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Governance as a tool to deliver sustainable transport systems: An institutional integration proposal for Monterrey, Mexico.

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Being a dissertation submitted to the faculty of The Built Environment as part of the requirements for the award of the MSc Sustainable Urbanism at University College London: I declare that this dissertation is entirely my own work and that ideas, data and images, as well as direct quotations, drawn from elsewhere are identified and referenced.

Eloy González Madrazo
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Abstract

Monterrey, Mexico is a city that faces air pollution and congestion crisis due to a heavy reliance on private motorised mobility. The purpose of this paper is to show that governance plays a significant role in this issue, as the provision of mobility is fragmented between different levels of government and institutions that do not collaborate effectively.

This research focuses on four topics, from a governance perspective: organisational structure, policy integration, finance and urban integration. It uses three progressive cities as case studies: Medellin, London and Singapore. These were selected as they have achieved a form of integration in their transport system and represent different political and cultural contexts. Documental research and semi-structured interviews were conducted in each city to understand their current framework and a coding matrix was created to perform a content analysis of the interviews.

Results show that governance does impact significantly the ability of a city to pursue sustainable mobility. Progressive cities have integrated institutions that oversee planning, implementation, administration and monitoring of mobility, where Monterrey has these attributions fragmented in at least six organisations that scarcely collaborate. These cities have strong local plans that direct strategies and projects and support collaboration between agencies, level of governments and stakeholders. In Monterrey, the last metropolitan plan is outdated and has no integrating powers. Financing in Monterrey is not an issue of the number of resources, but how effectively they are being used. And finally, urban integration to mobility is being done through plans and policy in progressive cities but mostly treated separately in Monterrey.

The paper concludes with a framework proposal for Monterrey, embedded in its current context, that would help the city overcome its issues. Further detailing would be needed for this framework to be realistically applied, but it is well-grounded on evidence.

Introduction

Mobility is essential for society and the economy (Vasconcellos, 2001). It enables or impedes us to access jobs, education, health facilities and leisure depending on its costs and availability. Streets as places promote community integration, providing a space to meet, explore and play; while heavy motorways severe communities. Walking and cycling as travel method is an easy way to do enough physical activity to reduce threats to our health due to sedentarism, including diabetes, dementia, depression, heart disease and cancer (TfL, 2017).

But with an increasing population and urbanisation worldwide, mobility of people and goods is also a source of concern. Air pollution contributes to 7.6% of all deaths on the planet, as 91% of people live in places where levels of pollutant concentrations are exceeded (WHO, 2016). Road fatalities take 1.35 million people's lives each year (WHO, 2013). Transportation-related greenhouse gases emissions account for 14.4% worldwide (EPA, 2010); 28% of the global energy demand comes from this sector; and it consumes 65% of oil demand (IPCC, 2018). Therefore, transitioning towards sustainable mobility in cities is a crucial step to mitigate climate change and improve our overall wellbeing.

The main argument of this work is that governance plays a key role in the ability of cities to deliver sustainable mobility projects and, therefore, achieve sustainable outcomes. Berrang-Ford et al. (2014) (cited in IPCC, 2018) assessed national level adaptation to climate change capabilities in 117 countries. They found out that good governance is one of the strongest predictors of how nations can respond to it.

Governance is how society or groups within it organise in structures and processes to make decisions (Institute on Governance, 2019). Institutionally, it is the "exercise of political, economic and administrative authority necessary to manage a nation's affairs" (OECD, 2007). It determines who has power, who makes decisions, how different stakeholders can participate, and how account is rendered (Institute on Governance, 2019). This is an important topic in sustainable mobility because, even though many cities in the developed world have achieved a reduction in car use, authorities in developing countries face "apparently insurmountable obstacles". These are related to low public funding and institutional inefficiency, limited by corruption and poor management (Flores Dewey, 2013).

Monterrey is a city in Mexico that, like many other Latin American cities, grew up with the car. Today it is its primary mode of transport, and the city's infrastructure, institutions, and people are well adapted to it. A comprehensive analysis of the governance framework of Monterrey will show that flawed institutional arrangements, fragmented attributions and a lack of collaboration acerbate the reliance on private motor mobility. It will also show that Monterrey has a great potential to change, but it needs a profound restructuring in the management of its policy, plans, finance and urban planning.

Aim

This study aims to make a comparative analysis of governance frameworks that allow the integration of public transport and active modes of travel, to enable sustainable mobility projects effectively. Then, a specific framework will be proposed for Monterrey, Mexico. The three main objectives are:

1. Identify the mobility challenges Monterrey faces related to governance issues.
2. Understand the progressive cities' governance framework and identify good practices.
3. Propose a governance framework for Monterrey, considering the city's actual context and best practices.

Chapters overview

This dissertation has five chapters. The first one will present an overview of the literature around transport governance and the conceptual framework topics that will be used in this analysis. Four topics are the focus: organisational structure, policy integration, finance and urban development integration. Chapter two details the methodology for the study, which is based on documental analysis and semi-structured interviews. Chapter three introduces Monterrey and three progressive cities that will be used as case studies. Medellin, London and Singapore are cities within different political and cultural contexts that have achieved a form of integration in their transport system with successful, internationally known projects. Medellin was specifically chosen because of its close context to Monterrey, being a city in a developing country in Latin America. These cities are analysed and compared in the light of the four governance topics in chapter 4.

Finally, chapter 5 presents a new governance framework for the city of Monterrey. This framework is intended to show how to overcome the main issues and barriers, based on lessons learnt from the progressive cities, Monterrey's context, and what the interviews in this city revealed.

Chapter 1: Governance in transport - Literature review

1.1. The case for government led transport vs. private led

The debate on whether the government or the private sector should provide public transport services, or an arrangement in between, has been extensive. Conclusions are often not definitive but context-related. In developing countries, when public institutions have operated transport services, evidence shows that it has lead to mismanagement, service unreliability, crowded vehicles, and overall inefficiency (Vasconcellos, 2001). This is due to overstaffing, political interest and unions pressure, a disregard of market opportunities to create new services and corruption in the institutions (Vasconcellos, 2001). Mexico City is an example of this, with the municipalisation of public transport provision in 1981 and the creation of a public company. The goal was to increase the governments planning and regulatory capacity. But problems presented, union leaders and managers started disposing of company assets as their own, so it declared bankruptcy in 1995 (Flores Dewey, 2013).

However, Mees, cited by Kennedy et al. (2005), argues that the most successful transit systems are generally managed by public bodies. This is backed up by the analysis of the three case studies in this research: London, Singapore and Medellin, Medellin being a developing country.

Private companies are, in general, more efficient than the public sector in the provision of services. Resource-constrained and institutionally weak states need to cooperate with a vibrant private sector, especially with a rapid demographic, economic and spatial urban growth (Flores Dewey, 2013). But the history of informal public transport shows that when transport is left solely to the market, strict market logic operates. As in any business, it is run according to the owners' best interests. Therefore, they often result in increased fares, poor vehicle maintenance and low fleet availability (Vasconcellos, 2001). Furthermore, privatisation decreases the public sector capacity to integrate transport infrastructure and complementarity. Cross subsidy of different modes, that can be competing with each other, becomes unfeasible (Hull, 2010). It also decreases the institutional capacity to plan the integration between development and transport to increase accessibility (Hull, 2010).

Benefits of privatisation depend largely on the establishment and maintenance of effective competition, where the private sector participation does increase efficiency and reduce costs and improve quality of service (Gómez-

Ibáñez & Meyer, 1993; Cowie, 2011). Evidence strongly supports that competition for the market, where private operators bid for area-based or route-based contracts, is better than competition in the market, where many vehicle-owner operators compete for passengers. The later causes overlap in the network that results in inefficiency and lack of physical integration of the system (Currie, 2016; Flores Dewey, 2013; López Cantú, 2013)

The literature shows in general that the provision of transport works best with central management from the government, where strong institutions regulate the participation of the private sector under competitive conditions.

1.2. Transport governance

Governance topics in the transport sector are broadly discussed. For example, regulation/policy, integrated systems, decision-making and planning. In most cases, authors cover mainly one or two of these topics and use one or more case studies to illustrate how the topic is addressed and what are the lessons to learn from it (Currie, 2016; Preston et al, 2000; Truelove, 1992; McConville, 1997; Tolley & Turton, 1995; Vasconcellos, 2001). Rode (2017) argues that even though these discourses underline the crucial role of governance, the discussion tends to focus on integrated planning processes. Three authors in particular address the issue from a more holistic governance point of view, they will be individually presented, as they are the main base for the construction of the approach of this dissertation.

Kennedy et al. (2005) sets governance as one of the four pillars to achieve sustainable transport (Fig.1). Here, governance is generally addressed as the government structures that have the mandate, responsibility and power to make decisions. They establish four main attributes shown in Fig.1 and argue about the trade-offs needed in each case. For example, in democracy the trade-off is on whether a publicly elected official is better to manage certain institutions because they are directly accountable; or a non-elected professional is better as would be less subject to political pressures and able to take a longer perspective on planning.

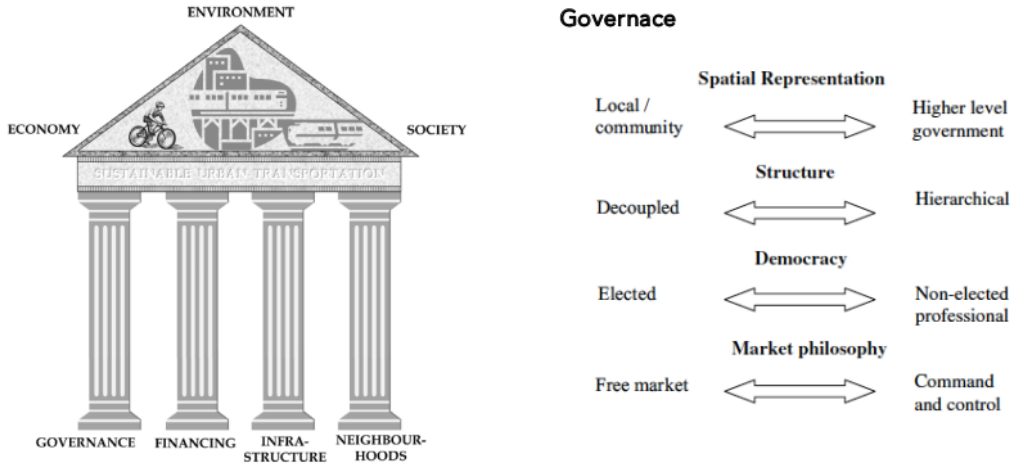


Fig.1 Four pillars of sustainable urban transportation & trade-offs in the establishment of regional governance (Kennedy et al., 2005)

Angela Hull (2010) defines governance as structures that are shaped by administrative divisions, laws, politics, human resources and culture. She presents a list of barriers to change towards integrated approaches to planning (Fig.2).

Financial	• High costs to build a business case to access grants. • Funds provided in a top-down way separate structures to plan and design major infrastructures and block innovation. • Lack of connection between funding schemes and government policy
Organisational	• Inefficient, counterproductive and overlapping roles in institutions. • Incompatible objectives and targets • Skill, resource and time limitations
Cultural	• Dominant status of car in society. • Experts taking decisions without broad stakeholder involvement. • Values of transport professionals, interested in narrow range of issues.
Legislative	• Permissive operating environment for privatized transport. • Limited regional powers of transport agencies. • Time and cost from legal requirements in project implementation.
Political	• Changes of power relationship between organizations • The election cycle creates a hurdle for innovatory schemes that might be controversial. • Lack of a political mandate at the regional level.
Technical	• Data quality and quantity is poor. • Shortage of skilled personnel and sophisticated land use and transport models. • Target setting and performance monitoring remains underdeveloped.

Fig.2 Barriers to integrated planning. (Adapted from Hull, 2010)

Philipp Rode (2017), classifies urban and transport planning integration in three types (Fig.3), and further develops the third classification, which is the integration of governance. He includes a broader concept of governance with all stakeholders conforming network structures, consisting of the general public, professional public and private networks that are based mainly on informal communication and coordination with mostly flat hierarchies.

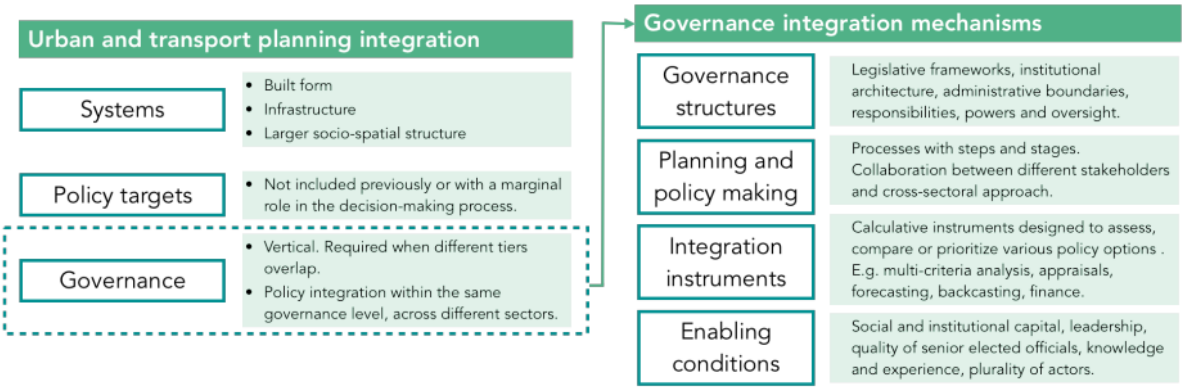


Fig.3 Forms of integration and governance mechanisms (Adapted from Rode, 2017)

1.3. Conceptual framework

The previous discussions in the literature were used to develop this work's conceptual framework. As the central representation of mobility governance is through government institutions and their interaction with other stakeholders, their organisational structure will be analysed as a starting point in all the case-study cities. The influence of a higher authority, mainly the national government, is addressed but taken mostly as a fixed condition. Three other subjects, recurrent in the literature, are going to be discussed in the light of governance. An assessment will be done about how governance acts as a barrier or an enabler to financing, policy integration and implementation and integration with urban development. This section provides a brief definition for each of the topics found in the literature.

1.3.1 Organisational structure and powers

The institutional architecture has a profound impact on how public officials behave. In the best-case scenarios, there are integrated structures of government, with robust legislative frameworks that can generate good planning and policy processes (Rode, 2017). Kennedy et al. (2005) argue that a body for providing sustainable

mobility at the city-level lies between a strong hierarchical form and a loosely coupled structure. With one having a higher degree of control over processes and personnel but regarded as unable to cope with more complex conditions (Kennedy et al., 2005; Rode, 2017). And the other, more flexible and inclusive, but weaker and without accountability for results (Kennedy et al., 2005).

In developing countries, coordination is performed inadequately because of fragmentation of powers and overlap of responsibilities between different government levels (local, regional and national) and institutions (Vasconcellos, 2001). Where institutions are weak, access to policy decisions rely on personal relationships with the decision-makers and decisions are taken rapidly, without a long discussion process. This increases the possibility of errors in policies and projects (Vasconcellos, 2001). Organisational complexities and rivalry between agencies affect the implementation of transport solutions. Interdepartmental committees can be useful to set responsibilities and reconcile conflicting priorities (Hull, 2010).

1.3.2 Policy integration and implementation

Transport policy is the "process of regulating and controlling the provision of transport to facilitate the efficient operation of the economic and social life of the country at the lowest social and environmental cost" (Tolley & Turton, 1995). James McConville (1997) sets four potential reasons for regulation: to ensure provision, protect users interests and ensure competition, safeguard the employment of workers and to control the risks generated by its provision. This analysis mainly addresses the first and second reasons.

National and regional controls and common objectives are important to achieve sustainable development. If working separately, local governments might go against this. For example, municipalities at the edge of cities looking for development-related incomes can promote land development irresponsibly (Kennedy et al., 2005). Even in Europe, city and city-region public officials frequently have no clear priorities on which actions to take to promote more sustainable mobility (Hull, 2010).

1.3.3 Financing

Finance has been said to be the number one barrier faced by transport projects (Hull, 2010). Without a secure financial basis, it is not possible to provide an efficient, sustainable transport network (Gwilliam, 2002). Long-term financing is essential for the investment in new infrastructure and the operation and maintenance of existing systems (Kennedy et al., 2005). Responsibilities for public transport have been decentralized to cities without an

adequate local fiscal base. Also, services are typically very fragmented, resulting in provision depending on different financial arrangements (Gwilliam, 2002).

The control of funds by higher tiers of government hinders policy integration and innovation at the local level, as they tend to have narrow scopes (Hull, 2010). Transfers should encourage metropolitan coordination (Gwilliam, 2002). This often leads to private sector involvement, but weak institutions lack the staff to search for the right private partners, collaborate with and manage them (Hull, 2010).

Local taxation is very limited in many countries, often only property taxation. Development charges and infrastructure contributions rely on the existence of strong development controls, often lacking in developing countries (Gwilliam, 2002). Most countries provide urban roads without any direct charge to the user. When roads are congested, there is an extra cost, e.g. time delays, imposed by individual vehicles to society, that each person, again, does not pay (Hull, 2010).

1.3.4 Urban development integration

Recently, there has been a shift from focusing on sole mobility to accessibility. This is, "the extent to which individuals can access day to day services, such as employment, education, healthcare, food stores and town centres" (DfT, 2014). The integration of transport and urban planning generates less need to travel long distances in motorized transport (Vasconcellos 2001).

Cities are complex systems where changes in one area trigger other unexpected changes. Thus, an integrated approach is needed to create policies that address these interactions with an understanding of possible outcomes (Kennedy et al., 2005). Nonetheless, these areas are often separated within and between the different tiers of government (Kennedy et al., 2005). Cities that have successfully managed transport and land-use, such as Curitiba, Switzerland and Singapore, have an integrated land-use and transport structure plan. In many countries, this is not possible due to a lack of appropriate institutions and political leadership in a city-region level (Gwilliam, 2002).

These four definitions were used as a starting point for a documental analysis and the formulation of interviews to mobility stakeholders in each city. Other important topics can be addressed from the governance point of view, but due to the scope of this paper, will not be discussed. For example, public participation, transparency,

accountability, the broad non-governmental network structures present in each city and the existence of indicators and their monitoring.

This research project provides a broad view of how governance structure affects areas that have been signalled in the literature as crucial for successful planning and implementation of sustainable mobility projects. This point of view has rarely been addressed in the literature. Moreover, the analysis of Monterrey, a city that does share many of the obstacles of a city within a developing countries' context, and follows the history of public transport provision, is original.

Chapter 2: Methodology

To have a better understanding of the topic, qualitative and quantitative methodologies were chosen. The main research technique of this dissertation was content analysis in two methods: a documental analysis and semi-structured interviews. The four topics presented in the literature review, organisational structure, policy integration, finance and urban development integration, were used as a descriptive coding method. This base was used both to perform the documental and interviews analysis.

2.1. Documental analysis

To understand the current governance framework of the different case study cities, laws, policy documents, urban development plans, organisational charts, financial reports, official government websites and news were reviewed. This data was then summarized into the four topics for each city. After a first understanding of each city, interviews were prepared and conducted, which led back to a brief document analysis to confirm information.

2.2. Semi-structured interviews

Semi-structured interviews were prepared, based on the initial descriptive coding method. Furthermore, close to this method, a deductive coding was applied to create subcodes. Other codes emerged during data collection and were included as inductive coding. Part of the coding matrix can be found in Appendix 1. This detailed code was made anonymous to maintain the participant's confidentiality.

As Monterrey is the city for which an improvement in its governance framework was intended, interviews were mainly focused on this city and many projects and actions were researched outside the initial descriptive codes. For the three progressive cities, the goal was to identify good practices within their governance, rather than a full understanding of their context. Thus, fewer interviews were conducted.

A full list of people interviewed, who accepted to appear with name and position, is included in Appendix 2. A coding was used to reference quotations or information provided by the interviewees, this was also made anonymous to maintain the participant's confidentiality (Table 1).

Table 1. Coding for interviewees in-text references

Organization type	CODE
MONTERREY	
Consultant	CO1_MTY
Consultant	CO2_MTY
Consultant	CO3_MTY
NGO	NGO1_MTY
NGO	NGO2_MTY
Public Official	PO1_MTY
Public Official	PO2_MTY
Public Official	PO3_MTY
Public Official	PO4_MTY
Public Official	PO5_MTY
Public Official	PO6_MTY
Transport Provider	TP1_MTY
Transport Provider	TP2_MTY

Organization type	CODE
MEDELLIN	
Academia	ACA1_MED
Academia	ACA2_MED
NGO	NGO1_MED
Public Official	PO1_MED
LONDON	
Consultant	CO1_LDN
Public Official	PO1_LDN
Public Official	PO2_LDN
Public Official	PO3_LDN
Public Official	PO4_LDN
SINGAPORE	
Public Official	PO1_SGP
Public Official	PO2_SGP
Public Official	PO3_SGP
Transport Provider	TP1_SGP

2.3. Analysing and comparing frameworks

A constant contrast and comparison was done using both the documental analysis and the coding matrix from the interviews. The goal of this section was to point out the main challenges Monterrey faces and how the case-study cities governance frameworks have helped them overcome any related challenges. Where appropriate, challenges that the progressive cities still face were also presented.

2.4. Ethics statement

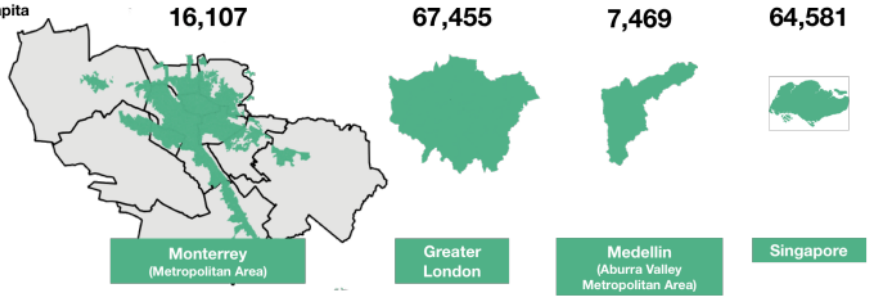
This research project was conducted with full compliance of research ethics norms, established by UCL Research Ethics Committee in the Codes of Conduct.

The research involved human participants with remote and face to face interviews. The participants were formally invited by an email that included a project information sheet, where they were explained the research goals and the focus of the interview. This sheet was available in English and Spanish. It also included contact information, should they had any inquiries or wished to retract information or withdraw participation at any point. Participants were given the option of allowing the use of their name and/or role in connection to their answers, or to remain anonymous. Audio was recorded in every interview with the permission of the interviewees.

Chapter 3: Monterrey, London, Medellin and Singapore, an introduction

Fig.4 Location of the four studied cities (Author w/information from Maps International, 2019).

	Monterrey (Metropolitan Area)	Greater London	Medellin (Aburra Valley Metropolitan Area)	Singapore
Population (million hab)	4.4	8.3	3.6	5.3
Territory (Km^2)	1,951*	1,569	1,152	712
Urban population density (hab/Km^2)	4,700	5,610	20,500	7,126
GDP per capita (USD, 2018)	16,107	67,455	7,469	64,581



* Territory from peripheral municipalities was adjusted to their urban area, to show a more realistic number comparable to the other cities. **Maps are not at precise scale.

Fig.5 Basic information of case study cities (Author w/information from various official government sites)

The four case study cities are located in three different continents (Fig.4). They represent large metropolitan areas both in territory and population. London and Singapore have a much higher income per capita than the Latin American Cities (Fig.5). Medellin has the largest density of the four cities and the lowest income per capita.

3.1. Monterrey, an introduction to the city of mountains (and cars)

For decades the Metropolitan Area of Monterrey was a model within Mexican cities because, despite its harsh natural conditions, in a hundred years, the city became one of the richest in the country and with highest income per capita (Pérez Esparza, 2008). With its success, there was a rapid increase in population (Fig.6), but more so was the increase of the urban area, leading to a decrease in density from 95 habitants per hectare (hab/ha) in 1970 to 47 hab/ha in 2007 as shown in Fig.7.

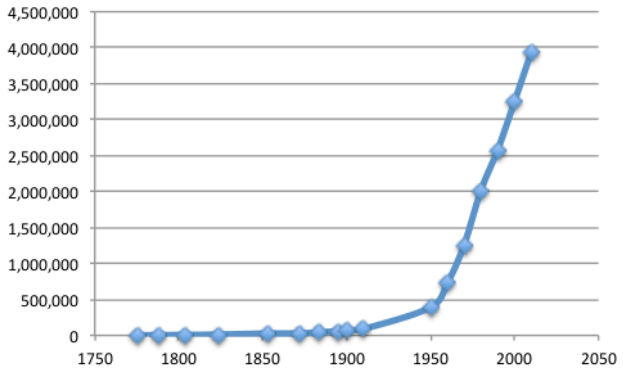


Fig.6 Population in the Metropolitan Area of Monterrey. Source: Author with information from INEGI (2015).

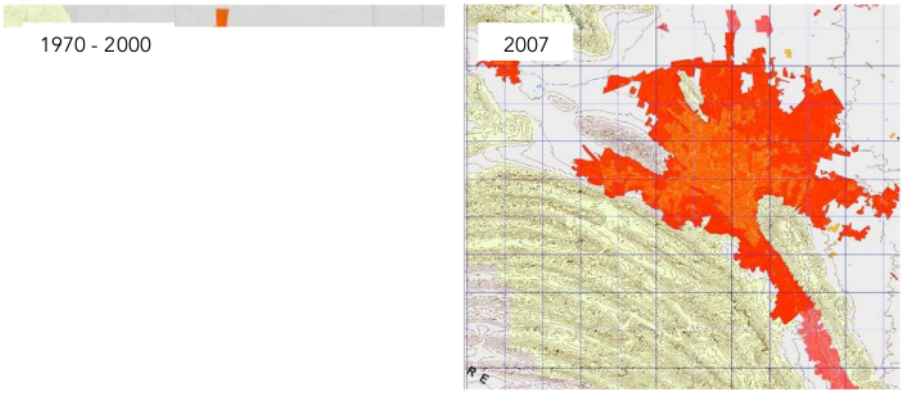


Fig.7 Urban footprint in the Metropolitan Area of Monterrey. Source: CETyV (2009).

The city< faces an urban, congestion and air pollution crisis. There are more than 2 million vehicles in the city (INEGI, 2017b), and 49.9% of the population travels by car, followed by a decreasing 33% by public transport (CVNL, 2016). Congestion is stated, by the general population, as the main urban issue (CVNL, 2016). The air in the city is one of the most polluted in Mexico. For example, in average, 272 days per year (Secretaría de Desarrollo Sustentable, 2017), the city surpasses the PM10 concentration limits, set by Mexican norms at 75 µg/m3 (The WHO, 2005, sets the daily maximun at 50 µg/m3).

3.1.1 Current governance structure

Mexico has three main levels of executive government: Federal, State and Municipal. Each level of government has different attributions related to Mobility (Table 2).

Table 2. Attributions of different levels of government.

Level of government	Public Institutions	Policy attributions	Areas of transport
National	Communications and Transport Secretary	• Roads and highways between urban areas • Strategic infrastructure (e.g. bridges) • Provides funds through grants and programs	• All modes
State	Sustainable Development Secretary	• Strategic Planning	• All modes
	Infrastructure Secretary	• Public Transport projects	• Major infrastructure in the state
	Metrorrey State transport Agency CETyV	• Strategic Planning • Projects and management	• Public Transport
Municipality	Planning Municipal Institute Public Works Secretary	• Local Planning • Local Projects	• Streets • Transit • Participate in the formulation and application of public transport programs in their territory

Monterrey is located in Nuevo Leon State, and is composed by eleven municipalities (Fig.8).

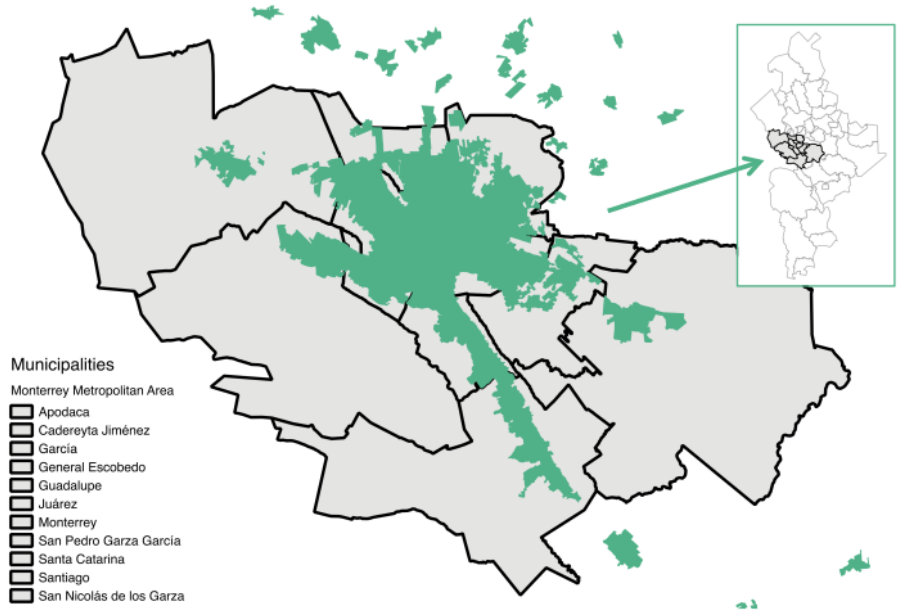


Fig.8 Monterrey Metropolitan Area (Author w/information from INEGI, 2016).

To provide context, the main agencies roles as stated in the law (Gobierno de Nuevo León, 2008; 2019)., are:

- Ministry of Sustainable Development. Main authority in transport and urban development but other agencies aren't accountable to it.
- Vehicular Control Institute. Organises, operates and administers the registration of vehicles and its drivers.
- Nuevo Leon Council. Integrated by public and private representatives, it does strategic planning, sets goals to the State Government and monitors related indicators.
- State Transport Agency (AET). Authorizes concessions and permits for bus operators to run routes. It regulates everything related to public transport.
- Metrorrey. Operates the metro system directly and has contracts with private suppliers for bus feeder lines to the system.
- CETyV. Technical, advisory and public participation organism that proposes and generates for the AET: Plans and studies of transport and roads, norms and laws, service tariffs, etc.

And the different systems are divided into:

- SINTRAM. Trust created with municipal funds to integrate the organization of traffic lights in the metropolitan area. Highly underfunded today.
- SITRA. Traditional Transport System within the whole State (Buses).
- SITME. Monterrey Metropolitan Transport System (Buses).
- SITCA. Freight Transport System. Regulates transport of goods, products and objects.

*All bus routes are concessioned to private operators in the state.

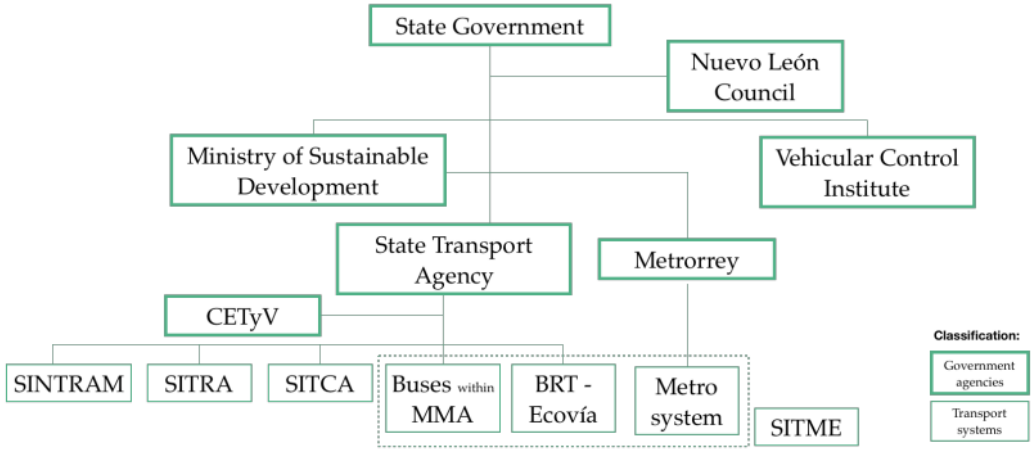


Fig.9 Current Governance Structure of Mobility in the State (Adapted from López Cantú, 2013 and Gobierno de Nuevo León, 2008).

The many issues happening today in Monterrey's transport governance are not visibly clear when presenting the general structure (Fig.9). It is within the links, the relationship between different levels of government institutions, operators and users where the flaws can be identified. This will be further analysed in the "organisational structure and powers" section.

More information about the city of Monterrey and a brief history of its public transport can be found in Appendix 3.

3.1.2 Monterrey today: hope and uncertainty

3.1.2.1. Tariffs increase

Since the end of 2018, transport providers have demanded an increase in tariffs to retain a profitable operation. Providers directly collect the tariff, the government only regulates it. When the state did not allow this, some threatened to stop operations, which would paralyze the city. NGOs have heavily criticized this as incapability from the state to manage public transport issues (Rodríguez & Dávila, 2019). Transport providers argue that a tariff increase is needed for them to be able to continue providing the service. They mention that the formula in the law to calculate it backs them up (it has several factors they provide), one even said that the government could do a street evaluation of the number of users to calculate their income (TP1_MTY & TP2_MTY). Another of their main arguments is that, with a sprawled city, they have to run each time more miles to pick up passengers.

3.1.2.2. PIMUS – Integral Sustainable Mobility Plan

PIMUS stands for "Integral Urban Sustainable Mobility Program". This study was comissioned in April 2019, by the Ministry of Sustainable Urban Development of the State. Its main goal is to function as a planning instrument that promotes equal and sustainable mobility that increases productivity of the city. It aims to integrate urban planning and mobility, containing specific prioritized projects to be implemented in the short and medium terms (Secretaria de Desarrollo Sustentable, 2019).

By its goals, the study seems to be a long needed guide towards sustainable mobility, and all but one (former public oficial) of thirteen interviewees assessed it as very positive. Critics say the delivery in November 2020 leavesjust one year for the current State administration to implement it. It is not uncommon in Mexico that administrations discard their predecessors' plans, if they are not legally binding, as is the case here (Cubrero, 2019).

The last Metro master plan dates from the creation of Metrorrey in 1987, the last serious analysis of the mobility in the state was done by CETyV in the Sectorial Plan of Roads Transport in 2000, followed by another plan published in 2009, based mainly on the previous one. Both include mostly policies and conceptual diagrams, with almost no specific projects (CETyV, 2009).

3.1.2.3. Mobility Law Proposal

On October 24 2018, the Governor of Nuevo Leon, sent to Congress a new Mobility Law proposal. This proposal has been criticised because, instead of improving the system, it accentuates its flaws and turns concessions even more discretional (CO02).

In the first half of 2019, three other proposals were submitted: two by opposition parties in the local congress and one by a group of NGOs, the latter an unprecedented action. Also in an unprecedented case and seen as very positive (NGO1, CO2 & PO6), promoted by Nuevo Leon Council, the discussion of this law was opened to a discussion held by a third party, the Institute of Transport and Development Policy (ITDP). The overall conclusion of a report ITDP handed in to Congress, in June, states that "The four initiatives do not count with the necessary contents to generate the mobility law that would contribute to solving the big problems on the State's urban transport. Nonetheless, they can be the base of a wider process…". A local congresswoman that is part of the commissions reviewing the matter, comments that ITDP process was very helpful (2019, personal communication). Although a preliminary document containing the results, in her opinion, was not ready yet, she felt confident that in October they could vote for the new law.

3.2. Progressive cities at a glance

3.2.1 London

The Greater London Authority (GLA) is the strategic regional authority for London, created in 1999. It consists of an executive Mayor of London and the London Assembly (with accountability powers). Transport for London (TfL) is a functional body of the GLA. It has the duty "to develop and apply policies to promote and encourage safe, integrated, efficient and economic transport facilities and services to, from and within London" (TfL, 2017). This institution is considered one of the most "progressive institutional arrangements for planning and operating transport at city level" (Rode, 2017). The city has one further level of government, the 33 London boroughs (Fig.10). Appendix 4 shows the difference in attributions in mobility for each level of government.

Fig.10 London Boroughs (Central Housing Group, 2019).

3.2.2 Medellin

In Colombia the Municipality is a level of government with great autonomy, all mobility subjects are within its responsibility (ACA1_MED). Medellin city is within the Metropolitan Area of the Aburra Valley (AMVA) (Fig.11).

Antioquia Department within Colombia.

Metropolitan Area of the Aburra Valley (AMVA)

Fig.11 Maps of levels of government in Colombia. Source: García Loboguerrero, 2017

Metropolitan areas do not have a directly elected representative but a director chosen by a board conformed by the departmental governor and the ten municipalities within the Metropolitan Area (AMVA, 2019). It is authority

in public transport, urban planning and the environment and functions as an articulator (See Appendix 4). Medellin municipality is considered the nucleus, as it is central to urban and economic activities in the area. Municipalities' autonomy creates a conflict with the AMVA authority's implementation capacity, for example with traffic management due to the Municipality authority over streets (ACA2_MED). Therefore, AMVA's authority relies more in the policy document it produces. According to the four interviewees in this city, its potential hasn't been fulfilled yet mainly because it is young, its mobility area was opened in 2008, and Metro de Medellín, which had more autonomy before, had already been operating for thirteen years. Medellin Metro is a public company that oversees the integrated transport system. It isn't limited by any territorial boundaries, so it reaches to other municipalities outside of Medellin; its board is composed 50% by Antioquia and 50% by Medellin municipality (Metro de Medellín, 2019). All the interviewees see it as the organisation that is actually achieving mobility goals in the city, and it is also very respected by the community.

3.2.3 Singapore

Singapore is a city-state. Therefore its governance system is quite unique as there is only one level of government that affects a single area, with no smaller territorial and political division. There is, however, an administrative division, the five Community Development Councils (Fig.12).

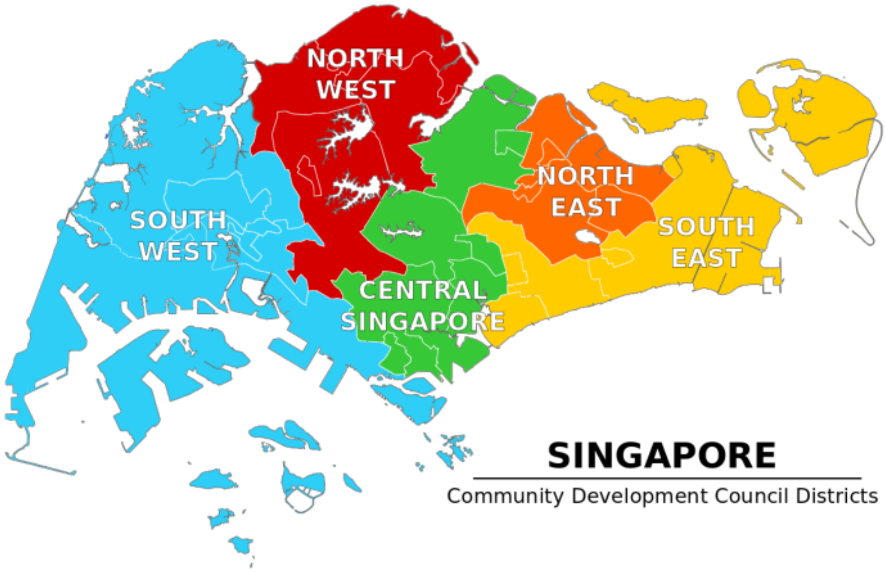


Fig.12 Singapore and its Community Development Councils. (CDC, 2019)

The councils have a more social purpose, they work as a feedback channel for members of Parliament and a way for Government to communicate its policies (PO1_SGP). Generally speaking, the Ministries are the political side of government, as all Ministers are elected politicians, though their teams are public officials (Prime Minister's Office, 2019). The Ministry of Transport oversees the development and regulation of the land transport sector. The statutory boards are the implementing bodies, including planning, they are accountable to each Ministry (PO1_SGP). Unique about Singapore is that every Ministry has a statutory body, not only Transport (PO3_SGP).

Chapter 4: Findings: Lessons from the case study cities

In this chapter, Monterrey will be at the centre of the discussion, the challenges it faces in each of the governance topics. Good practices from the progressive cities are presented and a comparison between the cities is done when it is convenient for the discussion.

4.1. Organisational structure and powers

4.1.1 Coordination between different local governments

In Monterrey, there is a clear delimitation that the street is overall a municipal competence and public transport is of the state. Nonetheless, the law does not limit either participation, with a written agreement with the other authority (CO2 & PO2). This delimitation is complex and, in practice, agreements are not easy to achieve because of the different political parties and city visions of each mayor (PO1_MTY, PO2_MTY & PO3_MTY). The real issue, arguably, lies in the actual separation, mainly in public transport. As it is a state duty, municipalities' focus and resources are away from it. As each level of government can bid for funds from the Federal

divided into five other departments, each with its own head, and often times they are in conflict with each other (PO2_MTY, PO3_MTY).

Singapore works under the "One public service" mind set (PO1_SGP, PO2_SGP, PO3_SGP). There is free flow of information and general collaboration between agencies, embedded in their culture and promoted by each Minister. In 1995, they decided to consolidate fragmented responsibilities among different government agencies into one, that's when the The Land Transport Authority (LTA) was formed (LTA, 2019).

4.1.3 Decision making at the top level of institutions

Decisions within state institutions that oversee mobility in Monterrey are mostly made by their head and, therefore, the Governor. Even in the decentralised bodies, like Metrorrey, as they are directly appointed by the Governor, he has the final say. There are not counterweights that allow for decision making to be more plural. The only body that is composed by a board is CETyV, where public officials, transport operators, NGOs and business chambers participate, but it only provides counsel, with no authority over decisions.

Medellin Metro has two boards. The first one is the board of associates, with 50% participation from Antioquia and 50% from Medellin municipality, which guarantees it being a public company. The second is a directive board, were most of the executive decisions are made. It is composed by 9 members: the governor and mayor of Antioquia and Medellin respectively, their two planning ministers and five representatives from private companies, which are appointed by the President of Colombia (Metro de Medellín, 2019). The head of the Metro is appointed by this board. Private participation and the fact that it acts as a company, with commercial income, is seen as two of the reasons why it has been more successful than other public entities. It drives the organisation to be more efficient, separate from political elections, which helps in the continuity of projects and with less probabilities of corruption (ACA2_MED & PO1_MED).

Transport for London has a board of 8 to 17 members appointed by the Mayor. This board decides the most important matters of the organisation by consensus or simple majority (TfL, 2017). Amongst the Members, there should be experience in transport, finance, government functions, management of organisations and trade unions. The Mayor also appoints a Commissioner, who becomes the lead of the organisation. This concentrates great power in the Mayor, but London has an Assembly of 25 elected members of different parties that question and scrutinize any action taken by the him. In practice, the board does seem to scrutinize TfL actions (PO4_LDN).

4.1.4 Capabilities of the institutions

Institutions in Monterrey have little capacity to address the huge issues the city faces. For example, the Ministry of Sustainable Development integrates three subjects: Environment, Mobility and Urban Development, but there are only 170 employees in that direction, of whom 50 oversee both mobility and urban development. In the previous state administration, urban development and the environment were separated and had more human resources (PO3_MTY). Also, the sub-direction for mobility has had no head for four years, so people from different teams, and the Ministry himself, deal with issues in this area (PO5_MTY).

As a simple, but eye-opening comparison, Fig.13 shows a rounded number of public officials working institutions that oversee mobility in the case study cities. This doesn't mean a simple increase in employees will solve the issue, but it does point the need to grow.

City	Institutions	#Employees	# Employees per 100,000 hab
Monterrey	AET, CETyV, Metrorrey, SEDESU and SINTRAM	**1,150**	**26**
London	TfL	**27,000**	**325**
Singapore	LTA, Ministry of Transport and Public Transport Council	**6,250**	**174**
Medellín	AMVA and Medellin Metro	**2,066**	**39**

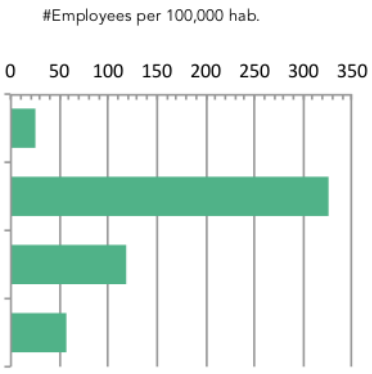


Fig.13 Number of public officials in mobility institutions (Author w/information from interviews).

Appendix 5 presents the organizational chart of a few of the institutions, to show the diversity of areas in progressive cities.

4.1.5 Private sector role in the provision of public transport

Bus route networks in Monterrey have a historical trace. Each company defined routes and then asked the State Transport Agency (AET) for a permit to operate, and that's how it still works today. This has created overcrowding of buses in certain areas and a total lack of service in others. Besides the regulation of tariffs, there is little monitoring and control of the quality of bus services as companies collect fees directly. Data from bus users is rarely asked by the government (TP1_MTY) and sometimes denied by the operators, even with the

integrated electronic payment system, "Feria" card, as some transport providers are part of that company (Dávila & Marroquín, 2019).

Operators pressure the government for a raise in tariffs that have been frozen for the last 5 years. The main argument is that they carry all the risks: loans from banks at high rates because permits have a low judicial certainty, diesel prices rising, number of users dropping because of urban sprawl (TP1_MTY & TP2_MTY). Reorganization of routes, payment by veh-km (kms operated) and the government leasing them units bought by the state, are seen by them as good measures, because this shares the risk and lowers uncertainty, even if it comes with tougher contract restrictions. They understand that a profound change is needed, but argue that the government needs to put money into it (TP1_MTY & TP2_MTY).

London and Singapore have both a different relationship with transport providers. In both cities, all the buses are operated by private companies but the planning of routes is done by the government. They tender them with strict rules in open competition. Fares are collected directly by government institutions and payment to operators is based on mileage (same as veh-km). Contracts last for five to seven years and both have an incentives system. London incentives are based on the reliability of the service, they measure "excess wait time" which accounts for the time gap of buses in one route, between stations. TfL is now moving to a measure that accounts for the actual customer experience (PO2_LDN).

Both cities establish also the specifications for the units. Singapore owns all buses, infrastructure and depos. They do this deliberately to reduce risks of the private operators and lower the barrier of entry, as they had only two bus companies and wanted to increase competition (PO1_SGP). Also, this allows them to do changes in the system much faster. London generally asks operators to buy the vehicles, but it has purchased a large fleet in the last years to reduce unitary cost and achieve the inclusion of electric buses faster, that otherwise would take longer within the tendering process (PO2_LDN & Edwards, 2012).

4.2. Policy integration and implementation

4.2.1 National policy framework

Nation wide policy in every city (except for Singapore were local equals national) seems weak. It does set the basic rules of operation, what each level of government can or cannot do, but as policy, it is seen rusty legislation and none of the interviewees said it was used as a guide. It often hinders change at the local level,

like a highway design code in the case of Colombia, were minimum width of lanes complicates changes in streets configuration (ACA2_MED). Or in London, the city is the one that pushes national policy to improve (PO4_LDN). What National policy can do is, in cases of National and International importance, for example air pollution levels and climate change, establish limits with legal consequences, like the EU yearly maximum concentration of pollutants or UK's housing targets.

In Mexico National policy's influence is mainly through grants, as most of the infrastructure investment of states and municipalities comes from here. But these programs perpetuate reliance on cars, as "There is no legal framework to incentivize, strengthen, structure the TP systems, but there are mechanisms to finance road works..." (CO2_MTY). Between 2013 and 2017, 74% of federal funds went to road infrastructure and only 6.73 to public transport (Méndez, 2018)

4.2.2 Regional/Local strategic plans

Plans are the main documents that say what the future of mobility in a city will be. They (should) provide a vision, goals, strategies and how to achieve them. Also, their elaboration phase can be an important forum for the integration of agencies between different areas and different levels of government; and the setting of a wide public participation. They are often, though, where most of the governance issues become evident. In all the case study cities there are main, legally binding, plans, fig.14 shows Monterrey's plans.

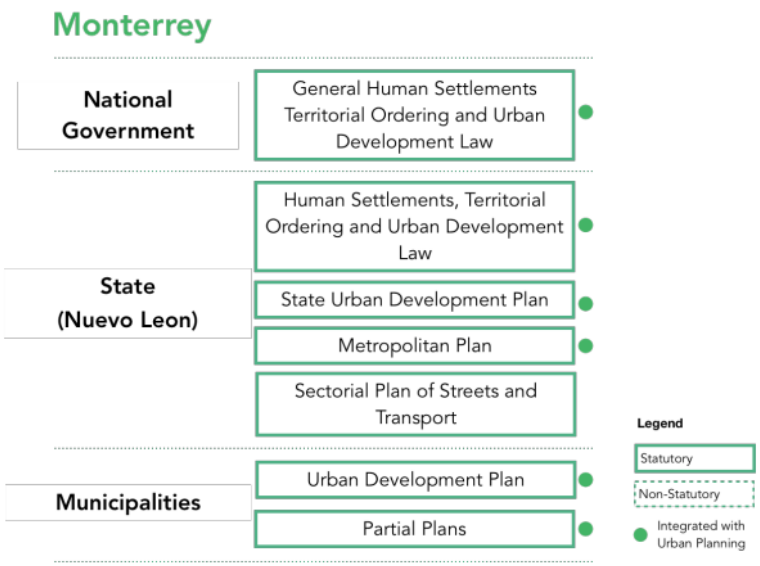


Fig.14 Main mobility plans and policies that affect Monterrey.

The main plan for Monterrey is the Metropolitan Plan, created by the state and from which Municipal Urban Plans need to be sound with. The last Plan dates from 2003, therefore municipalities argue that it doesn't correspond to reality and, as a consequence, soundness has been lightly awarded (PO05). In 2009 an update was proposed, but one of the municipalities was not in agreement with it, so the whole Plan could not be put in place (PO03). This is because the Human Settlements law (Gobierno de Nuevo León, 2017) requires all municipalities that are part of the metropolitan area to agree with the plan. The state is now working on an update, but the municipalities have scarcely been part of the process and one even presented a legal resource because the due process in the law was not being followed (PO01, PO2 & PO04). Even though there have been some workshops with other stakeholders, there isn't a wide participation process.

Most cities have a mandatory consultation process, but the extent to which they reach out to the public is mainly based on the institutions culture and decision. The "Examination in Public" done by London is worth highlighting, as it is done by a third party with participation from Boroughs, NGOs, other public bodies and community groups in meetings that are open to the public.

For approval, in London goes first through the Mayor and then by the Secretary of State. In Medellin, by the AMVA board. Regarding time frames there is no requirement in Monterrey and Medellín, London needs to update it every 5 years, and Singapore every 10. This does have implications, for example, while London has updated its Plan almost four times, during the same period, Monterrey hasn't been able to come out of its own legislative trap. Appendix 6 includes a full list of the consultation and authorization processes of the four cities.

Implementation of the plans in Monterrey then becomes a piecemeal approach, each municipality having an almost stand alone plan, where they implement their own vision for what is best for their territory, but barely taking into account the consequences for the rest of the city.

4.3. Financing

4.3.1 Funding: Scale

As a proxy for the total budget a city has to invest in mobility, the yearly income of the case study cities is shown in Fig.15. It can be noted that, even though Monterrey is indeed the city with the lowest budget, compared to Medellin or London the scale is close, specially taking into account that costs in Mexico are lower. For example, the Elizabeth Line in London costs £246.67 million per mile (TfL, 2019b), and the Metro Line 3 in Monterrey

£52.76 (Aveldaño, 2019), this is 4.68 times more, and the total budget of the GLA is only 2.4 times more. This is a vey simplistic comparison, but gives an idea that scale, in this case, is not necessarily the issue.

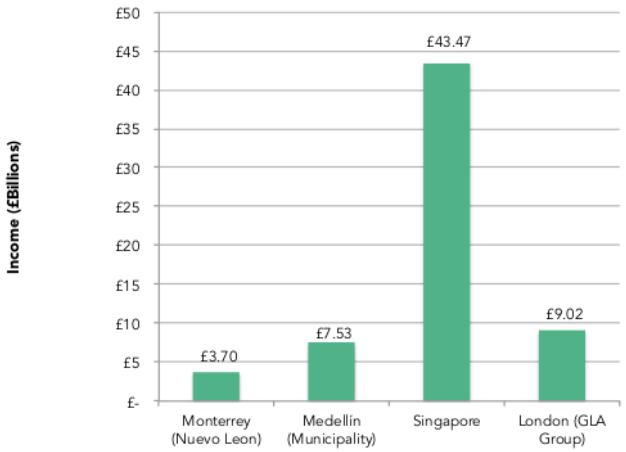


Fig.15 Cities yearly income in billions 2018-2019 (Author w/information from Gobierno de Nuevo León,2018; Contraloría General de Medellín, 2018; GLA, 2019; Singapore Government Agency, 2019).

Note: Budget in Monterrey is the total budget for the state, which covers more than the city, but 84% of the population lives in the Metropolitan Area.

4.3.2 Funding: Sources

Grants from the Federal Government accounted in 2018 for 78.6% of the Monterrey's income (Fig.16). It is important for cities to diversify their sources of funding, as grants from the federal government can be challenging both technically and politically. London and Medellin have an area, within TfL and Medellin Metro respectively, in charge of seizing opportunities to develop land around transport corridors, following closely the Transit Oriented Development concept. Even though this idea has been around for a long time in both cities, only three years ago both areas started really taking off (PO1_LDN & PO1_MED). This also raises the number of people that will use the transport system and has the potential to create a better urban environment.

Charging taxes for the use of private motor vehicles, besides limiting their use, can also generate a stream of income. Congestion Charge in London generated £250 million in 2018 (TfL), and it is reinvested in sustainable mobility projects (PO1_LDN).

It is also important to have a funding relationship at the local level that promotes collaboration. TfL, for example, provide the boroughs with around £180 million each year, of which a third is based on a formula and the rest is related to programs and projects related to the Mayor's Transport Strategy (PO4_LDN).

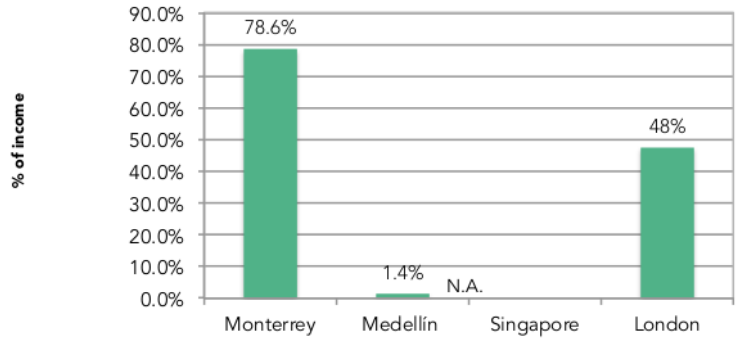


Fig.16 % of total yearly income (2018) from central government grants (Author w/information from Gobierno de Nuevo León, 2018; Contraloría General de Medellín, 2018; GLA, 2019 & Singapore Government Agency, 2019).

4.3.3 Investment

Monterrey is a city that seems uninterested in funding Public Transport projects. The PIMUS was stated by several public officials as a crucial document to plan the next public transport and active modes projects for the city. A grant was solicited to the Federal Government for this, but the resource never came. Four years into the current state administration, and after a change of Minister of Transport, the state finally decided to invest £2.8 million in it (PO5_MTY).

Fig.17 show the investment in Public transport in 2018 and the % it represents of the overall budget of each city. The investment in Monterrey corresponds to a single project, the Metro Line 3, for which resources came from the federal government and were negotiated in a previous administration. Other projects are could not be tracked due a lack of transparency. This graph, through the percentages, shows how strategically important transport is in Singapore and London.

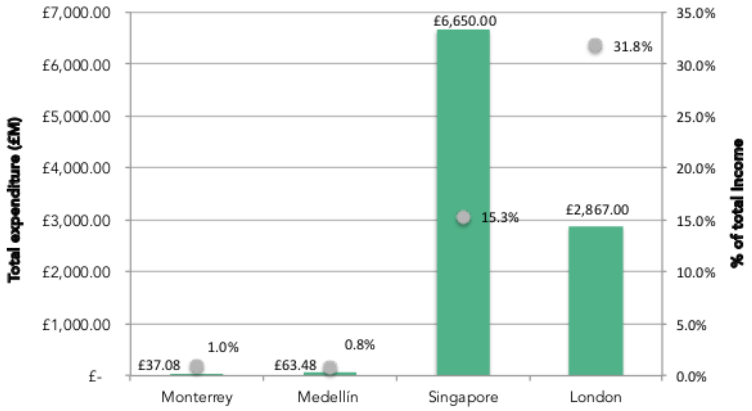


Fig.17 Investment in Public Transport and % of the city overall budget, 2018 (Author w/information from Gobierno de Nuevo León, 2018; Metro de Medellín, 2018; TfL, 2018; Singapore Government Agency, 2019).

Monterrey receives each year a Metropolitan Fund from the Federal Government. This is meant to go to strategic infrastructure projects for sustainable mobility (Secretaría de Gobernación, 2019), but in 2016 the Governor and metropolitan Mayors decided to invest 87% of the £37 million in repairing the streets asphalt (Gobierno de Nuevo León, 2016). Also, in 2018, 87% of the mobility infrastructure budget of 6 Mayors went to infrastructure for cars (CVNL, 2018), that is £32.6 million. The BRT line, Ecovía, had a cost of £90 million.

What could happen if collaboration was achieved in the funding of Public Transport projects? For example, £20 million from the Federation, £10 million from the state, £15 million from the Metropolitan fund and £5 million from municipalities yearly, builds one BRT line every two years.

4.4. Urban development integration

4.4.1 Organisational integration

Monterrey and Medellin have both institutions where mobility and urban development are integrated, the Ministry of Sustainable Development (SEDESU) and the Metropolitan Area of the Aburra Valley respectively. London and Singapore have two different institutions for each subject. In both Latin American cities, the general comment was that these institutions are not working well overall. In Monterrey, mainly because a lack of capacity and limited role (PO2_MTY, PO3_MTY, CO3_MTY & TP2_MTY); in Medellin, because it is young and Medellin Metro has more capacity and recognition (ACA1_MED, ACA2_MED & NGO1_MED). On the contrary, in London

and Singapore the comments were generally positive regarding the collaboration between the two agencies that oversee the subjects (CO_LDN & PO1_LDN; PO1_SGP, PO2_SGP & PO3_SGP). This at least shows that uniting them into a single agency is no guarantee of success. Related risks are a reduction of the ability of the agency to oversee both topics with the same relevance (PO5_MTY), a reduction of staff as it is one single institution (PO3_MTY), and therefore a decrease in capabilities, as each subject requires different technical skills. But it doesn't mean that separating them is the key either, as coordination between Ministries in Monterrey is very low (PO2_MTY).

4.4.2 Policy and plans integration

Transport for London develops a map with Public Transport Access Levels (PTAL) (Fig.18) using walk time to nearest transport stop and wait times (TfL, 2019). They use this to calculate maximum car parking for a development and minimum cycle parking and electric vehicle charging spots; it is also related to allowed density (CO1_LDN, PO3_LDN). This has had a positive effect. For example, land owners wanted to develop and area in London around Battersea Park, which had a low PTAL. They approached TfL to ask for an extension of the tube, so that they could develop more densly, TfL said yes, if they land owners paid for it (PO1_LDN, CO1_LDN). Today the extension is under construction.

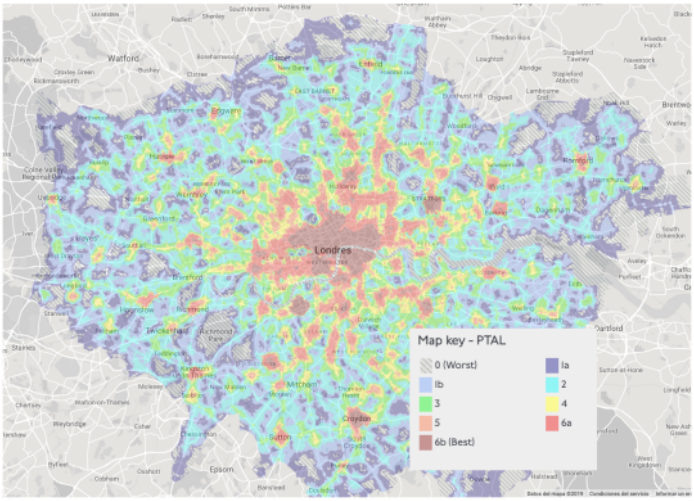


Fig.18 Public Transport Access Levels in London (TfL, 2019)

Chapter 5: Governance framework proposal for Monterrey

5.1. Organisational structure: A full integration and board decision-making

Medellin, London and Singapore show that actually to have an integrated transport, an integrated institution is needed. Fig.19 shows the different organisations that oversee mobility in the cities today. As can be easily noticed, London and Singapore are much more integrated than Monterrey and Medellin.

		Monterrey	Medellin	London	Singapore
Mobility	General Policy	SEDESU	AMVA	GLA	Ministry of National Development; Ministry of Transport
	Plans	SEDESU; Nuevo Leon Council; CETyV; Metrorrey	AMVA; Medellin Metro	GLA; Transport for London	Urban Regeneration Authority; Land Transport Authority
Public Transport	Implementation of projects	Metrorrey; SINTRAM; Ministry of Infrastructure	Medellin Metro; Metroplus; Ministry of Transport	Transport for London	Land Transport Authority
	Administration/ operation	State Transport Agency; Metrorrey	Medellin Metro; Metroplus; Ministry of Transport	Transport for London	Land Transport Authority
	Monitoring	Nuevo Leon Council; CETyV; Metrorrey	Medellin Metro	Transport for London	Land Transport Authority
	Accountability			Travel Watch	Public Transport Council

Leads the process; Municipal Level

Fig.19 Organisations that govern mobility. Source: Author

As a conclusion of the analysis in Chapter 4, an integrated governance framework is proposed for Monterrey. The new institution, "Metrorrey: Metropolitan Mobility Authority" (Fig.20) takes good practices from the progressive cities and from the new law proposals, especially the one promoted by NGOs (Iniciativa ONGs, 2019). It is not meant to be a detailed organisational chart, but a showcase of what should be part of it. The main changes in the recommended arrangement are:

- The Transport Council, CETyV and AET, transform into the Planning and Policy area within Metrorrey.
- The Vehicular Control Institute and SINTRAM become an area within Metrorrey.

- Metorrey's current organisation and the administration of Ecovia (as it is privately operated) become part of the Operations & Maintenance area (Metro & BRT).
- The Ministry of Infrastructure implementation functions, related to Mobility, are given to the Major Projects area.
- The Ministry of Sustainable Development remains as a global policy institution for the State.
- A new area called Walking and Cycling is created, but the authority over the streets remain to be the municipalities.
- To avoid a conflict of attributions over the streets, Metrorrey becomes the authority of streets where there is a new mass transit project, from property limit to property limit and including traffic lights and signalling.

Its main governing body and decision making organism should be plural and representative. Thus it would be integrated by:

- The Governor as Chair.
- Mayors of the Metropolitan Municipalities (11 today).
- The Minister of Sustainable Development, to assure collaboration between the institutions.
- Three representatives of the Private Sector, with an excellent reputation.
- One NGO.

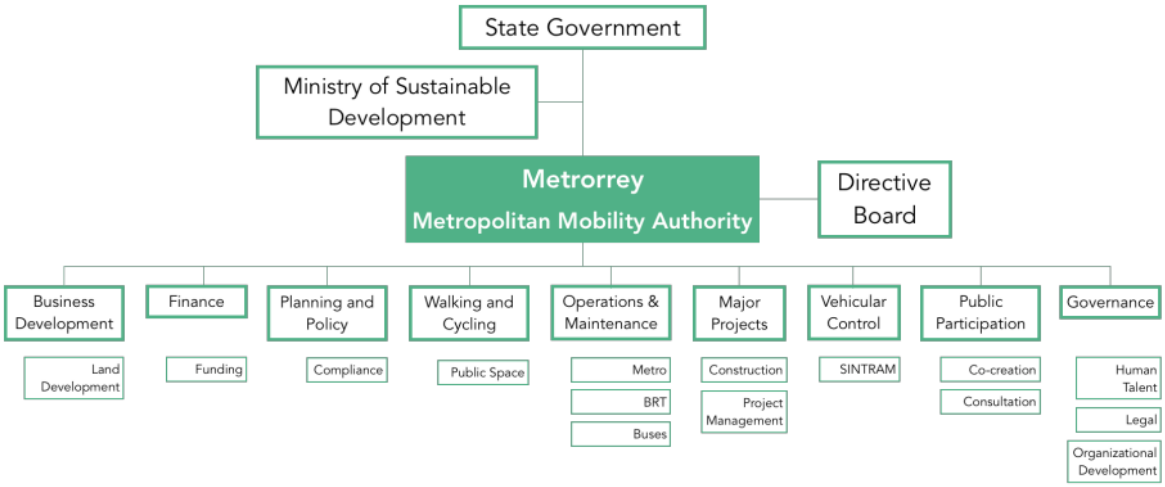


Fig.20 Integrated organizational chart proposal for Monterrey.

The three private sector representatives and the NGO should be separated from political tidings. As options for the selection process, Nuevo Leon Council, Civic Council (an NGO) or the Chambers of Commerce could partake that decision. The board would then designate a CEO for the Institution. Decisions in the board would be made by simple majority.

Bus operations should continue to be done by the private sector, but with a highly regulated relationship with the authority. Metrorrey would plan routes and gradually tender them openly, taking into account as one of the factors the company's experience in the city. A concession in the range of five to ten years would be awarded, with the option of renewal depending on compliance. Metrorrey needs to be the first owner of data. The organization needs real-time, reliable information to make decisions, and this must be secured through contracts. Private operators cannot participate as part of the provision of integrated payment systems, as the conflicts this generates have been widely experienced in Monterrey. Payment should be made to private operators by veh-km, including an incentive system to be defined, one that works in favour of the user's experience. Metrorrey would also specify the bus characteristics.

As of the new Mobility Law, evidence shows that it is not ready. The inclusion of ITDP was very important and demonstrated good disposition from Congress, but the conclusion of the report clearly stated that more work is needed.

5.2. Policy: The Metropolitan Plan as an integrator

In this proposal, the State Urban Development Plan continues to be developed by the Ministry of Urban Development. Metrorrey would be in charge of the following plans: The Metropolitan Plan, a Mobility Strategy, close to the current Sectorial Mobility Plan but including a Master Plan of projects and an Implementation Plan as proposed by the NGO mobility law (CO2_MTY).

To create a shared vision, the Metropolitan Plan should, besides consultation, include a mandatory model of "Examination in Public", where there are forums held by a third party to the board, where government officials, NGOs, academics, private companies and the general public can openly discuss the Plan. A report of these recommendations would be handed to the CEO of Metrorrey, who would, in turn, address the board proposing amendments to the Plan.

It should be mandatory for Metrorrey to update the Metropolitan Plan at least once every six years and as many times as the board deems necessary. Small revisions can be made to the Plan under strict rules. This minimum time frame aims to avoid large periods of time without such a crucial plan.

5.3. Finance: A diversity of income sources

A complete national revision of its programs and grants is needed, as the current framework only deepens our reliance on cars. But that is beyond the scope of this paper. Nonetheless, the State could create a fund for municipalities to support the delivery of the Mobility Strategy. The decisions for this would be made by a separate committee within the Board, that only excludes the Mayors and adds the Planning and Policy Officer.

A new area of Business Development is proposed, to diversify income and reduce dependence on federal grants. Land Development is proposed as a department of this area, where development opportunities around mass transit projects would be pursued, with the participation of the private sector.

Taxes that disincentive the use of cars as ownership tax, congestion charge, green tax (related to emissions), on-street parking and other more creative and context related taxes should be charged. The income of this should be immediately transparent and used for sustainable mobility projects and programmes. But this should be done with more alternatives in place. This, ultimately, remains a Local Congress decision.

5.4. Urban integration: Land development

Urban policies that promote sustainable mobility would be developed under the Planning and Policy area. In the current urban context of Monterrey, it is difficult to apply a policy directly related to public accessibility levels. Being close to a bus station does not guarantee a good public transport connection, and the Metro and BRT systems are very limited. Nonetheless, Monterrey Municipality already applies an increase in density if there is a Metro or BRT station by 500m walking. Policies like this should be analysed and included in the Metropolitan Plan.

The Land Development area would look to redensify the city and provide new places to live, work and recreate. It would also collaborate with the Housing Institute of Nuevo Leon, to develop affordable housing.

Conclusion

This work has shown the importance of studying transport governance in its broader sense. Not only the institutional arrangement and decision-making process but also how other elements as finance and policy are governed. Often times structures obey a historical trace, as the relationship between the government and private bus operators in the Monterrey and Latin America shows. But it is important to revise and reform governance structures as they are not sufficiently challenged.

The issue of mobility today in Monterrey requires government, academia, NGOs, private sector and citizens to collaborate and work towards a shared vision. As shown in previous chapters, that is not possible with a fragmented structure, where decisions that affect mobility are taken separately, even within the same level of government and for the same subject.

The framework presented for the city is a result of a comprehensive analysis of its current context and good practices from other progressive cities. It is a bold proposal that would require profound changes, but I have shown its need and benefits. It is based on the current law framework, but the changes would still need to be detailed, as a reform to the Human Settlements Law in the State of Nuevo Leon would be needed. It does have limitations, regarding the number of cities researched and important topics around governance that were left out due to scope. It also takes the national framework mostly as fixed, meaning almost no alteration is presented regarding the attributions of the Municipalities and the State, dictated by Mexico's Constitution. Only the national funding structure was challenged. Therefore, a wider analysis should be done before moving forward with the proposed governance framework.

The challenge is big, but so is Monterrey, a place than in 100 years became an economic motor for Mexico and a symbol of hard work. The city needs to seize the opportunity brought by the PIMUS, the update to the Metropolitan Plan and the discussion of a new law. Up to today, the process of the plan has been again without participation from municipalities, who will most surely not approve it, as a consensus is needed. This can still change, and the Ministry of Sustainable Development must create a wide collaboration process. That can be the legacy of this administration. A plural construction of a vision for the city, a strategy to make the vision a reality and a new governance structure that enables it. If this is done in the next 12 months, even a new project can be started by 2021, their last year. The alternative is a blocked Plan, the start of other projects that are rushed to show that something is being done, and failure. But I do agree with the majority of the people interviewed, this

is a historic moment, and a positive one, where mobility is being widely discussed and a completely transformational change is possible.

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Appendix 1. Code matrix sample

Organisational structure and powers				
Subcode	City	Interviewees comments	Organisation classification	Main points
Coordination between different local governments	London	In the same way between TfL and boroughs and between them, there are roads where one side depends on one and the other side to another. It can be problematic. Say a Borough wants to put a lot of filter permeability, push the traffic to the red route in the way that they saturate it and cars and buses get caught up in the general traffic. You need to balance that. TfL has sort of a Trump card because they can fix the red routes. For example Oxford Street, TfL wanted to do something and Westminster council denied it, as they are the highway authority for that.	Public Official	Issues in the roads when one side depends on TfL and the other on boroughs. TfL has the upper hand because of the red routes and bus routes control
Coordination between different local governments	London	The Boroughs get quite a bit of funding from TfL. I was working on a project on a neighbourhood, Westminster was not willing to do what TfL wanted, so TfL said "we might take the funding from you then" and Westminster turned around and said, "we don't need your £1 million. You have other boroughs who would love that money and would do what TfL wanted.	Public Official	There is funding between TfL and the Boroughs
Coordination between different local governments	London	The way I perceive it is that its working pretty well. The London Authority negotiates and discusses with the boroughs, the boroughs go to them, back and forth. Probably the relationships varies with the boroughs but overall I think there is very positive things going on in London and a large number of them. For example the Healthy Streets programme. That was initiated by one of the Boroughs Waltham Forest. It was picked up by the GLA and the mayor became part of London policy.	Consultant	GLA and boroughs function as a two way negotiation. Works well. Things get done
Coordination between different local governments	Medellin	Colombia has these four levels of government, however the municipalities in Colombia have an individuality, an autonomy that makes them fully responsible for what happens inside. There is an autonomy of powers in the country, located at the Municipal level. What the nation, the department and the AMVA do is support that local government level.	Academic	Municipalities are greatly autonomous in Medellin
Coordination between different local governments	Monterrey	For example, the expansion of sidewalks on Díaz Ordaz, when the State finishes it, will deliver it to the Municipality. For maintenance. The State cannot provide maintenance, but the Municipality can. Public services is from the municipality.	Public Official	Projects in streets between municipalities and state

Coordination between different local governments	Monterrey	Actually, the interweave of attributions is very complex, especially in a subject as porous as transport or mobility.	Public Official	Functions overlap is complex
Coordination between different local governments	Monterrey	Any public works on public roads is the responsibility of the municipal authority to maintain except if an agreement is signed. For example, in Ecovia, in the 3 municipalities, they gave the administration and maintenance of the central lane to whom the transport service concession operates. But an opposite example, the multimodal Zaragoza investment was done by the state. But Monterrey never wanted to receive it. If they do not receive it and a luminaire breaks “they will not be obliged to replace it”, or to water the plants.	Public Official	The municipality needs to "receive" public works from other entities to maintain them, otherwise they don't do it
Coordination between institutions within the cities	London	Bigger developments have to be sent to TfL and from a certain size it goes to the Mayor. Also the Mayor has the power to pull in any planning application. He is not going to do it lightly but it happens. We have a whole team in TfL in spatial planning that looks planning applications.	Public Official	Development applications can be pulled by the Mayor
Coordination between institutions within the cities	London	The board does work well, it does scrutinize the operations of TfL and the staff takes their scrutiny seriously, we respect their expertise. The Mayo probably fills the board with people that broadly support their views. It won’t be close patronage or that kind of thing. It would very unusual for the Mayor to appoint a trouble maker. It’s more the professional culture.	Public Official	The board, selected by the Mayor, works well
Coordination between institutions within the cities	Medellin	The AMVA is an administrative associative figure and its board is made up of the 10 mayors. AMVA controls the use and impact of natural resources and in addition to that, it is an authority on mass transport. It is the authority for the Medellin metro: Approves fare, new lines, etc. That is done by delegation of the ministry of transport.	Public Official	AMVA is the mobility authority
Coordination between institutions within the cities	Medellin	(AMVA) It has a limited role today. This has to do with two things, the first one that still conflicts with the powers of each Municipality, for example the traffic lights and roads, since in the Constitution the municipality has greater autonomy. But it also has to do with the maturity level of the metropolitan areas, they are relatively very new.	Academic	AMVA has a limited role due to attributions conflicts with Municipalities and because its new
Coordination between institutions within the cities	Monterrey	Public Works and Urban Development always work separately. What is common is that they do not ask for permission and what is worse is that they neither notify nor review whether the opposite is planned. This is going to have to change soon.	Public Official	Public Works and Urban Development don't work together.

Coordination between institutions within the cities	Monterrey	The person in charge of each agency greatly influences how management works, unfortunately. Those attributions come or go depending on the head that is directing them. For example, two years ago we basically didn't see any mobility issue and today we do. Two years ago, the secretariat focused 80% on environmental issues, 19% urban development and 1% mobility. The current vision is very different, the percentages are more distributed.	Public Official	The head of the Secretary influences greatly how it works and the relationship with other institutions
Coordination between institutions within the cities	Monterrey	The problem with this is that although the Ministry of Sustainable Development is in charge of mobility policy, the implementation is the AET, Metrorrey, Ecovía, the CETyV and also the SINTRAM. Each of these works separately and are often at odds with each other. Having so many decentralized agencies with different holders, they do not respond to the Secretary of SEDESU, when in theory they should.	Public Official	SEDESU is in charge of the Policy but implementation bodies are different
Coordination between institutions within the cities	Singapore	The statutory boards are actually the implementing bodies. How we work is in general, the statutory boards carry out the executive functions, including planning and so on. Ultimately our decisions are affected by the ministry in charge. The Ministry sets more the policy direction based on. It is headed by an elected politician	Public Official	Statutory boards are the implementing bodies
Coordination between institutions within the cities	Singapore	Basically, something that's unique about Singapore's governance is that we have the Ministries in Place and then we have the Statutory Bodies. This is within all the ministries, not specifically for Transport. Really the difference in roles and responsibilities, the Ministries in general review policies and study the entire landscape and then they come up the recommendations. Statutory boards are more focused on the operationalization of the policies that have been approved.	Public Official	Ministries are policy makers Statutory boards are the implementing bodies
Decision making	London	Executive decisions are made by TFL and GLA in a way creates policy direction and provides advices in terms of what the Mayor wishes. At the end of the day TFL makes the decisions. That has to do with the financial arrangements as TFL receives the funds from government and taxation locally and they can't agree to do things the mayor would like if the money isn't there to do it.	Consultant	Executive decisions are made by TfL which may lead to problems with political direction and funds available to do it.

Decision making	Medellin	I know that it is common to integrate different private sectors to boost processes and make strategic alliances, the same thing happens with other public entities of the government, it is like a model of PPP (Public Private Partnership) without having a concession, but a direct participation at the meeting, this way the administration is expected to be more efficient and less likely to be corrupt. I think of course that this is part of the success of these public companies, since it shows the difference they have with others that operate under traditional models and the reason is the type of vision regarding each part of the process that a career public official has and an entrepreneur who seeks profitability, the latter are characterized by their creativity and taking risks.	Academic	Participation of private sector in the boards of public companies

Appendix 2. List of interviewees

All interviews were conducted between June and August 2019

Monterrey

Ana Hierro	Public Policy Expert. Former public official at Ministry of Sustainable Development.
Anonymous	Public Official
Anonymous	Transport Provider
Anonymous	Transport Provider
Carlos Ayala	Urban Administration Director at San Pedro Municipality Former Public Official at Ministry of Sustainable Development and Director of Planning at Guadalupe Municipality
Carlos Botello	Director in Mexico of Ascendal Group Former Deputy Head of Post at Department for International Trade
Carlos Orozco	Director of Strategic Projects at Ministry of Sustainable Development
David Pulido	Pueblo Bicicletero
Eduardo Quintanilla	Member at La Banqueta Se Respeta
Hernán Villarreal	Consultant. Former Executive Director at State Council of Transport and Roads (CETyV)
Julia Neira	Former Director at Municipal Institution of Planning, San Nicolas (2016-2018) and San Pedro Municipalities (2015)
Mariela Saldívar	Local Deputy (Legislator)
Moisés López	Consultant

London

Andy Martin	City Planning team at Transport for London
Grace Burke	Investment Delivery Planning team at Transport for London
Kate Hamblin	Bus Policy team at Transport for London
Richard McGreevy	Policy Manager at Transport for London
Tim Pharoah	Consultant in Transport and Planning

Medellin

Emmanuel Ospina	Investigator at EAFIT University
Isabel Correa Angel	Investigator at EAFIT University
Juan Manuel Patiño	Urban Manager at Medellín Metro System
Lina López	City adviser Medellín, C40 Cities Former Public servant at AMVA

Singapore

Adam Leishman	Founder at Tower Transit CEO Ascendal Group
Anonymous	Public Officer at Urban Regeneration Agency
Anonymous	Public Officer at Land Transport Authority
Anonymous	Public Officer Ministry of Transport

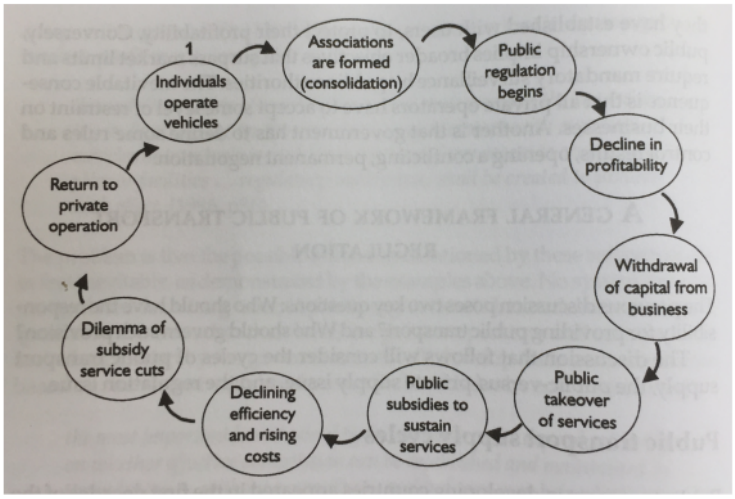
Appendix 3. A brief history of Monterrey's transport

Monterrey shares a transport history with many other Latin American cities. Foreign railroad and tram companies flourished in the beginning of the 20th centuries in the region, but were progressively replaced by bus operators (Figueroa et al,1993 cited in Vasconcellos 2001). The city had an electric tram by 1907 (Fig. X) but the increased use of private car and buses led to its removal thirty years after (Perez Esparza, 2008) .

Electric tram in 1907 and same avenue today

The city prioritised investment in roads and motorways, which lead to a suburban growth, close to the Texan city model around the car. For decades, public transport concessions were given mostly to a union directly related to the governing party (PRI), routes were planned by the solicitants, according to studied demand but with no regard to future growth of the city (Pérez Esparza, 2008). Most of these routes connected to the centre of the city (and still do). But with an increasing urban area and population, in 1987 the city began to build its first metro line (Pérez Esparza, 2008). After 30 years, today, the metro system has only 31.2 km in two lines, and a third one in construction with 4 years of delay (Reyes, 2019).

Many cities in both developed and developing countries have experienced a similar cycle of private and public involvement in urban bus service (Vasconcellos, 2001), as shown in the diagram below. Monterrey has never operated directly the provision of bus services, as Mexico City did attempt and failed in the 80's. Nonetheless, this year, the state has threatened private companies to do so because of their push to raise tariffs and threats of stopping provision. But other things happening in the city show that Monterrey can avoid falling into this cycle and move towards a more successful path.



Public transport supply cycle (Vasconcellos, 2001).

Appendix 4. Mobility attributions of the progressive cities' levels of government and institutions

London (Author w/information from TfL, 2017 and personal communications with public officials)

Level of government	Public Institutions	Policy attribuitions	Areas of transport
Central Government	Department for Transport	• General policy frameworks • Provides funds through grants and programs • Major projects like motorways and rail infrastructure	• All modes
Greater London Authority (GLA)	Transport for London	• Strategic Planning	• Transport for London Road Network (TLRN), the "red routes". Main routes that go in and out of London and within the city. • Public transport. • Traffic demand management: owns and operates all traffic signals.
London Boroughs	Varies. Usually either as a transport area or within a planning area	• Local Plans • Travel Plans • Community transport (e.g. people with special transport needs)	• Strategic road network. With importance in London as a whole • All the other roads within the borough • Parking

Medellin (Author w/information from AMVA, 2019; Metro de Medellín, 2019 and personal communications with public officials and academics).

Level of government	Public Institutions	Policy attribuitions	Areas of transport
National Government	Transport Ministry	• General policy frameworks • Provides funds through grants and programs	• All modes
Department (Antioquia)	Infrastructure Secretary	• In charge of mobility matter outside the Metropolitan area territory. Mainly connectivity between municipalities.	• All modes
Metropolitan Area of the Aburrá Valley (AMVA)	Subdirection of Mobility	• Strategic Planning • Major Projects	• All modes
Municipalities	Medellin Metro	• Administration of the Integrated Transport system: Metro, Tram, BRT, Cable Metro and feeder routes. • Public transport projects	• Public Transport
	Mobility Secretary	• Local Plans • Local projects	• All modes • Transit

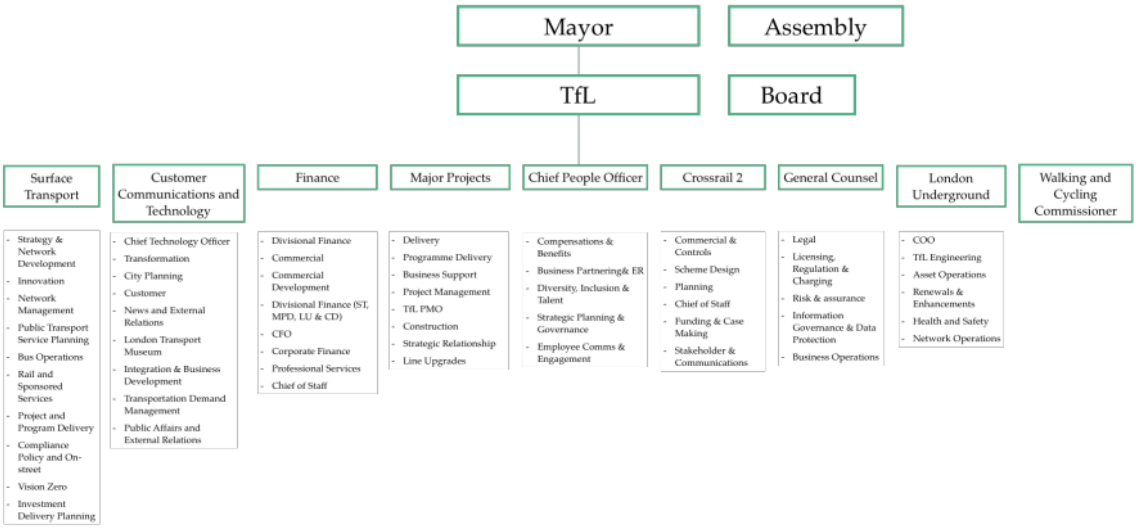
Singapore (Author w/information from LTA, 2019 and personal communications with public officials)

Level of government	Public Institutions	Policy attribuitions	Areas of transport
National Government	Ministry of Transport	• General policy frameworks • Funds authorization	• All modes of transport
	Land Transport Authority (Statutory board)	• Planning, designing, building and maintaining	• All modes of transport

Appendix 5. Organisational Charts of mobility Institutions within progressive cities

Transport for London, London

Adapted from original chart: http://content.tfl.gov.uk/data-transparency-organisational-chart.pdf



Metro de Medellin, Medellin

Original chart: https://www.metrodemedellin.gov.co/qui%C3%A9nessomos/estructura

Land Transport Authority, Singapore

Adapted from original chart:

https://www.lta.gov.sg/content/dam/ltaweb/corp/AboutUs/files/CorpOrgChart_GDLevel_010719.pdf

Appendix 6. Consultation and authorization processes of the main planning document

(Author w/information from official government sites, laws and interviews with public officials).

City	Plan name / Coordinating institution	General consultation process	Approval	Mandatory revision time framework	Years of publication
Monterrey	Metropolitan Plan / Urban Development Ministry	Thirty to sixty working days of open consultation, min. two public auditions and one meeting with a Council of Metropolitan Development	Unanimously by the Metropolitan Ordering Commission (the state and municipalities are part of the board)	None, as many as the Metropolitan Ordering Commission dictates	2019 (pending) 2003, 1988
Medellin	Metropolitan Development Plan / Metropolitan Area of the Aburra Valley (AMVA)	Open consultation, dialogues and workshops with members of the community	Simple majority in the AMVA board, which is composed by the 10 municipalities mayors	No mandatory frequency	2019 (pending) 2008, 2002, 1985,
London	London Plan / Greater London Authority	3 months open consultation, then an Examination in Public (EiP), where the Secretary of State appoints three planning inspectors, independent from the Mayor, to undertake an evaluation of Stakeholders opinions They write a report suggesting changes.	The Mayor decides changes and finally it is sent to the Secretary of State for approval.	At least every five years	2019 (pending), 2016, 2011, 2008, 2004
Singapore	Concept Plan / Urban Regeneration Authority	Done with every government agency.	None, as it is not statutory (a Land Transport Master Plan is created from this, statutory, and is approved by the Minister of Transport.	Every ten years	2011, 2001, 1991, 1981, 1971

Appendix 7. Risk Assessment

RISK ASSESSMENT FORM
FIELD / LOCATION WORK

The Approved Code of Practice - Management of Fieldwork should be referred to when completing this form
http://www.ucl.ac.uk/estates/safetynet/guidance/fieldwork/acop.pdf

DEPARTMENT/SECTION
LOCATION(S)
PERSONS COVERED BY THE RISK ASSESSMENT

BRIEF DESCRIPTION OF FIELDWORK

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section.
If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box.
Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.

ENVIRONMENT	**The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard**
e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals.	Examples of risk: adverse weather, illness, hypothermia, assault, getting lost. Is the risk high / medium / low ?

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
☐	work abroad incorporates Foreign Office advice
☐	participants have been trained and given all necessary information
☐	only accredited centres are used for rural field work
☒	participants will wear appropriate clothing and footwear for the specified environment
☐	trained leaders accompany the trip
☐	refuge is available

☐	work in outside organisations is subject to their having satisfactory H&S procedures in place
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

Examples of risk: loss of property, loss of life

CONTROL MEASURES

☐	participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/
☐	fire fighting equipment is carried on the trip and participants know how to use it
☐	contact numbers for emergency services are known to all participants
☐	participants have means of contacting emergency services
☐	participants have been trained and given all necessary information
☐	a plan for rescue has been formulated, all parties understand the procedure
☐	the plan for rescue /emergency has a reciprocal element
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

"

No

Examples of risk: inappropriate, failure, insufficient training to use or repair, injury. Is the risk high / medium / low ?

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	the departmental written Arrangement for equipment is followed
☐	participants have been provided with any necessary equipment appropriate for the work
☐	all equipment has been inspected, before issue, by a competent person
☐	all users have been advised of correct use
☐	special equipment is only issued to persons trained in its use by a competent person
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

LONE WORKING	Is lone working a possibility?	Yes	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. alone or in isolation *lone interviews.*	Examples of risk: difficult to summon help. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk

☐	the departmental written Arrangement for lone/out of hours working for field work is followed
☐	lone or isolated working is not allowed
☒	location, route and expected time of return of lone workers is logged daily before work commences
☒	all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle
☒	all workers are fully familiar with emergency procedures
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

ILL HEALTH	The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard.
e.g. accident, illness, personal attack, special personal considerations or vulnerabilities.	Examples of risk: injury, asthma, allergies. Is the risk high / medium / low?

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	an appropriate number of trained first-aiders and first aid kits are present on the field trip
☒	all participants have had the necessary inoculations/ carry appropriate prophylactics
☒	participants have been advised of the physical demands of the trip and are deemed to be physically suited
☐	participants have been adequate advice on harmful plants, animals and substances they may encounter
☐	participants who require medication have advised the leader of this and carry sufficient medication for their needs
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

TRANSPORT	Will transport be required	NO	☐	Move to next hazard
		YES	☐	Use space below to identify and assess any risks
e.g. hired vehicles	Examples of risk: accidents arising from lack of maintenance, suitability or training Is the risk high / medium / low?			

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☒	only public transport will be used
☐	the vehicle will be hired from a reputable supplier
☐	transport must be properly maintained in compliance with relevant national regulations
☐	drivers comply with UCL Policy on Drivers

	http://www.ucl.ac.uk/hr/docs/college_drivers.php
☐	drivers have been trained and hold the appropriate licence
☐	there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods
☐	sufficient spare parts carried to meet foreseeable emergencies
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

DEALING WITH THE PUBLIC	**Will people be dealing with public**	**Yes**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. interviews, observing	Examples of risk: personal attack, causing offence, being misinterpreted. Is the risk high / medium / low?		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
☒	all participants are trained in interviewing techniques
☐	interviews are contracted out to a third party
☐	advice and support from local groups has been sought
☐	participants do not wear clothes that might cause offence or attract unwanted attention
☒	interviews are conducted at neutral locations or where neither party could be at risk
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

WORKING ON OR NEAR WATER	Will people work on or near water?	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. rivers, marshland, sea.	Examples of risk: drowning, malaria, hepatitis A, parasites. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	lone working on or near water will not be allowed
☐	coastguard information is understood; all work takes place outside those times when tides could prove a threat
☐	all participants are competent swimmers
☐	participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons
☐	boat is operated by a competent person
☐	all boats are equipped with an alternative means of propulsion e.g. oars
☐	participants have received any appropriate inoculations
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

MANUAL HANDLING (MH)	Do MH activities take place?	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any

	risks
e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task.	Examples of risk: strain, cuts, broken bones. Is the risk high / medium / low?

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
☐	the departmental written Arrangement for MH is followed
☐	the supervisor has attended a MH risk assessment course
☐	all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities
☐	all persons performing MH tasks are adequately trained
☐	equipment components will be assembled on site
☐	any MH task outside the competence of staff will be done by contractors
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

SUBSTANCES	Will participants work with substances	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. plants, chemical, biohazard, waste	Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk

- ☐ the departmental written Arrangements for dealing with hazardous substances and waste are followed
- ☐ all participants are given information, training and protective equipment for hazardous substances they may encounter
- ☐ participants who have allergies have advised the leader of this and carry sufficient medication for their needs
- ☐ waste is disposed of in a responsible manner
- ☐ suitable containers are provided for hazardous waste
- ☐ OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS	Have you identified any other hazards?	No	If 'No' move to next section If 'Yes' use space below to identify and assess any risks
i.e. any other hazards must be noted and assessed here.	Hazard: Risk: is the risk		

CONTROL MEASURES	Give details of control measures in place to control the identified risks

Have you identified any risks that are not adequately controlled?	**NO**	☒	**Move to Declaration**
	YES	☐	**Use space below to identify the risk and what action was taken**

Is this project subject to the UCL requirements on the ethics of Non-NHS Human Research? ☐

If yes, please state your Project ID Number

For more information, please refer to: http://ethics.grad.ucl.ac.uk/

DECLARATION The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.

Select the appropriate statement:

☒ I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk

☐ I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above

NAME OF SUPERVISOR

SIGNATURE OF SUPERVISOR DATE