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Abstract:

A transition entails a change from a socio-technical system which is established in society to an emerging one that is pushed forward by niche actors. This process is undergone because it represents the best way to improve the overall sustainability of the system. Transport systems in cities need to transition from the automobile regime to the bicycle niche because it is the fastest mode in the city, it does not pollute and increases social welfare and healthiness.

I have studied the transition of the mobility system in Madrid, where transport stakeholders are to a certain extent managing the transition process since about a decade by being able to adapt to the changing circumstances from the regime and landscape level and at the same time utilising the opportunities that temporary measures like the bike priority lane produce to bring about the bike system and leave behind the car regime, so far.

I have based the research on qualitative data from literature and 6 interviews with key stakeholders in the process. Moreover, I have used the theories of MLP and Transition Management to analyse the topic.

I could conclude that the bike priority lane is supporting the transition because it helps constitute the bike as a utilitarian mode that southern European countries are lacking, with a low budget and prompts a future smoother transformation of the traffic lane to a bike lane.

MSc in Sustainable Cities

Aalborg University

June 2018

Transition of the Mobility System in Madrid

Master Thesis

Alonso Tormo Castelló

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Chapter 1 Introduction

In this chapter I will state that there is a problem in mobility systems of cities which do not have high levels of cycling. I will also number some of the benefits of cycling in relation to the environment, health or the economy and explain why the unknowing of these benefits is one of the causes for cities not having high levels of cycling, together with the lack of cycling culture or political will. Moreover, I will explain the difficulties of choosing a type of bicycle infrastructure for a city that does not possess a cycling culture and then point out the necessity of implementing this infrastructure by taking space from the road in order to reduce space for the unsustainable mode that the car represents. Finally, I will introduce the socio-technical system of the bike and the bike priority lane as a new type of bike infrastructure or fitting-out of the road.

1.1. The problem: non-high levels of cycling in cities

There is a worldwide concern to make cities more sustainable in the 21st century as 195 countries adopted the first legally binding global climate deal in the COP21 in Paris (European Commission). We, the humanity, have to make the settlements where most of the people are gathered around today less pollutant in terms of emissions expelled to the atmosphere and less resource consuming. And at the same time, we also have to fulfil the requirement that capitalism imposes of economic progress to countries in the western world.

Many of the paths that countries and local governments take in this direction are those of technological innovation, in most cases. Where only incremental innovation takes place in one of the systems that conform the city structure by the introduction of a new technology or the efficiency improvement in an existing one. This generally leads to a slight improvement in the carbon emission figures or in the resources used. Although, there are cases of full system innovation like the Dutch energy system, which is still in that process (Ministry of Economic Affairs 2016).

Looking at the city transport systems around the world, it can be seen how they are still based on the private vehicle as the main transport mode and transitions of this system to more sustainable ones based in less contaminant transport modes are absent. This can be seen in a list of selected cities around the world with more than 1 million inhabitants showing the modal split of journeys to work, where in the vast majority of them the governing transport mode is the car (Anon. 2018). And if we look at the cycling mode share, most of the cities have a figure below 10%, with a handful of them at a 0%. This means that in some cities, municipalities do not account for the bike mode share, though many of them are starting to collect this data. Here is where the problem lies, high levels of motorised transport in cities coupled to low levels of cycling where the average distance covered by citizens travelling by public transit is in most cases below 10 km (Moovit). This distance could be easily overcome by bike and the health benefits could be increased and the pollutant emissions decreased, at the same time.

1.2. The unknown benefits of cycling

If I had to ask myself why is it relevant to study the relation between a high cycling mode share in a city and its level of sustainability, then I could argue that cycling has a number of socio-economic benefits compared to other transport modes. The bicycle account of 2016 for the city of Copenhagen reveals these benefits with outstanding simplicity:

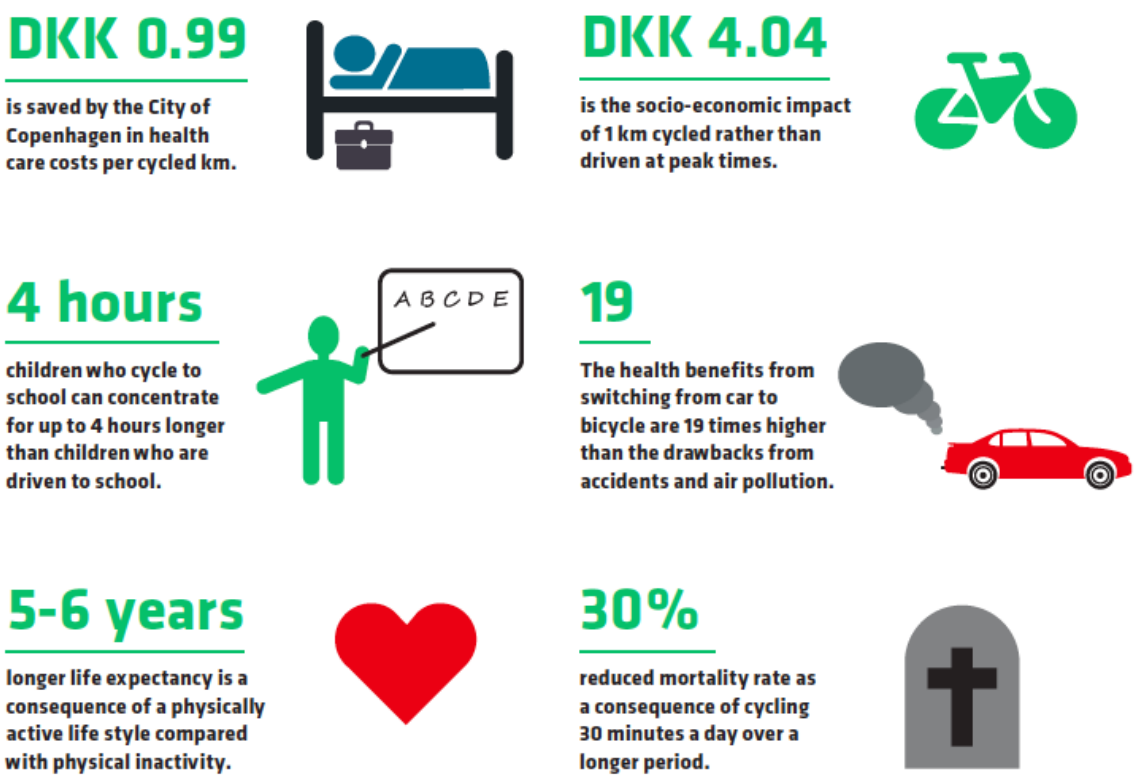


Figure 1.1. Socio-economic benefits of cycling (City of Copenhagen 2017: 23)

It can be observed how a city can save 0.99 dkk (0.14 €) in health care costs per cycled km, children who cycle to school can concentrate up to 4 hours longer and the socio-economic impact of 1 km cycled rather than driven by car at peak times is 4.04 dkk (0.54 €), among others.

What about the environmental benefits then? It is widely known that exhaust gases from combustion engines are speeding climate change while polluting the air in cities up to the point of making it unsafe to breath. There are cases of this effect in Spain, where high levels of traffic congestion are increasing pollution levels over the safety threshold defined by the World Health Organization (Ecologistas en acción 2017: 3).

Therefore, having a high percentage of people using the bike frequently in a city in opposition to motorised transport modes avoids the emission of these pollutants harmful for the health and for the environment.

One could argue that walking is another sustainable mode to travel throughout the city. Nevertheless, walking as a mode typically covers short distances, the average walking distance in Europe varies from under 1 km in Great Britain to 2.8 km in Finland (Wegman & Aarts 2005). It is true that it also has a positive effect on health and no cost at all, but it cannot reach longer distances in the time that the bike does. In that regard, the bicycle is more efficient in distances from 2 to 6 km, "*the average trip length for cycling is around 3 km in most European countries"* (Wegman & Aarts 2005). Thus, the convenient walking distances vary from 0 to 3 km and cycling would be suitable for longer distances, as I expressed previously, up to 5 km or even more. Specifically, the British Medical Association (BMA) considers 8 km as the distance that a `person can easily cover´ (Stewart et al. 2015).

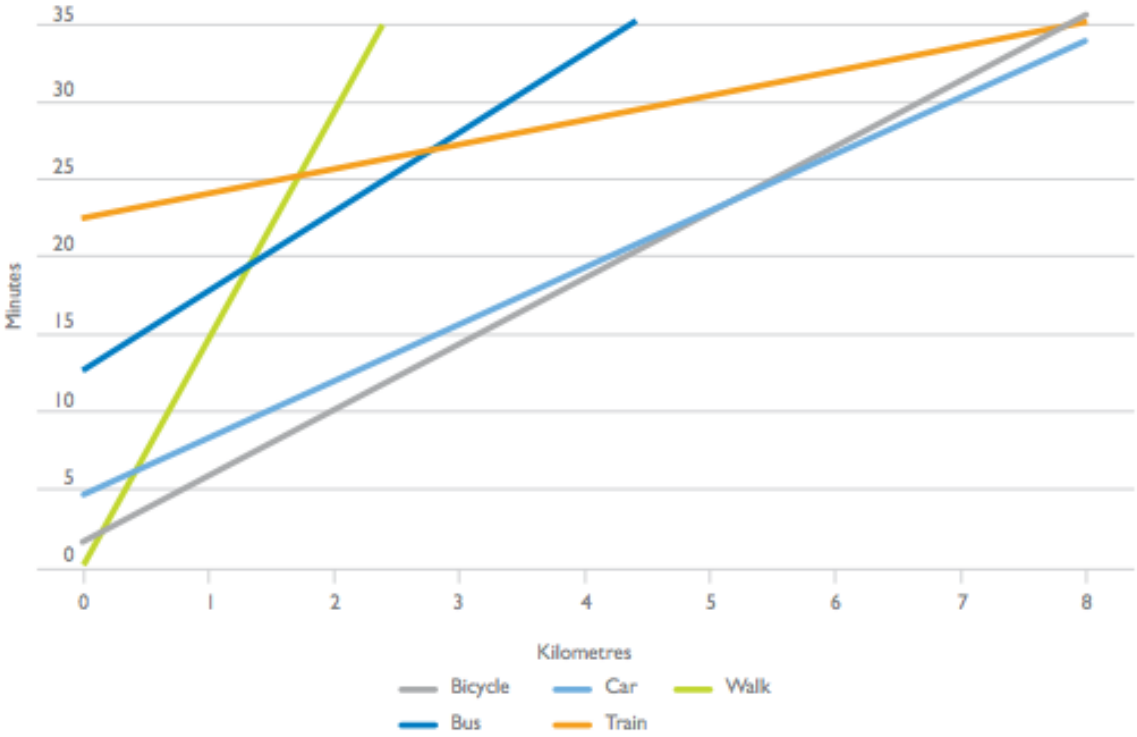


Figure 1.2. Comparative journey speeds of travel modes in an urban environment (Jim 2013)

It can be seen in the figure above how it is faster for a person commuting by bicycle to arrive to its destination in the city than if he or she takes the bus. Moreover, it shows that the bike is the fastest transport in the city for distances longer than 200 m an until 5 km - 6 km.

1.3. What is restraining having high levels of cycling?

The benefits of cycling stated in the previous section are not known in many places. Where they are mostly known is in The Netherlands and Denmark, whose citizens *hardly need to be convinced of the usefulness and benefits of cycling* (Oosterhuis 2016: 245).

Throughout the history of most of the English-speaking countries around the world, *the nationalist dimension of cycling did not involve utilitarian transport, which since 1960s has declined to the same low levels as in many other parts of the western world, but was linked to sports and (professional) racing* (Oosterhuis 2016: 246).

Policymakers, planning experts and bicycle researchers also acknowledge that the main problem is that non-bicycle users are not aware of its benefits (Oosterhuis 2016).

Moreover, apart from this fact, there is another relevant factor that influences the non-existence of high levels of cycling in cities, which is the lack of cycling culture. Certain societal developments during the twentieth century have had an influence on the cycling culture today, which have led the Netherlands and Denmark to a widespread use of the bicycle compared to other countries, resulting in contrasting bicycle cultures (Oosterhuis 2016). In southern European countries like Spain, there is a lack of cycling culture in terms of commuting, mobility expert David Álvarez acknowledges this fact:

"We have another problem and it is the cultural one, this one is really hard to change [...] that is to say that we lack culture and we lack political will…"

(Appendix 5: David Álvarez)

Nevertheless, if there is no culture of the bicycle or its benefits are not known in a country, it should be possible to make a transition towards achieving higher levels of utilitarian cycling, but the communication of the benefits of cycling is a condition that can definitely help boost it and should be included in the strategy as a soft measure, defined by the OECD (International Transport Forum 2010). However, transitions are difficult processes that take several generations to be accomplished and affect all actors in the socio-technical system in question, in this case: the transport system. No single actor can steer this process, instead, it consists of a group effort and consensus-driven action in which every stakeholder has his own goals and interests. Under these characteristics lies the difficulty of bringing about system change, and especially the one in the direction of sustainability.

Furthermore, until some years ago, governments in southern European countries have relied in their employees´ expertise or winning consultancies of tender processes to conduct policy interventions and implement transport infrastructure, without attending to other stakeholders' views and knowledge, such as researchers, society or associations and lobbies. Mainly because it has not been part of the tradition in these countries to have actions agreed by consensus, as it has been in the Netherlands or Denmark (Oosterhuis 2016). But if we want to make this change happen, then spaces for debate with all transport stakeholders are necessary to realise this transition. Still, politicians from countries like Spain are reluctant to implement city wide bike strategies:

"It is true that politicians are still scared of giving full commitment for bicycle development in cities, in terms of saying: we are going to make all the streets bikeable."

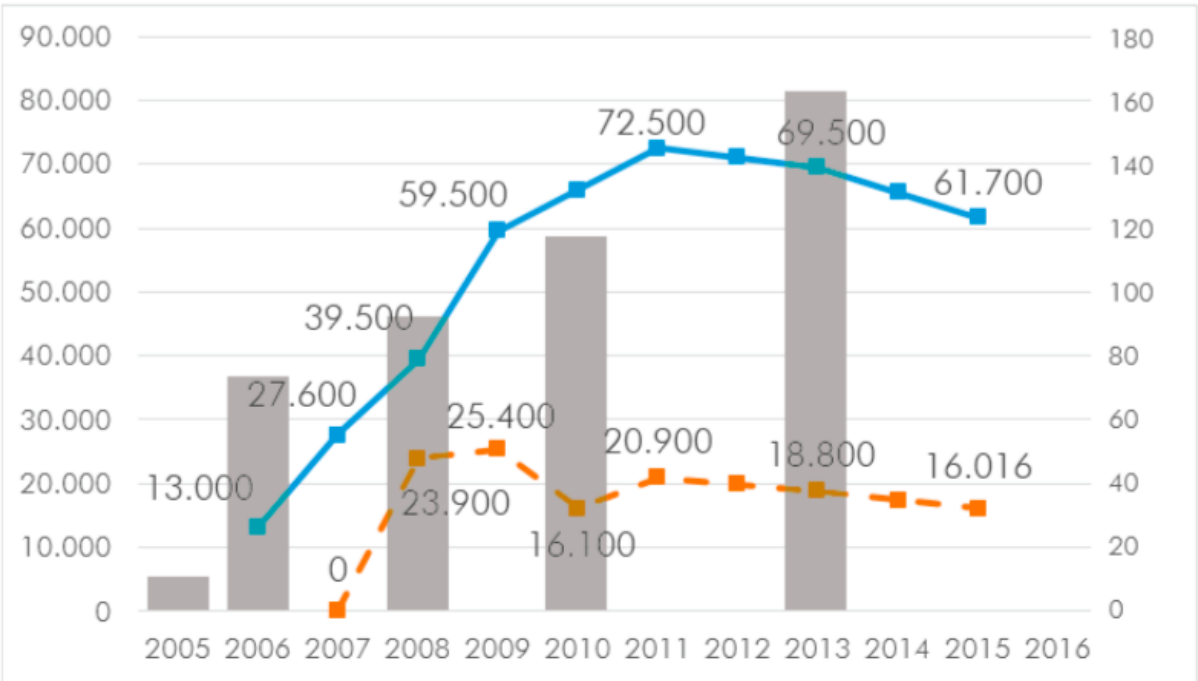
(Appendix 5: David Álvarez)

1.4. The difficulty of choosing an infrastructure as there are many models

Amsterdam and Copenhagen are two of the cities in the world with the highest biking rates, with 25%[1] and 29% (The City of Copenhagen 2015: 4) & (City of Copenhagen 2017: 2) respectively, does that mean that they have a high quality infrastructure? Well, if we look at the quality requirements defined in the PRESTO cycling policy guide, they are safety, comfort, directness, cohesiveness and attractiveness (Dirk Dufour, Ligtermoet and Partners 2010). This guide is made by 5 cities jointly and represents the first effort to unite *state-of-the-art European knowledge and experience on urban cycling policy* (Dirk Dufour, Ligtermoet and Partners 2010: 1).

In both cities, the level of safety of the cycle network can be observed in that the predominant form of cycling infrastructure is the cycle track. A review of the literature about the safety of urban cycle tracks points out that constructing cycle tracks on busy streets reduces collisions and injuries when effective intersection treatments are employed (Thomas, DeRobertis 2013). However, in the Netherlands, a big proportion of the cycling infrastructure is shared with the rest of the vehicles on the road and that is possible thanks to traffic calmed areas and zones with 30 km/h speed limits.

In the city of Seville in Spain, the bike mode share increased considerably with the construction of bike infrastructure. As we can see in figure 1.3, the length of segregated bike infrastructure increased from 10 km in 2005 to almost 120 km in 2010 and the number of bike trips grew accordingly from less than 13,000 to more than 65,000 trips.



[1] http://cyclingacademics.blogspot.dk/2016/02/recent-data-about-dynamics-in-amsterdam.html

Figure 1.3. Evolution of daily bike trips in Seville. In blue the total number of bike trips (left scale) and in orange the number of bike trips done with public bike (SEVici). The bar chart corresponds to the evolution of kilometres of bikeways (right scale) (Ricardo Marqués et al. 2016).

In relation to the type of cycling infrastructure recommended, generally, manuals on cycling consider mixing bikes with motorised traffic as the default option, when the intensity is not very high (*Average Daily Traffic < 3000 veh.*) (Dirk Dufour, Ligtermoet and Partners 2010). Nevertheless, as it is stated in a synthesis document by the Roads Safety Observatory in the UK: *"People tend to prefer cycling environments which are either separated completely from motorised traffic or have substantial separation."* (Observatory main category: Roads).

1.5. Implementing bike infrastructure by taking space from the road

As I specified in section 1.2, cycling has several benefits compared to the rest of the transport modes, especially the motorised ones. And the private vehicle represents the one transport mode which is necessary to reduce its use in the city due to it is the one which contaminates the most if it is not electric or hybrid, occupies the most space and does not impose any physical activity nor relationship to its environment to the person who is driving it. Old are now the times were we used to predict and provide the capacity for cars, at least in cities.

Therefore, looking at the example of how the city of Seville has started a transition towards including the bike in their city transport system in which the bike mode share passed from being marginal to a 6% in four years (Marqués Sillero 2011). The city based the cycling network on bike lanes on the sidewalk in 62% of the cases and only 10% of the infrastructure built was taking the space from the road (Gerencia de Urbanismo 2013). What I am trying to express with this is that, although segregated bike paths can be more comfortable and peaceful than driving through the road close to the cars, the majority of the infrastructure cannot take the space from another sustainable mode which is walking. If the aim is to make cities more sustainable, then we have to reduce the space for the unsustainable mode that the car represents. Therefore, if a bike route is planned to go on a street, this one should be taking the space from the road and not from the sidewalk. David Álvarez, mobility expert in the south of Spain, states the same in the following quote:

"Whether you use bike lanes, no matter what you use, what you want to do is to remove cars. You want to increase bike use instead of the car, no matter if you use bike priority lanes or bike lanes, the key is that one."

(Appendix 5: David Álvarez)

Once at this point, it is still difficult for a country that has no tradition of cycling as an utilitarian or commuting mode to plan a bike infrastructure in a city. There is no local data about accidents, perceptions of cyclists, comfortability or other. Urban and transport planners do not know when to mix the bike with motorised traffic and when to segregate it according to what criteria. Although there are experiences and guidelines from other

countries, stakeholders do not rely on these blindly due to there are local conditions that make the situation different.

1.6. The socio-technical system of the bike

Therefore, I have to look at the socio-technical system of the bicycle to try to see how it is gaining momentum during the beginning of this century, and starting to take a place in the transport system of cities around the world. It is not established yet, but it is progressively being incorporated into the urban mobility strategies in cities that do not possess an established cycling culture.

The figure below shows all the components, going from the vehicle - the bike, and the rest of technical components such as the infrastructure or the production and industry structure. To the more social components that are needed for the system to function, such as the markets and user practices or the culture and symbolic meaning, for example.

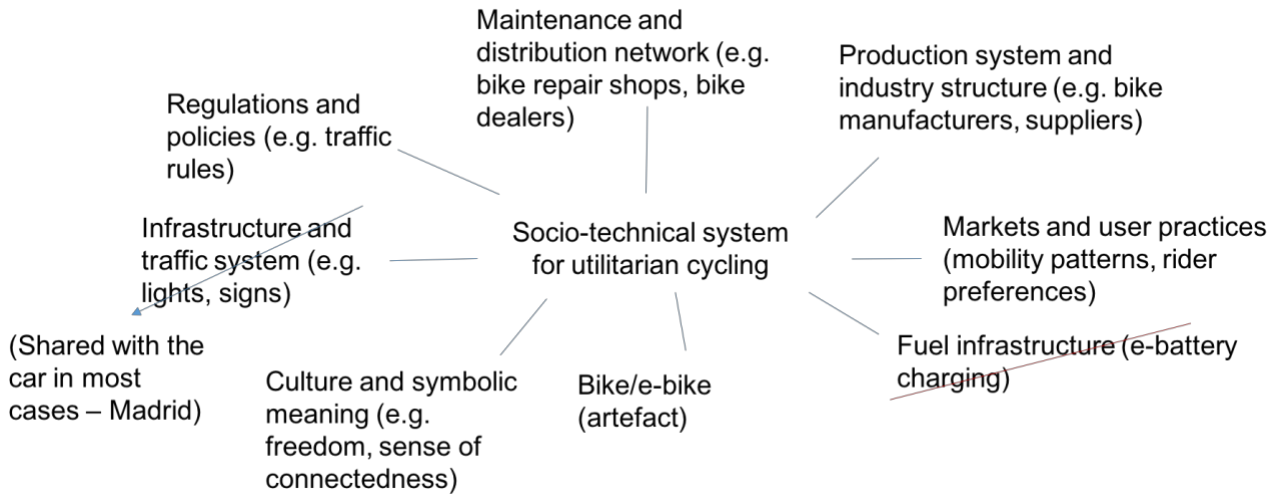


Figure 1.4. Socio-technical system for the bike (Own production from Frank W. Geels´ socio-technical system for land-based car transportation)

Chapter 2 Problem Formulation

To see how southern European countries can incorporate cycling as a socio-technical system that replaces the established one centred around the automobile, I am going to look at the case of Madrid, which has implemented a new type of infrastructure. The municipality of Madrid has recently introduced a novelty in the bike system of the city in the form of a bike priority lane, which is a fitting-out of the road to convert a traffic lane into a shared lane between cars and bicycles by means of road markings, namely a bike sign, two chevrons and a 30 km/h sign as maximum speed limit.

Figure 2.1. Bike priority lane in a street in Madrid (enbicipormadrid 2014).

The city council has also introduced a public e-bike sharing system, thus, these two represent significant changes in the socio-technical system of the bike that intend to turn the transport demand towards more sustainable modes of transport in the city. I will examine in this thesis if this infrastructure can support the transition of the mobility system towards a more sustainable one. Therefore, I state the problem formulation as the following:

Is the bike priority lane supporting the transition of Madrid´s mobility system to a sustainable one?

Chapter 3 Methodology

In this chapter, first I will explain why I chose the bike priority lane as the unit of analysis, then I will detail the list of terms that I have used throughout the report and why I decided to use them. Additionally, I will describe the research design that derives from the problem formulation and will explain the techniques followed to obtain the two main sources of data used for this report: literature review and interviews, plus the research validation technique of triangulation. I will wrap up the chapter by giving some details and timeline of the case study.

3.1. The focus on the bike priority lane to look at the transition of the mobility system

As I briefly explained the notion of socio-technical system in chapter 1, it consists of a melange of social and technical arrangements that help constitute and maintain the everyday needs of people who use the bike, from purchase to maintenance and use of it in an organised, reliable, well-functioning way, i.e. a system. Therefore, if I want to be able to find patterns of change, I have to focus in one or two elements of the socio-technical system of the bike and their relationships, as Frank W. Geels states in the following quote:

"Sociotechnical systems are complex and consist of linkages between several elements. Patterns can be found by making different cross sections, focusing on relationships between two or more elements."

(Geels 2005: 686)

I was able to identify the implementation of the bike priority lane in the city of Madrid because I previously saw that this same infrastructure is going to be implemented in my hometown, Granada. I went to a meeting where some transport stakeholders from my city were gathering to talk about transport solutions in the metropolitan area, and then the employee of the municipality Mª Dolores Trespando stated that the bike priority lane would be implemented in the near future in the city. Since I did not know about the existence of this infrastructure, I checked it online and most of the results that I could find were coming from the city of Madrid. This is how I could see that the event that is characterising the change in the mobility system of Madrid in the last years and the start of the implementation of the socio-technical system of the bike is the launching of the bicycle priority lane.

Additionally, a second event that is prompting a transition in the mobility system of Madrid is the implementation of a public electric bike sharing system in 2014. Once I started researching the bike priority lane I found information relating to the bike sharing system. Thus, starting from these two elements of change in the bike system, I am going to analyse and trace other developments that are influencing the transition process happening in Madrid.

3.2. List of terms used in the report

- Bike priority lane (BPL) or shared lane: In spanish called “ciclo-carril 30”, which its direct translation to English would be “cycle-lane 30”, but I did not translate it this way because it can be mistaken with the bike lane. I chose the term bike priority lane or shared lane, because these ones already exist and are similar in the type of infrastructure that they represent. There are some examples of this infrastructure in San Francisco (Alta Planning + Design 2004).

- Municipality of Madrid or Madrid city council: The city council is the governing and administrative body of the municipality of Madrid (Anon.2017), therefore I will use these interchangeably.

- E-bike: Electric bicycle.

3.3. Research design

Is the bike priority lane supporting the transition of Madrid´s mobility system to a sustainable one?

The research question that I have chosen leads directly to a case study design because I am focusing on a certain location (city of Madrid) and studying the phenomenon of implementation of a new bike infrastructure that is occurring at contemporary times. I could have chosen a more general question instead, for instance: are bike priority lanes or shared lanes supporting the transition of mobility systems in cities to sustainability? But if I had done this, then I would have had to study several cases at the same time, where bike priority lanes are also used (United States, Canada or Australia) and might not have been able to obtain as much information as I did for this case. Moreover, I would not have been able to conduct interviews in these places. This would have led me to not being able to study the process of transition in cities in depth and might have been difficult to determine other developments ongoing connectedly.

In this way, by studying this case I will gather enough insight of the process to determine whether the bike priority lane is supporting the transition. I will gather information about the context in order to understand causal processes (de Vaus 2001) and how developments took place and decisions were adopted. However, it will be difficult to generalise the results and apply the same consequences to other cases due to the specificity of the case.

3.4. Data collection techniques

One of the two main sources of data that I am going to base this project on is interviews. As I will analyse the mobility system in the city of Madrid for the last decade and assess whether there is being an incorporation of the niche of the bicycle as a socio-technical system in a way that it prompts sustainable development for the system, and consequently for the city. I have to investigate what were the causes for the implementation of the bike priority lane in order to be able to understand why it was adopted. But it is also relevant for the answering of the research question to investigate how this process was done.

This is a methodology that derives from the theoretical concepts that I am using to investigate the problem. For instance, the theory of MLP states that system innovation is a transition in the way that it is the change from one socio-technical system to another. The theory of MLP states that this transitioning from one system to another does not happen due to one simple cause. Instead, there are multiple non-linear developments at different heuristic levels that make the transition happen. Therefore, to be able to provide with an answer and state if bike priority lanes are supporting the transition towards sustainability, I have to know what motivated its implementation, but I also have to see its effects on the rest of the regimes existing in the transport system. In this case, the bike priority lane will modify the car regime in some way, because it is using its space, therefore, I will have to study how it affects it and see if it reduces any of the components of the regime or puts any pressure on it. Additionally, in the long term, I would have to see if it reduces the space available for the car.

And to study the process of how and why the bike priority lane was implemented I need the insight and experiences from the stakeholders that intervened during it. I can find some relevant data about this in reports that have been published by the municipality of Madrid or some research studies that have been conducted, and interviews can provide me with more specific data in order to establish the causes for change.

Moreover, to be able to know how the niche is being supported or pushed forward, this is being done by actors, stakeholders in the transport sector, which in this specific case of the bicycle niche, it is the bike associations and other transport stakeholders like Alfonso Sanz, mobility expert and consultant. I can look at the documents that they have published but it is much more constructive for the study of the problem to specifically address them with questions by means of an interview.

What I want to express here is that the problem formulation could lead the reader to think that the best way of analysing it is to look at what has happened to the mobility system once the bike priority lane has been implemented, i.e. by looking at its effects. To some extent, this is logical, but effects like for example the taking of the space from the road for the BPL might not be a consequence of just adopting the BPL. Of course if you implement this kind of infrastructure the direct effect is this one, that the space for the bike is taken from the road.

But the key here is that this effect should derive from the reasons for the adoption of the BPL, if it has been a rational, planned process.

3.4.1. Interview technique

I have followed the semi-structured technique for the consecution of the interviews because it helped me see what were the thoughts at that time, what were the procedures, how did the stakeholders interact and what were they thinking of what were the problems at the time and about the future of the mobility system. These are rather open-ended questions and this interview structure applies well (Stuckey 2013). I needed to learn about these in order to be able to assess whether there is a transition going on in the mobility system towards sustainability and if the bike priority lane is supporting this one. Therefore, I needed the interviewees to speak about them in an open way and without constraining excessively their opinion on that matter, but still I had to make the thread of the conversation stay in these points, related to the socio-technical system for the bike and the bike priority lane as the new infrastructure.

This is the reason why I have chosen the semi-structured technique for the interviews that I have conducted and not a structured one.

Moreover, I conducted the interviews during the first two weeks of April that I spent in Spain, and they were specifically held after having chosen the theories of Transition Management and MLP that I was going to use to analyse the topic and after I had researched the implementation of the BPL via bike master plans and reports from the municipality. Therefore, they were not introductory interviews to get an overview of the mobility system in Madrid but rather focused ones on the developments and decisions taken by the transport stakeholders. This is why an unstructured type for the interviews would not have lead me to obtain this information.

Furthermore, I sent the interviewees a document comprising a summary of what I had researched about the bike priority lane until the date of the interview, with Spanish and American references. And also a summary of the aim of the research and problem formulation in this thesis so they could be prepared for the interview and go directly to the main points that were of relevance to solve the problem formulation. These two documents can be seen in Appendix A.

Finally, I sent the quotes and the part of written text in connection with it that I have used in this report to the corresponding interviewee to check their conformity with the statements that they expressed and my transcription of them. This procedure will enhance the validity of the research results.

3.4.2. Interviewees

I have identified the interviewees by looking at the different documents that the municipality of Madrid has published. Some of them appeared as authors the document or as participants of the committee in question. I have interviewed the people stated below:

Alfonso Sanz - mobility expert working for the consultancy “gea21”

Gea 21 was the consultancy in charge of elaborating the Review of the Bike Master Plan of 2008, and Alfonso Sanz was one of the authors. *“Has studied geography, mathematics and urbanism. He has worked as a consultant for several cities in Spain collaborating in their mobility and urban planning. He has also conducted numerous studies and reports for the improvement of non-motorised modes of transport and collective transport modes.”* (gea21) He appears as one of the authors of the Review of the Bike Master Plan.

Ignacio Ramos - expert in communication of mobility and manager of mobility projects at “Empresa Municipal de Transportes (EMT)” (municipal transport company, in Madrid)

Ignacio started working for the “fundación Movilidad” (Mobility foundation) in 2006, and he conducted the “mesa de movilidad” (Mobility committee). In 2012 the foundation transformed or changed name to EMT, municipal transport company, and this one took responsibility of continuing with the Mobility committee. He appears as one of the people interviewed in the report “Informe de estado de la movilidad de la ciudad de Madrid 2013” (Report on the status of the mobility of the city of Madrid 2013).

Ramón Linaza - councillor aide for the department of Environment and Mobility of the municipality of Madrid. He is a bike activist as he is also part of the bicycle association “Pedalibre”. He offered himself to be interviewed when I contacted Inés Sabanés, councillor of the municipality of Madrid.

Ramón has been an advisor for this department since 2016. He participated, as a cyclist, in the committee for the Review of the Bike Master Plan of 2008, done in 2016.

Miguel Andrés - activist at the bicycle association “Pedalibre” from Madrid

He is the responsible for urban cycling at the association. He offered himself to be interviewed when I contacted the association. I found “Pedalibre” when doing information searches about the bike priority lane in Madrid, they have published a report in their website about the effectiveness of the bike priority lanes in Madrid and they are a very active association, having taken part in the Review of the Bike Master Plan.

Maria Dolores Trespando - works for the department of mobility in the municipality of Granada.

David Álvarez - mobility expert in the south of Spain

He is educated as a civil engineer and now runs his own transport and mobility consultancy, he helps with the mobility and transport planning to different towns and cities around Spain, like “Orihuela”, in Valencia.

All the interviews were conducted in person except for the last one to David Álvarez which I had to conduct by phone. There were some technical issues with the recording of this one and it is difficult to understand what it is said during the interview, therefore I have not provided a full transcription.

3.4.3. Literature search

The second source of data collection that I have used in this master thesis is written documents such as scientific papers, master plans, assessment reports and evaluations, research reports, books and websites.

For the Theory chapter I have mainly used the book “System innovation and the transition to sustainability” to explain my understanding and the use that I do of the theory of Multi-Level Perspective in the report. Additionally, I have used the scientific article “Transition Management in public policy creation” to understand and explain Transition Management Theory. Nevertheless, there are more references that I have used in this chapter that can be consulted by the reader in the Bibliography chapter.

For the Analysis chapter, I have focused my attention principally on the Bike Master Plan for Madrid of 2008 and on the Review of the Bike Master Plan of 2008, done in 2016. In the Discussion chapter there is no specific piece of literature on which I based the writing, as there are different topics that I address.

3.4.4. Triangulation technique

Between these two sources: literature and interviews, I have been able to correlate the information about the phenomenon of bicycle planning in Madrid. Since there are documents that have investigated it in depth and others that provide relevant information pertaining committee meetings. These ones, added to the interviews conducted to Alfonso Sanz, one of the authors of the Bike Master Plan for Madrid and to Ignacio Ramos, who coordinated the Mobility Committee meetings, have let me confirm the data extracted from the literature and also expand it.

This technique constitutes a method in social science that I can use to validate the veracity of my research results (Mertens, Hesse-Biber 2012: 75).

3.5. The case study

I chose Madrid as the case study, which is already addressed in the problem formulation, because I found conspicuous that the municipality of Madrid had implemented the bike priority lane as the only type of bike infrastructure during the period 2011-2013. Therefore, I

thought it was a relevant topic of study as the BPL represents a new type of bike infrastructure or fitting-out of the road in the country and in the world, actually.

- *Population: More than 3 million inhabitants.*
- *800,000 private motorised vehicles access the city every day.*
- *Population of the metropolitan area is similar: 3 million inhabitants.*

(John Orcutt, Elisa Barahona Nieto et al. 2016)

- *604.6 km^2 and 21 districts.*
- *Average population age: 40 years old.*
- *Average household size: 2.7 members per household*
- *Number of cars per inhabitants: 498 cars/1000 inhab.*
- *Density: 5.300 inhab./km^2*
- *79% of soil is residential.*
- *17% of soil is dedicated to services/tertiary.*
- *Dense city with varied ground use throughout its surface area, which makes it ideal for public transport use and non-motorised modes use.*
- *Nevertheless, this is not tendency observed, the growth of the metropolitan area with low densities and concentration of activities in these ones is generating new motorised trips and increasing the trip distance, less efficiency of the public transport and higher dependence on the car.*
- *In the last 20 years, density has decreased 10%.*
- *The difference in height level is 60 metres and the average slope is around 1%.*
- *Some areas have a 4% or even 6% slope.*

(CIMAS 2015)

In the figure below we can see the timeline for the events that have happened during the last ten years, the period that I have chosen to study the mobility system of Madrid. I chose this period because it consists of several events and developments that influence the bicycle planning in the city and produce a change in the planning practice, as I will later explain in the Analysis chapter.

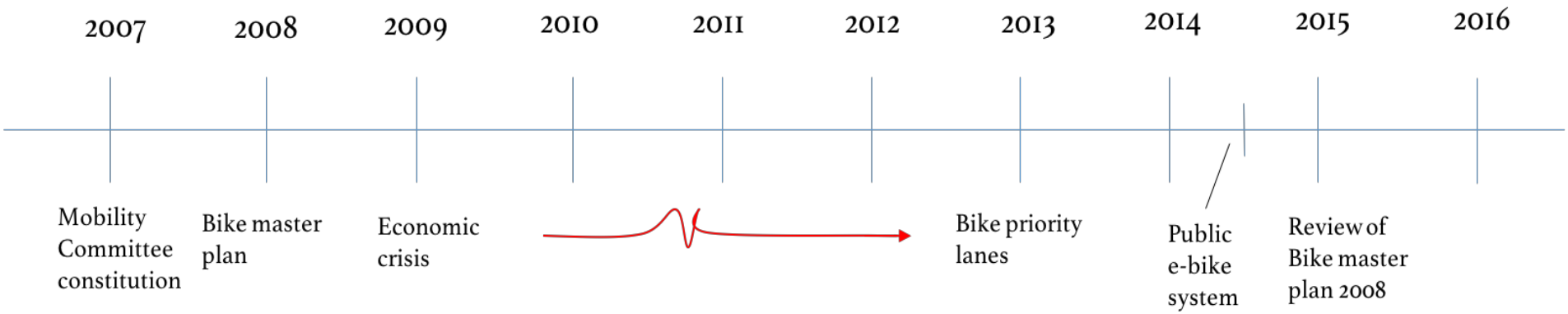


Figure 3.1. Timeline of the most important events (Own production).

Chapter 4 Theory

In this chapter, I will describe the theoretical framework that I have chosen to analyse the problem. I will explain my understanding of the theories of Multi-Level Perspective and Transition Management. It will consist of 5 sections in which I will detail the three heuristic levels (levels to understand or learn about reality but that do not exist in itself) described in MLP: the landscape, the regime and the niche level. I will explain how a transition is a shift from an established socio-technical system to an emerging system. Furthermore, I will describe the different socio-technical systems that I can see in the transport system competing between each other.

4.1. Choice of theory: Multi-Level Perspective and Transition Management

To analyse the problem stated in chapter 2, I am going to make use of the theories of Transition Management and Multi-Level Perspective. I decided to use these theories and not other because they can provide me with a framework to analyse a transition of the transport system as a transformation from the existing system to a different, new system, which is more sustainable and performs better in terms of environmental efficiency (Elzen et al. 2004: 1). As the reader can observe in the figure below, system innovation provides with a higher factor of environmental efficiency than system optimisation or radical change of the system, and that is what I intend to demonstrate in the research topic, a change of socio-technical system within the transport system from one based on the automobile to one centred on the bicycle that performs better in terms of environmental efficiency, but at the same time improves social wellbeing and health of people and still represents the most efficient form of transport in the city, as I have shown in chapter 1. Introduction.

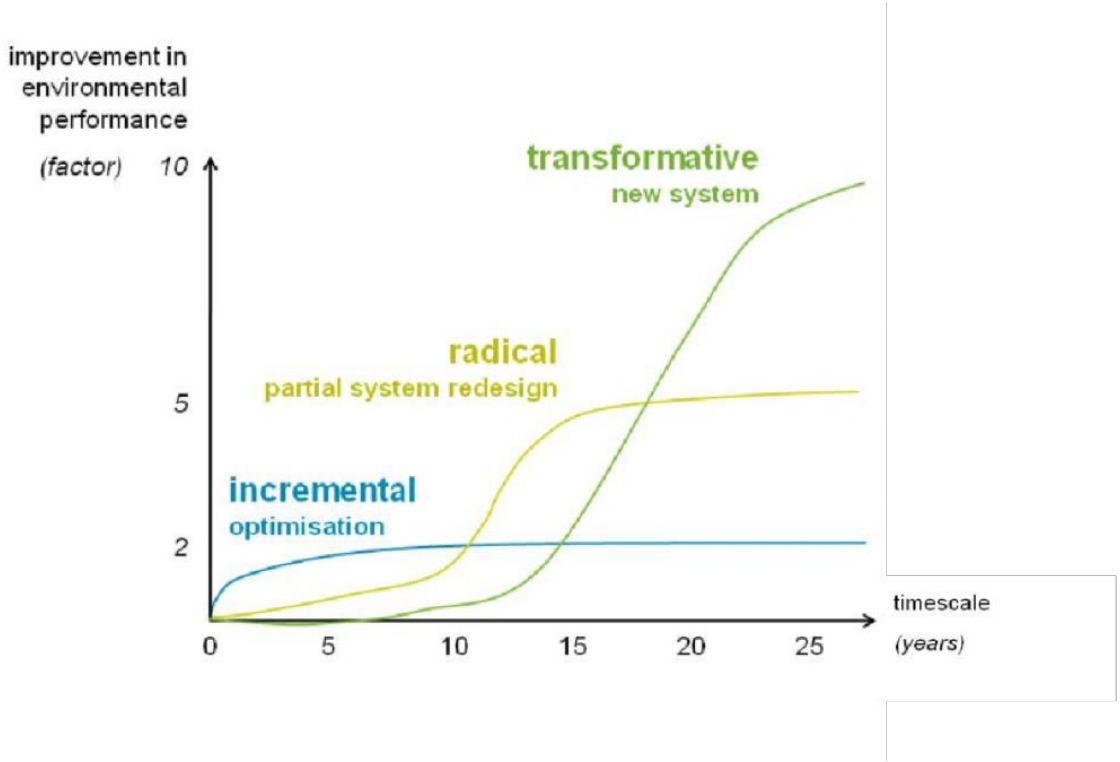


Figure 4.1. System optimisation versus system innovation (Weterings et al., 1997).

And the theory of MLP aims to achieve system innovation by empowering niche actors and bringing them into the decision-making process (Whitmarsh 2012: 484). In this case the niche would be the socio-technical system for the bike, because it is not an established one, so it represents a novelty in the transport system, at least in countries like Spain where utilitarian cycling is not rooted in the society.

However, Transition Management argues that we should aim for both system optimisation and system innovation (Rotmans et al. 2001: 25). Although in this report I am only going to look at the system innovation aspect through the implementation of the bike socio-technical system that is taking place in Madrid. And this theory further states that "*a transition can be brought about by the gradual transformation of an existing system, instead of the planned creation of a new system"* (Rotmans et al. 2001: 25). The bike priority lane is initially in line with this assumption, as it represents a fitting-out of the road, then I will study in the Analysis chapter if it prompts a future reduction of the space available for the car.

As I will also explain later in the analysis chapter, the bike priority lane represents a solution that does not involve a large-scale investment and that is valid in the "*existing system and in a system that satisfies the transition objective"* (Rotmans et al. 2001: 25). In this sense, Transition Management lets me identify ongoing dynamics and how the solution of the bike priority lane joins with these ones, this is another reason why I chose to use Transition Management to analyse the problem.

4.3. The three heuristic levels

MLP describes three heuristic levels from which to learn from reality or analyse it, these ones are the landscape, the regime and the niche level.

The regime level includes the practices and rules that all sort of stakeholders that take part in the socio-technical system in question, in this case the transport system, execute to drive the everyday activity of the different components of the system. Namely, "*engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, ways of defining problems, which are all embedded in institutions and infrastructures"* (Elzen et al. 2004: 33). In this way the regime accounts for the stability of the socio-technical system. Rules are clear and set, and there is some form of structuration where regime actors know how to execute everyday practices and interact with each other. System optimisation takes place in the regime, as the socio-technical system improves gradually.

The landscape level contains the more or less exogenous factors that are not modifiable or easy to change by the actors in the regime and niche levels. It comprises global trends or events and the structures that rule and constitute the world that are deeply rooted in societies. In the case of transport systems in cities, the landscape would represent the urban structure of the city that conforms the space available for the road transport, for instance.

The niche level represents the protective space where radical innovations (novelties) emerge. Technological novelties lack the necessary performance characteristics and economies of scale to compete in mainstream markets, therefore they need this space to develop. In the niche, relationships and rules are more loose than in the regime, they are not constituted yet, they need structuration and work from niche actors. These novelties in the case of Madrid, as I will explore in the analysis chapter, represent a public e-bike sharing system and the bike priority lane.

The concept of nested hierarchy is important here to understand the degree of structuration that each level bears, as shown in figure 4.2. It means that regimes form part of the landscape level and niches are set within regimes, which is to say that somehow the highest level conditions the one below. Niches appear to solve the problems occurring at the regime level derived from a malfunctioning of the linkages between the elements in the latter, for instance.

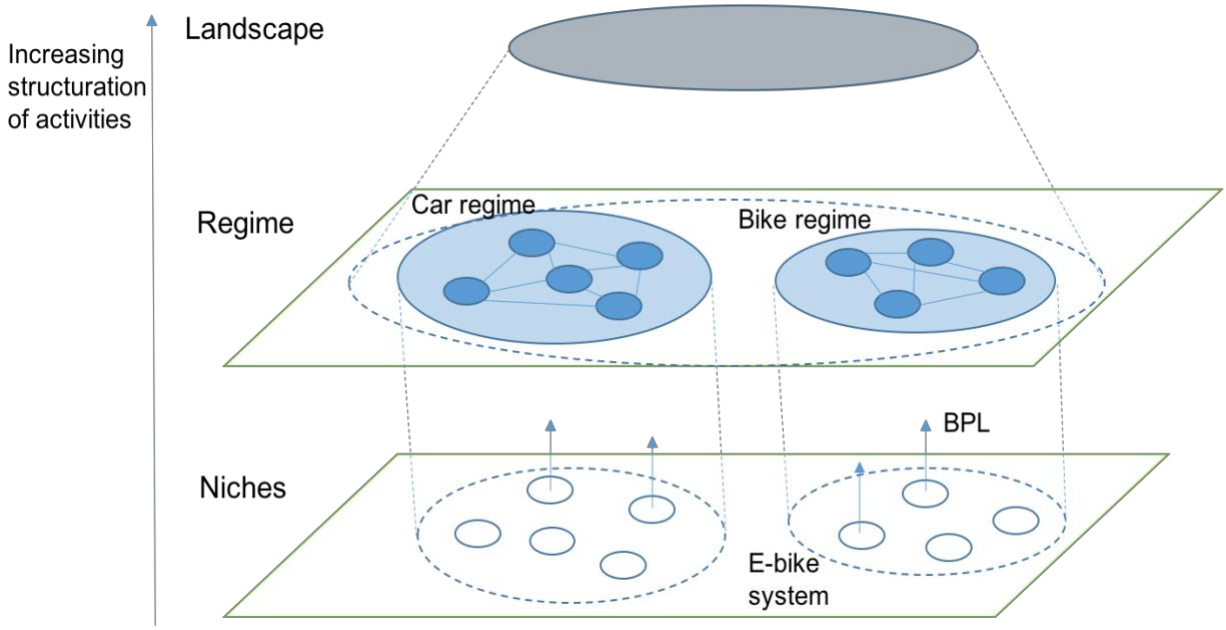


Figure 4.2. Multiple levels as a nested hierarchy in the transport system in Madrid (Own production from Geels 2002a).

4.4. Transition: Change from one socio-technical system to another

Changes emerge from niches which develop below the surface, i.e. the regime actors do not expect their appearance. Actors in the niche produce radical innovations, often geared towards the problems of the regime (Elzen et al. 2004: 37). In the case of Madrid, the transport stakeholders taking part in the mobility committee agreed to implement the bike priority lane and public e-bike sharing system taking into account the demands from some bicycle associations of having vehicular cycling, as I will explain more in depth in the Analysis chapter.

A radical innovation breaks through when there are 'windows of opportunity' at the regime level through which it can penetrate. These windows are generated from ongoing developments at the landscape level that put pressure on the regime. Which in my case these are the scarce bike infrastructure financing derived from the economic crisis in 2009 and the sustainable urban mobility paradigm (SUMP) instauration that is forcing cities to take action to combat energy consumption of city transport systems.

The 'windows of opportunity' can also be generated from internal technical problems in the regime or negative externalities that this one has on the system. Like, in the case of study, the pedestrian-cyclist conflict occurring on the sidewalk and the increasing bike mode share. Or simply because the user preferences have changed and the existing system or technology cannot meet them any more (Elzen et al. 2004: 38).

The regime thus opens up and allows the introduction of these novelties that produce a change in the socio-technical regime. The old regime is left behind and a new one makes its way through, configuring a new socio-technical regime.

It is important to note here that niches also take time to build up and constitute as a socio-technical system. As I showed in chapter 1. Introduction, a socio-technical system has many components. Niches are constituted as socio-technical systems as well, consisting of relationships between stakeholders, practices, rules and lines of knowledge and cooperation between producers, engineers, users, developers, planners, policy-makers, etc. Initially, the niche is loosely constituted, lacking many of these characteristics and components as it originated from a few of them like a new technology and new infrastructure, for example. Therefore, there has to pass some time before it constitutes entirely and can even operate at the regime level as the new socio-technical regime, it will take several decades to constitute and this is what is called a transition. In the following figure the process that I have explained is well exemplified:

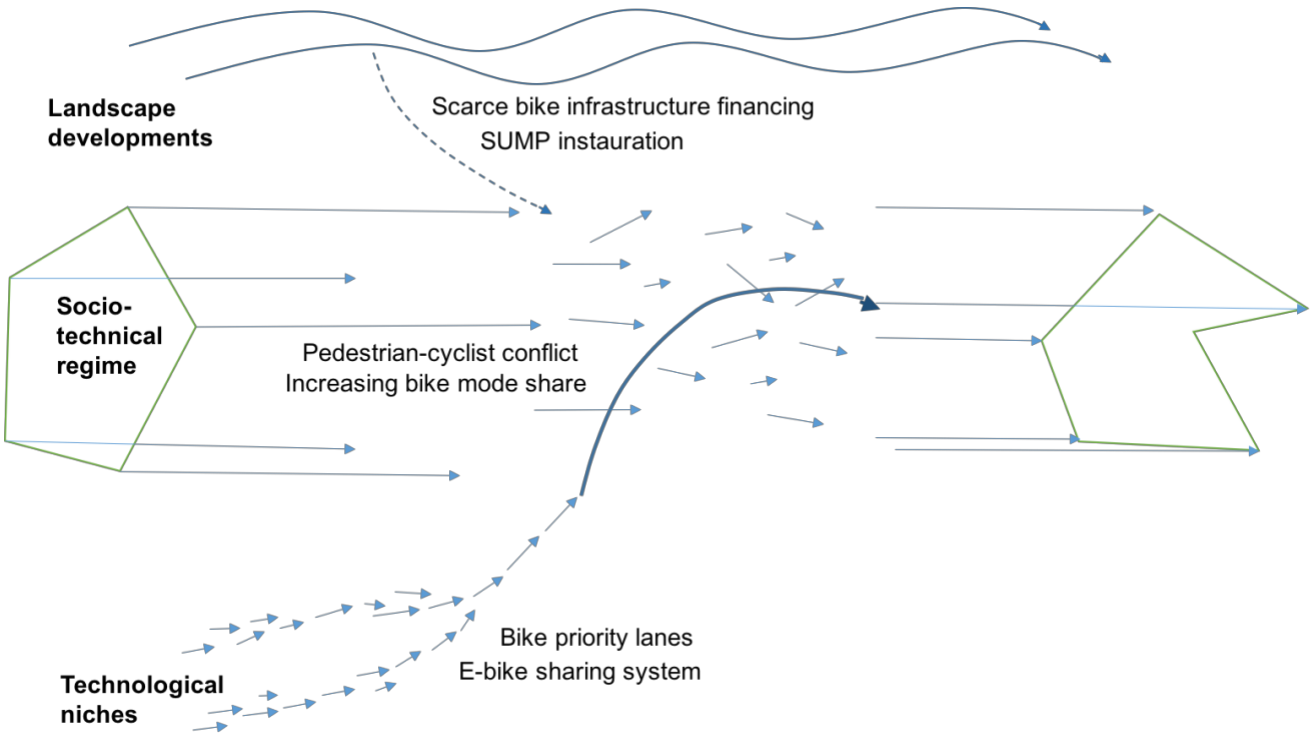


Figure 4.3. A dynamic multi-level perspective on Madrid´s city transport system innovation (Own production from Geels 2000a).

4.5. The different transport regimes considered in this thesis

The different regimes that I am going to consider during the analysis of the problem that compose the urban mobility system:

- Walking.
- Cycling.
- Automobile.
- Public transport: bus.

I have considered the division of the transport system in the city of Madrid into these regimes because each one of them is constituted by a different socio-technical system consisting of different components, although the walking regime, for instance, does not possess the same number of components as the rest of the regimes do, it still represents a socio-technical system different from the rest because it has its own infrastructure and users. In this sense, it can come into 'rivalry' with the other regimes by fighting over space.

Chapter 5 Analysis

In this chapter, I will look into process that has motivated the adoption of the bike priority lane as the main type of infrastructure that was implemented during the period 2011-2015 in the city of Madrid. I will describe how the transition started brewing from the consensus among transport and governing stakeholders and later examine who were the precursors of this change. Finally, I will look at different definitions of the bike priority lane from different stakeholders and propose some criteria that could be evaluated in line with the transition process.

5.1. Multiple developments emerging from different levels

As the theory of MLP argues, there are processes at multiple dimensions and levels simultaneously that motivate system innovations (Geels 2005a). In the case of bike priority lanes implemented in Madrid, I could observe throughout the data gathered (documents and interviews), that there were multiple developments that motivated its implementation. I will state them in this section of the analysis.

First of all, there was a reduction in the bike infrastructure financing when the global economic crisis hit the market in 2009. From having an investment of 12 million euro annually for the completion of a network of segregated bike lanes stated in the Bike Master Plan for Madrid in 2008 (Ayuntamiento de Madrid 2008c). The financing decreased to 2.5 million euro for the estimated cost of the bike priority lanes between the period 2011-2015 (CIMAS 2015: 51). This is a factor coming from the landscape level that is influencing the regime, it is also explained in the Review of Madrid Bike Master Plan from 2016:

> *"The economic crisis, from 2008 until today, linked to the enormous debt of the municipality of Madrid due to the tunnelling and extension of the M-30 ring highway at the south of the city centre provoked a sudden stop of the investments in the execution of the bike network"*
>
> (Ayuntamiento de Madrid 2015: 75)

A second development at the regime level was the increasing bike mode share that the city of Madrid was experimenting. An average of 27% annual increase among all vehicles (excluding walking) was happening from 2008 until the implementation of the first bike priority lanes in 2013-2014, as it is shown in figure 5.1:

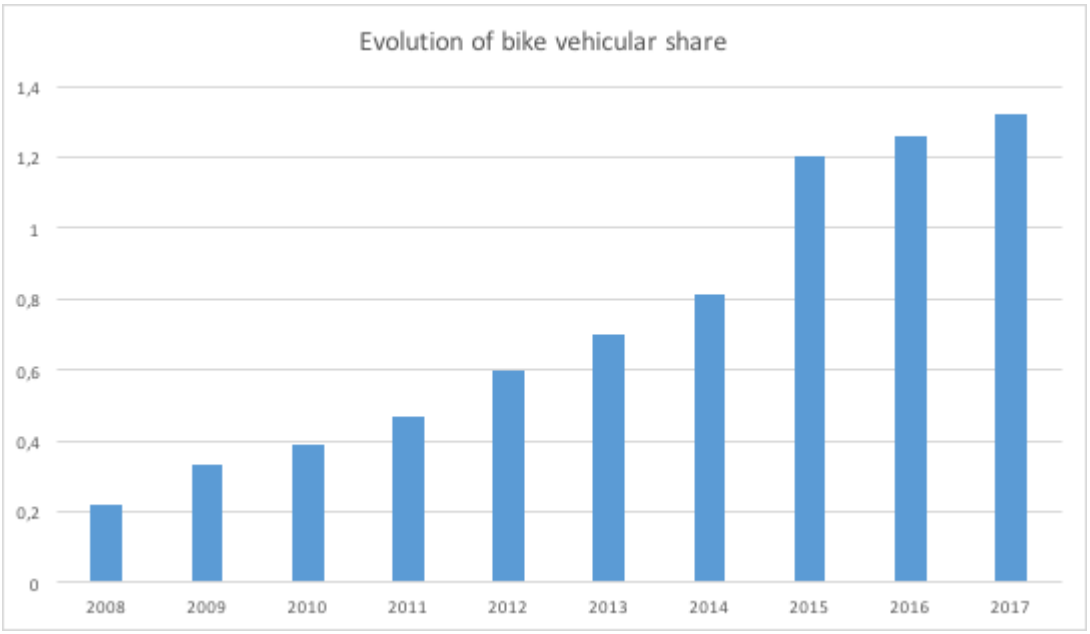


Figure 5.1. Evolution of percentage of bikes among vehicles in municipality of Madrid (Ayuntamiento de Madrid 2018)

The sustainable urban mobility paradigm that was thriving at the landscape level also had an influence on the city in the implementation of this new bike infrastructure. This influence was visible since the launching of the Bike Master Plan for Madrid in 2008, with an extensive plan for a network of segregated bike lanes in the city. But as the Great Recession hit the country and expected budgets were no longer feasible, a new type of infrastructure that required less budget had to be planned if the new paradigm was to be continued.

Moreover, another problem that was causing the previous cycling system to collapse was the pedestrian-cyclist conflict occurring on sidewalks due to the construction of bike lanes on the pedestrian area. The city counted with around 100 km of bike lanes on sidewalks in 2008 and the Bike Master Plan of 2008 designed a network mainly consisting of this type of bike infrastructure. As we can observe in the image below, it is easy for pedestrians to walk on the bike lane without noticing it, as there is no physical barrier or difference in level with the pedestrian footpath. Only the different colour makes the pedestrian aware of potential passing bikes.

Figure 5.2. Bike lane on sidewalk in a street in Madrid (Villaramblas 2013)

This generated a conflict between passing bicycles and pedestrians invading the bike lane because of several reasons and situations, i.e. because the sidewalk was too narrow in some cases, at crosswalks, at bus stops, etc (Ayuntamiento de Madrid 2015: 140). The conflict represents a destabilizing force for the existing bicycle regime at that time. The walking regime had been stable since decades the way it was, but in the decade of the 2000´s, the construction of bike lanes on the sidewalk started, thus had to fight for the space of the walking regime. In this sense, the user practices and the infrastructure (components of the socio-technical system) of the walking regime were altered by the bike system. Nevertheless, the latter did not manage to establish itself due to the previously mentioned pressures from users of the walking system (pedestrians).

The last and maybe most relevant reason for the implementation of the shared lane that I have identified emerging from the niche or micro-level is the adoption of a public e-bike sharing system in June 2014 (CIMAS 2015). Stated by the manager of mobility projects from the municipal transport company of Madrid, who collaborated in the coordination of the Mobility Committee organised from 2006 onwards, and the arena where the mobility related decisions for the city were adopted:

"It added up the fact that the new cycling mobility system was going to consist of electric bikes, therefore, the idea that someone said in one of those previous meetings, which there is nothing published about: well, it would not be a bad idea to put many 30 limit speed streets, or bike priority lanes, when we saw that the bike was going to be electric, we said: now it is the right solution! e-bikes have a speed that allow them to coexist with the car, then everyone saw it clear"

(Appendix 2: Ignacio Ramos)

Therefore, I can conclude that these developments reinforce the need for creating a new bicycle infrastructure in the city of Madrid with the following characteristics:

- Located off the sidewalk.
- Having a low budget.
- That allows the bike to gain importance and respect among citizens (drivers, pedestrians, etc.)

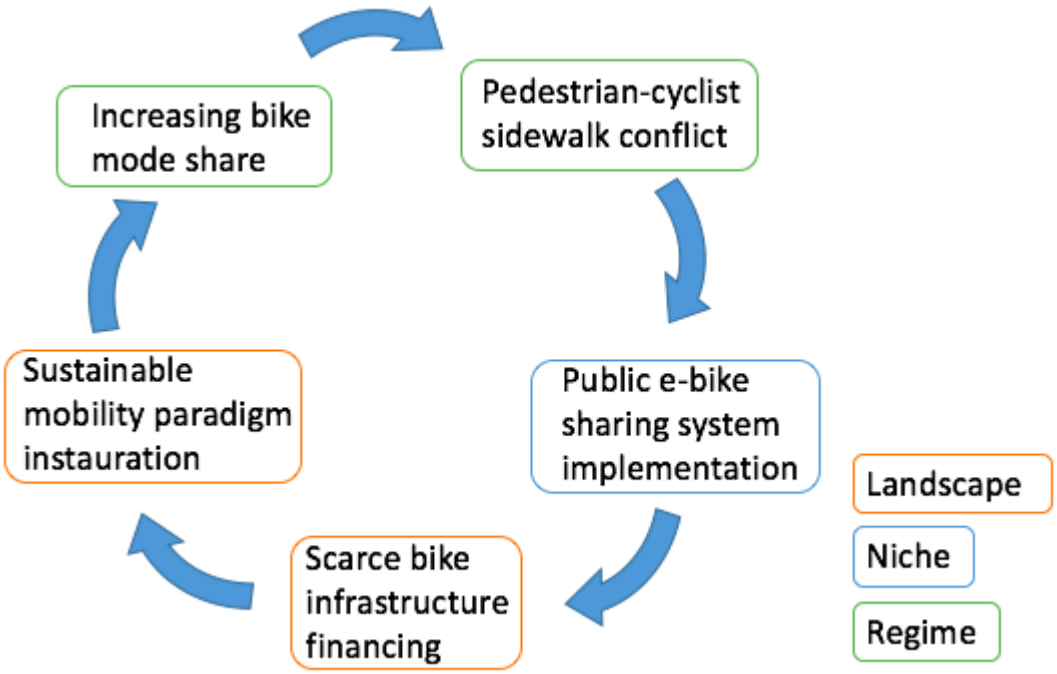


Figure 5.3. Circular causality diagram of developments that reinforce the implementation of bike priority lanes in Madrid (Own production)

MLP let me identify the sources of the developments that motivate the implementation of the bike priority lane, as shown in the circular causality diagram. Since the theory rejects simple causality in system innovations, and they materialise when processes reinforce each other (Geels 2005b), this diagram aims to reflect the reinforcing nature that each development at each level has on the rest. Therefore, I obtained the insight for this figure from the notion of "circular causality" (Geels 2005: 686) described in the theory of MLP.

5.2. The beginning of a transition

The "fundación Movilidad" (Mobility foundation), now the "Empresa Municipal de Transportes" EMT (municipal transport company) created in 2006 the Mobility Committee. This committee served as an arena for relevant stakeholders of the mobility sector to meet and reach consensus on the actions to adopt concerning the mobility in the city of Madrid. And its purpose was to work in order to achieve a higher degree of competitiveness,

universality, safety and sustainability of the mobility system (Mesa de Movilidad 2014), which represents a long-term vision.

Ignacio Ramos also refers to the aim of the committee:

"The committee was created with the commitment of all parties to barely make diffusion, it was to agree on ideas and opinions, that everyone had a common road map, the different parties and unions, that all had clear what were the real needs of the city."

(Appendix 2: Ignacio Ramos)

This long-term vision on improving the overall sustainability of the system helps the committee establish short-term objectives such as the radical positive discrimination in favour of least contaminating transport modes and more energy efficient (walking, bicycle and public transport), through a modification of the urban space assigned to each mode, to ensure a higher use of these sustainable modes to the detriment of the compulsive use of the car (Mesa de Movilidad 2014).

Therefore, with the committee, the transport stakeholders of the city of Madrid are starting what could be regarded as a transition management process. They are using a long-term vision which serves as a framework for formulating short-term objectives (Rotmans et al. 2001).

5.3. A fundamental change of assumptions

A transition, as argued by Jan Rotmans, René Kemp and Marjolein Van Asselt, implies a fundamental change of assumptions and the introduction of new practices and rules (Rotmans et al. 2001). As I have stated before, bike lanes were previously constructed on the sidewalk in the city of Madrid, interfering with the flow of pedestrians. But later on, some bicycle associations were claiming that the space for the bike should be the road, just as one more vehicle, this involved a change of assumptions:

"*...the construction of bikeways was suddenly stopped and it was not until 2012 that a new bikeway planned in the Bike Master Plan was made, the axis street Mayor/Alcalá, this time with a much more limited budget and opting for low cost solutions, in line with the new paradigm: the space for the bicycle should be taken from the road."*

(Ayuntamiento de Madrid 2015)

It can be seen in the following figure how there is a bike lane at the left side going in one direction, and then a shared lane for cars and bicycles (bike priority lane) in the opposite direction, the place for the bicycle ride is now moved to the road.

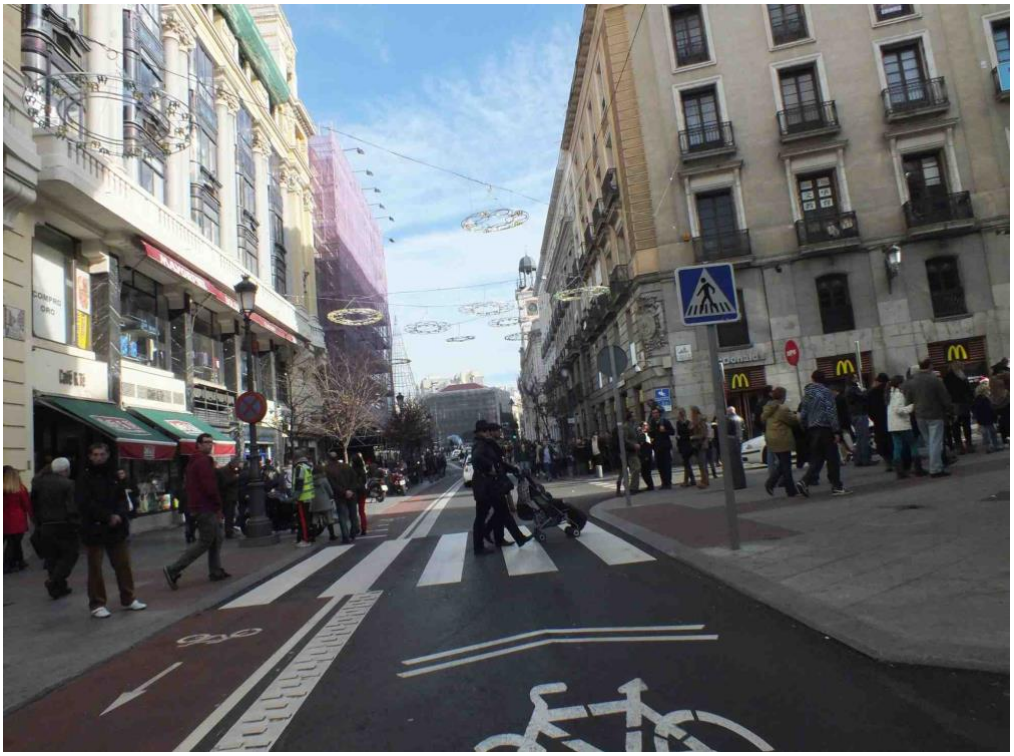


Figure 5.4. Bike lane in street "Alcalá", located on the road. (Anonymous)

When it is being written down in the review of the Bike Master Plan of 2016 that the bike infrastructure should take the space assigned to cars to be placed, the niche for the socio-technical system of the bike is gaining space over the socio-technical system of the car, which constitutes the established regime.

One could think that the bike priority lane represents a solution in which the regime remains intact. At first sight, implementing shared lane markings on a traffic lane puts no pressure on the car regime. However, it does put pressure on it, it makes cars be aware of cyclists and react to them in traffic. In this sense, it is changing the user practices of the socio-technical system of the car that now have to coexist with the bike, using a safety distance and overtaking cyclists by changing to the adjacent lane, just as if the bicycle was a vehicle like the car on the road.

This is a difficult goal to achieve, when in the city of Madrid, the bike vehicular share has represented less than 1% of the total of vehicles and the bicycle was not seen as a utilitarian mode of transportation, but rather as a sports vehicle, as it is exemplified in this piece of text: "*...in the consideration of the bike as a mobility solution that surpasses its labelling as a sports and leisure vehicle in which it was restricted."* (CIMAS 2015: 65)

Furthermore, bike priority lanes have helped to take a further step on the struggle with the regime by transforming them into actual bike lanes in the recent years. The municipality of Madrid has executed this measure in cases where the traffic volume and speed of cars is too high or where the slope was above certain levels. We can see in the following graphic how the evolution of the cross section of the streets in Madrid has been:

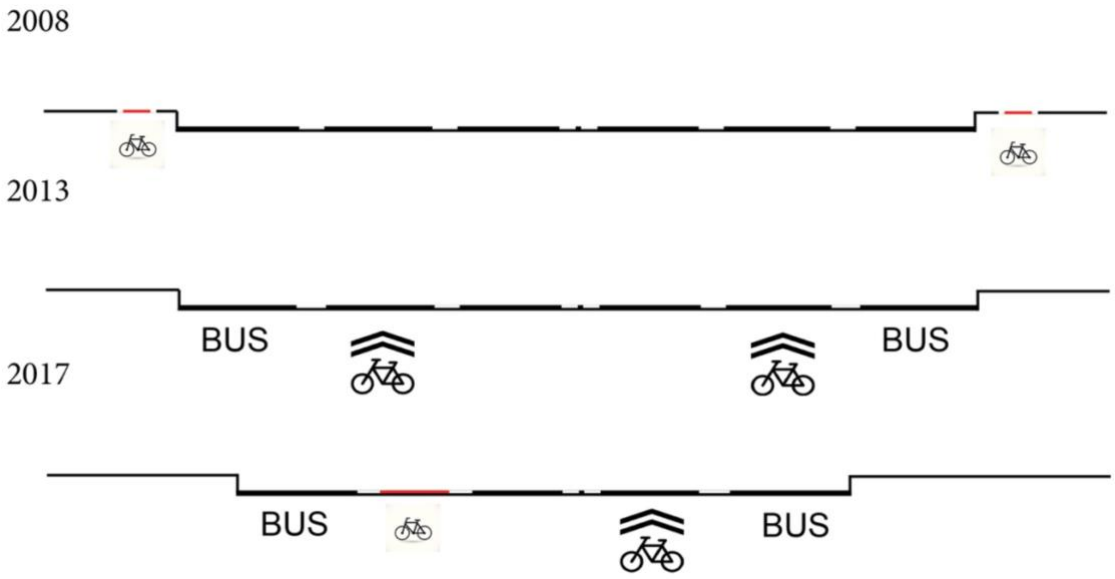


Figure 5.5. Evolution of the cross section of the streets in Madrid. (Own production)

This has not been the evolution of all the streets in Madrid, as not all the streets consisted of bike lanes on the sidewalk. For instance, bike lanes on the sidewalk represent 133 km of the total number (447 km) in the city, which are represented in figure 5.5 in the first road cross section with the bike sign and red pavement. Bike priority lanes represent 158 km of the total, shown as the mark that it is used on the road: two chevrons and the bike. Which represented in the second cross section on the diagram, belongs to the so-called M-10 cyclist ring. And finally, the last cross section coincides with the previous one except for the transformation of the bike priority lane in one of the directions to a bike lane, as it is being constructed now in the avenue of the city centre “Gran Vía”. These are the figures for the year 2015, expressed in Elisa Barahona´s article about the promotion of cycling mobility in the city of Madrid (John Orcutt, Elisa Barahona Nieto et al 2016: 31).

In 2008, the total number of bikeways was less than 140 km (Ayuntamiento de Madrid 2008b: 10), and less than 30 km of bike lanes on the sidewalk were constructed in the period from 2008 until today. Thus, if we take the existing total number of bike lanes on the sidewalk in 2015 (133 km) and we subtract the amount of them constructed after 2008 (30 km), that leaves us with around 100 km of existing bike lanes on the sidewalk in 2008, which represent the majority of the bicycle infrastructure, 100 km out of 140 km. The reader can see how the predominant type of bike infrastructure at that time, before the change of assumptions, was the bike lane on the sidewalk.

The situation changed after this as 158 km of bike priority lane have been implemented since 2013 and these have facilitated the reduction of the space available for the car after some years, where recently they are being transformed into bike lanes in some of the streets. Of course, this would not have been possible without the consensus among transport stakeholders achieved in the Mobility Committee and the recent proceedings of the municipality of Madrid.

5.4. Precursors of this change

"Experience with the MLP shows it to be a useful analytical framework for understanding transitions, which highlights the precursors, dynamics and complexity of both incremental and radical innovation" (Whitmarsh 2012: 484).

Bike associations that sustain the socio-technical system of the bicycle at the micro-level, try to exploit its capacity by putting pressure on the regime actors. Around the year 2008, some bike associations wanted to transfer the bike to the road, and some others were advocates of segregated bike infrastructure. All these associations form part of the niche of the bicycle, though they have different approaches to the infrastructure that it (the niche) should use. In this regard, the theory cannot elucidate which stakeholders are pushing the niche forward or which ones are restraining its possibilities of success.

What I have to do to be able to define the position of each stakeholder within the niche is to observe if their decisions and actions are going against the established regime or if they are favouring its lock-in. I have to look at the actions that stakeholders undergo within the bike niche in relation to their effects on the car regime, that is, in relative terms.

Ignacio Ramos gives his point of view on which city network model for bike infrastructure was the most supported one:

"It was not this model the most demanded one, the most demanded one was the bike lane (model), and in fact the Bike Master Plan of Madrid that was brewing in that time, 2007-2008, there, what is agreed upon is that what it should be done is a network of bike lanes and it is even done a map per district and neighbourhood of what should be the web of bike lanes of the city."

(Appendix 2: Ignacio Ramos)

Although at this time of the writing of the Bike Master Plan (2008), still the effects of the economic crisis were not tangible yet, and the bike infrastructure model that was planned for was the one containing bike lanes on sidewalks. It was not until the crisis started to have a major impact on the economy and that the other causes previously exposed happen that the model changed.

The city council did not invite bike associations to take part in the mobility committee but in the years following this one, it started to include them for the committee that revised the Bike Master Plan of 2008, and they were able to express their desires and concerns in relation to the bike infrastructure planning and mobility planning (Ayuntamiento de Madrid 2008a: 1), as it is shown here:

"...we have altogether decided in the committee for the Bike Master Plan, with the bike associations, we have gathered their idea that they do not want bike paths, segregated from traffic, what they want instead is the calming of traffic. We are also very interested, of course, in doing bike priority lanes, what is called bike priority lanes"

(CIMAS 2015: 75)

David Álvarez, as a mobility expert coming from Madrid, also states that when talking to bike associations, these ones prefer to ride the bicycle on the road:

"Associations have always told me that they prefer going through the road, because they feel safer confronting cars than confronting pedestrians"

(Appendix 5: David Álvarez)

However, this is not the predominant thought among bike associations in Madrid, there are some of them that support segregated bike infrastructure when the number of vehicles in the street and their speeds are too high, like the association "Pedalibre":

"*In a main street, there is not much sense to have it (bike priority lane), in a main street there has to be an exclusive lane that ensures a smooth flow and convenience for cycling, that is clear"*

(Appendix 3: Miguel Andrés)

In the following quote, Miguel from "Pedalibre" expresses how they, even though they advocate for segregated bike infrastructure, at the time when the model of bike lanes on sidewalks was going to be replaced by a new model, they supported the new one which was going to be a mixed model:

""Pedalibre", in that process that we were talking before about the bike lanes on the sidewalk that were constructed at the times of "Ruiz Gallardón" (2010) and all that, and then it switched to bike priority lanes, there were some stakeholders, almost, with regard to proposing a mixed itinerary, consisting of bike lane and bike priority lane, and we from "Pedalibre" applauded that measure because it legitimizes its space on the road, but experience has demonstrated in the end that the bike priority lane does not possess the necessary conditions to attract new cyclists"

(Appendix 3: Miguel Andrés)

Ramón Linaza, councillor aide for the Department of Environment and Mobility of the Municipality of Madrid, who is also part of the bike association "Pedalibre", expresses in the quote below the existence of pro-bicycle groups that supported bike priority lanes:

"And then there is a small sector of the cyclists in Madrid that is opposed to cycling infrastructures. This comes from the US 70´s, from vehicular cycling that considers the bike as one more vehicle, therefore it is not to be provided with specific infrastructure. This small sector says no to doing bike lanes."

(Appendix 4: Ramón Linaza)

Ramón Linaza further talks about the position of these bicycle associations with respect to allocating the bike on the road as one more vehicle, i.e. supporting the introduction of bike priority lanes in the city of Madrid:

"This ideology is represented in Madrid by a group that is called "Madrid Ciclista" and it is a minority among bicycle groups. If you talk to "Madrid Ciclista" they will tell you that it is the majority position, that we cyclists do not want bike lanes, etc, who is right? I do not know."

(Appendix 4: Ramón Linaza)

What I want to examine by looking at these contrasting ideas from different bicycle groups about the future of the bike city model is what I explained at the beginning of the section, identify which niche actors are contributing to the decline of the car regime. Once all the relevant quotes shown, initially, groups like "Madrid Ciclista" were not contributing to this process with their position, in line with vehicular cycling, because space was not reduced for the automobile. But still, as I stated in the previous section, this provoked a change in the attitudes of car users. And if the Director General of the department of Sustainability at that time understood this was the point of view of the majority of bike associations, then it became the option to adopt as they were incorporating associations´ views from that moment on.

Consequently, for "Pedalibre" and other bike associations or stakeholders that advocated for segregated bike infrastructure that I was not able to track or interview, even though they did not share this type of model, they did not go against niche groups like "Madrid Ciclista" and instead, they let the city advance in the direction of this model, where they finalised by constructing more than 150 km of bike priority lanes (Ayuntamiento de Madrid 2015) and around 50 km of bike lanes which took space from the road. We can see how there is an orientation to constructing more bike priority lanes than bike lanes, even though this is not the best strategy to defy the regime, because bike lanes eliminate space for cars and bike priority lanes do not, the conditions at that time for new bike infrastructure were:

- Low cost.
- Coexistence with motorised vehicle.

Therefore, advocates of segregated bike infrastructure had to lower their prospects and accept the new type of infrastructure: the bike priority lane. If they had not done this, the new model that was being planned might not have come into place and the transition could not have been initiated.

Furthermore, as I have shown in the previous section in figure 5.5, the strategy now is to transform some of the bike priority lanes into bike lanes (last road cross section). Therefore, in the long term, after some years of having implemented the temporary measure, the administration (city council) is now checking its validity and transforming them into bike lanes in those cases where there is a steep slope, etc. Both Ignacio Ramos from the municipal transport company and Elisa Barahona, former director general for the department of sustainability of the city council during the previous political mandate (2011-2015) made a statement in connection to the transient nature of the bike priority lane:

"It will be important to see how bike priority lanes evolve, which in the near future should be converted to being exclusively for bikes."

(John Orcutt, Elisa Barahona Nieto et al 2016: 26)

"When the city started implementing bike priority lanes and we had a network of these, deep down everyone knew that in the end, when there would be money, some day, there had to be made segregated infrastructure"

(Appendix 2: Ignacio Ramos)

Therefore, in a transition context, these niche actors were helping the socio-technical system for the bike to develop in the long term.

"Stakeholder-based, action research using the MLP may ultimately aim to achieve a re-categorisation of actors; by empowering niche actors and bringing them into decision-making processes, they may reconfigure regime membership, resources and lines of power" (Whitmarsh 2012). In this analysis this is also what is happening, the theory is letting me identify and empower niche actors, as the reader can see throughout this section.

5.5. BPL inherent goals in line with the transition

There are different considerations of what a bike priority lane is, according to the municipality of Madrid, a bike priority lane is *"a bicycle way especially modified to accommodate bicycles in first place, and in which motorised vehicles should drive at a maximum speed of 30 km/h, or less if it is indicated so"* (Ayuntamiento de Madrid 2015: 143).

However, there are other considerations to what a bike priority lane is, for instance, "Gea 21", the consultancy who wrote the Bike Master Plan from 2016, considers it as:

"We include the bike priority lane in a category of road interventions that we call fitting-out of the road, to differentiate it from more formalised infrastructures, more segregated ones, that have a certain exclusivity for the cyclist. Therefore, those fittings-out of the road include bike priority lanes, also include advanced waiting areas at traffic lights and other on-street improvements for the bicycle without creating an exclusive space for the bike."

(Appendix 1: Alfonso Sanz)

Another position is its consideration as *"an awareness raising campaign that makes the cyclist visible and helps normalise its presence on the road. In this sense, it is evident that it consists of a measure with a limited time horizon that ends once the use of the bike on the road is normalised, …"* (Ayuntamiento de Madrid 2015: 148)

From my point of view, the definition which applies best is the latter. The road markings of the chevrons and the bike make car drivers aware of the potential presence of bicycles. And in some cases, like residential areas with low traffic intensity and 30 km/h speed limit zones it serves as a fitting-out of the road and as the only bicycle infrastructure needed because in these calmed traffic conditions it is safe for the bike to coexist with motorised traffic.

Moreover, this is also the perception of some of the stakeholders of what the BPL is and what it can have an impact on, exemplified in the following quote:

"It is true that it has a positive point and is that it makes the bike visible, the bikes painted on the pavement… people ask themselves: oh look! are there bikes passing here? That is to say that it has the advantage of making the bike visible and legitimise it. This does not avoid the fact that you are riding on a BPL and a car horns at you and asks you to move, but well, I do not move aside because I am riding on the centre of the lane, end of the story."

(Appendix 4: Ramón Linaza)

In line with this categorisation of the bike priority lane, the municipality of Madrid should have defined some indicators in order to evaluate its effectiveness. Nevertheless, I must state that the municipality, after some years from the implementation of the first shared lanes, is now stating the problems associated through, for example, the only means that I was able to identify, feedback from bike associations that had conducted studies about the effectiveness of the shared lane through observation and opinions of users. Some of the problems are, stated in the review of the Bike Master Plan:

- *Overall noncompliance with 30 km/h maximum speed limit.*
- *Cyclists cannot advance through the BPL when it is congested.*
- *Heavy vehicles normally also use the right lane of the road.*
- *Higher perceived unsafety when the bike priority lane is adjacent to a bus lane.*
- *Lack of legislation at a national level that recognises the concept of BPL.*
- *Obligation of riding on the central position of the lane in extra-wide lanes.*

(Ayuntamiento de Madrid 2015: 145-147)

The indicators that I can think of that would have permitted an evaluation of the improvement in the role of the bike together with the shared lane, if we understand this one as *an awareness raising campaign that makes the cyclist visible and helps normalise its presence on the road* are*:*

- Does the BPL help normalise the use of the bike on the road?

- Higher number of cyclists (conditioned also by the adoption of the public bike).
- Perceptions - higher perceived safety from cyclists.
- The society now sees the bike as a utilitarian mode to commute.

The expert on communication of mobility of the municipal transport company expresses his view on the effect of normalisation that the BPL has had:

"My field is communication, thanks to the BPL, you end up pacifying traffic, you end up filling the city with bicycle icons, in all the streets, people end up seeing the bicycle everywhere, at first, generating a lot of rejection, a lot of conflict, you end up almost putting extra pressure on the cyclist, because it pisses off the people... at first, the driver gets angry, and he pays it with the cyclist, but as time goes by, they get used to it and they do not horn so much, the

cyclist does not get insulted anymore, and you still have there thousands of little drawings of the bicycle all over the city, what you are doing is reinforcing their presence."

(Appendix 2: Ignacio Ramos)

- Does it increase respect to cyclists?

- Safety distance that cars use.

Alfonso Sanz, mobility expert, talks further:

"... there is a value of the BPL that has to do with what we are talking, about empowerment, also promotion, make the presence of bikes emerge, when you implement the BPL, you paint it, in some way you are making the user that was not there before visible"

(Appendix 1: Alfonso Sanz)

- Does it produce a peaceful coexistence between the car and the cyclist?

On the other hand, certain stakeholders, like mobility expert and consultant David Álvarez, think that two of the most important indicators to evaluate the success of the BPL as a bicycle infrastructure are the evolution in the number of accidents among bike users and the evolution in the number of bike users and users from the public e-bike system (Appendix 5: David Álvarez).

"For me, the best indicator of success or failure of bike priority lanes is what rate, what level of cycling mobility it enables"

(Appendix 2: Ignacio Ramos)

- Does it produce a future reduction in the space available for the car?

I have previously shown, that after 5 years from its implementation, some bike priority lanes are being replaced by bike lanes.

5.6. Summary of findings

In this chapter, I have looked at how the transition of the mobility system with regard to including cycling as one more relevant option for commuting is taking place in the city of Madrid. Due to five important developments in different heuristic levels such as the scarce bike infrastructure financing, specified in the table below, transport stakeholders of the city agreed to implement the bike priority lane during the period 2011-2015. This one has facilitated the subsequent transformation of the space into space for bicyclists and consequently, to the reduction of the space available for the car.

The developments that have motivated this transition and the heuristic level which they come from defined in the theory of multilevel perspective are stated in the following table:

Landscape level	Scarce bike infrastructure financing
	Sustainable mobility paradigm instauration
Regime level	Pedestrian-cyclist conflict
	Increase in bike mode share
Micro level	Public e-bike system implementation

Figure 5.6. Developments emerging from the different heuristic levels in Madrid (Own production)

I have also been able to identify niche actors that have propelled the transition process, such as the bike association “Pedalibre” and other stakeholders from the mobility committee. Although it is sure I have not been able to interview and track all of them since the mobility committee was created more than 10 years ago and the discussions around the implementation of the bike priority lane took place 5 years ago, therefore they cannot be considered as the only actors driving the transition but they can serve as an example of actors that helped drive the transition.

Finally, I have briefly looked at the different perceptions of what the bike priority lane is and does. And what remains clear to most of the actors contacted in Madrid is that it serves as an awareness raising campaign and as a tool to normalise the use of the bike on the road which should be temporary in big avenues with high intensity and speed of vehicles as well as with steep slopes, but which can serve as a coexistence infrastructure in traffic calmed areas such as zones 30 or residential areas with one way streets and low volume of vehicles.

I have also proposed some criteria that could have been evaluated during the working period of the bike priority lane to check its validity.

Chapter 6 Discussion

In this chapter, I will discuss some relevant points in connection to the findings that I have discovered in the previous one. One of them will be what would have happened if the bike priority lane had not come into place. Moreover, I will reflect on the effects that the e-bike system implementation can have on the planning practice and the bike priority lane on the behaviour of cyclists, respectively. I will briefly compare the situation in the city of Granada to the one in Madrid and give some recommendations on implementing the shared lane. Additionally, I will try to forecast the changes in several domains that can happen throughout the transition and discuss possible effects on the mobility system and the city if certain events take place in the future.

6.1. A business as usual situation - no BPL

In this section I want to elaborate on the consequences of the hypothetical case in which the bike priority lane had not come into place, what could have happened then? If after 2008, bike infrastructure construction had completely been stopped in the city of Madrid, then the number of accidents involving a bike on the road might have risen due to non-existence of the bike priority lane, as this one has a positive effect on the level of respect from car drivers to cyclists, acknowledged by some of the transport stakeholders that I have interviewed. Alfonso Sanz speaks about this from his perspective as a cyclist:

> *"I have been riding a bike in Madrid for 44 years, and yes, there is a change since the implementation of the bike priority lane in the streets, I am more empowered, I have a security space of my own, that does not mean that road violence does not continue to occur on that space, but it has been smoothed…"*

(Appendix 1: Alfonso Sanz)

Moreover, it would have been difficult for the municipality of Madrid to execute bike lanes instead, because of pressures coming from those bike associations, as I showed in the Analysis chapter, who were opposed to segregated bike infrastructure. And it would have been even more difficult to transform those bike priority lanes in big avenues to bike lanes if there was not a bike priority lane first, that transition from a normal traffic lane to a bike lane would have represented a drastic measure against the car regime and therefore might have had high opposition from car lobbies and users such as taxi drivers.

Looking at the public bike system, the electric bikes would have been used through the bike lanes on sidewalks and this would have derived in an increase of the conflict cyclist-pedestrian also mentioned in the previous chapter. Since electric bikes can travel at higher speed than a normal bike and have more acceleration as well. Thus, they would have represented a higher threat to pedestrians on the sidewalks. At the same time, they could have been ridden on the road without any bike priority lane but the respect from drivers to

cyclists may have not been the desirable one and could have created more conflicts between them on the road.

6.2. Negative influences of BPL and e-bikes

Miguel Andrés from the bike association “Pedalibre” also makes a point about the undesirable consequences that electric bikes can have on bicycle planning: It is true that the e-bike allows the cyclist to accelerate and go at a speed that is better adjusted to motorised traffic on the road than a normal bike. Therefore, this characteristic can influence the planning of bike infrastructure in a way that it is less necessary to create segregated bike infrastructure when an e-bike sharing system is available to citizens.

Not all bike commuters in Madrid use the e-bike system “Bicimad”, a large proportion of them have their own bike and it is not an electric one. Therefore, when cycling through Madrid, cyclists have to encounter the ascent of slopes. When a cyclist is on a normal bike and he does not have his own space to confront this ascent and has to deal with traffic at the same time, it is more stressful for him or her to complete the climb than if he was on a bike lane or track, because then he can adjust the pace. However, being around traffic forces him/her to adapt the speed to passing cars.

So, as Miguel Andrés states in the interview, *“the e-bike can sometimes deviate us from what is really needed in those big avenues”* (Appendix 3: Miguel Andrés). Here, Miguel is thinking in relation to the change of socio-technical system that is needed to achieve sustainability. If the artefact component of the socio-technical system of the bike gains importance as a means of transportation in cities because of the e-bike implementation and some people transfer from using the car to using the e-bike but there is no infrastructure implementation, i.e. there is no bike lane implementation in those big axes with slopes. Then, there are many other citizens which have their own bicycle and do not use the e-bike sharing system and it is hard for the majority of them to travel by bike in these conditions. Therefore, a real transition to a sustainable system is not supported in this case if there is no bike lane implementation.

Another phenomenon that this time Alfonso Sanz, mobility expert for the consultancy “Gea 21” makes reference to is the theory of risk compensation. He has investigated this theory and consists on the risk compensation effect that takes place in car drivers when there is a modification of the road that makes it easier or safer to drive for car users. As they see themselves in a safer situation, i.e. the level of safety has increased, they lose tension and alertness because they feel safer. Alfonso Sanz states that this same phenomenon can be applied to cyclists. As cyclists in Madrid feel more empowered while riding a public e-bike on the bike priority lane, they ride at a higher speed and take risks that they might not take if they were not in these conditions. This might lead to an increase in accident rates as it has happened with the ABS brake system, the introduction of seat belts on cars or the treatment of black spots on roads (Alfonso Sanz 1995).

"And the risk compensation also works for the cyclist in this case. Due to you are more empowered, you lose precaution. That is also what happens with "Bicimad" users (public e-bike). They go at an excessive speed. Due to you are riding on the bike priority lane with that bike, let's say that you have lost the alert tension. Then, well, these are complicated exercises of road safety equilibrium that translate in more or less accidents depending on that relation between alert and precaution, well; between precaution and risk, etc."

(Appendix 1: Alfonso Sanz)

In this sense, if this phenomenon is happening in Madrid, which we do not know actually. Then the culture and symbolic meaning of the bike is increasing as an established mode if e-bike users are riding through the city more empowered and with a higher sense of safety. Which is good for the socio-technical system of the bike, because this a step forward towards establishing the bike system over the car regime. However, if e-bike users get to the point of compensating the safety gained for assuming more risks and interfering with pedestrians or with the car regime in a negative way that it can cause accidents, then the socio-technical system of the bike might lose reliability and confidence, as it happened before when the municipality of Madrid implemented the bike lanes on the sidewalk and interfered with the walking regime. Even if it leads to accidents involving only the e-bike rider, then it is also having a negative impact on the bike system due to it is not as safe and convenient as it could be.

6.3. What can Granada learn from Madrid?

Alfonso Sanz states that bike priority lanes should not be the only bike infrastructure to be built in a city as part of the bicycle network. There should be a strategy and an evaluation of the feasibility case by case, as he exemplifies in the following quote:

"Well, first, that should not be planned in that way, it is not a matter of substitution, the bike priority lane is an option amongst a group of measures to implement, part of a strategy and a plan in phases where you establish a series of measures depending on the objectives of normalisation of the use of the bike that you want to reach; it is assumed that we are all in one for that, normalise the use of the bike. Therefore, I think that you cannot plan to do a network of bike priority lanes, but instead I am going to make this bike policy and this is one of the pieces of the puzzle, but explain the rest of them, because otherwise this translates into just a picture [...]"

(Appendix 1: Alfonso Sanz)

By doing this declaration and incorporating this strategy in his everyday work as a consultant, Alfonso Sanz helps promote the correct way of doing planning, planning in a holistic way and from a strategy. By studying the feasibility of implementing the bike priority lane in each street because if you do not do this, the city will not be able to attract cyclists to ride in main avenues with the bike priority lane and the socio-technical system of the bike will not be able to establish in this case.

This seems to be partially known by the municipality of Granada, the engineers from the mobility area acknowledge the need of studying the feasibility of implementing the bike priority lane in every street although the agreement between the political parties in the municipality was to build a network of bike priority lanes as the only bike infrastructure, similar to the situation Madrid had when it implemented this same infrastructure. This is shown in the following quote:

"due to the institutional agreement derived from the political agreement, the city council has opted to go along the lines of the bike priority lane, what will be developed is an infrastructure consisting of bike priority lanes and cycle streets. Of course, we will have to study every street, there is streets that due to traffic volume, speed or volume of pedestrians that there can be in these areas [...] it will have to be studied if it is feasible to incorporate a bike priority lane or not, if it is not feasible, it will have to be moved to other area, but the development of the city in this moment will be all consisting of bike priority lanes and cycle-streets. There can be a specific and concrete place that needs a slight stretch of bike lane, but the instructions do not follow these lines."

(Appendix 6: Mª Dolores Trespando)

Moreover, Granada is using the bike priority lane in one of its main axes: street "Arabial", "Barcelona" avenue and street "Palencia" the city council will implement the bike priority lane and lower the speed limit in the entire street, not only in the bike priority lane, but all lanes. There will be cameras installed to enforce the 30 km/h speed limit. This measure will ensure the compliance with the speed limit at higher rates than it happened in Madrid. It represents an improvement that the municipality of Granada is accomplishing in comparison to Madrid, which also Alfonso Sanz talked about as a problem. This will have a calming effect on traffic and will lower the number of pollutant emissions. On the other hand, it will have a negative impact on the cycling conditions at peak hour as this street represents one of the main axes of the city, and the bike priority lane will disappear with traffic congestion.

"therefore, maybe in that specific axis, it was ideal to implement a bike lane, for all those reasons, additionally, there are many intersections, therefore, there will be implemented a bike priority lane and consequently we are bound to decrease the speed limit in the entire street, we are also bound to install speed control cameras, because otherwise there will not be adherence to the speed limit and moreover, after all this, technically, we have doubts about the suitability of the bike priority lane because it will lose the sense of bike priority lane in many moments during the day, in those moments in which the bike might have certain advantage, there will be traffic congestion, therefore the bike will have to overtake cars, well… thus, technically we have several doubts with respect to the development of the bike priority lane in that street"

(Appendix 6: Mª Dolores Trespando)

Nevertheless, in Granada most of the streets comprise one traffic lane per direction, there is only a few of them with more than one lane per direction. In this sense, it is difficult that in the long term the city can transform the bike priority lane into a bike lane, because there would be no space for the car then. But as most of the streets consist of one lane per

direction or even one only direction and many of these have a maximum 30 km/h speed limit, the bike priority lane is more suitable to this configuration than to the one of Madrid, with higher number of multi-lane avenues. I forecast that in Granada, the bike priority lane can have a higher effect in terms of increased visibility and normality of cyclists since mixing the bike with traffic in these conditions is more suitable for both the cyclist and the car. However, it will be difficult to have the same projection in the long term of reducing the space available for the car, and it will not have the same transition effect as in Madrid as the car regime will not be replaced by the bike niche.

6.4. Changes in different domains along the transition

In this section, I will elaborate on what influences the bike priority lane is having in other domains different from the infrastructural one of the society since this is one effect of transitions, as Boelie Elzen et al. state in their book: *"Thinking in terms of more than one domain (multi-domain) and different scale levels (mutli-level); how developments in one domain (level) gel with developments in other domains (levels); trying to change the strategic orientation of regime actors"* (Elzen et al. 2004: 145).

If we look at the process of transition taking place in Madrid, we could say it started in 2006 with the creation of the Mobility Committee and it might take several generations to complete. During this time, different things can happen and it is certain that changes in various domains will take place.

The inclusion of bike priority lanes on the street, as I have explained in the previous chapter, has had some impact on the cultural meaning of the bike, which is now starting to be seen as a vehicle for commuting and not just as a recreational one. This has had an effect on the habits of people that now commute by bike but who did not use to.

Additionally, the way of implementing the new bike lanes on the road through transformation from a bike priority lane, involves less money in its construction than it used to. Before, when bike lanes on the sidewalk were installed, a different pavement had to be used for the bike lane from the one of the sidewalk. Cobblestones or paving stones had to be removed and asphalt or concrete had to be placed instead. Now, as there is no need to change the pavement, the only cost is on the paint necessary to colour the road lane/bike priority lane. In this sense, there is a change in the financing of the bike infrastructure which was the outcome of the transition process. Not to be mistaken with the initial reduction in the budget for bike infrastructure as consequence of the economic crisis. In this case that I present here, I am referring to the outcome of the transition process that includes the bike priority lane. After having adopted it as a temporary measure agreed upon by most transport stakeholders, this milestone is now having a repercussion on the bike infrastructure construction that is being done in the present. The new bike lanes in some cases, those big axes that demand a bike lane in order to provide with a safe and convenient infrastructure for cyclists. Now, these ones are being done on the road by using the bike priority lane that was implemented previously and therefore do not need new consensus nor planning phase.

Therefore, this is an effect that the development in the domain of the infrastructure for the socio-technical system of the bike is having on the financing and the procedures established in the institutions. This fact characterises the transition of the transport system for the city of Madrid.

However, these bike lanes are still a type of bike infrastructure that does not suit all users of the bike as they pass between traffic at both sides, as the reader can observe in the image below:

Figure 6.1. Redesign project for street "Gran Vía". (Miguel Ángel Medina 2017)

Therefore, there will be certain users of the bike that will not feel comfortable with riding in this situation, as Alfonso Sanz states, this will be the vulnerable group:

" when you design a bike policy, what it must be done is to think to whom it is directed to [...] where we look to working with the two most relevant sectors from our point of view for the cycling mobility of the city at the moment that are: the vulnerable sector, the sector that we potentially think has to emerge in the following years for the bike to normalise and on the other side to facilitate the sector of users, of people that use the bike at the moment and which with less segregationist measures, with other kind of measures, can improve their current conditions, it is people who already use the bike and that would be more comfortable and safe if you improve (cycling) conditions thinking in them."

(Appendix 1: Alfonso Sanz)

6.5. Other socio-technical systems that are driving the transition

In this project, I am looking at how cycling mobility can help solve the different problems of cities which have high levels of car use, especially in southern Europe, in countries like Italy with one of the highest number of cars per inhabitant (European Commission 2018), it becomes critical to reduce the use of the private car.

As I have previously investigated, cycling scores high on overall sustainability requirements for a transport mode of the modern era which has not changed much since its invention two centuries ago. Compared to walking, it can take the commuter to a longer distance in less time and with less effort. "*Research suggests that a bicycle is an ideal transport mode in 2 km - 5 km travel distance range" (Zhang et al. 2015)*. However, the municipality of Madrid is also working towards increasing the capacity for pedestrians, i.e. widening sidewalks:

"*In street Gran Vía the priority is the pedestrian, because there is a high pedestrian activity, thus we eliminate a car lane to widen the sidewalk. That is a big priority of Gran Vía´s project, shifting from 3 to 2 lanes leaves less space [for the car]. There is a second priority, which is public transport, therefore we consider that there should be a bus lane, exclusively for the bus. Thus there is only one lane left for the rest, that is why we plan to implement the bike priority lane, the shared lane. To put it this way, public space is limited, there would be no sense in doing a bike lane if this goes in detriment of pedestrians or public transport. We have to integrate cycling mobility but we have to consider all aspects."*

(Appendix 4: Ramón Linaza)

This strategy seems sensible to undertake since Madrid (28% walking mode share in 2012 shown in fig 5.2.), and in general most cities in Spain, have a high walking share. If existing needs of pedestrians are to have more space to walk because the available one at the moment has a high density, then it should be increased. And as Ramón states in the previous quote, this widening of sidewalks in street "Gran Vía" leads to less space for the private car. This shows another socio-technical system of the urban transport system that is gaining importance over the established car regime, which represents another step towards the transition of Madrid to a sustainable city.

Nevertheless, as I previously wrote in the chapter 1, walking cannot cover the same long distances that the bike can. At longer distances than 2-3 km, the bike is the fastest transport city mode and until 8 km that it enters competition with the car, it is the most convenient for its health benefits, lack of pollution and overall savings that it produces to society.

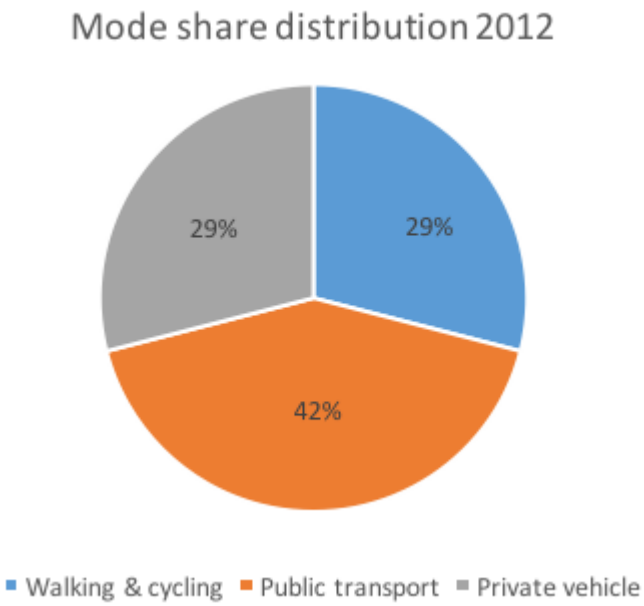


Figure 6.2. Mode share distribution for the city of Madrid in 2012. (John Orcutt, Elisa Barahona Nieto et al 2016)

However, Ramón Linaza points out that *"it is more efficient to carry 40 people in a bus than to construct a bike lane that has a capacity of around 300 people per hour"* (Appendix 4: Ramón Linaza). The question here is what are we planning for? are we planning to achieve efficiency or to achieve sustainability of the mobility system? Do we want to carry the most amount of people possible or do we want to carry less amount and increase their health, reduce pollutant emissions and reduce the costs for society?

6.6. Possible scenarios for the future of the city

In this section I will use the Socio-Technical Scenarios method to forecast a transition pathway for the future of the transport system in Madrid.

In case the country experienced another economic crisis in the next 10-20 years, there would be characteristics of the actual mobility system that would have consequences on the mobility patterns and behaviour of the citizens in Madrid.

Which ones? Well, if the system remained with 160 km of bike priority lanes, 122 km of bike paths, 133 km of bike lanes on sidewalks and 25 km of bike lanes (John Orcutt, Elisa Barahona Nieto et al 2016). 64 km of the total 122 km of bike paths correspond to the green cyclist ring which lies out of the city centre (Anon.). Thus, it cannot be counted as an infrastructure that serves for a utilitarian use of the bike and it is important to be aware that in this report I am taking into account the infrastructure that helps citizens carry out their daily commute, in the same way as mobility management does.

To sum up, that leaves the city of Madrid with the highest number of kilometres of bike infrastructure for the bike priority lane. Additionally, if we take a look at the web map of bike

infrastructure provided by the city council, it can be seen how this is the predominant bike infrastructure in the city centre (light blue lines):

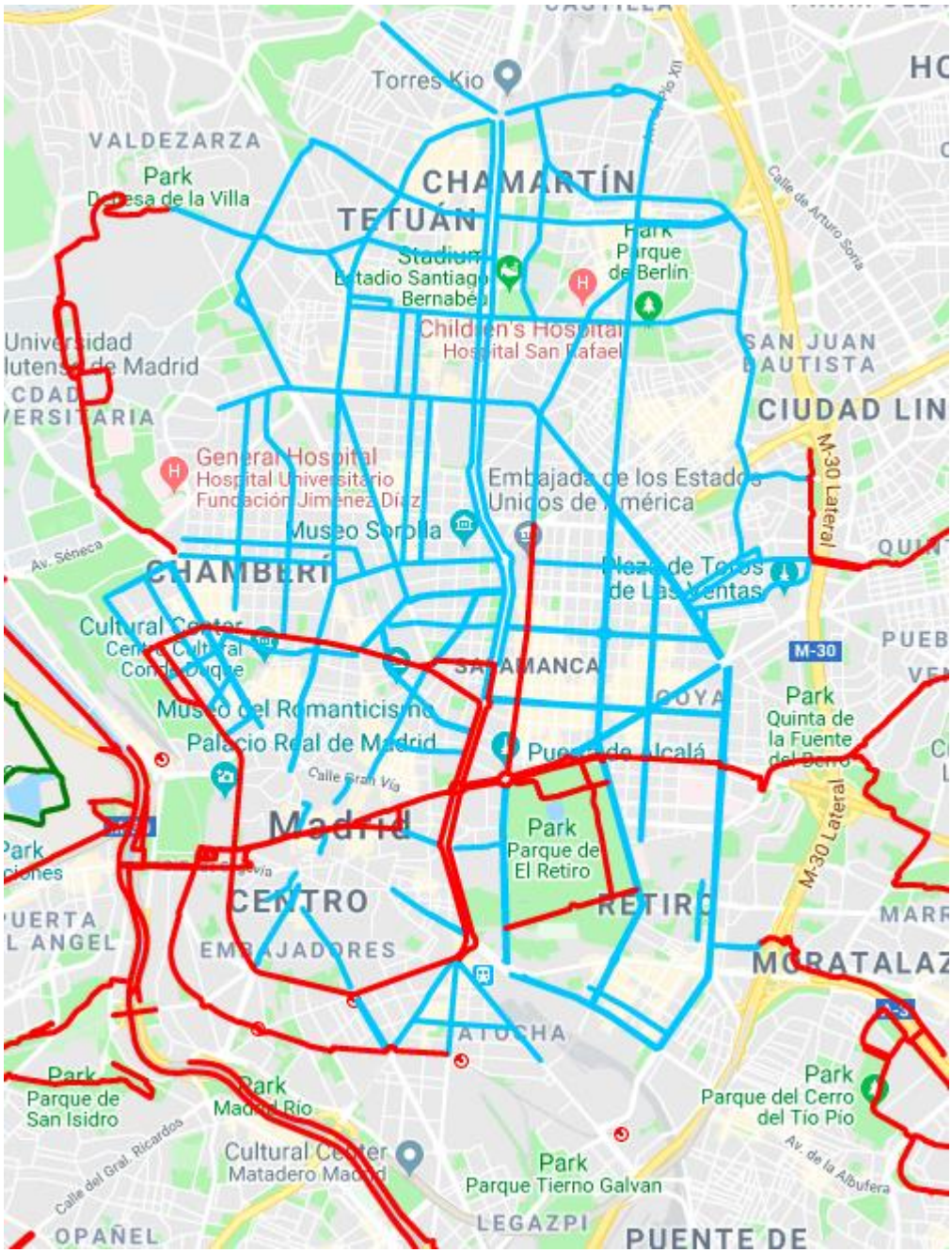


Figure 6.3. Bike priority lanes (light blue) and other bike infrastructure (red) networks in the city of Madrid. (Ayuntamiento de Madrid)

In this sense, if Madrid's citizens had to commute under this arrangement of another economic crisis, there might be less motorised traffic as it happened during last economic crisis, in which the car use decreased by 2% from before to during its period. This is shown in the figure below where the mode distribution from before the crisis (2004) can be compared to the one after it (2012):

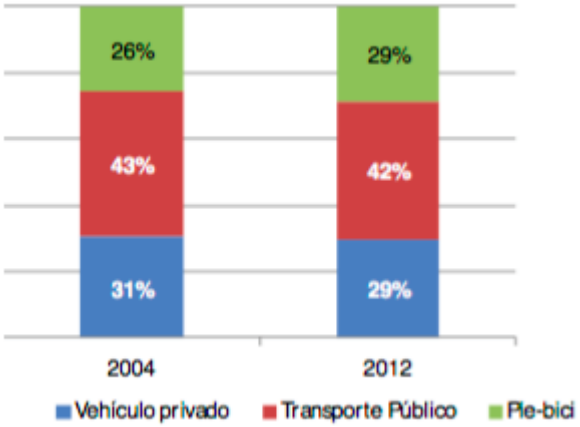


Figure 6.4. Evolution of mode distribution in Madrid, in green: walk & bike mode, in red: public transport and blue: private vehicle (May et al. 2014).

Therefore, cyclists could commute easier (safer and more comfortably) through the bike priority lanes as there will be less traffic.

As I have shown in the previous section of this chapter, Ramón Linaza states that cycling is not the top priority, but walking is, followed by public transportation, and then cycling. In line with this, if the country experiences another economic crisis in the following decades, cycling mobility will rise as a consequence of increase in unemployment rates and impoverishment of the people. At this stage, cycling mobility will gain importance and escalade positions to overtake the other two regimes of walking and public transport. Actors will understand the benefits of cycling better as more appraisals will be executed.

The sustainable city paradigm will also gain importance as concerns towards climate change and pollution will continue rising.

Other developments that can take place are the increase in competitive prizes of EV´s, which will continue with the same, actual design of the car. Or the growth in population in cities, which is forecasted to an increase to 66% by 2050, globally (United Nations 2014). The effect of these hypothetical developments in the car regime and the landscape trends on the socio-technical system of the bike would be that this one would continue having trouble to develop and constitute as the predominant regime in cities, if cars continue to have the same shape and size but change its fuel source, as it would have to take the same space. Mobility expert David Álvarez talks further about this on the following quote:

“I go to many conferences, and people say to me: we are going to remove diesel cars and we will have them all electric. Well, excuse me – I say – the problem is not it to be electric or not, nor that it contaminates more or less, well it is, but what we really want to do is to remove cars, because of the space that they take up, because of the time that they remain unused (95% of the time), etc.”

(Appendix 5: David Álvarez)

Furthermore, if the population increase that is forecasted for 2050 becomes a reality, then urban densities might increase if cities do not keep expanding and creating larger

metropolitan areas. With the increase in density, there would be less public space available and the car would have to be replaced by another form of transport that requires less space, in this sense the bike would gain advantage as it requires less space per passenger travelled than the car, or at the utmost, the same space if a car carries 4-5 people. Even though, this is not a common characteristic and the average vehicle occupancy for instance in Germany, the UK and the Netherlands was in 2006 1.45 passengers per vehicle (European Environment Agency 2010).

Chapter 7 Conclusion

In the final chapter I will provide with an answer to the problem formulated in the first chapter by summarising the most relevant effects that the bike priority lane has had in the transition of the mobility system of the city and under which conditions it is suitable to implement it.

The research question or problem formulation for this project, as detailed in chapter 2, is:

Is the bike priority lane supporting the transition of Madrid´s mobility system to a sustainable one?

After having conducted the analysis of the mobility system in the city of Madrid for the last 10-15 years by focusing on the bike priority lane as the point of departure from which to establish or trace the connections to the rest of the elements of the system, I can give an answer to the problem investigated in terms of what the BPL has facilitated in relation to the transition:

- All transport stakeholders reached consensus on the BPL: It was the outcome of the debate process undertaken by all transport stakeholders of the city.

  It is essential in transitions to include all relevant stakeholders and work in an open and exploratory way (Rotmans et al. 2001).

- Bike associations that are supporting the niche of bike transportation were involved and their concerns were listened to and taken into account. They supported vehicular cycling and the road as the space for the bike as another vehicle.

- It served as an infrastructure under the conditions of the new paradigm: bike infrastructure should take the space from the road. Although the bike priority lane does not reduce the space for the car, it puts pressure on the regime by modifying drivers´ behaviour and cultural values, components of the socio-technical system. And which in the future has prompted its conversion to bike lanes, and this one is reducing the space available for cars.

- It was a solution that fit with the existing developments at the different levels.

- The BPL had inherent goals that were not defined explicitly or set in stone by the transport stakeholders of the city interviewed for this project but which somehow laid in the statements that they made of what the BPL should do and in the rhetoric used in the interviews. As the reader can see in the following quotes:

“It is true that it has a positive point and is that it makes the bike visible, the bikes painted on the pavement… people ask themselves: oh look! are there bikes passing here? That is to say that it has the advantage of making the bike visible and legitimise it…”

(Appendix 4: Ramón Linaza)

"My field is communication, thanks to the BPL, you end up pacifying traffic, you end up filling the city with bicycle icons, in all the streets, people end up seeing the bicycle everywhere… and you still have there thousands of little drawings of the bicycle all over the city, what you are doing is reinforcing their presence."

(Appendix 2: Ignacio Ramos)

"... there is a value of the BPL that has to do with what we are talking, about empowerment, also promotion, make the presence of bikes emerge, when you implement the BPL, you paint it, in some way you are making the user that was not there before visible"

(Appendix 1: Alfonso Sanz)

In this sense, I can assert that the bike priority lane is supporting the transition of the mobility system of the city of Madrid to a sustainable one, but there are local specific conditions or factors that influence the suitability for its adoption:

1. Scarce bike infrastructure financing.
2. Poor cycling culture in terms of commuting or transportation - mostly regarded as a leisure mode.
3. Pedestrian-cyclist conflict on the sidewalk.
4. E-bike sharing system implementation.

Nevertheless, these conditions are not requirements that should happen altogether to be able to implement the bike priority lane. Instead, they represent local developments that make the adoption of the BPL more suitable.

To ensure that the process of transition was stepping forward, the municipality of Madrid should have defined some criteria to evaluate the effects of the bike priority lane, similar to the ones I proposed in the analysis chapter:

- Does the BPL help normalise the use of the bike on the road?
- Does it increase respect to cyclists?
- Does it produce a future reduction in the space available for the car?

They could have evaluated these criteria by conducting a survey to the users and evaluating perceptions, just like the municipality of Copenhagen does with the bicycle account, conducted every two years.

This transition is helping introduce the benefits of the bike in the city of Madrid and at the same time reducing the space available for the unsustainable mode of the private vehicle. This will help lower the pollution levels of the city which rose over the acceptable threshold defined by the World Health Organisation (WHO) and the European legislation for NO_2 and O_3 in 2016 (Ecologistas en acción 2017). Not only this, but it will help commuters appreciate the benefits of cycling in terms of health or well-being, as they do not stay stuck in traffic jams while driving a car. This is a bit too optimistic as this situation or progress requires a

deeper analysis to determine which are the users that are shifting to the bike. To make sure that there is a relevant percentage of them which shift from the car, the municipality would have to conduct localised plans or measure the actual mode shift. In the present moment, the “Consorcio Regional de Transportes” (Regional Transport Consortium) is in the process of conducting the “Encuesta Domiciliaria de Movilidad” (Household Mobility Survey) which will be released along this year. This will give a hint of the changes in the demand of the mobility system. It might be a bit soon to expect large changes in the demand, and as I analysed in my report, the goal during the transition is to work in an open and exploratory way for the common goal of achieving sustainability of the system by reaching consensus. It will take several decades to see relevant changes to the demand.

A question worth raising and which some stakeholders from the transport sector fear of happening is the shifting of modes from walking or PT to bicycle, as Ignacio Ramos expresses, “*we need new bicycle users that shift from using the car, but not the ones who use the bus please*” (Appendix 2: Ignacio Ramos).

Another one is that for cyclists, riding on the bike lanes that stand between traffic lanes is not the most comfortable situation, they inhale tailpipe gases from motorised vehicles to a higher extent than if they were next to the sidewalk, but still on the road. Apart from the fact that it is not totally comfortable or safe to ride in that position of the road as they have to take care of cars coming from both sides.

However, only with the infrastructure and the public e-bike system we do not guarantee that there will be a mode shift, we have to provide with other measures, as the OECD states, there should be soft-measures, i.e. persuasive and information and communication measures. Madrid´s city council used these ones by creating an information leaflet when they implemented the bike priority lane.

Figure 7.1. Information leaflet about the bike priority lane rules (Oficina de la bici).

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Chapter 9 Appendixes

Appendix 1: Alfonso Sanz

Alfonso Sanz´s background is mathematical, geography and urban planning technician.

How do you see from Gea 21 and from your position the bike priority lane, as a cycling infrastructure or as a soft measure?

We include the bike priority lane in a category of road interventions that we call fitting-out of the road, to differentiate it from more formalised infrastructures, more segregated ones, that have a certain exclusivity for the cyclist. Therefore, those fittings-out of the road include bike priority lanes, also include advanced waiting areas at traffic lights and other on-street improvements for the bicycle without creating an exclusive space for the bike.

It is an important differentiation because it also translates into a different perception of what you are doing from the institutions.

The bike priority lane is a measure that has a goal specifically towards a certain type of user profile, when you design a bike policy, what it must be done is to think to whom it is directed to, therefore, in the Review of the Bike Master Plan we established a system that we called dual where we look to working with the two most relevant sectors from our point of view for the cycling mobility of the city at the moment that are: the vulnerable sector, the sector that we potentially think has to emerge in the following years for the bike to normalise and on the other side to facilitate the sector of users, of people that use the bike at the moment and which with less segregative measures, with other kind of measures, can improve their current conditions, it is people who already use the bike and that would be more comfortable and safe if you improve (cycling) conditions thinking in them. This dual system can also be reflected on the type of infrastructure that is needed for each of these profiles. The vulnerable would principally be kids, the elder and adults that do not feel comfortable riding through traffic and that are not so experienced.

From Gea21 we think that the bike priority lane corresponds to that group of more experienced cyclists, which helps them.

Don´t you think that any segregated infrastructure would meet the needs of everyone?

Well, not necessarily. When you make a segregated infrastructure, you have certain rigidity for certain movements. That rigidity makes a person avoid it. That is why there is also a very important battle between the obligation to use the bike lane or not, placing a square (suggestion) or round (obligatory) sign.

In this sense you do not have to force the bike lane use, you always have to put the square signal, because there may be cyclists who are not comfortable with the segregated

infrastructure, and want to go faster, as it happens now with the electric bike. That does not mean that a cyclist´s ride does not improve with a segregated infrastructure.

The bike priority lane was made at a time when the Bike master plan proceedings stopped and at the same time wanted to launch the element of public bike. They fit the pieces when they said we are going to do something that gives continuity to the public bike and at the same time continuity to the Master Plan. The result is those bike priority lanes.

We could make a diverse assessment according to which section, I think we did it in the Review of the Bike master plan. So it is not all bike priority lanes are valid, thus you cannot make a general categorization and say: all are bad, all are good and everything is like that.

You define in the Bike Master Plan 2016 that the bike priority lane must be implemented in streets with an IMD between 5000 and 15000 ...

Traffic engineering is very narrow-minded, there is no solution based on a number, it depends on the environment, how the rest of adjacent streets are, pedestrian crossings, etc.

The fundamental idea is to have a strategy, and that is what civil engineers do not usually understand it, we are going to take these steps, not to build the best cycling city in the world now, but to improve bicycle mobility in the city.

What you are referring to is planning, right?

Yes, but planning from a strategy, and that strategy, you make an infrastructure that you know will be worth a while but then you know that it will have to be modified.

And the bike priority lane is an option within that strategy, but it cannot be the whole strategy. Just as the segregated cyclist network cannot be the whole strategy.

There may be manuals that tell you the type of infrastructure that needs to be set according to different variables such as traffic intensity. But we must reflect on where we are in Madrid, how long it has been implementing the bike priority lane and what will happen in the future with the other roads and infrastructure that are proposed.

Talking a bit about the result of the bike priority lane in Madrid

I have been riding a bike in Madrid for 44 years, and yes, there is a change since the implementation of the bike priority lane in the streets, I am more empowered, I have a security space of my own, that does not mean that road violence does not continue to occur on that space, but it has been smoothed, for good and for bad, because there is a phenomenon that is not usually understood in all this road safety and it is the risk compensation. In any of my books you can find it.

As you are more empowered, you lose caution. That is also what happens with “Bicimad” users. As you go through the bike priority lane with this bike, we have lost a bit of tension. These are complicated exercises that translate into that relationship between alertness and caution, well; between caution, risk, etc.

Has any type of study been made by the Town Hall in which the effectiveness of the bike priority lane of giving more safety to the cyclist is analysed? because if you spoke before about planning from a strategy, and the bike priority lane was set as the conditioning of the road that sought to make the bicycle visible, once they have reached acceptable levels of security, there could be a survey done to users and see that they are safe up to certain limits that have been chosen, to see if you will have to move to another type of infrastructure or not, or remove them or not, I do not know.

As far as I know, there is no study of that kind. It has a lot to do with perception, so they are not valid for all profiles. That analysis of perception has its load of work to do, and the conclusions even more work.

Based on bike priority lanes, and that I have very clear, I will not get children to ride a bicycle in Madrid, in the next 10 years.

And in other cities?

In other cities, maybe yes, because there are other traffic calming conditions, or the combination of infrastructure with the type of streets can lead you to favourable conditions. There is the case of Zarautz, there the children go by bike. But it has been a process, with little infrastructure. Now there is a lot more, but there is a culture.

That is somehow the conclusion, then, there is a value of the bike priority lane that has to do with everything that we are talking about, empowerment, as well as promoting, making emerge the presence of bikes, when you implement the bike priority lane, you paint it, somehow you make visible this user who was not there before. Well, I believe that it is processes, the important thing is to understand that we are in a process, and to know that this process has its rules in each moment.

There is another interesting process here in Madrid, the route of the Rounds:

In “Sagasta” and “Alberto Aguilera” streets there has been no controversy. The modality and the place is fundamental to understand the functionality of each of the infrastructure or bicycle conditioning.

Do you think it would have been essential or advisable to have conducted a surveillance and control campaign to verify that the maximum speed allowed in the bike priority lane was met?

Yes, of course. As always in this country we have the pending subject of the evaluation and the follow-up, to know how if it has worked and to know if they can be improved. Because some of these bike priority lanes should be deleted or replaced by segregated infrastructure. Some of the ones that are going up a slope, due to the heterogeneity of speeds.

Indeed, there are measures to raise awareness, it occurs to me, one thing, a stupid thing, municipal police cyclists riding the cycle lanes.

Ramón Linaza states that the maximum speed limit should be applied in all the lanes of the street and not only in the bike priority lane, do you agree with that?

It would be necessary to see in what cases. In main roads, you cannot do that. It would be really good for us if in the 80% of the roads that are not the main ones, the speed limit of 30 km/h is effective.

The problem is the multi-lane streets, these ones already stimulate going at a high speed, then stimulating a high speed, it is not enough ...

It seems like there is speed reduction in the bike priority lane with respect to the rest of the lanes, what do you think of this?

It is the one closer to the right side of the road, the cars are thrown to the left and go faster, and in the one on the right, there is the bus, cars that turn, etc.

What recommendations would you give to a city that intends to replace the bike lane and implement the bike priority lane?

Well, first of all, the cycle lane is not an infrastructure that can replace other infrastructure. But it is one more within a range of possibilities. It should be done a plan in phases in which you are introducing a series of measures depending on the objectives that you want to fulfil of normalisation of the bicycle, we are all supposed to agree on that. I think that what cannot be planned is to do a network of bike priority lanes, rather I will make a bicycle policy and the bike priority lane is one within it, and explain the others, otherwise this becomes the photo.

Where we want to go and how. We are going to make a bicycle policy, the famous governance, we are going to establish it in the political agenda through a plan, do not tell me about infrastructure.

Appendix 2: Ignacio Ramos

When did you start working for the EMT?

I started working for the Mobility Foundation in 2006, which was the one that the Mobility Committee did, which in 2011-2012 became the EMT. Because the EMT decides to take the commitment to move forward with the Mobility Committee, then it absorbed us.

What is your academic background?

Bachelor of Information Sciences, marketing and public relations.

And your position in the company?

I am in the Communication Department and I am part of the projects that have to do with communication or participation.

Now you have acquired the management of "Bicimad" (public e-bike sharing system), right?

Yes, and the results are pretty good. Apart from the controversies that are seen in the press ... I trust my colleagues enough. What I have very clear is that the service works much better. It has broken the record of users throughout 2017 and record of use.

Was the suitability of the implementation of the bike priority lane debated and agreed upon in a group?

Yes, I tell you, it is that it may not be published all the information of the Mobility Committee. The committee was created with the commitment of all parties to barely make diffusion, it was to agree ideas and opinions, that everyone had a common road map, the different parties and unions, that all had clear what were the real needs of the city. It was launched close to an election, then a kind of gentlemen's agreement was made so that no one used the information that was handled there publicly to berate the other, so that the issue was not politicized. It was respected, and then many sessions and many debates were held at the beginning that served for all to be formed, be informed so that they created an opinion and an idea; more or less reach that common line but precisely to respect those rules of no publicity, thus hardly anything was published. Until Mobility Status Reports began to be published, there are no ideas about what was discussed in those sessions. The first year, in 2007, it is when a meeting is held per month, each one with a thematic axis, and that is when big lines were drawn. One of those meetings was the one dedicated to the ... the first year was only the promotion of soft modes, then it was in 2008-2009 when a specific workshop was held with 4-5 sessions on the public bicycle, if Madrid needed or not public bike. And it is in those sessions when it is debated that the public bicycle by itself does not do any miracles and talks about measures that should accompany it happen. Then, it started the talk about the bike priority lane.

At that time, we are already in the economic crisis, there is no money, and when there is no money the first one to carry the can in those times, and almost now also but especially in

those times were the bike lanes. Cycling mobility was not important in the city, thus if it is necessary to reduce investments it is reduced from bicycle lanes. So the bike priority lane was attractive to many, even for those who had no idea say, well, it is cheaper for me, I have a commitment to make bike lanes and so on ... But then we also saw that it could be a quite effective way because it moved towards what was the perfect model of coexistence of the car and the bicycle on the road. It was not this model that was most demanded, the most demanded was bicycle lane, and in fact the Master Plan for Cycling Mobility that is brewing at that time (2007-2008), there what is agreed that must be done is a network of bike lanes and even a map by district and neighbourhood of what the city's bike lane mesh should be.

It is decided later, that in calm streets with little traffic, maybe the bike priority lane can be made.

The model of the bike priority lane was also very much supported by cycling associations because it was the way of saying: we are going to coexist on equal terms with the car, then, it is like the bike priority lane came across. We are going to move towards the bike priority lanes. Always keeping in mind that the basic network, the great axis of all the mesh that you made of this type of infrastructure had to be the segregated lane, it was understood that “La Castellana” could not be based on bike priority lanes, you needed large axes that joined the north with the south, the east and the west, made with segregated infrastructure. So, Madrid´s model was always really a mixed model. Of segregated infrastructure and coexistence infrastructure. When we started doing the bike priority lanes and we had a network, deep down everyone knew that in the end, when there was money, some day, we had to do segregated infrastructure. When now segregated infrastructure is being done in large axes, because in the end what is being done is advancing in that same model for Madrid, which we have always talked about. With all the controversy that is generating, because there is a very strong movement that defends only the coexistence achieved that what it has done is to provoke a very strong movement defending the benefits of the segregated infrastructure.

And what this controversy has achieved is the division into two fronts, I think the solution is mixed.

With the bike priority lanes what you see is that the demand of cyclists has gone up very little, there are no official data, but we can be moving in 1.5% -2%, well. Compared to other cities with double-digit figures, it seems to me that success is questionable. It is also true that the bike priority lane is coexistence, coexistence is habit and behaviour, and any change in any of these takes time.

Of course, he who is afraid, is still afraid, does not take his bike. The new cyclist which is the one that you have to go for, you have to generate new users of the bike that get off the car, not to be bus users, and that change to the bike. But this one will only do it if he feels safe. And many will only feel safe if they have a segregated bike lane.

We need new bicycle users that shift from using the car, but not the ones who use the bus please. But this one (user of the car) will only do it if it feels safe, and many will only feel safe if they have a segregated bike lane. When they will lose that fear, they will dare to enter the streets of coexistence and they will not have any problem in circulating next to the cars.

The shift is clear, which means if we are stuck there with 2% (bike mode share), is that people do not dare to get directly (in traffic), if you are not a regular user, from not being an urban cyclist to getting into traffic, no one makes this shift.

You said that the bike priority lane was something that you came across, due to the public bike system that was going to be implemented and the arrival of the economic crisis.

It added up the fact that the new cycling mobility system was going to consist of electric bikes, therefore, the idea that someone said in one of those previous meetings, which there is nothing published about: well, it would not be a bad idea to put many 30 limit speed streets, or bike priority lanes, when we saw that the bike was going to be electric, we said: now it is the right solution! e-bikes have a speed that allow them to coexist with the car, then everyone saw it clear

In order not to do all the street at 30 km/h speed limit, you mean? And only the introduce one lane with that speed limit? That is, thanks to the electric bike that it was not needed to limit all the street to 30 km/h?

Above all it was considered that doing it all zone 30 was a very drastic measure, that if there are bike priority lanes on tracks that are considered arteries, of greater flow, so you were not going to do all lanes 30, when the normal speed it was assumed that in the city it should be limited to 50 km/h, when we all know that people drive at 70 km/h. So, transforming a lane seemed like an option, like that ... pretty sensible. Leave the car to keep going at 50 km / h, not to complain at you. Keep in mind that if you take and modify the whole city in favour of the bicycle, what you are going to generate is a brutal rejection to the bicycle by all those who do not use it. If you are introducing small changes in the habit and people get used little by little, you even get to see it as a good option. A phrase that we said a lot in those meetings of the committee, which used to say the former director of the Foundation Mobility: a city without a bike is like a pond without ducks, thus in the end it was that, if you get used to seeing them little by little, people see it is a good idea, I am a car driver and I have to go in the left lane. If I want to go at 50 km/h speed because in this lane the priority is for the bike and I'm in a hurry, well, but in the background I see bikes and I say: the street is looking better.

That in the end was the way a bit of getting to the rest of the city, if you make all streets 30 km/h maximum speed limit, the shock is so strong, you create so much rupture, the disruptive in the end can create a lot of rejection and conflict could go against the bicycle itself and it was about the bicycle being perceived as something kind and something positive for the city.

So the reasons for implementing the bike priority lane are multiple and interconnected from what you have explained?

Yes, yes. The fundamental one was that the public bike arrived, that was the one that decided that from night to morning they would start up many kilometres of bike priority lanes and also that the public bike was going to be electric.

Do you think of any way in which you could enforce the speed limit in the cycle lane, or some other design?

I would not enter in the design issue, I think it's more a matter of time, it's true that if the two studies conclude that the limit is really 40 km/h, I think it can be even more, I'm telling you without data, this is perception, just like I tell you that with the limit of 50 km/h people go at 70 km/h, 30 km/h is a reference, that it is true that it must be enforced, and the way to do it to comply with it is through sanctions, so many times we have talked about whether we put cameras on or not, radars, but that in the end, which can be very dissuasive, because it also implies an important problem and is that it requires a lot of courage and I return a little before to the issue of conflict. That is to say, to what extent we want to generate a lot of conflict with the bicycle or instead let it continue to assimilate little by little in a positive way. What is that conflict? I do not remember now what legislation says that if you exceed the speed limit 10 km above the double, that it you multiply by two and you add 10 km/h, that is in the case of the bike priority lane, 70 km/h can be a prison sentence.

If suddenly a Town Hall, put the radars and start to catch people traveling at 70 km/h, you can find yourself with some first cases that you have to put jail sentence on them. You have to assess a little how far you want to go, the day you do that with several people, the stir that is going to set is…

The police, the mobility agents make specific campaigns of 1 month - two weeks' duration.

For me, the best indicator of success or failure of bike priority lanes is what rate, what level of cycling mobility it enables, we have been growing by 25% -30% a year, of course, we started from so low that we continue to stay at 2% (bike mode share).

Segregated infrastructure in the backbone of the city to avoid fear fighting with traffic in the bike priority lane. I have a large axis that takes me comfortably from east to west, and from north to south. And then, when I'm nearing my destination, I'll go through secondary streets.

I do not know if that can happen, for commuters, day after day, to have to deviate towards that axis, take it, and then deviate again to go out and go to their destination, people do not want to think about it or lose time in that.

Well, that's why that structuring mesh is not a crosspiece, in the background, you have to have 6 or 7, you have to have several, thus, a mesh. A basic network, and that is fundamental. The capillarity at the neighbourhood level, the key is the bike priority lane.

In addition, you do not make it mandatory, like most European cities, which make compulsory the use of the bike lane. They do not let the cyclist go circulating in the traffic.

In Granada, we want to implement the bike priority lane system throughout the city now. But we do not have a public bicycle.

The public bicycle is the perfect excuse to put the network of BPL in place, but the main advantage of the BPL is that there can be cyclists on the road traveling on equal terms with

a car. You do not need to have the public bike, what happens that this one too, was considered in Madrid to be a great measure of bike promotion, but you can perfectly make a BPL network without having public bicycle.

My field is communication: Thanks to the BPL, you end up pacifying traffic, you end up filling the city with bicycle icons, in all the streets, people end up seeing the bicycle everywhere, at first, generating a lot of rejection, a lot of conflict, you end up almost putting extra pressure on the cyclist, because it pisses off the people... at first the driver gets angry, and he pays it with the cyclist, but when the time goes by, they get used to it and they do not horn so much, the cycling does not get insulted anymore, and you still have there, thousands of little drawings of the bicycle all over the city, what you are doing is reinforcing their presence.

Appendix 3: Miguel Andrés

Miguel does not think that the cycle-lane is a cycling infrastructure, since no construction work has been done, only one marking is painted. He does not think this is a cycling infrastructure.

Miguel says that the bicycle mobility in the city centre in 2017 is at 1.37% vehicular and 0.4% modal. And that it has grown at a rate of 0.07% each year.

He Defend that you cannot compare and put on equal terms a bicycle with a motor vehicle.

You must also have a cycling infrastructure for all types of users and not have to discriminate between profiles. From 3 to 100 years old. The bike must also be seen as a mode of collective transport, such as the cargo bikes or the accessories (saddles) for normal bicycles.

What is your function in the association?

Head of urban cycling

In which committees has "Pedalibre" participated?

In the Reviewing commission of the Madrid Bicycle Master Plan, in the draft of the new municipal ordinance, in Plan A for air quality.

Did "Pedalibre" participate in the mobility committee organized by the municipal transport company?

He does not remember, he does not know.

There is a foundation in the data, that we are still in a 1.37% vehicular cycling share, then, is the municipality really doing things for the bicycle? Or it is being sold that things are done for the development of bicycle planning but then in reality…?

The same geometrical characteristics cannot be assumed for cycling infrastructure as they are for cars, turning radios, traffic light regulation. Because the bike is not on equal terms with the car, and we run the risk of putting it on an equal footing if we do that. You have to go over everything, because otherwise we have everything made for the car dimension!

Why should the bike priority lane not be discarded?

Because there are many residential streets that are of coexistence, and we must remember it. The concept of bike priority lane is a little condemned in that sense, because the city will become a city with a 30 km/h speed limit. From "Pedalibre" and "conbici" this city 30 is demanded.

I have also read that there is an effect that when there is a shared lane, the cyclist goes through the centre of the lane and the car tends to respect more or less, but

when the bike is traveling in a lane that is not a shared lane, then car drivers believe that because they are not in a bicycle priority lane, the bike no longer has priority to circulate in the centre of the lane. How do you see this?

Well, there is a terrible fact, the Mapfre Foundation published a report last year on vulnerable groups and on non-compliance with regulations. And there is a horrific conclusion that says: the lower the speed, the greater the number of cars that do not comply with the rules. And that's terrible, is not it?

Therefore, many times we have to consider whether in educational environments is still acceptable that at least in the hours of entry and exit, for example, there are cars. Because in the end the car is a vehicle that is not suitable.

The bicycle proposes a rational use of transport, which if it is already important, is more so in a city. Because here the population is concentrated, therefore public space is very important. Therefore, let us make it easy for everyone to use a medium such as the bicycle that occupies as little as possible.

It is true that the bike priority lane makes the bike visible, which has helped to make it visible, with respect to distances and to the cyclist being placed in the middle or not of the lane, the mobility ordinance already contemplates that right to circulate in the centre of the lane. Therefore, there should not be such an association that when there is a bicycle priority lane, the cyclist does have the right to occupy half the lane and if there is not, no. That is to say, that situation I do not know if it can be deliberated by someone, but evidently it is not anywhere.

Do you think that the bicycle priority lane helps to slow down the cars on the road? As it has been seen in several works, although the speed limit is not met, cars circulate at slower than in the rest of the lanes.

Sure, that's for the simple reason that the bike priority lane is the furthest to the right. The right lane is used to make the parking manoeuvre; it is used to park in double row. In other cities not so much, but in Madrid we have streets, the main ones, that do have parking lots, those that do not have them are scarce. And we also have the problem of the double row parking. And triple.

So do you think it makes the transit of bicycles difficult?

Sure, because there is no continuity. If we go to the criteria that qualifies a cycling route and considering that the bicycle priority lane could be qualified as such, the non-compliance is maximum when the criterion of continuity is not given. Then by the constant interruption in traffic, either by parking manoeuvres or by double row parking.

Then, the failure to comply with the speed limits on the bicycle priority lane from the cars is incompatible with the practice of cycling.

But there has to be an express acknowledgment that these are not conditions for cycling. Those of us who have been cycling for a while have left a mark. That is, if what we want is

for the bicycle to be part of a new mobility model and for the bicycle to be open to the entire population.

Do you think that even with the public bicycle it is not possible to cycle on the bike priority lane?

The bicycle has good points and bad points. A point that is not so good: it does save the lack of capacity that different people can have when traveling distances, it has electrical assistance and that makes it easier. With which, there are people who at a given time do need this assistance and it is phenomenal. Wonderful.

Then as well, the bike sharing service itself means that at any given moment, your mobility on a bicycle does not have to be based on the possession of a bicycle and having it stored in your home. It also satisfies that need for timely displacement that you only need the bike to go somewhere but not to go back.

And what is the perverse point that it has? The public bike is limited to more than 14 years old if they are supervised or more than 16 years old if not, so the perverse point is if the autonomy of the schoolchildren is really favoured to reduce the circulation in car the days of school with this system.

The perverse side is to identify the bicycle as a vehicle with the capabilities of an electric bike in terms of facing the slopes or when the bicycle has its own space. That is to say, an assisted pedalling bicycle probably has greater similarities with a motorcycle in the average speed that many times is developed in the city than with a conventional bicycle. So, we are deviating from the subject in terms of thinking of a bicycle, a human traction vehicle.

Therefore, for example, it is foolish to deny that Madrid has an orography that sometimes goes against the use of the bicycle, many of us will say that this is not a problem, and me the first, but if we consider all people feasible to use the bicycle, there is a problem. Then, the very fact of the use of the electric bicycle minimizes that problem, but we are also neglecting an infrastructure that facilitates the overcoming of these barriers, that is, if you are a cyclist, it has nothing to do, to climb a slope feeling harassed by a car behind or a bus, than to climb a hill when it only depends on you to dose the forces and that in a calm way you end up climbing it, that is, the opinion that we can have of the effort used in one way and the other one is very different, it's not the same to go up the “Delicias” boulevard with a bus behind or a car behind you, even if you get ahead, than when you have your own space, then that orographic barrier is seen more if you do not have that own space if you have that space, because in the end it is you what matters, it depends on yourself when to go up the hill. Then the level of stress drops enormously, and we know that stress is one of the reasons why the bicycle is used or not used. The less stress that needs to be supported, the greater the number of potential cyclists there will be. Then we must reduce that stress, then the electric bike can sometimes mislead us of what is really needed when dealing with these major axes.

In theory the bicycle priority lane is designed so that this harassment to the cyclist is avoided, is not it?

It has been seen, that the bicycle priority lane is not valid. “Pedalibre”, in that process that we were talking before about the bike lanes on the sidewalk that were constructed at the times of Ruiz Gallardón (2010) and all that, and then it switched to bike priority lanes, there were some stakeholders, almost, with regard to proposing a mixed itinerary, consisting of bike lane and bike priority lane, and we from “Pedalibre” applauded that measure because it legitimizes its space on the road, but experience has demonstrated in the end that the bike priority lane does not possess the necessary conditions to attract new cyclists.

It depends on which situations, doesn´t it? In residential streets with low traffic intensity and speed, then it is valid, isn´t it?

Of course, we are talking about the bike priority lane badly implemented. On a main road, it does not make much sense, there must be an exclusive lane that ensures fluidity and cyclist comfort, that is clear. But, on the other hand, we have to work so that traffic conditions are appropriate for coexistence with the bicycle. Because you do not always ride on the bike lane, obviously, we already talked about the different places of origin and destination, they are diverse, then, for the main avenues if you could plan an exclusive lane that allows you ride to long distances, but then there are some cases where you are going to leave the main lane and go to other places, you are going to turn and share the road and so on, well, then, those conditions of the rest of the traffic have to be suitable for the cycling practice as well. As important is one thing as the other.

The bicycle barometer that is done by the network of cities for the bicycle, and where the “DGT” (General Traffic Direction) also participates, is a large survey conducted to both cyclists and non-cyclists, it is asked here: What conditions must be given for you to take the bicycle? There are always two reasons and are always the same, one of them is danger and the intensity of traffic and the other one is the lack of cycling infrastructure, and then after these ones there are the climatic issues, the orographic, the risk getting the bike stolen, the bike parking, these ones go later in importance

Therefore, if we want to promote the bicycle, we have to do one and another, if we only do one, we are incomplete. From there we have the manuals, and the master plans, and all agree in using an appropriate typology that solves the bicycle mobility in the big axes, and there is a decided bet that it has to be with a lane of exclusive use. And well, that is what is done in cities in which the bicycle has its importance. The bicycle priority lane has its importance, sometimes we are confusing between bicycle priority lane and bicycle street, which is not the same.

The cycle-lane is doomed to disappear; the bicycle street is not. These are streets in which there is a unique direction for the car and there is usually a double direction for cyclists, they are streets in which there is no parking. You can have road markings for cyclists or you may not have them, but in all of them limited to 30 or 20 km / h.

The bicycle cannot be banned like that in the rough, you cannot. Because the bicycle is very sensitive to the time of the journeys, the efficiency of the journeys. In street “Fuencarral”, which is pedestrian, in theory the mounted bicycle could not be used. So we are restricting the transport capacity of the bicycle.

There are tables that tell how to treat the bicycle in the case of pedestrians, in relation to the pedestrian influx and the cyclist affluence, and can be platforms where coexistence occurs naturally or allocate separate spaces or directly, make the cyclist get off the bike, that may be occasionally, at some time of day, that is very normal.

But it is a mistake to forbid, for example, through street “Fuencarral” and street “Montera” you cannot go by bicycle. The bike should be able to go through these two because it is the shortest route. You cannot truncate the natural cycling itineraries, because if you do truncate them, you discourage the use of the bike. What we talked about earlier, the cyclist road network sometimes does not have to go through the same network for the cars and buses. There lies the success of the bike, if we want it to be successful.

Appendix 4: Ramón Linaza

Ramón Linaza is an advisor, which is a political position. And he is a bike activist, he was on the monitoring committee of the Cycling Mobility Master Plan, as a cyclist. He has been, since 2016, advising in the area of Environment and Mobility, which has no responsibility for the infrastructure. Mobility is divided into two areas in the City Council of Madrid, mobility planning is the responsibility of the Sustainable Urban Development area, which executes the cycling infrastructure. The mobility area is responsible for mobility management.

On the one hand, the bike priority lane is done because the Town Hall is very indebted and this is a way of making cycling infrastructure with a short amount of money. It is true that it has a positive part which is that it makes the bicycle visible, the bicycles painted on the ground ... people ask themselves: Do bicycles pass here? That is, it has the advantage of making the bike visible and legitimizing it.

That does not mean that you go through a bike priority lane and a car horns you and asks you to move, but hey, I do not leave because I'm in the middle of the lane, stop.

But then, of course, bike priority lanes depending on which routes, are more or less useful. On roads with high of traffic and several lanes, there are several problems, at rush hour when there is a lot of traffic, the bike priority lane disappears, is buried by cars that are stopped, then there for the cyclist has no use.

Then, when there are several lanes and you have the bike priority lane at 30 km/h limit, there is an effect of mimicry that makes the cars not respect the speed limit. If you in one lane can go at 50 km / h and in another at 30 km / h and you change from one to another, then in the end you do not respect it, there is even a curious thing, that this has been commented to us by the municipal police, which is that drivers believe that speed limitation means that bicycles should not go more than 30 km / h, well this is nonsense because a bicycle does not go at 30 km / h, goes at 10 or 15 km / h. It is indicative of the mentality, that is, the one who goes by car sees limitation at 30 km / h and a symbol of a bicycle and says, bah ... this does not go with me.

Maybe it's a design problem?

Yes ... well, it is a lack of information and it is a culture that we come from in which the car is the most promoted means of transport. And then there is a small sector of cyclists in Madrid who is opposed to cycling infrastructures. This comes from the 70's in the USA, of vehicular cycling that considers that the bicycle is a vehicle more therefore it is not necessary to provide with specific infrastructure. This small sector says that there is no bike lane to do.

My opinion is that vehicular cycling is conservative, because it does not aspire to transform the city, it does not consider making cycling infrastructure, and then it is very elitist, because it comes to say, the one who wants to go by bike must get used to going between the cars and lose the fear of going between them, then it does not take into account the needs of a

whole series of bicycle profiles that at least in Madrid they do not dare to ride a bicycle, because they are afraid of it, etc.
Some cyclists say that certain bike lanes are dangerous, most cyclists want more bike lanes and more safety. And also from the STARS program, there are collectives like the Association of students´ parents who ask that more bike lanes to be made. Does this mean that you have to do bike lanes all over the city? Well no, you have to do bike lanes on some tracks, in others, no.

For example, in the area of zero emissions, the interior of the M-10 cyclist, which would be a large area of residential priority where traffic would be restricted to residents and services, and electric vehicles. Then, obviously, in an area of residential priority, where the traffic intensity drops a lot, the bike lane does not make much sense, in quiet streets, with speed at 30km / h, there the bike lane does not make sense. So the idea right now, which has the city council of Madrid is to combine different technical solutions depending on the characteristics of the road, therefore, bike priority lanes are maintained, even they are still being made, but at the same time, they are made also bike lanes where necessary. And there the city is a bit like in transition, then they are trying different technical solutions and from there, for example, in “Santa Engracia” street you have a lane that is bidirectional and segregated from traffic.

There are still some bike lanes on the sidewalk, the idea is that they will be dismantled, the most modern ones are those of street “Serrano” and street “O'donnell”, so it is currently considered that this is a mistake. There are other cities where bike lanes have been made basically on the sidewalk, for example in Seville. But in Madrid this is considered an error, then those bike lanes will end up being dismantled and taking them to the road that is where they should go.

Why do you think it's a mistake? Because of the conflicts that are generated with pedestrians?

Because you are invading the pedestrian space, the pedestrian at the end is the most vulnerable element, then when the bike lane is on the sidewalk at the same level .. You have to make a detour when you reach an intersection, the one that goes by bike usually prefers to go down the road.

Bike lanes on the sidewalk can be useful for children under 14, for skateboards, wheelchairs; but the idea is that they end up extinguishing. The idea is to combine different solutions.

Do you think that another reason for the implementation of the BPL was the implementation of a public bike system, apart from the fact that there was no money?

Yes, that's another reason ...

Do you think that the electric bike is necessary to circulate in a safe and adapted way in the cycle-lane or do you think that with a normal bike it is possible?

It does not depend so much whether the bike is electric or not. The intensity of the traffic and the speed of the traffic and then the expertise of the cyclist. There is another added factor

that is health and pollution. I prefer to go by a bicycle lane than to circulate through traffic. Because the effect of pollution will be reduced by 30-35%.

The shared lane is suitable in some circumstances and is not suitable in other circumstances. If it is a road with a lot of traffic, and speeds of 50 km / h and more, then it is not very safe, obviously. For whom is it less safe? for those who have less experience.

How do you think the maximum speed limit in the cycle lane could be enforced?

With surveillance and with sanctions. Appealing to education and the good will of the people is fine, but it is insufficient.

Have you carried out surveillance campaigns or coordinated with the police?

Yes, they are probably not enough. You cannot have a policeman behind every citizen. It is difficult to meet the speed limit of 30 km / h when you have a parallel lane where the speed is 50 km / h. Either you put the limitation of 30 km / h for the entire road, or that would be confusing for the driver.

Do you know who implemented the BPL?

No, but what is true is that it was undertaken at the same time in which the public bike sharing system was adopted (BiciMad), in 2014.

In street "Gran Vía", there is a bicycle lane in the upward direction but a BPL in the downward direction. Is the model changing and are the bike lanes replaced by cycle lanes or not?

In Gran Vía there is a priority that is the pedestrian, because there is a lot of pedestrian occupation, then a lane of traffic is eliminated to extend the sidewalks. That is a great priority of the "Gran Vía" project, going from three lanes to two, since there is less space (for the car). There is a second priority, which is public transport, then it is considered that there must be a bus lane, exclusive for the bus. Then there is only one lane for everything else, so for that reason the shared lane is considered. That is to say, the public space is limited, it would not make sense to make a bike lane if that is at the expense of pedestrians or if it is at the expense of public transport. Cycling mobility must be integrated, but all aspects must be considered.

Public space is limited and if you plan, if you want sustainable mobility, the most efficient means of transport is the bus, which has more capacity to transport people. In other cities in Europe people do not walk so much, in Madrid 30% of people walk, it's a lot.

Is there an objective for 2020 or 2025 of reaching some figure of cyclist mobility, such as increasing it by 5%, for example?

Well, yes there are objectives to expand the cyclist network and the bicycle sharing system, but that there is no objective (number) written down. What I am saying is that this goal cannot conflict with other modes of transport.

Before, there were no cyclists. Cycling mobility in Madrid is minoritsary, but it is visible. Now cyclists are seen on the streets, 15 years ago, you could not see them. The goal now is to increase; how can it increase? By doing educational programs in schools, improving the safety of cyclists, both cycling infrastructure and traffic restriction measures and speed reduction and finally extend the public bike beyond the central almond.

Is this one the position of the Madrid City Council, and those are the priorities? You know this because you are working together with the technicians, together with the politicians, or how is it?

We are working with free float public bicycle companies to occupy areas where the public bicycle has not arrived. So they do not overlap.

So, yes, of course it is a goal. Madrid is not advanced in terms of bicycle mobility like in Amsterdam or Copenhagen, but it is far above in terms of pedestrian mobility.

Do you have any recommendation for a city that wants to implement the bike priority lane?

It is not convenient to put a shared lane on a street with several lanes because of that contagious effect. If you are going to put a shared lane on a road with several lanes, you should limit the speed in the whole road. It is the most effective thing to do.

Madrid is a city in transition, in terms of mobility, then they are trying different technical solutions that are not written in stone, probably within 10 years there will be issues that have to be rethought, obviously, if the use of the bike increases a lot, then the city will have to adapt to this use of the bike.

We think that in order to increase the use of the bike, it is necessary to favour the use of the bike with specific cycling infrastructure. From the city council and from the vast majority of cycling groups.

Is it not the position in Madrid? That the bicycle must go along the road as a vehicle?

That position here in Madrid is represented by a group called “Madrid Ciclista” and is a minority position among the cycling groups. If you are going to talk to “Madrid Ciclista” they will tell you that this is the majority position among cyclists, that cyclists do not want bike lanes, etc. Who is right? I do not know, every day I use the bike lane of street “Santa En Gracia”, I see about 10 or 15 bikes and I see some bikes circulating on the road.

I believe that the cyclist tends to use what is most comfortable, now, if you have an idea, like these anti-bike lanes associations do, that they compare cycling mobility with racism and consider that doing bike lanes is the same as racism because it is segregationist, well, this is a very radical ideological position that suits them very well to those who do not want cycling mobility to develop, there is a lot of opposition to limiting the space for the car, then, as all of these the People´s Party , the Citizens party, who say no, we need more space for the car, because the important thing is that you can drive to the door of your house and you can park

and so on. So these are the ones who use this type of arguments, then you have headlines: "Manuela Carmena makes bike lanes that even the cyclists say are very dangerous". With “the cyclists” they are referring here to that group of “Madrid Ciclista”, which is a very radical group, very much with this idea that doing bike lanes is the same as apartheid in South Africa.

Now, does that mean you have to fill the city with bike lanes? Well no, in cases where it is not necessary, why are you going to do a bike lane on a street where it is not necessary.

Appendix 5: David Álvarez

You would have to know if the modal split for the bike has increased in recurring trips, and the second, the level of accident that may be bringing, if there have been many accidents. If you have statistical data on number of accidents, number of accidents in which a bike is involved and such, that may be interesting, to see how it evolved before they existed and after they were created and after the period of maturity that always needs a system of this type, because at the beginning we know that people need some time to adapt and that adaptation should take place, then if there is that growing and descending curve.

Whether you use bike lanes, no matter what you use, what you want to do is to remove cars. You want to increase bike use instead of the car, no matter if you use bike priority lanes or bike lanes, the key is that one."

The associations have always told me that they prefer going through the road, because they feel safer confronting cars than confronting pedestrians

The transport consortiums in Andalusia are formed on 45% by the Junta de Andalucía (government of the region), 5% the Diputación (government of the province), and the remaining 50% are distributed by the municipalities of the metropolitan area.

The objective of the consortiums is intermodal travel, for these ones the ideal is to promote public transport, pedestrians and bicycles.

I do not need that all my city to be bikeable, only that the main attractor and generators trip points of the city are connected, either by bike priority lane or mixed infrastructure, and where it is not possible, then by segregated bike lane.

We have another problem and it is the cultural one, this one is really hard to change [...] that is to say that we lack culture and we lack political value…

It is true that politicians are still scared of giving full commitment for bicycle development in cities, in terms of saying: we are going to make all the streets bikeable.

We have to go little by little, we cannot say: two years from now, the best cycling city.

There is a lack of cycling culture and political will, and there are also political parties that have positioned themselves so much in favour of the bicycle that the others have been forced to position themselves contrary to the bike development.

I go to many conferences, and people say to me: "we are going to remove diesel cars and we will have them all electric". Well, excuse me – I say – the problem is not it to be electric o not, nor that it contaminates more or less, well it is, but what we really want to is to remove cars, because of the space that they take up, because of the time that remain unused (95% of the time), etc.

The rows of parked cars are barriers too, just like the motorways or train lines.

I would be happy if we go to the quarters: 25% pedestrians, 25% bicycles, 25% bus and 25% car.

Appendix 6: Mª Dolores Trespando

The problem we have, as you well know, is that legal situation that we have a little in parentheses, in which the legal status of the bicycle is not very clear. The DGT establishes very well (the position of the bicycle) on interurban roads, but on the urban tracks it leaves it to the town halls and there is no ... no one speaks. So from “FEM”, the Spanish Federation of Municipalities, this one is trying to generate information, unify criteria, then we are a bit there, at the legislative level I think it is necessary to outline certain concepts. And we usually rely on experiences, at least here in Granada, which at this moment we are modifying the bicycle ordinance, we try to base ourselves or rely on experiences from other cities both nationally and internationally.

If you are thinking of modifying the municipal ordinance, then, I have seen that the Granada ordinance does not say that the bicycle must circulate or has the right to circulate in the centre of the lane on the road, is not it?

Yes, the ordinance that we have right now is a bit old, it was done at a time when the bicycle was not yet ..., it did not have the impact and the preponderance that it has right now, then, right now, yes, the ordinance that is obviously developing the bicycle takes its place in the road, we are going to give it that plus that it takes its place on the road. We are going to say clearly that it has to go through the right lane preferably in streets of more than one lane, that it has to go through the centre of the road and that in those roads where there is no lateral parking, there is a recommendation which is that it is preferable to stick to the right side of the lane. Though we are going to introduce an important thing in the ordinance, which of course is pending approvals and others, but in 30 km/h speed limit areas, we will make a limitation or a prohibition on vehicles that they cannot overtake the bicycle. To preserve the safety of the bicycle and also serves as a measure of traffic calming.

Are we talking on single lane streets?

We in Granada have a very broad bounded area 30 that normally corresponds to the old town, but within that zone 30 there is a street, a couple of them, three streets, which are not of a single lane. Then, even so, if you want to overtake the bike you have to go to the other lane, you will not be able to overtake, you will have to join the other lane and when you have travelled a considerable distance past the bike, return to the right side. And in no case, they will be able to overtake the bicycle in zone 30. Why? Because although we have single lane streets and maybe the width of the roadway allows you to overtake the bicycle, we are not going to allow that for ... it is also a measure that will help us with the calming of traffic. Then, on the one hand, we preserve the safety of the bicycle, secondly, what we do is to calm the traffic and lower our speed a bit.

And also, I suppose that many of those streets in zone 30 are going to implement the bike priority lane or the road marking of the bicycle to ...

Yes, it is going to be marked ... it is going to be a revulsive one perhaps in the city, because right now the bicycle has a rather peculiar place in Granada, then some itineraries are going to be marked as bike priority lane and many streets are going to become cycle streets with

absolute preference of the bicycle, there will even be some sections in pedestrian streets are going where the bicycle will be in coexistence with the pedestrian.

Okay, that does not mean that there is a kind of bike lane or road lines in pedestrian areas ... simply that space sharing is encouraged, right?

In Granada, an institutional agreement has been made between all the parties in which the bike lanes are not going to continue to be implemented; all actions will be limited to cycle streets, bike priority lanes and some empowerment will be given to the bicycle but on the road. And obviously, there will be specific places where there will be coexistence with the pedestrian in pedestrian streets, but they will obviously go down on the sidewalks.

It occurs to me, for example, on the "Constitución" boulevard, on the entire pedestrian promenade, what would happen there?

There still, in that area is not planned to make a cycling itinerary, but even so, probably pass to the road, would go to the lane on the right of the road. In principle, okay?

As a bike priority lane?

As a bike priority lane, in principle. Because well, there is still the feasibility study going on because right now the Andalusian Bicycle Plan is being developed.

The plan is still being studied, where will the future cycling network of the city go and well, there are sites that are more controversial, which are still being studied. But due to the institutional agreement derived from the political agreement, the city council has opted to go along the lines of the bike priority lane, what will be developed is an infrastructure consisting of bike priority lanes and cycle streets. Of course, we will have to study every street, there is streets that due to traffic volume, speed or volume of pedestrians that there can be in these areas [...] it will have to be studied if it is feasible to incorporate a bike priority lane or not, if it is not feasible, it will have to be moved to other area, but the development of the city in this moment will be all consisting of bike priority lanes and cycle-streets. There can be a specific and concrete place that needs a slight stretch of bike lane, but the instructions do not follow these lines.

Appendix A: Pre-interview summary for interviewees

Thesis summary

What I intend to research in this thesis is the “ciclo-carril” (cycle-lane), which is a new type of cycling infrastructure, or rather cycling priority infrastructure where a traffic lane in the road gets shared lane markings for bikes and a speed reduction to 30 km/h.

This has been introduced in the capital of Spain, Madrid. The city council started implementing it in 2013 and there are 125.6 km (to this date: 30/12/16) of cycle-lanes or bicycle priority lanes.

Figure. Cycle-lane 30 with shared lane and speed markings.

As it is stated in Madrid´s Bike Master Plan, this measure was conducted mainly due to two reasons, there was a need for bike infrastructure to achieve the goals pursued by the Climate Action Plan of pollution levels reduction as well as to accommodate cyclists needs in terms of safety and visibility in traffic, and there was scarce financing for doing it. The second reason is the implementation of an electric bikes public sharing system (Bicimad) which the bike infrastructure at the time mainly consisting of bike lanes on sidewalks could not cater for the speed requirements of the electric bike. (Gea 21, 2016)

Therefore, this new system of allocating cyclists on the road with the rest of motorised traffic was launched in 2014 with the intention of making the bike be considered as one more vehicle, and to be respected by the rest of road users. However, this seems like a political strategy that was not sufficiently backed up with scientific knowledge, no single study about its possible effects on cyclists or car drivers has been published.

Moreover, the city of Granada in southern Spain intends to introduce this same measure in the coming months, where they are still at the study phase.

The aim of this report then is to study what effects has the network of bicycle priority lanes had on mobility in Madrid during the 4 years of operation and argue whether it is an appropriate cycling infrastructure or not, and what other elements need to be linked to it:

What are the effects of bike priority lanes and how can they be improved to represent a safe and convenient bike infrastructure?

One student has conducted a master thesis and a bike association has written a report to date analysing, namely, the effectiveness of this new bike priority infrastructure in reducing car speeds when encountering or not a bike in the lane and impressions from different users of the lane, both drivers and cyclists. The results are not very optimistic as the average car speeds in 5 streets analysed are higher to the maximum speed limit (30 km/h) and there is a confusing use of signals and discontinuity in the infrastructure.

The state-of-the-art in bicycle priority lanes or other places which have longer tradition of its use is for instance, San Francisco. In a report prepared for the San Francisco Department of Parking and Traffic in 2004 analysing the type of shared lane markings and its effects on drivers and bikers' behaviour, they concluded that 60% of the cyclists felt that the markings increased their sense of safety whereas one third of the drivers felt that the markings improved their behaviour. Overall, the markings improved the position of both cyclists in the road, and of cars, when overtaking cyclists, they also reduced sidewalk cycling (in 35%) and wrong way cycling (in 80%).

However, these markings are recommended to be used in bike routes Class III in the US, which have low traffic volume. Also, they don´t recommend the use of shared lane markings in substitution of bike lanes wherever the latter are feasible.

These shared lane markings used in the US seem to be slightly different from the ones that have been implemented by Madrid´s government in terms of purpose, while in the US it is a way of improving cycling safety, in Madrid they have been used to substitute the construction of bike lanes and to create a whole "bike" network.

With respect to theories that I am thinking of using, I could think of Transition management and Multi-level perspective to explain the transformation process ongoing in Madrid´s transport infrastructure and focus on cycling. But in order to use these theories, I would have to look at the socio-technical system of bike transportation as a whole, and not just at the bike infrastructure (bike priority lane). I would have to consider the new technology introduced in the city: public e-bike sharing system (Bicimad). Moreover, while exploring the implementation process of the bike priority lane, I found out that the municipality established a Mobility Committee, including several stakeholders such as traffic safety professionals, bike associations, university researchers, politicians, etc. As well as a review committee for the Bike Master Plan in 2008 and the Review and Updating of the same one in 2016.

It was also established in the Bike Master Plan the creation of a Bike Office as an online tool for help and participation of the public. These initiatives represent an institutional change which is also contributing to the transition of this socio-technical system. Thus, I would have to look at all these advancements in different domains to be able to study the apparent transition, which would deviate me from the initial unit of analysis: bike priority lane. Another option is to look at this new infrastructure as a niche for future bike infrastructure development, and thus use the theory of Strategic Niche Management.

Nevertheless, to study the convenience of this infrastructure, I guess I would also have to study the theory behind bike infrastructure design and planning, such as CROW or Presto.

With relation to the methodology, I will conduct expert and non-expert interviews in Madrid and Granada. In both mobility departments of the municipality to transport planners. Also to police officers, politicians, researchers and consultants, as experts. Then I will interview public such as users of the infrastructure: cyclists, car drivers, taxi drivers.

I could do a survey to the users instead of interviews, this way I can reach a bigger sample.

I could also collect field data such as video recordings of use of the bike priority lane.

References:

Gea 21. Plan Director de Movilidad Ciclista de Madrid (Revisión y Actualización). 2016

** Translation:* Gea 21. Madrid Cycling Master Plan (Review and Update). 2016

Pre-interview summary

The master's degree project is a research project for the Master in Sustainable Cities. It is about finding a real problem visible in society and conducting research by applying a methodology to be able to offer a solution based on an analysis through the magnifying glasses of a theory.

The problem that I have found is that there are different opinions, experiences and studies that question the effectiveness of cycle-lane when it comes to representing a safe and comfortable infrastructure for cyclists and cars (technical aspects).

With the implementation of this type of infrastructure, the city is trying to make a change of the urban transport model to a more sustainable one. In addition to trying to avoid the conflicts that occurred on the sidewalks between pedestrians and cyclists with bike lanes constructed on the pedestrian area.

Another relevant aspect to be analysed for the city council of Madrid is to know if this infrastructure really represents a transition towards the desired sustainable model (social aspects). As the multilevel theory (multilevel perspective) argues, reality is composed of socio-technical systems composed of people and technology, as well as norms, customs, everyday practices, knowledge, etc. And a transition occurs when there is a change of socio-technical system.

Therefore, what I have to analyse in this work, if I want to answer this question, is if all the stakeholders have been included in the process and if there are multiple causes that motivate and reinforce each other affecting directly the mobility of the city, apart from other specific issues that will be relevant to ask in the interview.

The type of structure I suggest following in the interview is semi-structured. So I can guide the interview towards the subject in question and the interviewee will have the option to link with topics outside of these questions that he thinks are relevant for me having a better understanding of the general picture.