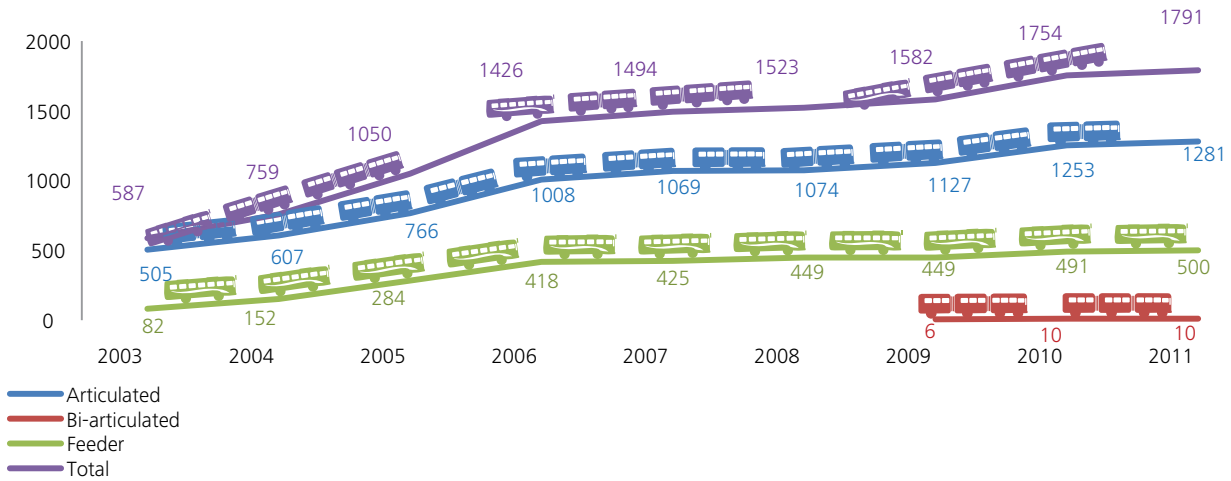
Graph 4.6 Bogota's Historical Vehicle fleet split



Source: Alcaldía Mayor de Bogotá. Secretaría Distrital de Movilidad. *Movilidad en Cifras 2011*. Bogotá, 2011. P. 4. http://www.movilidadbogota.gov.co/habwebx_archivos/audio_y_video/boletin%20de%20cifras%2011-07-2012.pdf

This tendency has been present since the last ten years. The only difference is that the car rate has been growing exponentially. Despite that factor, the Municipality of Bogotá has implemented actions in order to increase their public transportation fleet as well. Measures include the introduction of Bi-articulated buses to their Integrated Public Transport System.

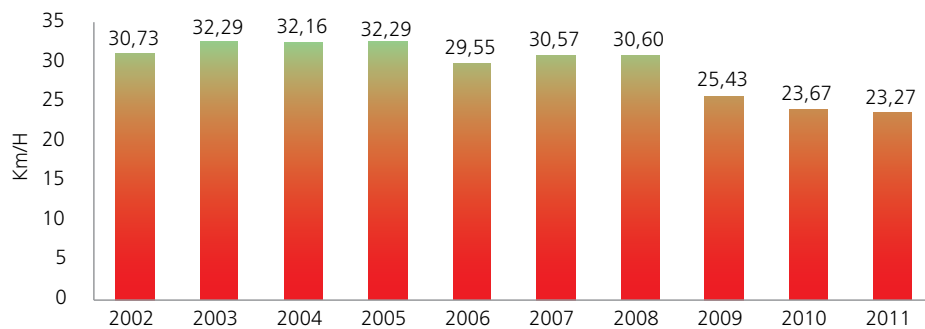
Graph 4.7 Bogota's Public Transport System Historic Modal Split.



Source: Alcaldía Mayor de Bogotá. Secretaría Distrital de Movilidad. *Movilidad en Cifras 2011*. Bogotá, 2011. P. 8. http://www.movilidadbogota.gov.co/habwebx_archivos/audio_y_video/boletin%20de%20cifras%2011-07-2012.pdf

During this last years, the average speed of the vehicles has had major ups and downs, following an improvement on the first years of the implementation of the Transmilenio System, a decrease tendency starts mostly by 2006. This tendency hasn't been able to change.

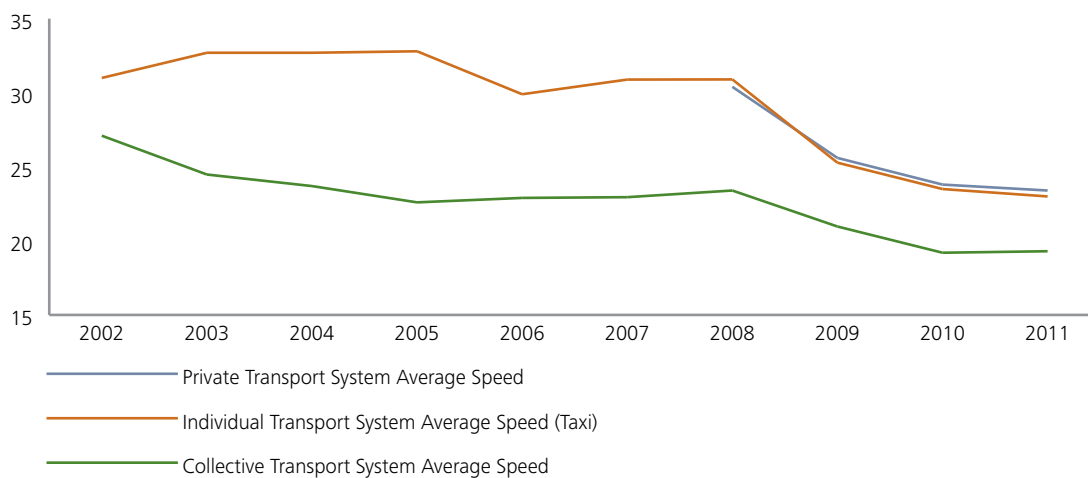
Graph 4.8 Bogota's Historic Average Speed



Source: Alcaldía Mayor de Bogotá. Secretaría Distrital de Movilidad. *Movilidad en Cifras 2011*. Bogotá, 2011. P. 16. http://www.movilidadbogota.gov.co/habwebx_archivos/audio_y_video/boletin%20de%20cifras%2011-07-2012.pdf

Despite the decrease of the average speed, there's the presence of this tendency for a private transport system with a higher average speed than the Public Transport System.

Graph 4.9 Bogota's Historic Average Speed per Transport System

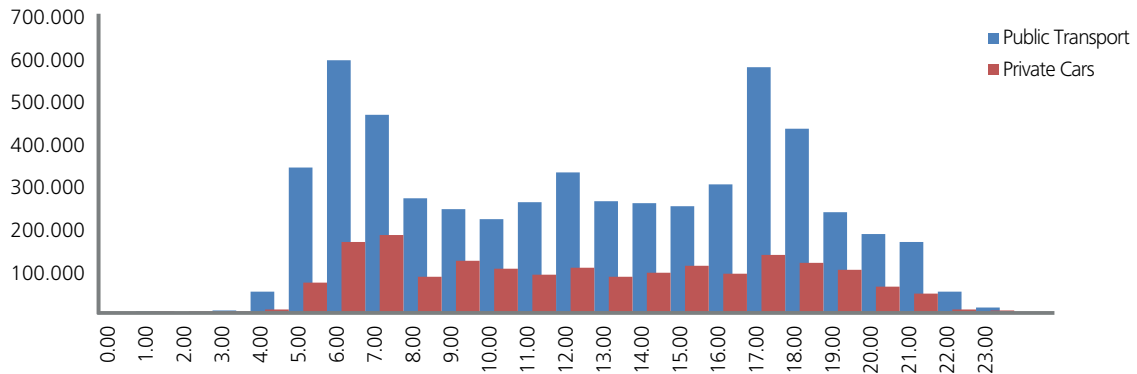


Source: Alcaldía Mayor de Bogotá. Secretaría Distrital de Movilidad. *Movilidad en Cifras 2011*. Bogotá, 2011. P. 18. http://www.movilidadbogota.gov.co/habwebx_archivos/audio_y_video/boletin%20de%20cifras%2011-07-2012.pdf

B) When

Depending on the type of service, the system reaches a 24hr serving schedule on the Public Transport Integrated System. This gives great possibilities for the people to move elsewhere in safe and organized conditions, although a considerable movement of people is seen from 4am. From that point till the 23hr, a whole cycle of journeys are displayed inside the Metropolitan area.

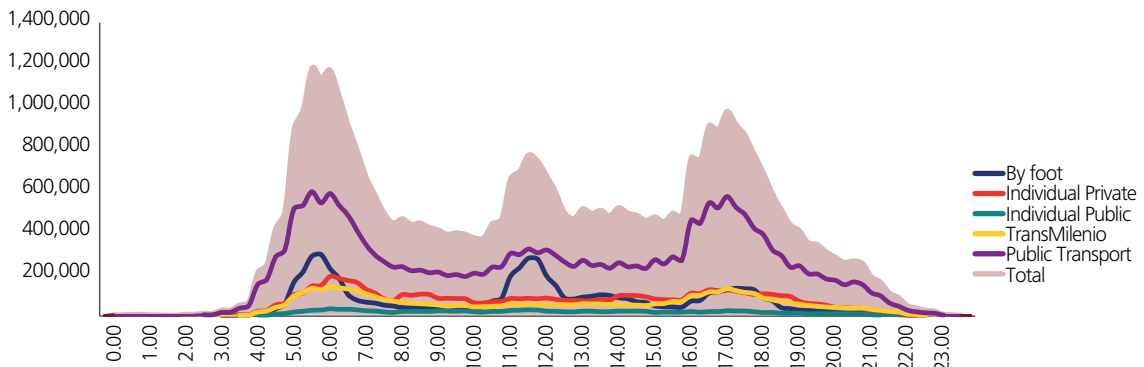
Graph 4.10 Bogota's Journey Volumes per Hour and Transport Mode



Source: Alcaldía Mayor de Bogotá. *Diseño Conceptual De La Red De Transporte Masivo Metro Y Diseño Operacional, Dimensionamiento Legal Y Financiero De La Primera Línea Del Metro En El Marco Del Sistema Integrado De Transporte Publico-Sitp- Para La Ciudad De Bogotá. Nota Técnica. Modelo De Transporte Mejorado.* Bogotá, December 2009. P. 67. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>

Interestingly, what we can see during a regular day is the presence of three peaks, one in the morning ranging from 5-7, the second from 11-13, and a last one from 16-19. What's even more interesting is the fact that this does transcend the transport mode the people chooses. Therefore, the same journey patterns are present, mostly with journeys done with the public transport, and in second place the pedestrians. Even the least quantity of journeys, done in this case with private cars, follow the same path.

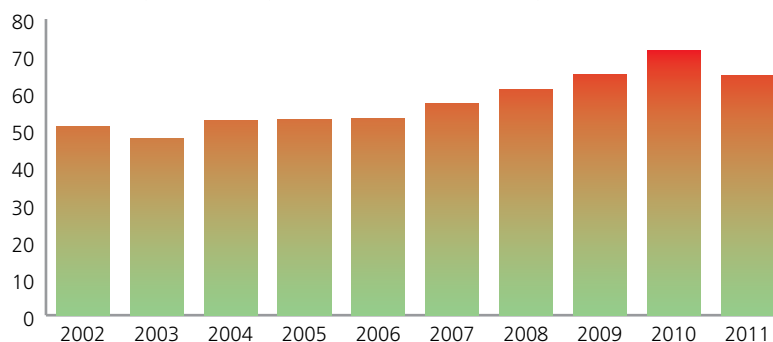
Graph 4.11 Bogota's Total Distribution of Journeys per Hour and Type



Source: Alcaldía Mayor de Bogotá. *Diseño Conceptual De La Red De Transporte Masivo Metro Y Diseño Operacional, Dimensionamiento Legal Y Financiero De La Primera Línea Del Metro En El Marco Del Sistema Integrado De Transporte Publico-Sitp- Para La Ciudad De Bogotá. Producto No. 1. Documento de Diagnóstico.* Bogotá, December 2009. P. 238. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>

Indistinctly from the daily patterns, there has been a strong tendency to increment the commuting time periods inside the city. The lowest time periods are recorded in 2003, three years after the inauguration of the TransMilenio System, with an average of 47 minutes recorded. But seven years later, by 2010, this amount of time gets increased by more than 50%, reaching 71 minutes the average commute time.

Graph 4.12 Bogota's Average Journey Time Period History



Source: Alcaldía Mayor de Bogotá. Secretaría Distrital de Movilidad. *Movilidad en Cifras 2011.* Bogotá, 2011. P. 19. http://www.movilidadbogota.gov.co/hiwebx_archivos/audio_y_video/boletin%20de%20cifras%2011-07-2012.pdf

C) Where

The origins of public transport trips are usually on the outskirts, and to be specific, in the western part of the city of Bogotá, opposite to the center of the capital. On the other hand, the origins of private trips are scattered a bit more homogeneous in the east and closer to the City Centre.

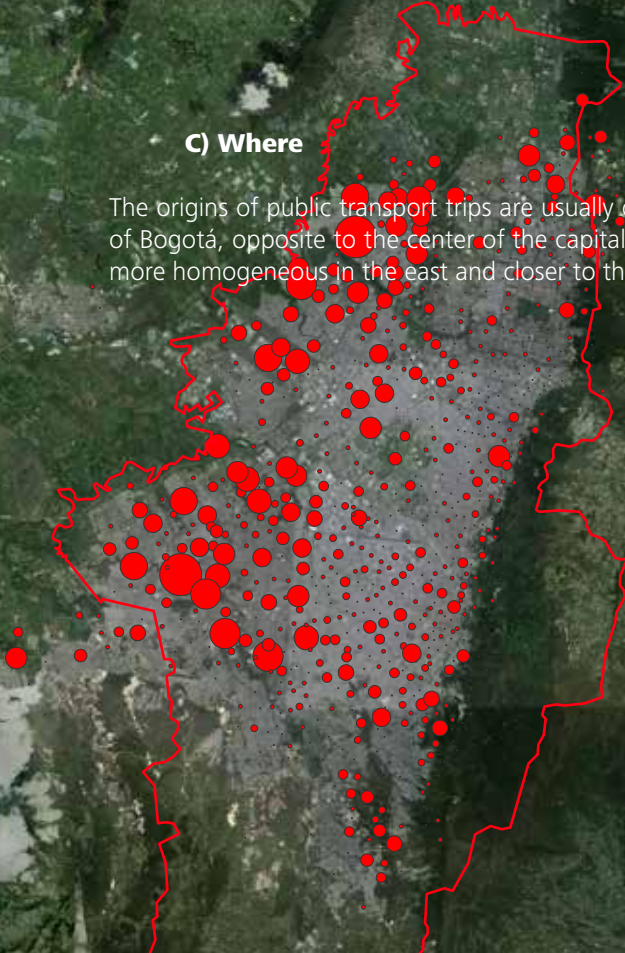


Fig. 4.14 Bogotá's Public Transport Journey Origins.

Source: Steer Davis Gleave. *Revisión, Actualización y Calibración del Modelo de Transporte de Cuatro (4) Etapas de Bogotá y la Región Capital. Informe 3.* Bogotá D.C., August 2011. Annex C1. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>

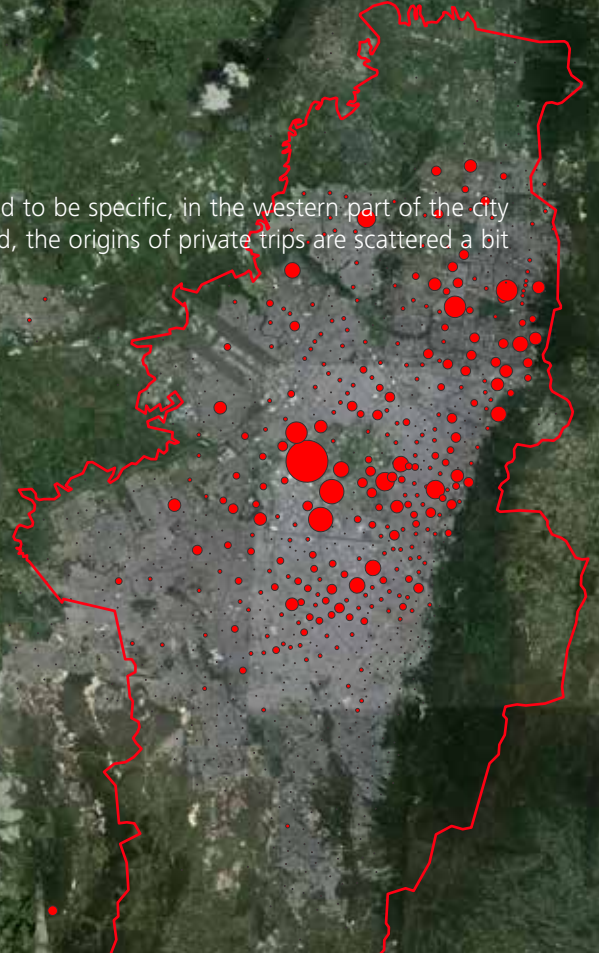


Fig. 4.15 Bogotá's Private Transport Journey Origins.

Source: Steer Davis Gleave. *Revisión, Actualización y Calibración del Modelo de Transporte de Cuatro (4) Etapas de Bogotá y la Región Capital. Informe 3.* Bogotá D.C., August 2011. Annex C2. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>

The destinations of travel by public transport have a tendency to concentrate in the central part of the capital, which is located in the eastern part of the metropolitan area. Instead the private travel destinations are, again, much more dispersed, although there is a trend towards concentration in the City Centre.

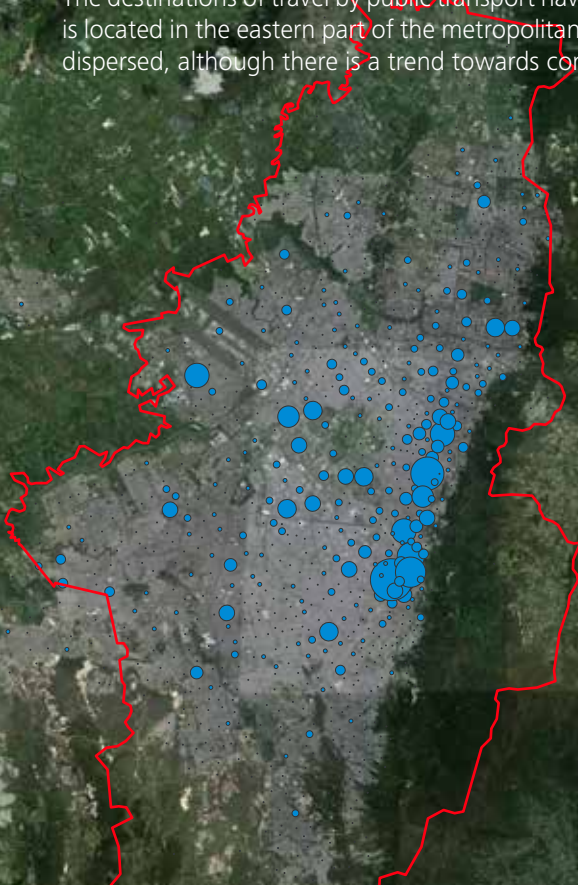


Fig. 4.16 Bogotá's Public Transport Journey Destinations.

Source: Steer Davis Gleave. *Revisión, Actualización y Calibración del Modelo de Transporte de Cuatro (4) Etapas de Bogotá y la Región Capital. Informe 3.* Bogotá D.C., August 2011. Annex C3. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>

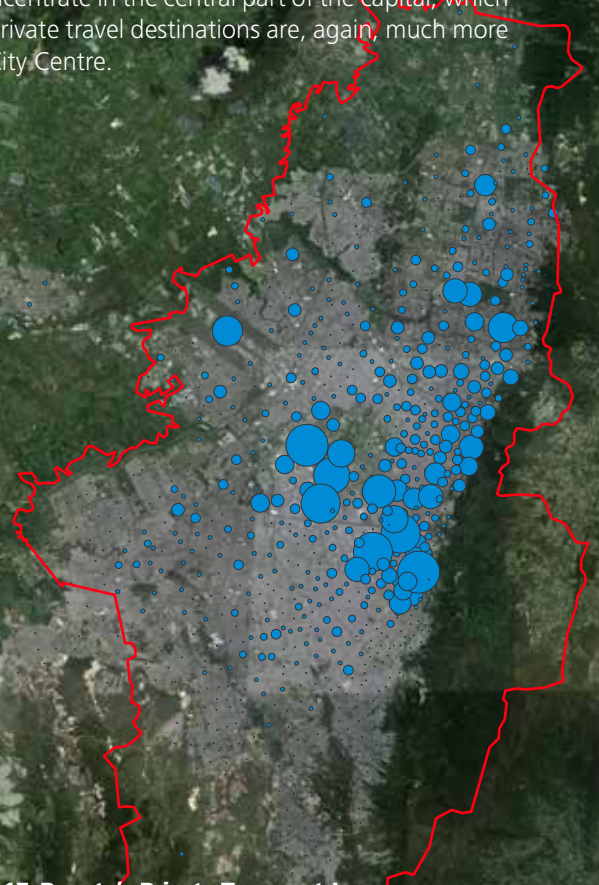


Fig. 4.17 Bogotá's Private Transport Journey Destinations.

Source: Steer Davis Gleave. *Revisión, Actualización y Calibración del Modelo de Transporte de Cuatro (4) Etapas de Bogotá y la Región Capital. Informe 3.* Bogotá D.C., August 2011. Annex C4. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>

Having in consideration the origin and destination patterns, various average travel times are seen in this map, depending on the location of people in the City. In general there's a tendency where the closer location is to the center, a smaller commute time will be present.

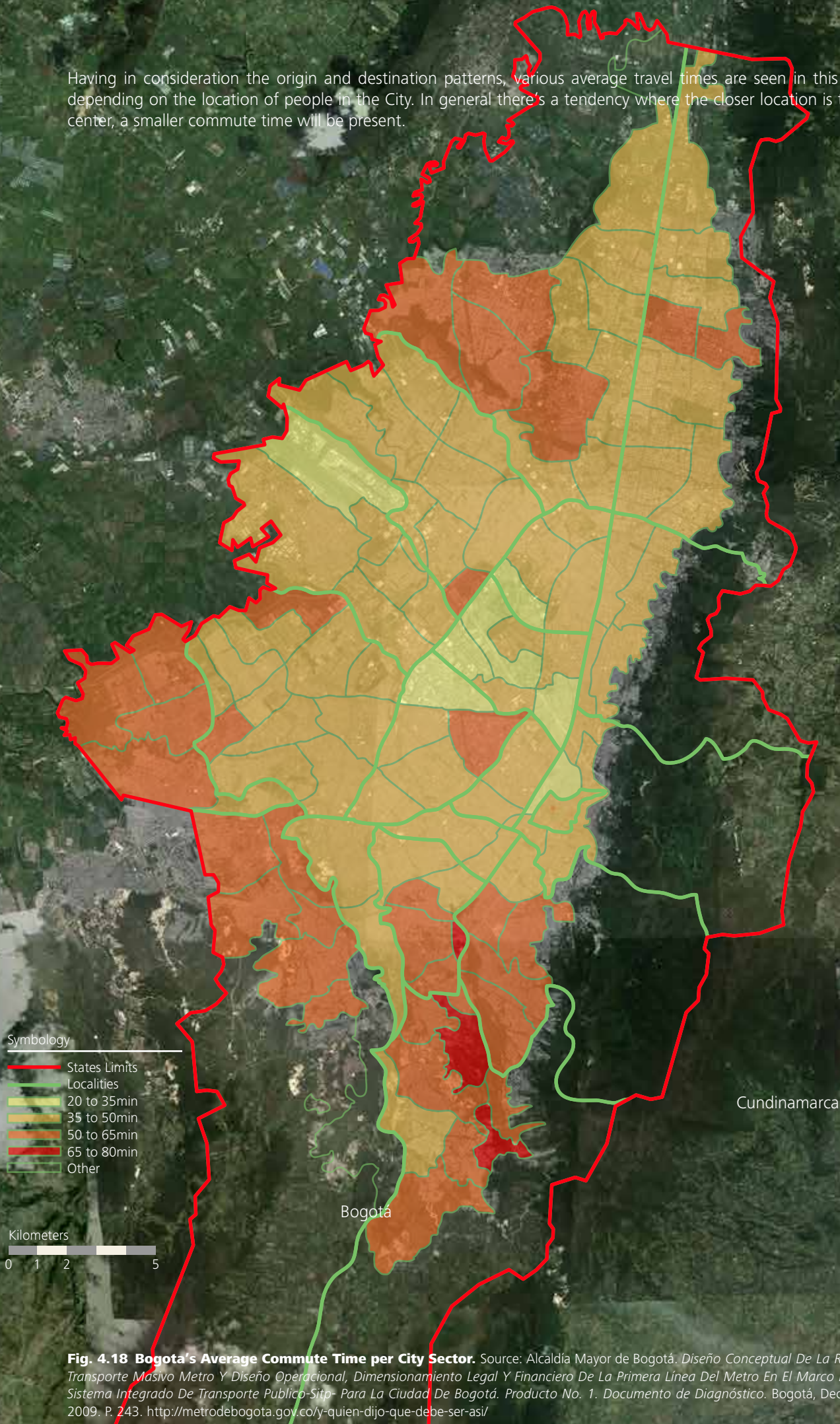


Fig. 4.18 Bogotá's Average Commute Time per City Sector. Source: Alcaldía Mayor de Bogotá. *Diseño Conceptual De La Red De Transporte Masivo Metro Y Diseño Operacional, Dimensionamiento Legal Y Financiero De La Primera Línea Del Metro En El Marco Del Sistema Integrado De Transporte Publico-Sito- Para La Ciudad De Bogotá.* Producto No. 1. Documento de Diagnóstico. Bogotá, December 2009. P. 243. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>

It seems that the origin and destination patterns also influence the distance to travel inside the city, because based on the location of a person in the city depends the average distance you can travel. Again, the closer a person to the city center, a less travel distance will be present.

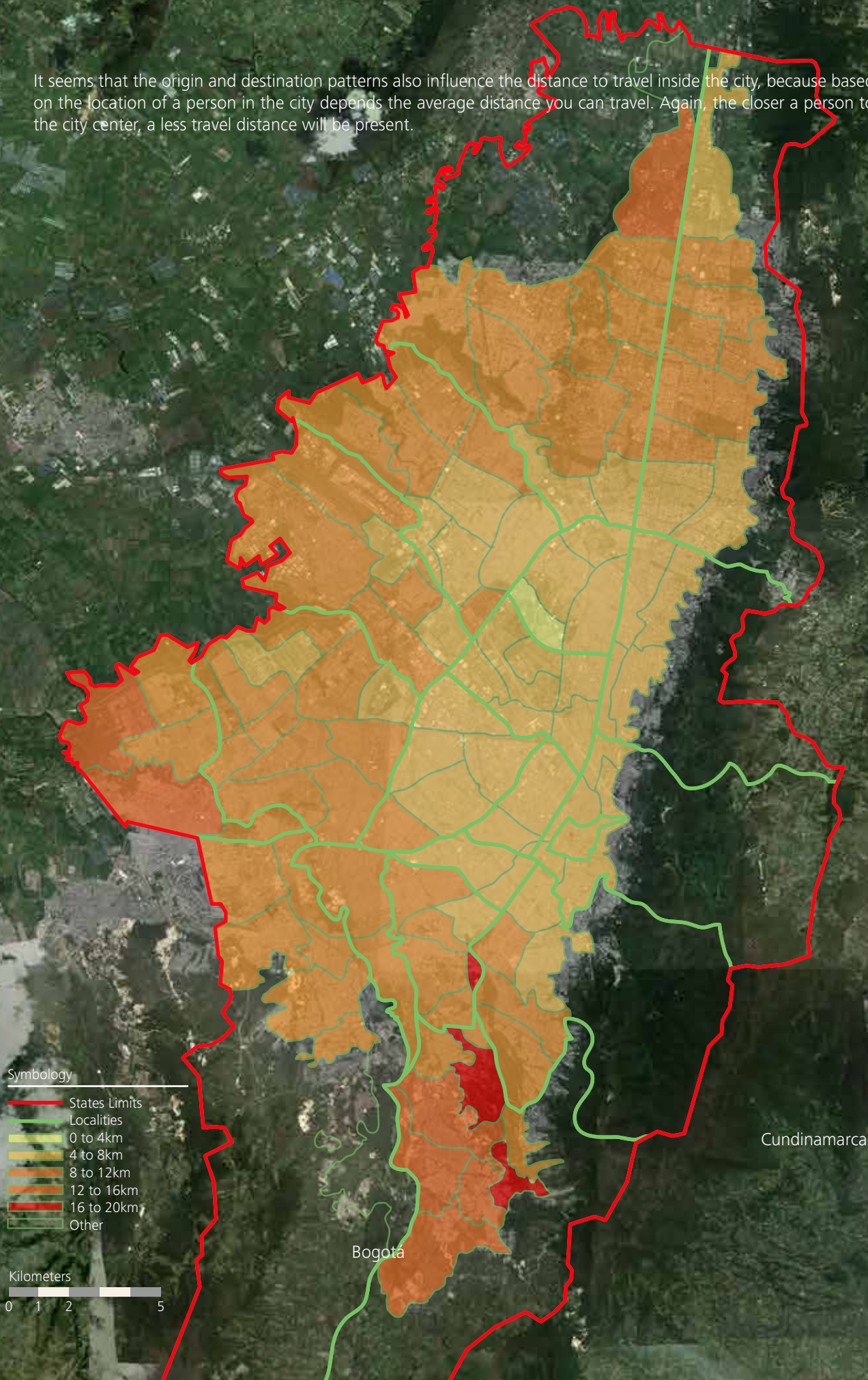
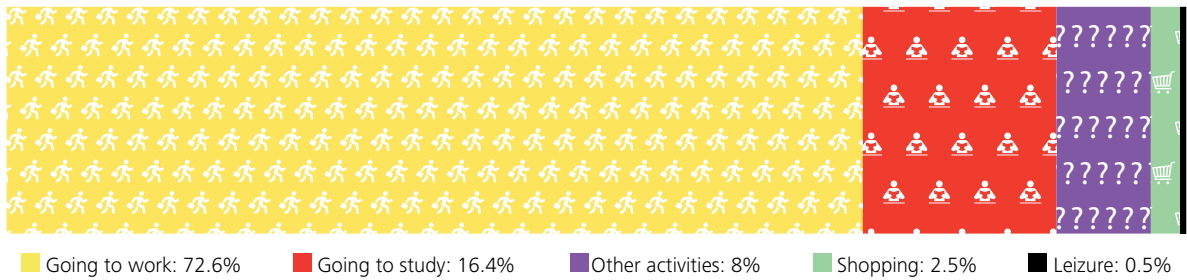


Fig. 4.19 Bogotá's Average Commute Distance per City Sector. Source: Alcaldía Mayor de Bogotá. *Diseño Conceptual De La Red De Transporte Masivo Metro Y Diseño Operacional, Dimensionamiento Legal Y Financiero De La Primera Línea Del Metro En El Marco Del Sistema Integrado De Transporte Publico-Sitp- Para La Ciudad De Bogotá. Nota Técnica. Modelo De Transporte Mejorado.* Bogotá, December 2009. P. 67. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>

D) Why

Graph 4.13 Bogota's Travel Split per Activity

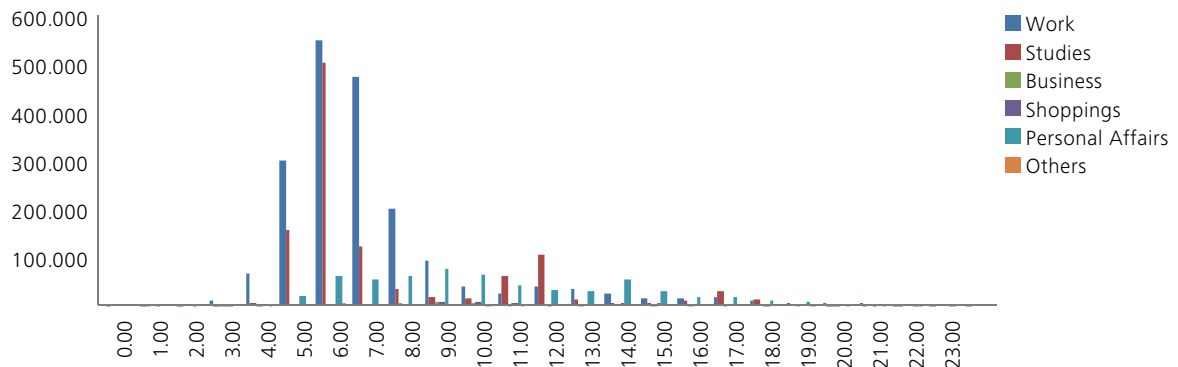


Source: Alcaldía Mayor de Bogotá. Secretaría Distrital de Movilidad. *Movilidad en Cifras 2011*. Bogotá, 2011. Pp. 19. http://www.movilidadbogota.gov.co/hiwebx_archivos/audio_y_video/boletin%20de%20cifras%2011-07-2012.pdf

The main reason to move inside Bogotá is to go to the workplace, with 72.6% of the trips done solely for that purpose. Other main activities involving transport are to go to the school, to go shopping, or for leisure activities.

Although these percentages are present inside the city, the quantity differs depending on the moment of the day and the departure place of the journey. Most of the journeys started in the houses have as a primary destination the workplace and schools. And most of the people do these commutes on a time between 4 to 8am.

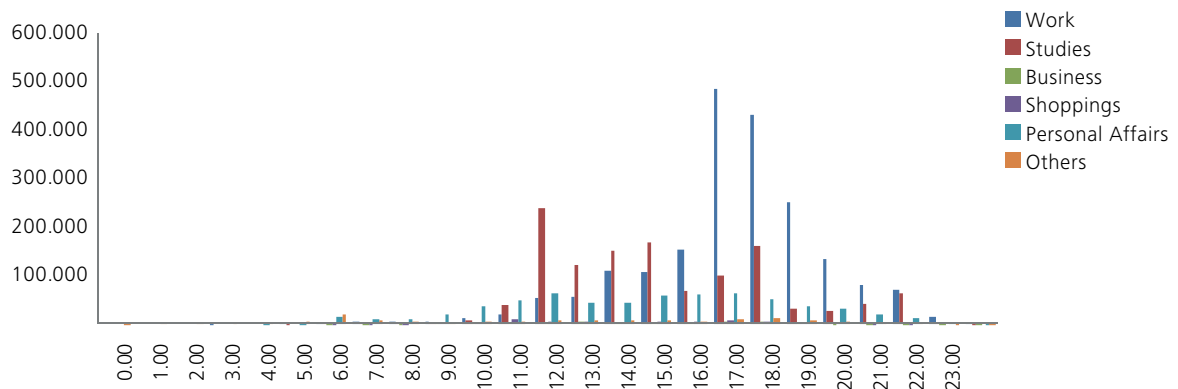
Graph 4.14 Bogota's Motif of Journeys Split (starting those from the Home) per Hour of Day



Source: Alcaldía Mayor de Bogotá. *Diseño Conceptual De La Red De Transporte Masivo Metro Y Diseño Operacional, Dimensionamiento Legal Y Financiero De La Primera Línea Del Metro En El Marco Del Sistema Integrado De Transporte Publico-Sitp- Para La Ciudad De Bogotá. Nota Técnica. Modelo de Transporte Mejorado*. Bogotá, December 2009. P. 62. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>

There's a similar (yet mirroring) behavior with journeys whose destinations are the houses. Most of the commuters are located in the workplace or the schools, and most of the journeys are done in a time from 15 to 20hr. Although now there's a slight different trend regarding the students, since most of their commutes are distributed along a period from 12 to 22hr.

Graph 4.15 Bogota's Motif of Journeys Split (with the Home as destination) per Hour of Day



Source: Alcaldía Mayor de Bogotá. *Diseño Conceptual De La Red De Transporte Masivo Metro Y Diseño Operacional, Dimensionamiento Legal Y Financiero De La Primera Línea Del Metro En El Marco Del Sistema Integrado De Transporte Publico-Sitp- Para La Ciudad De Bogotá. Nota Técnica. Modelo de Transporte Mejorado*. Bogotá, December 2009. P. 62. <http://metrodebogota.gov.co/y-quien-dijo-que-debe-ser-asi/>

4.1.4. Urban Intermodality and Architecture

By definition, the Public Space is understood as all the areas needed to support the mobility, whether it is pedestrian, automobile or public transport, or others. But it is as well the parks, pedestrian paths, squares, among other types of spaces, and the furniture needed for the use of those. The Municipality of Bogotá is in charge of the creation and maintenance of those, and the office in charge of these matters is the District Planning Secretary¹⁴.

[14] Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. *Espacio Público*. Bogotá, 2014. <http://www.sdp.gov.co/portal/page/portal/PortalSDP/OrdenamientoTerritorial/EspacioPublico/QueEs>

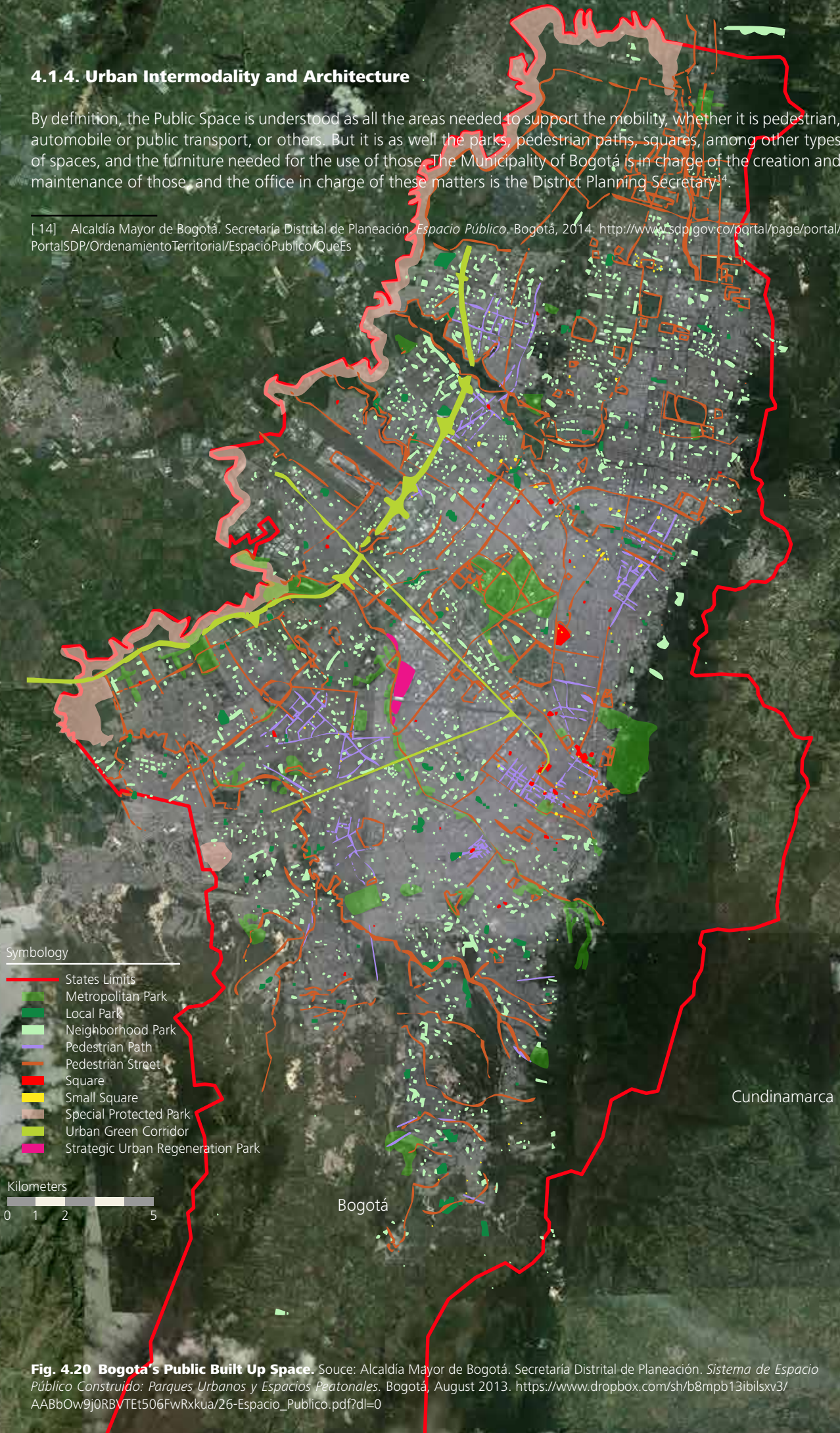


Fig. 4.20 Bogotá's Public Built Up Space. Source: Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. *Sistema de Espacio Público Construido: Parques Urbanos y Espacios Peatonales*. Bogotá, August 2013. https://www.dropbox.com/sh/b8mpb13ibilsxv3/AABbOw9j0RBVTt506FwRxkua/26-Espacio_Publico.pdf?dl=0

A) Metropolitan Park¹⁵

Free areas with a surface above 10 hectares with amusing uses, and for the generation of landscape and environmental values whose influence covers the whole city.



Fig. 4.21 Simón Bolívar Park. Maps.google.com



Fig. 4.22 Access to Simón Bolívar Park. Maps.google.com

B) Local Park¹⁶

Free areas with a surface ranging from 1 to 10 hectares with amusing uses for the particular needs of a certain neighborhood, such as sports centers, pools, playgrounds, skate parks, among others.

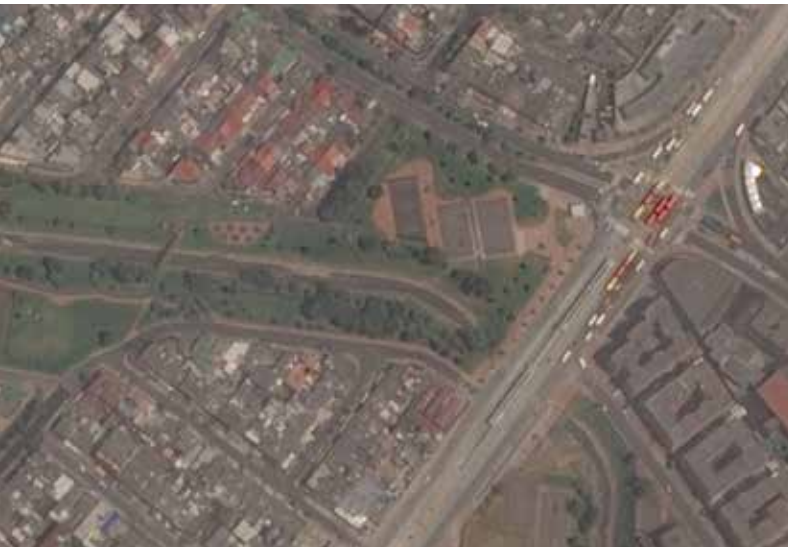


Fig. 4.23 South Garden City Park. Maps.google.com



Fig. 4.24 South Garden City Park Access. Maps.google.com

[15] Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. *Parques Distritales*. Bogotá, 2014. <http://www.sdp.gov.co/portal/page/portal/PortalSDP/OrdenamientoTerritorial/EspacioPublico/Sistema%20de%20Espacio%20P%20FAblico/Parques%20Distritales.pdf>

[16] Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. *Parques Distritales*. Bogotá, 2014. <http://www.sdp.gov.co/portal/page/portal/PortalSDP/OrdenamientoTerritorial/EspacioPublico/Sistema%20de%20Espacio%20P%20FAblico/Parques%20Distritales.pdf>

C) Neighborhood Park¹⁷

Free areas for the recreation, reunion and integration of the community, covering the particular needs of a certain neighborhood.



Fig. 4.25 Ángeles 3 Neighborhood Park. Maps.google.com



Fig. 4.26 Ángeles 3 Neighborhood Park. Maps.google.com

D) Pedestrian Path¹⁸

The pedestrian paths aims to improve the mobility conditions and to diminish the pollution levels. It pursuits as well the acknowledgment of the environment with the improvement of the quality of life of the people living in those surroundings. These pedestrian paths form part of the “many ways to arrive” that are currently developing in Bogotá, to achieve the urban intermodality: the use of both, motorized and no motorized transport modes to move inside the city.

E) Pedestrian Street¹⁹

Public spaces, or wide pedestrian paths arranged with trees and in most times with a bicycle path. It’s purpose is the spreading and recreation of pedestrians.



Fig. 4.27 Pedestrian Path on Carrera 15. Maps.google.com



Fig. 4.28 Pedestrian Street on Carrera 13. Maps.google.com

[17] Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. *Parques Distritales*. Bogotá, 2014. <http://www.sdp.gov.co/portal/page/portal/PortalSDP/OrdenamientoTerritorial/EspacioPublico/Sistema%20de%20Espacio%20P%20Fablico/Parques%20Distritales.pdf>
[18] Alcaldía Mayor de Bogotá. Instituto de Desarrollo Urbano. *Redes Peatonales*. Bogotá, 2014. http://www.idu.gov.co/web/guest/espacio_redes
[19] Alcaldía Mayor de Bogotá. Instituto de Desarrollo Urbano. *Alamedas*. Bogotá, 2014. http://www.idu.gov.co/web/guest/espacio_alamedas

F) Square and Small Square²⁰

Public spaces areas designed as a hard zone, aiming to the spreading and joy of the population. The main difference between each other is the extension of the square: a square covers a whole block, while a small square only uses half block.



Fig. 4.29 Nemesio Camacho Stadium Square. Maps.google.com



Fig. 4.30 Rosario Small Square. Maps.google.com

G) Urban Elements Standards and Guidelines

The City of Bogotá has developed a series of regulations that determines the physical, material and constructive elements of each of the public spaces. Such regulations are set into two inventories:

Pedestrian Paths and Streets Inventory²¹

This document, presented in a series of maps and drawings, shows the diverse types of configurations of pedestrian paths and streets. The document is organized in three parts: prefabricated elements, typical sets and constructive processes. On the first part, prefabricated elements, are well detailed each and every one of the elements conforming the public spaces. Colors, materials, designs, dimensions are well explained both in words and with drawings. The second part, typical sets, are enumerated diverse configurations of pedestrian paths and streets. This part features as well diverse configurations of their Street Sections of the Bogotá Paths Network. On the third part is enumerated some basic construction principles.

This document, although it aims to be a guideline for the proposal of pedestrian paths, states well that it does not substitute the need of a spatial and architectural design of such spaces.

Urban Furniture Inventory²²

This document, as well presented in a series of maps and drawings, shows diverse types of urban furniture as well as its materials, certain placing principles and typical urban layouts. This document is organized in three parts: the first one details each and every one of the urban furniture, its materials and dimensions. The second part features a series of typical configurations with some placement guidelines. The third part shows some example layout of such furniture placed inside the streets.

[20] Alcaldía Mayor de Bogotá. Instituto de Desarrollo Urbano. *Plazas y Plazoletas*. Bogotá, 2014. http://www.idu.gov.co/web/guest/espacio_plazas

[21] Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. Taller de Espacio Público. *Cartilla de Andenes*. Bogotá, 2007. <http://www.idu.gov.co/html/ftp/Manual/CARTILLA%20DE%20ANDENES%20-2007.pdf>

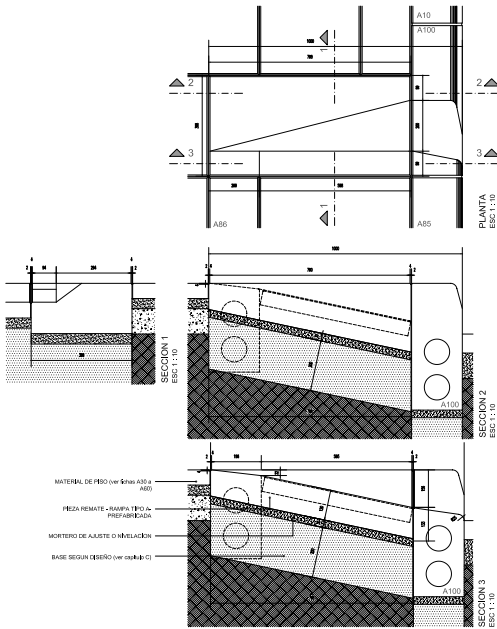
[22] Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. Taller de Espacio Público. *Cartilla de Mobiliario Urbano*. Bogotá, 2007. http://www.idu.gov.co/html/ftp/Manual/CARTILLA_MOBILIARIO-2007.pdf

Cartilla de Andenes

Secretaría Distrital de Planeación
Taller del Espacio Público

Pieza de Remate -Rampa Vehicular Tipo A

A 105



Descripción
Pieza prefabricada en concreto de 20 MPa de módulo de rotura a 28 días, con acabado liso. Se instala sobre una capa de hormón de nivelación con protección de capa de juntas de construcción de espesor mínimo 20 mm, con juntas de construcción de juntas de construcción de espesor mínimo 20 mm, con juntas de construcción de juntas de construcción de espesor mínimo 20 mm.

Dimensiones nominales
800mm x 400mm x 270mm.

Dimensiones estándar
750mm x 350mm x 250mm.

Junta
Con.

Mantenimiento
Reemplazar si la base falla. Reemplazar en caso de rotura.

Desarrollado por
Taller del Espacio Público - SDP

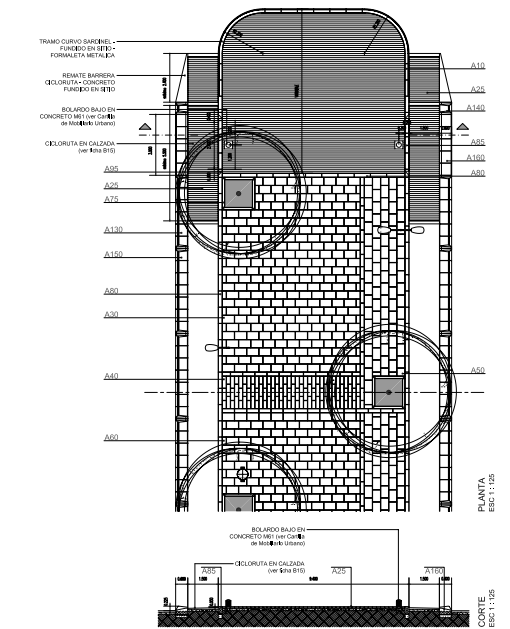
Características físicas y mecánicas
NORMA NTC: 4 105 Bascillo, curado y protección de concreto, PESO APROXIMADO: 11,4 Kg. MEDIDAS ETC. referencias

Cartilla de Andenes

Secretaría Distrital de Planeación
Taller del Espacio Público

Remate Alameda en Separador (con ciclo-ruta en calzada)

B 135



Descripción
Remate fabricado en aluminosilicato en separador, con acabado en aluminio, en el cual se incorporan elementos de protección. La zona del remate se construye en el mismo material de la calzada. En el momento de instalación se debe considerar el nivel de la calzada en la intersección, así como el vano posterior a través de la barrera prefabricada.

El elemento que se muestra en la foto es un ejemplo de aplicación del elemento. Pueden presentarse situaciones distintas siempre y cuando se respeten y aprovechen las características del elemento.

Referencias
Para información en cuanto a las características de los planes, ver los ficheros respectivos en el capítulo A. Para información sobre los materiales constructivos, ver los ficheros respectivos en el capítulo C. Para información sobre análisis y características de los elementos de mobiliario, ver el capítulo de Mobiliario Urbano.

Medidas ETC. referencias

Desarrollado por
Taller del Espacio Público - SDP

Cartilla de Andenes

Secretaría Distrital de Planeación
Taller del Espacio Público

Ciclo-ruta - vía -V-2A Troncal Ciclo-ruta - Vía -V-2B

V 2



Descripción
Elemento prefabricado en concreto de 20 MPa de módulo de rotura a 28 días, con acabado liso. Se instala sobre una capa de hormón de nivelación con protección de capa de juntas de construcción de espesor mínimo 20 mm, con juntas de construcción de juntas de construcción de espesor mínimo 20 mm.

Dimensiones nominales
800mm x 400mm x 270mm.

Dimensiones estándar
750mm x 350mm x 250mm.

Junta
Con.

Mantenimiento
Reemplazar si la base falla. Reemplazar en caso de rotura.

Desarrollado por
Taller del Espacio Público - SDP

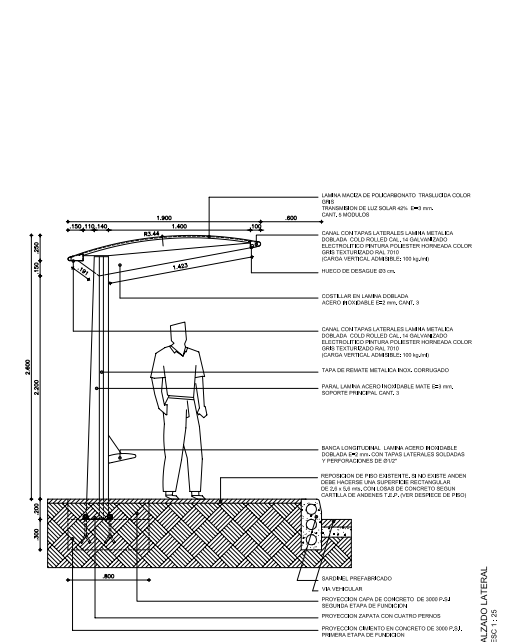
Características físicas y mecánicas
NORMA NTC: 4 105 Bascillo, curado y protección de concreto, PESO APROXIMADO: 11,4 Kg. MEDIDAS ETC. referencias

Cartilla de Mobiliario Urbano

Secretaría Distrital de Planeación
Taller del Espacio Público

Paradero

M 10



Descripción
Este elemento de mobiliario urbano está diseñado para ser instalado en zonas de tránsito de alto flujo de personas. El elemento está compuesto por una estructura metálica en acero inoxidable y una cubierta fabricada en policarbonato.

Este elemento de mobiliario urbano está diseñado para ser instalado en zonas de tránsito de alto flujo de personas. El elemento está compuesto por una estructura metálica en acero inoxidable y una cubierta fabricada en policarbonato.

Materiales
Estructura en Acero Inoxidable. Cubierta en Policarbonato.

Acabados
Acero inoxidable mate. Policarbonato transparente.

Mantenimiento
Se debe cuidar el acero en caso de ser roto o dañado. Se debe cuidar el policarbonato en caso de ser roto o dañado.

Instalación
Se debe instalar sobre una base de concreto de 200 mm de espesor y 100 cm de ancho sobre la calzada. Se deben instalar los postes de iluminación en los puntos de apoyo de la estructura.

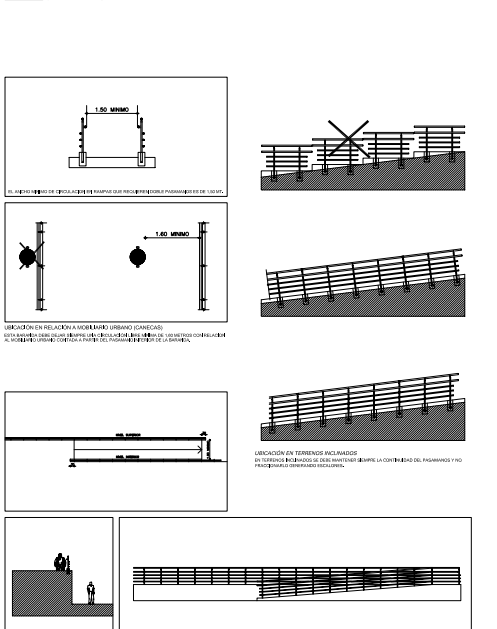
Anotaciones
NOTA: El elemento de mobiliario urbano está diseñado para ser instalado en zonas de tránsito de alto flujo de personas. El elemento está compuesto por una estructura metálica en acero inoxidable y una cubierta fabricada en policarbonato.

Cartilla de Mobiliario Urbano

Secretaría Distrital de Planeación
Taller del Espacio Público

Baranda de tres tubos -Movilidad reducida

M 82



Recomendaciones de ubicación
Es importante que la baranda se instale siempre sobre un firme firme de 20 cm de espesor de concreto armado de 20 MPa de módulo de rotura a 28 días, con acabado liso. Se instala sobre una capa de hormón de nivelación con protección de capa de juntas de construcción de espesor mínimo 20 mm, con juntas de construcción de juntas de construcción de espesor mínimo 20 mm.

Cuando se use la baranda en descensos, la base en concreto se debe instalar sobre una base de concreto de 200 mm de espesor y 100 cm de ancho sobre la calzada. Se deben instalar los postes de iluminación en los puntos de apoyo de la estructura.

Cartilla de Andenes

Secretaría Distrital de Planeación
Taller del Espacio Público

Cruce

MEA40

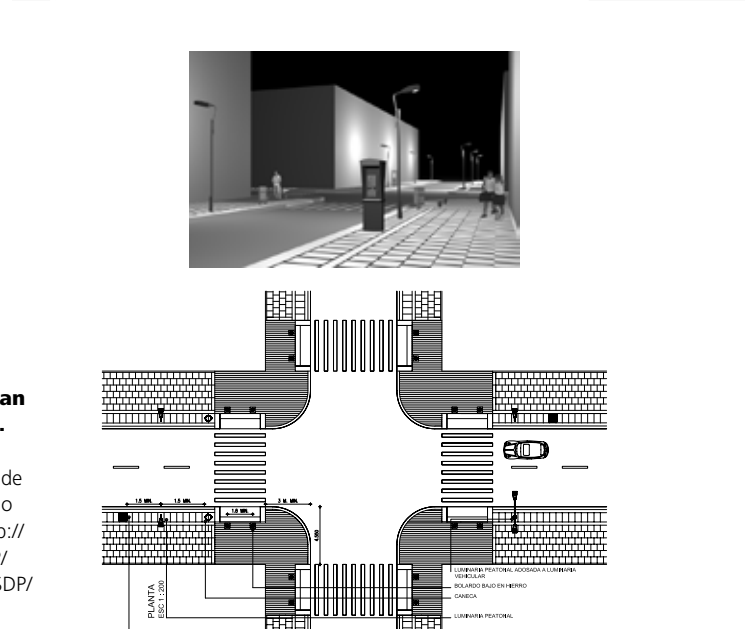


Fig. 4.31 Extracts of the "Pedestrian Paths and Streets" and "Urban Furniture" Inventories.
Source: Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. Taller de Espacio Público. Bogotá, 2007. http://www.sdp.gov.co/PortalSDP/ciudadania/Publicaciones_SDP/PublicacionesSDP

H) Influence of Public Transport System and Architecture towards each other²³

Since its conception, the infrastructure of Transmilenio has not only included the solely transport system infrastructure, but as well considered others to contribute to the transformation of the city as an urban organizer. In this case are included the exclusive lanes and mixed traffic ones, rehabilitation of roads for feeder routes, public spaces (sidewalks, squares and bike paths), stations, and intersections that both the Transmilenio system and the city need to allow the exclusive lanes operate in efficient conditions.

The Public Transport System fall under the concept of high-density housing in order to concentrate demand service in nearby corridors in which they operate. With this high-density approach, nearby public space to the stations must compensate the high demand of users.

The Public Transport System requires public space design for it. The main transformation that produces a Public Transport System in urban areas is the occupation of public space, especially by the profile of the trunk roads, if the system is a surface level one, like the BRT. Giving the priority to the pedestrian as the only actor of mobility that accompanies Transmilenio has translated in architectural transformations that stands out the mass transit system as its cause.

The stations of the transport system requires accompanying pedestrian walkways in adequate service conditions, which allow users to access in quality conditions. In areas where Transmilenio operates, pedestrian infrastructure of station access from nearby areas ($\leq 500\text{m}$) forms part of an integral concept of "pedestrian mobility" which invites users to move to and from various stations "on foot".

The dual combination (Public Transport System and pedestrian) motivates the visitor of the area to use mass transit with the security of having spaces that facilitate a quality and enjoyable walking. This, understanding the term pedestrian quality as depending on a spatial amplitude ($\geq 2\text{m}^2$) and rare interactions with vehicle intersections.

In the case of an access level by a pedestrian crossing the road profile of the Transmilenio occupies a street section of 19 meters which includes lanes (7 meters by road) plus the space station (5 meters). In this case, the pedestrian is level access is through stoplight intersections, without requiring space for installing special access platforms through steps or ramps.



Fig. 4.32 High-density buildings on Caracas Avenue and 127th Street Station featuring pedestrian crossing design with a level access. Maps.google.com

An example of pedestrian access on a very busy avenue would be the NQS avenue. The high traffic flow and its consequent lack of crossings prevent pedestrian access to the stations by access level or with zebra crossings. This forces to establish structures that can be raised (as currently happens with pedestrian bridges) or underground (situation that would reduce the space occupied on the platform).

The infrastructure of bike paths is added to the pedestrian landscape fostering more open public spaces that allow more efficient mobility in terms of commute time to and from the stations, in a context of greater security against vehicular traffic by having its own roads, therefore spatially segregated.

With regard to pollution it can be said that the displacement and replacement of public transport by the Transmilenio

[23] Urazán Bonells, Carlos Felipe *et al.* "Relación entre el espacio público y la infraestructura de un sistema de transporte masivo. Caso Transmilenio en Bogotá" on *Studiositas*. Volume 5, No. 2, August 2010. http://portalweb.ucatolica.edu.co/easyWeb2/files/21_5444_espacio-publico-e-infraestructura-trasmilenio.pdf



Fig. 4.33 Transmilenio elevated access to “El Campín” Station and bike path on a primary avenue. Maps.google.com.

System allowed significantly to reduce pollution levels during non-peak hours by regulating the number of buses in operation. Similarly, the use of new technologies in parallel with maintenance programs and defined stops makes the system a less polluting one.

4.1.5. Strengths and weaknesses of the system

A) Strengths

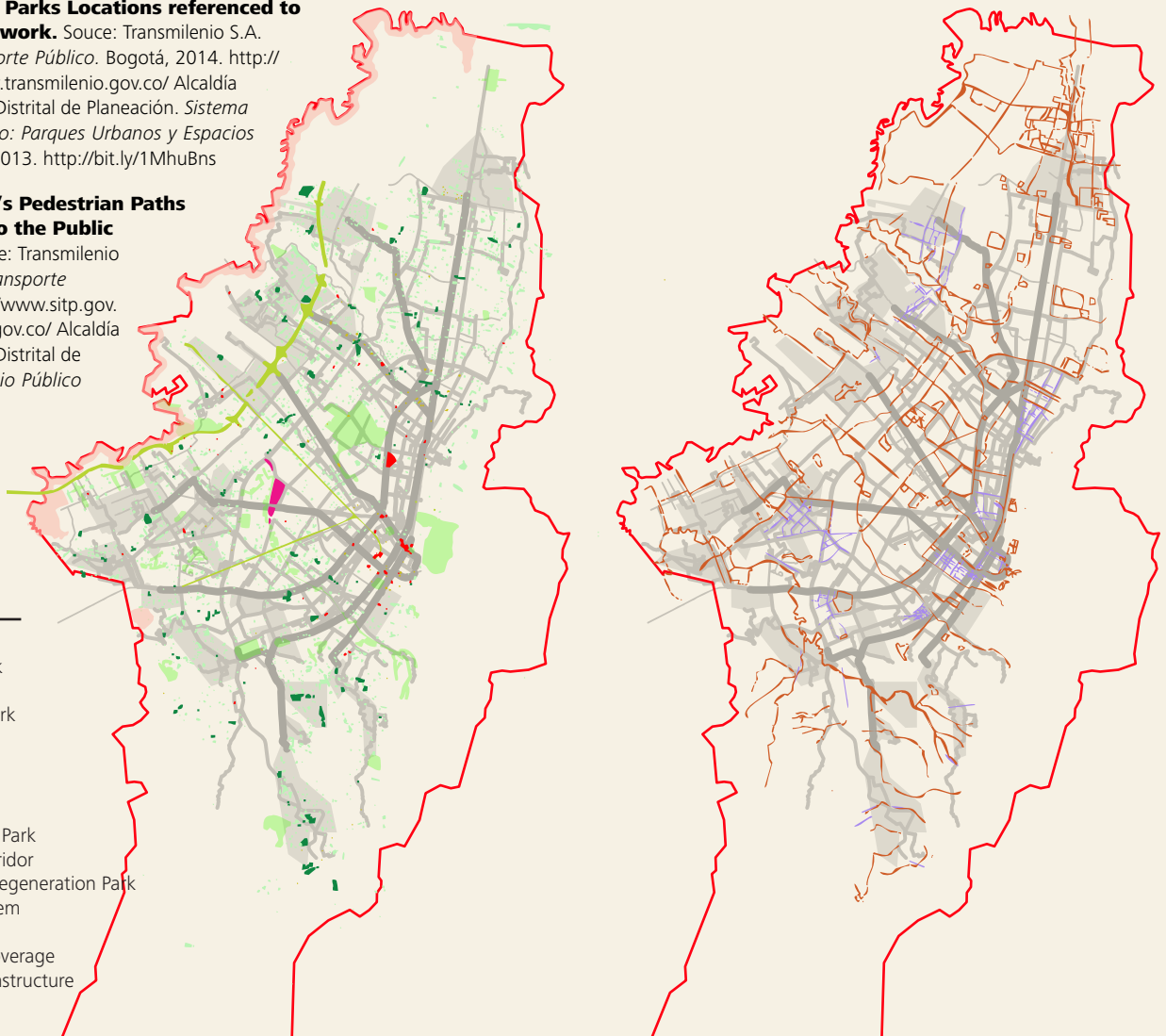
Mobility

The organization of the transport system, as well as public spaces in Bogotá, depend mostly of two regulations: the 2013 Land Use Plan and the Mobility Master Plan. In turn, these may stem from a number of regulations that are based on the citizen’s right to decent transportation and insurance, and the right to a healthy and safe environment. This aims to ensure a development of mobility alongside the public spaces²⁴.

[24] Alcaldía Mayor de Bogotá. *Formulación Del Plan Maestro De Movilidad Para Bogotá D.C. Marco de Referencia*. Bogotá, 2006. P.

Fig. 4.34 (Left) Bogota’s Parks Locations referenced to the Public Transport Network. Souce: Transmilenio S.A. *Sistema Integrado de Transporte Público*. Bogotá, 2014. <http://www.sitp.gov.co/> <http://www.transmilenio.gov.co/> Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. *Sistema de Espacio Público Construido: Parques Urbanos y Espacios Peatonales*. Bogotá, August 2013. <http://bit.ly/1MhuBns>

Fig. 4.35 (Right) Bogota’s Pedestrian Paths and Streets referenced to the Public Transport Network. Souce: Transmilenio S.A. *Sistema Integrado de Transporte Público*. Bogotá, 2014. <http://www.sitp.gov.co/> <http://www.transmilenio.gov.co/> Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. *Sistema de Espacio Público Construido: Parques Urbanos y Espacios Peatonales*. Bogotá, August 2013. <http://bit.ly/1MhuBns>



- Symbology
- States Limits
 - Metropolitan Park
 - Local Park
 - Neighborhood Park
 - Pedestrian Path
 - Pedestrian Street
 - Square
 - Small Square
 - Special Protected Park
 - Urban Green Corridor
 - Strategic Urban Regeneration Park
 - Transmilenio System
 - Urban Service
 - Feeder Service Coverage
 - Bicycle Paths Infrastructure

The mobility system in Bogotá consists of four subsystems, which makes the development of one linked to another²⁵: **Streets subsystem, Transport subsystem, Traffic regulation and control subsystem, and Pedestrian road subsystem.**

Among the objectives pursued, these are the main ones concerning transport and street design²⁶: structure the regional urban planning, strengthen the urban area, contain Bogotá's conurbation with neighboring municipalities through efficient connectivity with the city network, improve sector productivity, improve levels of accessibility to and from peripheral sectors of Bogotá, reduce environmental pollution levels from mobile sources, reduce travel times and vehicle operating costs, improve road safety and reduce accident rates, organize traditional public transport routes to avoid excess in the frequency and concentration of routes, and address the urban areas with higher connectivity deficiencies through local mobility corridors.

Due to the very way of operation of the Transmilenio system, which is based on journeys rather than lines, various travel configurations are originated in a practical, easy to configure and to use system. This results in a system with many more journey possibilities than just a ride on a line.

Public Spaces

There's a notorious presence and connection between the public spaces and the transport network. The constant presence of parks, squares (Fig. 4.34), pedestrian paths, pedestrian streets (Fig. 4.35), and other public spaces (reinforced by the main goals stated on their Plans and Laws) speak for a soon-to-be network of public spaces and public paths.

In Bogotá has recently been approved a new Land Use Plan, which (according to the Mayor of Bogotá) needed revision after seeing changes²⁷ in the population dynamics of the District, as well as mobility and the growth of the City. This plan is quite specific and deals with various topics such as urban areas, green, rural and urban development, to the detail design of various types of streets, sidewalks, crosswalks, among others.

Several improvements have been adopted in order to concentrate the population inside the city such as²⁸: easy access to housing in central areas of the city for low and middle class income families, uses mixing is introduced, and among other benefits there's a new mechanism in which the capital gain is directly applied to the public transport.

However, due to various differences between the government and several groups, this plan has been appealed in federal courts who have decided that up to today is suspended. This will cause the previous plan of 2000 remain in effect²⁹. There's no prevision to change this in a near future perspective.

B) Weaknesses

Mobility

However, currently in Bogotá are situations that compromise mobility and public spaces, such as³⁰:

- The public, individual and collective transport is inefficient because it operates under conditions of oversupply, overcrowding which contributes to increased congestion, pavement wear, accidents and pollution.

1-1. http://www.movilidadbogota.gov.co/hiwebx_archivos/ideofolio/01-MarcodeReferencia_14_51_27.pdf

[25] Alcaldía Mayor de Bogotá. *Formulación Del Plan Maestro De Movilidad Para Bogotá D.C. Marco de Referencia*. Bogotá, 2006. P. 1-28, 1-29. http://www.movilidadbogota.gov.co/hiwebx_archivos/ideofolio/01-MarcodeReferencia_14_51_27.pdf

[26] Alcaldía Mayor de Bogotá. *Formulación Del Plan Maestro De Movilidad Para Bogotá D.C. Marco de Referencia*. Bogotá, 2006. P. 1-29, 1-30. http://www.movilidadbogota.gov.co/hiwebx_archivos/ideofolio/01-MarcodeReferencia_14_51_27.pdf

[27] Alcaldía Mayor de Bogotá. *Modificación Excepcional de Normas Urbanísticas del Plan de Ordenamiento Territorial 2013. Memoria Justificativa / Documento Resumen*. Bogotá, 2013. Pp. 7-8. http://www.sdp.gov.co/portal/page/portal/PortalSDP/POT_2020/por_que_se_modifica/MEMORIA_JUSTIFICATIVA_DECRETO_364_DE_2013.pdf

[28] Bogotá Humana. "El principal móvil del decreto del POT es la vida": Alcalde Petro. Bogotá, August 27th, 2013. <http://www.bogotahumana.gov.co/index.php/noticias/comunicados-de-prensa-alcalde-mayor/4294-qel-principal-movil-del-decreto-del-pot-es-la-vida-q-alcalde-petro>

[29] Alcaldía Mayor de Bogotá. Secretaría Distrital de Planeación. *MePOT Decreto 364*. http://www.sdp.gov.co/PortalSDP/POT_2020

[30] Alcaldía Mayor de Bogotá. *Formulación Del Plan Maestro De Movilidad Para Bogotá D.C. Transporte Público*. Bogotá, 2006. P. 8-67, 8-68. http://www.movilidadbogota.gov.co/hiwebx_archivos/ideofolio/08-TransportePublico_15_9_24.pdf



Fig. 4.36 Aerial Views of the Central Sector of Bogotá. Maps.google.com.

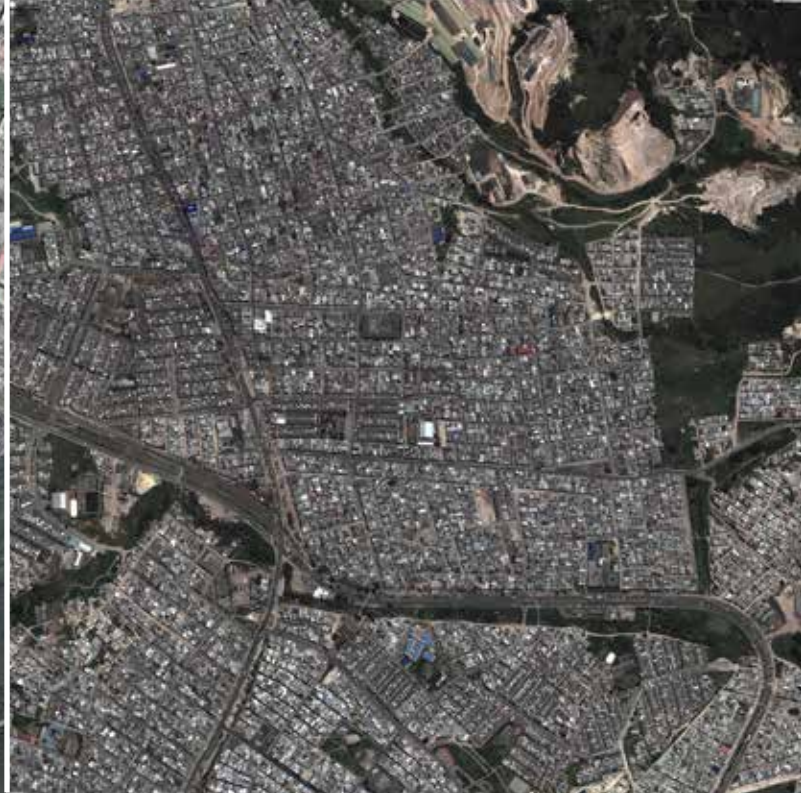


Fig. 4.37 Aerial Views of the Southern Sector of Bogotá. Maps.google.com.

- Some routes have low occupancy in peak hours.
- There are low-income peripheral areas with deficits in service coverage.
- There are deteriorated sections of the road network, which contribute to the reduction of the speed and therefore higher operating costs.
- There's a lack of bus stops with the minimum requirements regarding technical conditions for the waiting and boarding of passengers.
- Overcrowding in units of the TransMilenio system is usually seen, affecting the quality of service.

Public Spaces

Mobility issues affects public spaces, resulting in the current lack thereof. Even though there's currently an index of 16,9m² of public space per habitant, there is currently a shortage of public spaces. Currently are only dedicated 6.3m² of green area per habitant, and around 3.9m² of effective public space per habitant. Furthermore, this distribution is highly uneven; for in the central sectors of Bogotá, a much greater amount of public space is located,



Fig. 4.38 Informal Businesses on Carrera 13 with 59th Street. Maps.google.com.

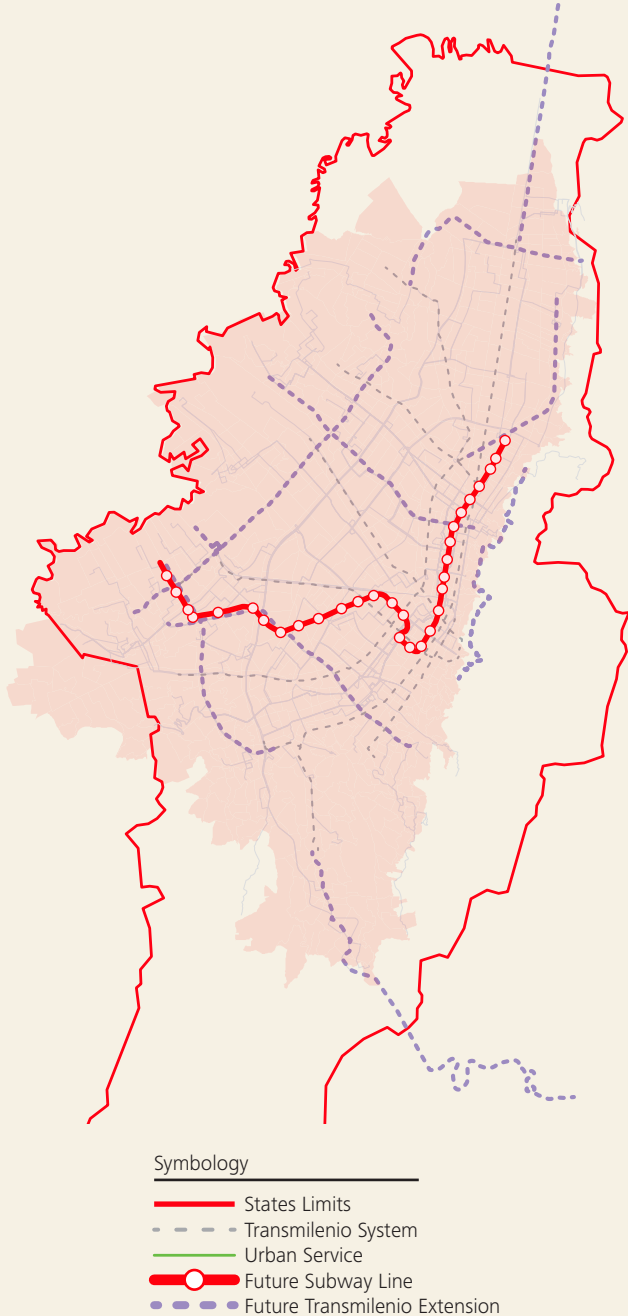


Fig. 4.39 Bogotá's current transport system with future implementations. Source: Alcaldía Mayor de Bogotá. *Formulación Del Plan Maestro De Movilidad Para Bogotá D.C. Transporte Público*. Bogotá, 2006. P. 8-45, 8-46. http://www.movilidadbogota.gov.co/hiwebx_archivos/ideofolio/08-TransportePublico_15_9_24.pdf.

unlike the most distant areas of Bogotá, as a result of the illegal organization and sale of land³¹.

Another recurring problem is the emergence of informal commerce in public spaces, obstructing the public highway and in many cases damaging it. Due to the lack of formal jobs inside the city, some people are forced to set up an informal business, and the most common and easy way to do it is in the street. But this is becoming a problem in the pedestrian paths in the center of the city, where an everyday pedestrian has to walk on the road since the sidewalk is filled with informal business. This could lead to different types of situations, from insecurity to road accidents or even fatalities³².

4.1.6. How they're dealing with those

Mobility

Bogotá has a Mobility Master Plan created in 2006. In it, Bogotá is portrayed as a city with an hierarchic public transit system in which the majority of trips are made in high capacity corridors routes to distribute the most people. Hence medium capacity corridors to bring people to their destinations would be used, and if necessary, would be arranged in various flexible internal or external corridors. Inside this vision, Bogotá has as well an interurban metropolitan connection inside its public transport network³³.

The first problem facing mobility issues inside Bogotá is the saturation of the Transmilenio system. To address this situation, studies have been carried out for planning, construction and operation of the first metro line of Bogotá. Negotiations between the federal and local government are underway right now³⁴. A loan from the Inter-American Development Bank has been approved. As of today there is no planned date to start work³⁵.

The Transmilenio system has an expansion program within local policies inside the Mobility Master Plan³⁶. Inside are detailed the future expansions by streets and tentative timelines. The plan has been projected up to the year 2031. Although these corridors are defined, the exact location of the stations is still under planning. The program provides some guidelines for the location of future stations.

Public Spaces

Even though refurbishment of new urban public spaces continues, mostly of them are on the hold due to the main halt of the new Land Use Plan. There's as well little done regarding the new metro line due to the main conflicts between federal and local governments. Most of their projects regarding public spaces will have to follow the

[31] *Ciudad Bolívar, la localidad que presenta más problemas de espacio público*. El Espectador.com. February 27, 2013. <http://www.elespectador.com/noticias/bogota/ciudad-bolivar-localidad-presenta-mas-problemas-de-espa-articulo-407207>

[32] *Siguen los problemas de espacio público en Bogotá* on Caracol.com.co. July 9, 2009. <http://www.caracol.com.co/noticias/bogota/siguen-los-problemas-de-espacio-publico-en-bogota/20090709/nota/842745.aspx>

[33] Alcaldía Mayor de Bogotá. *Formulación Del Plan Maestro De Movilidad Para Bogotá D.C. Marco de Referencia*. Bogotá, 2006. Pp. 8-71, 8-72. http://www.movilidadbogota.gov.co/hiwebx_archivos/ideofolio/08-TransportePublico_15_9_24.pdf

[34] *Minhacienda y alcaldía buscan destrabar recursos para el Metro de Bogotá* on El Espectador.com. October 28th, 2014. <http://www.elespectador.com/noticias/economia/minhacienda-y-alcaldia-buscan-destrabar-recursos-el-met-articulo-524624>

[35] *El BID confirmó que financiará primera línea del metro de Bogotá*. El Espectador.com. April 10th, 2008. <http://www.elespectador.com/noticias/bogota/articulo-el-bid-confirmo-financiar-primera-linea-del-metro-de-bogota>

[36] Alcaldía Mayor de Bogotá. *Formulación Del Plan Maestro De Movilidad Para Bogotá D.C. Transporte Público*. Bogotá, 2006. P. 8-46. http://www.movilidadbogota.gov.co/hiwebx_archivos/ideofolio/08-TransportePublico_15_9_24.pdf

previous Land Use Plan.

4.1.7. Applicable measures in MCMA

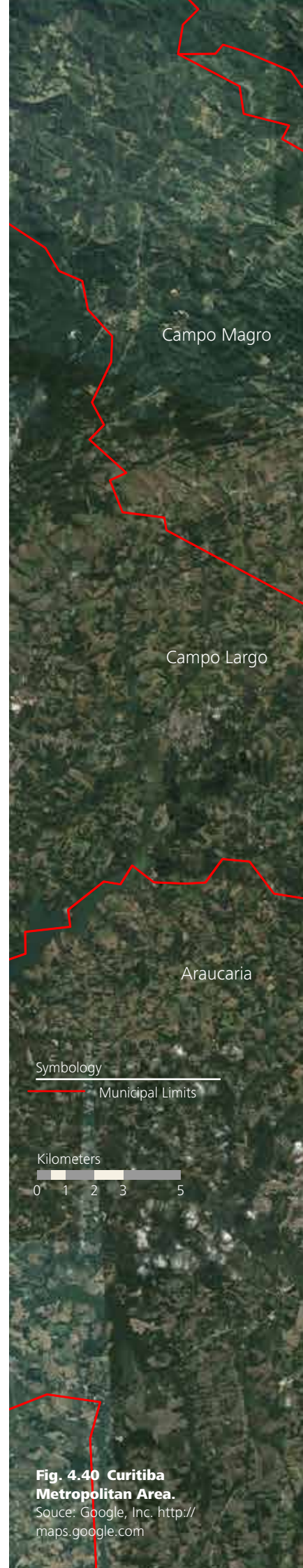
In Bogotá, both architecture and transportation go hand in hand. The **mobility system** of the city is conceived as **a system composed of four elements**: roads, transport, traffic control and pedestrian paths. It is not possible to develop one without the other. The link between the buildings and the transport modes is the urban architecture, and is developed as a necessary link.

Several measures have been adopted to ensure the balanced development of their mobility system on their new Land Use Plan. Among such measures, the ones that could be adopted, and that could benefit the development of a mobility system, could be:

- The concentration of the city
- The diversity of uses inside the city
- The development of short, medium and long term development of the transport system perfectly
- A connection of such transport system with the city via an urban spaces

4.2. CURITIBA

4.2.1. Brief description of the city³⁷

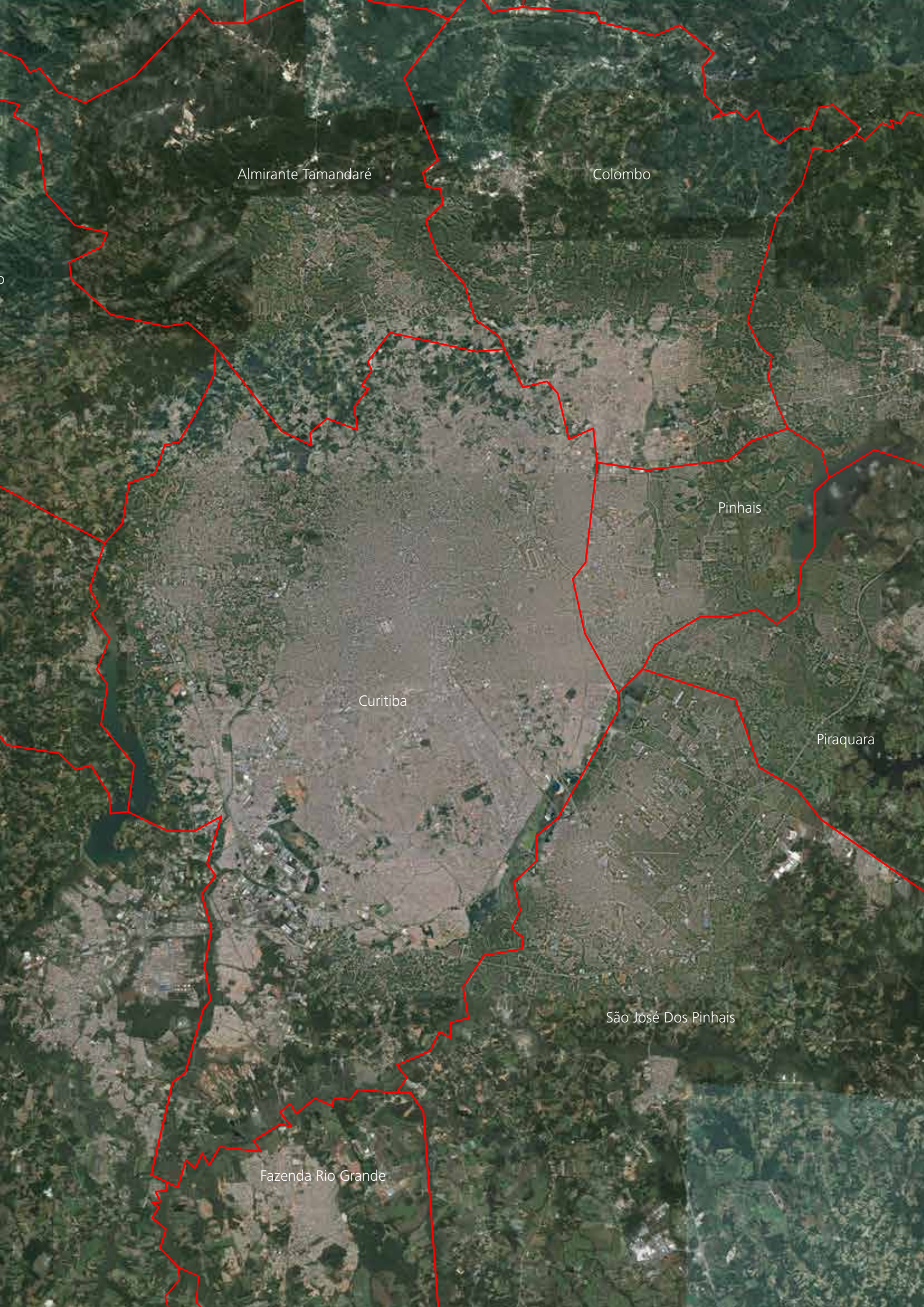


Curitiba is the capital city of the state of Paraná, one of the three states that comprise the Southern part of Brazil. Curitiba is the main city of the set of 26 municipalities that form the Metropolitan Region of Curitiba. It is around 400 Km away from the city of São Paulo. Curitiba has a humid subtropical climate, with a rainfall index of 1,434mm/year. Its average altitude measures 935 m (3,067 ft) above sea level, which gives the city its own features, such as a colder winter compared to other capital cities in Brazil. Curitiba, founded in 1693,

[37] Prefeitura Municipal de Curitiba. Agência Curitiba de Desenvolvimento S/A. *The Investor's Guidebook 2010*. Curitiba, 2010. <http://www.agencia.curitiba.pr.gov.br/multimedia/PDF/00000073.pdf>

Fig. 4.40 Curitiba Metropolitan Area.

Source: Google, Inc. <http://maps.google.com>



Almirante Tamandaré

Colombo

Pinhais

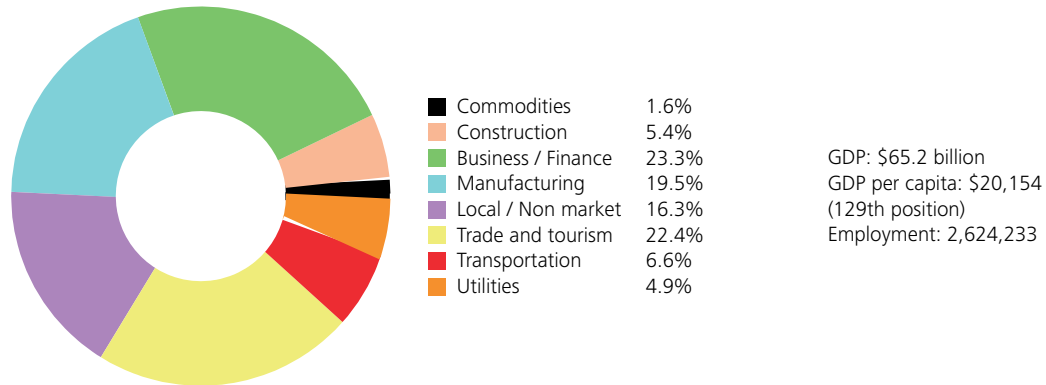
Curitiba

Piraquara

São José Dos Pinhais

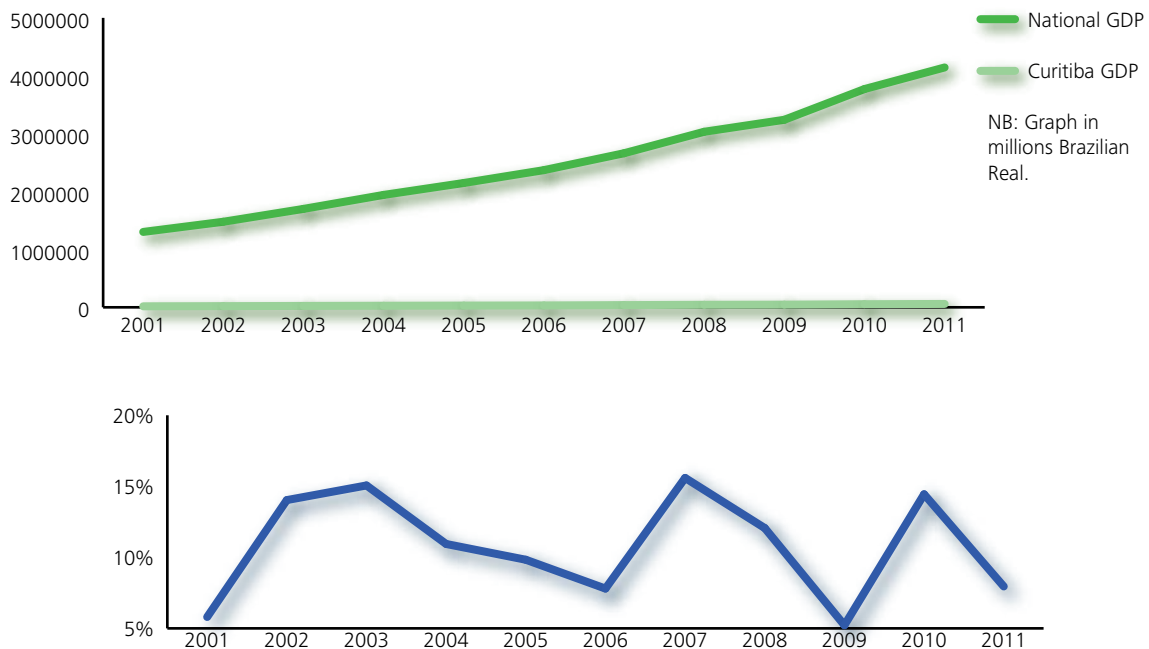
Fazenda Rio Grande

Graph 4.16 Curitiba's Metropolitan Area Output by Industry.



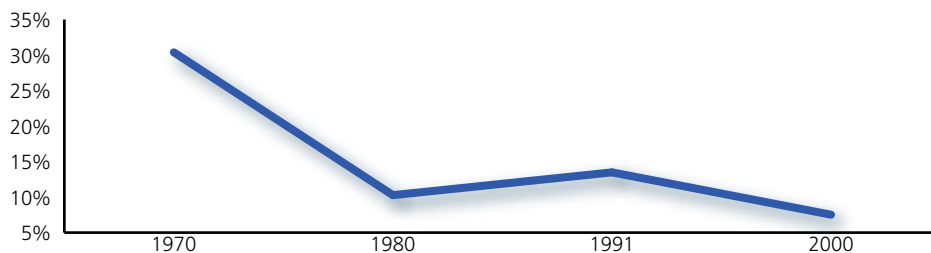
Source: The Brookings Institution. *Global MetroMonitor*. <http://www.brookings.edu/research/interactives/global-metro-monitor-3>

Graph 4.17 Curitiba and Brazil's GDP Comparison with Annum Variation.

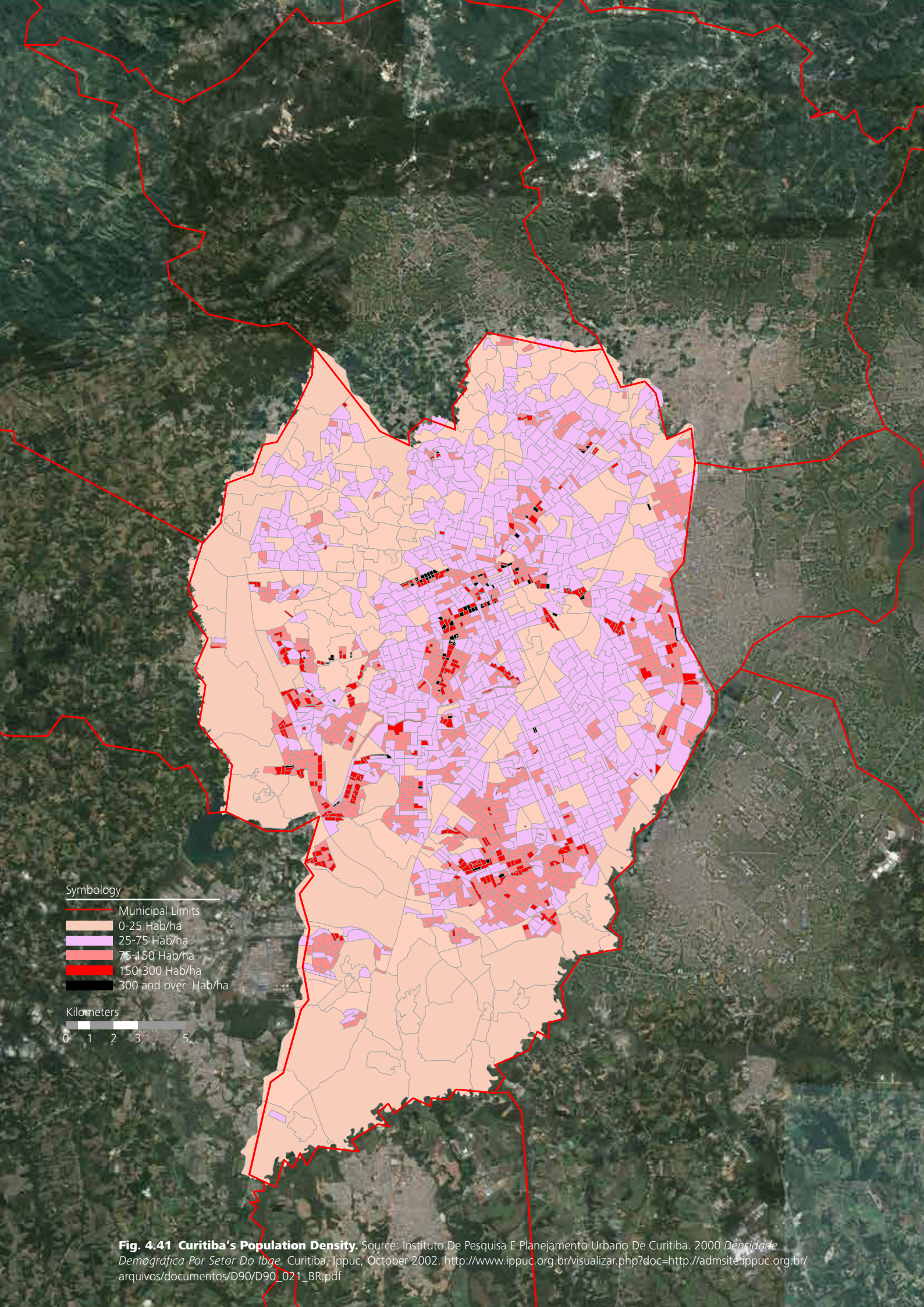


Source: Instituto Brasileiro de Geografia e Estatística. *Produto interno bruto a preços correntes Brasil e Curitiba*. Rio de Janeiro, 2014.

Graph 4.18 Poverty Percentage in Curitiba.



Source: Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Desenvolvimento Sustentável: Indicadores de Sustentabilidade de Curitiba - 2010*. Curitiba, IPPUC, 2011. P. 27. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D175/D175_002_BR.pdf



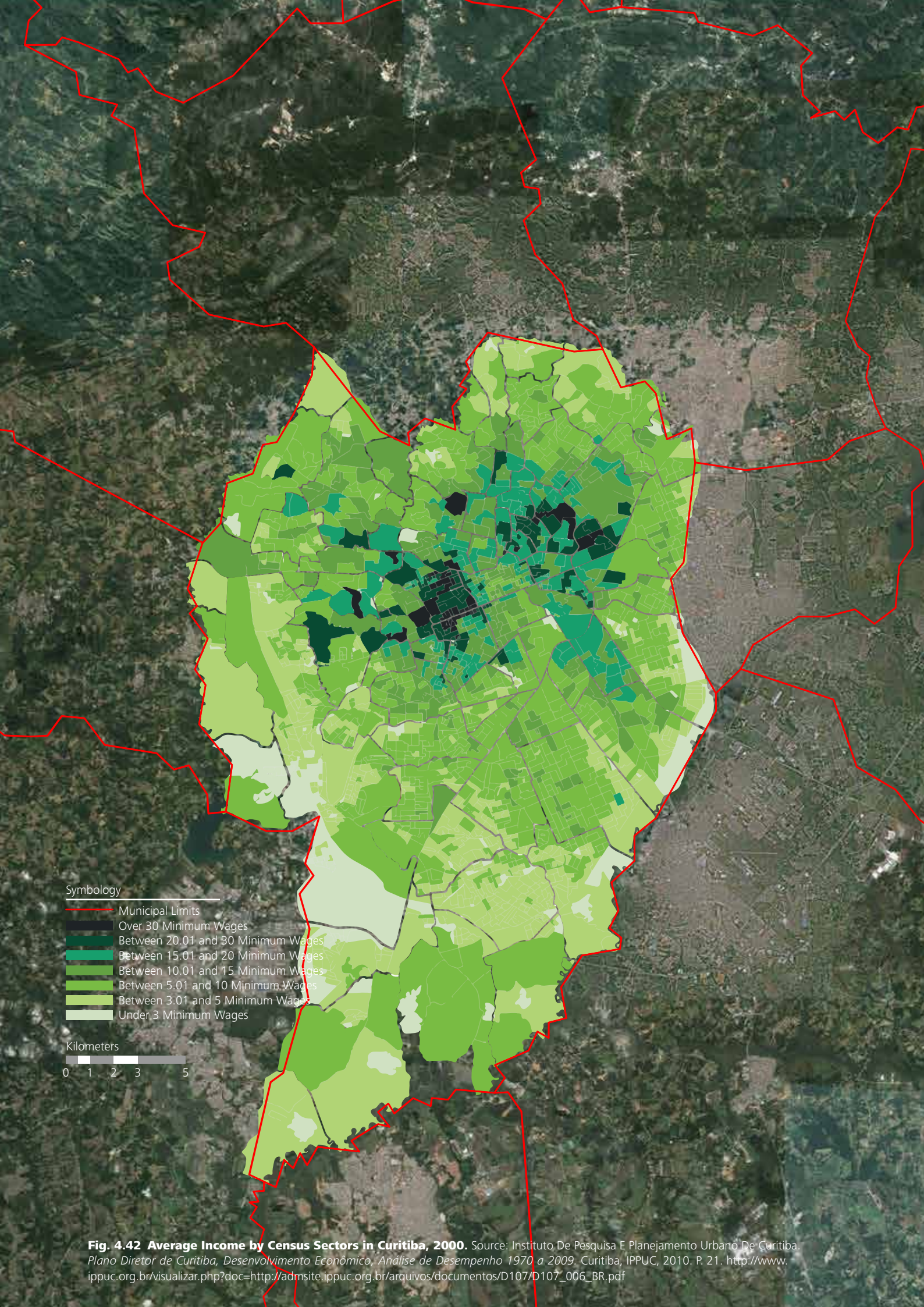
Symbology

- Municipal Limits
- 0-25 Hab/ha
- 25-75 Hab/ha
- 75-150 Hab/ha
- 150-300 Hab/ha
- 300 and over Hab/ha









Kilometers

0 1 2 3 5

Fig. 4.41 Curitiba's Population Density. Source: Instituto De Pesquisa E Planejamento Urbano De Curitiba. 2000 *Densidade Demográfica Por Setor Do Ibge*. Curitiba- Ippuc, October 2002. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D90/D90_021_BR.pdf



Symbology

-  Municipal Limits
-  Over 30 Minimum Wages
-  Between 20.01 and 30 Minimum Wages
-  Between 15.01 and 20 Minimum Wages
-  Between 10.01 and 15 Minimum Wages
-  Between 5.01 and 10 Minimum Wages
-  Between 3.01 and 5 Minimum Wages
-  Under 3 Minimum Wages

Kilometers

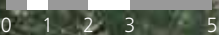
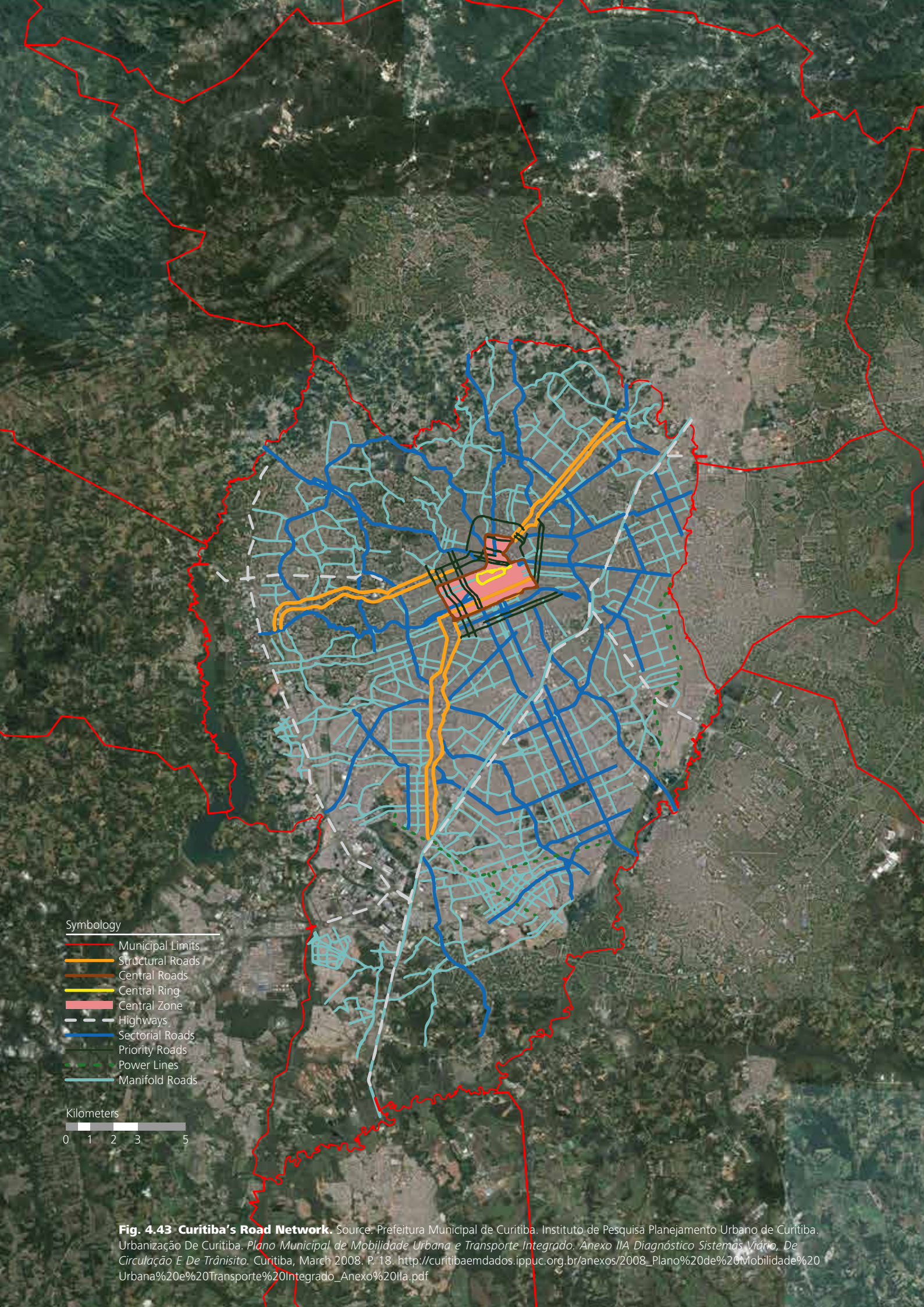


Fig. 4.42 Average Income by Census Sectors in Curitiba, 2000. Source: Instituto De Pesquisa E Planejamento Urbano De Curitiba. *Plano Diretor de Curitiba, Desenvolvimento Econômico, Análise de Desempenho 1970 a 2009.* Curitiba, IPPUC, 2010. P. 21. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D107/D107_006_BR.pdf



- Symbology
- Municipal Limits
 - Structural Roads
 - Central Roads
 - Central Ring
 - Central Zone
 - Highways
 - Sectorial Roads
 - Priority Roads
 - Power Lines
 - Manifold Roads



Fig. 4.43 Curitiba's Road Network. Source: Prefeitura Municipal de Curitiba. Instituto de Pesquisa Planejamento Urbano de Curitiba. Urbanização De Curitiba. *Plano Municipal de Mobilidade Urbana e Transporte Integrado. Anexo IIA Diagnóstico Sistemas Viário, De Circulação E De Trânsito.* Curitiba, March 2008. P. 18. http://curitibaemdados.ippuc.org.br/anexos/2008_PlanodeMobilidadeUrbanaeTransporteIntegrado_Anexo%20IIa.pdf

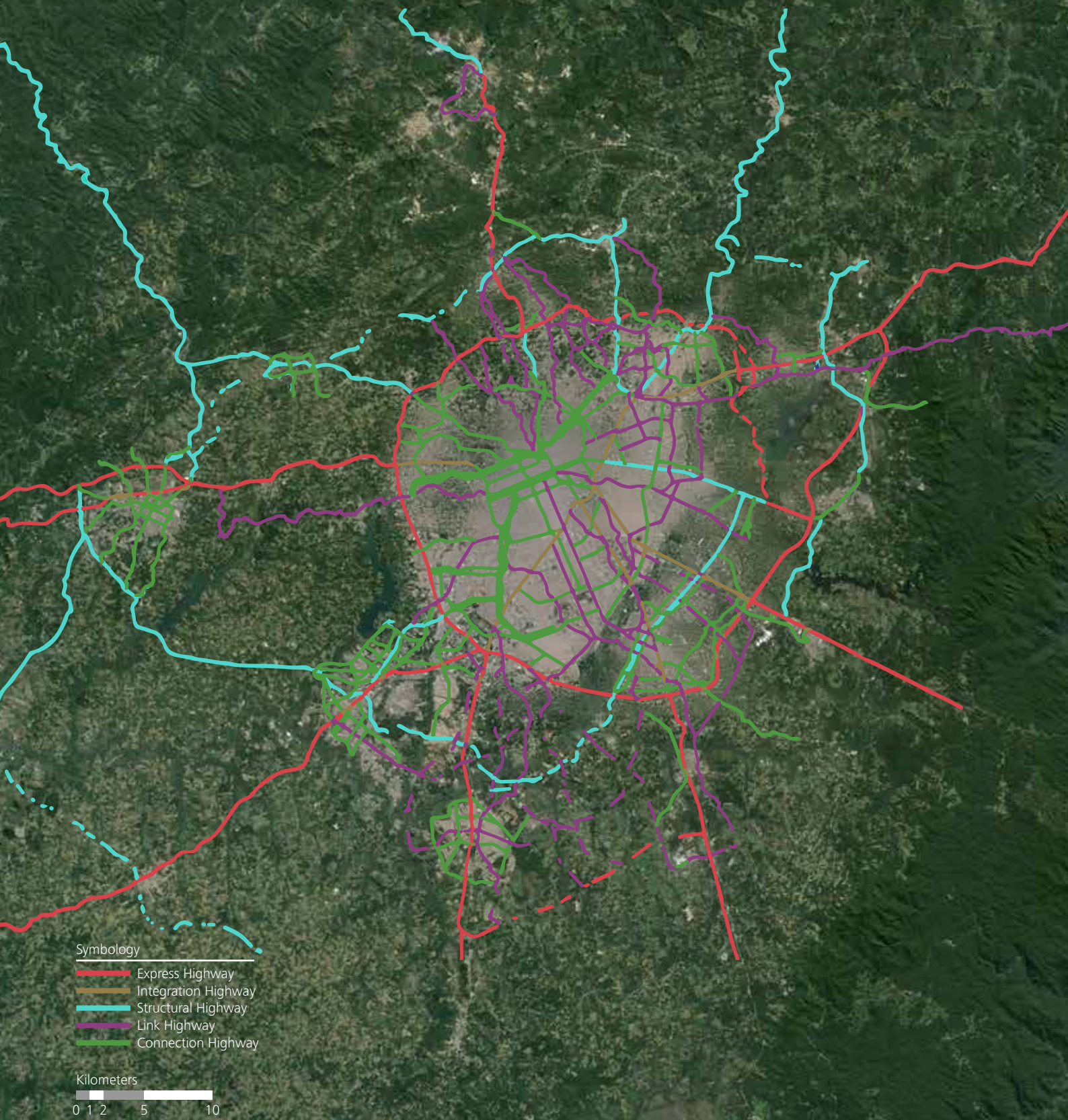
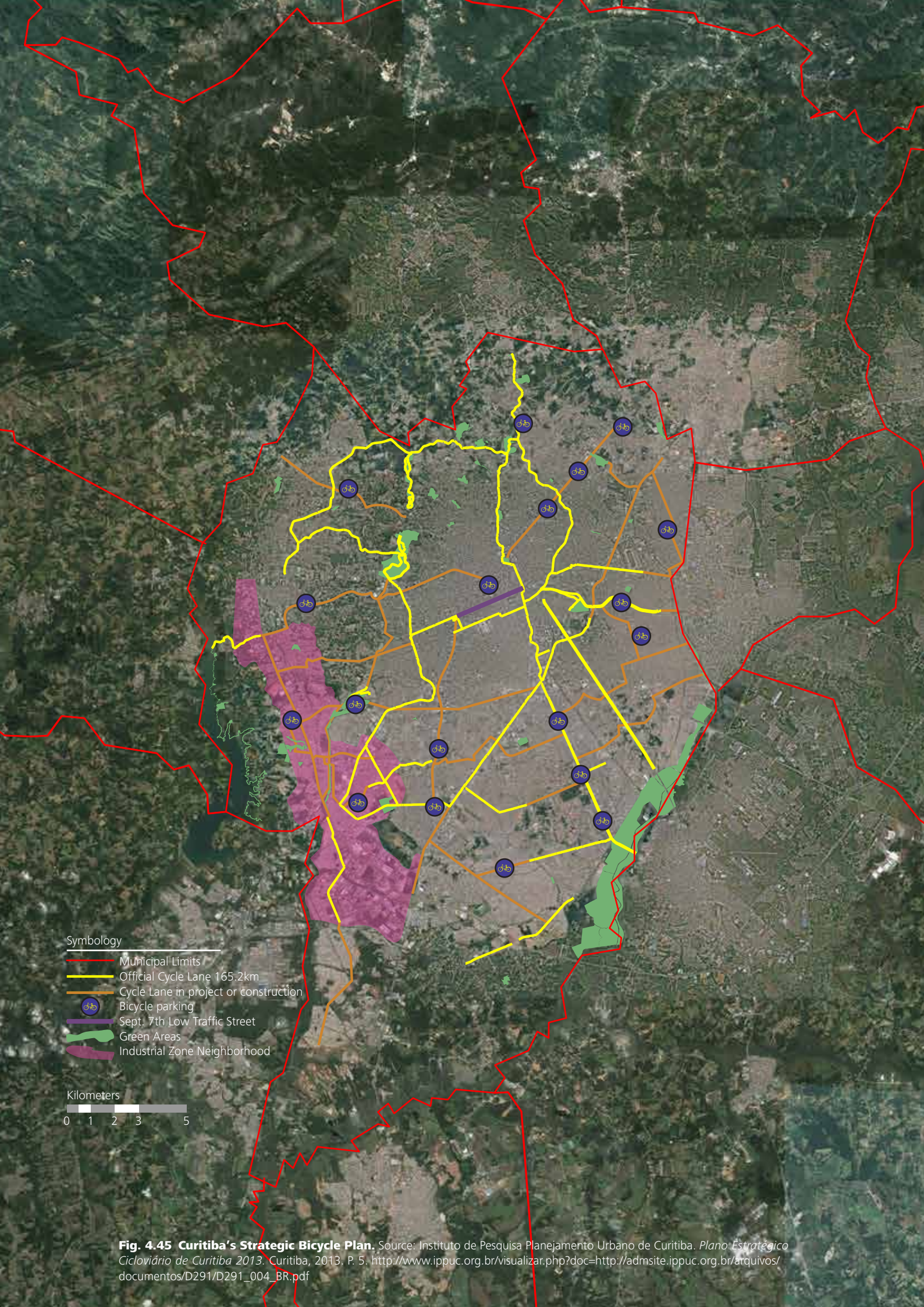



Fig. 4.44 Curitiba's Metropolitan Area Road Network. Source: Prefeitura Municipal de Curitiba. Instituto de Pesquisa Planejamento Urbano de Curitiba. Urbanização De Curitiba. *Plano Municipal de Mobilidade Urbana e Transporte Integrado. Anexo IIIA Diagnóstico Sistemas Viário, De Circulação E De Trânsito.* Curitiba, March 2008. P. 20. http://curitibaemdados.ippuc.org.br/anexos/2008_Plano%20de%20Mobilidade%20Urbana%20e%20Transporte%20Integrado_Anexo%20IIa.pdf



Symbology

- Municipal Limits
- Official Cycle Lane 165.2km
- Cycle Lane in project or construction
-  Bicycle parking
- Sept. 7th Low Traffic Street
- Green Areas
- Industrial Zone Neighborhood

Kilometers

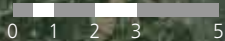


Fig. 4.45 Curitiba's Strategic Bicycle Plan. Source: Instituto de Pesquisa Planejamento Urbano de Curitiba. *Plano Estratégico Ciclovitário de Curitiba 2013*. Curitiba, 2013. P. 5. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D291/D291_004_BR.pdf

is a city with little more than 300 years and occupies an area of 432 km².

In the year of 2009 the estimated population of Curitiba was 1.85 million, which ranks the city on 7th place in the ranking of the largest Brazilian capital cities based on their population. In the state of Paraná, Curitiba stands out as the largest city in number of population, which accounts for 17.3% of the total population of the state.

With an estimated GDP worth BRL 40 billion (nearly USD 23 billion) in 2009, which represents a participation of 1.42% in the national GDP, Curitiba is ranked 5th in the ranking of Brazilian cities with highest GDP. The estimated GDP per capita for Curitiba in 2009 was worth BRL 21.7 thousand (USD 12.2 thousand). Compared to the state of Paraná and to Brazil, Curitiba has a higher GDP per capita.

The average income of households in 2009 was BRL 2.7 thousand/month. Compared to the Metropolitan Region, to the state of Paraná and to Brazil, the income of Curitiba is significantly higher and it surpasses the national income by 86%.

The Metropolitan Region of Curitiba (RMC - Região Metropolitana de Curitiba)), which is the greater Curitiba, is comprised by 26 cities. According to data from the Brazilian Institute of Geography and Statistics/2009, the Metropolitan Region of Curitiba has 3,307,945 inhabitants in a 15,419 km² area, and the annual growth rate is 2.02%. The 26 cities of the Metropolitan Region gather 91% of the total urban population of the state of Paraná. Its GDP in 2007 was worth R\$65.2 billion, which meant a participation of 40.3% in the total GDP for the whole state. Remarkable companies are established at the RMC: Renault do Brasil, Volkswagen do Brasil, Boticário (Brazilian Perfume Company) and Bematech, among others.

Among the many economic centers in the city, located in the west of the city is the Industrial City of Curitiba, which was planned for the development of non-polluting industrial activities, with spaces for work, housing and leisure. As for social services, since the 70s, Curitiba began to deploy schools, health centers, supply units, sports and leisure facilities, adolescents programs and child care centers especially in peripheral areas, allowing the creation of a network of social care.

The action of preserving green areas and valleys has inspired the creation of urban parks - 31 to date - with sanitation facilities, leisure and recreation.

4.2.2. Curitiba's transport system

The Curitiba transport system, has earned national and international prestige by the way solved its urban and environmental problems, becoming a reference in public transport. Carrying solutions in the city resulted from the implemented development policy from the 70s. The planning and urban development of Curitiba, as defined by the Master Plan 1965, relies on an inseparable tripod composed of land use, road traffic and public transport. Curitiba's Collective Transport System serves as a model for other centers in the country and abroad for innovation and the efficiency of the service. It is structured in an integrated network, which covers more than 80% of the municipal area and 14 cities in the metropolitan region. The Integrated Transport operates the Express lines, Direct, Interbairros, feeders, plus the integration terminals. Complement the conventional system bus, the *madrugueiros*, the Circular Center, the fleet of the Integrated Transportation of Special Education - SITES, transporting students with disabilities - and the tourism line. Buses are color coded. The fleet consists of bi-articulated buses, articulated buses, the *Padron* type (or conventionals), minibuses, special care with lifts for the disabled, with standards defined of characteristics and special techniques for each³⁸.

Curitiba's Integrated Transport Network (ITN) allows the user to use more than one bus line with paying just one fare. The integration process occurs from integration terminals where the citizen can land a line and embark on any other within that area without a new payment. Thus, the user can choose their own path to move by several districts of Curitiba and the Metropolitan Region. In all, there are 14 cities connected by this network of lines that provides ample mobility for more than 2 million people daily.

The lines of the Central Urban Core - NUC, are identified as: lines integrated into the Integrated Transport Network - RIT, lines not integrated into RIT and lines that meet the municipalities of the NUC³⁹.

[38] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Transportes, Ficha Técnica*. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D49/D49_015_BR.pdf

[39] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Qualidade de vida 2003. Transporte*. 2003. Pp. 15. <http://ippuc.org.br/mostrarpagina.php?pagina=174>

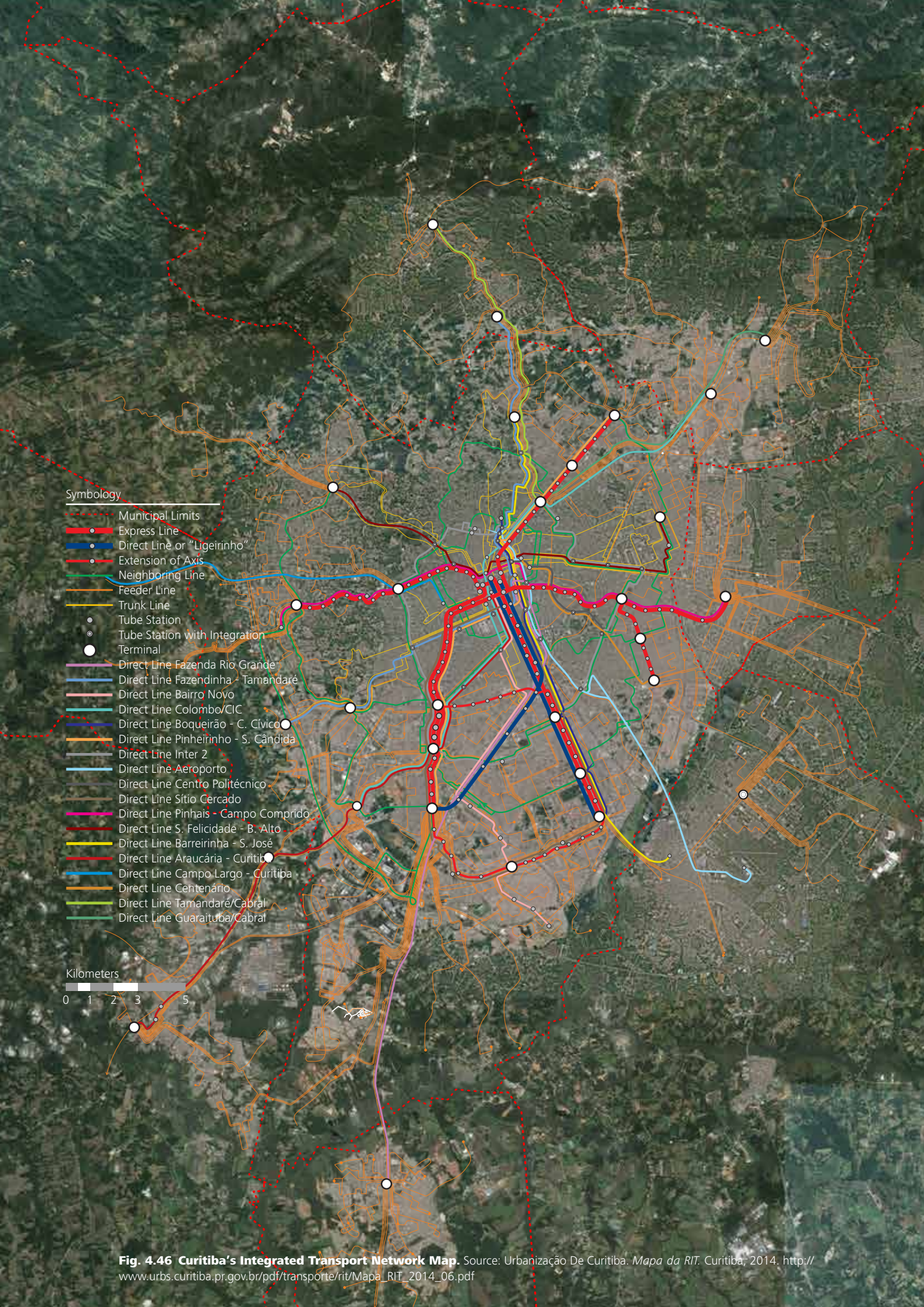


Fig. 4.46 Curitiba's Integrated Transport Network Map. Source: Urbanização De Curitiba. *Mapa da RIT*. Curitiba, 2014. http://www.urbs.curitiba.pr.gov.br/pdf/transporte/rit/Mapa_RIT_2014_06.pdf

A) Curitiba's Integrated Transport Network lines⁴⁰

These are lines located in the conurbated area municipalities as a regional pole, that has bigger dependency with the capital, but connected with the Curitiba System. These are 185 lines that connect areas of NUC with many terminals inside Curitiba or in other municipalities. The fare payed can be the same as Curitiba, calculated according to the distance of the journey.

The integrated system of public transport is formed by a network, composed of integration terminals, express lines, feeder, neighboring and direct as well as conventional attending the terminals located in neighborhoods. The basic structure consists of five axis characterized by exclusive lanes where are located the terminals attending RIT. In Curitiba, the vehicle set for the public transportation system is the urban diesel buses, with types, technical and functional characteristics for each type of line. The fleet of the RIT is formed by articulated buses, biarticulated, buses, minibuses, special buses with elevator for handicapped care.

Light Express and Express Lines

These are operated by bi-articulated buses with a capacity of 270 passengers that travel in dedicated lanes. The embarkation and disembarkation are made within the same level with an anticipated payment of the fare, reducing the travel time. While the Light Express buses do selected stops, the Express buses do all of them.



Fig. 4.47 Curitiba's Express Line Buses. <http://www.curitiba.pr.gov.br/include/handler/download.ashx?t=i&m=153221> https://blogpontodeonibus.files.wordpress.com/2014/11/rosa_rejeitado.jpg

Feeder Lines

Connect the integration terminals to the neighborhoods of the region operated by public buses, with capacity for 80 passengers integrated into the Express system. These transport the user of the neighborhoods to the terminals using the same fare of Express system.

Neighboring Lines

Operated with articulated and regular buses, interconnect the city's neighborhoods in circular paths without passing

[40] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Qualidade de vida 2003. Transporte.* 2003. Pp. 15. <http://ippuc.org.br/mostrarpagina.php?pagina=174>



Fig. 4.48 Curitiba's Feeder Line Buses. <https://flic.kr/p/qj3lqu> <https://flic.kr/p/q9J4Fp>



Fig. 4.49 Curitiba's Neighboring Line Buses. <https://flic.kr/p/qi3iuh> <https://flic.kr/p/q9a9Xn>

through the center, avoiding radial displacements. These lines also allow integration with the express lines, direct and feeder.

Direct Lines or "Ligeirinho"

This line is designed as an aid system for the express and neighboring lines. It has few stops, since it is designed for longer-routes. Operated by special buses without steps, with the door located on the left. These stop only at tube stations, located on average every 3 km, and the boarding is done in the same level. It was established in 1991.



Fig. 4.50 Curitiba's Direct Line Buses. <https://blogpontodeonibus.files.wordpress.com/2012/04/novo.jpg> http://upload.wikimedia.org/wikipedia/commons/9/95/COP8MOP3_2006_Curitiba_bus_1.jpg

Trunk Lines⁴¹

The trunk lines connecting the neighborhoods centers with the city center, sharing the same road lanes with the other vehicles in the basic road system, which constitutes traffic corridors. The types of vehicles are conventional ones with capacity for 96 passengers, or articulated for 160 passengers, and all vehicles have the characteristic yellow of conventional lines.

[41] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Urbanização De Curitiba. Plano de Mobilidade Urbana e Transporte Integrado. Anexo III.* March, 2008. Pp. 35. <http://www.ippuc.org.br/mostrarpagina.php?pagina=35>



Fig. 4.51 Curitiba's Trunk Line Buses. [http://2.bp.blogspot.com/-TUGAbQKONS8/U7S6PMbQvOI/AAAAAABtnA/6t3aliW5eeE/s1600/onibus+blumenau+\(8\).JPG](http://2.bp.blogspot.com/-TUGAbQKONS8/U7S6PMbQvOI/AAAAAABtnA/6t3aliW5eeE/s1600/onibus+blumenau+(8).JPG) [http://3.bp.blogspot.com/-amvBcwOaXY/UUKG-WDtifl/AAAAAABNfi/UZ8DqZ87Tdg/s1600/%C3%B4nibus+\(5\).JPG](http://3.bp.blogspot.com/-amvBcwOaXY/UUKG-WDtifl/AAAAAABNfi/UZ8DqZ87Tdg/s1600/%C3%B4nibus+(5).JPG)

Intercity Lines⁴²

The intercity lines promote the connection between the metropolitan municipalities of Curitiba, connecting integration terminals of Almirante Tamandaré, Colombo, Pinhais and São José dos Pinhais. The vehicles uses the RIT integrated terminals and have an orange color, the common type for 94 passengers.

Conventional Lines⁴³

Conventional lines make the connection between the city center and the neighborhoods and areas of the city not served by the RIT. Itineraries are radial for the neighborhood-city center link or diametrical for the neighborhood-city center-neighborhood link. The vehicles are in color yellow, some are minibuses for up to 40 passengers while some are buses for 70 passengers that meets the low demand; there are some for up to 96 passengers or common to 94 passengers for medium demands; and articulated to 160 passengers for the highest demands.



Fig. 4.52 Curitiba's Conventional Line Buses. <https://blogpontodeonibus.files.wordpress.com/2011/11/c3b4nibus-curitiba.jpg> <http://www.curitiba.pr.gov.br/include/handler/download.ashx?t=i&m=149228>

Circular Center Lines⁴⁴

Circular center line provides trips in the area of the expanded center, connecting many places in the downtown area. There are two itineraries, clockwise and counterclockwise, with the use of micro type vehicles color white. The vehicle has no automated fare collection system, with the fee collected by the driver. Special rates, usually costs half of the social tariff, and depending on the itinerary could be shorter.

[42] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Urbanização De Curitiba. Plano de Mobilidade Urbana e Transporte Integrado. Anexo III.* March, 2008. Pp. 36. <http://www.ippuc.org.br/mostrarpagina.php?pagina=35>

[43] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Urbanização De Curitiba. Plano de Mobilidade Urbana e Transporte Integrado. Anexo III.* March, 2008. Pp. 36. <http://www.ippuc.org.br/mostrarpagina.php?pagina=35>

[44] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Urbanização De Curitiba. Plano de Mobilidade Urbana e Transporte Integrado. Anexo III.* March, 2008. Pp. 36. <http://www.ippuc.org.br/mostrarpagina.php?pagina=35>



Fig. 4.53 Curitiba's Circular Centre Line Buses. <http://www.curitiba.pr.gov.br/include/handler/download.ashx?t=i&m=150612> <http://www.curitiba.pr.gov.br/include/handler/download.ashx?t=i&m=111892>

Interhospital⁴⁵

The Interhospital line aims to serve the users who need to move to the hospitals, laboratories, and specialized clinics located in a distance of 5km from the central area. The vehicles, in white and with a special lay-out, have a capacity of 22 seated passengers, equipped with lifts to facilitate access to the vehicle and space for wheelchairs. Rate is the same for the other services of the public transportation system.

Tourism Line⁴⁶

The Tourism line connects the main sights of Curitiba, with a circular route of 44 km, with travel time of two hours and a half. The line opening hours are Tuesday to Sunday, from 9 am to 17:30 when the first trip starts from the Tiradentes Square, a half-hour interval between trips. These use special vehicles, that have different side panels and panoramic, with a special layout and comfortable seats. The vehicles are equipped with sound system that provides recorded information about the places visited in three languages - Portuguese, English and Spanish. Rate is differentiated, currently costing 15BRL, with the user getting a ticket that entitles the first trip with four more included, allowing the passenger to move inside the city according to their interests. Each of the 25 stops are identified by a group formed by post and sign indicating the route and times of the buses.



Fig. 4.54 Curitiba's Interhospital and Tourism Lines Buses. http://www.neyleprevost.com.br/fotos/noticia_35347.jpg <http://multimedia.turismo.curitiba.pr.gov.br/2014/8/jpg/00000198.jpg>

Dawn Line⁴⁷

The Dawn or Madrugueiro lines aim to serve users who have evening activities. The operation is between 01h and 05h, with an interval of one hour, with itineraries keeping an approximate distance of 1 km.

Sites Line⁴⁸

The exclusive lines of the Integrated Special Education System - SITES serves network of specialized schools for people with physical and / or mental deficiencies, with the bus seeking students at home, taking them to the SITES terminal where they're transferred to the bus attending special schools. Common vehicles are transformed, adapted with lifts for wheelchair users and with the placement of seats fitted with seat belts. These lines serve approximately 3000 students at no cost to the user, with the system being paid by the City Department of Education.

Executive Airport Line⁴⁹

[45] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Urbanização De Curitiba. Plano de Mobilidade Urbana e Transporte Integrado. Anexo III.* March, 2008. Pp. 37. <http://www.ippuc.org.br/mostrarpagina.php?pagina=35>

[46] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Urbanização De Curitiba. Plano de Mobilidade Urbana e Transporte Integrado. Anexo III.* March, 2008. Pp. 37. <http://www.ippuc.org.br/mostrarpagina.php?pagina=35>

[47] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Urbanização De Curitiba. Plano de Mobilidade Urbana e Transporte Integrado. Anexo III.* March, 2008. Pp. 38. <http://www.ippuc.org.br/mostrarpagina.php?pagina=35>

[48] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Urbanização De Curitiba. Plano de Mobilidade Urbana e Transporte Integrado. Anexo III.* March, 2008. Pp. 38. <http://www.ippuc.org.br/mostrarpagina.php?pagina=35>

[49] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Urbanização De Curitiba. Plano de Mobilidade*

The Airport Line (executive) connects the Afonso Pena International Airport, located in the municipality of São José dos Pinhais with the central area of Curitiba, operated by a special minibus, executive type, silver color. Route has stops at specific points such as Rodoferroviária, which are identified by signs indicating the timetables for each point.

B) Lines not integrated to the RIT

These are the lines that meet the municipalities of NUC area, that requires several access to the central area of Curitiba. The management of the operation of the lines is performed by Urbanização de Curitiba S.A. - Urbs, with compensation per passenger transported. The rate charged by the lines may be the same or different from Curitiba, calculated according to the distance of the journey.

C) Lines meeting the municipalities of NUC

To promote connections between municipalities and the NUC there are lines that make connections between some municipalities, providing a service to peripheral demands, which need not to go through the central area.

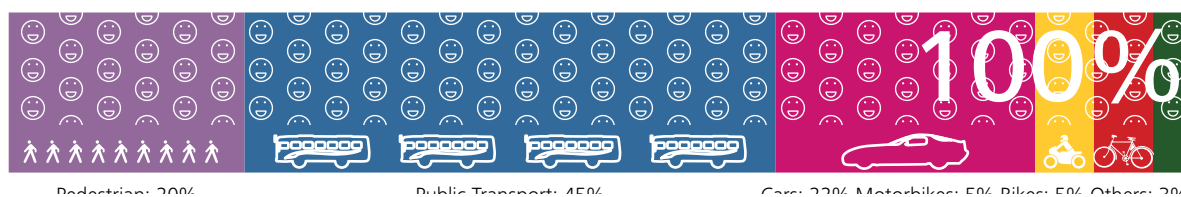
4.2.3. How, Where and Why

The Integrated Transport Network (ITN) allows the user to use more than one bus line with paying just one fare. The integration process occurs from integration terminals where the citizen can land a line and embark on any other within that area without a new payment. Thus, the user can choose their own path to move by several districts of Curitiba and the Metropolitan Region. In all, 14 cities are connected by this network of lines that provides ample mobility more than 2 million people daily⁵⁰.

A) How

In Curitiba, almost half of the population makes their journeys with public transport. The second most popular way to move is by car and, following, by feet.

Graph 4.19 Curitiba's Mobility Modal Split



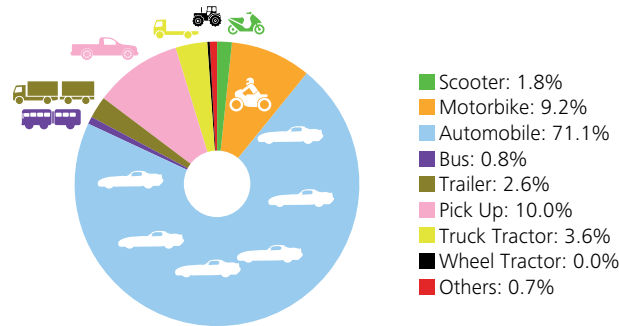
Source: Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. Urbanização De Curitiba. *Plano De Mobilidade Urbana e Transporte Integrado. PlanMob Curitiba. Anexo III: Diagnóstico Transporte Coletivo E Comercial.* March 2008. Pp. 14. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D35/D35_051_BR.pdf

In opposition to the way people moves in Curitiba, of the total vehicle fleet present 71.1% are private cars. Is interesting to notice that after this majority, the next type of vehicles most present are the loading ones. Interestingly, almost 1% of the total of vehicles riding in Curitiba are meant to transport almost half of its population.

Urbana e Transporte Integrado. Anexo III. March, 2008. Pp. 38. <http://www.ippuc.org.br/mostrarpagina.php?pagina=35>

[50] Urbanização De Curitiba S/A. *Rede Integrada de Transporte.* <http://www.urbs.curitiba.pr.gov.br/transporte/rede-integrada-de-transporte>

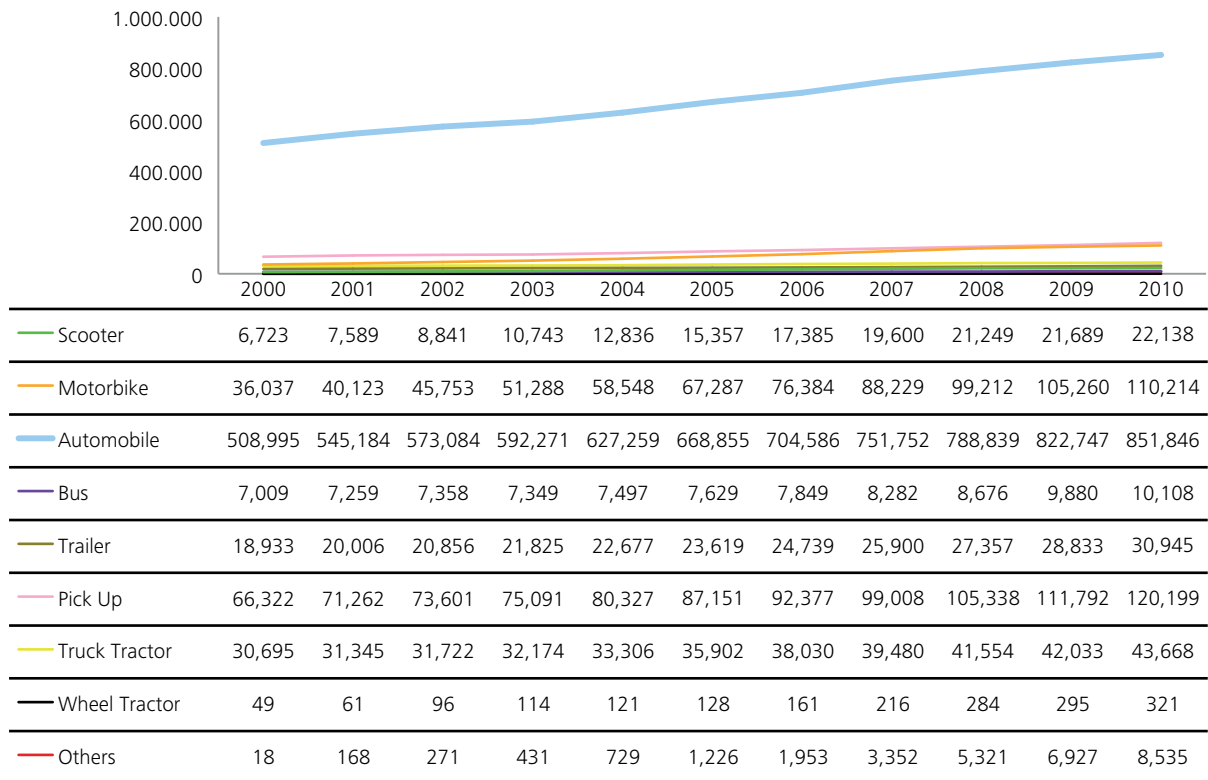
Graph 4.20 Curitiba's Vehicle Fleet Split



Source: Instituto de Pesquisa e Planejamento Urbano de Curitiba. 2010 desde 1994, *Evolução da Frota de Veículos Automotores por Tipo, em Curitiba*. http://curitibaemdados.ippuc.org.br/anexos/2010%20desde%201994_Evolu%C3%A7%C3%A3o%20da%20Frota%20de%20Ve%C3%ADculos%20Automotores%20por%20Tipo,%20em%20Curitiba.xls

From 2000 until 2010 there has been an increment in the vehicle fleet of Curitiba. But the most significant one is the private automobile, with an impressive 60% increment.

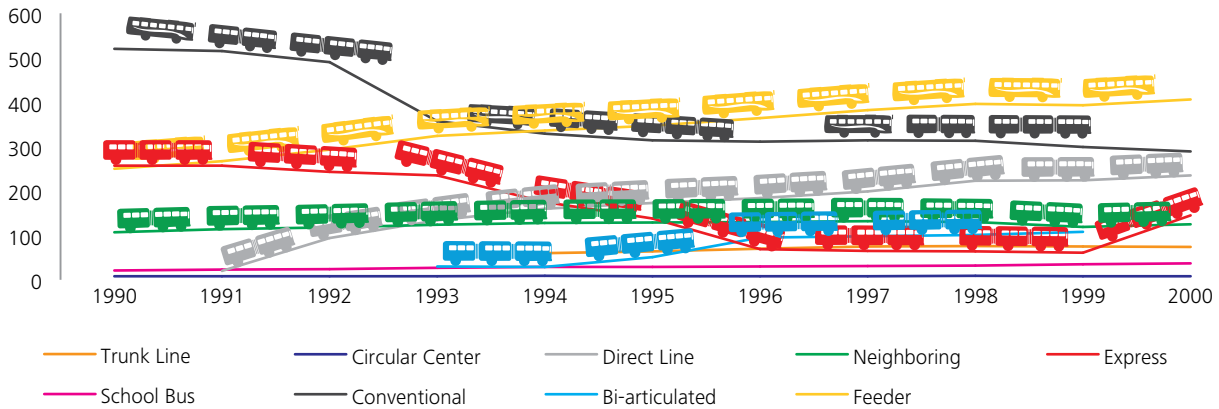
Graph 4.21 Curitiba's Historical Vehicle Fleet Split



Source: Instituto de Pesquisa e Planejamento Urbano de Curitiba. 2010 desde 1994, *Evolução da Frota de Veículos Automotores por Tipo, em Curitiba*. http://curitibaemdados.ippuc.org.br/anexos/2010%20desde%201994_Evolu%C3%A7%C3%A3o%20da%20Frota%20de%20Ve%C3%ADculos%20Automotores%20por%20Tipo,%20em%20Curitiba.xls

Within the Public Transport fleet there has been as well some increments, as shown from the period 1990 to 2000. The feeder lines as well as the direct lines are the ones with the greater fleet increment. After a decrease tendency, in the late 1990's there's an incremental in the express line fleet. In contrast, the conventional lines presented a decrease in their fleet. The rest of the lines almost don't present a significant change.

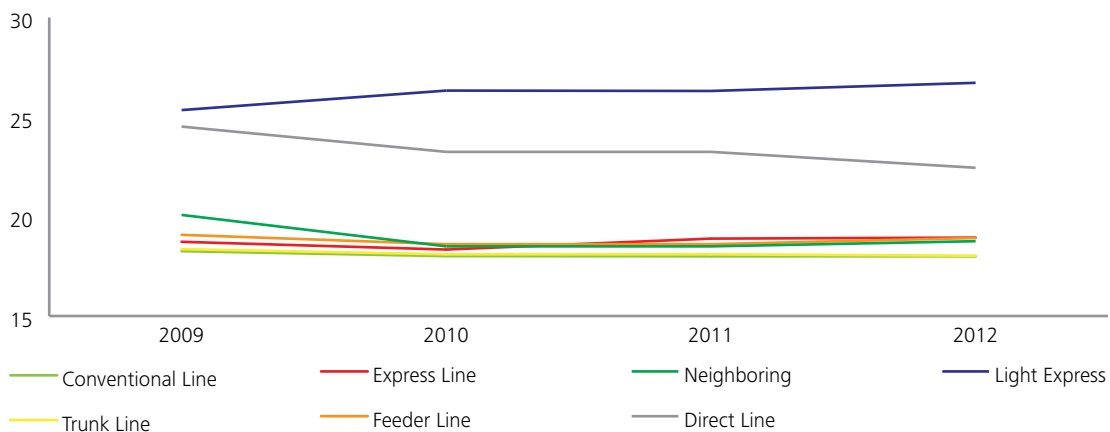
Graph 4.22 Curitiba's Public Transport System Historical Modal Split



Source: Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. Qualidade de Vida 2003. P. 21. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D174/D174_001_BR.pdf

From the 2009-2012 period, average speed of most of the system hasn't had an interesting change. It is worth to be noticed that there's not a single line reaches 30k/h. The fastest line, which had a slight improvement is the Light Express. Following in second place and with a decreased performance is the Direct line.

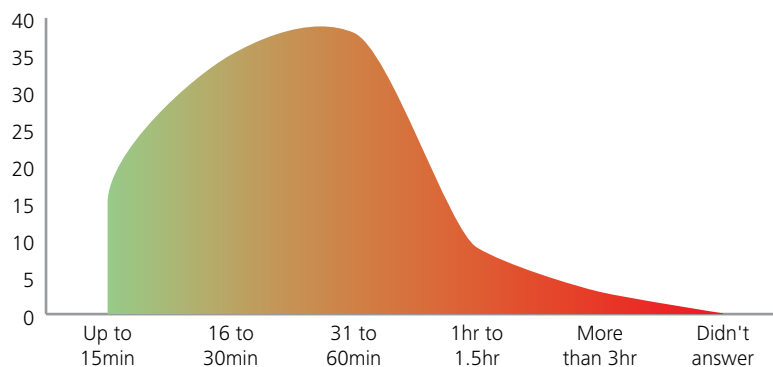
Graph 4.23 Curitiba's Historical Average Speed per Transport System



Source: Trisotto, Fernanda. "Velocidade média dos ônibus em Curitiba está estacionada em 17 km/h" on *Gazeta Do Povo*. August 15th, 2013. <http://www.gazetadopovo.com.br/vidaecidadania/conteudo.phtml?id=1399775#ancora>

Most of the users traveling with the Public Transport Network spend 15-60 minutes to reach their destination, although there are some cases where people have to spend from to 1-2hr. Only a small percentage makes journeys longer than 2hr.

Graph 4.24 Curitiba's Average Journey Time Period



Source: Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. Urbanização De Curitiba. *Plano De Mobilidade Urbana e Transporte Integrado. PlanMob Curitiba. Anexo III: Diagnóstico Transporte Coletivo E Comercial*. March 2008. Pp. 17. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D35/D35_051_BR.pdf

B) Where

The locations that draws more people inside Curitiba are the work places. Below is a location inside the city of the zones allowing work places. It is to be noted that most of them are either inside the central area, reaching their structural roads, or on the outskirts, as the industrial facilities.

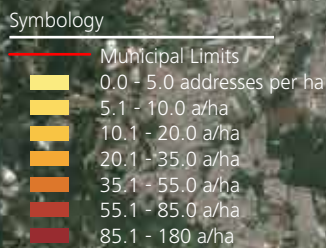


Fig. 4.55 Curitiba's zones allowing job placement. Source: Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *População e Domicílios, Segundo Zoneamento de Curitiba - 2010*. Curitiba, 2010. http://ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D174/D174_005_BR.pdf

C) Why

Most of the commutes done inside Curitiba are related with working activities, while persons moving for studies purposes represent only 10%. The rest of the activities represent 30%.

Graph 4.25 Curitiba's Travel Split per Activity



Source: Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. Urbanização De Curitiba. *Plano De Mobilidade Urbana e Transporte Integrado. PlanMob Curitiba. Anexo III: Diagnóstico Transporte Coletivo E Comercial.* March 2008. Pp. 58. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D35/D35_051_BR.pdf

4.2.4. Urban Intermodality and Architecture

To speak about architecture inside the urban spaces in Curitiba is to speak about its own planning process, which is to speak about the image of city they have. For since that's the departing point of the way they think their spaces.

A) Urban Scale

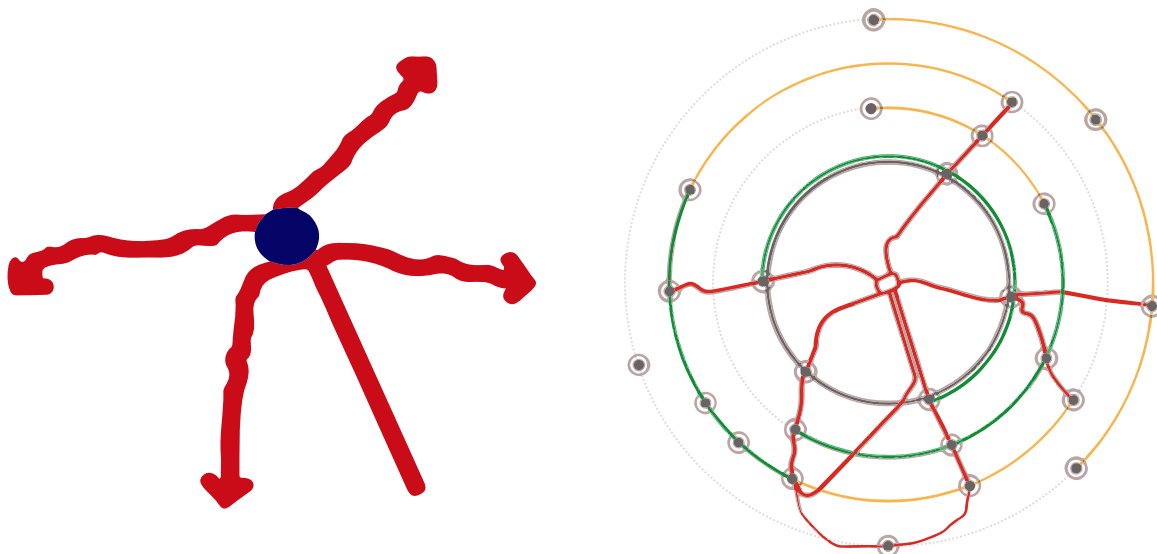


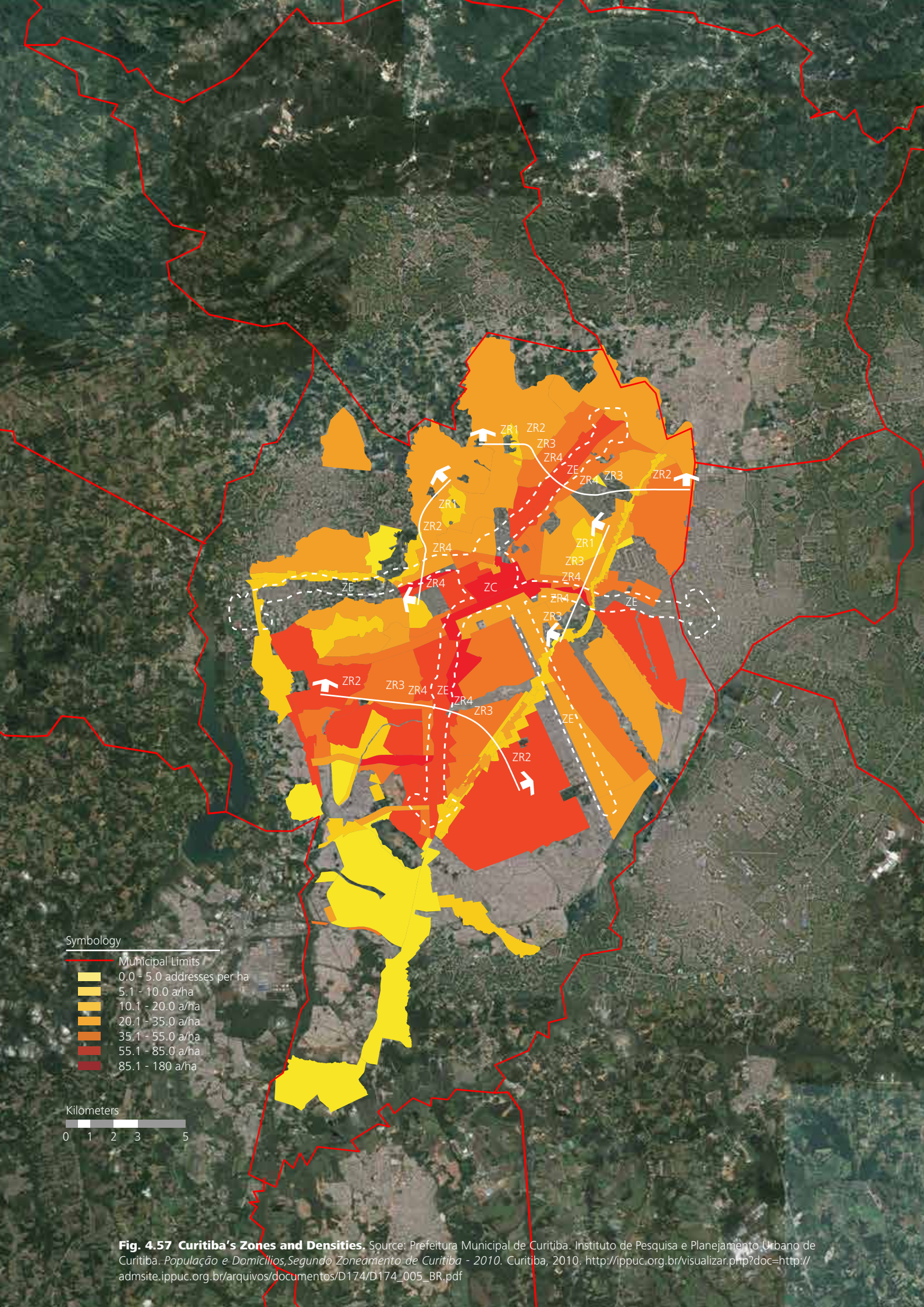
Fig. 4.56 Curitiba's Urban (Left) and Public Transport Schemes (Right).

Curitiba long have a planning tradition which has as a boosting point the 1965⁵¹ Curitiba's Transport Main Plan, establishing the structural axis of the city which would state the directions to where the city would develop. These structural axis would not only serve to transport, or to housing, or to a single function of the city. These axis concentrate most of the population and its aim is to concentrate as well their activities either in a single place, or to facilitate their commuting through an efficient transport system⁵².

While concentrating the activities in the main axis, the main goal for the rest of the urban land, or zones, is to gradually decrease their concentration with several zones, each one allowing certain construction quantity. Hence

[51] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. Urbanização De Curitiba. *Plano De Mobilidade Urbana e Transporte Integrado. PlanMob Curitiba. Anexo III: Diagnóstico Transporte Coletivo E Comercial.* March 2008. Pp. 1. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D35/D35_051_BR.pdf

[52] Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Zonamento e Uso do Solo.* Curitiba, 2015. <http://www.ippuc.org.br/mostrarpagina.php?pagina=13&idioma=1&titulo=Zonamento%20e%20Uso%20do%20Solo&liar=n%E3o>



Symbology

- Municipal Limits
- 0.0 - 5.0 addresses per ha
- 5.1 - 10.0 a/ha
- 10.1 - 20.0 a/ha
- 20.1 - 35.0 a/ha
- 35.1 - 55.0 a/ha
- 55.1 - 85.0 a/ha
- 85.1 - 180 a/ha

Kilometers

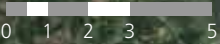


Fig. 4.57 Curitiba's Zones and Densities. Source: Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *População e Domicílios, Segundo Zoneamento de Curitiba - 2010*. Curitiba, 2010. http://ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D174/D174_005_BR.pdf

the dimension and typology of the urban spaces would as well gradually modify (see Fig. 4.57 on page 183 and schematic section on Fig. 4.58).

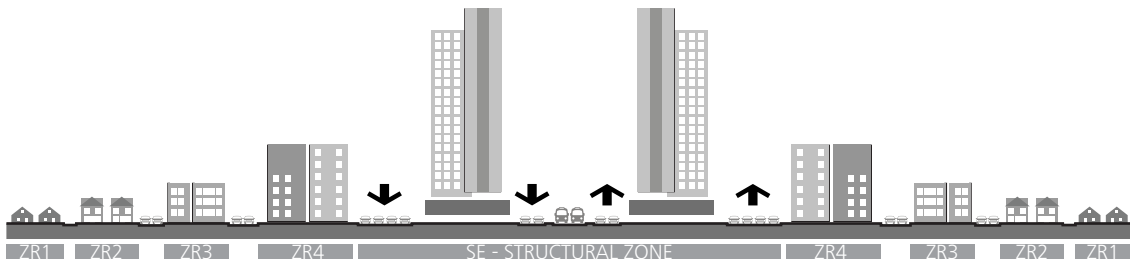


Fig. 4.58 Curitiba's Zone Scheme and Degradation of Density.

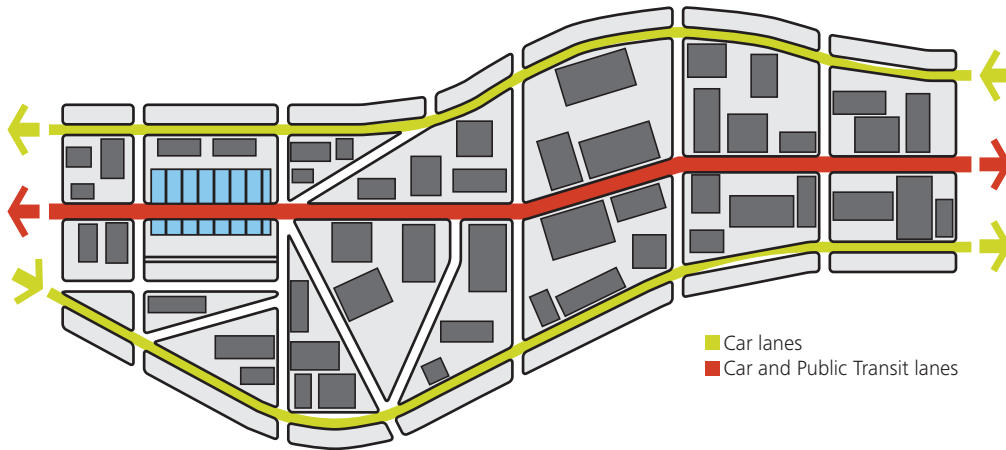


Fig. 4.59 Curitiba's Structural Zone Schematic Functioning.

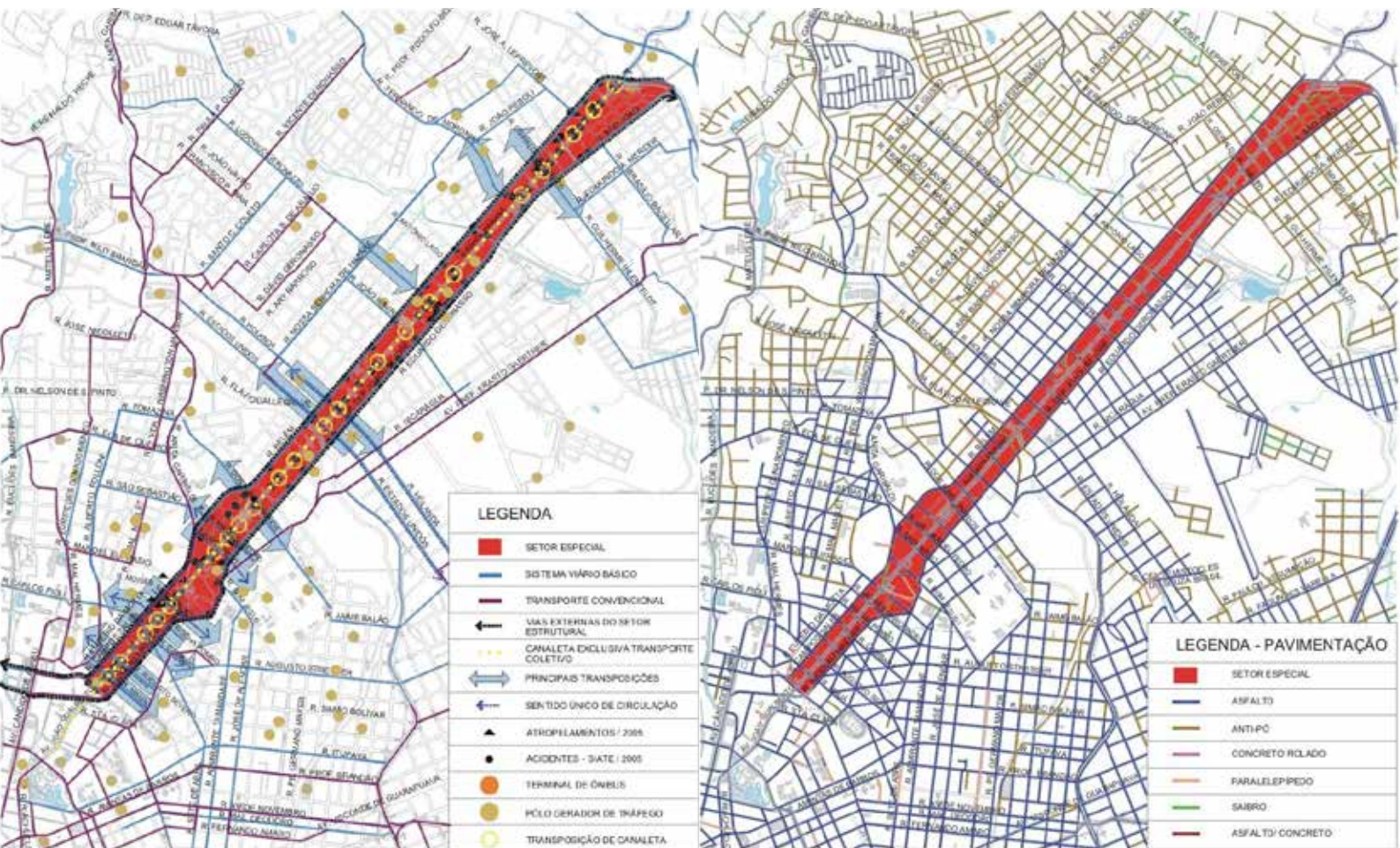


Fig. 4.60 Curitiba's Structural Zone Planning and Paving. Source: Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. Urbanização de Curitiba. *Plano De Mobilidade Urbana e Transporte Integrado. PlanMob Curitiba. Anexo Ila: Diagnóstico Sistemas Viário, De Circulação e de Trânsito.* March 2008. Pp. 39, 40. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D35/D35_030_BR.pdf

Each of the structural zones respond to the basic functioning (Fig. 4.59), yet all of them have different planning according to their location.

B) Zoning Scale

General Planning

According to the urban criteria previously established, the different zones are solved. Elements such as traffic generators, main crossings, buses terminals, main location of accidents, and other factors are located and have certain influence in the final solution. The final result (e.g. Fig. 4.60) includes the location of express buses stops, the path of the express buses and the definition of paving materials.

Public Transport Lanes⁵³

The Public Transport Network runs on a series of dedicated lanes, each of which has its unique characteristics:

- Exclusive Street: Located mostly in the center of the city, its sole purpose is to serve the Public Transport Network. There's an exception for neighboring cars to transit.
- Exclusive Lane: Its the central pathway in the structural zone for the movement of express lines. The lane with 7.00m wide, defines the mass transit corridors.
- Exclusive Segment: Is the segment of the lane for the movement of South Circular Express line, defined by bump lanes separators.
- Shared Street: In some segments of the structural axes, especially at the center and in the west axis stretches, the movement of Express Lines is shared with other vehicles.

Integration Terminals⁵⁴

These terminals play several roles: Allow the integration between the various lines of the Public Transport Network: express, neighboring, feeder, direct, trunk and intercity (for

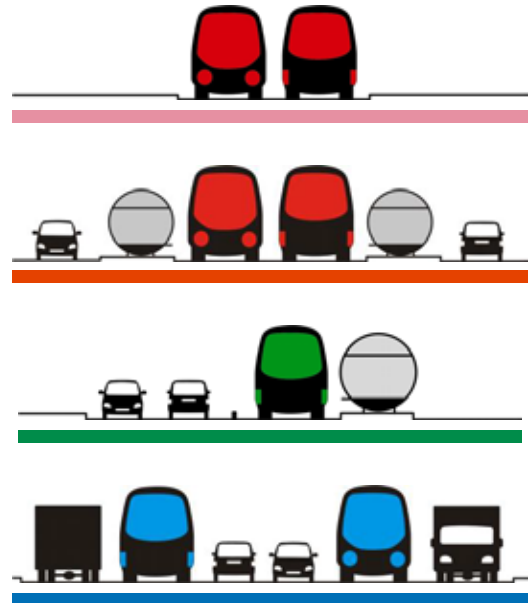


Fig. 4.61 Curitiba's Public Transport Lane Schemes. From Top to Bottom: Exclusive Street, Exclusive Lane, Exclusive Segment and Shared Street.

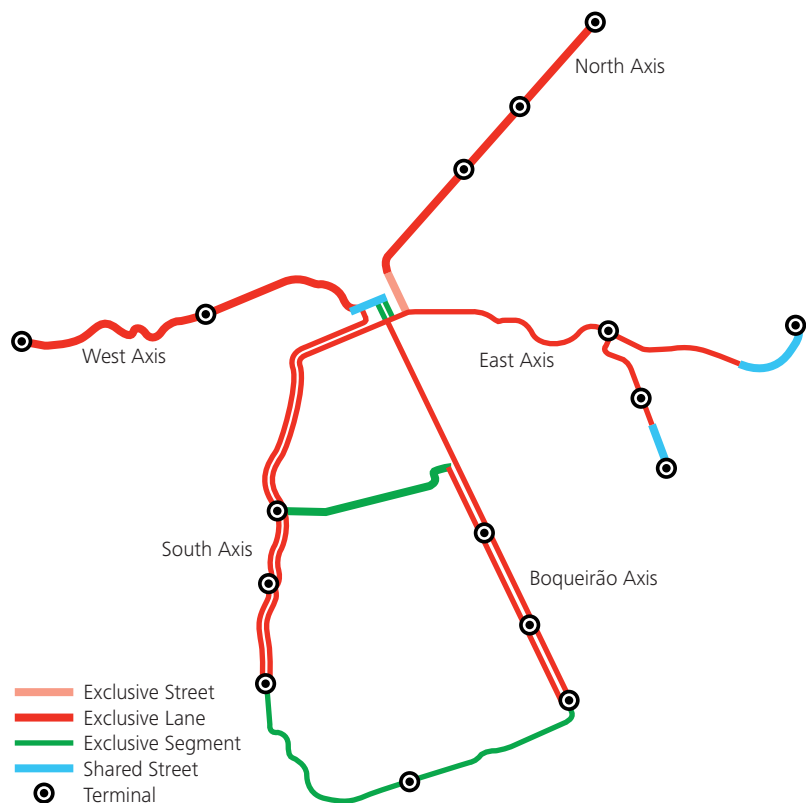


Fig. 4.62 Curitiba's Routes of Express Lines. Source: Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. Urbanização De Curitiba. *Plano De Mobilidade Urbana e Transporte Integrado. PlanMob Curitiba. Anexo III: Diagnóstico Transporte Coletivo E Comercial.* March 2008. Pp. 41. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D35/D35_051_BR.pdf

[53] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. Urbanização De Curitiba. *Plano De Mobilidade Urbana e Transporte Integrado. PlanMob Curitiba. Anexo III: Diagnóstico Transporte Coletivo E Comercial.* March 2008. Pp. 39-41. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D35/D35_051_BR.pdf

[54] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. Urbanização De Curitiba. *Plano De Mobilidade Urbana e Transporte Integrado. PlanMob Curitiba. Anexo III: Diagnóstico Transporte Coletivo E Comercial.* March 2008. Pp. 41-46. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D35/D35_051_BR.pdf

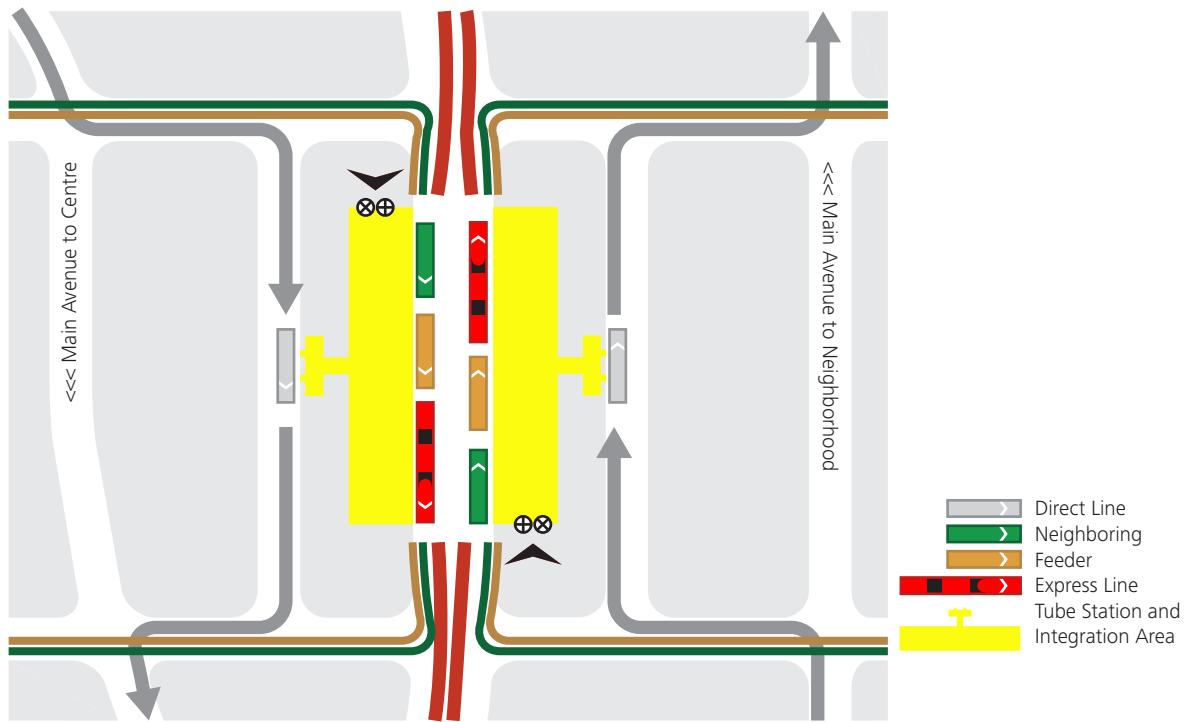


Fig. 4.63 Curitiba's Integration Terminals Structure Scheme. Source: Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. Urbanização De Curitiba. *Plano De Mobilidade Urbana e Transporte Integrado. PlanMob Curitiba. Anexo III: Diagnóstico Transporte Coletivo E Comercial.* March 2008. Pp. 42. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D35/D35_051_BR.pdf

metropolitan terminals). Enable the deployment of shorter feeder routes, with better service to neighborhoods, while increasing the number of travels with the reduction of travel time; Concentrate the demand; Structure the neighborhoods, with the concentration of various activities.

The distribution of the bus lines in these terminals seek to ensure priority for express lines and direct lines. The other lines (feeder and neighboring), are distributed through the platforms that define the areas of integration.

Such terminals are implanted in six different types, which are characterized below:

- Terminus stations: Larger stations, housing a larger number of lines, with large platforms, distribution of user flows through underground or level passages, spaces for commercial activities and services defined by a roof, and with tube stations. Hosts easy passages to commute from one line to another, specially delimited by zebra crossings. The platforms have indications regarding embarking and disembarking areas.



Fig. 4.64 Pinheirinho Terminus <http://static.panoramio.com/photos/large/7070019.jpg> Maps.google.com

- Intermediate stations: Deployed in all axes, defined with loading and unloading platforms, with fiberglass domes, pillars and truss beams. In charge of the distribution of user flows through underground or level crossings, and with tube stations. This ones as well have delimited crossings and the commute from one line to another is



Fig. 4.65 Do Portao Intermediate Station. http://www.opengreenmap.org/sites/default/files/user_upload/portao1.jpg <http://bit.ly/19krt8m>

easily done through these.

- Neighborhood stations: Inserted in neighborhoods whose demands for the central area resulted in many conventional lines. With the implementation of neighborhood terminal there was an operating gain, with the transformation of conventional lines onto feeder ones and the deployment of trunk and straight lines. In this case the integration with the public transport network is done with the neighboring lines. These have the same structure of intermediate stations.
- Metropolitan stations: Meet the demands of the municipalities inside the Greater Curitiba integrated into the public transport network, served with direct, trunk, feeder and intercity lines.



Fig. 4.66 Bairro Alto Neighborhood Station, Pinhais Metropolitan Station. <http://static.panoramio.com/photos/large/40622713.jpg> <http://maps.google.com>

- Stations in the Central Area: Several terminus and stations inside the central area. The terminus are for the main axis express lines, while the rest are for metropolitan lines not integrated in the public transport network. In these cases the design is completely discrete as it needs to blend with its surroundings, yet distinctive so people can acknowledge the stations and use them. Most embarking and disembarking areas with turnstiles and a fare collector. The station is above ground so some steps or a handicap platform are needed to access the station.
- Buses stops: There are various types of the PTN stops, such as: tube station, NBS type stop, dome type, Chinese hat type and defined by signpost. About the tube station: these are intended for boarding and disembarkation of passengers in level with prepayment rate, and exclusive for the express lines and direct lines of the PTN. The characteristics of these stops are: made by high platform, modulated, with an enclosed waiting area, checked by the collector, with turnstiles and electronic card readers, and door for wheelchair, and as well an exit turnstile. Its physical characteristics are: metal structural system, with steel plates and tempered glass, forming the harmonious



Fig. 4.67 (Top to bottom) Praça Carlos Gomes Central Area Terminal and Standard Tube Station. <http://maps.google.com>



Fig. 4.68 (Top to bottom) Contorno Leste Bike Lane, Floriano Peixoto Avenue Bike Track, Sete de Setembro Avenue Slow Street and Sete de Setembro Shared Promenade. <http://maps.google.com>

shape that stands out in the urban landscape, not only inside the city but as well worldwide.

Bicycle infrastructure⁵⁵

As set in the Bicycle Strategic Plan (Fig. 4.45 on page 171) and in the Mobility Plan, the bicycle is a way of sustainable mobility to which the municipality is developing in order to prioritize it and disincentive the use of private cars. To do so, several elements have been implemented inside the city such as a differentiation of bicycle paths:

- **Bike Lane:** Exclusive space for bicycles flow. There is a physical separation - short wall, bump lanes separators, concrete blocks - isolating cyclists from other vehicles. Therefore, the bike path is isolated.
- **Bike track:** Exclusive track for bikes at a same care level. Signaling is made with painting on the asphalt, and there may be bump lanes separators to improve the identification of it.
- **Bicycle boulevards:** a common low traffic street, with horizontal and vertical signs warning of the presence of cyclists. Motor vehicles and bicycles share the same space, with a preference for cyclists. In the bicycle boulevard there is a low speed limit, forcing drivers of motor vehicles to drive slower.
- **Shared promenade:** fully isolated space from vehicular traffic, where cyclists and pedestrians share the same space. In this case, the pedestrian has the preference over bicycles.

In addition, several modifications are in progress to create "slow streets". The first one has already been set up in September 7th avenue. This slow streets include a designated space for the bicycle traffic, the implementation of bike boxes, a 30km/hr speed limit to cars and speed bumps every 60m.

Pedestrian Infrastructure⁵⁶

It has been launched a new Plan for Revitalization of Pedestrian Infrastructure. Some of the objectives sought are to improve the accessibility and security, and the creation of pedestrian walkways and regularization of several houses. To do such, the plan is articulated with elements like:

- **Pedestrian Promenades:** Through a selection process in each of the regions of Curitiba a street will be chosen to be enabled as a pedestrian

[55] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Plano Estratégico Cicloviário de Curitiba 2013*. Curitiba, 2013. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D291/D291_004_BR.pdf
 [56] Prefeitura Municipal de Curitiba. "Plano prevê calçadas nas regionais e revitalização de calçadas". Curitiba, March 27th, 2014. <http://www.curitiba.pr.gov.br/noticias/plano-preve-calcadoes-nas-regionais-e-revitalizacao-de-calcadas/32407>

promenade. It is intended that, besides encouraging sustainable mobility, trade incentive on the tracks where they are located promenades.

- Light Paths: street lighting will be placed in strategically selected streets leading to sports facilities in various areas of Curitiba.
- School Paths: pedestrian environments of municipal schools will be improved. It is intended to be connected by walkways to schools with facilities around the area.

4.2.5. Strengths and weaknesses of the system

A) Strengths

About the Development of the City

From its 1966 Master Plan the guidelines for the operation of the city were established, this in order to avoid the phenomenon of urban sprawl. The key elements are:

- Linear growth of the city
- Concentration of activities and land uses in the structural axes
- Concentration of transport in the structural axes

This leads to the division of Curitiba into different areas (close to 50 different types) each with different guidelines for density, construction, growth, type of public transport, etc. The trinary or structural system is the element that helps to organize the development of the city, for in them their key elements come together and develop. From this point the density of the city is degraded to a point that is almost minimal. Having accomplished this, then the need for transportation in the city minimizes. Besides the fact that the city has a linear development mode, gives many opportunities for growth regardless of the amount of people⁵⁷.

The city planning is carried out by the IPPUC, *Instituto de Pesquisa e Planejamento Urbano de Curitiba*; whereas administration of the transport system is carried out by private enterprise Urbs: *Urbanização de Curitiba*. The fact that an institute and a private company are the ones responsible for making such plans, does their work an independent one, avoiding the various political changes that could affect the planning of the city⁵⁸.

About transportation

The city is making efforts to make people use public transport instead of private cars. Some incentives range from fare subsidies⁵⁹ to the ban on using the car in some parts of the city (especially downtown). Public transport is planned according to the area and population density of the city. This translates into different types of service from the expresso in the structural sector to the feeders, or even some as particular like the hospitals line.

Something that is very particular about Curitiba's Transport Network is its adaptability. Since it is based on buses in streets (which may be confined or shared), the necessary infrastructure for running is considerably more economical and quick to perform⁶⁰. Even more the corresponding lines can carry modifications without much complications.

[57] Suzuki, Hiroaki *et al.* *Eco2 Cities. Ecological Cities as Economic Cities*. Washington, World Bank Publications, 2010. Pp. 170-173. <https://books.google.com.mx/books?id=5pDvVUsYctgC&lpg=PR5&ots=gSV22Ai6zK&dq=%20Eco2%20Cities%3A%20Land%20Use%20and%20Public%20Transportation%20Planning%20in%20Curitiba&lr&hl=es&pg=PA173#v=onepage&q=curitiba&f=false>

[58] Curitiba, Brazil. BRT Case Study. P. 17. http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp90v1_cs/Curitiba.pdf

[59] Prefeitura Municipal de Curitiba. Instituto de Pesquisa e Planejamento Urbano de Curitiba. *Plano De Mobilidade Urbana e Transporte Integrado. PlanMob Curitiba. Anexo III: Diagnóstico Transporte Coletivo E Comercial*. March 2008. Pp. 18. http://www.ippuc.org.br/visualizar.php?doc=http://admsite.ippuc.org.br/arquivos/documentos/D35/D35_051_BR.pdf

[60] Suzuki, Hiroaki *et al.* *Eco2 Cities. Ecological Cities as Economic Cities*. Washington, World Bank Publications, 2010. Pp. 170-173. <https://books.google.com.mx/books?id=5pDvVUsYctgC&lpg=PR5&ots=gSV22Ai6zK&dq=%20Eco2%20Cities%3A%20Land%20Use%20and%20Public%20Transportation%20Planning%20in%20Curitiba&lr&hl=es&pg=PA173#v=onepage&q=curitiba&f=false>

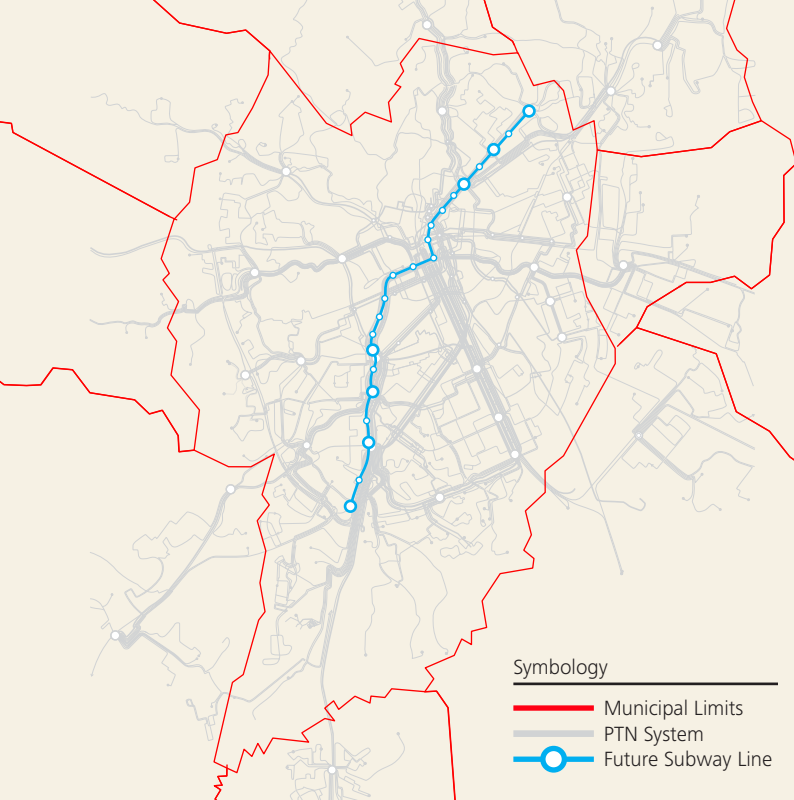


Fig. 4.69 Curitiba's Metro Scheme. Source: Prefeitura de Curitiba. *Anexo III: Diretrizes Básicas Do Projeto. Volume IV - Projeto De Engenharia E Material Rodante. Projetos Arquitetônicos E Demais Projetos Técnicos Prediais. Projeto Arquitetônico.* Curitiba, 2014. P. 8. http://multimedia.curitiba.pr.gov.br/conteudos/metro/licitacao/Anexo_III_Vol_IV_07a.pdf

The fare integration is a great incentive for people to use public transport. Through a single payment, people can use the system, removing restrictions on the movement of people inside the city.

About urban spaces

These efforts to develop the city in a sustainable way translate into transport spaces oriented to productivity, without neglecting the image.

The trinary system or structural zone is the first element that promotes mobility in the city. With the trinary system is given priority to public transport without neglecting the private, having already defined spaces for each transport modes.

The city has certain types of stations, and they depend on several factors such as location in the city, its use, the number of people who will transit through, among others. The important thing is that such design meets those needs. For example, stations in the Structural Zone have a design that allows the interconnection between feeder and express lines quickly. While the terminal stations concentrate various services to avoid unnecessary transfers of

people.

In order to encourage sustainable mobility, Curitiba has a Bicycle Mobility Plan, as well as Streets Pavements Plan. They specify how they should be the streets, depending on flows of people and uses.

It should be noted that the participation of society is essential for the realization of their master plans.

B) Weaknesses

However in recent years the transport system has had a decrease in their use, while the number of cars is increasing in the streets of Curitiba. The phenomenon is explained by a number of factors, including the facility to purchase a car with the comfort that gives⁶¹.

The possible saturation of Public Transport Network could be another factor that subliminally promotes the use of private transport. Added to this is the latest years low average speed of the system which results in a decrease in the frequency of bus passing, and therefore a decrease in their productivity levels⁶².

As time passed by several services in the Structural Zone were concentrated, so that today the real estate market has overvalued properties near these axes. In addition to the relative easy acquisition of cars, created in these recent years, there's a phenomenon in which most of the population living on the axes is middle class, with access to a car, while population requiring use public transportation (the middle and lower) need to commute to use it. This could explain the occurrence of traffic in recent years in Curitiba⁶³.

4.2.6. How they're dealing with those

Several projects are in hand, and some are already being put into action, including the implementation of the first

[61] Senthilingam, Meera. "Brazil's idea for future mobility: the good old bus" on CNN.com. September 22, 2014. <http://www.cnn.com/2014/09/22/living/curitiba-buses/>

[62] Demery, Jr., Leroy W. "Bus Rapid Transit in Curitiba, Brazil - An Information Summary" on Public transit.org. December 11, 2004. <http://www.publictransit.us/ptlibrary/specialreports/sr1.curitibaBRT.pdf>

[63] Bolich, Glenn and Husnick, Kelsey. "Traffic hobbles renowned bus system" on Dateline Brazil. <http://www.datelinebrazil.org/traffic-hobbles-renowned-bus-system/>

subway line. The first metro line, blue line, will have 22km in total, building a first stage of 17km with 14 stations, and a second 5km. Currently the project is under negotiation and public biddings⁶⁴.

Moreover there are critics who think that by expanding the public transport system to the point of having a network, it is possible to eliminate the problem of trafficking. There's also as well the possibility of changing some land uses, so that people who really need to use the shuttle (the middle and lower) live near the structural axes.

But there is a major constraint, the political divisions of the city. In reality the metropolitan area includes not only the city of Curitiba, but also some neighboring municipalities such as Almirante Tamandaré, Colombo, Araucaria, among others. In order to truly create a Public Transport Network with a metropolitan scope, several negotiations and agreements with such municipalities are needed (therefore some extra time is needed as well)⁶⁵.

4.2.7. Applicable measures in MCMA

Despite the age the planned Curitiba has, it leaves us today several learnings. The fundamental concept of mixing different uses in one place and supply them with a fast and efficient transport system would be first. By having multiple land uses concentrated in the same place, including housing, possible commutes done by the population are reduced. If they are also given an effective, fast and accessible transportation system, people will use it to make their commutes. All this depends on effective planning with a bigger scope than just the municipal, or even the state level. We have seen that in the case of Curitiba, the city presents difficulties for their transportation planning when having to consult with other municipalities on these issues.

On the planning of a city -or in our case the MCMA- is also worth considering bringing the closer the people to their destinations to avoid possible long commutes. This does not mean an efficient transportation system for the metropolitan area should be ruled out. Despite being a megalopolis, there are areas where its possible to consider diversifying its uses so that the most recurrent activities (work-study) could be located much closer to the housing areas. Once done this, its possible to work in the urban and neighborhood level, thereby allowing diversification of uses in the same area. Following would be work on details of pavements, street furniture, promenades, among others.

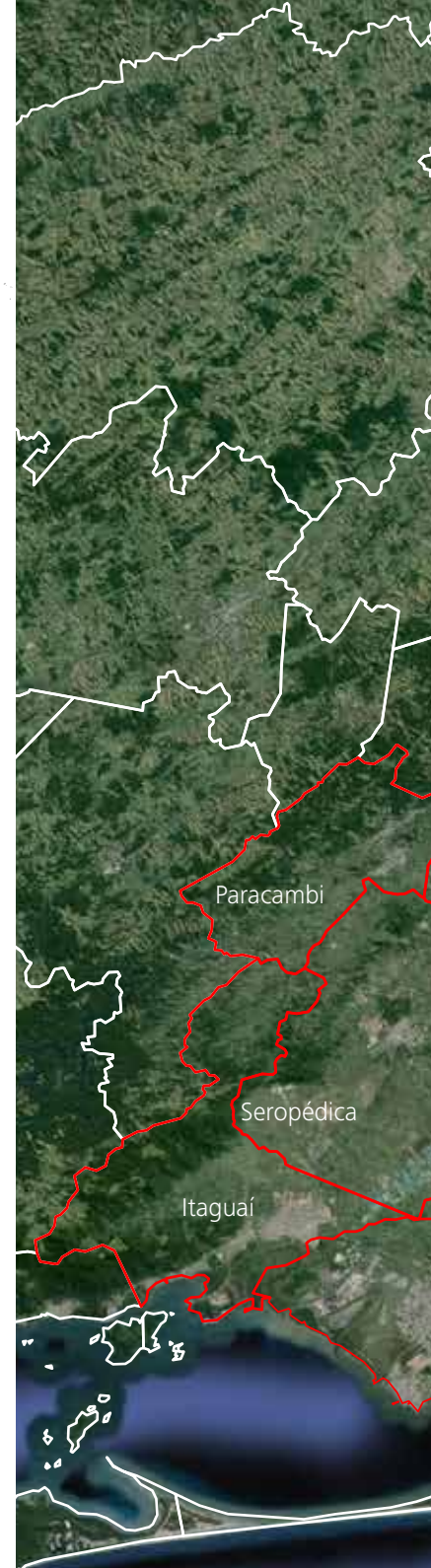
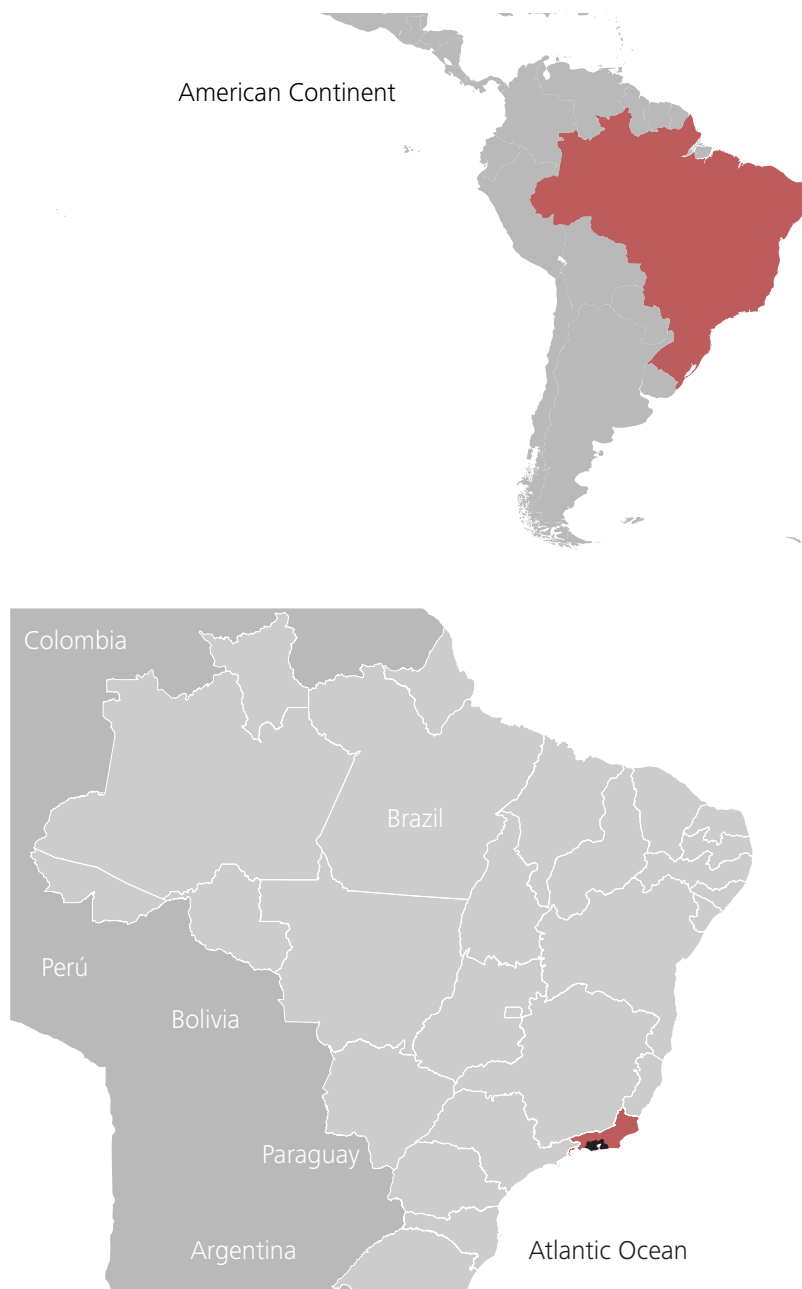
Regarding transportation, we can say that the city of Curitiba is always pushing measures to discourage car use (although in recent years has increased its use because of the ease of purchase, as well of the convenience). But it needs its counterpart, an efficient public transport system. Failure to do so can cause a vicious cycle that only fuels car purchases and therefore the phenomenon of traffic in the city. The integration fare is a good incentive for use, since it allows people to move all around the city without any restrictions. The specialization of different lines based on user needs is another benefit, ie. Identifying the various transportation needs and translate them into efficient transport lines.

An important point is to stimulate a network of sustainable mobility for both bikes (bike network paths and bike sharing system) and pedestrians (pedestrian paths and promenades). A network that interconnects (if possible) the entire metropolitan area efficiently and allowing safe movements. The moment people are convinced that sustainable mobility is -apart from environmentally friendly- much more practical, economical and efficient than traditional means of mobility, they'll considered it as second choice, or even as a first one.

[64] Urbanização de Curitiba. "Primeira fase do metrô terá 17,6 quilômetros, entre a CIC e o Cabral" on Urbs website. October 29, 2013. <http://www.urbs.curitiba.pr.gov.br/noticia/primeira-fase-do-metro-tera-17-6-quilometros-entre-a-cic-e-o-cabral>

[65] Bolich, Glenn and Husnick, Kelsey. "Traffic hobbles renowned bus system" on Dateline Brazil. <http://www.datelinebrazil.org/traffic-hobbles-renowned-bus-system/>

4.3. RIO DE JANEIRO



4.3.1. Brief description of the city

Rio de Janeiro is the state capital of Rio de Janeiro State, located in southeastern Brazil. It is the third largest city in Brazil⁶⁶, boasts the busiest international tourism in the country and is the first Olympic City in South America. Rio de Janeiro is considered a beta global city by the 2008 World Cities Ranking by the University of Loughborough (GaWC)⁶⁷.

It is one of the major economic, cultural and financial centers of the country, and is internationally known for its cultural icons and landscapes, like the Sugar Loaf, the Christ the Redeemer statue, the beaches of Copacabana and Ipanema, Maracanã Stadium, Tijuca

[66] Instituto Brasileiro de Geografia e Estatística. “Censo 2010: população do Brasil é de 190.732.694 pessoas”. Brasília, November 29th, 2010. <http://saladeimprensa.ibge.gov.br/noticias?view=noticia&id=1&busca=1&idnoticia=1766>

[67] Globalization and World Cities Research Network. “The World According to GaWC 2008”. Leicestershire, Globalization and World Cities Research Network, April 13th 2010. <http://www.lboro.ac.uk/gawc/world2008t.html>

Symbology

- Greater Rio de Janeiro
- Municipalities
- Remaining Municipalities of Rio de Janeiro State

Kilometers



Fig. 4.70 Rio de Janeiro Metropolitan Area. Maps. google.com.



Nova Iguaçu

Duque de Caxias

Magé

Guapimirim

Japen

Queimados

Belford Roxo

Itaboraí

Tanguá

Mesquita

São João d.M.

Nilópolis

São Gonçalo

Rio de Janeiro

Niterói

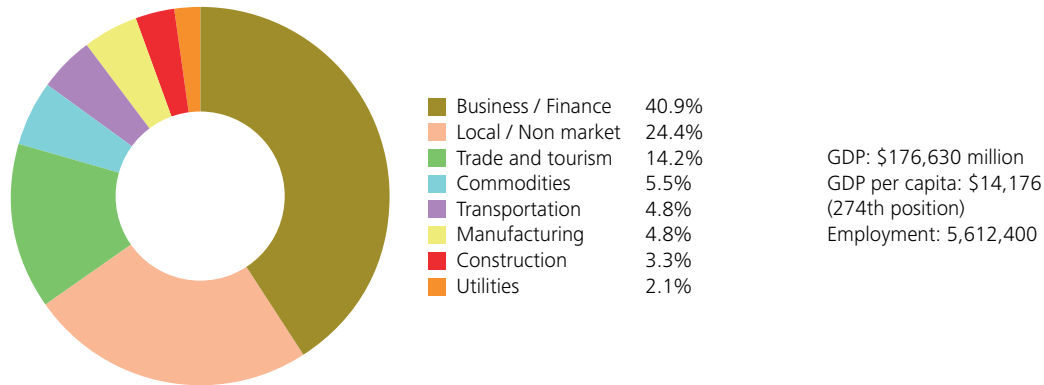
Maricá

National Park, the celebration of Carnival, among others.

Rio de Janeiro represents the second largest GDP in the country⁶⁸ and 31 largest in the world, besides being home to two of the most important Brazilian companies: Petrobras and Vale do Rio Doce, as well as major oil and telephone companies, among others. It is the second largest center of research and development in Brazil, reaching 19% of the national scientific production⁶⁹.

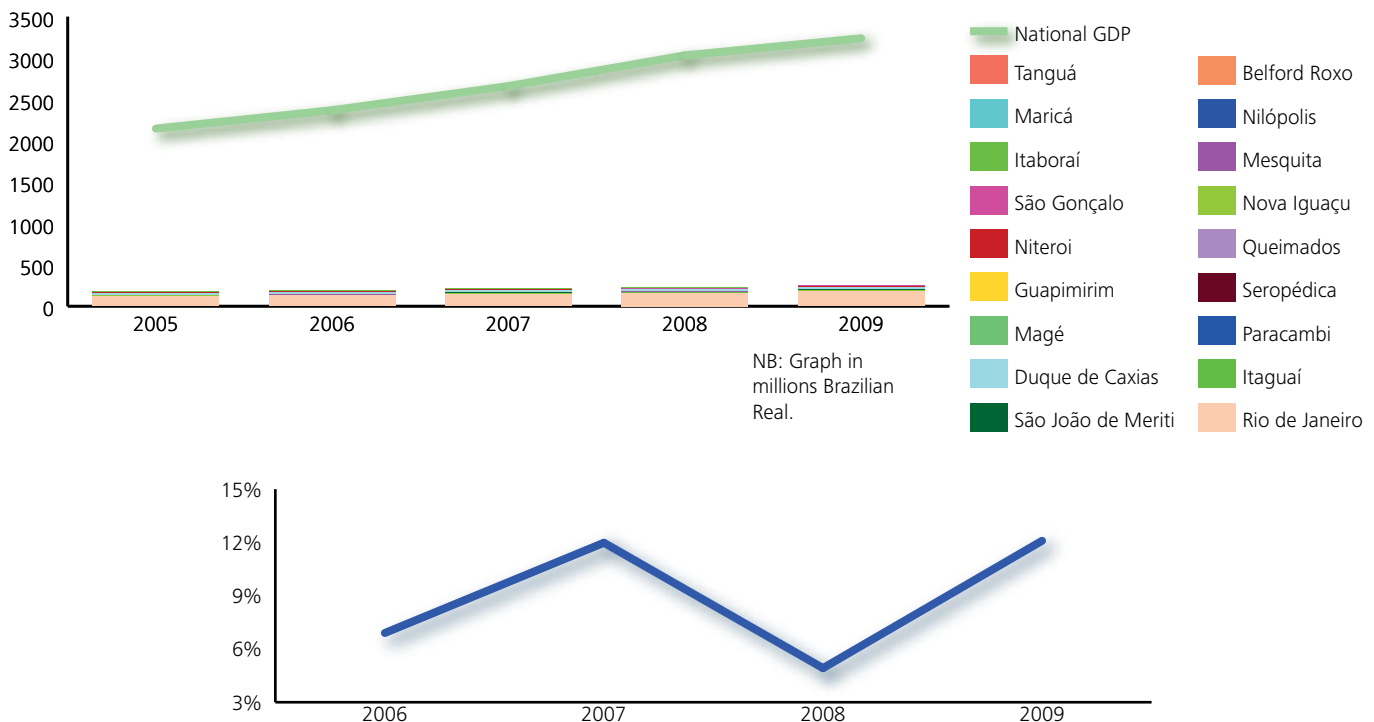
The metropolitan region of Rio de Janeiro, also known as *Greater Rio* is the 2nd largest in Brazil⁷⁰. It was created

Graph 4.26 Rio de Janeiro's Metropolitan Area Output by Industry.



Source: The Brookings Institution. *Global MetroMonitor*. <http://www.brookings.edu/research/interactives/global-metro-monitor-3>

Graph 4.27 Rio de Janeiro and Brazil's GDP Comparison with Annum Variation.

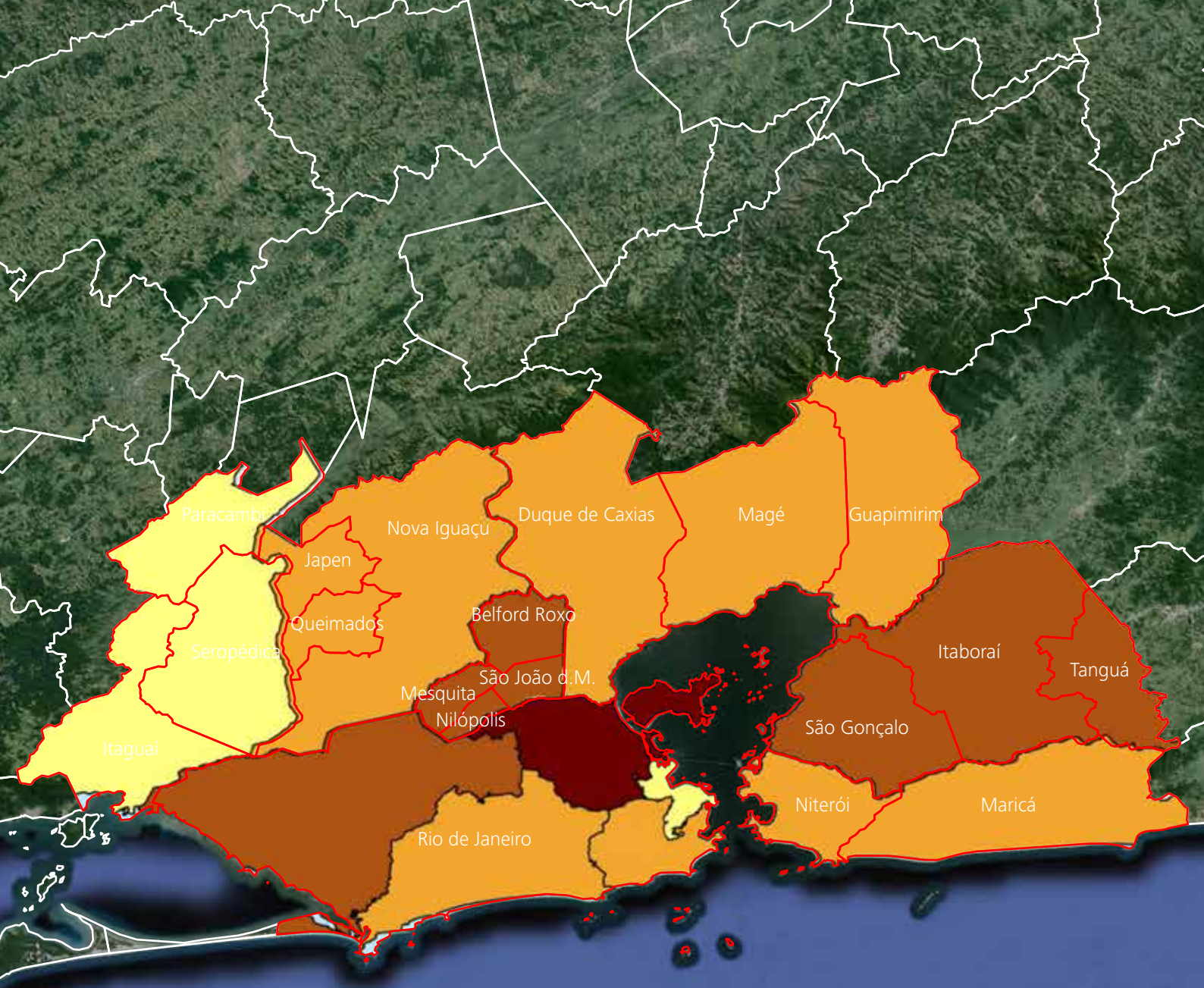


Source: Instituto Brasileiro de Geografia e Estatística. *Tabela 1 - Produto Interno Bruto a preços correntes e Produto Interno Bruto per capita segundo as Grandes Regiões, as Unidades da Federação e os municípios - 2005-2009*. Brasília. http://www.ibge.gov.br/home/estatistica/economia/pibmunicipios/2005_2009/tabelas_pdf/tab01.pdf

[68] Instituto Brasileiro de Geografia e Estatística. "PIB dos Municípios: indústria de transformação provoca queda na participação de grandes municípios no PIB em 2012". Brasília, December 11th 2014. <http://saladeimprensa.ibge.gov.br/noticias?view=noticia&id=1&busca=1&idnoticia=2788>

[69] Castro, Roberto. "Os números da inovação no País" on *Jornal da USP*. São Paulo, Universidade de São Paulo. <http://www.usp.br/jorusp/arquivo/2005/jusp726/pag03.htm>

[70] Instituto Brasileiro de Geografia e Estatística. "2010 Census first final results: Brazil has a population of 190,755,799 residents" Brasília, April 29 2011. <http://censo2010.ibge.gov.br/en/noticias-censo?view=noticia&id=3&idnoticia=1866&busca=1&t=primeiros-resultados-definitivos-censo-2010-populacao-brasil-190-755-799-pessoas>



Symbology

- Greater Rio de Janeiro Municipalities
- Remaining Municipalities of Rio de Janeiro State
- 0 to 3.00%
- 3.01 to 5.00%
- 5.01 to 10.00%
- 10.01 to 15.00%
- 15.01% and more

Kilometers



Fig. 4.71 Rio de Janeiro's 2010 Percentile Population per Macrozone. Source: Governo do Estado do Rio de Janeiro, Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 161. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

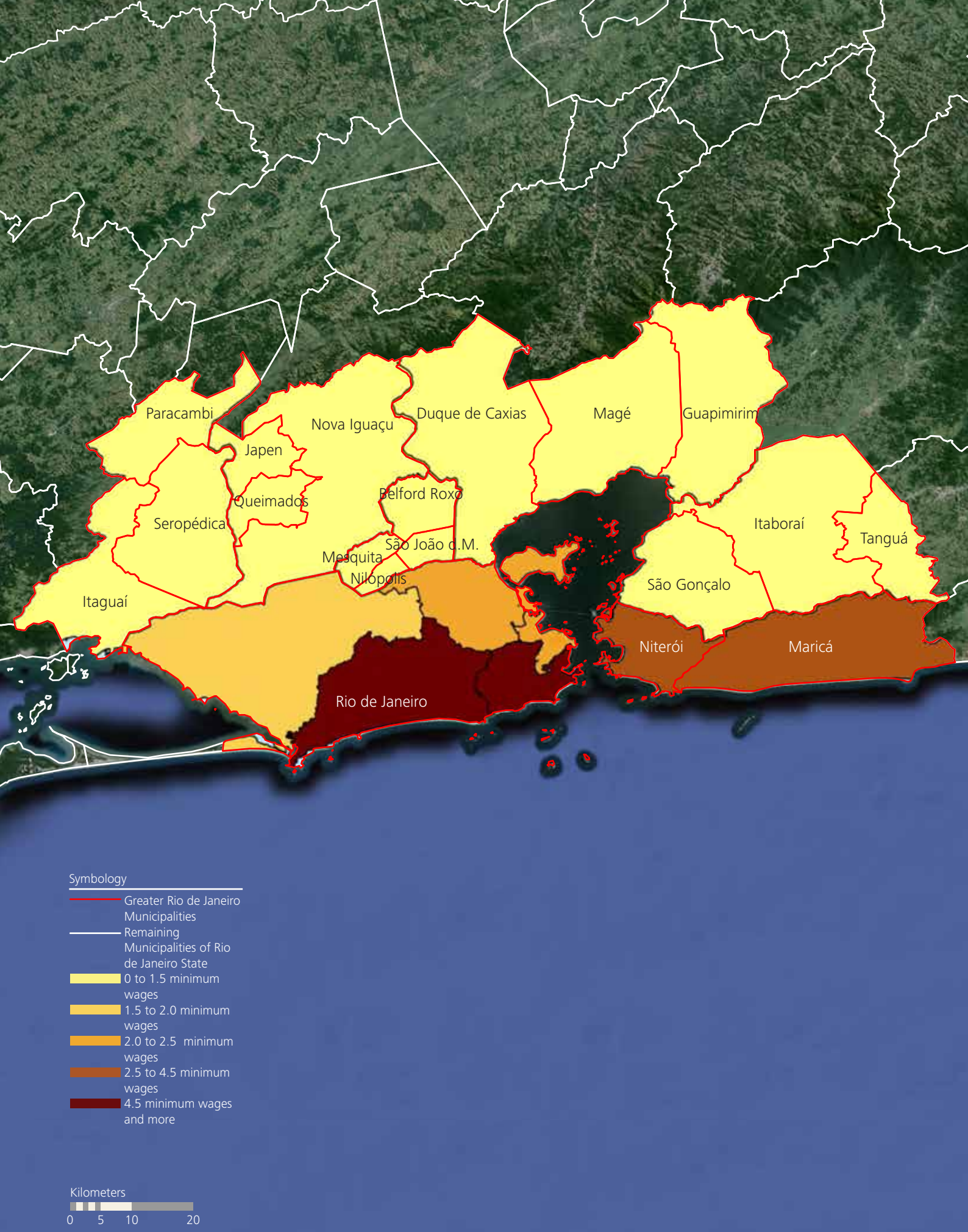


Fig. 4.72 Rio de Janeiro's 2010 Average Income. Source: Governo do Estado do Rio de Janeiro, Secretaria de Estado de Transportes, Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 161. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

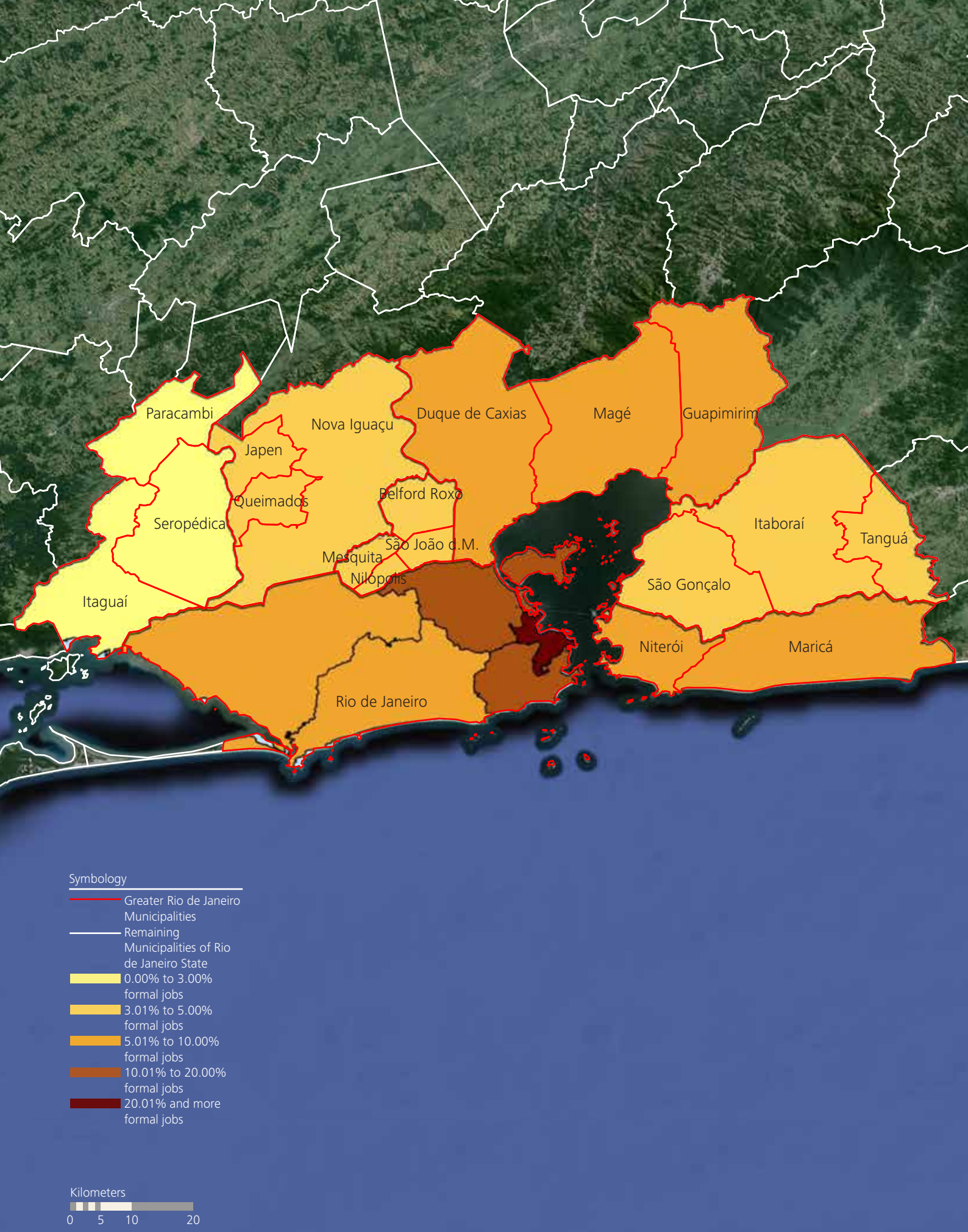
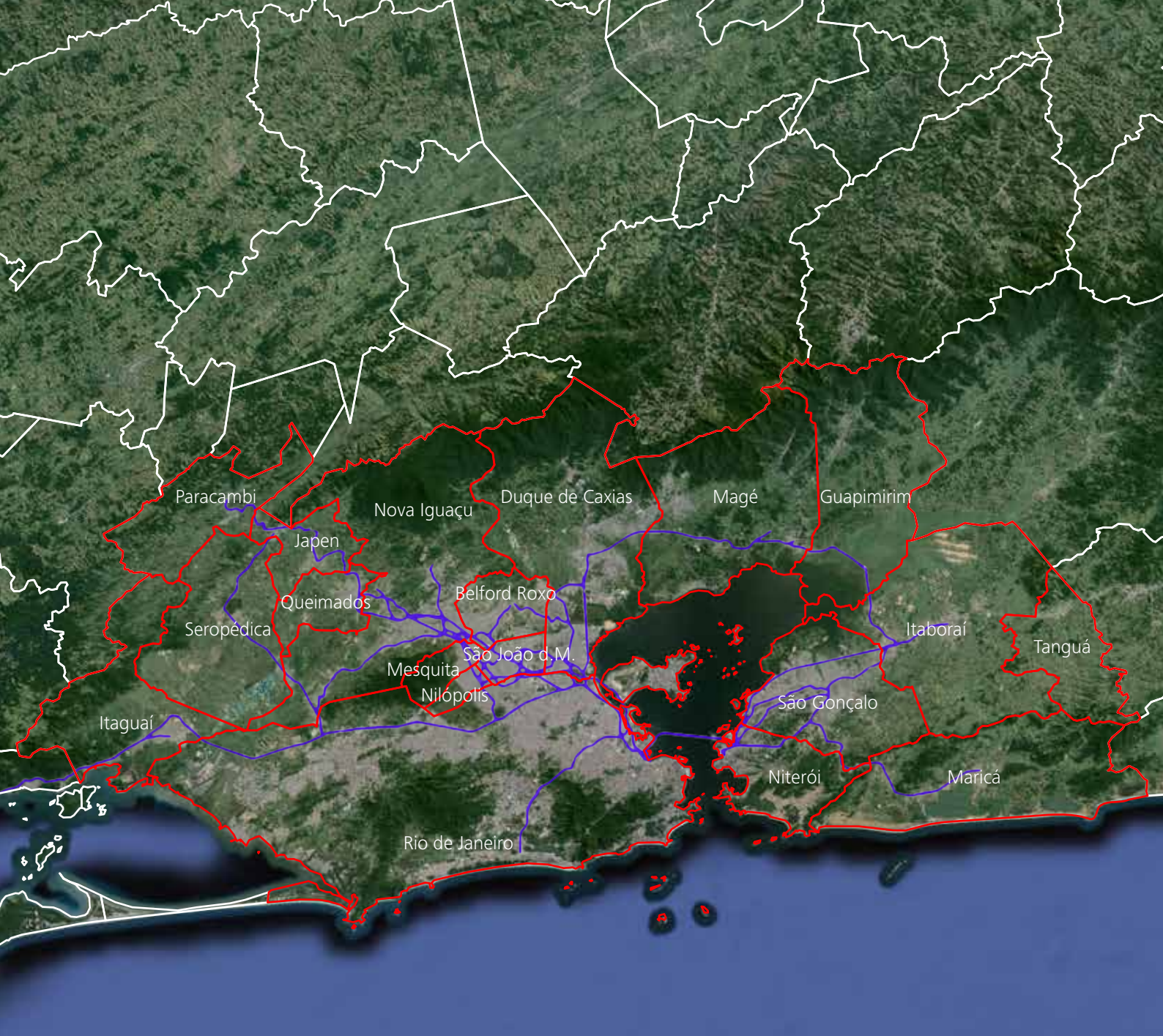


Fig. 4.73 Rio de Janeiro's 2010 Formal Jobs Percentile Map. Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 161. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>



Symbology

- Greater Rio de Janeiro Municipalities
- Remaining Municipalities of Rio de Janeiro State
- Metropolitan corridors



Fig. 4.74 Rio de Janeiro's 2010 Metropolitan Corridors. Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 234. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

by the *Lei Complement n°20*, in July 1st 1974, following the merger of the former states of Rio de Janeiro and Guanabara.

According to the 2010 census results, Rio de Janeiro has a population of 15,993,583 inhabitants⁷¹. In recent years, the average annual growth rate of population was 0.82% (2000-2005) and 0.75% (1991-2000) in Rio de Janeiro, and 1.05% (2000-2005) and 1.18% (1991-2000) in the metropolitan region, indicating a slight slowdown in growth rates, except in Rio de Janeiro which shows a small increase⁷².

4.3.2. Rio de Janeiro's transport system

Passenger transport and cargo inside Greater Rio de Janeiro use a complex road network, specially by land use particularities, socioeconomic and institutional aspects involved. The metropolitan transport network transport modes includes rail systems, subways, ferries, aerial tramway, intercity buses, city buses and regular vans of several cities that make up the metropolitan area.

A) SuperVia Train Infrastructure

In November 2010, Odebrecht TransPort, a company with a focus on urban mobility, assumed control of the train infrastructure. Supervia operates in a road network of 270 km in eight lines with 102 stations. The route crosses the Rio de Janeiro and eleven municipalities in the Metropolitan Region (Duque de Caxias, Nova Iguaçu, Nilópolis, Mesquita, Queimados, São João de Meriti, Belford Roxo, Japeri, Magé, Paracambi and Guapimirim). SuperVia carries an average of 620,000 passengers per working day. As can be seen in Fig. 4.76, the passenger rail network has radial structure linking the Capital center with the West Zone and Baixada Fluminense, with no links to the East Metropolitan⁷³.

Supervia Trens Urbanos offers these services⁷⁴:

- Regular: Making stops in all stations.
- Express: Currently, these are trains of Japeri and Santa Cruz lines that between Central and Deodoro stations only perform stops in Madureira and Maracanã station. Only on weekdays.
- Japeri Semi-direct: These trains stop at all stations between Japeri and Deodoro stations; between Deodoro and Brazil Central, only make stops at transfer stations (Silva Freire, Madureira, Cascadura and Engenho de Dentro). The service is on Saturdays only until 14h Japeri direction, and 9am Brazil Central direction.
- Santa Cruz Semi-direct: These trains stop at all stations between Santa Cruz and Deodoro; between Deodoro and Brazil Central, only make stops at transfer stations (São Francisco Xavier, Silva Freire, Engenho de Dentro, Cascadura and Madureira). The service is on Saturdays only until 14h Santa Cruz direction, and until 9am Brazil Central Direction.

[71] Instituto Brasileiro de Geografia e Estatística. "Total População Rio de Janeiro". http://www.ibge.gov.br/home/estatistica/populacao/censo2010/tabelas_pdf/total_populacao_rio_de_janeiro.pdf

[72] Ministério da Saúde. "Indicadores Demográficos do Brasil". Brasília, 2006. <http://tabnet.datasus.gov.br/cgi/ibd2006/a03.htm>

[73] SuperVia Trens Urbanos. "Quem Somos" on Supervia.com.br. Rio de Janeiro. <http://www.supervia.com.br/quemsomos.php>

[74] Supervia Trens Urbanos. "Tipos de Serviços" on Supervia.com.br. Rio de Janeiro. <http://www.supervia.com.br/servicos-supervia/>



Fig. 4.75 SuperVia train and Central do Brasil Terminal Station. <http://www.brasil247.com/images/cms/Image-000412930.jpg>
http://upload.wikimedia.org/wikipedia/commons/c/c7/Esta%C3%A7%C3%A3o_Central_do_Brasil.jpg



Symbology

- Greater Rio de Janeiro Municipalities
- Remaining Municipalities of Rio de Janeiro State
- Supervia Train Infrastructure
- Supervia Aerial Tramway
- MetrôRio Subway Infrastructure
- CCR Barcas Ferry Routes
- BRT Routes



Fig. 4.76 Rio de Janeiro's Transport Modes. Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014, P. 13, 18, 23. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

B) SuperVia Aerial Tramway⁷⁵

The Aerial Tramway is the first and only mass transit cable from Brazil. Integrated into the rail system, it has six stations along its line: Bonsucesso/Tim, Adeus, Baiana, Alemão/Kibon, Itararé and Palmeiras.

With 152 gondolas, it can carry up to 8 passengers each one in its 3.5 kilometers long. From its first station (Bonsucesso / Tim) to the last (Palmeiras), the trip takes about 16 minutes. The cable car is open Monday to Friday from 6am to 21h, and on Saturdays, Sundays and holidays from 8 am to 20h.

Residents of Alemão complex, duly registered in RioCard are entitled to two daily free tickets (one-way and one back). The unit price costs 1brl for non residents using the VT, Expresso, Bilhete Único or Bilhete Único Carioca cards, and 5brl when paid at the box office.



Fig. 4.77 SuperVia Aerial Tramway and Brazil's President Dilma Rousseff hopping off an aerial car. <https://favelaissues.files.wordpress.com/2011/11/arial-view1.jpg> <http://www.rio.rj.gov.br/igstatic/19/09/27/1909277.jpg>

C) MetrôRio Subway Infrastructure⁷⁶

The subway network, in turn, is limited to the municipality of Rio de Janeiro, and the Pavuna station also serves the city of São João de Meriti, for it's position on the border.

The subway network currently has 40.9 kilometers in length and 35 stations divided in two lines:

- Line 1, which connects the Praça Saens Peña in the Tijuca neighborhood, to the Praça General Osório in Ipanema neighborhood; and
- Line 2, which connects the Estácio neighborhood to the Pavuna municipality.

This network is being expanded with the construction of Uruguay station in Tijuca, and Line 4, leading the network to Barra da Tijuca.

Currently, weekday, the section between the Central and Botafogo stations is shared between two lines of operation in Y. There are two dedicated bus lines, called "Metrô na Superfície" (Surface Metro) linking current network stations in the south following the axis extension to Line 1.

Recently MetrôRio invested about usd350 million in the acquisition of new compositions manufactured in China, a total of 19 trains. According to the Government of the State of Rio de Janeiro, the goal is to eventually change all current trains (Maferesa and Alstom) with new, more modern compositions as those acquired in the Asian market in order to optimize the service offered, as well as providing also higher level comfort to users.

[75] Supervia Trens Urbanos. "Teleférico" on Supervia.com.br. Rio de Janeiro. <http://www.supervia.com.br/teleferico.php/>

[76] Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 17-22. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>



Fig. 4.78 MetrôRio Train and Uruguai Station. http://upload.wikimedia.org/wikipedia/commons/4/4b/Metro_Rio_01_2013_Ipanema_Osorio_5408.JPG <https://querometro.files.wordpress.com/2014/04/uruguai-plataforma.jpg>

D) CCR Barcas Ferry Infrastructure⁷⁷

CCR Barcas is the only public ferry service dedicated to mass transport operation in the waterway. It's currently the fourth largest water transport operation of passengers in the world, reaching about 640,000 kilometers a year and carrying an average of 110,000 passengers a day. The dealership has 24 vessels, 1,100 employees and operates six lines in five seasons and three docking points⁷⁸.

The ferry system has more defined links and, historically, was created to fulfill the crossing of the Bay of Guanabara, and until today the main line is precisely the one that connects the cities of Rio de Janeiro and Niterói.

The ferry waterway network of Greater Rio de Janeiro (Fig. 4.76) consists of 5 stations and operates currently four lines as follows:

- Praça XV (Rio de Janeiro) - Praça Araribóia (Niterói) - Praça XV (Rio de Janeiro)
- Praça XV (Rio de Janeiro) - Paquetá (Rio de Janeiro) - Praça XV (Rio de Janeiro)
- Praça XV (Rio de Janeiro) - Charitas (Niterói) - Praça XV (Rio de Janeiro)
- Praça XV (Rio de Janeiro) - Cocotá (Rio de Janeiro) - Praça XV (Rio de Janeiro)



Fig. 4.79 CCR Barcas Praça Araribóia Terminal and a CCR Barcas Catamaran. <http://imageshack.com/f/mubkmuj> http://imagem.band.com.br/f_270764.jpg

E) BRT Infrastructure

Rio de Janeiro also has a BRT system operated by the company "BRT Rio". The system is based on buses that run on dedicated and exclusive lanes, so they are particularly segregated from vehicular traffic lanes. Currently the system

[77] Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 22-23. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

[78] Grupo CCR. "CCR Barcas" on Grupoccr.com.br. <http://www.grupoccr.com.br/barcas/sobre-a-ccr-barcas>



Fig. 4.80 BRT Rio articulated bus and Novo Leblon Station. <http://viatrolebus.com.br/wp-content/uploads/2015/02/brt2.jpg>
<http://bit.ly/18CZyRc>

has two lines⁷⁹: “Transoeste” and “Transcarioca”. The system also has feeder routes that connect the most remote areas of the city with the BRT. BRT Rio offers the following services⁸⁰:

- Express: The buses make selected stops from the line at special hours.
- Regular: The buses make all regular stops.
- Direct: The buses travel from one point of the line straight into another.

F) Intercity Buses⁸¹

The Intercity bus system consists of over 750 lines operated by more than 60 companies, which carry about 65 thousand trips / day with a fleet of about 5,800 vehicles. The average length of lines is 33 km. Intercity buses offer different services: Service A: seated passengers (7% of intercity buses fleet), Service AC: seated passengers and air conditioning (5% of intercity buses fleet), Service SA: seated and standing passengers, with turnstile (82% of intercity buses fleet) and Service SAC: seated and standing passengers, with turnstile and air conditioning (6% of intercity buses fleet).

G) Municipal Buses

The municipalities of Greater Rio have very different bus systems with different sizes. In the Capital for example, there are more than 700 lines and 10 thousand vehicles; in the municipality of Tanguá, on the other hand, there is no municipal transport system by bus.



Fig. 4.81 Buses on Rio de Janeiro streets and interior of bus with turnstiles and ticket clerk. <http://viatrolebus.com.br/wp-content/uploads/2013/05/aumento-da-passagem-de-onibus-rio-de-janeiro-.jpg> <http://www.prefeitura.sp.gov.br/cidade/secretarias/upload/comunicacao/noticias/imagens/203-11-08-co-duascatracas-03.JPG>

[79] BRT Rio. “Estações” on Brtrio.com. <http://www.brtrio.com/estacoes>

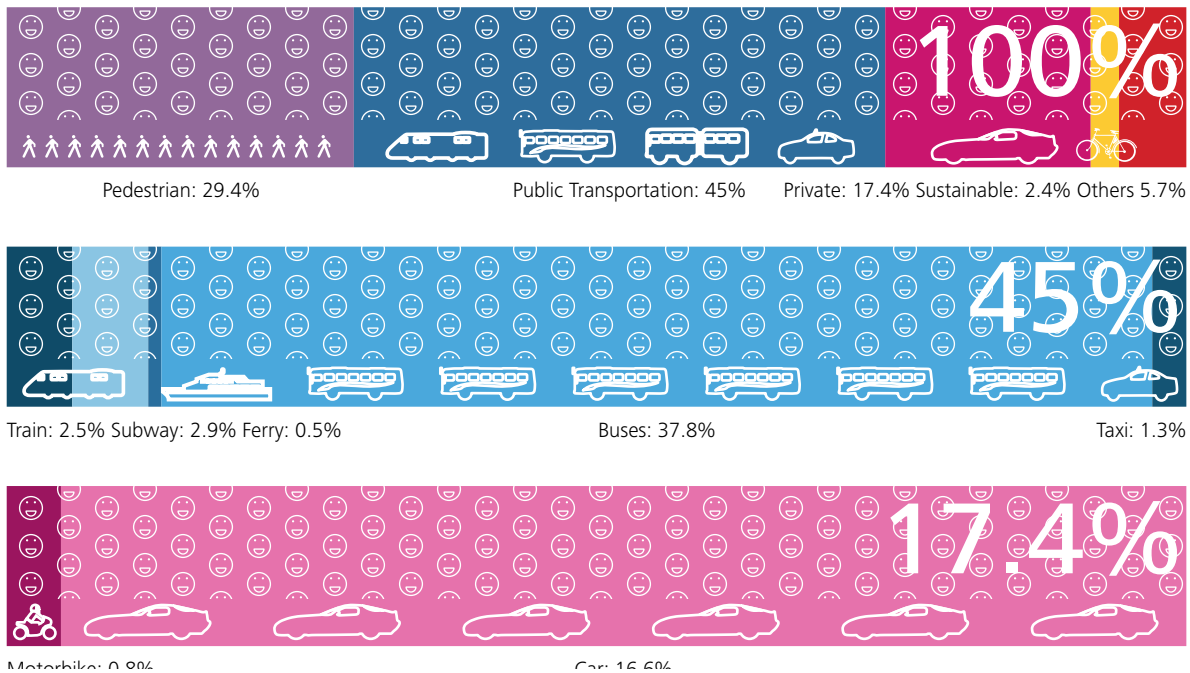
[80] BRT Rio. “Dúvidas Frequentes” on Brtrio.com. <http://www.brtrio.com/duvidas>

[81] Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 25. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

4.3.3. How, When, Where and Why

A) How

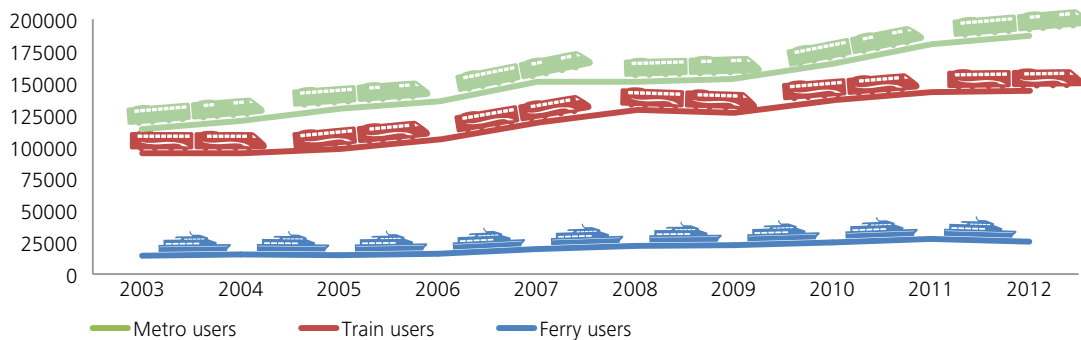
Graph 4.28 Rio de Janeiro’s Mobility Modal Split



Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 120. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

The public transport vast offer makes it the first choice for most of the inhabitants of Greater Rio. Following is people moving on foot and then a considerable portion of people moving in private cars.

Graph 4.29 Rio de Janeiro’s Public Transport System Historic Modal Split.



Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 3. Atualização da Base de Dados.* January 2014. P. 71-73. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

Train users have grown mainly by technological improvements in infrastructure and greater investment in the system, specifically in the purchase of new cars equipped with air conditioning.

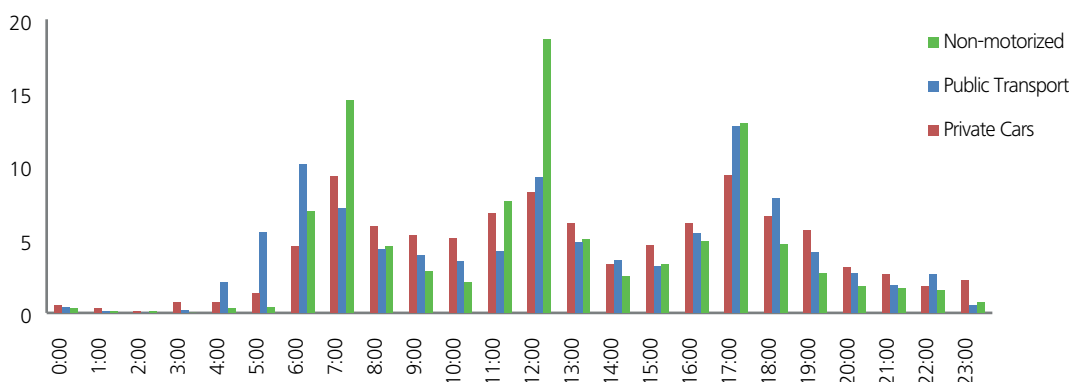
However the increase in users of the subway system is mainly due to fare integration that allows the change of mode of transport easily and without affecting the economy of the people.

Finally, increasing the boats is explained by its historical link between the various ports and central Rio de Janeiro⁸².

[82] Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 3. Atualização da Base de Dados.* January 2014. P. 70-74. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

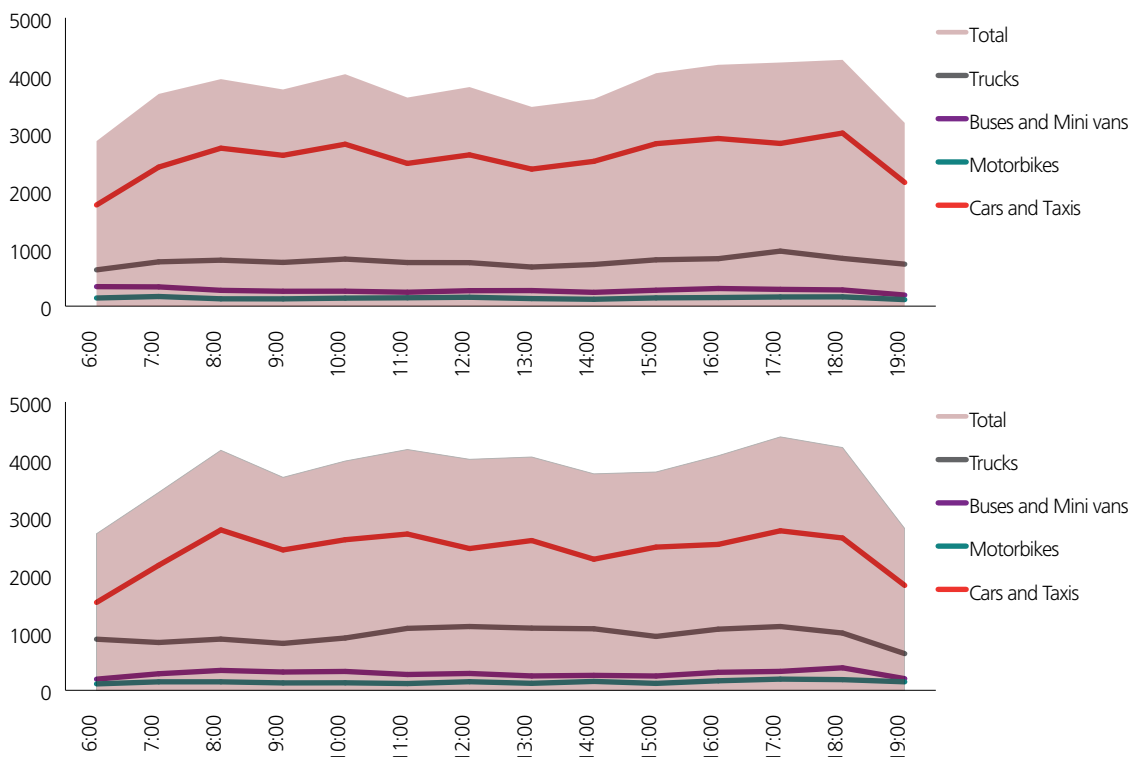
B) When

Graph 4.30 Rio de Janeiro's Journey Volumes Percentage per Hour and Transport Mode



Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 130. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

Graph 4.31 Rio de Janeiro's Total Volume of Entering and Exiting Vehicles per Hour and Type

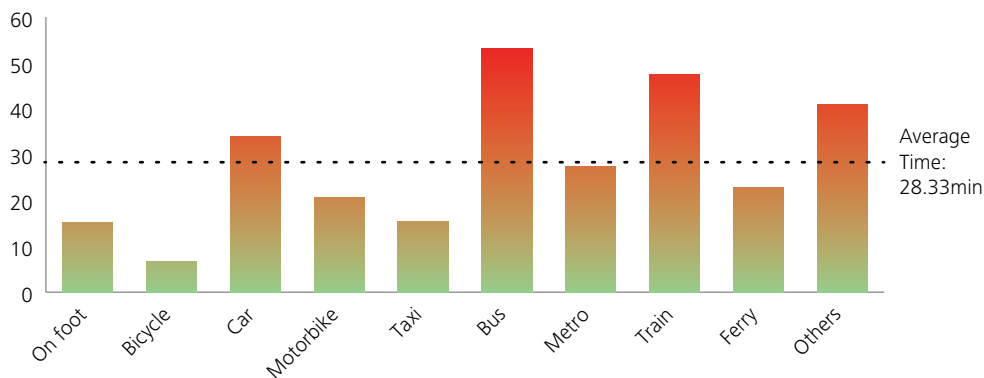


Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 142. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

The hourly fluctuations in transport shows three daily peaks. The individual transport has the highest peaks in the morning (07:00) and afternoon (17:00). Mass transit has the morning peak earlier than the individual, at 06:00, but the afternoon peak is the same. Non-motorized travel has the highest peak in the middle of the day⁸³.

[83] Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 129. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

Graph 4.32 Rio de Janeiro's Average Journey Time Period per Transport Mode



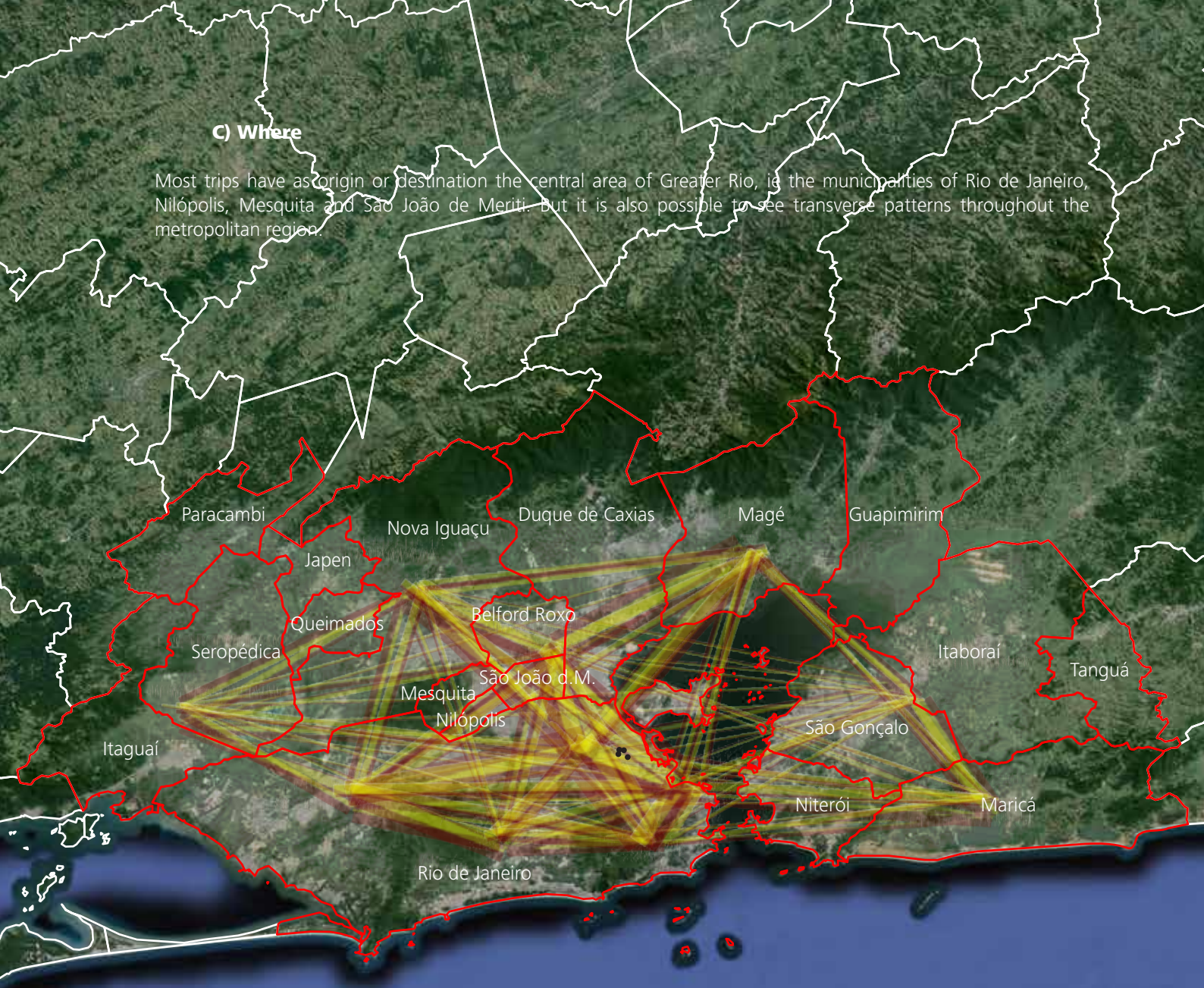
Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 129. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

The highest commute time average is achieved by the personnel bus service, with almost one hour and a half. This happens due to the few embarks and disembarks done, as oppose with private cars which do longer yet more direct commutes. The rest of the bus services have more constant embarks and disembarks all along their routes with a high penetration level, lowering their commute times. Lastly, the subway and the ferries have smaller networks, therefore they have lower commute times than the train service⁸⁴.

[84] Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 129. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

C) Where

Most trips have as origin or destination the central area of Greater Rio, i.e. the municipalities of Rio de Janeiro, Nilópolis, Mesquita and São João de Meriti. But it is also possible to see transverse patterns throughout the metropolitan region.



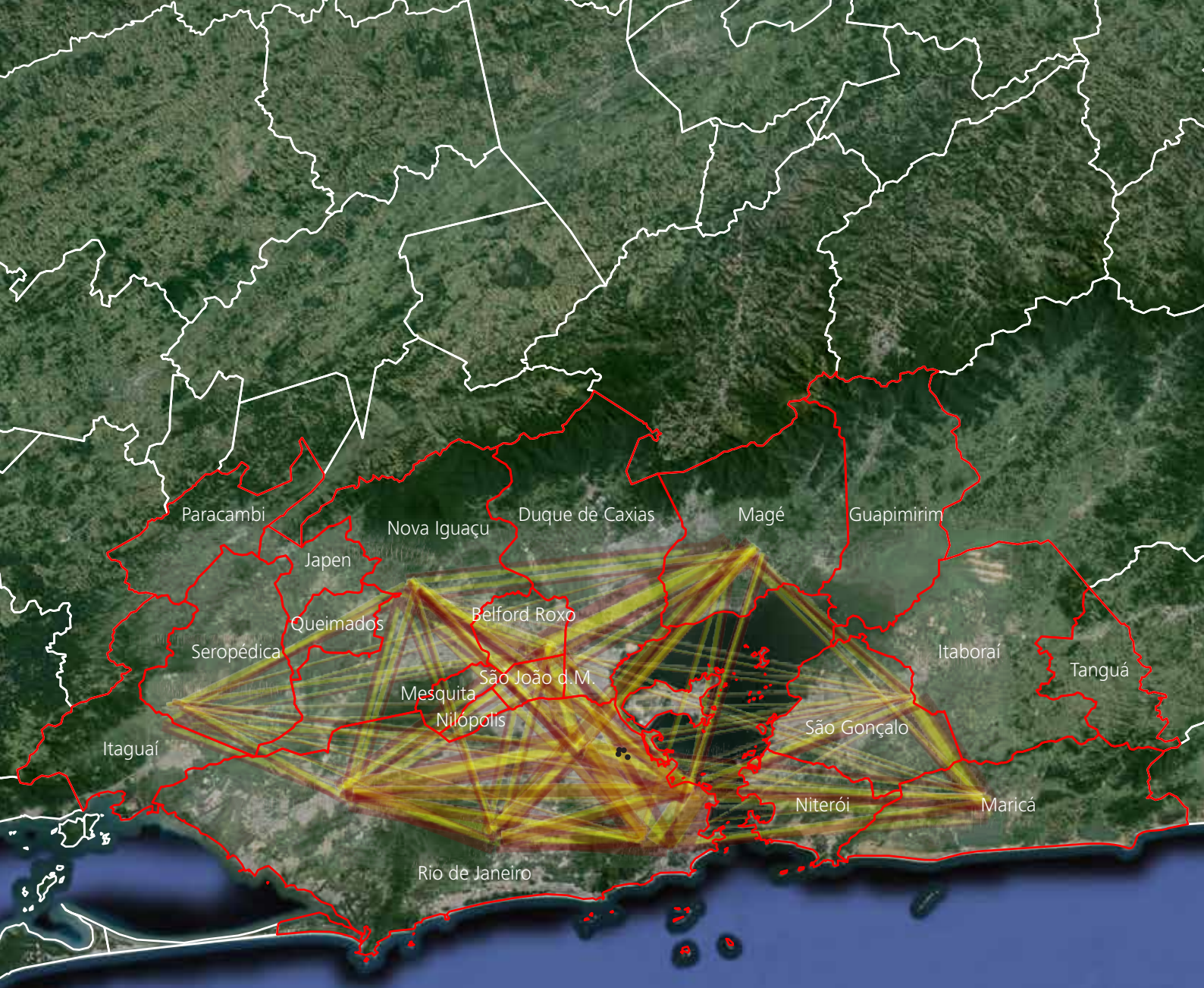
Symbology

- Greater Rio de Janeiro
- Municipalities
- Remaining Municipalities of Rio de Janeiro State
- Origin Fluxes
- Destination Fluxes

Kilometers



Fig. 4.82 Rio de Janeiro's Public Transport System Morning Journey Volumes. Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 173-178. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>



Symbology

- Greater Rio de Janeiro Municipalities
- Remaining Municipalities of Rio de Janeiro State
- Origin Fluxes
- Destination Fluxes

Kilometers

0 5 10 20

Fig. 4.83 Rio de Janeiro's Public Transport System Evening Journey Volumes. Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 179-184. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>



Symbology

- Greater Rio de Janeiro Municipalities
- Remaining Municipalities of Rio de Janeiro State
- 0 to 60' commute time
- 60' to 90' commute time
- 90' to 120' commute time
- 120' to 180' commute time
- 180' or more commute time



Fig. 4.84 Rio de Janeiro's Average Commute Times with the Central Area as Destination. Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 179-184. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

D) Why

Chart 4.1 Rio de Janeiro's Travel percentage matrix for each purpose for individual transport.

Origin/ Destination	Studies	Leisure	Others	Housing	Health	Work	TOTAL
Studies	1.03%	0.06%	0.06%	4.93%	0.01%	0.14%	6.23%
Leisure	0.00%	1.30%	0.04%	6.10%	0.03%	0.00%	7.47%
Others	0.03%	0.06%	1.86%	11.81%	0.12%	0.57%	14.46%
Housing	5.64%	5.54%	11.06%	4.17%	2.85%	18.17%	47.42%
Health	0.00%	0.20%	0.27%	2.03%	0.18%	0.23%	2.91%
Work	0.34%	0.28%	0.74%	16.11%	0.08%	3.96%	21.51%
TOTAL	7.04%	7.43%	14.03%	45.15%	3.28%	23.07%	

Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 124. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

Chart 4.2 Rio de Janeiro's Travel percentage matrix for each purpose for public transport.

Origin/ Destination	Studies	Leisure	Others	Housing	Health	Work	TOTAL
Studies	0.34%	0.01%	0.04%	9.92%	0.02%	0.12%	10.44%
Leisure	0.01%	0.16%	0.09%	2.13%	0.00%	0.01%	2.38%
Others	0.06%	0.00%	0.97%	4.25%	0.13%	0.11%	5.53%
Housing	9.80%	2.49%	4.56%	4.52%	2.38%	27.17%	50.92%
Health	0.01%	0.01%	0.27%	2.02%	0.34%	0.03%	2.69%
Work	0.51%	0.30%	0.36%	24.85%	0.06%	1.98%	28.05%
TOTAL	10.73%	2.96%	6.28%	47.67%	2.94%	29.42%	

Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 124. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

Chart 4.3 Rio de Janeiro's Travel percentage matrix for each purpose for sustainable transport.

Origin/ Destination	Studies	Leisure	Others	Housing	Health	Work	TOTAL
Studies	0.80%	0.06%	0.08%	23.39%	0.00%	0.05%	24.39%
Leisure	0.00%	0.55%	0.09%	2.83%	0.00%	0.08%	3.56%
Others	0.03%	0.09%	1.34%	9.90%	0.00%	0.18%	11.55%
Housing	23.10%	2.66%	9.81%	3.62%	1.30%	9.26%	49.73%
Health	0.02%	0.03%	0.05%	0.96%	0.02%	0.02%	1.10%
Work	0.12%	0.12%	0.30%	8.11%	0.05%	0.97%	9.67%
TOTAL	24.07%	3.51%	11.68%	48.81%	1.37%	10.56%	

Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 124. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

Excluding the residence, which has the highest percentage of origin and destination, as people leave and return to their homes, the second highest reason is the work, both for private and public commutes. For non-motorized transport, the highest reason to commute (apart from the residence), is the study, with 24.07%, showing that a significant proportion of people living near the schools.

4.3.4. Urban Intermodality and Architecture⁸⁵

If the fare integration advanced significantly with the use of the Metropolitan Single Ticket and the Carioca and Niterói Single Ticket, and an electronic, very comprehensive and modern system, on the other hand the physical and operational integration still has many problems.

On Fig. 4.85 it is possible to see the different physical integrations between different transport modes inside Greater Rio de Janeiro. While some commuters tend to use two or more different transport modes, the majority choose to stay in one: the buses and vans.

The precariousness in multimodal integration inhibits the use of public transport and promotes the construction of an even more irrational transport network, with overlapping lines, creating more traffic jams and damaging the whole community, also inhibiting the growth of the economy and new housing opportunities and land use outside the central area. This lack of articulation contributes to the rupture between the central area and the periphery by promoting the concentration of jobs and services in the central area, creating imbalances in the organization of transport systems and land use occupation of the entire metropolitan area, contributing even more to the construction of a divided, less competitive and unequal city.

There are several factors -classified in 4 groups- that come out as a general constant all over Rio de Janeiro's Transport Network:

A) Accessibility

Although virtually all subway stations count with exclusive elevators for the use of elderly, pregnant women and disabled people, only a few Urban Train stations have this important improvement. It is also notorious the precariousness of pedestrian spaces of bus stops, in addition to small size, there's as a constant the lack of sidewalks, especially in other municipalities of the metropolitan area.

B) Operation

Throughout the metropolitan area, it can be considered that there is no vehicles logistics or timetables at bus stops, creating queues and disorder while embarking or disembarking buses. Due to the increase in recent years of private cars, most of the Metropolitan Region municipalities have congestion problems, especially in the central areas, where are located the main transfer points of public transport networks.

C) Signaling

Throughout the metropolitan area, with rare exceptions, only the BRS bus lanes in the Capital have information boards with the bus lines list, yet still without informing regarding times of the lines. In BRT TRANSOESTE there is as well efficient signaling. There are in subway stations and urban train, maps of the metropolitan transport network informing and promoting integration between different types of transport. The transport modes websites have limited information, including information regarding the best way to arrive to any place. There is no systematic nomenclature of the lines and public transport stations that is rational, ie, that allows users to use them without help, usually leading to people to ask on site how to reach certain location.

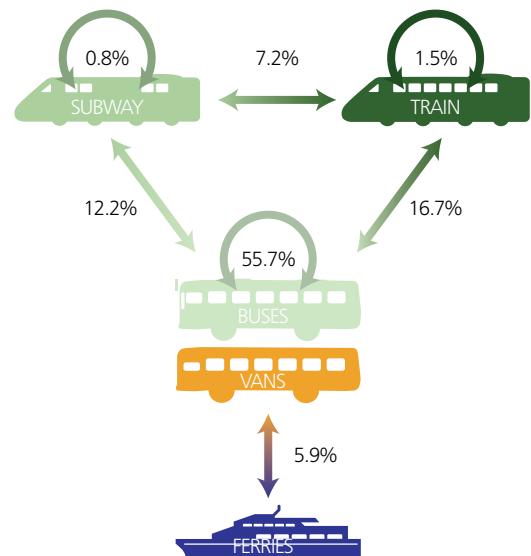


Fig. 4.85 Rio de Janeiro's Graphic Representation of Physical Integration between Transport Modes. Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 89. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

[85] Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 89-100. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>



Fig. 4.86 Rio de Janeiro's Pavuna and Belford Roxo Train Station Neighborhoods. Maps.google.com.

D) Comfort

The lack of hygiene and the presence of informal sector is a constant in most of the connection points of the metropolitan area, especially in commercial areas where there is greater pedestrian circulation. Most of the points does not have adequate roofs for protection against sunlight and rain.

E) General considerations

There is a very large number of problems at the terminals, stations and stops that interfere in drawing demand for public transportation. Among them are:

- Lack of conditions of access for people with special needs;
- Urban Access Infrastructure without capacity or with inadequate conditions for pedestrian movement;
- Distance between feeder and trunk systems;
- Lack of both static and dynamic signaling (waiting time, upcoming bus or train, etc.);
- Communication systems with little or no effectiveness, particularly in situations of abnormal operation;
- Lack of maintenance conditions;
- Disconnection with the neighborhoods;
- Lack of coverage.

4.3.5. Strengths and weaknesses of the system

A) Strengths⁸⁶

Mobility

In the last ten years Greater Rio de Janeiro has invested heavily in public transport. This fact is evident in the increase of users in all its modes:

- On the ferries, users have increased by 3% annually, mainly because investments have gone to expand the number of ports and therefore the waterway system.
- In the subway the implementation of "Y" operation between lines 1 and 2 have had a positive impact, in addition to efforts to increase the frequency of trains and offers several new commutes compositions. This has led

[86] Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 278-281. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

to increase by 7% annually the number of users.

- The rail network has also increased their users more than 7% per year, despite not having changed the physical network. This is due to the increased commutes offers, with a more regular frequency, and operational adjustments and reduced train intervals.
- The cable car has begun its operation as a mass mobility mode.
- Bus transport is still responsible for the largest number of trips with a higher level of coverage than in the past, both by vehicle fleet increase and lines created, representing an increase in its area of influence. Its passenger numbers increased, although a smaller percentage than the other modes, but in absolute terms grew by 3% per year. However, it has lost a part that could cover other mass mobility mode.
- In the public transport decreased the average travel time due to the significant increase in the number of passengers, increased operating speed, setting priorities for buses (BRT and BRS) and the adoption of electronic fare system for most of the users, reducing embarking times.

Urban Integration

Reducing the amount of non-motorized travel is not at all a bad thing, since the adoption of the Metropolitan Single Ticket it is possible for the users to complete their journey by integration with other mode, instead of doing the opposite, with more physical demanding activities.

The rate change with the adoption of the Metropolitan and Capital Single Tickets obviously played an important role in the process of increasing demand for public transport. The application of unified metropolitan rates resulted in the reduction of intercity buses fares, and through subsidies to passenger lines with higher prices, the accessibility of the residents of the outermost regions of Greater Rio significantly improved. Also was drastically reduced the fare differences between modes of transport, affecting markets and attracting new passengers, especially in areas where there was some advantage for specific transport modes.

These are the main changes affecting demand and supply in the last 10 years, but it turns out that none of them resulted in a significant expansion of the integrated transport network.

B) Weaknesses⁸⁷

Mobility

Since the Federal Constitution does not force to the creation of transport institutions, these policies - the planning, management and execution - are made completely independently of the state and municipalities. Nothing has changed in the last 10 years and this is very negative situation.

In the last 10 years, easy conditions to buy cars and motorcycles encouraged their use, and increased congestion in the road system. This is a very negative aspect to highlight, but this also happens because the low quality of public transport.

Those who earn less use more public transport, spending more time in commutes and having less time to adjust their schedules. This is perhaps the most serious or negative aspect of metropolitan commuting.

The appearance of the unofficial buses -later almost completely disappeared- was followed by the appearance of vans, initially unofficially. In its peak it owned up to 18% of the passenger market. Later it was legalized. Its use is currently in decline, as they are related to insecurity and violence, and banned in most of the metropolitan area.

In these 10 years is undeniable that the public transport system has improved, so that the number of passengers

[87] Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Minuta do Relatório 4. Planejamento e Execução das Pesquisas: Parte 3 Diagnóstico da Situação Atual.* June 9 2014. P. 278-281. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

increased. But the problems of comfort, safety, speed and reliability, although improved, are now being observed by a population with a higher demand for quality transport services.

Urban Integration

The public transport road system still has much to improve, especially because it is a system with a high amount in passenger flow and high capillarity.

Lack of physical, operational and fare integration between transport modes affects the overall efficiency of the transport offer to meet demand, increase urban economic costs, and decrease quality of life of the population. It increase business costs by higher prices for their workers and loss productivity at work costs.

Transport investments has focused on routes with high concentration of flow, which are important to improve urban mobility, but almost nothing has been done to reduce the need for urban mobility through policies and investments of integrated land use.

4.3.6. How they're dealing with those

Mobility⁸⁸

The Government of the State of Rio de Janeiro made a mobility plan with a horizon to 2021. Inside are stated the current conditions of transport and three scenarios are shown:

Scenario 2012: a scenario with the transport system they currently have and use it as a control model.

Scenario 2016: a planned scenario which includes improvements to the public transport system, including:

- BRT system: TransCarioca, TransOlimpica, TransOeste and TransBrasil in Rio de Janeiro, and Niteroi TransOceânico lines are included.
- Metro: Line 3 section Niterói - São Gonçalo - Itaboraí.
- Metro: Line 4 section Jardim Oceânico in Barra da Tijuca to Ipanema.
- Trains: Reactivation of some branches to Saracuruna.
- Tram: Project for a tram line in the center of Rio de Janeiro.
- Road: Metropolitan arc surrounding the periphery of the metropolitan area from east to west without transit possibility for public transport.

Scenario 2021: After consulting sectors of society, 17 projects or expansions to be implemented were chosen. Here are presented in order of priority: 1) Metro Line 2B, Estacio - Praça XV, 2) extension of Line 1, Uruguai - Gávea, 3) Line 4B, Alvorada - Praça XV, 4) extension of the train network Nova Iguaçu - Belford Roxo - São Bento, 5) extension of Metro Line 3 Praça XV - Araribóia, 6) extension of the train network Honório Gurgel - Caxias, 7) Metro Line 6 Alvorada - Fundão, 8) ferry Line Praça XV (Rio de Janeiro) - Gradim (São Gonçalo), 9) extension of the train network Santa Cruz - Itaguaí, 10) construction of road RJ 104, 11) extension of the train network Costa Barros - Japeri, 12) extension of TransCarioca, 13) Extension of Metro Line 1, 14) construction of road RJ 106, 15) adaptation of TransBrasil, 16) ferry Line Cocota (Rio de Janeiro) - Gradim (São Gonçalo) and 17) inclusion of public transport in the metropolitan arc.

Besides the plan consider future projections regarding users. With these forecasts were also conducted exercises to see if the system can withstand slight increases in the cost of the Metropolitan Single Ticket. Finally, the plan concludes that the adjustments done, investments in these projects and fare adjustments, the plan is able to

[88] Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Relatório 7 – Planejamento de Transporte e Plano de Ações para Viabilizar a Alternativa Mínima*. August 29th 2014. P. 4-10. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>



Symbology

- Greater Rio de Janeiro
- Municipalities
- Remaining Municipalities of Rio de Janeiro State
- Ferries Network
- Subway Network
- Train Network
- Metropolitan Arc
- BRT
- Tram

Kilometers



Fig. 4.87 Rio de Janeiro's 2016 Transport Network Plan. Source: Governo do Estado do Rio de Janeiro, Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Relatório 7 – Planejamento de Transporte e Plano de Ações para Viabilizar a Alternativa Mínima.* August 29th 2014. P. 6. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>

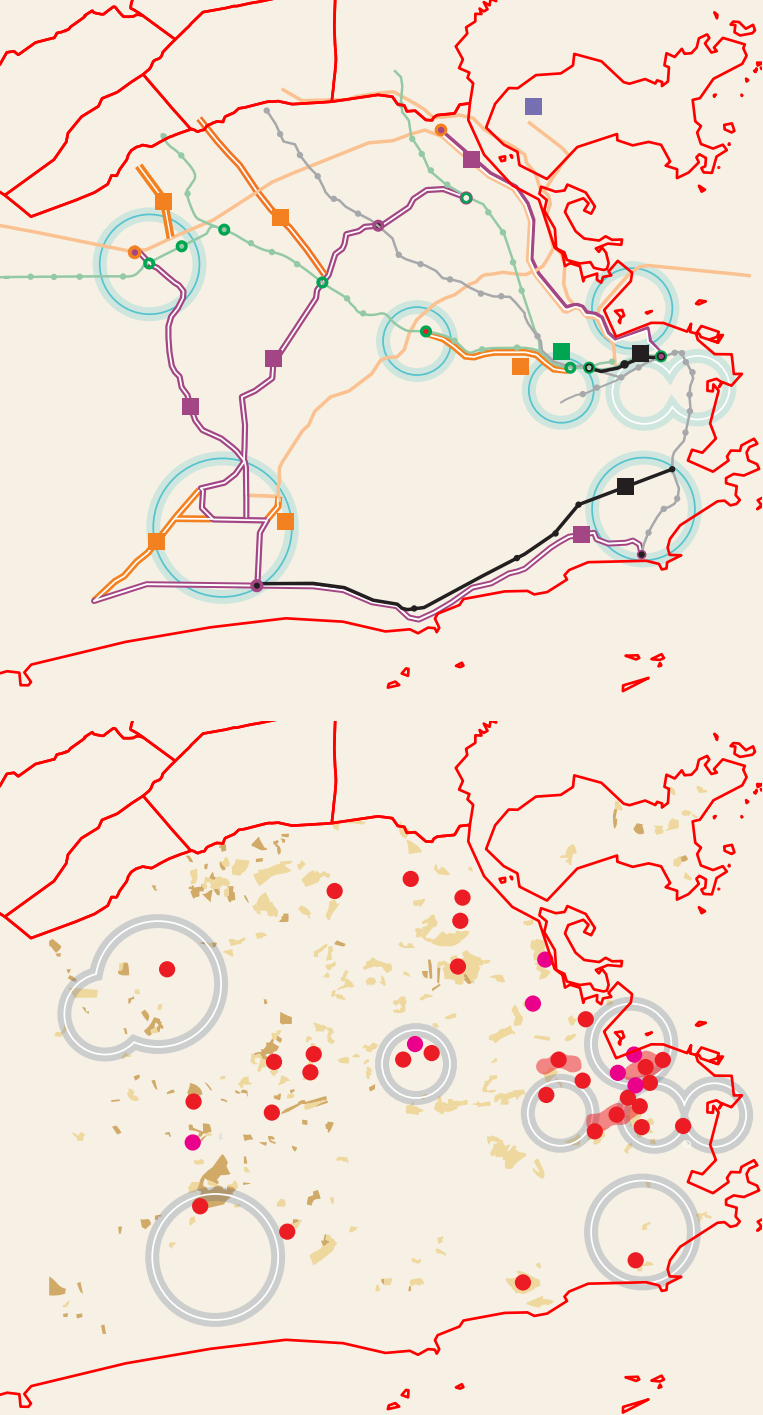


Symbology

- Greater Rio de Janeiro
- Municipalities
- Remaining Municipalities of Rio de Janeiro State
- Ferries Network
- Subway Network
- Train Network
- Metropolitan Arc
- BRT
- Tram



Fig. 4.88 Rio de Janeiro's 2021 Transport Network Plan. Source: Governo do Estado do Rio de Janeiro. Secretaria de Estado de Transportes. Companhia Estadual de Engenharia de Transportes e Logística. *Plano Diretor de Transporte Urbano da Região Metropolitana do Rio De Janeiro 2013. Relatório 7 – Planejamento de Transporte e Plano de Ações para Viabilizar a Alternativa Mínima.* August 29th 2014. P. 10. <http://www.rj.gov.br/web/setrans/exibeconteudo?article-id=626280>



- Symbology**
- Greater Rio de Janeiro Municipalities
 - Airport Transport Projects
 - Train Network Projects
 - Subway Network Projects
 - Road Network Projects
 - Street Network Projects
 - Traffic Control Projects
 - Existing Train Lines
 - New Train Lines
 - Existing Metro Lines
 - Metro Extension and New Lines
 - Existing Road Network
 - Road Network Projects
 - BRT Corridor
 - Social Housing Projects
 - Social Infrastructure
 - Irregular Installment Favelas
 - Urban Space Structure
 - Housing
 - Social Development
 - Cultural Heritage
 - Transport

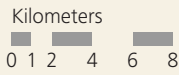


Fig. 4.89 Extracts of Rio de Janeiro's Municipal 2016 Olympic Games Legacy Urban and Environmental Planning.
 Source: Prefeitura da Cidade do Rio de Janeiro. Secretaria Municipal de Urbanismo. *Plano de Legado Urbano e Ambiental Olimpíadas Rio 2016*. Cartogramas. Pp. 4, 7, 9. <http://www.rio.rj.gov.br/web/smu/exibeconteudo?id=4250561>



meet current and future demands of transportation in the metropolitan area.

Public Spaces⁸⁹

As for land use planning and urban spaces, this is a much more fragmented topic since each municipality is responsible for conducting its planning (as had been mentioned as a weakness of the system). In the municipality of Rio de Janeiro, the Olympic Games to be held in 2016 in the same city presents a unique opportunity for the city of renewal and improvement.

Several projects are underway at the municipal and local levels, not only for the improvement of transport but also for the health, environment and housing sectors.

In addition to these projects, some others are being carried out in certain districts of the municipality such as Cidade Nova, Maracanã, Deodoro, among others.

However these projects seem to have only a municipal scope, as it seems that other municipalities are not carrying out this type of planning and projects, or are not releasing enough information about them.

[89] Prefeitura da Cidade do Rio de Janeiro. Secretaria Municipal de Urbanismo. *Plano de Legado Urbano e Ambiental Olimpíadas Rio 2016*. Cartogramas. Pp. 4, 7, 9. <http://www.rio.rj.gov.br/web/smu/exibeconteudo?id=4250561>

4.3.7. Applicable measures in MCMA

Greater Rio de Janeiro is an example of a metropolis which gives firm steps towards the mobility of its inhabitants. Despite being composed of several municipalities, through its transport policies at regional level has made progress enough to connect much of the metropolitan area. But still has much to reach its proposed 2021 scenario.

In general we can say that the premise of the design of the city should be to avoid as far as possible large commutes with a proper city planning, while when required to do, transport modes should be reached in an accessible way.

The next suggestions could be achieved in order to improve mobility:

- A heavy investment in mass public transport systems.
- Improve quality of public transport system.
- Optimize operation of mass public transport.
- Organize informal public transport, or if necessary to eradicate it.
- Optimize frequency times of mass public transport.
- Coordination between different companies in order to
- Equate public transport fares, and
- Implement use of Electronic Single Tickets and a Single Fare.

As for the space planning for the cities, the next suggestions could be implemented:

- Include the obligation of planning at a metropolitan level public transport, as well as land use and occupation.
- Perform projects at an urban and architectural scales to facilitate accessibility to public transport.
- Increase density in public transport corridors to encourage their use.

4.4. SUMMARY OF MEASURES IMPLEMENTED IN THE PREVIOUS CASES

Below is a summary of the lessons learned from the previous cities studied in this chapter. An interesting thing to highlight is that some of these appear in more than just one city.

Transport Improvements	Bogotá	Curitiba	Rio de Janeiro
Conceive the mobility system as one composed by four elements: roads, transport, traffic control and pedestrian paths.	✓		
Organize concessioned public transport	✓	✓	✓
Short, medium and long term transport planning	✓		
A preferred metropolitan planning rather than an urban one			✓
Public Transport System should be fast, comfortable and efficient	✓	✓	✓
Coordination between different companies to decrease transport fares			✓
Fare integration to boost mobility		✓	✓
Payment integration to boost mobility			✓
Encourage non-motorized transportation (bicycles)	✓	✓	✓
Avoid long commutes			✓
If necessary, those long commutes should be accessible.			✓
A considerable investment in transportation is needed		✓	✓
Optimize public transport operations as well as frequencies	✓	✓	✓

As for the planning and use of public spaces, here is a summary of their measures implemented.

Land Use and Public Spaces Improvements	Bogotá	Curitiba	Rio de Janeiro
Increase density in the areas nearby the massive public transport corridors	✓	✓	✓
Concentrate the city footprint	✓		
Diversify land uses across the city	✓	✓	
Short, medium and long term land use planning	✓	✓	✓
Connection between the public transport and the users with the public spaces	✓	✓	✓
A preferred metropolitan planning rather than an urban one			✓

Though there are as well some problems presented both in their Public Transport systems and their Land Use planning. Here are enlisted the first:

Transport Issues	Bogotá	Curitiba	Rio de Janeiro
Currently Public Transport System is saturated and with a high demand	✗	✗	✗
There's the presence of routes with low demand while in rush hours	✗		
Low income areas have a few public transport system routes	✗		
Most of the people living closer to the public transport system buys a car		✗	
Each municipality does their own public transport policy, leading to disorganization and traffic	✗	✗	✗
Public transport system is slower than private cars, affecting most of the commuters (low incomes)			✗
There's the phenomenon of illegal public transport (unauthorized buses or vans) with their current lack of safety, organization and velocity			✗

The next features a list of common issues regarding land use and public spaces planning:

Public Spaces and Land Uses Issues	Bogotá	Curitiba	Rio de Janeiro
There's the need of certain bus stops with minimum conditions to embark	✗		
There's a deficiency of public spaces, and their distribution is unequal	✗		
Informal businesses are present in the sidewalks and public spaces, obstructing the pedestrians	✗		

Properties nearby the public transport axes acquired an overvalue, expelling low income people (the ones that use the most public transport) from the Center and forcing them to commute				X
Each municipality does their own land uses policy, without any regard towards the metropolitan needs	X	X	X	
Lack of architectural integration between all of the public transport systems				X
This lack affects the efficiency, increments costs and decrease quality of life				X
Lack of urban planning outside their primary public transport axes				X

Being the three Latin American cities, it's not surprising that the same successes and mistakes can be found in the same cities. That is why the above are factors to consider when planning a model of public transport and land use in MCMA.

Finally, the measures that can be implemented in MCMA are the following. Regarding to Public Transport:

- Implementation of a metropolitan level policies planning.
- Conception of a metropolitan mobility system composed by: roads, transport, traffic control and pedestrian paths.
- Planning subjected to small, medium and long terms evaluations and improvements.
- This metropolitan public transport system should have as main objectives to be fast, comfortable and efficient.
- This metropolitan public transport system should have and integrated fare and payment system to ensure its usability.
- This needs be dependent from a consistent and strong public finance and investment (at least from the first stages).
- On the other hand the frequencies of the public transport should improve with time.
- The organization of concessioned public transport is needed.
- Their inclusion on the integrated fare system via local fares adjustments should encourage them to improve their services as well their revenues.
- Inclusion of non-motorized transport modes such as bicycle, on foot, bicycle taxis and such.

The measures regarding to Land use that can be adapted in MCMA are the following:

- An implementation of a metropolitan, urban and neighborhood policies on MCMA.
- This policy should boost multiple land uses within its area.
- This policy should try to contempt the city foot print.
- This planning should have a short, medium and long terms evaluations and improvements.
- This policy should be supported with its public transport counterpart and complement it by increasing densities in the public transport corridors.
- This plan should be aware that the connection between the public transport and the users will be the public spaces.
- This plan should try to avoid long commutes, and if done, should ensure those are done in a comfortable way.





5. INNOVATIVE MOBILITY IN MCMA



As seen in previous chapters, Mexico City Metropolitan Area currently has several difficulties regarding public transport and land use. Problems that made it become the city with the most painful congestion in the world according to a 2011 study carried out by IBM¹. But so does the cities seen in the previous chapter, and yet these are managing to combat traffic with several changes both in the public transport and land use fields.

It would be incorrect to affirm that Latin American countries are the same, but it is true that they share certain similarities. And it is between these similarities that we can state that some measures adopted by those previous cities could help to counteract traffic and improve local economies in order to improve MCMA's productivity. This chapter will enclose those several recommendations to improve urban mobility and the metropolitan economy.

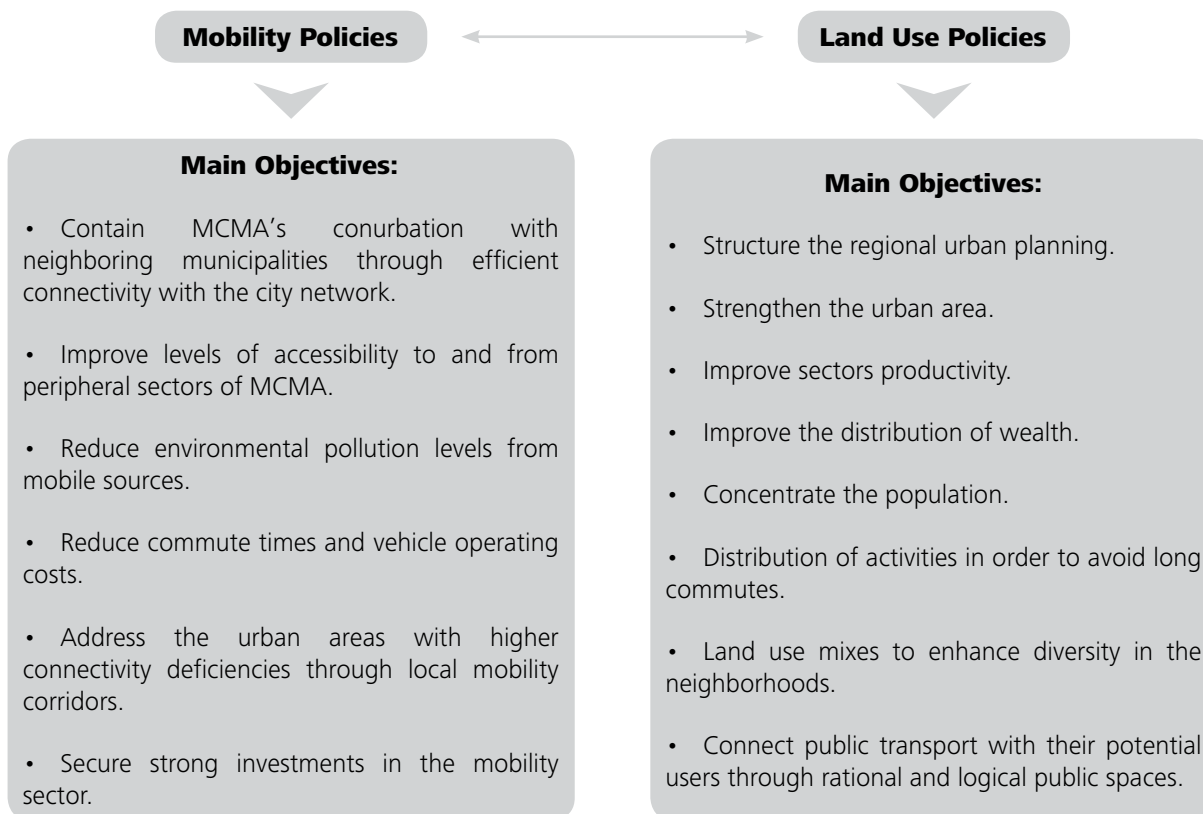
5.1. A NEW METROPOLITAN TRANSPORT AND LAND USE POLICIES FOR MCMA

To improve mobility in the MCMA, first of all, firstly is necessary to update the Origin Destination Survey, for which the current one (2007) is obsolete and therefore attempting to do projects based on this information could be detrimental to current trends movement and development of the MCMA. This chapter will make suggestions based on the 2007 survey.

From reliable information, and based on previous experiences of Bogotá, Curitiba and Rio de Janeiro is clear that planning should begin with clearly defined objectives. Moreover we have two areas of influence, mobility and land use, although different from each other, the study already done in the previous chapter can conclude that the development of each one has a reciprocal influence. Therefore both policies should complement rather than move separately.

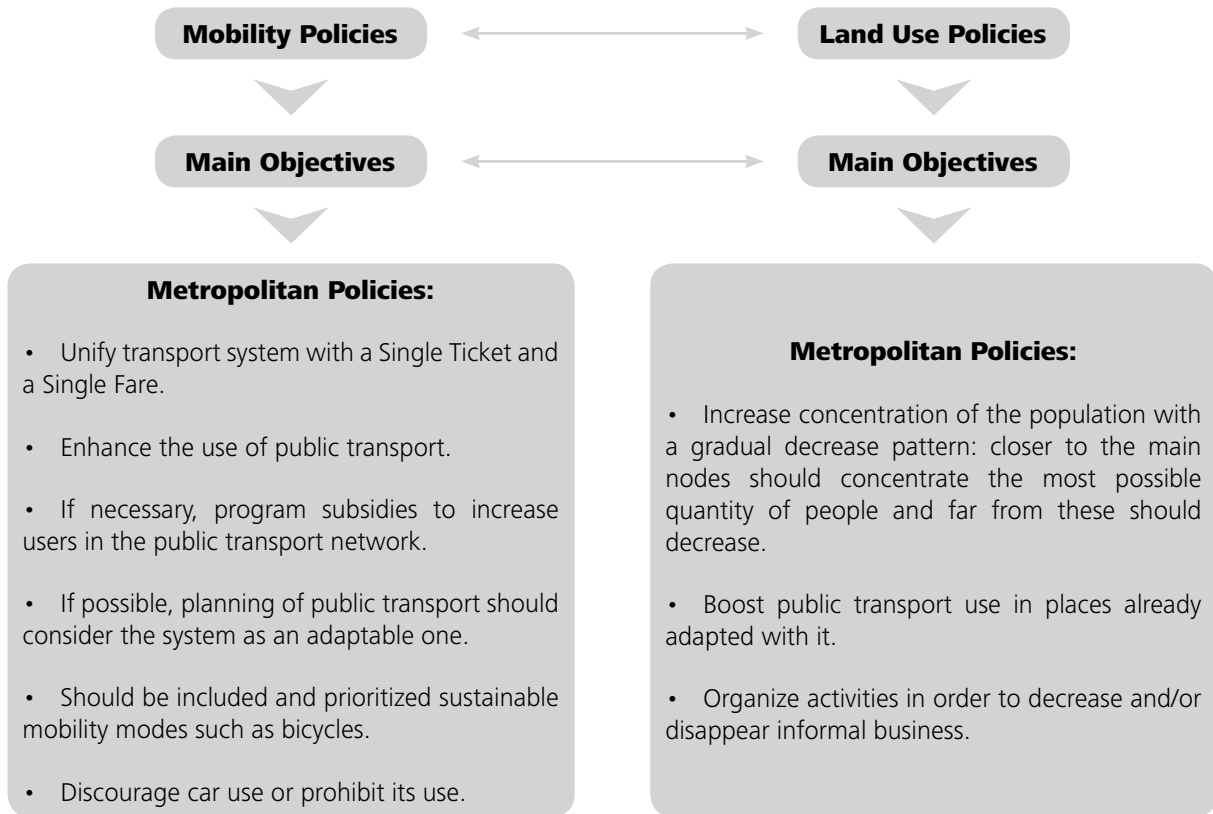


These policies should draft objectives regarding sustainable mobility and urban development, not only for this generation but for the coming ones. As stated, these goals should complement each other in order to have a harmonic development and improvement of the city.

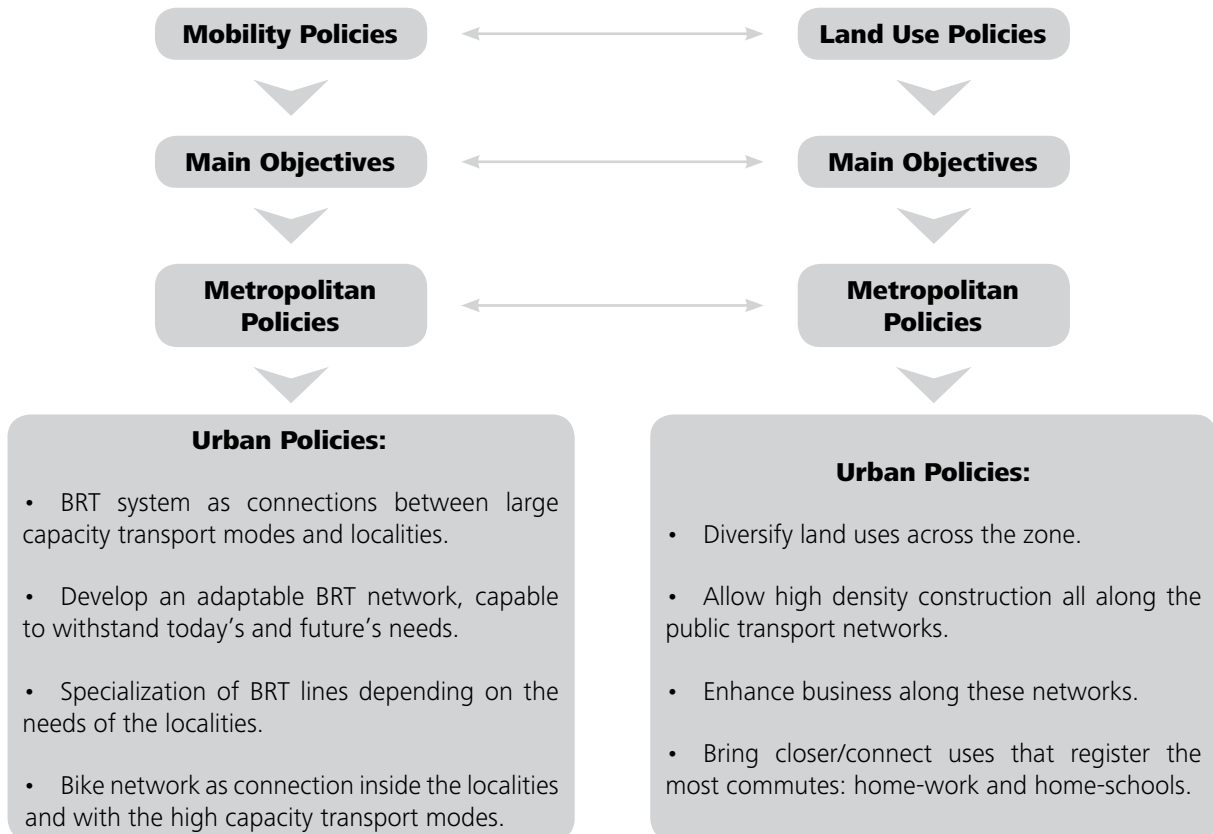


[1] International Business Machines Corp. "IBM Global Commuter Pain Survey: Traffic Congestion Down, Pain Way Up" on IBM.com. Armonk, N.Y., September 8th 2011. <http://www-03.ibm.com/press/us/en/pressrelease/35359.wss#release>

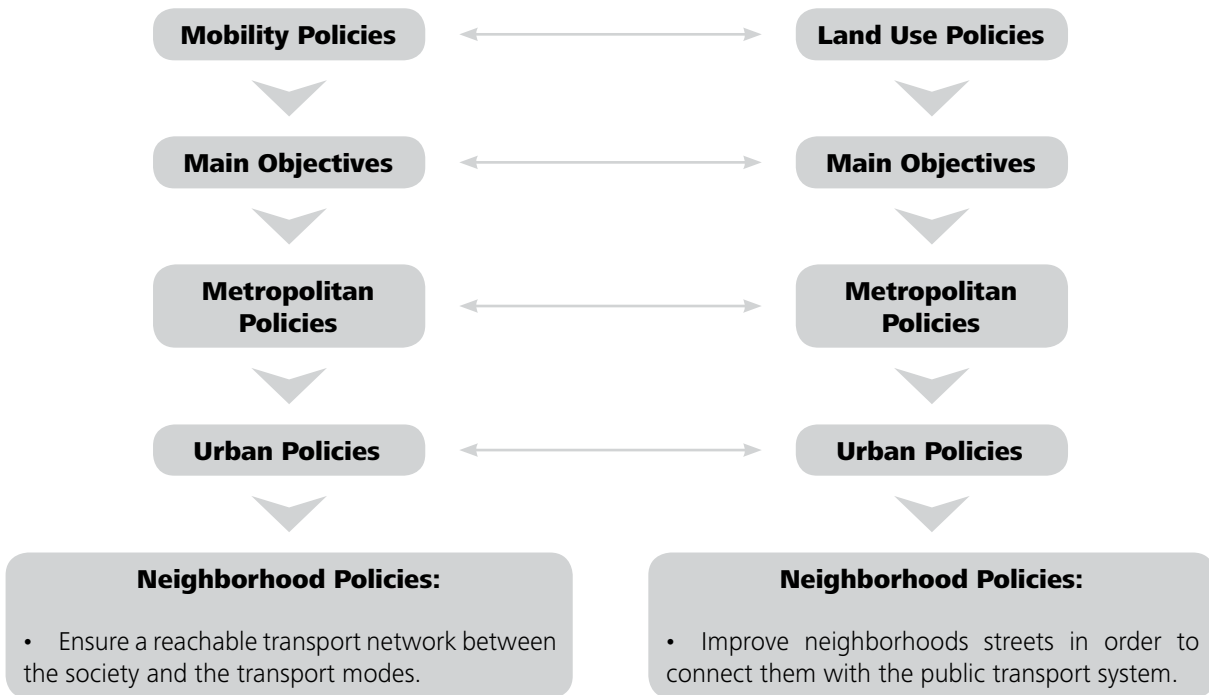
In order to fulfill those goals, planning and coordination between Federal, State and Municipal levels are required. To do so should be the task of a Metropolitan Institute capable to withstand political changes, and with a scope big enough to cover the States and Municipalities inside MCMA and involved in the urban planning. As main goals should have:



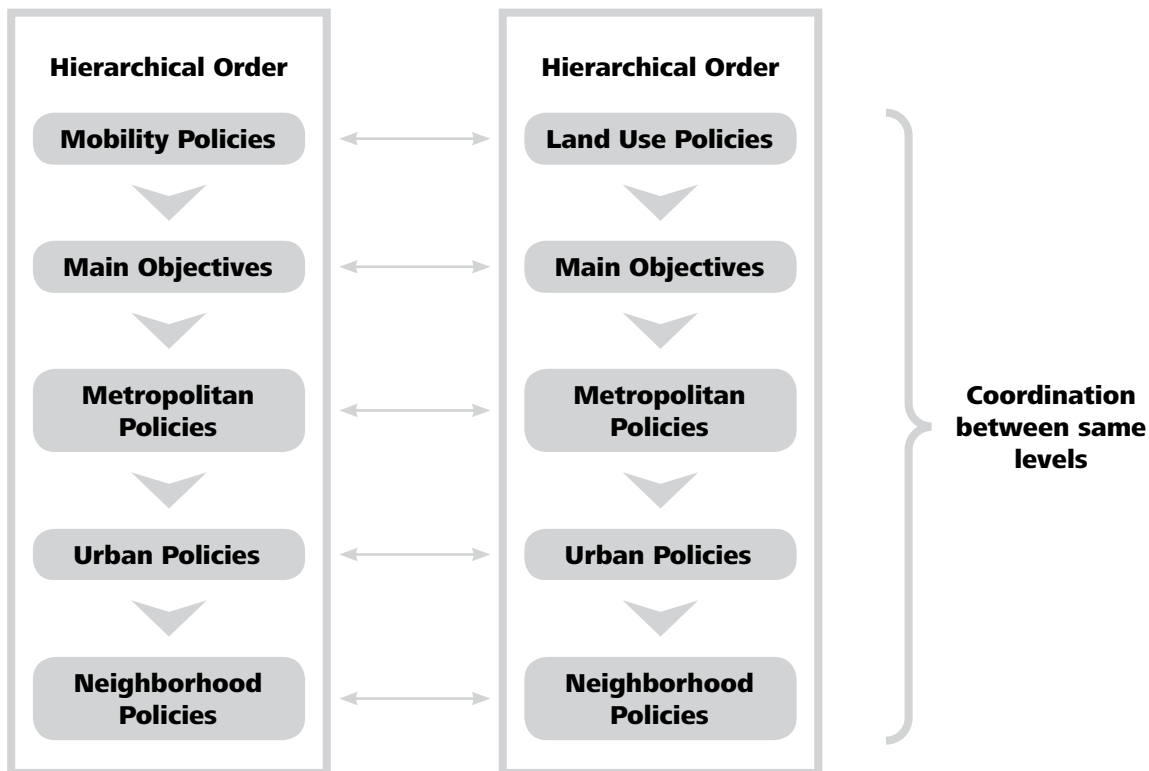
Then next set of policies should have a local scope, yet depending from the guidelines of the metropolitan ones:



Finally neighborhood policies should stem from participation with the society. Still, some guidelines that can be applied to most of them are described here:

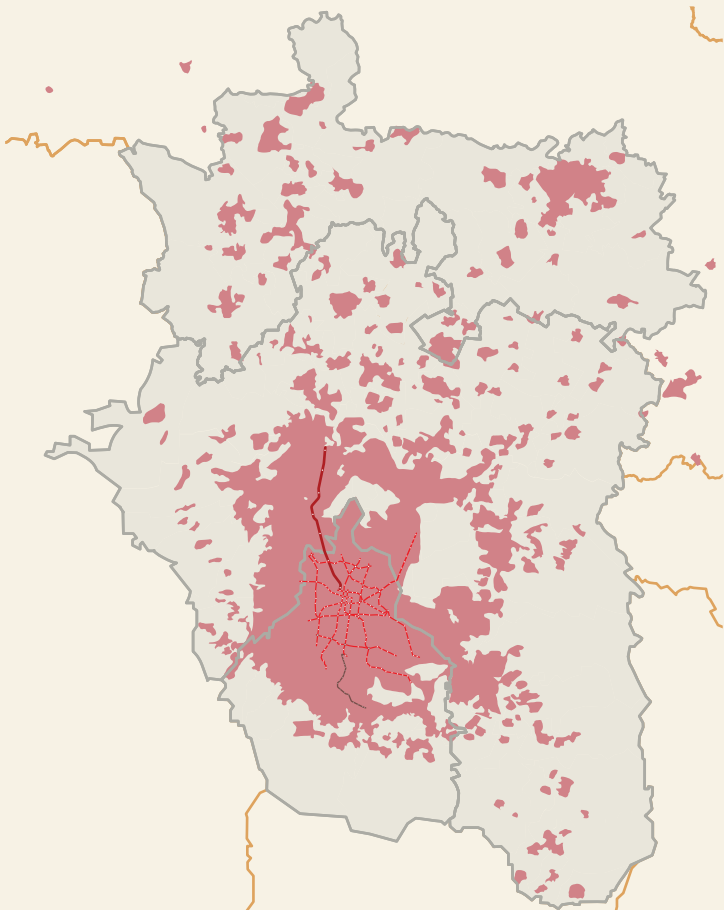


The next diagram sums up the new order and hierarchy of the mobility and land use policies:



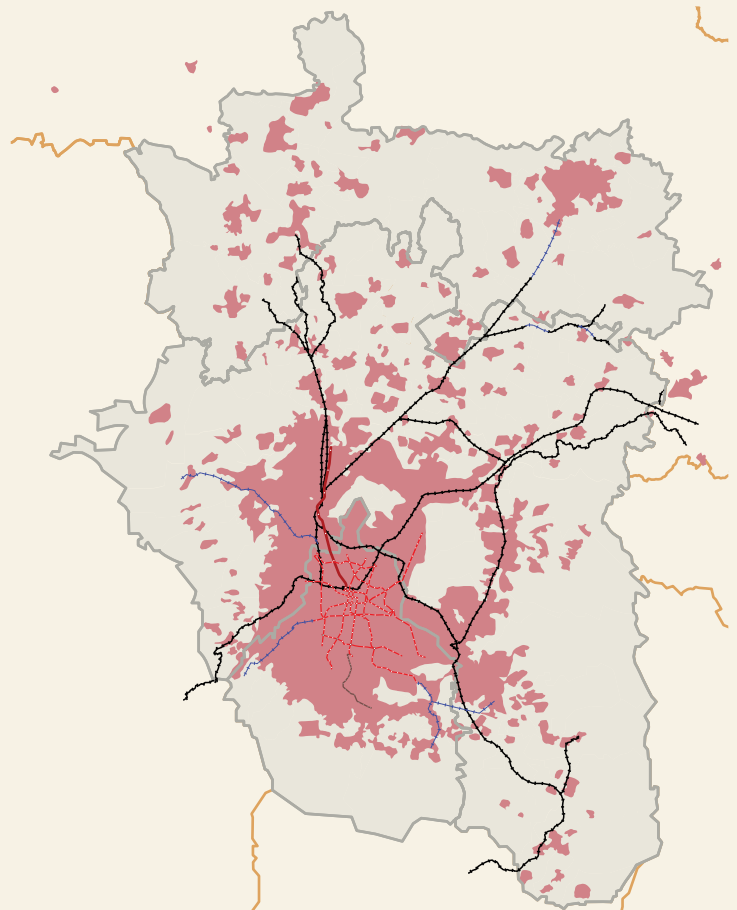
5.2. METROPOLITAN LEVEL INTERVENTIONS

As we saw in Chapter 2, the former Mexico City now MCMA has gradually passed from a central growth to a polycentric one. This is demonstrated in travel trends originating both in the State of Mexico and the Federal District (Fig. 3.27 on page 89) of which a percentage fails to move to the other entity. That is, there are people that do not need to go to the “central” city for their primary activities.



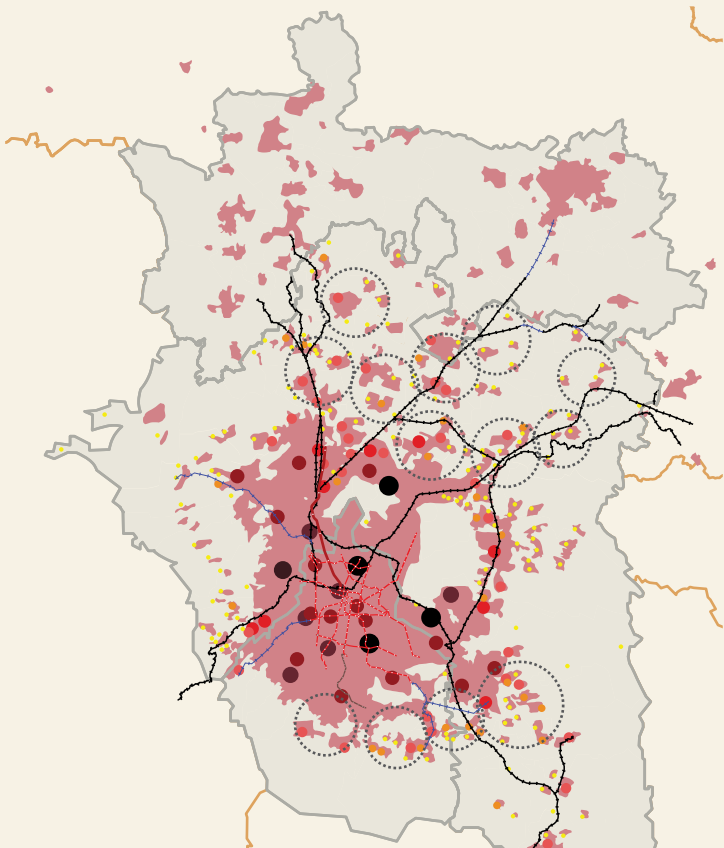
The actual configuration of MCMA does not allow an efficient public transport. It does not serve most of the metropolitan area. Massive public transport is unequally distributed.

Fig. 5.1 MCMA's current public transport configuration.



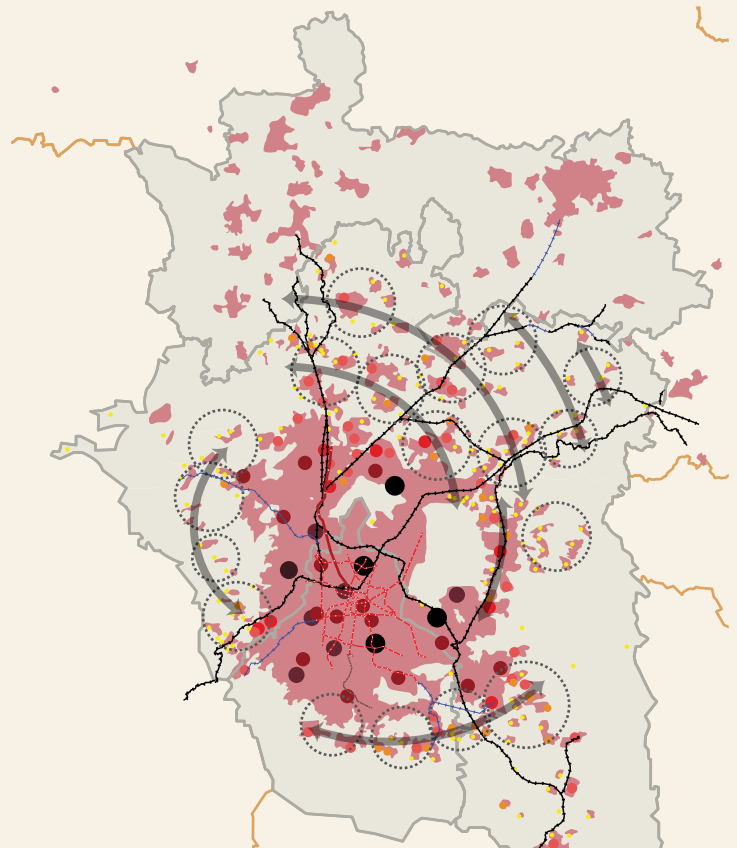
MCMA can reuse the railroad network and use it as spinal cord of public mobility.

Fig. 5.2 MCMA's conceptual mobility main scheme (1st step).



At the same time most of the localities can be consolidated via effective land use planning considering construction densities, permissions and prohibitions to build.

Fig. 5.3 MCMA's conceptual mobility main scheme (2nd step).



Transversal connections through these localities could be achieved as well with medium capacity transport modes.

Fig. 5.4 MCMA's conceptual mobility main scheme (3rd step).

Considering also that in Rio de Janeiro, a densely populated city, suburban rail has given a viable solution to the problem of connecting the periphery to the central city (Fig. 4.76 on page 200) and seeing the existence of infrastructure and right-of-way, its possible to pick up them in order to implement a suburban railway system connecting the central city to the suburbs. This could be thought as a “structural” system or “spine” of public transport.

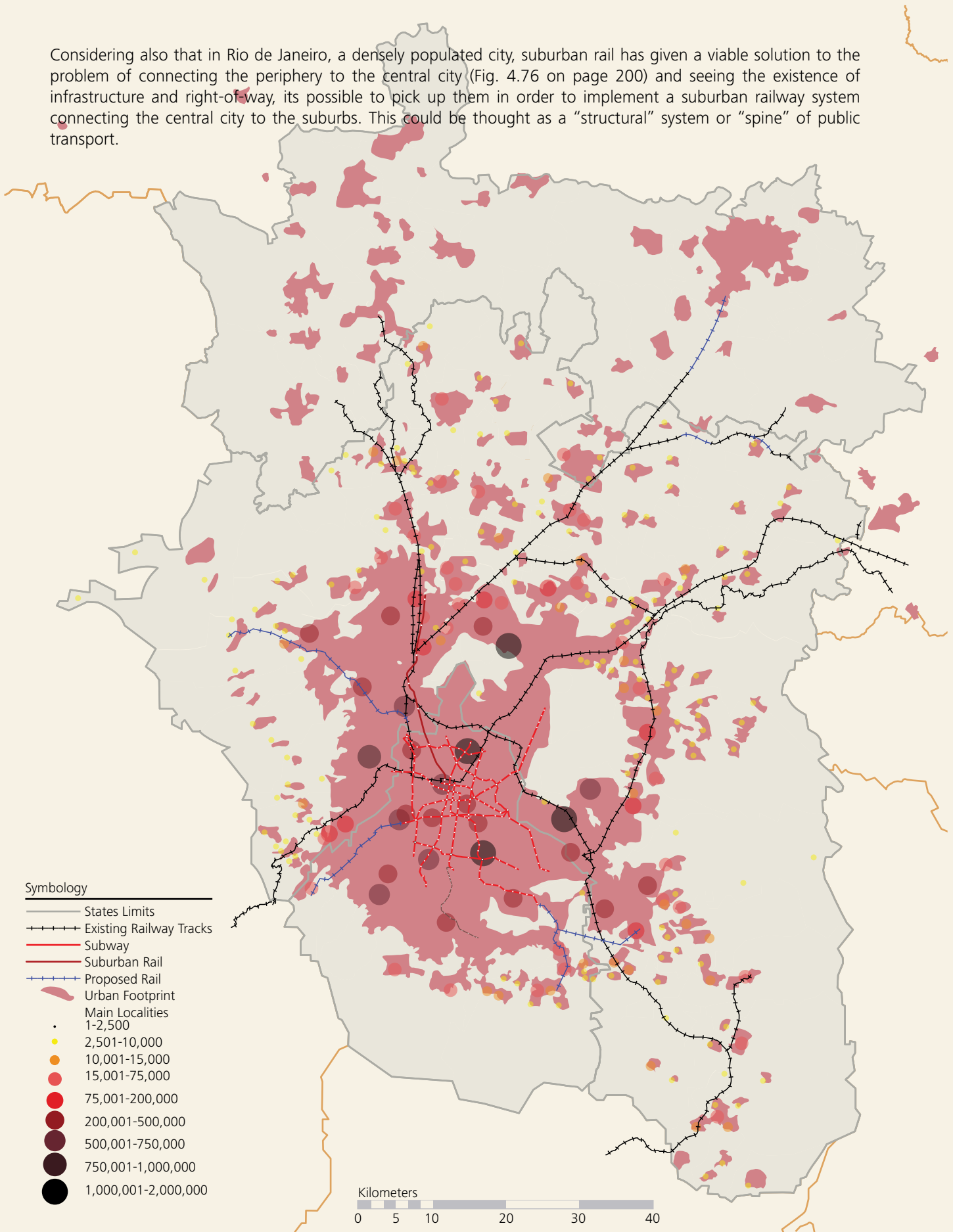


Fig. 5.5 MCMA's proposal for a railway network.

As for the land use topic, it's clear that the MCMA has a tendency towards urban sprawl, where a mixture of built space and urban voids are present. This could difficult in a future an ordered development of the metropolis. Curitiba has shown the benefits of redistribution population densities and concentration. That's why it's suggested to pass to a polycentric model with a consolidation of the localities through new policies which could include population density incremental as well as boosting diverse economic activities and the connection between the central city via a high capacity suburban rail.

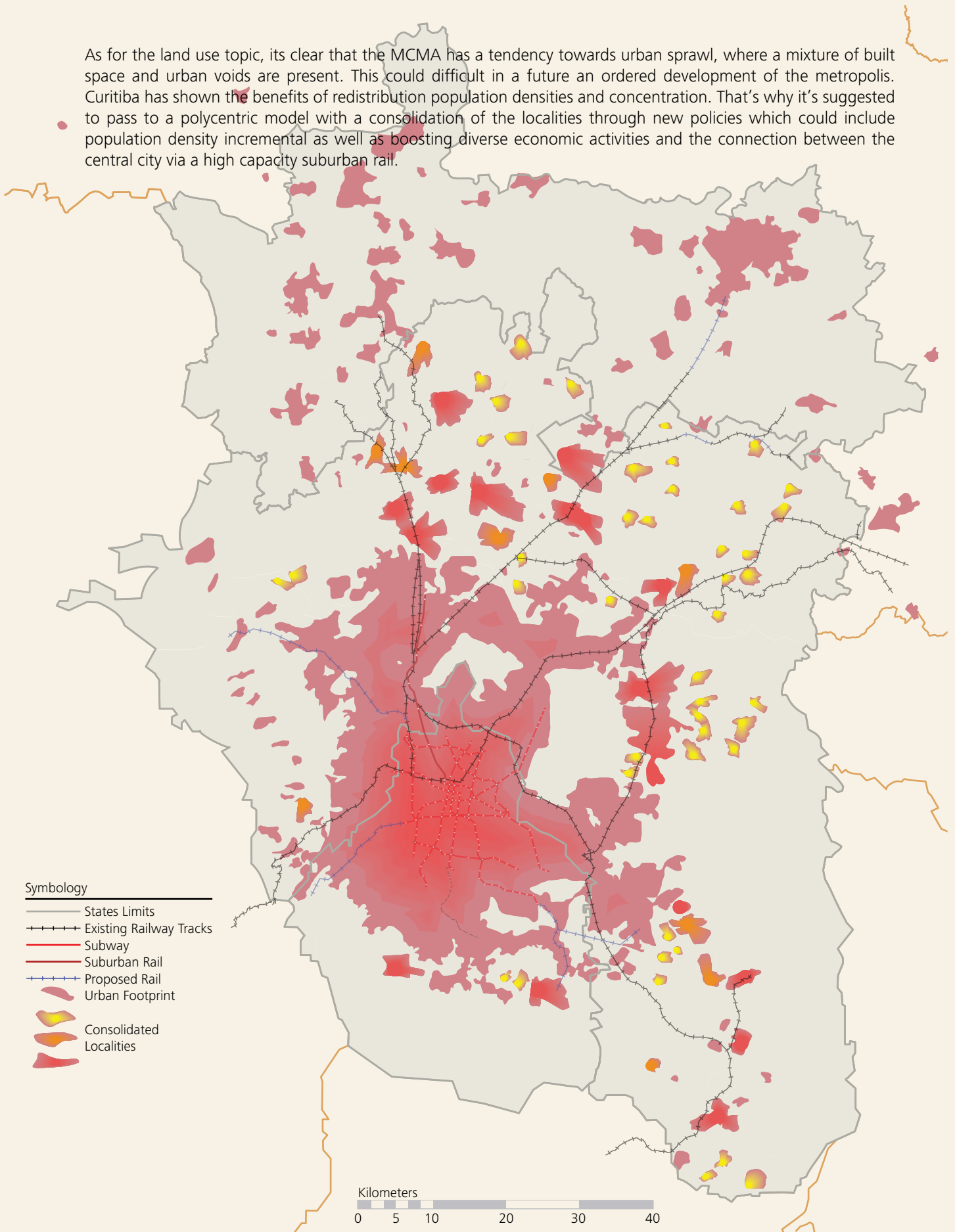
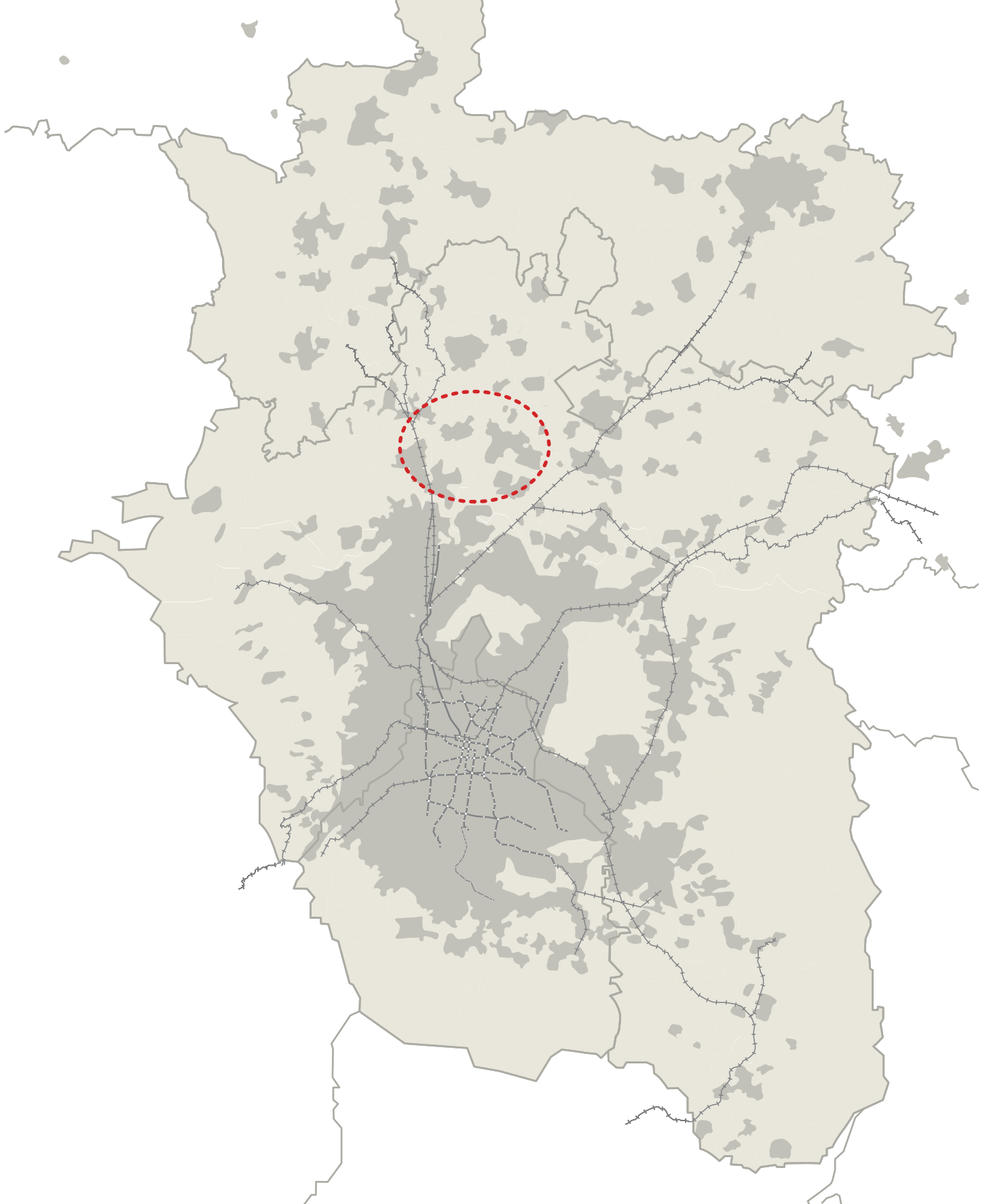


Fig. 5.6 MCMA's proposal to increase density and consolidate localities.

5.3. URBAN LEVEL INTERVENTIONS

To illustrate the application of the proposed regulations at the local level, one of MCMA's regions with a lack of connectivity has been chosen. The area includes the towns of Huehuetoca, Coyotepec, Teoloyucan, Jaltenco, Nextlalpan Santa Ana, San Sebastián de Ocampo Zumpango and San Juan Zitlaltepec.





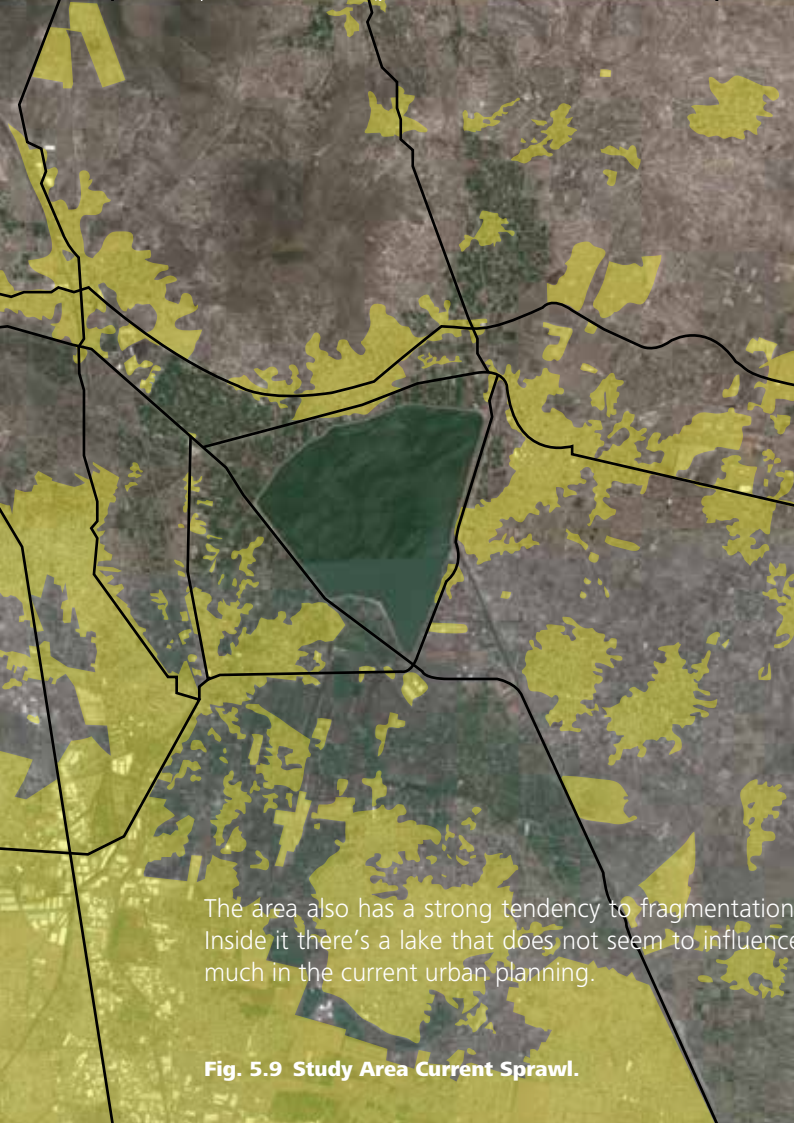
The area has connectivity through roads. The public transport lines are dispersed and not organized. These are managed by private companies or organized drivers. The area also has rail infrastructure. Currently it is only used for cargo transporting to the Federal District.

Fig. 5.7 Study Area Current Connectivity.



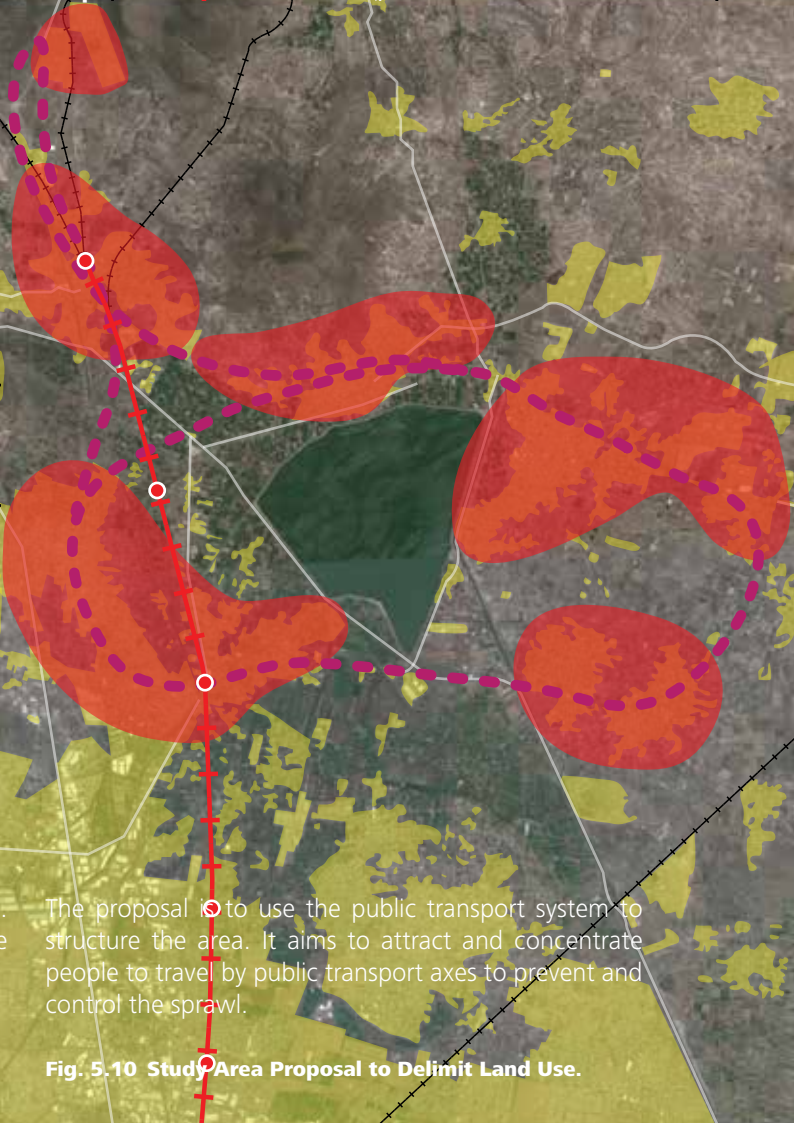
With this proposal the aim is to connect this area with the "Central City". To do such will be used the extension of the suburban rail and a BRT circular transport system connecting all locations among themselves and with the suburban rail.

Fig. 5.8 Study Area Public Transport Conceptual Proposal.



The area also has a strong tendency to fragmentation. Inside it there's a lake that does not seem to influence much in the current urban planning.

Fig. 5.9 Study Area Current Sprawl.



The proposal is to use the public transport system to structure the area. It aims to attract and concentrate people to travel by public transport axes to prevent and control the sprawl.

Fig. 5.10 Study Area Proposal to Delimit Land Use.

The proposal concentrates a dedicated buses transport system running in confined lanes around the towns and connecting them to the suburban train. To avoid fragmentation and thereby increases in private commutes, the new urban regeneration polygons are defined. These polygons will contain diverse land uses besides housing to ensure economic sustainability, while providing employment opportunities, hence reducing as far as possible long commutes.

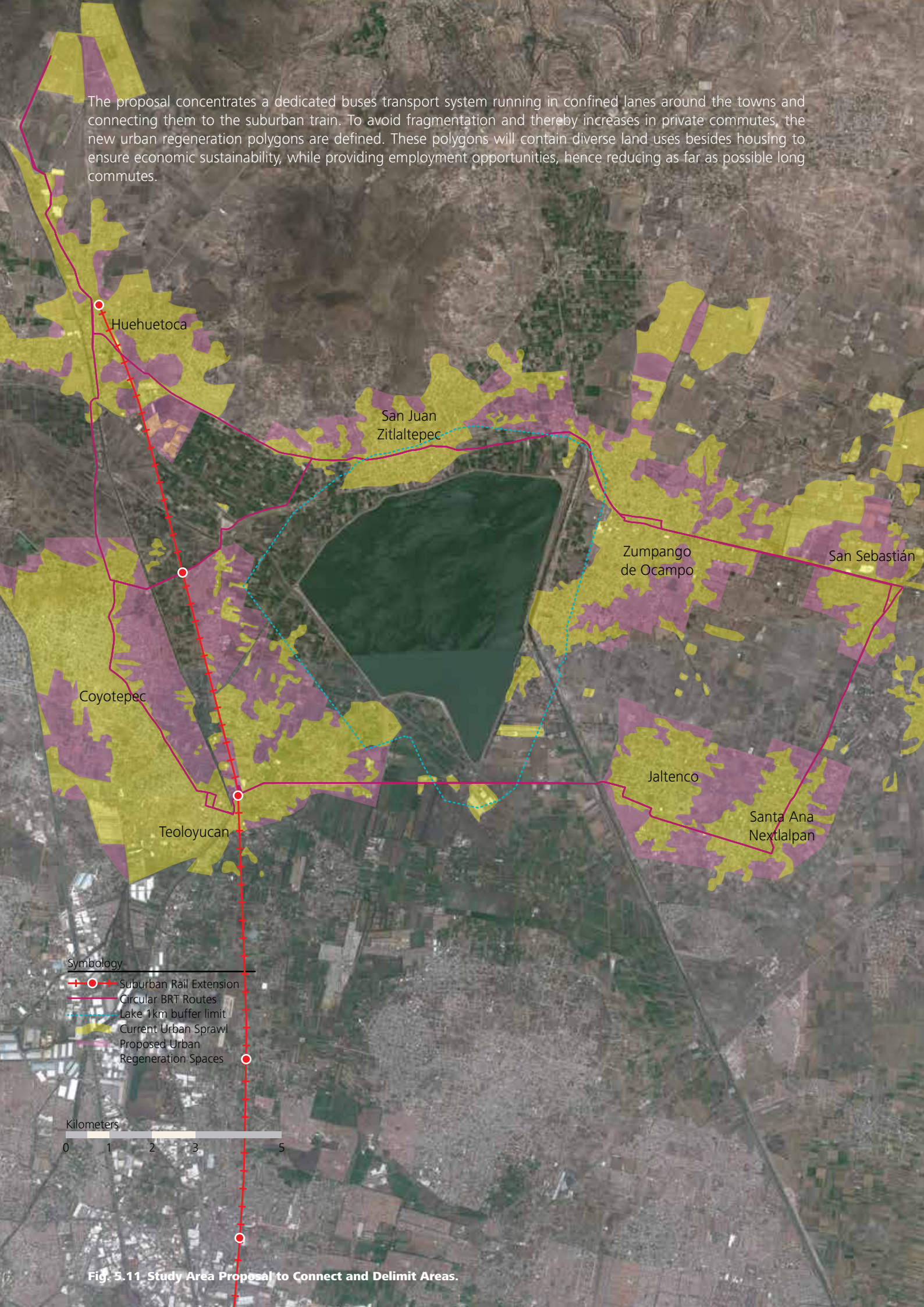
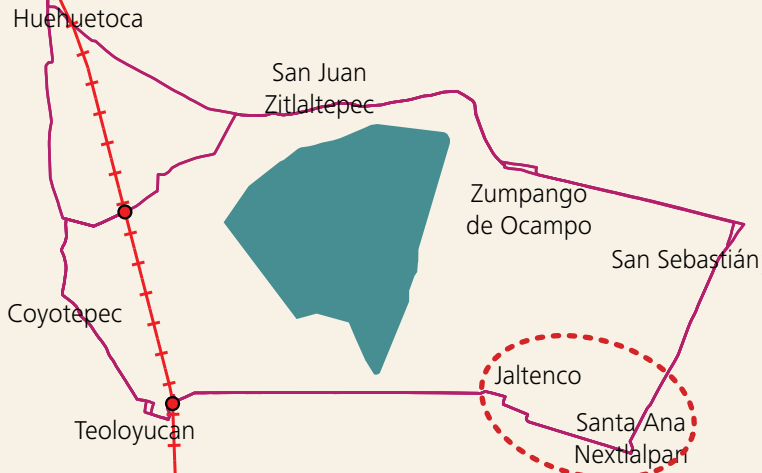


Fig. 5.11 Study Area Proposal to Connect and Delimit Areas.

5.4. NEIGHBORHOOD LEVEL INTERVENTIONS



The localities of "Jaltenco and "Santa Ana Nextlalpan" has been selected to demonstrate the next set of policies. This thwo localities will be connected via the Circular BRT running through the rest of the municipalities and with connection to the future extension of the suburban rail.

Fig. 5.12 MCMA's Selected Localities to demonstrate the Neighborhood Policies.



The zone currently has connectivity via main roads. There's no local public transport system. The only way people move is either with private cars or concession public transport. The zone presents a high index of fragmentation.

Fig. 5.13 MCMA's Selected Localities Current Status.



With help of the Circular BRT and new feeder bus lines, there's the possibility to give connection inside the zone and with the Federal District.

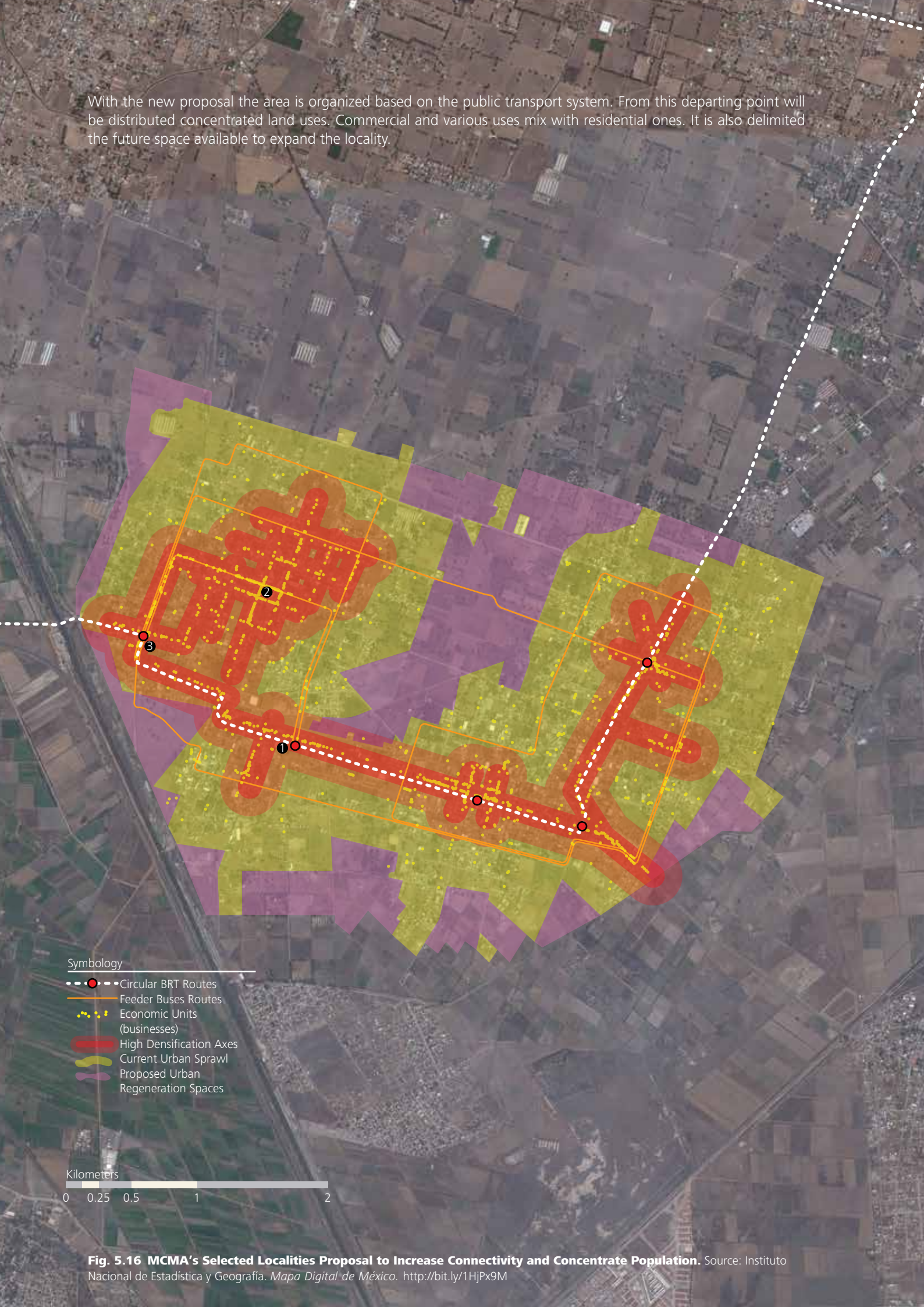
Fig. 5.14 MCMA'S Selected Localities Public Transport Proposal Scheme.



The Feeder buses also help to articulate and delimit land uses. Increasing densities through the main economic axes of the zone and slowly decreasing them towards the outskirts will concentrate population around the businesses and amenities they need the most, decreasing the number and length of possible commutes to do.

Fig. 5.15 MCMA's Selected Localities Land Use Proposal Scheme.

With the new proposal the area is organized based on the public transport system. From this departing point will be distributed concentrated land uses. Commercial and various uses mix with residential ones. It is also delimited the future space available to expand the locality.



- Symbology
- Circular BRT Routes
 - Feeder Buses Routes
 - Economic Units (businesses)
 - High Densification Axes
 - Current Urban Sprawl
 - Proposed Urban Regeneration Spaces

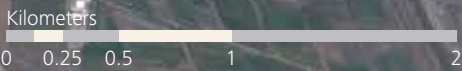
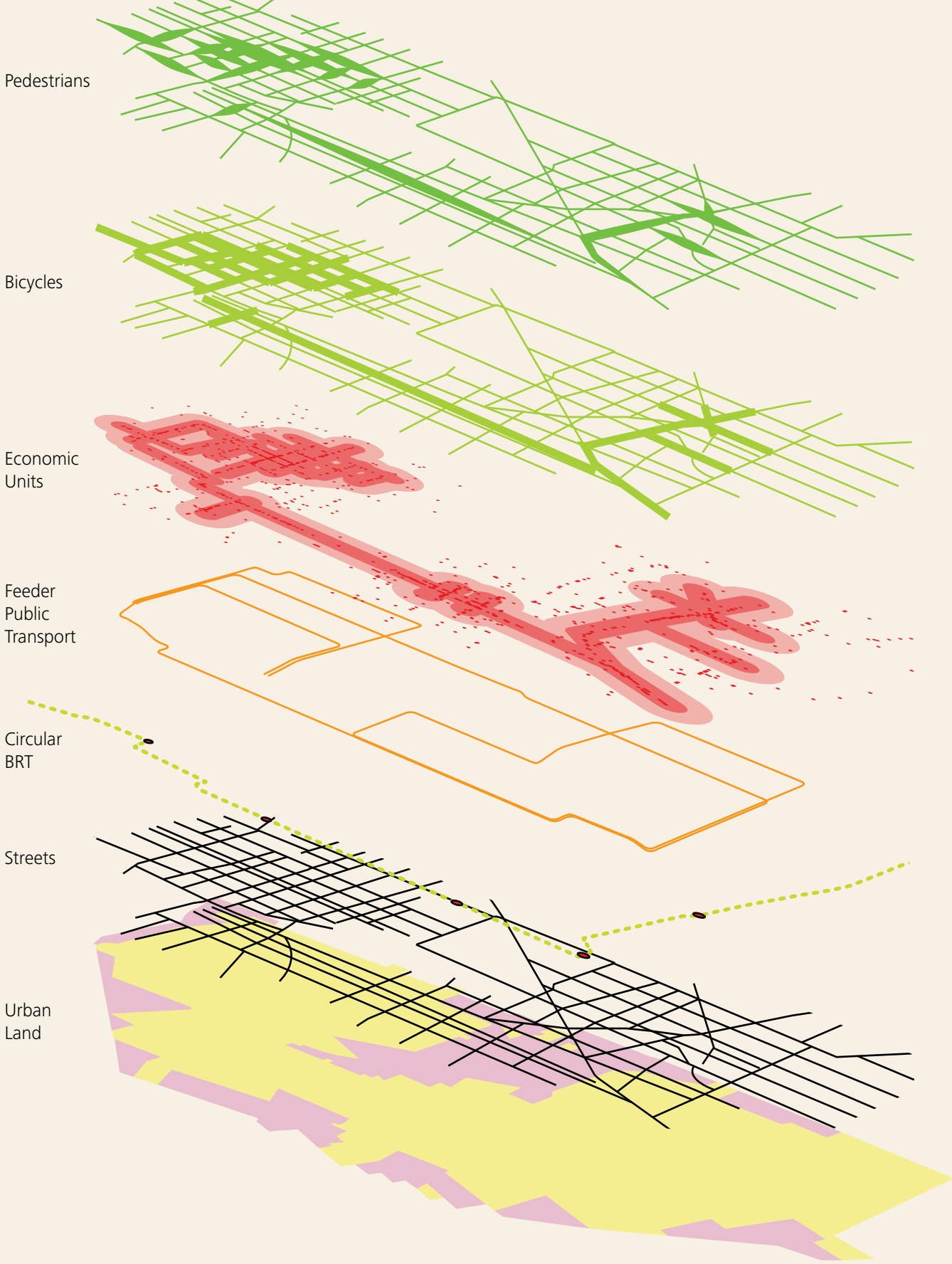


Fig. 5.16 MCMA's Selected Localities Proposal to Increase Connectivity and Concentrate Population. Source: Instituto Nacional de Estadística y Geografía. *Mapa Digital de México*. <http://bit.ly/1HjPx9M>

Mobility is the main articulator in this proposal. Actual land uses, specifically the economic units, complement and connect the locality. The streets will have a differentiation depending their users. Most of the street with business will feature: comfortable sidewalks for pedestrians, a dedicated lane for bikes and bus stops for the feeder buses. On the other hand, the rest of the streets with low traffic will feature low traffic and calming elements such as speed bumps and the preference to pedestrians and cyclist on the streets.



A) Example 1

In this avenue now is flourishing commercial activities. It is a wide avenue and also connects to the next town. It is therefore proposed to place the Circular BRT lane. This location will connect to mass transit lines, but will also give life to the street through a connection such as the public transport. Among the changes proposed are the following:

- Creating the Circular BRT confined lane.
- New street and sidewalks pavement, durable and nice view.
- Stop signage for easy identification.
- Boost commercial land uses on the same street.
- Implementation of the bike path.
- Even with the preference for the BRT, there's as well a dedicated lane for private cars.



Fig. 5.17 Selected locality Nowadays View and Proposed Changes (Example 1).

B) Example 2

In this example is shown the main square. It also has business and their attractiveness is demonstrated with all the cars parked around. In this place is proposed a mandatory step for public transport, not only to continue drawing the population, but also to continue growing the economic dynamics of the city center. It is proposed:

- Prevent access by private vehicles in the square.
- Encourage non-motorized mobility: the use of bicycles and pedestrian movement.
- Placing an attractive and durable pavement.
- Placement of attractive bus stop signage.
- Encourage commercial activities in the area.
- Designing streets safe crossings for pedestrians and vehicles.



Fig. 5.18 Selected locality Nowadays View and Proposed Changes (Example 2).

C) Example 3

On this point it is proposed to place the BRT Circular connection with feeder buses. Nowadays is a crossing streets with a square. Its drawing power is seen by business presence plus the school located in the area. Here is proposed:

- Ensuring priority to the BRT Circular circulation to avoid car congestion.
- Delimit clearly pedestrian, private cars and the Circular BRT spaces.
- Mark the stops both of the Circular BRT (left) and the feeder buses (right) and ensure a safe, easy and short connection between the two.
- Encourage non-motorized mobility: the use of bicycles and pedestrian movement.
- Encourage commercial activities in the area.
- Design safe crossings for pedestrians and vehicles.



Fig. 5.19 Selected locality Nowadays View and Proposed Changes (Example 3).





6. CONCLUSION

We have seen that the design of cities can help diminish this gap of inequality that exists between rich and poor. Cities can contain activities that make them interesting at the same time that can stimulate economic flows. The cities, regardless of their ages, represent an investment in the future, so those should be planned carefully to be productive. There's not a visible future trend to shrink cities, so those should be planned them properly. One way to help improve the economic flow is through transport. Strategically placing activities in one place and connecting them through an efficient transportation system encourages economic flows. And doing the opposite result otherwise harmful for the city. The more the links between economic sectors that seem so different and disconnected, the greater the transactions between them, improving the equity in the city.

Mexico City was already a city before colonization process. We have seen that public transport has always been a problem, even before the period known as "Mexican Revolution". The issue of transportation has always been solved by palliative measures rather than address it comprehensively. Although today Mexico City is a great megalopolis, a true investment, and a significant proportion of gross domestic product depends on it, the city has not tackled properly and hasn't issued significant changes regarding the public transport issue. However, the value of the City merits that the subject be considered and modifications to improve transport conditions of citizens should be done in order to improve their quality of life.

In the study of three Latin American cities that have made changes in their transport systems, as well as its land uses, it can be seen that: 1) both the policies of the transport system and land use are unified and go together allowing complementation between each other; 2) the integration of transport systems encourages its use among the population, and it happens much more when the rate is integrated; 3) regulation and inclusion of current transport systems is possible through policies aimed at increasing the level of quality of public transport; 4) decentralization, increasing density and a better city planning can do much more to mitigate the need for transport in cities.

Making several changes to the city, taking advantage of existing infrastructure already in existence as the experience of cities already seen, it's possible to think of a system that meets the current needs of transport in the city. Using as a mobility backbone the train can be decentralized the city, while connecting it in an easier way. Through BRT buses, people can be connected with this mass transit system, allowing a connection between the central city and other towns. Finally, by connecting the population with feeder buses to the BRT system, the purpose of having an efficient and affordable public transport network for the population is achieved, which encourages the creation and flourishing of business, and attacks promptly the problem of vehicular traffic.

Despite having great difficulties as a developing economy, Mexico City has enough tools to improve the mobility of its inhabitants. However it is necessary for the Government to assume its leadership role and begin to take firm steps towards an enjoyable city for its inhabitants. Without a prior study on why residents move in this city, very little can be done in favor of the mass movement of people. The participation of society is fundamental, because they are the ones who dictate the future of the city itself. It is them who know the needs of the city and it is therefore necessary to listen them.

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