TÉCNICO LISBOA

MOBILITY IN URBAN CENTER

How can we reduce the impact of the car in urban center by other aternatives ?

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Dissertation to obtain the Degree of Master in Civil Engineering

Dissertation of Master in Civil Engineering

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Jury

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In memory of my grandmother.

Thanks

This research project was developed under the supervision of Mr Nunes da Silva, professor of the Instituto Superior Técnico in the Department of Civil Engineering, Architecture and Georesources. I thank him for his investment, for his advice and guidance.

I would like to express my gratitude to Mr Pierre Soulard, Urban Engineer and Head of Urban Mobility Service of the Highway Department, his assistant Mrs Michèle Clauzier and Mr Vasco Colaço from TIS (Transportes Inovação e Sistemas) in Lisbon. Thank you for meeting me, for all the data you have given me, and for the time you have devoted to me.

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To my best friends and their families who made me the one I became. Those with whom I grew up and who allowed me to persevere when the roads were strewn with pitfalls. We are only at the beginning of our adventure.

To my older sister Severine and my older brother David. Thank you for being here. I have a little bit of both of you in me. You have seen me grow. Despite our age differences, our links are strong and will form the solid foundation of our future great family. Never forget that I owe you a great deal of my success.

And finally, an unconditional thank you to my parents, Nadia and Jacques. A unique family for a unique love. I am conscious of the sacrifices you have made for me, and will give it to you a thousand times. I love you with all my heart and owe you all of my success until the slightest dust of success.

Lisbon 2016-2017

Summary

English

The purpose of this work is to study the policy of car management in the city of Lisbon and the community of municipalities of Grand Lyon. It will be a question of analyzing the limitation of the impact of the car in town by two ways: the reduction of the car in the modal split and the fluidification of the traffic. We will see that the stories of the cities of Lyon and Lisbon, as well as the resulting decision-making organization, are of paramount importance to the effectiveness of the policies pursued today. The ultimate goal will be to consider future orientations and propose solutions that could be used as a basis for reflection on improving urban mobility in each of these two cities.

Portuguese

O objetivo deste trabalho é estudar e analisar a política de gestão da mobilidade e do tráfego automóvel na cidade de Lisboa e na comunidade de concelhos do Grande Lião. Tratar-se-á de analisar a limitação do impacto do automóvel particular na zona urbana sob duas perspectivas: a diminuição do automóvel na repartição modal e a fluidez do tráfego. Será evidenciado que a história da cidade de Lião e Lisboa, assim como a dos processos de decisão aí existentes têm uma importância de peso em relação à eficácia das políticas adotadas hoje em dia. O objetivo final será o de enunciar orientações para o futuro e propôr soluções que podem ser utilizadas como base de reflexão para a melhoria da mobilidade urbana em ambas as cidades e conjunto de concelhos.

Keywords

Urban mobility, Lisbon, Grand Lyon, automobile, alternative transports.

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I- Introduction

1) Purpose of the report and state of the art

Throughout the second half of the twentieth century, the place of the car increases over the whole of the planet. In developed and developing countries, the purchase of a car becomes a priority need among households. This possession of the individual car is permitted by the democratization of the car, becoming the main mode of travel. The city is then adapted to the car, the streets are enlarged and the sidewalks narrowed.

Some families move away from the city centers in order to have more comfortable spaces at lower costs. They go to their workplace, often located in the centers, thanks to their car. This over consumption of the car allows an urban sprawl causing the inhabitants to travel more and longer and to spending on infrastructures of the higher local authorities.

Moreover this increase every year of the car leads very quickly to a congestion of the cities and an air pollution, sound, or visual each time more troublesome. There is a direct link between car related air pollution and many adverse health effects such as increased chronic lung disease such as asthma, worsening lung cancers, and the increase of heart disease. It has also been shown that the emission of greenhouse gases is responsible for global warming, a major challenge of the 21st century.

Despite the negative aspects of the car, it is difficult to fight against this hegemony of the automobile, being a priori more desirable than public transport. When travel time is equal, users prefer the car rather than public transport because they are less constrained to fixed schedules and routes.

A radical solution would be the direct abolition of cars in the city, but it would be an irrespective solution to the needs, including the need for relief, security, economic activity, and so on. Nevertheless, looking for a relative decrease in the use of the individual car seems beneficial. To do this, it is necessary to move towards an attractive alternative offer, information, the search for the adhesion of all to the common project. It would appear that undue hardship and discontent by all do not lead to lasting and accepted results.

Sir Colin Buchanan had already noted in his report « Traffic in Towns », in November 1963, that the car was « a happy invention whose future is assured [...] and that its integration into cities large or small is both necessary and fair. »

However, his report is more and more pessimistic as his report progresses. Indeed, he warns that « bad traffic conditions and their consequences will are detrimental to the environment and human lives. »

The solution of the problem according to Sir Buchanan is « the existence of cheap and convenient public transport and the goodwill of the general public. »

This is the direction that the cities of Lyon and Lisbon seem to have taken at the end of the 20th century and the beginning of the 21st century. The problem of cars in cities is a major issue in these two cities. For a long time, as

we shall see, Lyon was invaded by the car in town and pursued a « car-centric » policy before resigning itself towards the end of the 1970s and changing its political orientation. Awareness in Lisbon will appear later in the early 2000s as we will see in this study.

The purpose of this report will ultimately be to understand and respond to the following problem : How can we conduct an effective car management policy through other alternatives ? The cases of Lisbon and Lyon will constitute our leading threads.

Thus, prior to this analysis, it is necessary to specify our areas of study. Lyon is located in the eastern part of France in the Auvergne-Rhône-Alpes region, more precisely in the Rhône department (Cf. Appendix 1). When talking about Lyon's city center, we consider the 9 districts to which we will add the commune of Villeurbanne, directly attached to these districts and where mobility is very important. However, mobility in Lyon is organized on an extended territory. Indeed, on the 1st of January 1969 was created the urban community of Lyon (COURLY) which later became Grand Lyon[1], then in 2015 the metropolis of Lyon. We will use the denomination of Grand Lyon throughout the report to designate the study area, even after the year 2015, for reasons of understanding.

Figure 1: Territory of the Grand Lyon (Source : Meyzieu, consulted in november 2016)

The city of Lisbon belongs to the region of Lisbon, one of the five regions of Portugal (Cf. Appendix 2). Within the Lisbon region, we will focus on Lisbon itself. However, we will also carry out analyses on the periphery of the White City, as in the case of Lyon,

[1] http://www.meyzieu.fr/article2827.html

because part of the surrounding municipalities appear as an extension of the urban fabric of Lisbon and mobility goes beyond the capital's borders alone.

Figure 2: Study area of Lisbon

2) Methodology

First of all, the subject's understanding involved a discussion with the tutor of this research project, Mr Fernando Nunes da Silva, about the problems related to an important use of the car and an uncontrolled development. He advised initially to orient myself towards a very global research work with works such as « Déplacement : l'ère de la gestion ». The latter brings together the work of several specialists on the subject of mobility and deals with subjects such as urban tolls, the influence of public transport quality or an analysis of the understanding of users' choices between cars and alternative solutions. At the same time, research was carried out on the work « Traffic in Towns » by Sir Colin Buchanan and on some reports written by the IAURIF (Institut d'aménagement et d'urbanisme de la région Île-de-France). This first phase gave a general idea of the problem of the car in the city. The book « Déplacement : l'ère de la gestion », as well as the IAURIF reports, provided a history of the reflections already carried out in France and in Europe, while the work « Traffic in Towns » showed that the phenomena observed nowadays was predictable.

At the end of these readings, it was possible to meet specialists and discuss more clearly and broadly with them, such as Mr. Pierre Soulard, Urban Engineer and Head of Urban Mobility Service of the Grand Lyon Road Authority or Mr Vasco Colaço from the TIS (Transportes Inovação e Sistemas).

The meeting with Mr. Soulard took place on December 2016, with the aim of developing the case of the city of Lyon. He brought to the project very complete documents from Grand Lyon and directed the research to a book dealing with the question of the management of the car in the city in the 20th century with as a red thread the case of Lyon : « Goût de bouchons » by Sebastien Gardon.

On February and May 2017 was organized the meetings with Mr Colaço. As a preparation for the first meeting, consultation of the book « Lisbon : the challenge of mobility » was an obligation. This book deals mainly with the year 2004, a pivotal year in the change of mentality regarding the car in Lisbon. The study of this book made it possible to

prepare this interview with a knowledge already acquired of the subject and to know the data to be obtained for the development of this report.

At the end of these two meetings and after working on the many documents mentioned above, the final plan was defined with the help of Mr Nunes da Silva.

3) Structure of the study

Thus, we will first analyse the emergence of the car in the 20th century in these two cities. Indeed, from the way in which the city and the car have developed together, the alternative transports that can be put in place subsequently depend on this. Thus, we will see that a real enthusiasm has been consolidated around the car to the point of organizing our cities in relation to it. Automobile development intensified in Lyons after World War I, while it was not until the 1970s in Lisbon. In order to resist the automobile wave and not reach the congestion announced by Sir Colin Buchanan, Lisbon as Lyon have carried out major works for the service of the car. However, these « car-centric » have limits, as we will see, and the awareness appeared at the end of the XXth century.

We will study in a second part the management of the car as well as the emergence of alternative solutions and management of urban mobility based on the car. This awareness of the need for conciliation between cars and alternative solutions for city travel began in the late 1970s in Lyon, whereas it was not until the early 2000s in Lisbon. It will therefore be necessary to understand how these two cities tend to reduce the share of the car on one side and to thin the traffic on another side in order to reduce its impact. Finally, we will conclude as to the causes of these results and the orientations announced and possible in these two cities, as well as at the European level.

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II- The emergence of the car in the 20th century

The car began to appear in the 19th century during the Industrial Revolution. In its beginnings, the automobile was a luxury good. Step by step, access to the car became more grassroots, but remained rather elitist until the end of the First World War in France. In Portugal, it was not until the 1970s and 1980s that the car was massively developed.

The automobile revolutionized transport and brought deep societal changes, particularly in the relationship between individuals and space.

Thus, a real craze for the car took place. In Lyon, an entire economy developed in this sector, as well as a new administrative decision-making organization around the automobile matter. However, in Lisbon, this activity has always been imported and the development of the automotive sector economy was a minor one compared to Lyon.

1) A craze for the car

Sources :

Fernando José Nunes da Silva, 1990, *Les coûts de l'exploitation des routes au Portugal - L'analyse comptable comme support d'un instrument de planification*, p. 216.

Website of European statistics (Eurostat) : http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=tsdpc340

At the beginning of the 20th century, the automotive industry was an innovation that completely changed the functioning of our societies. Urban territories were the first to be conquered, especially those near the poles of the automobile industry. France was one of the major players in the development of the automobile industry, and its growth was more striking than in Portugal. Thus, while Lyon experienced a strong development of the automobile at the end of the First World War, this growth was only witnessed in Lisbon in the 1970s – 1980s. The data shown below allows a better understanding of the major growth of the automobile in France in opposition to Portugal.

	Germany	France	Netherlands	Italy	UK	Switzerland	Portugal
1964	124	171	95	88	157	143	23
1973	272	276	239	250	243	285	81
1986	441	388	337	392	323	412	221
1991	393	408	371	503	362	453	278
1997	504	437	381	541	403	469	375
2002	542	475	426	591	447	510	557
2014	550	483	-	610	-	539	451

Table 1: Motorisation rate in European countries (1964 - 2014)

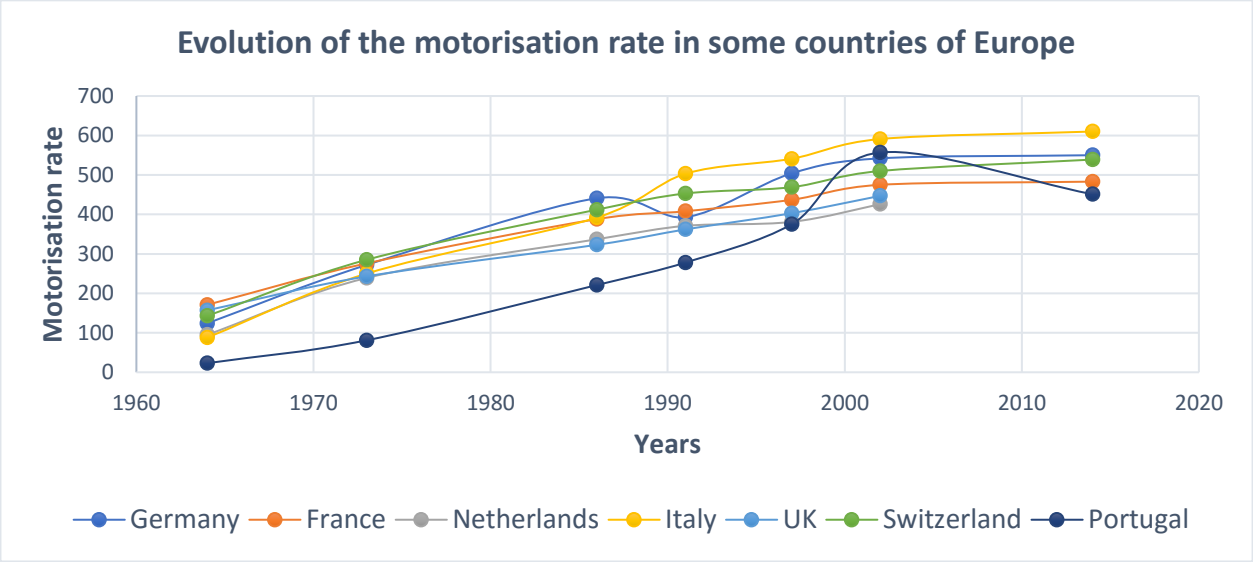

Figure 3: Evolution of the motorisation rate in some European countries (1964 - 2014) (Source values before 1986 : Fernando Nunes da Silva, 1990) (Source values after 1986 : Eurostat, 2017)

i. A new economic sector

Sources :

Sébastien Gardon, 2011, *Goût des bouchons – Lyon, les villes françaises et l'équation automobile*.

Fernando José Nunes da Silva, 1990, *Les coûts de l'exploitation des routes au Portugal - L'analyse comptable comme support d'un instrument de planification*, p.214.

Website of Ine : https://www.ine.pt/

Website of Pordata : http://www.pordata.pt

Christian Vignol, 21 april 2016, *La curieuse et amusante histoire de l'automobile* [online].

In the beginning of the automobile, its development is closely linked to the presence of manufacturers. In France their number was high at the end of the 19th century compared to other European countries and none in Portugal :

Countries	Number of automobile manufacturers
France	719
Germany	76
Belgium	63
UK	49
Italy	26
Switzerland	24
Netherlands	11
Portugal	0

Table 2: General automobile directory of 1898, number of automobile manufacturers per country (Source : Sébastien Gordon, 2011)

The French manufacturers were headquartered mainly in Paris and Lyon. At the time, we know about one hundred and fifty Lyonnaise brands. However, some builders disappeared, others merged, and there were only fifty-six on the eve of the First World War.

At the same time, a new theory of production was born : Taylorism, named after its inventor, American engineer Frederick Winslow Taylor. The objective of this method was to obtain maximum yield at lower cost. Taylorism advocates a detailed analysis of the gestures, rhythms, cadences and higher and motivating wage conditions for employees.

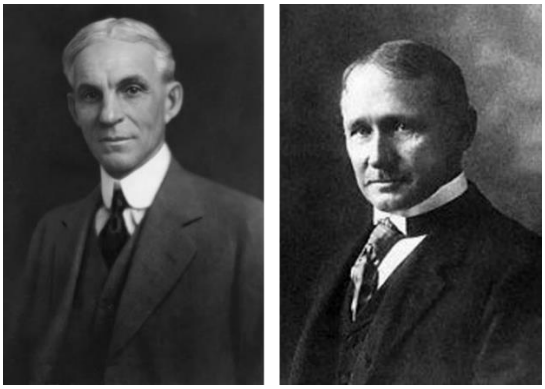

Figure 4: Henry Ford[2] (1863 - 1947) / Frederick Winslow Taylor[3] (1856 - 1915)

(Source : Notichias Coches, consulted in december 2016) (Source : biografiasyvida, consulted in december 2016)

Thus, American industrialist Henry Ford introduced this technique in his factories by renaming it « Fordism » and made it his philosophy as early as 1908. A few years later, in 1912, Renault adopted this technique with Renault type « AX », followed by Citroën in 1919, with the Citroën type « A ». The consequences of « Fordism » are a complete popularization of the automobile object.

Thus the period of the First World War saw the emergence in France of major brands such as Citroën, Peugeot and Renault, which no longer aimed only to elites but expanded their customer base. Other manufacturers have shifted to new occupations (OEMs, body builders, accessories, repairers, pump attendants, insurers, etc.). The « garage » activity also appears. In Lyon, the Lafayette garage and the Perrache garage are developing, as well as the emblematic Citroën garage in the 7th arrondissement, built between 1930 and 1932, with five floors. A real automotive economy was then created in the urban area, and in 1960 this sector employed more than a third of the assets of the region.

At the same time, the building sector is involved in the construction and maintenance of roads and infrastructure dedicated to the automobile industry. After the Second World War, the automotive economy began to spread

[2] http://noticias.coches.com/noticias-motor/historia-henry-ford/31920
[3] http://www.biografiasyvidas.com/biografia/t/taylor_frederick.htm

to the periphery. Fuel dispensing stations will, for example, be poised along the campaign zones. This is the first phenomena of urban sprawl.

Beyond the economic activities that were developing, several associations are formed around the question of the automobile in Lyon. They work for the development of the car in the cities and anticipate the actions of the public authorities for whom the cause of the automobile appears at the end of the First World War as a major issue in the development of our societies, to which we must provide clear and effective answers.

At this moment in Portugal, the automobile is emerging. Its development continued to increase in the 1920s and especially in the early 1970s, but at the time of the exponential economic development of the automobile in France, a tiny part of the Portuguese population has access to this societal revolution.

The real popularization of the car will not appear until the accession of the country to the European Economic Community (EEC) on 1 January 1986. Since that accession, motorisation has continued to grow.

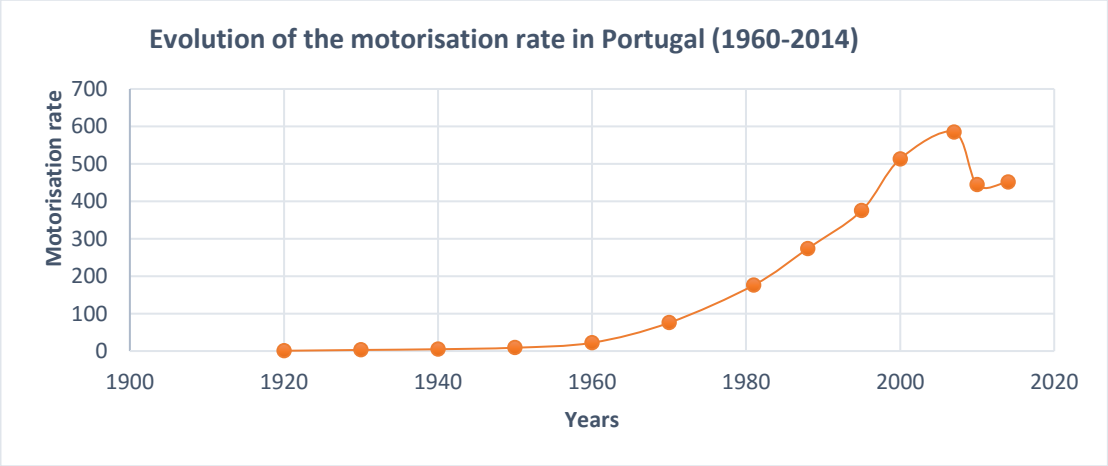

Figure 5: Evolution of the motorisation rate in Portugal (1960 - 2014) (Source values before 1988 : Fernando Nunes da Silva, 1990) (Source values after 1988 : INE, PORDATA, 2017)

Notes :

(1) Motorisation rate in vehicle per 1000 inhabitants.

ii. A strong link between powerful association and political decisions in Lyon

Source :

Sébastien Gardon, 2011, *Goût des bouchons – Lyon, les villes françaises et l'équation automobile*.

In Lyon, a real associative dynamism appeared at the beginning of the 20th century around the automobile problematic. In 1902, the Automobile Club of the Rhône (ACR) was created, encompassing all the clubs and associations associated with the sector. In 1911, the Automobile Union of Lyon was created with the aim of defending the common interests of motorists. These associations recruited most of their members in the social, media, sports and industrial of Lyon. On the eve of the First World War, the Union automobile de Lyon will be absorbed by the ACR becoming an enormous and powerful association, weighing in the balance of decision.

To understand the decisional impact that the ACR will have on future Lyon automotive policies, it is necessary to take note of its organization. There is a steering committee (a chair, vice-chairs, secretary-general, deputy secretary-general, treasurer, deputy treasurer and elected members), secretariat, library. One of its policies is to create close ties with local and national personalities appearing in the ACR as honorary members. There are municipal councilors, general councilors, cohabiting with members of the tribunal of Lyons or members of the police services. In order to have access to all its members, the ACR organizes numerous promotional events (car races, banquets, galas, conferences, etc.). In these events are mixed up many political personalities, media, administrative, industrial of Lyon. When a new prefect or governor of Lyons are elected, they are, directly, received by the ACR.

The ARC was a gathering place for some local economic and public decision-makers. It gradually became a support for the public authorities by participating in the integration and development of the automobile in Lyon. The ACR subsidized technical tests such as tarrying tests in 1909 or light-signaling in 1928.

They were directly involved in the training of police officers and the driving licence examination operations from 1925. At the same time, the ACR is involved in several development projects, particularly roads, first motorways, parking projects with the construction of car parks or the implementation of a regulation and signage.

The ACR has clearly intervened in the development of the car in the Lyons region, first by promoting the car, then by developing the city and educating the authorities and automobile users. At the same time, thanks to all the political personalities to whom the Club is linked, one of the activities of the ACR was to develop close relations with the public authorities. Generally speaking, after the President Deydier's term from 1909 to 1931 in the ACR, the presidents mainly dealt with traffic and road safety, and not with other major subjects (tourism or sport). There is thus a clear link between the presidents of the ACR and the question of the automobile in Lyon. Finally, the ACR has played a central role in decision support since the 1920s. The president is often called to participate in committees set up by public authorities such as the Highway Traffic Commissions of prefectural or municipal (City of Lyon and Villeurbanne), transport or traffic commissions, etc. Apart from the president of the ACR, members are sometimes called to these committees, and it is not uncommon for them to replace them as deputies to the mayor of Lyon.

All the missions of the ACR, ultimately, lead to the hegemonic development of the car in the city. From the production stage of the automobile to the development of road structures, through the development of rules of conduct and the defense of the motorist, the ACR touches the whole automotive prism and its power clearly allows to explain the considerable weight of the car in Lyon in the 20th century.

Thus, before the nationalization and the establishment of a national policy in the 1970s, then local road safety in the 1990s, one can talk about a private management of the automotive question from the end of the 19th century until the end of the 20th century, at the end of the 1960s in Lyon. This private management can be explained by a very hasty appearance of the car which deeply changed the society and which then demanded fast and relevant decisions which only the private by its reaction force could answer. Lyon appeared in a certain way like one of the laboratories of the development of the automobile, very often in an archaic way, it was first necessary to observe the limits of the car and take the decisions after that.

2) The first limits of the « car-centric » policy and implementation of rules

Source :

Sébastien Gardon, 2011, *Goût des bouchons – Lyon, les villes françaises et l'équation automobile*.

The center of Lyon with its narrow streets, coupled with commercial and industrial activities already led to congestion phenomena long before the arrival of the car. Thus, at the beginning of the 20th century, the popularization of the automobile didn't enhance the situation.

Initially, the automotive activity was mainly developed in the IIIrd and VIIIth arrondissements as well as in the suburbs. The particular topography of Lyon, with not only the presence of two rivers but also of two hills, did not facilitate the first automobile circulations. Until the 1960s, congestion mainly affected the slopes of the Fourvière and Croix-Rousse hills, Vieux-Lyon and the Presqu'île. This can be explained by the narrowness of the streets, the dangerous descents or the configuration of the crossroads. The first measures implemented in these zones were one-way traffic in some streets as early as the 1920s. Other causes of congestion are the bad cohabitation between the automobile and other modes of transport, where most terminals were between Rhône and Saône.

As mentioned earlier, the problems of trafficking have been taken into account gradually and regulatory responses have been constantly tested and reexamined. In this way, public space, roads and streets are gradually organized with a succession of general regulations following several taken as a matter of urgency according to particular cases (accidents, work, etc.). These decrees are for some set up before 1921 and before the creation of the highway code. The decree of November 16, 1912 which institutes traffic on the right giving priority to the main streets over the secondary streets. In 1924, a by-law prohibits parking on the roadway unless absolutely necessary. And on 1 February 1926 the first general traffic regulations were published, modified five times until the year 1967.

These various regulations gradually fixed the rules of city traffic. In the 1960s and 1970s, the emergence of new associations led to a renewal of the organizations represented in the municipal traffic council. Henceforth, the

number of associations representing different users (motorists, cyclists, pedestrians, etc.) is too great for motorists to be the sole interface of public authorities.

Beyond the regulatory framework that was gradually introduced during the 20th century so that the car finds its place in our society, the decision-makers of the city of Lyon allocated part of their budget to the development of the city for the automobile, especially during the period of the Thirty Glorious.

3) The paradigm of « Predict and Provide »

The automotive facilities in Lyon were progressive and spread out over time, with some emblematic constructions which we will analyze later. However, in Lisbon the transformations of the city happened very fast, and on a shorter time to attend the new arrival of the car.

i. The beginning of the automobile in Lisbon

Sources :

Direcção geral de transportes terrestres (Lisboa) – Institut de techniques des transports (EPF/Lausanne), 1974, *Estudo de transportes da região de Lisboa – Volume I*, Chapitre II, p.12, p.13, p16.

Website of Pordata : http://www.pordata.pt

Serge-Christophe Kolm, 1976, *Chili – Portugal : Vers une théorie des processus révolutionnaire modernes* [online].

In 1960s – 1970s mass economic immigration to the capital took place. Thus whole families came to settle either in Lisbon itself, or more often in its region. Indeed, at that time the Portuguese economy was shaken and a large part of the economy was regrouped in the city of Lisbon.

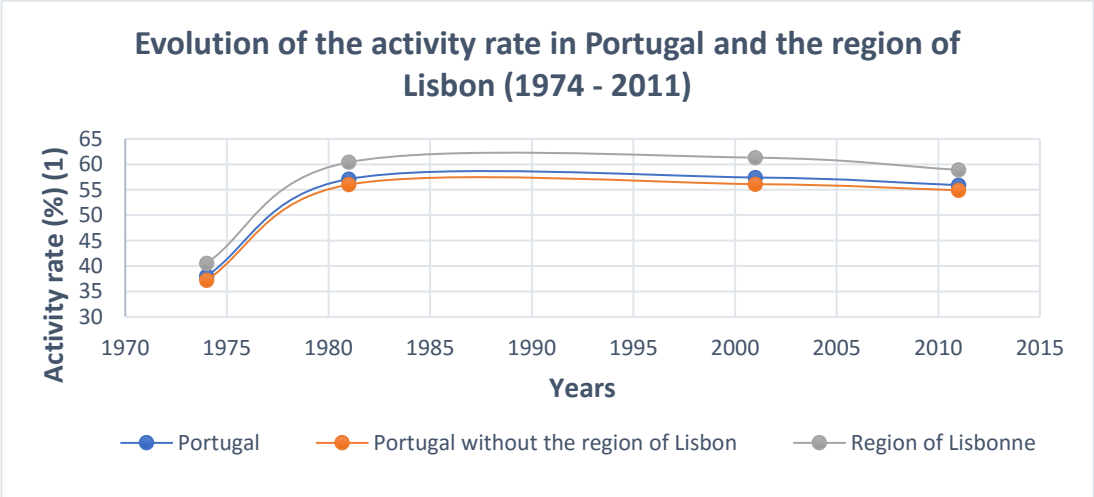

Figure 6: Evolution of the activity rate in Portugal and the region of Lisbon (1974 - 2011) (Source values before 1974 : EPF/Lausanne, p13, 1974) (Source values after 1974 : PORDATA, 2017)

Note :

(1) The results of activity rates of the « Portugal without the Lisbon region », after 1974, obtained using activity rates of the region of Lisbon and Portugal which are known, and in considering that a quarter of the population is in the region of Lisbon and three-quarters is in the rest of the country.

The population increase was of 47% in nearly 15 years. Finally, a quarter of the Portuguese population was concentrated in 3% of the continental Portuguese territory.

Years	Country	Pays withous region of Lisb.	Region of Lisbon	% Region of Lisbon compared to Portugal
1930	6330	5400	930	14,8%
1940	7220	6120	1100	15,2%
1950	7920	6630	1290	16,5%
1960	8290	6810	1500	18,1%
1974	8500	6300	2200	25,9%
1981	9883	7389	2494	25,2%
2001	10364	7699	2665	25,7%
2015	10358	7547	2811	27,1%
Evolution 1960-1974	2,5%	-7,5%	+46,7%	-

Table 3: Evolution of the national and regional population (in thousand inhabitants) (Source values before 1974 : EPF/Lausanne, p12, 1974) (Source values after 1974 : PORDATA, 2017)

Thus this very significant migration of Portuguese from the interior of the countryside to Lisbon translated into a necessity of displacement. On the outskirts of Lisbon there was no public transport, so the workers in this area were obliged to buy a car.

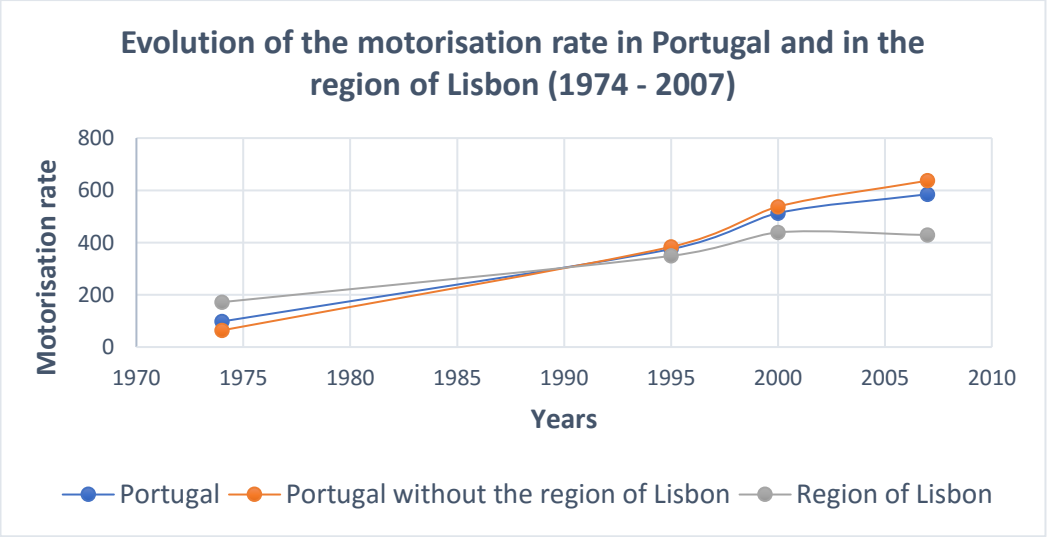

Figure 7: Evolution of the motorisation rate in Portugal and in the region of Lisbon (1974 - 2007) (Source values 1974 : EPF/Lausanne, p16, 1974) (Source values after 1974 : PORDATA, 2017)

Note :

(1) The results of motorisation rates of the « Portugal without the region of Lisbon » , after 1974, were obtained using the motorisation rates of the region of Lisbon and Portugal which are known, and in considering that a quarter of the population is in the region of Lisbon and three-quarters is in the rest of the country.

Moreover, in April 1974, a major event happened in Portugal : the Carnation Revolution. This revolution led to the collapse of the Salazar dictatorship in place since 1926. There was a union of soldiers who destroyed the political regime. They were then the bearers of a democratic project (establishment of a civil government, organization of free elections and decolonization). (Serge-Christophe Kolm, 1976, *Chili – Portugal : Vers une théorie des processus révolutionnaire modernes* [online]).

There was a very significant increase in the motorisation of the end of the revolution in 1973 until 2005. This is explained first of all by the increase in purchasing power at the same time as the rise in wages and then by the end of the Carnation Revolution which allowed access to bank loans. The table 3 « Evolution of the motorisation rate in Portugal (1928/1988) » shows this increase in the motorisation rate at the level of Portugal. These figures are even more pronounced in the case of Lisbon, where the motorisation rate is higher than at the national level. In the same thing in the case of the following GDP figures.

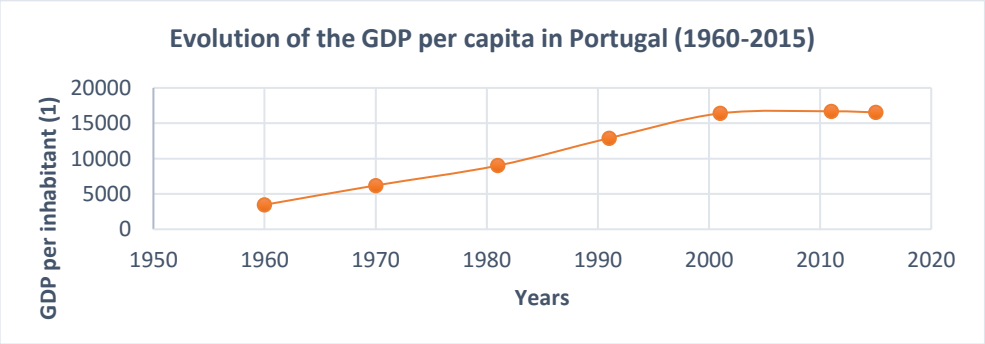

Figure 8: Evolution of the GDP per capita in Portugal (1960 - 2015) (Source : PORDATA, 2017)

Note :

(1) Gross domestic product is an economic indicator measuring the level of production in a country.

Moreover, the entry of Portugal into the European Economic Community on 1 January 1986 allowed the Portuguese administrations to have the capacity to make major developments in the service of the automobile. What is, in the case of the region of Lisbon, this induced very heavy traffic in the direction of Lisbon itself.

At that time and until 2004-2005, he persisted in the idea that the car made it possible to have a real social[4] status[5]. Like in the case of Lyon until the end of the 1970s. Thus, an individual transport policy was pursued at the expense of alternative means of transport.

Figure 9: The automobile, a social symbol (Publicity of 1960s) (Source : TigerSun, consulted in January 2017)
(Source : Plan 59, consulted in January 2017)

ii. Transport investments in Lyon and Lisbon

Sources :

Sébastien Gardon, 2011, *Goût des bouchons – Lyon, les villes françaises et l'équation automobile*.

European conference of the transport ministries, OCDE, 2000, *Les investissements en infrastructure de transport -- 1985-1995* [online].

Alfredo Marvão Pereira et Jorge M. Andraz, 2010, *On the Economic and Fiscal Effects of Investments in Road Infrastructures in Portugal* [online].

Alfredo Marvão Pereira, Jorge M. Andraz, 2006, *Public investment in transportation infrastructures and regional asymmetries in Portugal* [online].

Pierre Soulard, 2011, *Education au Développement Durable - Les déplacements dans le Grand Lyon : situation actuelle des solutions pour une mobilité durable*.

Madalena Sottomayor Machado Costa e Silva, July 2015, *Padrões de Mobilidade e Crescimento Urbano – Análise Comparativa entre Lisboa e Florianópolis*.

SYTRAL, 1997, *Le plan de déplacements urbains de l'agglomération lyonnaise* [online].

SYTRAL, 2005, *Révision du PDU de l'agglomération lyonnaise*.

Town hall of Lisbon, July 2005, *O desafio da mobilidade*, p 82 et 5.

Until the 1990s in France and 2000s in Lisbon, policies of anticipation, also called policies of the «predict and provide », are put in place. It can be summarized thus: «The more cars there are the more investments will be made. » In fact, policies are guided by this idea. The paradox of this paradigm is that we are faced with a vicious circle. « The more cars there are the more investment will be made and therefore the more cars there will be, etc. » It is a somewhat fatalistic thought of believing that nothing can be done against the emergence of the car.

At the end of the 20th century, investments in France and Portugal are mainly in the service of automobiles. France was economically more developed than Portugal, that's why investments are much higher. However, in both cases, the development of road constructions tends to grow faster than the construction of the urban railway network The following chart, whose the unit is the « European Currency Unit » (ECU) shows the investments in France and Portugal between 1987 and 1995 :

[4] http://www.renaultoloog.nl/reclame-francais.htm
[5] http://www.plan59.com/cars/cars216.htm

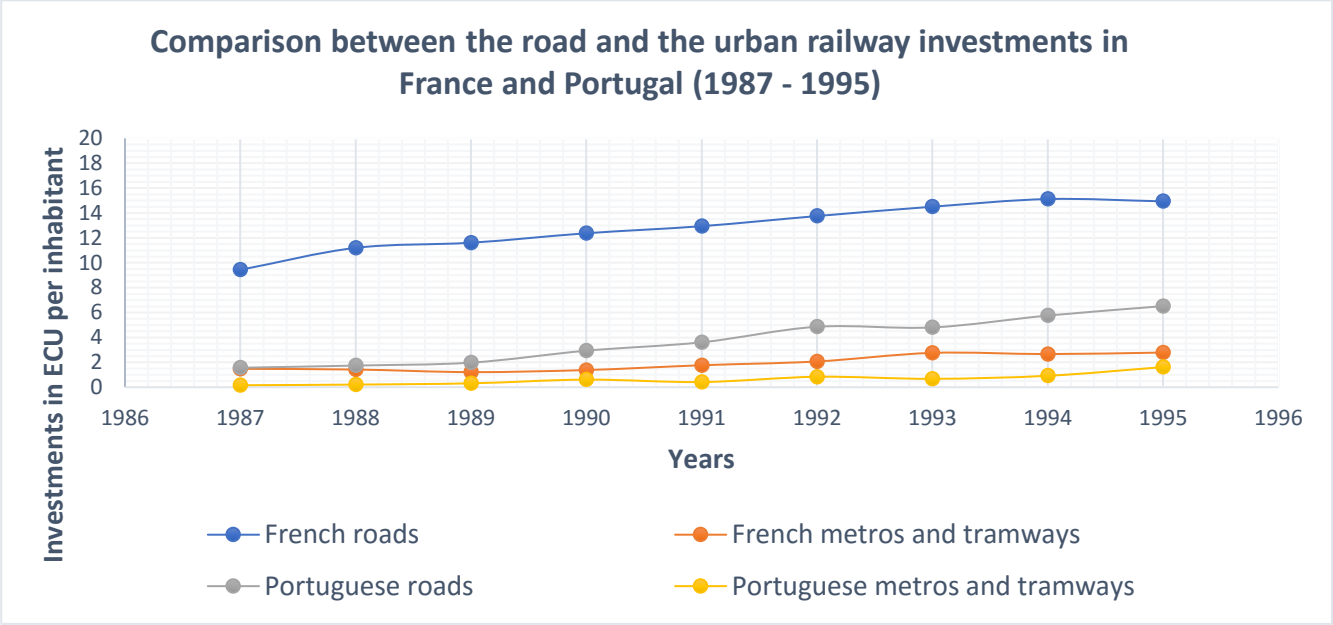

Figure 10: Comparison between the road and urban railway investments in France and Portugal (1987 - 1995) (Source : Alfredo Marvão Pereira and Jorge M. Andrz, 2010)

In France, from 1992, the budgets allocated to metros and tramways stagnated. This increase corresponds to the awareness of the end of the 20th century. From 1994 - 1995, road network budgets decreased slightly. As for Portugal, we see that the metro and tramway budget is almost constant over the eight years, while the road network budget is increasing. To better understand this, the case of Portugal should be examined :

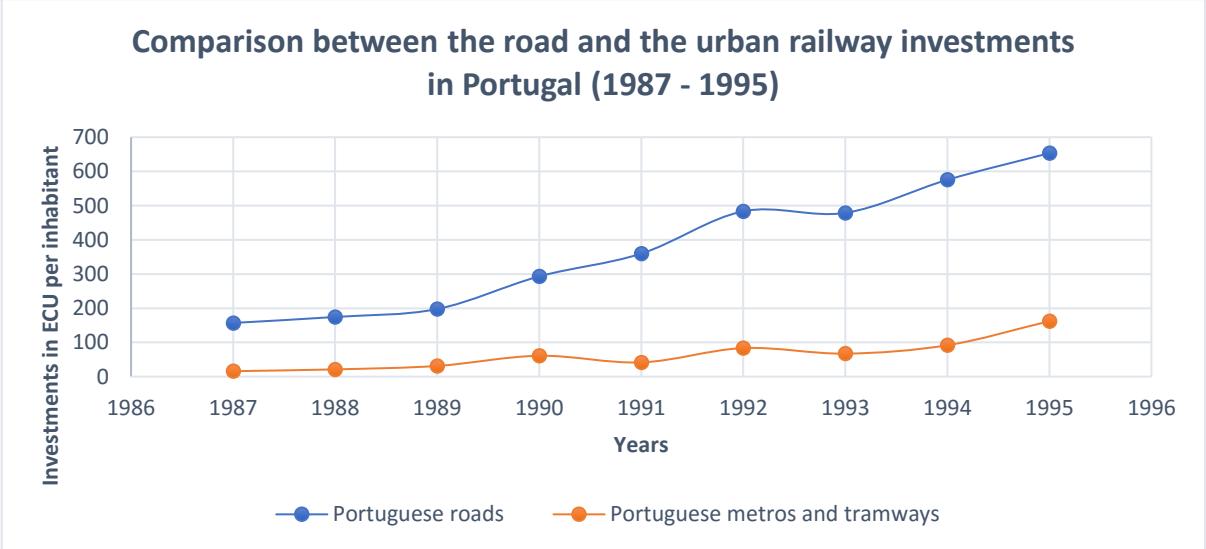

Figure 11: Comparison between the road and urban railway investments in Portugal (1987 - 1995) (Source : Alfredo Marvão Pereira and Jorge M. Andrz, 2010)

In view of the above figures, it should be noted that they are at the level of both countries. It turns out that road investments in Portugal were mainly in the northern region and in the region of Lisbon.

The following table shows the breakdown of road investments of the State by region :

	1980 - 1988	1989 - 1993	1994 - 1998
North	35,3	30,7	35,9
Center	33,2	24,1	19,4
Lisbon	16,6	25,5	29,1
Alentejo	9,3	8	13,1
Algarve	5,6	11,9	2,5
Total	100	100	100
%GDP	0,9	1,3	1,6

Table 4: Distribution of the road investments in millions in Portugal (1980 - 1998) (Source : Alfredo Marvão Pereira et Jorge M. Andraz, 2010)

When talking about the « car-centric » policies in Lyon, we can talk about the main access roads of the Part-Dieu district, starting from Garibaldi, Servient and Bonnel streets of the 1970s. In addition the dismantling of the old military precincts of the 19th century allowed the development of axes along the railway tracks (Berthelot avenue, Tchécoslovaques boulevard, Vivier Merle boulevard, Thiers avenue, Villette street). (Cf. Appendix 3).

In the 20th century, beyond the minor works mentioned above and the installation of a car signage, Lyon experencied changes dramatically changing its structure and obliger the cyclists and pedestrians to go another areas. First of all let us mention the many access roads to the motorways that enter the city and cross the exchange center of Perrache inaugurated in 1976 and placed in the middle of the peninsula of Lyon. (Cf. Appendix 4).

Secondly, the development of the most abrupt areas, such as the hills of Fourvière and La Croix-Rousse by two tunnels, or the ascents of Choulans and La Boucle, show a behavior, in the 20th century, towards an « automobile radicalism ». The Croix-Rousse and Fourvière tunnels, which were inaugurated in 1952 and 1971, symbolize this policy of the automobile, allowing thousands of cars to go to the city of Lyon every day. (Cf. Appendix 5).

In addition, the amount of cars entering the city increased due to the construction of numerous gigantic underground car parks. Between 1960 and 1980 the car parks of Bellecour (1963), Hôtel de Ville (1980) and Opéra (1980) were built, comprising approximately 1000 parking spaces for the three of them. (Cf. Appendix 6).

In Lisbon, in the 20th century, the city was clearly remodeled by major road constructions. Among them are both famous bridges, the 25 April Bridge, inaugurated on 6 August 1966 and the Vasco de Gama Bridge, which was opened to the public on 29 March 1998 shortly before the Universal Exhibition of the same year.
In addition, we can add the North-South axis (NS) linking the A1 motorway and the 25th April bridge, the North-East / South-West axis (NE-SO) which allows access to Cascais and Sintra to the west via the A5 and A13 motorways and the Tagus (T) axis.

These axes allow a considerable number of cars to enter the city every day. The figures for 2003-2004 show that 163 000 cars were returning to Lisbon every day by the bridge on 25 April, 68 000 vehicles by the Vasco de Gama Bridge, 119 000 vehicles were arriving from the North, 217 000 from Cascais and 190 000 from Sintra and Amadora (Cf. Appendix 8).

Start area	Number of vehicles incoming
Vasco de Gama bridge	68 000
25 april bridge	168 000
North	119 000
Cascais	217 000
Sintra et Amadora	190 000

Table 5: Number of vehicles incoming in Lisbon for each start area

Among the 163 000 cars entering Lisbon by the bridge on 25 April, the whole penetrated Lisbon by the N-S axis before dividing into the secondary axis, in green on appendix 8.

With regard to the 68 000 vehicles entering the Vasco de Gama Bridge, 40 800 were moving towards the T axis, and 14 960 to other destinations, some of them which, undoubtedly, were moving towards the N-S axis by the northern axis of Lisbon.

The motorists coming from Cascais were mainly heading towards the N-S axis and intersecting it from the west. Indeed, 93 800 were moving towards this axis. 55 650 vehicles entered Lisbon via the NE-SO axis, about 60 000 by the T axis and 76 200 by other destinations.

On the Sintra and Amadora side, 53 000 vehicles entered Lisbon via the NE-SO axis, 84 000 vehicles penetrated Lisbon by the NS route, heading west upstream, 33 700 passing through the T axis and 19 450 vehicles were moving to other destinations.

And finally, the vehicles integrating the network by the North were mostly directed towards the NE-SO axis and the T axis. 89 450 were oriented towards the NE-SW axis and 84 900 towards the T axis. The rest of the cars traveling from other destinations.

In summary, each day these major axes attracted a lot of cars as shown in the following table :

Main axis	Number of vehicles attracted per day
N-S	34 0650
NE-SO	229 000
T	219 300
Total in the 3 axis	**788 950**

Table 6: Total number of vehicles attracted by the 3 main axis each day

It is thus these major restructurings that have created in part the exponential development of the car in Lisbon with axes that cut the city at its heart. The T axis initially consisted of 5 lanes before being reduced to 2 lanes during the projects of reappropriation of the city to the pedestrians and the redevelopment of all the south coast of Lisbon.

The city of Lyon, on the other hand, has not really been modeled for the automobile. Indeed the developments presented here are particular cases that demonstrate certain victories of the « car-centric » camp, but the developments carried out are more generally oriented towards a balance between the automobile and the other modes of transport.

There are also some defeats of the automotive camp. For example, the tunnel projects under the hills of lyon initially included three branches with a planned exit to Hôtel de ville (Croix-Rousse) and another one to the south of Perrache (Fourvière).

For many actors of the time, these failures testify to a turning point in the development of the automobile in the city. The social, political, economic and environmental context was no longer conducive to such achievements. Beyond the failures of projects in the service of the automobile, one can emphasize a real desire to balance the cohabitation between the different modes of transport. Despite the abolition of tramways and the decrease in the frequency of public transport, after 1945, Lyon developed a vast network of trolleybuses and became the city of reference in this field. In addition, Louis Pradel, often described as a « car-centric mayor », defends the project of the metro, inaugurated in 1978 with three lines.

In parallel with the installation of metros, many pedestrian zones are inaugurated. The Park of the Tête d'Or, which was initially open to all, was banned from motor traffic. Since the 1970s, the Vieux Lyon district and the Mercière street were transformed into pedestrian zones. Later in the 1980s, the Plan Presqu'île, under Michel Noir, enabled a reconquest of the surface parking spaces, compensated for by the creation of the underground car parks that we mentioned earlier. (Cf. Appendix 7).

Figure 12: Michel Noir and Louis Pradel from left to right (Source : Wikipédia, consulted in january 2017) (Source : Grand Lyon, consulted in january 2017)

The exchange center of Perrache, decried as a horror, proves to be one of the first models of intermodality. Today, all modes of transport, cars, trains, metros, buses, coaches, taxis, pedestrians and tramways are connected there. Finally, Louis Pradel inaugurated the first relay parks of the agglomeration and in 1972 the first priority bus corridors to facilitate the transport of public transport.

But the most significant reconquests began in the 1990s in Lyon after the automobile model reached certain limits and in 2004 for the case of Lisbon. Indeed, during each of these periods, there is a real collective awareness of the very detrimental effects of the use of the car in town in Lyon and Lisbon. However, this awareness did not take place in the same way in both cities.

Here is a summary of the modal split at that time in the cities of Lyon and Lisbon :

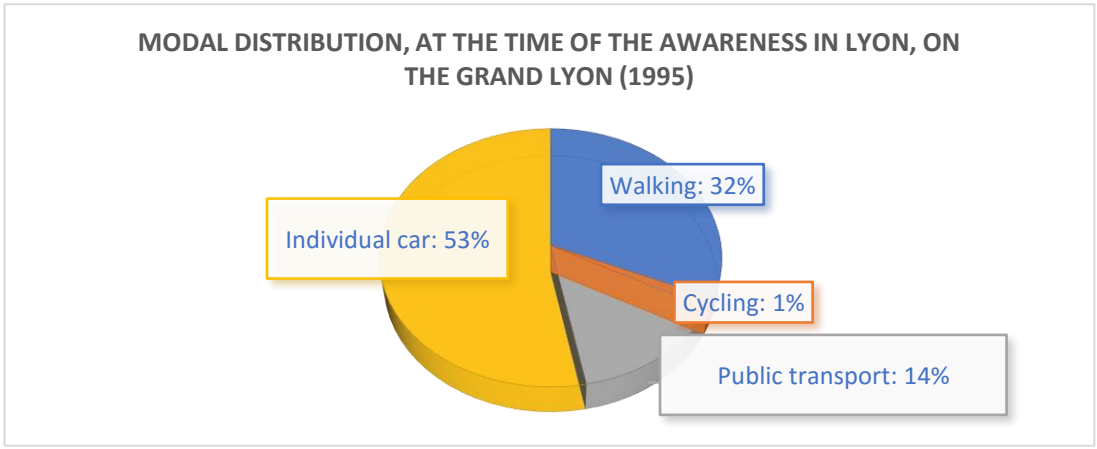

Figure 13: Modal distribution, at the time of the awareness in Lyon, on the Grand Lyon (1995) (Source : Pierre Soulard, 2011)

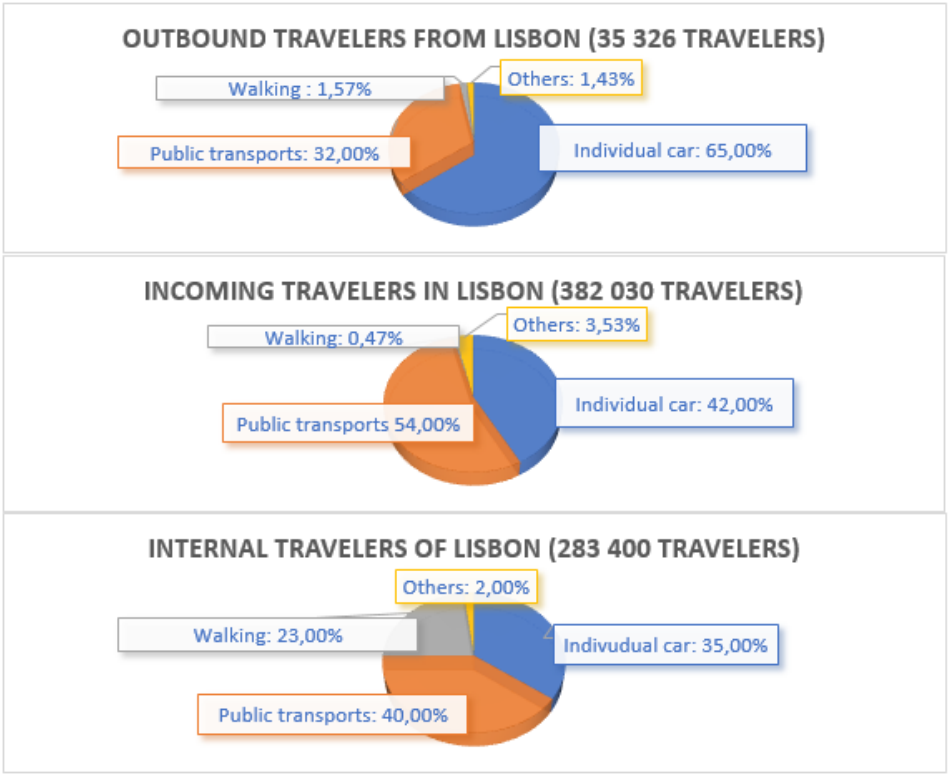

Figure 14: Modal distribution in Lisbon in 2001 (Source : Madalena Sottomayor Machado Costa e Silva, 2015)

4) Two different awarenesses

In the northern countries, the awareness began to emerge in the 1970s. This awareness is linked, on the one hand, to the oil crisis of 1973. Indeed, one understands the dangers of having an economy and a society that develop around an invention like the car, dependent on a single export resource.

It was necessary to wait until 1992 and the Maastricht Treaty for affirm an European policy on environmentally friendly mobility was adopted, with the integration of environmental protection standards in transport policy, which was reinforced in the published Commission White Paper, the same year on the common transport policy. This publication highlights the principle of sustainable mobility.

In addition, in 1997, the Amsterdam Treaty introduced new environmental protection measures in the transport sector. It gives the European Parliament powers of co-decision with the European Council in practically all areas of transport policy. Thus the end of the 20th century is marked by a certain number of legislative advances at European level with the environmental problematic as a red thread.

Moreover, the automobile has the consequence of a large urban sprawl and thus more costs of energy and infrastructure. The appendix 9 presents the correlation between energy requirements and city density. The cities of Lyon and Lisbon are not spared by this phenomenon of urban sprawl. (Cf. Appendix 10 and Appendix 11).

But this awareness, especially in France, is mainly linked to an excessive increase in pollution, accidents and congestion in cities. An estimate of 2006 compared the total investment cost of roads and infrastructure with all the indirect costs related to the car in Europe :

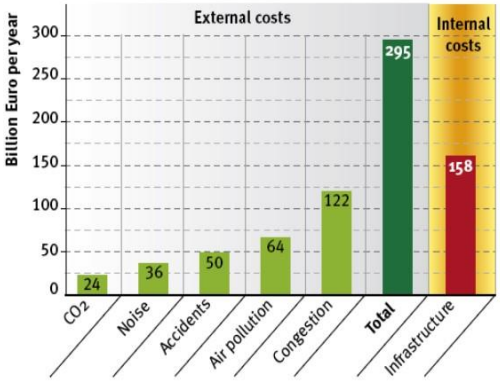

Figure 15: Comparison of the investments and the indirect costs due to the cars in Europe (2006) (Unit Study, 2006)

In Lisbon, it was above all the congestion due to cars, which caught the attention. Indeed a car occupes a space too important for too few individuals inside.

Figure 16: Spaces occuped (Car / Bus / Bike) (Source : Nunes da Silva, 2013)

In both cities, we have moved from the paradigm of « predict and provide » to the paradigm of « define and manage ». The idea now is to find the limits and define the management. Instead of predicting the number of cars that will be in the city, now, we prefer define the acceptable car limit and the management measures introduced.

In France, The Law of Orientation of Internal Transports (LOTI) of 30 December 1982 affirms the stakes in public transport. This law demands a right to transport, which must make it possible for all to travel « under reasonable conditions of access, quality and price as well as costs to the community ». Chapter II (Article 28) affirms the

implementation of Urban Travel Plans (PDU) as tools for planning and organizing transport, coordination of different modes of transport, and accessibility of these means of transport.

In 1997 the first French PDU was developed in Lyon. The latter sets the objectives for modal splitting to be achieved. The observation, at that time, was that the noise nuisance created by the uncontrolled circulation of the automobile became intolerable. Moreover, despite the heavy investments made in public transport, the results in terms of attendance were not satisfactory. Thus, the objective of the PDU of 1997 was to reduce the role of cars in urban mobility by other alternatives.

	Situation in 1995	Purposes of the PDU during 10 years
Walking	31,5%	31,5%
Two wheels	1,3%	2,1%
Public transport	14,1%	15,4%
Individual car	53,1%	51%

Table 7 : Purposes of the PDU of 1997 (Source : SYTRAL, 1997)

In Lisbon, this new paradigm emerges in the years 2004-2005. Indeed, the congestion of the city of Lisbon was manifested by a lot of uncontrolled parkings, as Mr. Colaço said. Parking was initially free and motorists took advantage of the opportunity to park at random, to the point that sidewalks had become unusable. It was therefore on the basis of the problem of parking that the concept of car management was introduced, not around the issue of air pollution or noise, as in Lyon.

Thus, in Lisbon, initially a policy of paid parking was put in place. In the second phase, the elected representatives decided to increase the supply of alternative transport. In Lyon, on the contrary, a policy of paid parking has been introduced, but it appears to be secondary in view of the increase in the supply of alternative transport. It must be understood that the offer of parking has a double role : it must make it possible to propose a viable offer for motorists, while limiting the number of entrants in the city.

In the next section, we will analyze alternative transport offers and the policies implemented in the cities of Lisbon and Lyon in order to meet the mobility challenge posed by the automobile.

III- Political orientations and mobilities offering in both cities

As mentioned above, a change of mentality has taken place in our two cities of study. We will now study the alternative offers proposed in these two cities today, analyzing their complementarity for the purpose of an inter-modal organization.

The objective of these two cities is to have better management of the car in order to limit its impact. There are two ways of doing this : reducing the rate of motorists to the benefit of alternative transport and fluidify the traffic in order to limit the nuisance of the remaining motorists.

1) Reduce the role of cars in urban mobility

In order to reduce the relative share of the car in town, it is possible to move towards the choice of dissuasive measures concerning the car, in seeking to « force » the user to get rid of his « addiction ». For examples, the urban tolls or the restriction access to the center for certain types of vehicles are dissuasives measures.

But there are also incentives for the alternative modes. It is a question of proposing more virtuous means of travel to the user, increasing the quality of these trips, etc.

In our case studies, neither Lyon nor Lisbon, use the urban toll or the restriction of access to the center. In the case of Lyon, a real incentive policy for alternative transport modes has been put in place. Lyon has the first public transport network in France (without Paris). Lisbon is the first urban network in Portugal.

So we will only talk about the policy of incentives that seem to have the most direct impact on changing mobility of users.

i. Management of the mobility in Lyon and Lisbon

It is observed that the absence of a mix between urban planning and transport organization, as well as the lack of multimodal planning of transport networks, leads in general to bad results in terms of mobility on a scale Local and at the scale of a « mobility area ». We will analyze in the next section the difference in organization between the cities of Lisbon and Lyon at the organizational level of mobility.

- Decision-making organization of the mobility in Lyon

Sources :

Fernando Nunes da Silva, Nuno Marques da Costa, 2001, *Território e administração – Gestão de grandes áreas urbanas - Chapitre « Transportes públicos urbanos – A situação em Portugal*. »

SYTRAL, December 2014, Dossier de presse – *Le SYTRAL devient la nouvelle autorité organisatrice des transports du Rhône* [online]

Website of Sytral : http://www.sytral.fr/

The French system ensures a clear separation of roles between public authorities and operators : the former are responsible for the definition of the transport policy and the type of financing envisaged and the latter must carry out the actual service.

The institutional organization of public transport is currently governed by the LOTI Act, which clearly defines the separation of the functions of the organization and the execution of transport services.

It is at the local level that the decisions are made, but the operation of the network presupposes that an organizing authority would be constituted when a large number of basic administrative units (the communes) exists.

In Lyon, the organizing authority for transport is the « Mixed transport union for the Rhône and the agglomeration of Lyon » (SYTRAL). Its territory of action includes 293 communes of the Rhone department, 1.7 million inhabitants and include among others the metropolis of Lyon. 28 elected members sit on the SYTRAL trade union committee, which is the decision-making entity that dictates the mobility orientations of SYTRAL.

The following table shows the distribution of seats and financial contributions :

	Seats	Financial participation (Millions of €)
Metropolis of Lyon	21	148,5
Rhône department	4	58,4
CAVBS (1)	1	2,1
CCEL (2)	1	0,9
6 other communes (3)	1	0,5
Total	**28**	**210**

Table 8: Distribution of the seats and financial participation in the SYTRAL (2014) (Source : SYTRAL, 2014)

Notes :

(1) The community of agglomeration of Villefranche-Beaujolais-Saône.

(2) Community of agglomeration of East of Lyon.

(3) Chaponost, Brindas, Grèzieu-la-Varenne, Messimy, St Consorce, Thurins

At the beginning, SYTRAL organized the networks of public transportation of Lyon (TCL), operated by the company KEOLIS, and OPTIBUS, a transport network for people with reduced mobility. But since 2015, SYTRAL is the

sole organizing authority. In addition to the TCL network and the OPTIBUS service, it organizes the CARS DU RHÔNE, LIBELLULE de Villefranche networks and the RHÔNEXPRESS rapid line which serves the Saint-Exupéry airport. (Cf. Appendix 12).

- Decision-making organization of the mobility in Lisbon

Sources :

Fernando Nunes da Silva, Nuno Marques da Costa, 2001, *Território e administração – Gestão de grandes áreas urbanas - Chapitre « Transportes públicos urbanos – A situação em Portugal*. »

Website of the tawn hall of Lisbon : http://www.cm-lisboa.pt/viver/mobilidade

In Portugal, the organization of urban transport by bus and tramways is a municipal responsibility. Metro and the trains still belong to the State. Thus, it is a complex organization at the level of the metropolitan area, because it involves, on the one hand, a dialogue between several municipalities, not always on the same political side, as far as, buses and tramways are concerned and, on the other hand, a dialogue between municipality and State, as far as subway and trains are concerned. Usually, no organization plays the role of organizing authority in Portugal.

In Lisbon, the decision-making organization for mobility is currently divided between five deputy mayors : one responsible for road planning and transport in general, one responsible for bicycles and alternative energies, one responsible for managing traffic and parking, another for pedestrians and one for security and traffic police. Thus, within a municipality such as Lisbon, decision-making can not be quick and efficient because the different mobility variables are not controlled by the same entity.

In the region of Lisbon, urban and suburban transport is guaranteed by many operators. In the cities of Lisbon, urban transport concessionaires, Carris, Comboios de Portugal (CP) and Metropolitano de Lisboa, are state-owned enterprises. In Lisbon, on 17 March 2015, the bus company Carris, the nationalized companies Metropolitano de Lisboa and Transtejo Group (river shuttles) joined together to create « Transport of Lisbon ». The latter was created in a way of reducing expenses due to the organization of boards of directors but not in a multimodal logic, according to Mr. Colaço. Nevertheless, this grouping of the various public transport managers made the set-up of intermodal solutions possible.

Moreover, since the end of 2016, the Carris transport company has been municipalized, which enabled to offer a richer and more precise bus service, in consultation with the decision-making powers of the municipality. At that time, it was also envisaged to municipalize Metropolitano de Lisboa but salary oppositions prevented it. But when Carris was municipalized, this resulted a failure concerning the challenge of mobility because « Transport of Lisbon » was cancelled the beginning of 2017.

The municipalization of Carris was possible because the mayor of the city and the government were in the same political side. Unfortunately, it is sometimes conflicts of interest between different political boundaries that

complicate the development of a rich public transport offer in the region of Lisbon. Indeed, to have a diversified offer, it is necessary a strong cooperation and coordination between the different town halls. The creation of a common organization, as in the case of the city of Lyon, makes it possible to overcome these political conflicts.

We will see later that the offer of public transport is more complete in Lyon than in Lisbon. This is due to a number of reasons, including the fact that awareness has arisen earlier in Lyon than in Lisbon, France's financial resources are then higher than in Portugal in terms of investment but above all decision-making has been centralized in Lyon through SYTRAL since 1990 and even more in 2015, while Lisbon failed on that.

ii. Public transport in both cities

- The mobility offer proposed by the SYTRAL in Lyon

Sources :

Grand Lyon, May 2016, Diaporama – *Grand Lyon - Panorama de la Mobilité*.

Website of Sytral : http://www.sytral.fr/

Website of TCL : http://www.tcl.fr/

Website of Vaporetto : http://www.lesyachtsdelyon.com/vaporeto.html

Website of Cars du Rhône : http://www.carsdurhone.fr/

REAL, 2014, Plaquette de communication – *REAL - Ensemble, plus vite, plus proches*.

Pierre Soulard, 2014, Diaporama – *Le bouquet de mobilité du Grand Lyon*.

SYTRAL, December 2016, *Enquête déplacements 2015 de l'aire métropolitaine lyonnaise - Résultats sur le Scot de l'agglomération lyonnaise* [online].

Over the whole of the Lyon metropolis, we counted over 4 054 000 trips per day in 2015 (SYTRAL, December 2016). The constraints of the automobile revealed at the end of the 20th century still persist in Lyon. It is necessary to continue to reduce the dependence of men on the individual car. The mission of the SYTRAL in Lyon is to develop public transport in the Rhône and Grand Lyon by offering a complete range of public transport services. This organization is responsible for funding the network and awareness campaigns of soft modes such as cycling and walking. In addition, it develops and pilots the Urban Travel Plan (PDU).

Here the entity of SYTRAL, which will mainly interest us, will be the organization TCL. On the whole TCL network, represented 1.5 million users are counted every day in 2016. The TCL network is divided in 4 subway lines of 30.3 km, representing 47% of TCL traffic each day, 5 tramway lines 48.3 km corresponding to 15% of the traffic and 132 bus lines and 8 trolleybus lines for 38% of the traffic. In addition, there are 2 funiculars on a 1.2 km network and 7,300 parking spaces for the users of the network (Source : TCL, 2016). (Cf. Appendix 14).

We can also precise that there is a river shuttle service along the Saône, manage by the society named Vaporetto, which serve 4 station, La Confluence, Bellecour, Hôtel de Ville and Vaise. However, this service is new and

very little developed. In average there is a shuttle every hour and a half. Moreover, it is perfectly private and independent (Vaporetto, 2017).

Let us also mention the Cars du Rhône network, with its 33 lines serving the main axes of the department and the main connections (with other bus, train or bus lines in the TCL and Libellule). In figures Cars du Rhône represents 320 000 inhabitants served, 7.5 million trips per year and 25 000 students transported each year (Cars du Rhône, 2017).

And finally, there is in Lyon the « tram-train of the West of Lyon » which serves the periphery of Lyon. This train was partially inaugurated from Lyon-Saint-Paul to Sain-Bel on September 22nd, 2012 and from Tassin to Brignais on December 8, 2012. The network has three ways starting from Saint-Paul station and serving twenty-three stations direction of Brignais, Sain-Bel and Lozanne. And of course, the TER Auvergne Rhône-Alpes is used by workers in Lyon, living outside the metropolis (Source : REAL, 2014) (Cf. Appendix 13).

	Belongs to the SYTRAL	Doesn't belongs to the SYTRAL
Subway	X	
Bus and Trolleybus	X	
Tramway	X	
Cars du Rhône	X	
Trains		X
River shuttle		X

Table 9: Management of the public transportation by the SYTRAL

Thus, in Lyon, it is interesting to note that the SYTRAL organization manages and organizes a large number of alternative transports. We are going to see that in the case of Lisbon, this type of decision-making power is not present.

- The mobility offer formerly proposed by « transport of Lisbon »

  - Metropolitano de Lisboa

Source :

Website of Metropolitano de Lisboa : http://www.metrolisboa.pt

In Lisbon, the organization responsible for running the metro is Metropolitano de Lisboa. The network is divided into four independent lines, covering approximately 43.2 km and 55 (Cf. Appendix 15). Every day 500 000 users use the Lisbon metro network. With regard to the quality of the offer, the waiting time is on average less than 4 minutes during peak hours and up to 12 minutes during periods of declining demand.

○ Carris

Source :

Website of Carris : http://www.carris.pt

The company operating the bus and tramway network is Carris. The network is divided into 57 lines of urban mechanical tramway, 78 bus lines extending over 677 km in the region of Lisbon. There are also three urban funiculars, two of them date from 1914 and one from 1926. Their cumulated capacity is 109 seated and standing users (Cf. Appendix 16). In 2013, the Carris network had 170 million users, an average of 465,750 passengers per day. Within the city of Lisbon there are 80 km of bus lane. However, a paradoxical phenomenon appears in the offer proposed by Carris because, since 2012, an increase in tariffs has taken place (approximately 25%) and coupled with a reduction of lines and services (of the order of 20% per kilometer traveled) by decision of the government which wishes to reduce the operating deficit of the company.

As far as the quality of the offer is concerned, this varies. It turns out that during periods of increased demand, inter-vals between services are on average 10 minutes. As for the other periods, this time is doubled.

○ Transtejo & Soflusa

Source :

Website of Transtejo : http://www.transtejo.pt

Transtejo & Soflusa is the river shuttle service of Lisbon metropolis area (AML). This is the merge between Transtejo created in 1975 and Soflusa created in 1993. It is a key element in the crossing of the Tagus River. Nowadays, the shareholder of this transport service is the State.

In 2010, there are 28 500 000 users of inland waterway transport per year, representing 4% of total transport in the metropolitan area of Lisbon, which is connected to the network by 11 stations.

○ Other operators in the region of Lisbon

Source :

Madalena Sottomayor Machado Costa e Silva, July 2015, *Padrões de Mobilidade e Crescimento Urbano – Análise Comparativa entre Lisboa e Florianópolis*.

In addition to Carris and Metropiltano de Lisboa, the rail network of Portugal is operated by CP. To this must be added Vimeca Lisboa Transportes, a company that serves the suburbs of Lisbon with cities such as Amadora, Queluz or Oeiras or Transportes Sul do Tejo (TST), a bus route network on the south bank with some connections to Lisbon.

Thus, in the case of Lisbon and its region, operators are very numerous. It is therefore more difficult to implement an intermodal organization on a large scale.

	Number of kilometers (km)	Number of stations	Number of users (2010)
Metropolitano de Lisboa	43,2	55	182 781 204
Carris	678	2106	220 554 380
CP	143	143	94 711 885
Vimeca	1490	2153	53 807 245
TST	3418	3790	72 364 373
Transtejo & Soflusa	36	11	28 500 000

Table 10: Different actors of the mobility in Lisbon (Source : Madalena Sottomayor Machado Costa e Silva, 2015)

This leads to the following modal distribution in 2010 :

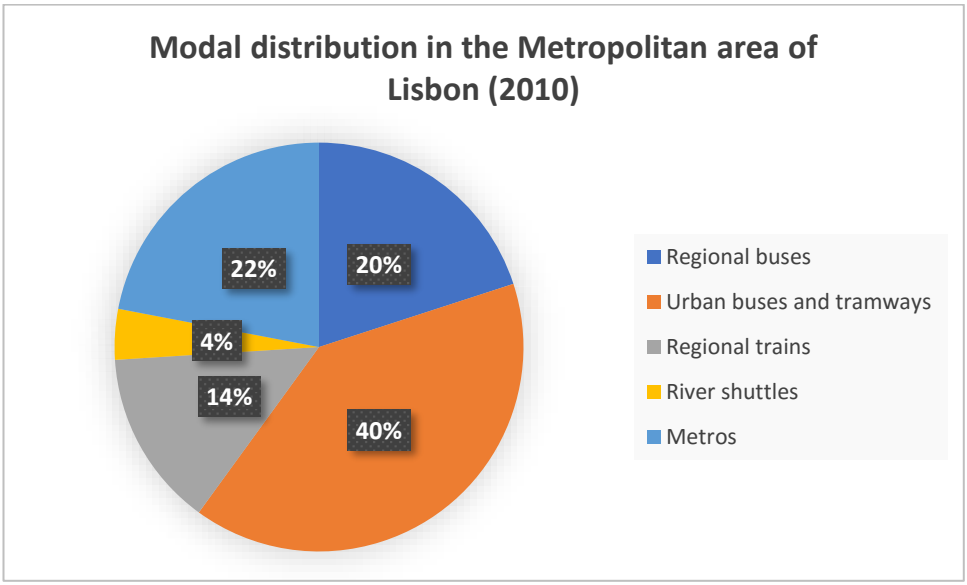

Figure 17 : Modal distribution in the Metropolitan area of Lisbon (2010) (Source : Madalena Sottomayor Machado Costa e Silva, 2015)

Thus, as opposed to Lyon, there is no decision-making power that brings together all the players in order to organize mobility throughout the territory. It is imperative to create a decision-making authority that can organize mobility over several municipalities, as in the case of SYTRAL.

Over the whole region of Lisbon, this disparity of mobility actors poses problems. For instance the level of prices or transport schedules. Transport operators do not necessarily coordinate when changing schedules, connections or tariffs, especially in the metropolitan region, where the problem remains mainly in the link between urban transport and suburban transport. The absence of an entity that plans, coordinates and finances public service obligations and establishes uniform and consistent pricing rules leads to that the public transport situation is deteriorating despite major investments in infrastructure and equipment which have been achieved in recent years.

Finally, the wishes and orientations in Lyon and Lisbon are almost as strong. However, effi-ciency is greater in Lyon thanks to the existence of a single decision-maker : the SYTRAL.

- Policy orientations in Lyon and Lisbon

In Lyon, the objectives are fixed over ten years in the Urban Travel Plan. Thus, the orientations are truly known because they are discussed, noted and presented to the entire population on the Grand Lyon website. However in Lisbon no document of this kind exists.

The following section will analyze the PDU of 1997 and the PDU of 2005 where are formalized the political orientations of the SYTRAL and the metropolis of Lyon until 2015. Regarding Lisbon, we will rely on the ideas revealed in the book « O desafio da mobilidade » in order to grasp the orientations, in Lisbon, even though this book is not an official document.

- Urban Travel Plan of Lyon

Sources :

SYTRAL, 1997, *Le plan de déplacements urbains de l'agglomération* lyonnaise [online].

SYTRAL, 2005, *Révision du PDU de l'agglomération lyonnaise*.

Grand Lyon, May 2016, Diaporama – *Grand Lyon - Panorama de la Mobilité*.

REAL, 2014, Plaquette de communication – *REAL - Ensemble, plus vite, plus proches* [online].

To understand the political choices made in Lyon, it is important to analyze the various PDU implemented since the first one of 1997, developed by SYTRAL. The PDU of 1997 was oriented towards a voluntarist scenario in favor of soft modes and public transport. In 2002, many of the objectives advocated in the PDU were already achieved.

One of the most emblematic actions is the commissioning of two tramway lines (T1 and T2), serving the main university sites of the agglomeration and the communes of Bron and Saint-Priest. Other measures include the development of the Optibus network, the creation of new relay carparks, the development of pedestrian and bicycle charters or the extension of the cycling network. In 1992, Lyon inaugurated the metro line D. And in 2000, the line B is extended to the Gerland stadium. This PDU made possible to affirm the place of the soft modes by registering them physically in the city.

	Situation in 1995	Purpose of the PDU for 10 ans	Situation in 2006
Walking	31,5%	31,5%	32,5%
Two wheels	1,3%	2,1%	2,2%
Public transport	14,1%	15,4%	16,1%
Individual car	53,1%	51%	49,2%

Table 11: Purposes of the PDU reached on the territory of the Grand Lyon (Source : Grand Lyon, 2016)

However, these figures are to be nuanced, because the still have a very high degree of inequality, in 2006, between Lyon-Villeurbanne and the Grand Lyon.

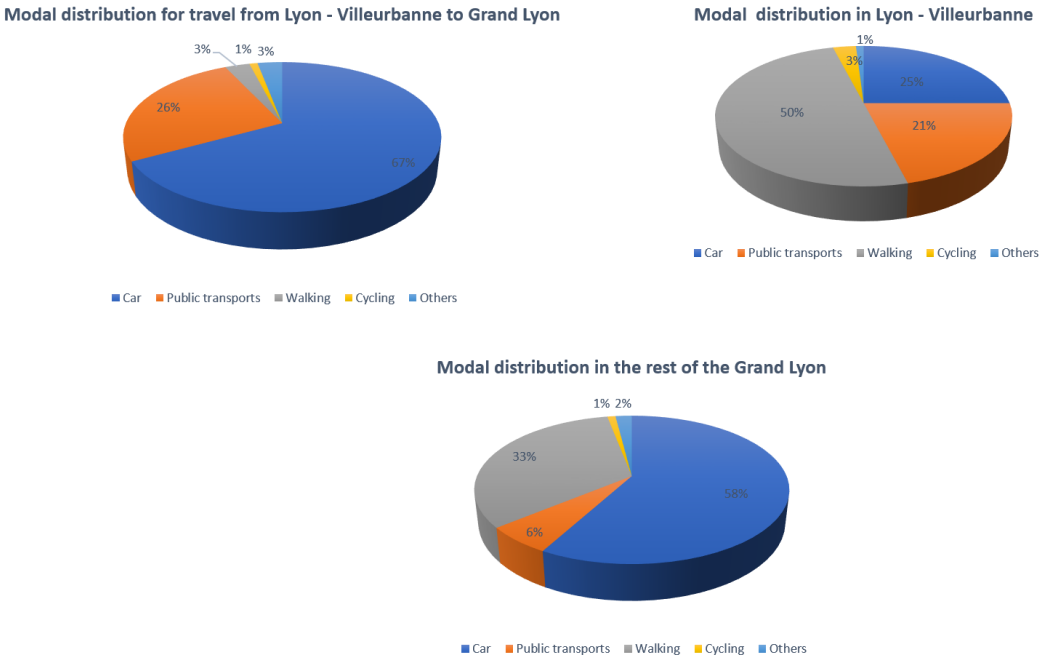

Figure 18: Modal distribution in the region of Lyon (2006) (Source : Grand Lyon, 2016)

Despite the launch of the TER Rhône-Alpes in 1986, a large number of users outside Lyon and Villeurbanne use the car. It is important to note that the State was responsible for the regional rail networks until 1997. After this year, the Rhône-Alpes region became officially responsible for the TER network, which enabled them to better organize the long distances mobility over the region.

The results of the PDU of 1997 appear satisfactory. Nevertheless, in 2005, the SYTRAL decided to revise the PDU previously drawn up in order to match the law on solidarity and urban renewal SRU and with the possibility to jointly conduct the reflections between the PDU and the local urban plan (PLU). Among other things, the SRU Act, ratified in 2000, affirms the existence and necessity of a link between mobility and urbanism in the reflections of urban development.

The objective of the revision of the PDU is to reinforce the policy pursued since 1997 to truly increase the role of alternative modes and reduce the share of the car. The revised PDU was approved on June 2, 2005 and is organized around three main axis : leave room to all modes of transportation in agglomeration, to have a safe and pleasant agglomeration and to have a fair agglomeration. This is reflected in these actions :

- Reducing air pollution and noise
- Improving travel safety
- Propose real choices of public transport

At the end of the PDU of 2005, 200 actions were defined. Each community had to carry out the actions in its field of competence in a coordinated way. But overall, the management of the 200 shares was managed by SYTRAL and the Grand Lyon. It is imperative, in this PDU, to improve the quality of public transport. For this purpose, the PDU plans to continue to develop strong lines such as tramways and metros in Lyon : « In general, the growth of the public transport clientele will have to lead to a reflection on the increase in the supply of the strong lines (metro, tramway) as for the surface network ». « The revision of the PDU is now an opportunity to improve the circulation and regularity of bus lines in order to increase the number of public transport customers and to reduce operating costs » (Revision of the PDU of the metropolitan area of Lyon, June 2005).
Within the framework of the objectives set out above, the following is an overview of the arrangements made between 2005 and 2016, within the framework of the PDU of 2005.

Subway lines A, B, C and D already existed before that the PDU of 1997 was established. However, as part of the PDU of 2005, extensions took place. In 2007, line A was extended to Vaulx-en-Velin, east of the line, in the Carré de soie district. In 2013, line B is extended from Gerland to Oullins station, the current terminus of this metro B.

Concerning the improvement of the tramway offer, we have already stated the commissioning of the T1 and T2 tramways in 2001 under the PDU of 1997. However, the T1 line was extended in 2005 by three stations in the South of Perrache on the Charlemagne course and in 2014 it is extended to the station Debourg of line B of the metro, in order to connect the peninsula to Gerland. The T2 line was extended to Saint-Priest-Bel-Air in 2003.

Moreover, three lines have been added since these extensions. First of all, the line T3 in 2006 between the station of the Part-Dieu in Lyon and the industrial zone of Meyzieu in the east of Lyons. The T4 line is also added in 2009 linking the Feyzin clinic to the Doua scientific campus located in Villeurbanne. Finally, the line T5 is inaugurated in 2012. This new line connects Grange Blanche to Eurexpo.

The offer of trolleybuses and buses has also been improved. Here we will only talk about the addition of two new trolleybus lines. In 2006, the C1 trolleybus line was put into service. The line C1 rolls, almost entirely, on a track reserved for it. It connects the Lyon Part-Dieu station to the Cuire metro station. In 2007, line C3 is inaugurated. It is also on a reserved road. Its mission is to facilitate the travel between Vaulx-en-Velin and the center of Lyon by crossing Villeurbanne and many major poles of the agglomeration such as the district of La Part-Dieu and its station or the peninsula of Lyon. It connects the station of Lyon-Saint-Paul with the municipality of Vaulx-en-Velin.

As part of the PDU of 2005, the metropolitan railway network was developed. In August 2010, the Rhônexpress was created. It connects the Part-Dieu business district with Saint- Exupery International Airport of Lyon. However, the major project is the REAL project launched in 2005.

The REAL project is made up of 12 partners, all public transport operators (Rhône-Alpes Region, Ain Department, Isère Department, Rhône Department, Grand Lyon, metropolis of Saint-Étienne, Agglomération of Isère, the community of agglomeration of the Pays Viennois, Community of agglomeration of Villefranche-Beaujolais-Saône, SYTRAL, SNCF). It focuses on major work-at-home routes. And as part of the REAL project, the TER network has been widely developed.

- « Urban Travel Plan » of Lisbon

Source :

Town hall of Lisbon, July 2005, *O desafio da mobilidade*.

The guidelines of Lisbon for the years 2004 - 2005 and the following decade are based on the idea of increasing the supply of public transport in order to reduce the part of individual cars.

In this context, the objectives are :

- Ensure that the proposed offer can meet the demand with quality and satisfactory alternative transports.

- To encourage the use of public transport and soft modes, less space-consuming and with a lower ecological impact.

-Integrate a pricing strategy for all transit users to meet the need for intermodality.

In order to achieve these objectives, the following study proposes :

- Promote the centralization of different modes of public transport in order to encourage the intermodality and to reduce the need for individual car.

- Ensure the inclusion of mobility studies in the municipal plans at all levels.

However, with respect to soft modes, only the pedestrian subject appears as an alternative response to the car for short distances in 2004-2005. In order to promote walking, it is decided to create pedestrian spaces which are ranked so that the pedestrians have better conditions for circulation. We are going to see in the next part how both cities have dealt with the question of soft modes, and how they seem to orient themselves for the years to come.

iii. The renewal of soft modes

- A willingness of soft modes policy in both cities ?

Source :

SYTRAL, 2005, *Révision du PDU de l'agglomération lyonnaise*.

When we talk about the active modes, we consider cycling and walking. In Lyon, in the PDU of 2005, is affirmed the desire to reinforce the policy in favor of soft modes : « Before being a motorist or passenger of public transport, all the users of the city are pedestrians. It is therefore around the pedestrian that the urban space must be organized. » (Revision of the PDU of the metropolitan area of Lyon, June 2005). To encourage the use of these active

modes, it is necessary to ensure the safety of these users. Thus, the PDU of 2005 calls for a real separation of the different means of transport : « For the agglomeration network, the separation as far as possible of public and collective transport […] the zones 30 where pedestrians and other modes coexist harmoniously, will be systematized on the local service network to constitute a mesh of zones with calm traffic over the agglomeration ».

In Lyon, only the cycling network development policy has been formalized. The results obtained for walking are nevertheless encouraging. In the case of Lisbon, walking was considered the only viable solution to replace the car on short journeys. This fundamental difference between Lyon and Lisbon is explained by different meteorological and topographical conditions (Cf. Appendix 17). Indeed, Lisbon politicians considered in 2004 - 2005, rightly or wrongly, that the users of the bicycle would not be numerous. However, this mentality seems to change nowadays, as we will see later.

The development of these soft modes responds to multiple challenges : public health, equity and social cohesion, sustainable development (economical in terms of space, energy, noise, pollution, etc.), desaturation of public transportation networks, reduction of expenditure. In Lyon, as we saw earlier, the choice was to move towards the development of cycling. However, this latter orientation seems more visible. In Lisbon, initially, the policy of soft modes is assumed in favor of walking, but a change tends to take place in recent years.

- Development of cycling in Lyon

Sources :

Grand Lyon - Direction de la voirie, 2003, *Plan mode doux 2003* [online].

Grand Lyon - Direction de la voirie, 2008, *Plan modes doux 2009 – 2020* [online].

Grand Lyon, Mai 2016, Diaporama – *Grand Lyon - Panorama de la Mobilité*.

Pierre Soulard, 2014, Diaporama – *Le bouquet de mobilité du Grand Lyon*.

Clément Cerniot, Florian Perdrix, Julien Fernandez, 2015, Rapport – *Tunnel de la Croix-Rousse mode doux*.

In order to ensure good management of these soft modes and to provide an effective response to the requirements of the PDU, the Grand Lyon set up in 2003 and from 2009 to 2020 the soft modes plans (PMD).

Under the PMD of 2003 (PMD1), over 80 km of cycling routes were created between 2001 and 2008 (10 km / year) for a cycling network totaling 320 km in the end 2008, a total of 4000 bike parking lots at the end of 2008. An other purpose was improved safety on more than 30 difficult points of the bike network (blackheads of safety or discontinuity). But especially on May 19, 2005 is launched the urban bike rental system Velo 'v.

Under the PMD of 2009-2020 (PMD2), the emphasis is on the development of bicycles. Indeed, the development of walking, in the Lyon mentality, seems to be considered more as a consequence of a reflective and moderate urban planning than a real responsibility of the service mobility.

The objectives are clear for the issue of cycling : reaching 5% modal share by 2014 and 7.5% by 2020 through the extension of the existing bike network of more than 200 km and the development and diversification of Bicycle services.

Thus, to encourage the use of bicycles, the Grand Lyon in 2009 wanted to develop the reserved roads on the structuring axis of the network. This is reflected in the development of bike lanes, mixed bus / bicycle corridors, bike paths, bi-directional bike lanes that allow bi-directional traffic on one-way roads For other vehicles under certain safety.

	Existing in 2008	Purpose in 2014	Purpose in the end of 2020
Size of the cycling network in the Grand Lyon	320 km	520 km	920 km
Extension of the network	+10 km/year	+30 km/year	+50 km/year
Purpose concerning the cycling modal distribution	2,5%	5%	7,5%

Table 12: Summarize of the purposes of the PMD2 (Source : PMD2, 2008)

In addition, to cycling facilities, it is important to limit major obstacles to cycling, such as the risk of theft or vandalism, for example. In addition, it is necessary to facilitate access to an electrically assisted bicycle for some. To this end, the city of Lyon has set up in 2012 assistance for the acquisition of Bikes with electrical assistance (VAE), 1,618 grants have been allocated for a 75% declared modal shift.

It is also important to promote the combination of bikes and public transport. The problems of intermodality and safety of the parked bike are linked. To meet the demand for long-term parking, it was decided to set up secure parking areas at railway stations, transit parks, etc. In particular, the 2012 REAL project will modernize stations, parks and parking lots of the public transport.

As an emblematic construction for « soft modes », we can mention the tunnel « soft modes » of the Croix-Rousse. This project appears as a symbol as regards the orientation of Lyon towards the soft modes. This tunnel completes the historic road tunnel of the Croix-Rousse of 1757 meters. Initially the secondary branch, which became a tunnel reserved for soft modes, was a safety tube. The city also wanted to push the project a little further. The latter, with a length of 1763 meters, is unique in the world. It has 3 traffic lanes : a first central lane for pedestrians, a second lane on one side for buses and a third lane for cyclists on the other. Light and musical atmospheres are provided in order to reduce the anxiety caused by the journey on foot in a tunnel of this length. In 2014, there were almost 5000 users at the weekend and around 3500 each day of the week.

In addition to the development of soft modes, especially cycling, particular emphasis is placed on the development of information and awareness. Thus, within the framework of the PMD2, it is decided to develop the website

dedicated to Vélo'v. As part of the development of the site, maps of the cycling network, the Vélo'v network and all existing and future cycling services are available online. Information and sensitization campaigns on the themes of cohabitation between users, road safety or Vélo'v's offer are also in place.

- Make the life easier for the pedestrians

Sources :

Website of the town hall of Lisbon : http://www.cm-lisboa.pt

Town hall of Lisbon, December 2013, *Plano de Acessibilidades Vol 1*.

Fernando Nunes da Silva, 2013, Diaporama - *Lisbon : mobility for the XXI century*.

Accessibility can be defined as the ability to use a public space equally, permanently and autonomously. Accessibility is therefore an objective quality factor.

In order to respond effectively to the need to develop this active mode, the town hall of Lisbon set up the first Lisbon Pedestrian Accessibility Plan (PADL) under the aegis of Mr Nunes da Silva, then deputy mayor, in 2013. The idea is to make of « Lisbon City for All » a collective challenge. The document being young, it is difficult to directly evaluate the arrangements that have already been made. So, here, it will be state the main ideas of this document and some emblematic facilities.

Thus the objectives of the PADL are :

- To prevent the creation of new obstacles ;

- To mobilize the community to create a city for everyone.

In this context, it is asserted the idea that the road network must guarantee pedestrians the opportunity to move without taking any risk for their physical health. Some areas do not allow this, it is decided to correct these dangerous areas. The best thing to do, according to the responsible, is to create a true pedestrian network, continuous, confortable and safe.

In 2013, when the PADL was written, only the historic center of Lisbon was really a safe place for pedestrians as shown on the following map :

Figure 19: Pedestrianl potential in Lisbon (Source : Fernando Nunes da Silva, 2013)

However, the goal of the PADL is to extend the red zone to the entire city of Lisbon. In order to do this, the first project involves bringing the sidewalks back into compliance. Indeed, the PADL reveals that the objective of comfort and safety of the sidewalks is compromised by the lack of conformity with the technical standards of accessibility. (Cf. Appendix 18).

It is also recalled the right that the pedestrian must have a continuous, regular and unobstructed circulation space with more than 1,20 m throughout its length. This right is altered when the installation of obstacles on the pedestrian paths creates interruptions or irregularities. (Cf. Appendix 19).

Moreover, another problem is the sometimes doubtful cohabitation between cyclists and pedestrians. The creation of the cycling network remains useful and necessary, however this sometimes leads to the degradation of the pedestrian network. It is necessary that this cohabitation is well thought out to avoid that the establishment of cycling infrastructure on the tracks reduce the free width of the pedestrian path.

As part of the PADL, some of the facilities of Lisbon are truly emblematic to the point that tourists visiting the historic center on foot are fascinated by that. We can talk here about the two elevators of the Lisbon castle inaugurated in August 2013, which provide quick access to the Baixa district until the São Jorge castle (Cf. Appendix 20). In terms of quality improvements and the reappropriation of the public space by the pedestrian, we can also talk about the redevelopment of the place of commerce along the Tagus River :

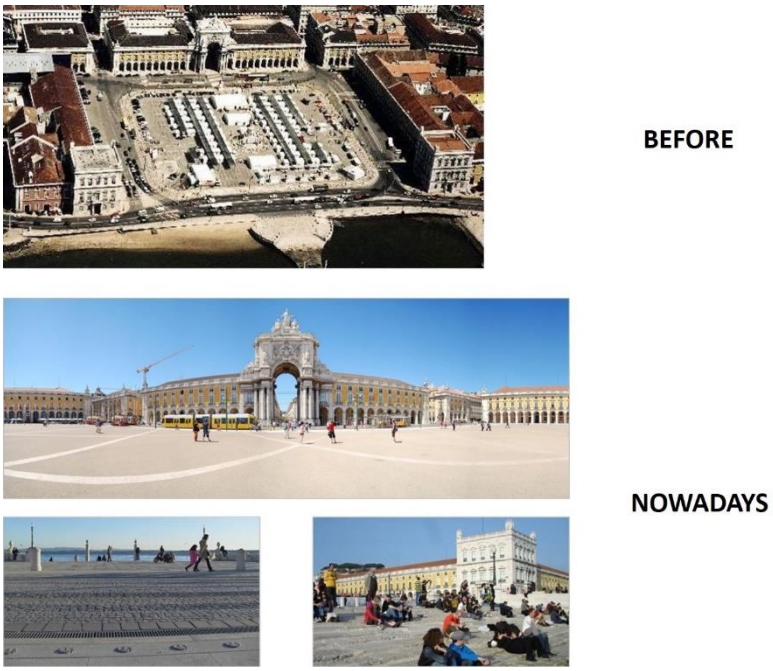

Figure 20 : Redevelopment of the Praça de comercio in Lisbon (Fernando Nunes da Silva, 2013)

In Lisbon, the emphasis was placed on developing the pedestrian potential of the city. The aim is a pedestrian quality throughout the city of Lisbon like in the historic center. However recently the bike seems to have found its place in the White City.

- Towards a development of the cycling in Lisbon

Source :
Website of the town hall of Lisbon : http://www.cm-lisboa.pt

At the present time, in Lisbon, it is still in a verification phase that the bicycle is no longer considered as a recreational use tool, but as a transport which promotes public health and which makes it possible to create better conditions for urban harmony. A shift has recently taken place, and the joint use of public transport and bicycles seems to play a key role in achieving this objective and also in reducing traffic flows. Currently, the establishment of a bicycle sharing service is under discussion.

Lisbon wants to create a cycling road network linking the main parks and green spaces of the city as part of a strategic investment in soft mobility and cycling as a complement to the local and regional transport system. This involves the installation of bicycle parking areas throughout the city for owners and sets of areas for renting electric bicycles in the event that this system is developed (Cf. Appendix 21). These investments are intended to contribute to reversing the trend of private car use in short haul routes where bicycles are a competitive mode of transport and to promote the use of bicycles in daily commuting.

The existence of a first network of quality infrastructures for cycling in Lisbon is an urgent requirement for increased use in the city and consequently for the creation of conditions for the widespread use.

Thus the cohabitation between different modes of transport is complicated in the management of the mobility. However, in the city of Lyon, the establishment of zones with regulated speed allows a gentle cohabitation, notably within the framework of zone with limited speed to 30 km/h (« Area 30 »).

- Areas 30 and cohabitation between different users : the example of Lyon

Sources :

Website of the city of Lyon : http://www.lyon.fr

Pierre Soulard, 2014, Diaporama – *Le bouquet de mobilité du Grand Lyon*.

Here we will only mention the case of Lyon where the « areas 30 » are much more developed, although Lisbon is beginning to move towards the establishment of these same types of zones.

In France, this type of zone is introduced into the highway code by the decree of 29 November 1990. It corresponds to a regulated speed zone at 30 km / h. This leads to a more regular rate of traffic, an increase in safety, less pollution, without penalizing the motorist. In the case of Lyon, the average speed in the peninsula, before the creation of this zones, was 21 km / h. Are concerned all areas where « local life predominates » : shopping, school, residential, etc.

The Lyons area is recognized as the largest in Europe (500 ha). The « area 30 » in the downtown of Lyon has 87 km of paved traffic lanes (from La Croix-Rousse to Perrache via Vieux-Lyon). (Cf. Appendix 22).

iv. The new ways to use cars

Thus we analyzed the offer of public transport in the cities of Lisbon and Lyon as well as the soft modes such as cycling and walking. However, the goal is not to completely eliminate the car in our societies. Indeed, the car rate must be decreased because the car space occuped, as well as the pollution which is producted become too large. However, it is possible to have about the same number of people who take advantage of the use of the car while decreasing the number of cars. Indeed, the average occupancy rate per car is 1,25 people/ veh in Europe. It is on this observation that the principle of carpooling is based. The carpooling is the sharing of the same vehicle by several people who can use one car each.

- Carpooling

Sources :

Website of carpooling of Lyon : www.covoiturage-grandlyon.com

Grand Lyon, 2013, *Enquêtes Covoiturage 2013* [online].

Pierre Soulard, 2014, Diaporama – *Le bouquet de mobilité du Grand Lyon*.

In the case of the cities of Lyon and Lisbon, the interest is to develop carpooling more regularly on commuting journeys within their respective regions.

Thus it is in this perspective that the Grand Lyon has created its own carpooling website, whose number of registered in 2016 is 19200. On this website, we can find the 53 carpooling areas created by the Grand Lyon. 5% of the inhabitants of the Grand Lyon affirm that they regularly practice carpooling for study or work trips, that is 40 000 regular carpoolers.

The carpooling does not appear in the PDU of 2005, so its development is not yet optimal in the metropolis of Lyon. However, in 2015, a revision of the PDU took place, taking effect in 2017, and carpooling became a key concept.

In Lisbon, carpooling is not formalized by the municipality, but it is present at the nodes of the motorways of Cascais and at the intersection between the bridge of 25 April and the municipality of Almada. However, it is difficult to evaluate its effectiveness since it is a popular initiative, not supervised by services of the municipality.

In Lyon, the carpool survey of 2013 reveals very interesting data on carpooling, the conclusions of which can be generalized in the case of Lisbon as well.

The following table presents the reasons for refusal to use carpooling according to this study :

Reasons	%
Working hours too variables	28
I don’t know any capooler	24
I like my current transport	21
I prefer to be quiet	21
I never thought about it	19
Variable destinations	9
Other activities before and after work	8
I am afraid that my carpooler will not make the return trip	3
Carpooling poses insurance and safety problems	2

Figure 21 : Main reasons for not use carpooling (Source : Grand Lyon, 2013)

From this table, it can be seen that some reasons for refusal to use carpooling are unchangeable and will persist (yellow), however some reasons can be avoided and improved (green) if the politicians take charge of the management of carpooling on the basis of this study.

The following table shows the number of future potential carpoolers :

Behavior regarding the carpooling	%
I would be able to use carpooling in the future	32
Why not	44
I don't want to use that	24

Figure 22 : Future potential users of carpooling (Source : Grand Lyon, 2013)

It is interesting to note that the potential of carpooling is high, especially with the emergence of a new generation accustomed to this type of practice and perhaps more concerned with the issues related to global warming.

In addition to the ratio of car use recalled in the introduction to carpooling, it is important to remember that an individual car is little used in a day, only 1 hour per 24 hours on average. The rest of the time it occupies a public or private space, visually and physically. The idea of carsharing is based on this observation. We will analyze the offer of carsharing in the cities of Lyon and Lisbon.

- Carsharing

Sources :

Website of the city of Lyon : http://www.lyon.fr

Website of the town hall of Lisbon : http://www.cm-lisboa.pt

Website of Mobi.E : https://www.mobie.pt

Grand Lyon, Mai 2016, Diaporama – *Grand Lyon - Panorama de la Mobilité*.

Pierre Soulard, 2014, Diaporama – *Le bouquet de mobilité du Grand Lyon*.

The carsharing responds to a challenge of reducing the number of cars per family and the recovery of public space. In Lyon there are 4 different carsharing companies (Citiz LPA, Bluely, Sunmoov, Wattmobile), for a total of 400 vehicles and 4000 subscribers. Like carpooling, carsharing is not treated in the PDU of 2005, but it is included in the PDU of 2016.

The carsharing also exists in Lisbon with Mob Carsharing, a subsidiary of Carris, and the Mobi.E network of electric cars with 1300 stations in 25 portuguese cities.

Some studies say that if people use carsharing, they could realize a monthly saving of more than 100 euros, which is not insignificant in Lisbon, where the GDP per capita is approximately 16 000 euros per year.

Thus, carsharing allows optimization of the automobile since these shared cars are used over a grea-ter part of the day unlike the individual car. In addition, these shared vehicles are new and less polluting vehicles.

At present, carsharing is limited to short-term and occasional trips. In Lyon the majority of carsharing sta-tions are mainly in the city center. But little by little they begin to develop in the periphery.

In summary, the carsharing is a nascent project in the cities of Lyon and Lisbon. For now, it is used mainly for short journeys for which public transport is a good solution.

However, it is necessary to continue to encourage the reduction of cars per family and to optimize the vehicles to reduce the influence of the automobile on the public space. The package of shared car services must be enhanced and integrated into a multimodal approach to complement the public transport offer. However, we should not induce too many new car trips by this initiative, much less that there is too much transfer of public transport and bicycle users to carsharing. Indeed, a 2014 study carried out in the Paris region, which can be generalized in the case of Lyon and Lisbon, shows that subscribing to a carsharing company (Autolib, Mobizen here) results in a change in usage patterns modes of transport :

	Autopartage en trace directe IdF (Autolib')			Autopartage en boucle IdF (Mobizen)			Autopartage en boucle hors IdF		
	Part des usagers avant	Part des usagers après	Evolution	Part des usagers avant	Part des usagers après	Evolution	Part des usagers avant	Part des usagers après	Evolution
Voiture personnelle	13%	5%	-63%	9%	1%	-93%	15%	4%	-76%
Transport en commun	61%	50%	-18%	64%	65%	+2%	40%	45%	+14%
Vélo	3%	2%	-25%	11%	10%	-6%	29%	35%	+20%
Vélo en libre-service	4%	4%	0%	5%	7%	+30%			
Marche à pied	25%	23%	-7%	35%	36%	+4%	36%	38%	+6%
Deux-roues motorisés	9%	5%	-42%	8%	8%	0%	4%	4%	0%
Autopartage	/	16%	/	/	0,2%	/	/	0,5%	/

Table 13 : Evolution of the users of the public transport after a subscription in a carsharing company (Source : Etude Autopartage en trace directe, 6T, 2014)

We see here the very beneficial effects of carsharing as regards the use of the individual car. Car-tracking in direct track (return to the starting point not mandatory) is much more popular than that in loop (return to the starting point mandatory). However, in the case of carsharing, a subscription to car-sharing results in a loss of public trans-port, bicycles and walking. The loop carsharing seems to lead to beneficial effects on other means of transport, but is still too unpopular. As for its use on the periphery, excluding IDF, all the results show its interest.

In addition, carsharing, if properly oriented, reduces pollution and greenhouse gas emissions, for example with the use of alternative cars in carsharing, such as Are doing the Bluely companies in Lyon and Mobi.E in Lisbon with their electric models.

- Electromobility and alternative energies

These alternatives to petroleum only address the problems of pollution and public health. The objective is to reduce the share of individual cars polluting. Here we will only talk about electric cars and cars NGV (Natural Gas Vehicle).

o NGV cars

Sources :

Website of NGVA : https://www.ngva.eu/

French Association of Natural Gas for Vehicles, 2011, *Le gaz naturel dans les transports* [online].

As a reminder, NGV is a fuel with many environmental advantages. It rejects 25% less carbon dioxide compared to a conventional car, 80 to 90% less ozone production and no emissions of harmful substances. The performance of these vehicles are similar to those of a petrol car and the engine is less noisy.

In France and Portugal, its development is limited because the public authorities prefer the electric car as an alternative to the gasoline or diesel car. There are only about 100 NGV stations in France, including two on the Grand Lyon.

In general, NGV cars are still very little on the market. Indeed, in 2011, 70% of the vehicles running on the NGV are present in five national markets : Argentina, Brazil, India, Iran and Pakistan. Only about 20 countries have an NGV car ensemble that reaches or exceeds 1% of the local car market. At the European level, only Bulgaria and especially Italy have a market superior of 2% of vehicles running on natural gas.

o Electric cars

Sources :

Website of the city of Lyon : http://www.lyon.fr

Website of the town hall of Lisbon : http://www.cm-lisboa.pt

Grand Lyon, Mai 2016, Diaporama – *Grand Lyon - Panorama de la Mobilité*.

Pierre Soulard, 2014, Diaporama – *Le bouquet de mobilité du Grand Lyon*.

Thus, as we said earlier, France and Portugal have mainly focused on the use of electric cars. In 2016, there are 4300 electric vehicles in the Grand Lyon, seven times more than in 2006. In addition, there are a total of 112 electrical recharging stations.

In Lisbon, the rate of electric cars is not known, but there are 500 electric charging stations on the public road. This no doubt corresponds to an important use of the electric car (Cf. Appendix 23).

However, the electric car still poses questions. Indeed, its capacity for autonomy is not satisfactory, its price is high, the electrical recharging stations occupy a lot of space, and more deplorable, the CO2 balance is mitigated and these cars lead to dependence on rare metals.

There are two problems with electric car batteries. The first concerns the use of lithium. Indeed, it is not known if the quantities of lithium will be sufficient to bet on an im portant future development of the electric car. In addition, there are serious ethical issues raised. Indeed, lithium extraction is often carried out by children in exporting countries. The second problem posed by lithium is that we doesn't know how to recycle it, at the moment, and the batteries of the electric cars comprise of it. And to finish the extraction of lithium has an important environmental impact.

Thus it is important to move towards a diversification of the automotive sector in France and Portugal to allow equal use of electric cars and NGV, or even privilege NGV cars given the problems posed by the electric car. Electro-mobility, like the NGV car, meets the objective of air quality, but little concern for congestion of cities. Thus it seems essential to concentrate the efforts of the administrations on the development of the other modes of trans-port pre-sented above and to organize them to encourage intermodality.

v. Intermodality, parking and pricing policies

The intermodality corresponds to the linking between the different modes of transport and the ease with which users switch from one mode to another.

Each form of transport isolated from others, brings a lesser performance. Mobility management is the inte-gration of all modes of transport into a multimodal network. There are three levers : creating multimodal pricing to make life easier for people and encouraging them to use different modes of transport in succession ; creating car parking areas for users to abandon their cars for the benefit of the intermodal network ; setting up a real time manage-ment and monitoring system for the different transport systems in order to orient the users of the network towards the best choices. These levers are useful provided that there are sufficient connections between the different modes of transport, which is what we will analyze in the following section.

- Connections between the different transports

Source :

Website of Regolis : http://www.resilogis.com/wp-content/uploads/2014/02/TCL-LYON-OK-R_modifié-2.jpg

The first condition for the use of the intermodality principle by users is the existence of a multimodal network. In Lyon, there are many connections between all the modes of transport.

These connections are numerous, between metros, tramways and bus, and supplemented with the offer of Vélo'v. We will only mention the connections between the TCL network and the train stations TER and SNCF, here.

The TER network goes into the city center of Lyon in 4 stations : Vaise station, Saint-Paul station, Jean Macé station and Gorge de Loup station (Cf. Appendix 24, orange triangle). The station of Vaise is one of the end of the subway D, which also passes by the Gorge de Loup station. There are 15 different buses in Vaise station and 15 others in Gorge de Loup station. In the Jean Macé station there are metro B, tramway T2 as well as 8 buses. There are only 2 buses on the Saint-Paul station, but only a small bridge separates the train station from Hotel de Ville, where one can take the metro A and C as well as 10 other buses.

The SNCF network enters the city in 2 stations : Perrache station and the Part Dieu station (Cf. Appendix 25, red square) In Perrache, there is metro A, as well as the tram T1 and T2 and 14 buses. In Part Dieu you can find the metro B, tram T1 as well as 11 buses.

Like Lyon, it is also possible to enjoy the possibilities of intermodality through several connections. The different trains integrate the network of Lisbon, via the metro into several poles. Especially at the Cais do Sodre station terminus of the green metro line where mix metro, river shuttles, trains and many buses nearby. The trains also include Lisbon in Santa Apolónia station, the terminus of the blue metro line, and nearby, but not directly, from the Jardim Zoológico stations on this same line and Rossio on the green line. In addition, the Entre Campos station, in the middle of the yellow line, the Roma – Areiro station, on the green line and the Oriente station on the red line.

Thus, all metro lines allow users of trains to return to the network of the city of Lisbonne. Moreover, a difference with the city of Lyon lies in the fact that the airport is in the urban center and not in the outskirts. Thus there is also a continuity between the use of the plane and the entry on the network of metros since the airport is a terminus of the red line.

There are two operators of the trains used in Lisbon and its region. The following table shows the stations of Lisbon served by both operators : CP and Fertagus.

	CP	Fertagus
Cais do Sodre	X	X
Santa Apolónia	X	
Entre Campos	X	
Roma - Areeiro	X	
Oriente	X	

Table 14 : Train stations of Lisbon and different operators of trains

However, before they can integrate train networks or directly into urban mobility networks, users need to get rid of their cars. To do this, the provision of car parks is an indispensable condition.

- Park the car in the aim to enter on the network

Sources :

SYTRAL, 2005, *Révision du PDU de l'agglomération lyonnaise*.

Website of TCL : http://www.tcl.fr/

Fernando Nunes da Silva, 2013, Diaporama - *Lisbon : mobility for the XXI century*.

The parking is a major lever for the modal shift. In Lyon, the establishment of relay parks is asserted in the PDU of 2005 : « The main objective is to develop the supply of relay parks, while paying particular attention to those who are obliged to use the car for their profession ».

For example, having a OùRa card gives access to secure bicycle parking in the TER stations as well as the numerous car parks. In total the TER network is 3100 parking spaces at the entrance to the stations.

Similarly, TCL has set up 22 relay parks, or 7500 parking spaces throughout the area of the Grand Lyon, reserved for TCL customers (Cf. Appendix 26). All located near a TCL station. The car park can be used for TCL network users who present a ticket validated the same day on the network.

However, among the TCL relay park offerings, sixteen car parks are often saturated, which leads to around 1700 vehicles parked around car parks on the municipal roads. This is problematic because it is known that a bypassed use of certain relay stations is done. Indeed, because the TCL rates are lower than the parking or parking rates, some motorists use it as parking, without the use of public transport. Thus, in general, the inspections must be intensified.

In Lisbon, there are 22 relay car parks throughout the metro network, for a total of 11 000 parking spaces. They are located throughout the metro network in order to allow a rapid and efficient change of mode of transport (Cf. Appendix 27).

There are many car parks, but they depend on the decision of each operator. Unlike Lyon, there is no real policy of car parks in Lisbon.

We have previously analyzed the multimodal connections, as well as the possibility for the user to station his car. However, logical and thoughtful pricing can make it possible to incite the users to a modal shift if financially intermodality is more advantageous than the use of the car.

- A multimodal pricing

  - The case of Lyon

Sources :

Grand Lyon, Mai 2016, Diaporama – *Grand Lyon - Panorama de la Mobilité*.

Website of Onlymoov : https://www.onlymoov.com/

Website of TCL : http://www.tcl.fr/

When traveling on the whole TCL network, whose is the buses and trolleybuses, metros and tramways, the classic ticket for 1.80 euros is valid for one trip, on the whole network during the hour following its first validation. It is possible to complete a journey beyond one hour and the last validation occurs before the limit of one hour. Thus, this basic ticket allows to take advantage of its right of intermodality over the entire TCL network for 1 hour.

There is the possibility of having a subscription, weekly, monthly or annually, which is put on the Técély card. A subscription to the TCL network, a few the chosen formula gives access to the bike network Vélo'v free during the first hour.

For those who do not have the utility to start with a means of transport of the TCL network, but who must be, for example, to take a vehicle from the network of Cars du Rhône or Libellule or the TERs of the region. This card can be reloaded with the desired titles : subscriptions, combined titles, to circulate on the Cars du Rhône, Libellule, TCL, TER networks.

There are also subscriptions according to the intermodality chosen. Indeed, for those who wish to make travel TER + TCL There is a subscription, another for Cars du Rhône + TCL, These subscriptions give the right to the advantageous price but not use a common card.

  - The case of Lisbon

A major problem, already stated earlier, is that there is no logic of metropolitan mobility in Lisbon and its region. There are many train operators depending on the area concerned. Consequently, each of the operators has car parks. Thus, there are in Lisbon « pass transports » on which tickets can be combined combining for example the metro with other transport but these prices vary according to the area. There is no similar price for all car parks. Since each operator is independent, they set prices as they wish. In Lisbon, it was estimated that there were more than 300 tariff modalities a few years ago, because there were too many possible combinations according to Mr Colaço.

Thus one can speak about a multimodal pricings on Lisbon and its region, but not about a pricing policy. Indeed, a homogeneous policy on the whole of the metropolitan area is not possible due to the diversity of the actors in place.

Now, the offers and pricing have been presented, it is now necessary to focus on the last lever of intermodality : information to users. Indeed, if the potential users of the network do not have the knowledge of the network, then they will not exploit it.

- Real time multimodal information

Sources :

Urban Mobility Service of the Metropole of Lyon, 2015, Rapport – *Optimod Lyon – Optimiser la mobilité durable en ville – 2012/2015 Résultats et perspectives du projet.*

Website of Onlymoov : https://www.onlymoov.com/

Website of Transporlis : http://www.transporlis.pt

Pierre Soulard, 2014, Diaporama – *Le bouquet de mobilité du Grand Lyon*.

International Francophone Congress, 1998, *Déplacements : l'ère de la gestion*.

When the multimodal offer is rich, it is still necessary to advise the users so that they choose the most advantageous solution for them. « Traveler information » means communication actions that reduce the uncertainty of customers about their travel. The purpose of the « operational » information is to present the offer, show where the stops are, identify the vehicles to be borrowed, and indicate the ways to be taken. The « promotional » information aims to make public transport have new customers or for new uses. « Appropriative » information is meant to give the user the elements to choose his or her trajectory.

For the sake of appropriate information, Lyon has developed the OPTIMOD'LYON project since 2012 in order to build high level services for users. Among these services, OPTYMOD'LYON and ONLYMOOV.

OPYMOD'LYON is the first urban multimodal GPS on smartphone in France. This application gives access to all the mobility information of the agglomeration with a real time computer. This application integrates the prediction of traffic at 1h and advises as to the routes to take and the transport concerned in the metropolis.

ONLYMOOV is a website that brings together all mobility offers. It allows all those who move on the territory of the metropolis of Lyons to have on one site all the information to go from a point A to a point B and to know the duration of their journey according to the transport used. For its part, there is the website of TRANSPORLIS in Lisbon, for an appropriate purpose. It is a travel optimization site that provides information on the best transport solutions in terms of time and cost, just like ONLYMOOV.

Knowledge of transport possibilities, time for each solution and price are paramount for a modal shift from car to public transport. The three objectives of this type of information are : to inform upstream of the networks, to give real multimodal information and to take advantage of the means of communication in real time. These priority actions intersect with the need to take into account the diversity of clienteles, their lifestyles and their situations. Managing efficient mobility lies in the perfect combination of diversified transport offerings and information on the same offer.

vi. Results

- Results of the policy of Lyon

Sources :

SYTRAL, December 2016, *Enquête déplacements 2015 de l'aire métropolitaine lyonnaise - Résultats sur le SCOT de l'agglomération lyonnaise* [online].

Website of the SYTRAL : http://www.sytral.fr/

In order to analyze the effectiveness of the arrangements made in the PDU of 2005, we will compare the results of the mobility in 2006 and 2015 summarized on the website of the SYTRAL. In the results of 2006, 25 000 people had been questioned about their modes of travel and for the results of 2015, 27 000 people.

In 2015 SYTRAL is a total of 2 million inhabitants, 16% more inhabitants than in 2006. Concerning the motorisation rate, in 2006 there are 1,30 cars per household and 1,25 in 2015.

In terms of travel, they have increased by 10% between 2006 and 2015. In 2015, an average of 7 589 000 trips are made per day, that is 3,55 daily trips per inhabitant, compared with 3,75 in 2006. Concerning these trips 53 % by car in 2015 compared with 58% in 2006 and 73% in 1995. 31% of trips in soft modes in 2015 compared to 29% in 2006. In 1995, walking was not even considered a way transport. 13% of public transport users in 2015 compared with 11% in 2006. Moreover, the use of the TER has doubled in 10 years. 77 700 trips per day in 2015 compared with 36 000 in 2006. As a result, 62 minutes per day is spent on trips on average, 6 minutes less than in 2006.

		2006	2015
Modal distribution on the Grand Lyon	Individual car	49,2	42
	Public transport	16,1	19
	Soft modes	32,5	36
	Others	2,2	3
Use of the TER on the territory of the SYTRAL		36 000 travels	77 700 travels

Table 15 : Evolution of the modal distribution between 2006 and 2015 (Source : SYTRAL, 2016)

However, it still persists that 80% of the exchanges between the Metropolils of Lyon and the neighboring territories are still in car. Thus it is important that in the years to come these figures decrease. To do so, only the TER and SNCF network can meet this need.

In addition, car sharing or car pooling is not analyzed in this study. However, it can be assumed that they have an impact on the motorisation rate.

It would seem that the policy of Lyon is performing well but efforts must be continued so that the share of individual car continues to decrease. In addition, the number of alternative energy cars should be included in the next study. In the next section we will analyze the case of the municipality of Lisbon.

- Results of the policy of Lisbon

Source :

Madalena Sottomayor Machado Costa e Silva, 2015, Thèse – *Padrões de Mobilidade e Crescimento Urbano – Análise Comparativa entre Lisboa e Florianópolis*.

In order to compare the performance of the Lisbon arrangements, we will compare the mobility figures for 2001 with those for 2011. No more recent figures are available.

	2001		2011
Total travelers	283400	↘	267722
Individual car	35%	↗	45%
Public transport	40%	↘	35%
Walking	23%	↘	19%
Others	2%	↘	1%

Table 16 : Evolution of the modal distribution for the internal travels in Lisbon (2001 - 2011) (Source : Madalena Sottomayor Machado Costa e Silva, 2015)

	2001		2011
Total travelers	382030	↘	364523
Individual car	42%	↗	46%
Public transport	54%	↘	53%
Walking	0,47%	↗	0,69%
Others	3,53%	↘	0,31%

Table 17 : Evolution of the modal distribution concerning the incoming travelers (2001 - 2011) (Source : Madalena Sottomayor Machado Costa e Silva, 2015)

	2001		2011
Total travelers	35326	↗	38719
Individual car	65%	↗	74%
Public transport	32%	↘	24%
Walking	1,57%	↘	1,03%
Others	1,43%	↘	0,97%

Table 18 : Evolution of the modal distribution concerning the outbound travelers (2001 - 2011) (Source : Madalena Sottomayor Machado Costa e Silva, 2015)

The results obtained are not very convincing between 2001 and 2011. The number of users of the individual vehicle has increased, regardless of the destination. More surprisingly, its use has increased even within Lisbon, where journeys can be made by public transport or even by foot. As a result of this increase in the use of private cars, public transit and walking users have decreased.

However, these figures compare the years 2001 and 2011. However, it is known that until 2004 - 2005, policies were oriented towards the development of cars in cities. Thus, these figures show only six years of Lisbon policies between 2005 and 2011, after the awareness. It would have been more interesting to see the figures for 2015 or 2016 in order to take account of new modes of transport such as a highly developed electric car in Lisbon or the impact of carpooling and carsharing.

In spite of everything, these unsatisfactory results reveal, in comparison with those of Lyon, a difficulty with the challenge of the individual car in town. Indeed, in addition to the more important means in France compared to Portugal, it is mainly the political and decision-making organization that differentiates the cities of Lisbon and Lyon and which justifies the increased efficiency of Lyon thanks to the SYTRAL.

Thus, reducing the share of individual cars in town remains a necessity but arriving at a zero rate seems utopian nowadays. Indeed, the automobile still finds its place in our society and it would be economically dangerous to claim that it can be eliminated in the short or medium term.

However, regarding the remaining cars in circulation, it is necessary to limit their impact. To be regulated and to streamline the traffic seem to be a solution. The optimization of traffic management and mobility in urban areas are particularly complex subjects, with high stakes whether economic, societal, public health, or even in terms of perception of the quality of life in cities.

2) Fluidify the traffic

We are going to deal here with two important aspects of traffic regulation. First, the urban logistic. Indeed, the untimely stops of the car in double file or on sometimes narrow tracks lead to congestion zones. Secondly, traffic control by means of special tools to organize the traffic lights and to orient users in real time. Taking into account the importance of urban logistics, this IT management of regulation becomes one of the most important issues for mobility in the city of tomorrow.

i. The urban logistic

Sources :

SYTRAL, 2005, *Révision du PDU de l'agglomération lyonnaise*.

Grand Lyon, Mai 2016, Diaporama – *Grand Lyon - Panorama de la Mobilité*.

Urban Mobility Service of the Metropole of Lyon, 2015, Rapport – *Optimod Lyon – Optimiser la mobilité durable en ville – 2012/2015 Résultats et perspectives du projet.*

TIS, 2005, *Estudo de logistica urbana para a zona piloto do Baixa de Lisboa – Caracterização e diagnóstico da ZPILU.*

TIS, 2005, *Estudo de logistica urbana para a zona piloto do Baixa de Lisboa – Propostas de intervenção e plano de ação.*

Urban logistics has a direct impact on the economy and quality of life for residents and visitors, as it can lead to increased congestion, abusive use of loading and unloading parking lots, increased air emissions, noise or more simply a degradation of public space. In addition, poor urban logistics also have an impact on the service provider. Indeed, the inefficiency of urban logistics, ultimately, can lead to an economic loss, direct or indirect, which can lead to an increase in the final price of products and impact the consumer.

Freight trucks occupy considerable space on the road network. A Bordeaux study revealed that in 2005 « a quarter of the occupation of roads by motorized vehicles is devoted to the movements of goods in the agglomeration ». Moreover, in Lyon, in Presqu'île, 70% of the deliveries were carried out in illegal parking in 2005 and once in two in double file. Only 3% of deliveries were made to pre-screened areas. (Revision of the 2005 PDU).

Thus, in Lyon, the PDU of 2005 affirms the need to manage the goods in town : « The taking into account of the goods in town must be widened. Now, the rationalization of supplies, the consistency of regulations on deliveries within the urban transport area, the need for surfaces necessary for the smooth functioning of deliveries must be integrated. »

Since 2007, the North of the Presqu'Ile is a real « urban logistics laboratory ». It deals with the management of goods. This included an innovative regulation of the delivery areas with new ground surfaces for trucks (29 m² on the ground), limitations on access to the EURO standard. The results seem positive. There is an increase of 30% in use of the areas and a decrease of 20% of double parking. Results from the North of the Presqu'Ile being encouraging, these actions have been developed throughout Lyon and downtown Villeurbanne since 2013. Other experiments were conducted as night deliveries in 2014.

Also, from the point of view of commodity management, and in the framework of the Optimod Lyon project, Renault Truck, partner of the Grand Lyon, developed in 2013 a merchant truck navigator. This browser allows drivers to choose the best delivery route by taking into account real time traffic data and eventualities.

In the same spirit, IBM has developed a path optimization tool. This tool is used to organize company tours in order to obtain a gain in terms of kilometers traveled and travel time.

In Lisbon, in 2003, EMEL (Municipal Empresa de Mobilidade e Estacionamento de Lisboa) carried out a study to develop the regulation of loading and unloading trucks in the city of Lisbon and in 2004 proposed the implementation of A new regulation of the circulation of these vehicles and distribution of goods. Several aspects were examined, notably the dimensioning of the network of spaces for loading and unloading or the definition of a monitoring system.

Since 2004, the city of Lisbon has approved a municipal loading and unloading regulation. This Regulation defines the restrictions on the movement of the various categories of vehicles, their timetables and the stopping and parking of vehicles for loading and unloading. This Regulation specifies the spaces for loading and unloading and the rules relating to them.

In 2005, the TIS drafted a file for the town hall, with the aim of defining an urban logistics stra-tegy for implementation from 2012 onwards. In the end, the policy was not put in place because of the different Suc-cessive governments, as Ms. Macário had indicated. However, nowadays, the implementation of the ideas developed in 2005 is back on the agenda and the current government wants to put the proposals in place. Thus, in Lisbon, there has been no major progress in terms of urban logistics, despite the fact that this new variable has emerged on a Eu-ropean scale since 2005 with cooperation projects between Europe, Brazil and Peru around the « TURBLOG project ».

The TIS study is not carried out on the whole of the city of Lisbon but on a smaller area of 80,4 hectares called ZPILU (Cf. Appendix 28). In 2005, there were 188 places reserved for loading and unloading on public roads, or 13% of the total free parking space. The study proposes a certain number of guidelines in order to have a high-quality urban logistics on the ZPILU and subsequently on the whole of Lisbon according to the same model.

The main ideas developed are, first of all, the use of bus corridors by freight trucks to facilitate the distribution process. This would require a revision of the Highway Code and the preparation of a feasibility study to define time intervals that do not interfere with the smooth functioning of public transport. Then it is proposed to intensify the monitoring of compliance with signage and regulations. Also to define areas of « micro-logistics » in order to concentrate distribution in strategic areas, in consultation with the Lisbon City Hall. These logistics terminals should be equipped with the technology required to manage the entire logistics process information including operations management, inventory management, contract management with dealers and supplier contracts, and Compliance with local regulations. In summary, this measure consists of granting a proximity zone whose function is to manage a capillary distribution in the study area.

Thus, as stated above, these provisions were proposed to the town hall of Lisbon in 2005 but have not yet been put in place. It will analyze the policy of the new government in the years to come to see if these provisions are im-plemented, and especially if they are useful.

Traffic control involves the management of goods trucks that can cause significant congestion problems in cities. The tests carried out in Lyon are interesting and the results obtained are encouraging but the efforts to be made in this field remain numerous. Concerning this issue, the policy of innovation between public and private partners remains the best way to offer effective management for the populations and companies. As part of the Optimod project, developed navigators facilitate the lives of deliverers and help them make the best decisions to optimize their journeys and reduce their impact in the city. In Lisbon, the ideas are present, and only need to be tested. As in Lyon, the 2005 TIS study limits its analysis to an experimental zone, the ZPILU, and will wait to observe the results when the regulations are implemented by the town hall, In order to extend this process to a wider area.

In addition to efficient urban logistics, another way to fluidify the traffic is the use of mobility processing software to ensure a reduction in congestion in the city. We will analyze feedback from the cities of Lyon and Lisbon on two software programs : CITER used in Lyon since 2000 and GERTRUDE used in Lisbon since 1986.

ii. Traffic management tools

Source :

OptiCities, D. Marquois, C. Montano, 2016, *Prédiction de trafic à 1h et gestion de trafic urbain : quels usages possibles* [online].

- Traditional traffic management practices

Usually in surveillance rooms surveillance is done visually on a wall of images, the latter presenting some video cameras. There are more cameras than monitors on the wall of images, so it is necessary to choose the ones that are being observed. The cameras are located at strategic locations whose images alternate. This has the disadvantages of showing the operator only a specific image of a few seconds, while others are forgotten. A localized, punctual and unusual event can not be detected.

For critical events, such as a car stopped in a tunnel, the risk of non-observation can be mitigated by an Automatic Incident Detection (DAI) system which presents the image analyzed as unusual.

When an event occurs, the operator must display the appropriate video image, assuming that he is familiar with the locations of the cameras. Some extended events require multiple cameras to analyze them, but the operator can only concentrate on a single camera and thus not grasp the full extent of the disturbance.

The experience of road traffic shows that the operator has little time to intervene on a trafic event. Once the congestion has been established, actions become mostly ineffective and the only way to do this is to wait for the congestion to diminish on its own.

However, assuming that the traffic control system has the precise knowledge of traffic, it is therefore logical that it is the traffic control system that controls the video system. It must detect disturbances and give priority to

interesting images. By this means, the operator can be alerted automatically in real time. All the upstream detection work carried out allows the operator to be alerted of the event at the earliest, to save time and to concentrate on its main function of traffic regulator or traveler information. It is on this principle that the operation of the CRITER software used in Lyon is based.

- Use of the CRITER software in Lyon

  - How CRITER works ?

The CRITER traffic control system supports the development of the tram system in Lyon, in order to manage absolute priorities at crossroads. It replaced the PASCAL PC in place since 1994, having only a supervisory role for the equipment. The spirit of the PC CRITER is to calibrate the offer. It operates mainly on the basis of scenarios, activated locally more or less automatically, or by the manual intervention of an operator.

This control software manages a network of road sensors. On the territory of the Metropolis of Lyon, this corresponds to almost 1000 measurement points (flows and occupancy rates) and gives real-time traffic conditions.

CRITER also manages events such as cultural and sporting events, tunnel closures and lane cuts that have a direct impact on traffic. From these types of events, CRITER can therefore automatically manage traffic disruptions using pre-established scenarios, based on upstream studies. Scenarios may contain traffic control strategies by changing the traffic light settings, appropriate messages on variable message signs, and video displays by selecting and prioritizing the relevant cameras on the image wall.

Measurements of traffic density measured by the sensors and the current disturbing events are used in decision trees evaluated in real time. When the traffic conditions are verified, the CRITER system triggers the appropriate scenarios. The decision trees are set by the operators, which allows them to manage the selection of the cameras, the orientation and the level of zoom desired.

The video scenarios are set in the video system. A video scenario includes a list of cameras to be displayed with a stored position (zoom and direction) and a display format (large or small) for each camera. Currently, in rush hour CRITER manages nearly 80 video scenarios that can not be displayed on the wall of images at a t time . To sort and display only the important events, the decision tree manages the priorities between the traffics events.

In this same display space there are the manual assignments made by operators (prioritized) and the automatic assignments carried out by the video scenarios. A management algorithm applies the video priorities to op-timize the display space without disrupting the operator. The algorithm permanently displays the highest priority images in terms of operation, taking into account the display format, in order to move as little as possible the automatic video streams already installed on the wall of images. Scenarios that can not be displayed are placed on the waiting list and the operator can delete a scenario from the already processed image wall, which causes the highest priority stream to be displayed on the video wall at same format.

- Feedback

The result visible every day is that the operators of the PC CRITER have significantly changed their use of video images. They understood that their interest was to leave as much space as possible to the auto-scenario. Now, in off-peak times, the wall of images is virtually empty, except in the case of a particular disruptive event. When approaching the peak hours of a typical day, low priority scenarios begin to appear in small images ; Then during peak hours, all the available space is occupied, especially by the most priority scenarios, and represented by images of large sizes.

The new video system offers Greater Lyon an additional tool for operators to better manage the urban road network. Operators have a better working comfort and find their work more interesting because they spend most of their time managing situations and no longer detect situations. Moreover, the data are communicated to other services such as Onlymoov or the police in order to facilitate their work and improve their efficiency.

The results are satisfactory since the use of the CRITER PC, since it is measured that the congestion has been divided by 2, and that the system was accompanied by the increase in the TC supply (+ 5% capacity).

We will now analyze the operation of the GERTRUDE software. Indeed, in Lisbon, the municipality has chosen to use this other software since 1986.

- Use of GERTRUDE software in Lisbon

- How GERTRUDE works ?

GERTRUDE is a system invented in the 1970s in France and used in the cities of Bordeaux and Lisbon. It requires a large quantity of sensors on the ground. This is one of the reasons why this system was not developed in Lyon. Indeed, initially this investments was not made in Lyon.

The objectives of this system are to :

-Reduce urban congestion

-Optimize existing infrastructure

-Reduce travel times

-Reduce the energy impact and accompany climate-related issues

-Reduce accidents and ensure the safety of people

In summary, the purpose of this system is to modify the modalities of traffic regulation in order to adapt to demand. It operates on the basis of algorithms at the scale of a crossroads, in centralized automation.

Today, a system like CRITER, based on scenarios, tends to integrate adaptive regulation modalities to achieve optimization margins at the crossroads (vector mode, intelligent approach delays, predictive regulation, anti-saturation ,etc.). An adaptive system such as GERTRUDE (or SCOOT in London) tends to integrate scenarios to keep track of traffic patterns and seek optimizations on the road network.

- Feedback

In Lisbon, the major problem of GERTRUDE is political. Indeed, the technical services of the city of Lisbon were for several years « the hostages » of GERTRUDE. The company that developed this software does not share its knowledge and does not have the pedagogical approach to explain to the members of the Lisbon City Council how it works. Thus, as soon as the model has to be modified to adapt to the changes in the city, it is necessary to contact the creators of GERTRUDE directly so that they intervene themselves, for very high costs and delays. This lack of knowledge is the great weakness of the management of the mobility of Lisbon.

GERTRUDE is currently scheduled to organize a competition with other software to find more efficient software so that GERTRUDE owners can leave their comfort zone.

It is difficult to get feedback because there is no reference to Lisbon since GERTRUDE is the only software used. Initially, it was expected to have comments from people working at the Mayor of Lisbon, being previously better placed to provide answers. It was not possible, but Mr. Colaço agreed to answer all the questions, but he himself said, he did not have a precise knowledge of the subject, and the remarks must be apprehended but judged.

From what we know of Mr. Colaço, GERTRUDE is a little old and his technology is not modern. The system does not cover the whole city, it concerns a small part of the city, corresponding approximately to the city center. What is known is that the system controls the entries of the zones and the number of cars and buses entering the area in order to determine the traffic capacity in this area and to delay the entry of private cars in order to do not create congestion. However, this software does not distinguish modes of transport, it is possible to give priority to buses and tramways, but locally. Indeed, there is a local controller that is linked to a central controller. The local controller can when he has a request for a green light for a tramway or bus pass it to GERTRUDE through the central controller. Finally, the definition of priorities is the primary responsibility of the local controller. Thus, the human factor predominates in decision-making contrary to CRITER. In addition, accidents and events are not taken into account directly by the system as in the case of CRITER.

It seems difficult to have a stock of the action of GERTRUDE on Lisbon, so that the town hall of Lis-bonne has a partial knowledge of the operation of this software. If Lisbon wants to improve the efficiency of road traffic, it is necessary to have all the information on the system and the possibility to say, like Mr Colaço want, « we want to make a consultation on this system and not be imprisoned existing system. »

So when we talk about optimization, improvement, we have to agree on what we hope for. In Lyon and Lisbon, the objectives of the policy are to support the mobility needs of the inhabitants, while using less the individual car.

Thus, in terms of traffic engineering, we must find the right balance between fluidity and induction of traffic. Indeed, the more a channel is the capacity (widening, optimization of green light times, etc.), the more it attracts traffic. A study in Lyon shows that by optimizing a traffic junction by giving it + 15% capacity, this leads to a traffic increase of + 25% and therefore a reduction in traffic flow of -5%.

In a city in full economic and demographic development, the shaping of traffic is ultimately not feasible or even desirable, as it guides users towards the use of the individual car. It is therefore necessary to work on the control of automobile flows and the development of the multimodal offer to orient towards a more sober mobility model.

IV- Conclusions

1) The chronological evolution of the car in the 20th century

In the process of development of the automobile, we can distinguish several phases. The period before the First World War was the discovery of a new mode of transport. Then, the period between the wars for Lyon is marked by the confrontation of the automobile system with the rest of the urban activity. The result is an automotive regulation, a mode of transport that has entered into the customs, and thus a consolidation of automobile mobility in our societies. The years 1960-1970 corresponded to the development of mass automobile traffic in Lyon until the crises of the 1970s, while in Lisbon we are witnessing the emergence of this new means of transport, following the democratization of the country In 1974 and the subsequent accession to the EEC in 1986. The majority of the investments were in the service of the automobile at that time. Then in the years 1980-1990 in Lyon and 2000 in Lisbon a collective consciousness began to emerge with a more sustained development of urban mobility and a reorientation towards equity of investments for all means of transport. However, it seems that mobility has been better controlled in Lyon rather than in Lisbon.

2) More convincing results in Lyon

As we have seen throughout this report, the management of mobility has been better controlled in Lyon. Indeed, since the late 1970s, the city of Lyon has decided to move towards a decrease in the share of the car in town. This has resulted in a re-appropriation of the public space by pedestrians and bicycles, as well as an increase in the supply of public transport on the territory of Greater Lyon. The PDUs of 1997 and 2005 made it possible to set a course, with precise objectives and a definition of the means to be put in place. On two occasions the objectives of the PDUs have been reached in Greater Lyon, thanks to the development of different means of transport (bus, TER, subway, tramway, bicycle, etc.). As a result, the share of private cars in the Greater Lyon area has largely declined in favor of other means of transport.

The change of mentality appeared late in Lisbon. In comparison with Lyon, Lisbon has been much more oriented towards the development of walking rather than the development of bicycles. The ambition is the same, reduce the car share in town. Thus, in this perspective, Lisbon has developed a rich network of trans-ports with many connections between different modes. However, the 2011 figures show a policy failure. Indeed, the share of the individual car has largely increased at the expense of other means of transport, and in particular of public transport. Potentially, this is due to the lack of a real multimodal pricing and parking policies to accompany the multimodal network.

3) The causes of these results

Historically the car developed earlier in Lyon than in Lisbon. Lyon throughout the 20th century had time to experiment with the limits of the development of the automobile in town. Thus the management of the car was spread out over a century, while in Lisbon the development of the car was a rapid phenomenon spreading over less than half a century. Thus, like any rapid phenomenon, management was more difficult.

The management of mobility is complicated because it presupposes the definition of a territory of reflection. Thinking on the scale of a city or a commune was possible before the invention of the car because the cities were dense and less spread out on the territory. However, the automobile has led to a de-densification and spreading of cities, and thus the installation of families on the outskirts of cities. The place of residence is no longer the same as the place of work or leisure. Lyon understood this need to reflect on the scale of a « mobility basin » and thus created the SYTRAL in 1985, formerly STCRL since 1942. The SYTRAL is the organizing authority of the transports grouping 293 municipalities of the Lyon area, Including the territory of the Grand Lyon. In Lisbon, a similar attempt was made with the creation of the « Transport of Lisbon » brand, which is supposed to regroup the subway, bus and tramway management company and the river shuttles. However, this regrouping was recently stopped, and is a testament to the failure of a necessary initiative. Indeed, in regions such as Lisbon and Lyon, where the objective is to reduce the car share in the modal shift, it is essential to create a single decision-making body for the entire territory in order to organize mobility according to a purpose of intermodality.

Another reason, very little spelled out in this report, is the geographical situation. Indeed, mobility seems more complex to organize in the territory of Lisbon with the presence of the Tagus which cuts, radically, Lisbon in two. Thus there are two bridges which concentrate a large part of the trips to Lisbon while the Lyon bridges crossing the Rhone and the Saône are 24. The statement made in this report must be nuanced since the very complex geographical situation Of Lisbon undoubtedly has a direct impact on the difficulty of manage the mobility.

4) Formalized orientations for the future and possible prospects

Source :

Urban Travel Plans ofthe agglomeration of Lyon – Vers une nouvelle dynamique de mobilité », TCL SYTRAL, December 2016 [online].

In Lyon, the future orientations are in line with the PDU 2015 - 2017. Since the organization in place is performing well, the objectives remain considerably the same. However, in this PDU, SYTRAL affirms the willingness to take a closer look « at neighboring territories to the agglomeration of Lyon generating many displacement flows », as well as « low density and / or remote territories with energy vulnerabilities ». The idea is to extend the territory of the « mobility basin » for an even more comprehensive reflection.

The reduction of the share of the car remains the main subject of this PDU. The SYTRAL and the Metropolis of Lyon want a significant reduction in air pollution, noise and greenhouse gas emissions. In order to do so, the SYTRAL

wants to continue diversifying modal practices at the level of the Metropolis of Lyon and to extend the network, develop new lines, strengthen the capacity of existing lines and improve the performance of the bus network. Some projects are already known, such as the extension of the metro B, the renovation of metro stations, the addition of a park-relay in Mermoz-Pinel or the installation of the T6 tramway. It also aims to continue to develop walking and cycling. In order to do so, it will seek to « initiate a change of view and discourse in the communication actions in their favor because walking and cycling is beneficial for health. »

In order to achieve a modal shift from motorists to other modes of transport, in addition to diversifying supply, the SYTRAL wants to « propose tools to accompany changes in behavior ». The aim is to pursue the development of multimodal information services already deployed and to move towards a real deployment of « mobility advice to various audiences (users, new residents, economic players in particular) ».

Beyond the objective of reducing the car, the increase in traffic qualities, within set limits, persists. Thus, the SYTRAL wants to stimulate reflection on the new modes of distribution of goods in the city. It is proposed « to integrate urban freight transport into the overall travel policy ».

Intercommunal reflections are already effective on the region of Lyon, but the SYTRAL wants to « put in place a partnership work for the review, implementation and monitoring of the PDU ». The aim is to make the PDU a common and shared document for all municipalities in the Metropolis of Lyon. The principle of inter-municipal cooperation is strengthened here in order to increase the efficiency of the measures taken.

A possible orientation in Lyon would be to develop river transport. In spite of the desire of Lyon for intermodality, the development of river shuttles has been at a standstill. Indeed, the city of Lisbon benefits from the Tagus to offer transport through it while Lyon exploits only a very small percentage of the potential mobility of the Rhone and Saône. Using both rivers would make it possible to decongest the city by assuming a modal shift of some motorists towards river shuttles.

In Lisbon, the future objectives are not formalized, but in view of the current arrangements, it is possible to propose certain orientations. Currently Carris and EMEL are municipalized. This can lead to the development of an integrated and coherent transport and parking policy with relay car parks. An attempt of this kind had failed because the price of the car parks was too high, but strong of this experience, this could be taken into account in a future project.

Lisbon has already defined areas with reduced emissions on part of the city, it would be interesting to put a strict control in order to reduce car pressure in downtown Lisbon and reduce air pollution at the same time.

In addition to this, it will be necessary to pursue the soft-mode policy by developing soft mobility support infrastructures with a larger cycling network, without discontinuities, a wider pedestrian area and not only concentrated in the historic center, Network of funiculars and lifts that encourage pedestrians to get rid of their car by decreasing their efforts and optimizing their time.

A centralized management system for automotive traffic and real time information will have to be set up, taking into account the movements of all urban trams, which are often the cause of congestion in downtown Lisbon. In the image of what is done in Lyon, taking into account the cohabitation between the different modes of transport must be at the heart of the IT management of mobility to relieve congestion in the city center.

Above all, in Lisbon, priority should be given to the creation of an intercommune decision-making organization to reflect mobility throughout the metropolitan area of Lisbon. A posteriori, it is necessary that only the train be nationalized, while the metro becomes a municipal responsibility, as it had been envisaged. Like the project that had been initiated with « Transport of Lisbon », Lisbon must create a metropolitan transport authority like the SYTRAL. It is only on this basis that Lisbon will be able to enjoy increased efficiency in the light of the political guidelines it will choose.

5) European orientations and future prospects

Source :

European commission, 2011, *LIVRE BLANC - Feuille de route pour un espace européen unique des transports – Vers un système de transport compétitif et économe en ressources* [online].

At the European Union level coherence is vital. A discontinuity between mobility patterns would end the free movement in Europe.

The main challenge for the European Union is to « break the dependence of the transport system on oil without sacrificing its efficiency or compromising mobility ». Indeed, curbing mobility is not an option, but each country must have a complete transport system with connections between different modes.

At the communal or intermunicipal level, the European Commission stresses that cities are « most affected by congestion, poor air quality and exposure to noise » but that their scope is wider, with the possibility of using the bike or walking in addition to the other modes. In 2011, urban transport accounts for about one-quarter of transport-related CO2 emissions, and 69% of road accidents occur in cities according to the same commission.

In this document, the European Commission has defined 2 objectives in order to improve urban mobility through a « competitive and resource efficient transport system » in the European Union :

- Reduce by half the use of cars using traditional fuels in urban transport by 2030 and eliminate them from cities by 2050. In addition, establish a CO2-free urban logistics system for 2030 in large urban centers.

- Achieve a zero death target in road transport for 2050. With this in mind, the EU wants to halve the number of fatal road accidents by 2020.

Finally, the document states that « the quality, accessibility and reliability of transport services will become more important in the years to come, in particular as a result of the aging of the population and the need to promote public transport ». In order for users to use public transport, their quality must be sufficient. Quality is based on « sufficient

frequencies, adequate comfort level, easy access, high reliability and intermodal integration », as well as the availability of information on travel times and alternative routes.

In view of these proposals and orientations, it would seem that Lyon is already on the right track. Lisbon, meanwhile, must continue to affirm its will to improve traffic and promote mobility that is more environmentally friendly. Once the region of Lisbon has set up a joint inter-municipal decision-making body, then the policies decided upon can be implemented. Especially since the renewal of the generations is in the direction of this awareness of the need to respect the environment in its uses, and especially in the context of urban displacements. John Elkington in « The Guardian » in june 2011 reveals this change in mentality in Generation Y. Younger generations no longer have the same vision for car ownership. Unlike previous generations, for those who own a car was a signal of independence, social success, young people today are showing much less desire to have their own car, taking into account their costs of use (taxes, tolls, paid parking, insurance, etc.) and maintenance. Younger generations are more likely to use their mobile phones, applications, to move to carpooling, to rent a self-service car, or to make the best choice using the advice sites Mobility like Onlymoov in Lyon for example, Transporlis in Lisbon or more generally GoogleMaps.

Thus, the mentalities of the new generations are conducive to the development of « soft » mobility and politicians have also had this awareness.

In conclusion, all the fires are green for the success of the establishment of an efficient and equitable mobility provided that the legal framework essential to this success is implemented, according to the example of the model of Lyon, in cities and regions of the scale of the White City.

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Appendix 1 : Map of France, the region and departments (Source : Carte-de-France[6], consulted in December 2016)

Appendix 2 Map of the regions of Portugal

[6] http://e-sushi.fr/cartes-du-monde/la-carte-de-france-avec-ses-regions

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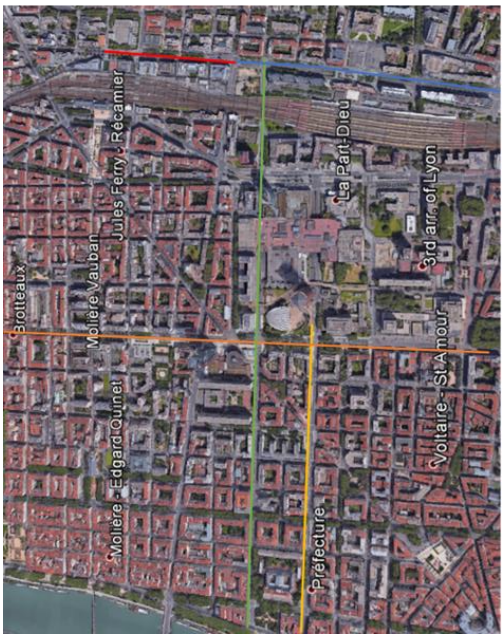
Servient street (Jaune), Bonnel street (Green), Garibaldi street (Orange), La Villette street (Turquoise), Thiers avenue (Red)

(Source : Googlemaps, 2017)



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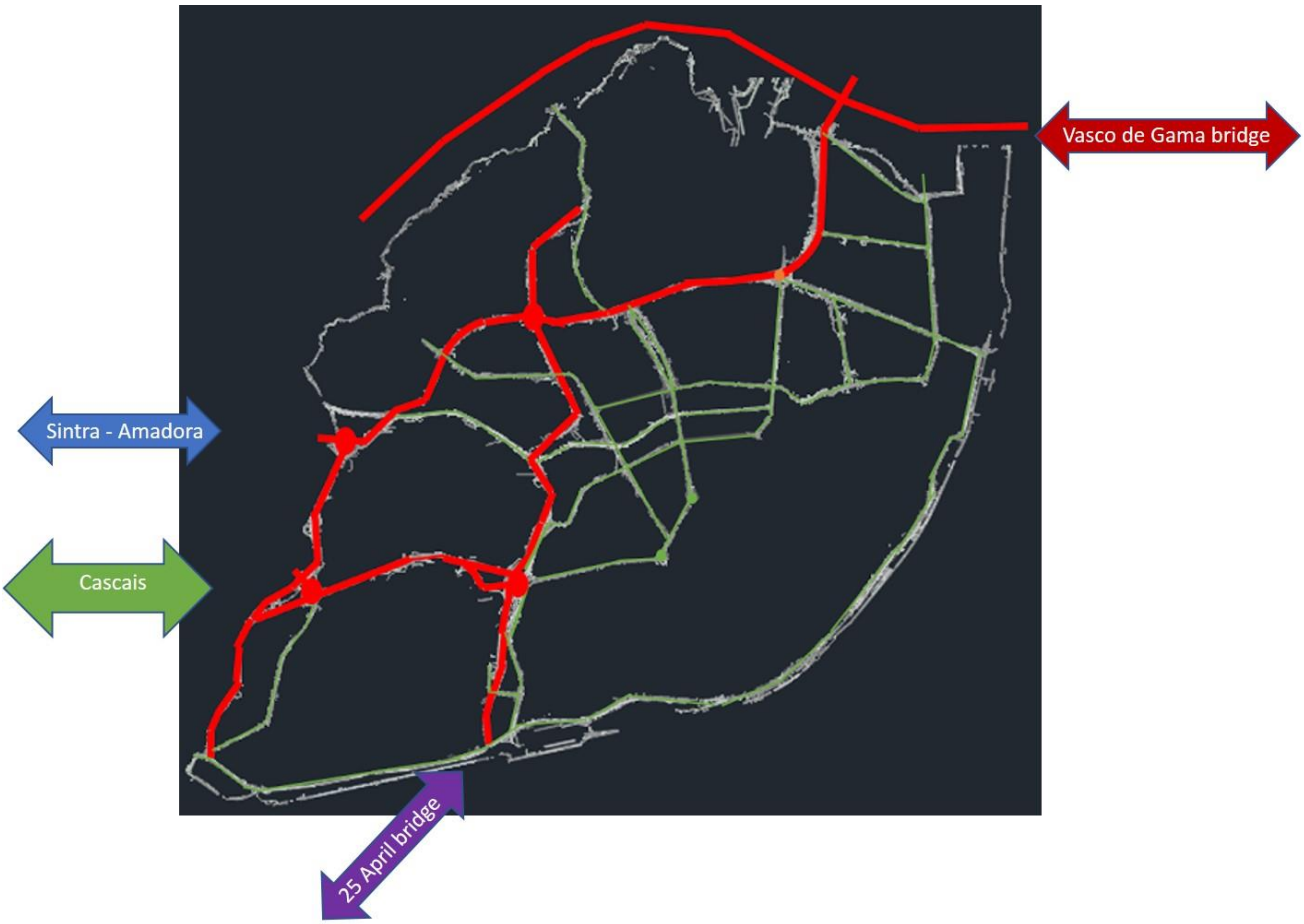

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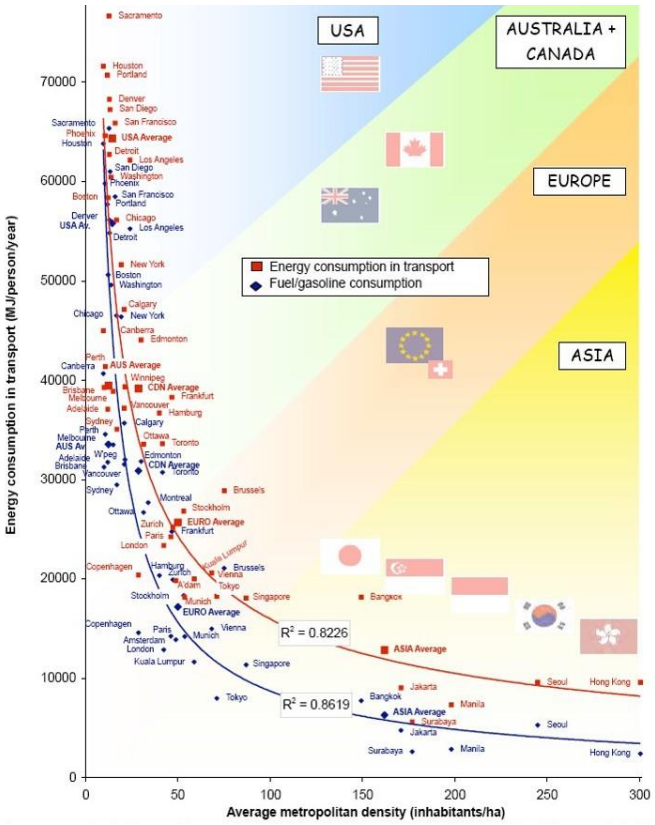

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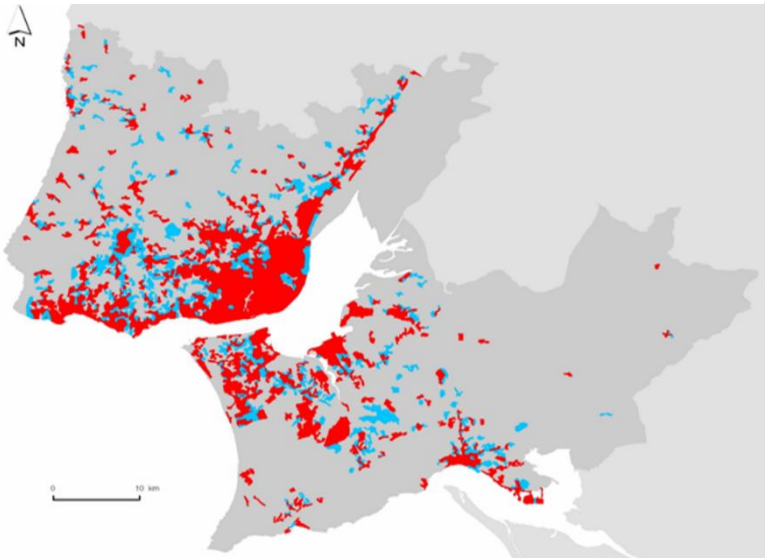

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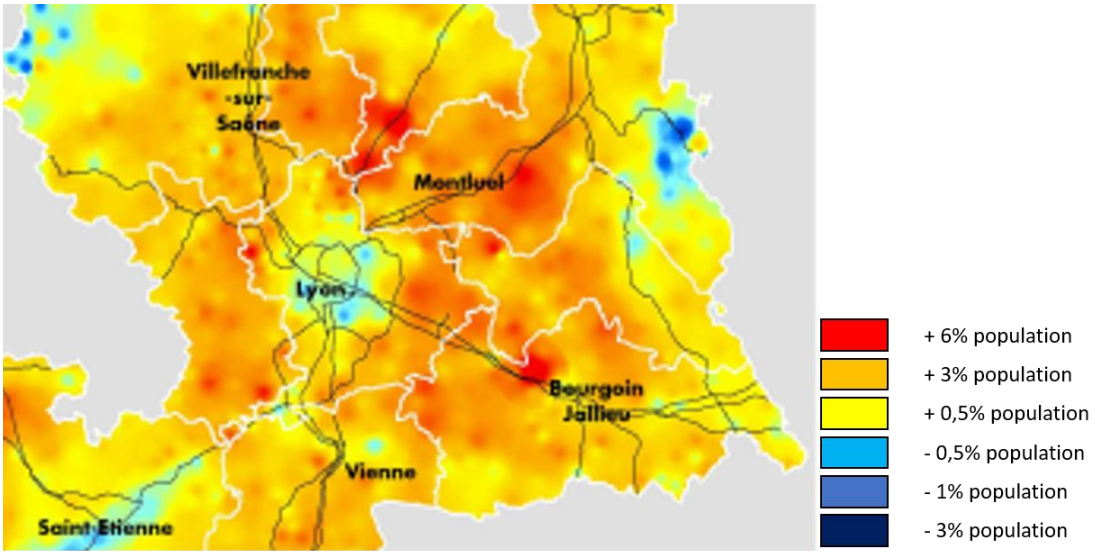

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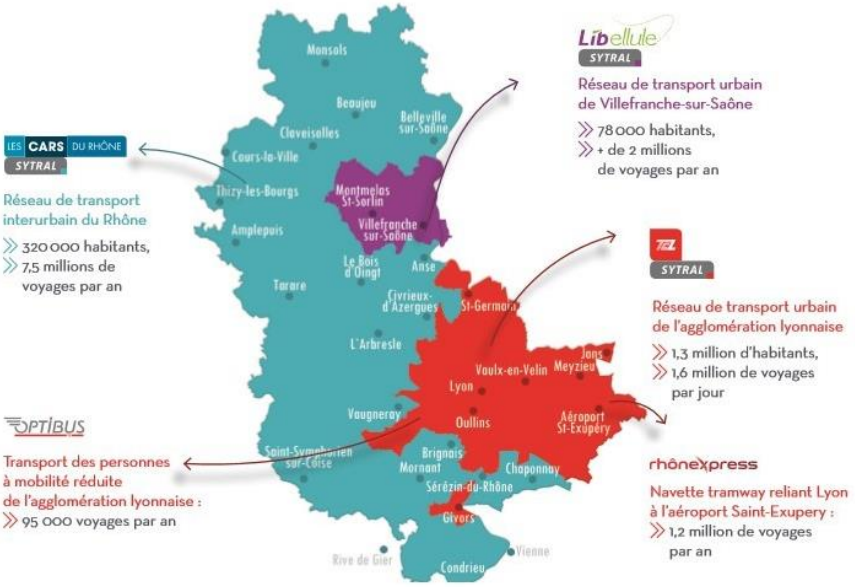

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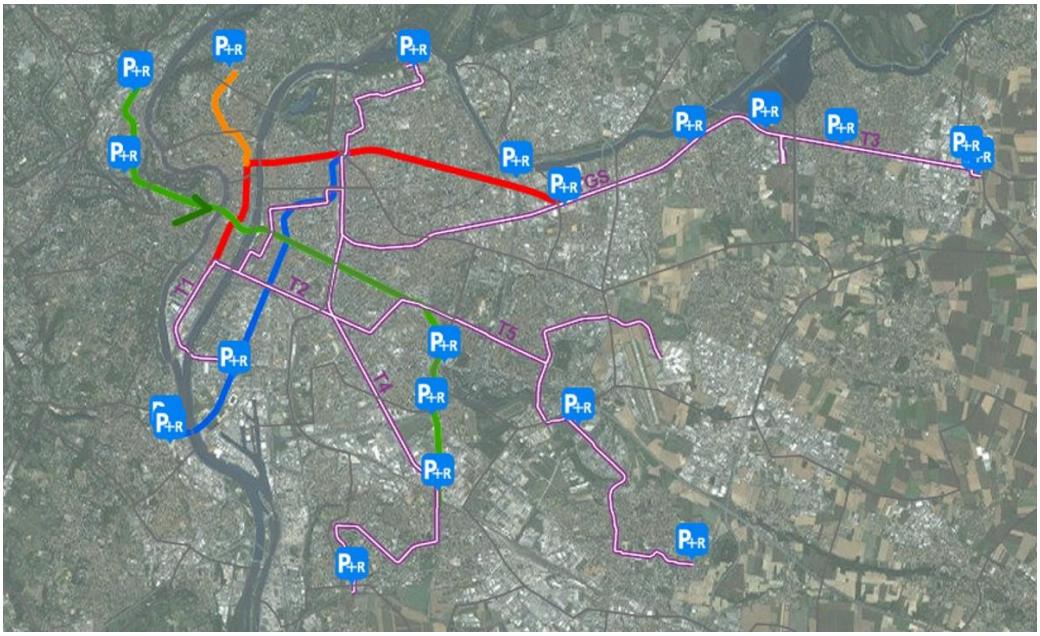

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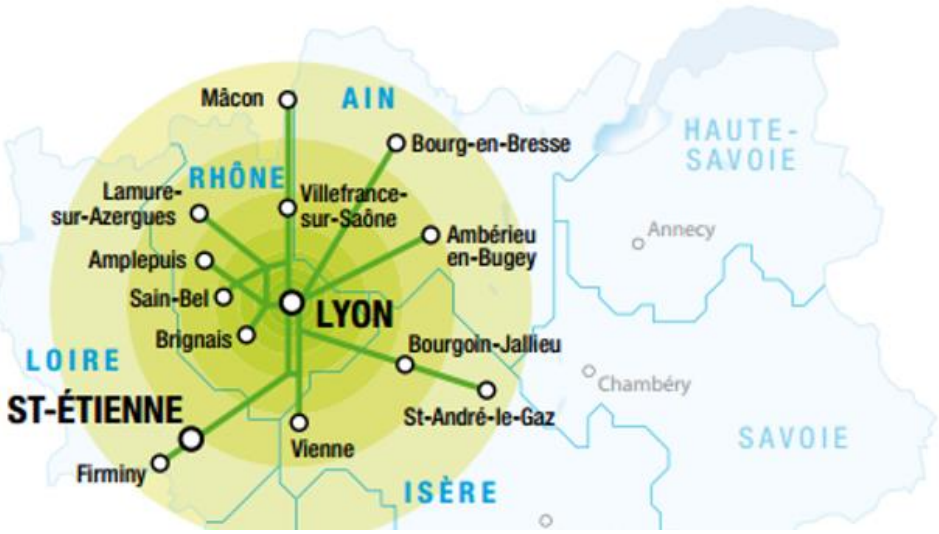

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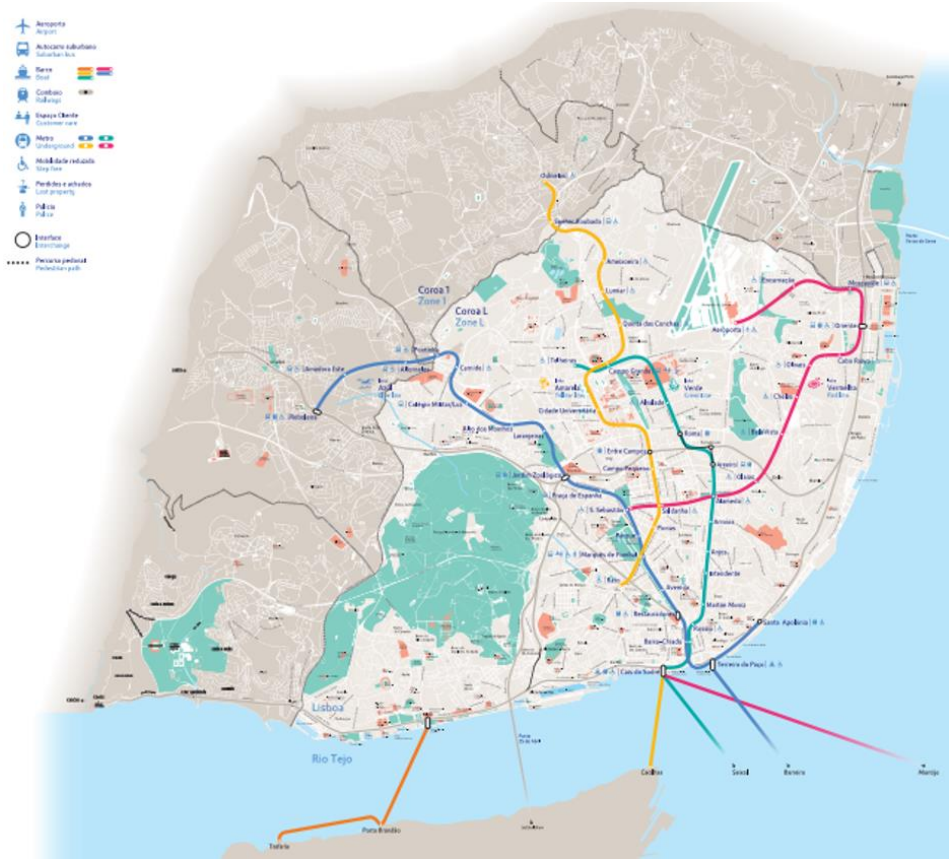

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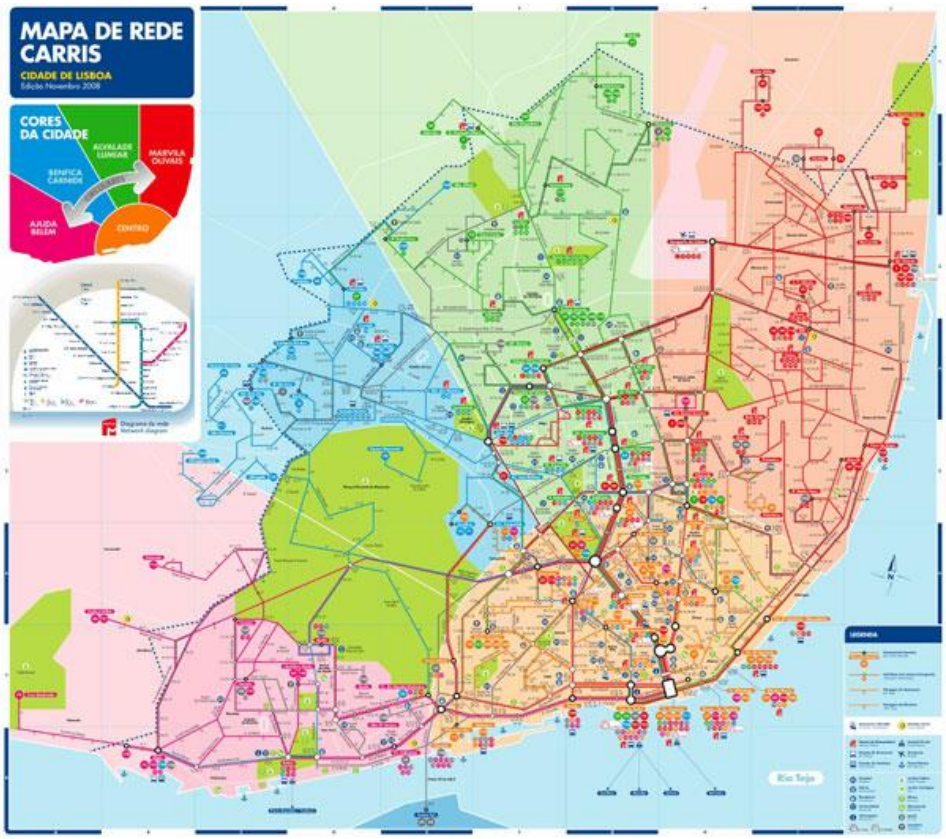

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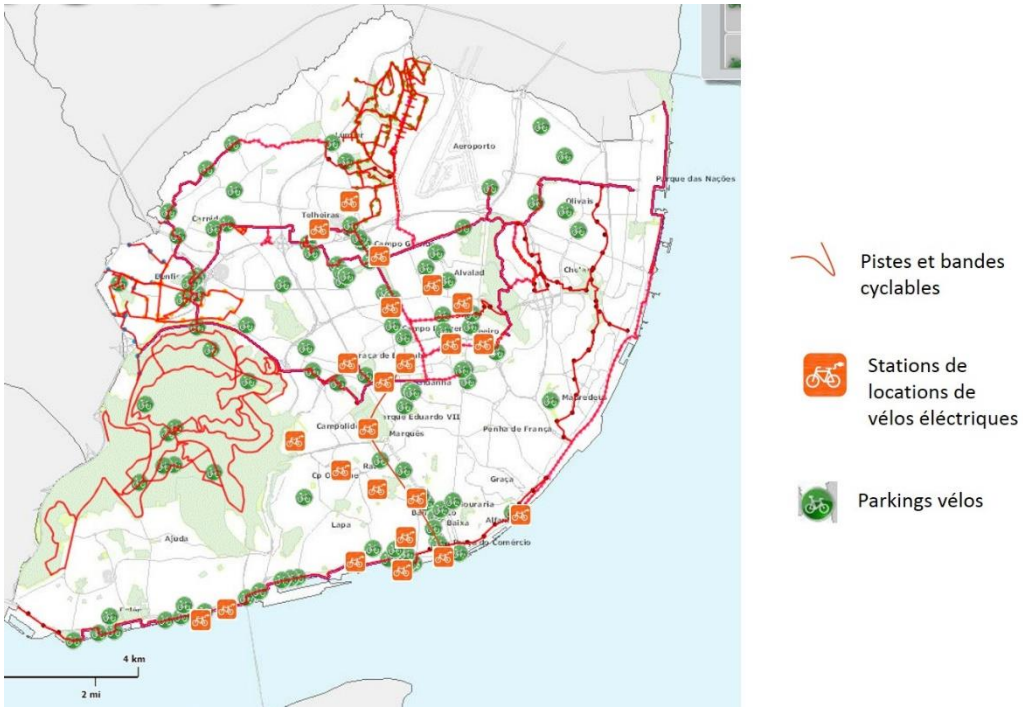

[7] https://lisbonne.net/ascenseur-chateau-lisbonne

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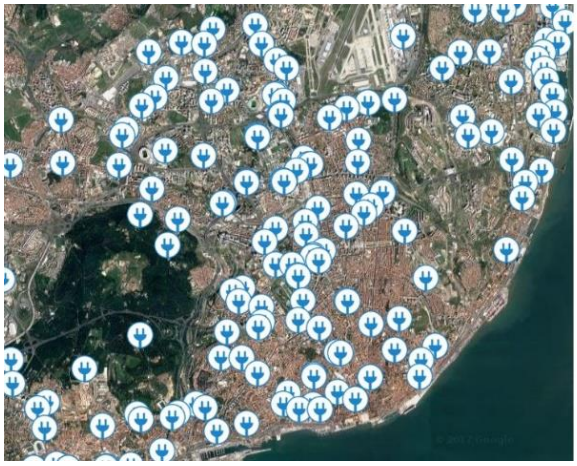

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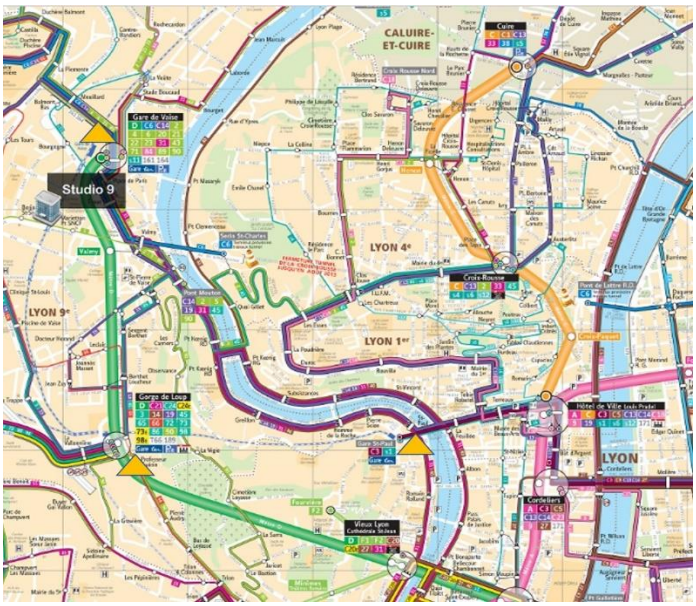

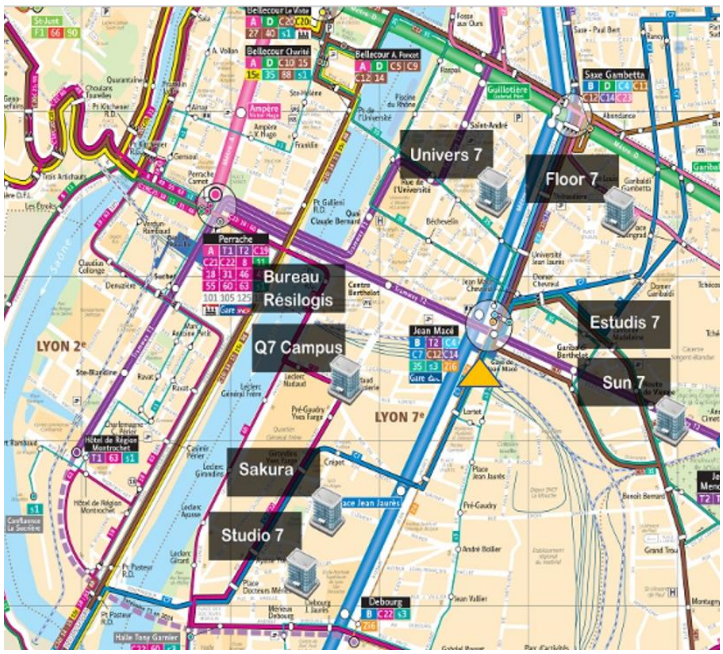

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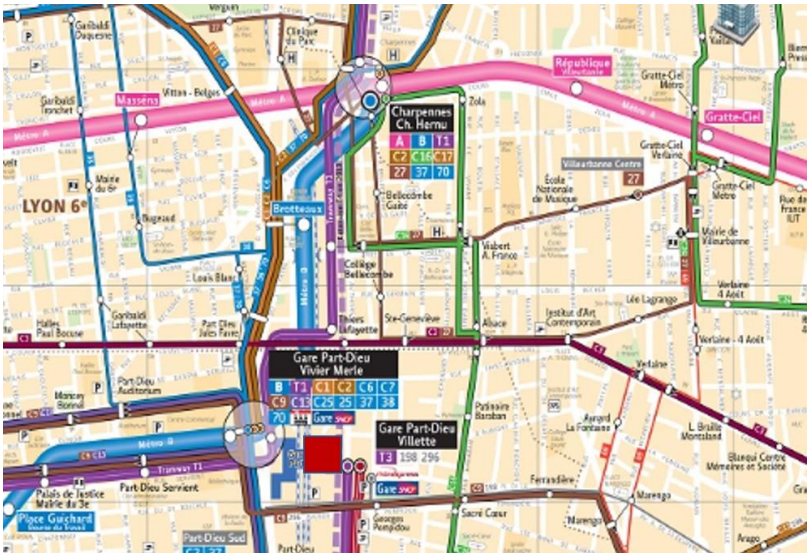

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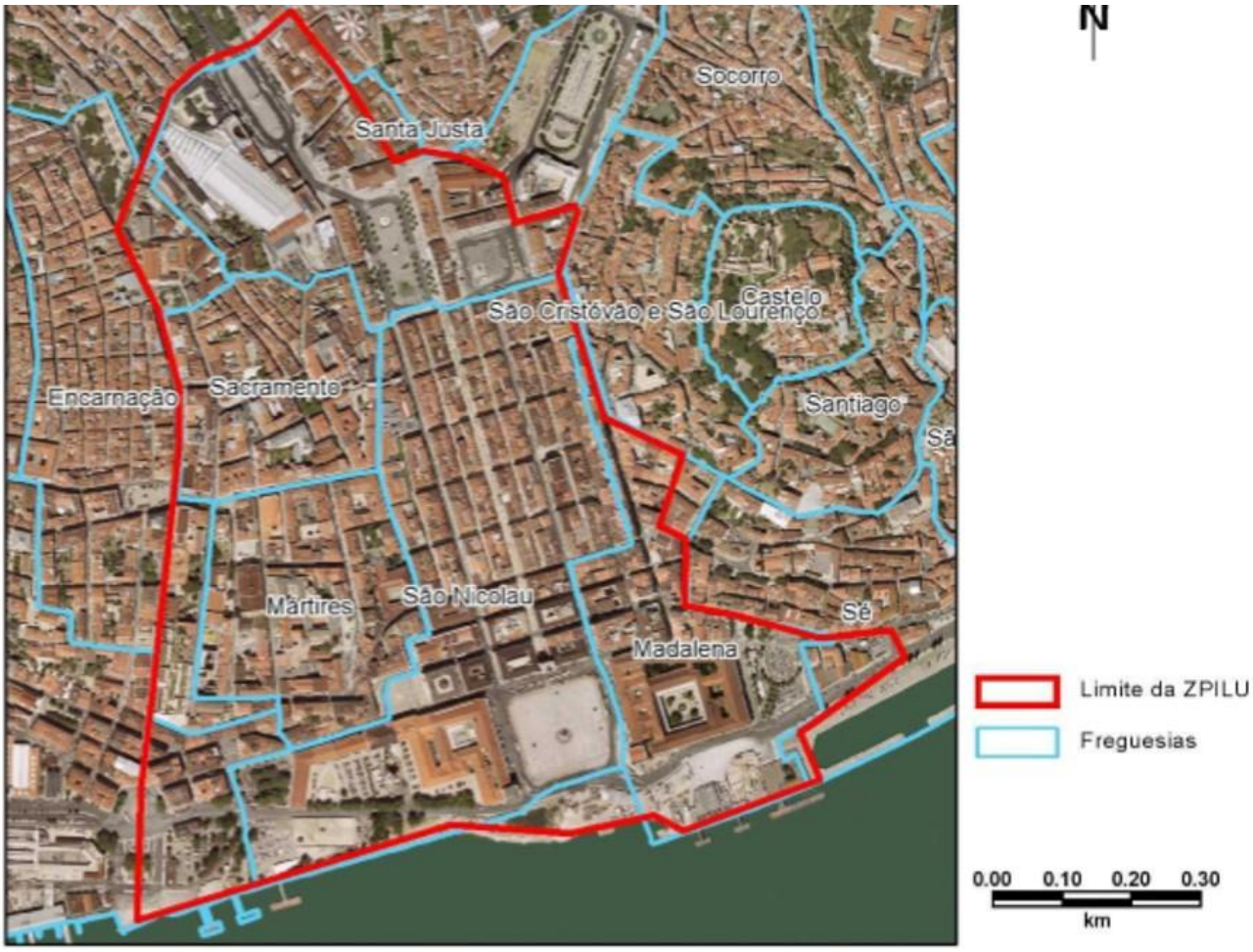

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Sitography

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https://lisbonne.net/ascenseur-chateau-lisbonne

- **Carris :**

http://www.carris.pt

- **Cars du Rhône :**

http://www.carsdurhone.fr/

- **Carpooling Lyon :**

www.covoiturage-grandlyon.com

- **Eurostat :**

http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=tsdpc340

- **Ine :**

https://www.ine.pt/

- **Legifrance :**

https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000319738

- **Town hall of Lisbon :**

http://www.cm-lisboa.pt

- **Metropolitano de Lisboa :**

http://www.metrolisboa.pt

- **Mobi.E :**

https://www.mobie.pt

- **NGVA :**

https://www.ngva.eu/

- **Onlymoov :**

https://www.onlymoov.com/

- **Pordata :**

http://www.pordata.pt/en/Portugal

http://www.pordata.pt/en/DB/Municipalities

- **Resilogis :**

http://www.resilogis.com/wp-content/uploads/2014/02/TCL-LYON-OK-R_modifié-2.jpg

- **Sytral :**

http://www.sytral.fr/

- **TCL :**

http://www.tcl.fr/

- **Topographic - map :**

http://fr-fr.topographic-map.com

- **Transporlis :**

http://www.transporlis.pt

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http://www.transtejo.pt

- **Vaporetto :**

http://www.lesyachtsdelyon.com/vaporeto.html

- **City of Lyon :**

http://www.lyon.fr