

# A FRAMEWORK FOR FUTURE DEVELOPMENT OF NEIGHBORHOOD MOBILITY PLANS IN PORTUGAL

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## ABSTRACT

When developing a new urban area, town and transport planners have to establish the type of transport infra-structure and service that best fits the particular site and its future inhabitants. However in the existing urban areas one does not have the advantage of a “blank sheet” start, several restrictions have to be faced if one is to manage mobility geared towards efficiency and people’s aspirations. During the last decade Mobility Plans have been developed in many cities of the world. These plans deal with major policy orientations in key subjects such as parking, traffic and land use. But when we zoom in to a closer scale, we face a more detailed mobility situation that many times stays unobserved and unmanaged. Neighborhood Mobility plans are meant to respond to that specific need, detecting localized problems and opportunities and trying to foster them to neighborhood and city agendas, supported with specific proposals of intervention.

This paper presents a framework for the development of neighborhood mobility plans, and tests that framework for the neighborhood of Campo de Ourique in Lisbon (Portugal), engaging in a reflection of its importance in solving and taking advantage of specific problems and opportunities of this neighborhood. This is useful in establishing an orientation for future development of these plans as part of Lisbon’s Mobility Plan.

Some of the conclusions of this study point out to the importance of developing this kind of integrated analysis; it may become a powerful decision making tool that will give policy makers a more accurate knowledge of the actual mobility situation in each neighborhood, allowing to better respond to people’s needs and at the same time helping to promote the acceptance of some mobility changes to local citizens. But possibly the most important conclusion of this work is that neighborhood mobility plans are able to find simple and inexpensive solutions for some of the Problems/Opportunities which otherwise could stay undetected.

*Keywords: Mobility Plans, Parking, Traffic, Pedestrian Mobility.*

## INTRODUCTION

The main goal of a mobility plan, independently of its scale, is to improve the quality of movement for people and goods within a study area, allowing the development of active economic regions and favoring the increase of welfare for all its agents. In order to achieve that goal, an adequate range of transportation options must be provided and livable communities must be developed putting together not only mobility vectors but also environmental and safety benefits.

At a city scale, the main object of a mobility plan is to define a strategy for global management of transportation. Although it may address some specific interventions, these tend to be proposals that benefit all the city's inhabitants, workers and visitors. This plan must be based upon regular updating of several studies that reflect the reality of that area, involving perspectives and possible solutions for the different sets of problems that arise; they must engage all the decision makers responsible for the definition of the city transport networks and land use.

At the neighborhood level one zooms in to a finer scale and this should allow greater precision in the study of problems that occur daily. Each neighborhood, similarly to a city, must have its own mobility system relating to the other areas by means of transportation. Mobility management in a closer scale is not new: in England and Wales the white paper: "An New deal for Transport: Better for everyone" (Department of Transportation, 1998) introduced the Local Transport Plans (LTP) as a means to better manage mobility in a closer scale in England and Wales (Local refers to the Borough and not to the neighbourhood or parish scale).

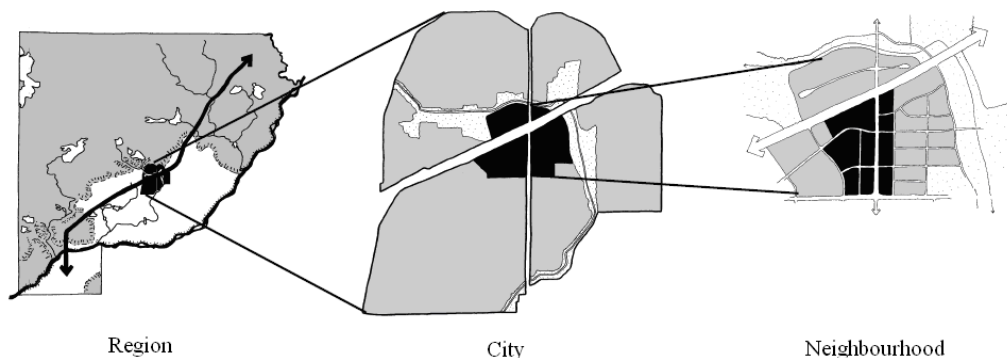


Figure 1. Planning Scales. Source: (Bonsignore, 2002)

A mobility plan for the city of Lisbon (Portugal) was developed recently, as part of the Municipality's Master Plan revision (Câmara Municipal de Lisboa, 2005); this plan emphasized the need to make neighborhood mobility plans as an essential instrument to manage mobility at a local scale, stating that this is the only way to solve specific problems or to take advantage of opportunities in each neighborhood.

Traditionally mobility planning at a local scale in Portugal is only made for new urbanized areas, in the so called *Planos de Pormenor* (site plans), in which parking, traffic and transportation networks are planned from scratch. But for the consolidated areas it is only in some situations of urban renewal that these studies are required for project approval, leaving mobility management for the Parish Councils, traditionally short in resources and technical knowledge, or to the city council, which has many difficulties in finding localized problems or opportunities.

It is clear that even in consolidated urban areas of the city, permanent mobility management is required to maintain good conditions for all who travel in and out of the neighborhood, but that's not the only reason for mobility supervision. As people's voice increase through a more significant participation level in public management (Docherty; et al., 2001) also mobility policy has to change and adapt to the new demands.

One of the examples of these changes has been the increasing importance of pedestrian mobility by opposition to the creation of more curb parking or traffic lanes. Walking in and around local neighborhoods is one of the most important components of the adult's total physical activity (Humpel et al., 2004), moreover improving walkability can provide a variety of benefits, including improved accessibility, transportation cost savings, community livability, and of course improved public health. A more thorough economic evaluation indicates that walking is receiving less than its appropriate share of resources. When all impacts are considered, walkability improvements can provide a high economic return on investment (Litman, 2003). But the truth is that, quite often in Lisbon, sidewalks are not very attractive to pedestrians. The quality of sidewalks is incompatible with its use, the space is occupied with illegally parked vehicles, there's not quality urban furniture as well as adequate signalization. These factors combined with a general disregard for the urban landscape contribute to a non harmonious site for pedestrians to enjoy walking (Viegas, 2004).

But there are other important issues in neighbourhood mobility planning that need to be addressed. Land use is a key factor of trip generation, although local shopping alone does not show great promise as a strategy for reducing automobile use, it does show promise as an instrument for enhancing quality of life in neighborhoods, at least partly by making driving once again a matter of choice. Local shopping often acts as a fostering factor for a sense of community in the neighborhood (Handy and Clifton, 2001).

In a broader way integration between land-use and transport is especially important because the lowest transition costs between activities occur when there is little or no need to travel from the location of one activity to that of the next one undertaken by the same person or enacted upon the same piece of material goods (Viegas, 2003). However, in the short and medium-run, land use change in consolidated neighbourhoods isn't a good option to mitigate traffic problems, because it is a process that takes too much time to produce results. At the

same time, the solution for automobile circulation should not lead to reduced commercial activity, because there's the risk of losing support from neighbourhood agents.

Parking also plays a major role in any neighborhood mobility system, for residents, workers and visitors accessibility. In most cities, potential demand for parking space largely exceeds available supply, that's why technical and political decisions in this subject must gear towards a better sharing of the available space by the various demand groups; a priority scale must be established where the first to be attended are the residents. But one must take into account the great influence that parking supply can have in resident's motorization rates, by sometimes promoting a second or a third household vehicle. Moreover if we are planning parking supply for a central neighborhood, some street space must be allocated for rotation of visitors who come to local shopping. Providing on-street or underground parking does not have the same influence in people's choice to shop in a specific neighbourhood, because visitors prefer to park close to their destinations(Golias et al., 2002).

These and other subjects are part of a neighborhood's complex mobility system and ultimately they all influence the livability of each community determining a neighborhood's attractiveness as a good place to live, work or visit. The Term "Community Livability" refers to the environmental and social quality of an area as perceived by residents, employees, customers and visitors (VTPI, 2005). "Developers and managers of neighbourhood subdivisions should realize that the social, economic, and physical features of the subdivision do play an important role in the subdivision residents quality of life" (Sirgy and Cornwel, 2002).

The purpose of this paper is to establish a framework for future development of neighbourhood mobility plans in Portugal. The development of this framework is tested at the neighbourhood of Campo de Ourique (Lisbon) in order to understand if there is added value to mobility management, and if so in which particular aspects. The paper is organized in the following way: The proposed framework for neighbourhood mobility plans is described in Section 2, while Section 3 contains the Case Study - The neighbourhood of Campo de Ourique.

## **PROPOSED FRAMEWORK FOR NEIGHBORHOOD MOBILITY PLANS**

The neighborhood mobility plan has to start with the definition of objectives. These mobility objectives should consider the relevant guide lines at all political and management levels: European, National and Urban, the latter through the City Mobility Plan (CMP).

The European Union has been publishing policy orientation documents in Transportation. One of the recurring themes is transport sustainability. At the National Level, the statement of mobility objectives depends of each country's concern in establishing orientations for mobility policy. These directives can be affirmed in several kinds of documents ranging from the Constitution to the Government Program.

The CMP helps to establish the neighborhood plan objectives in a more accurate way, integrating the city mobility perspective in its various neighborhoods.

The next stage in the preparation of the plan must be an initial observation and boundary definition of the study area. In this phase technicians must make a reconnaissance visit to the neighborhood (walking is preferable) - To get a sense of how the study area functions there is no substitute for being there. A photographic report is an effective tool to evaluate the location. Special attention must be given to all mobility factors like traffic, parking, and infra-structure quality. No defined itinerary must be followed; the path should be chosen in order to observe what seems more interesting.

This tour should help establish with better precision the limits of the study area. This has a great influence in the efficiency of the information gathering; we can't risk losing time collecting unnecessary data or in the opposite lose information that's going to be needed in subsequent analysis. The study area may be defined by an administrative border, but the real neighborhood to be studied may depend on the objective, sometimes it could be more productive and significant to establish a different border.

The next stage of the process is the data gathering phase, which is crucial for the quality of the plan. Data is collected and mapped on natural resources, transportation systems, land use, local economy and social issues. This step should result in a good understanding of the study area as well as surrounding areas of potential impact. Information gaps can also be identified and filling up those gaps should be a priority. Better precision in this phase should result in a more accurate plan, one that really responds to local problems, takes advantage of the existing opportunities and answers to people's aspirations.

At its simplest, two tasks have to be accomplished in this phase: Task 1: Collect relevant studies and reports – Information such as statistical data, social service assessments and transportation reports can be collected. Similar projects already developed are another form of useful research early on and throughout the process; Task 2: Take advantage of available mapped data – Many Institutions/Organizations have Geographic Information System Databases (GIS) and Cad drawings that contain data layers useful to mobility analysis (Correia et al., 2005).

Four Institutions/Organizations can be pointed as the main sources of information connected to the neighborhood mobility management: The Municipality, Transport Operators, Parish council, and National Statistics.

After gathering the available information, this has to be worked in order to identify Problems and Opportunities in the neighborhood. Problems arise through perceived deficiencies of transport to society. Opportunities may arise through programs of transport investment either directly by the Parish council, Municipality or together with those involved in specific aspects of transport service (Essex County Council Environmental Services, 2000). This stage connects the Mobility Plan Objectives with an integrated transport strategy, allowing categorizing problems and opportunities in a set of integrated transport themes.

Some of the information is self expl, and only needs to be presented in tables, graphs or maps (ex: motorization rates and population income level). For other mobility issues, raw

data has to be combined in order to produce indicators that translate the mobility reality of the neighborhood and some other related issues. An example could be service and commerce density or the number of people in the catchment area of Bus stops.

Outside the range of the information that can be given by institutions/organizations lie other mobility characteristics of the neighborhood which are more difficult to obtain and keep track by administrative services. That's the case of traffic congestion, infra-structure quality, parking rotation (number of vehicles parked per day and per parking space) and transport reliability which demand a systematic observation on site through electronic means.

One of the most important things about making a mobility plan, whatever the scale, is to gain the widest support for the resulting proposals, which suggests that people's opinions must be integrated early in the process. In this stage of identifying problems and opportunities, a survey should be made to obtain this contribution.

Having set the problems and opportunities of the neighborhood a strategy to achieve changes in mobility is required. A transport strategy means: a set of policies, initiatives and schemes which together act in an integrated manner to develop an area's transport system, to provide for present and future demands in the neighborhood and also peoples aspirations to a better quality of life. Reaching the various objectives must not be planned independently if a more global outcome is to be achieved.

The global strategy can be divided in a set of transport themes. One example of those themes could be: "Managing overall Travel Demand and the Transport Network" this is, for example, associated with Transport Demand Management schemes (TDM) and Urban Traffic Control systems. These transport themes must attend to the identified problems and opportunities and the compliance of the mobility objectives.

Having defined this transport strategy one is able to identify Service Delivery Areas which are composed from objectives in each of the strategic themes. For instance parking must follow a strategic path in order to encourage the use of public transport and reduce the need to travel in private transport. This encompasses both "Encouraging Sustainable Development and Travel Patterns" and "Managing overall Travel Demand and the Transport Network". In this phase specific goals must be established, technicians must try to convert mobility objectives in quantifiable targets based in the data and indicators defined earlier, for example: number of traffic accidents reduction of 10%.

For these targets to be accomplished proposals have to be made. These are based on three main sources of information. A state of the art investigation, including among other things, scientific papers, mobility guide-books and International policy applications (Case studies) provide an important background. The second source is a systematic observation of specific mobility aspects of the neighborhood; this implies going back to the neighborhood following a methodology of observation and doing the corresponding results report. The third should be a public participation exercise that must come at this stage as a validation method of the proposals. Hence, it is of paramount importance to make a good presentation of the proposals, trying to gain all the stakeholders support.

The proposals also have to be analyzed from an executor point of view, because at a neighborhood level the power to implement certain kinds of measures is very restricted. For instance, everything which has to do with policy changes has to be implemented at a Municipal Level or at a National Level. Thus some of the neighborhood mobility plan proposals are just suggestions/contributions for the CMP and in that sense the plans complement each other. There are several categories of proposals: engineering interventions, change of regulations, management of activities, land use change, pricing changes, etc.

Finally monitoring the plan is essential to assess the efficiency and effectiveness of the proposals in accomplishing the targets for each Service Delivery Area. Monitoring uses the indicators already established in the plan to observe the occurring transformations. We can distinguish between two types of monitoring objects: the outputs, which describe what is produced by the plan, and the impacts, which describe the effect produced by the outputs. So, both allow monitoring different aspects of the plan: the outputs enable to measure the plan's implementation program whilst the impacts measure the effectiveness of the transportation strategy.

The following scheme summarizes the framework described in this chapter (Figure 2).

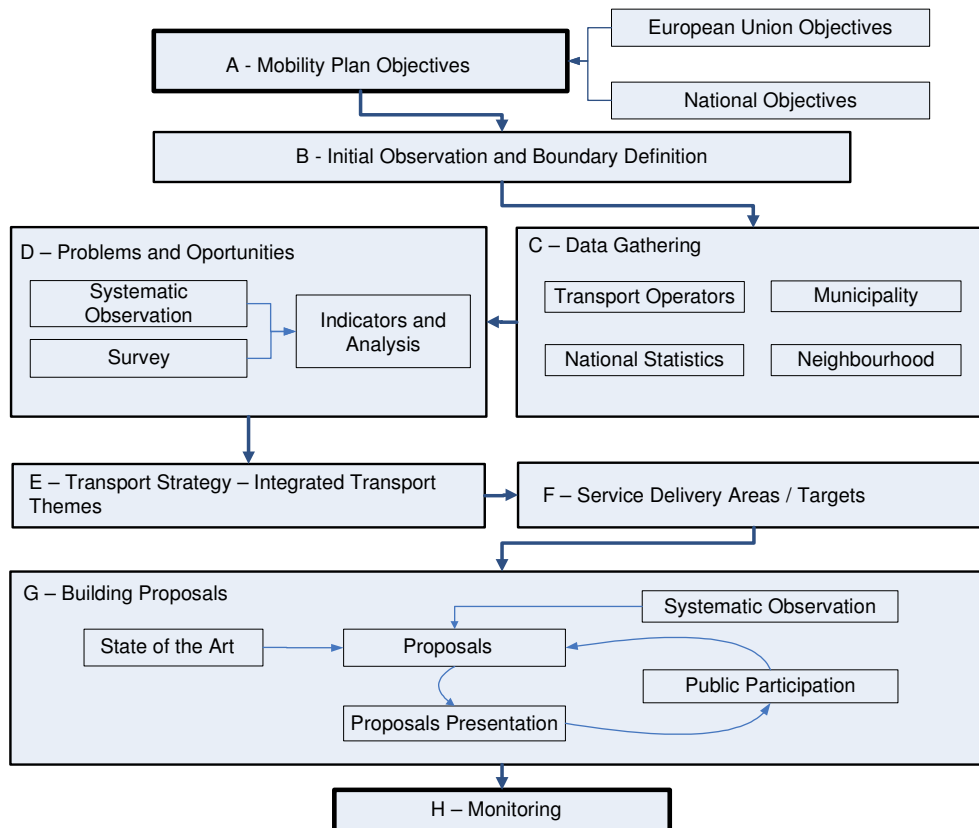


Figure 2 – Mobility plan framework

## CASE STUDY: THE NEIGHBORHOOD OF CAMPO DE OURIQUE

In order to evaluate the proposed framework it was decided that the best process would be to study a specific neighborhood in Lisbon (Correia et al., 2004). The work developed included the entire path between the mobility plan objectives and the Proposals. The monitoring phase couldn't be evaluated since the plan has not been implemented yet.

The chosen neighborhood, Campo de Ourique, is located close to the city centre (about 2Km) and encompasses an area of about 50 ha. This neighborhood presents a series of attractive factors which make it a good case study to test the proposed framework:

- Strong commercial activity, with street shops attracting both local and surrounding inhabitants;
- Local traffic streets as well as some city level connections with peak hour congestion;
- Curb parking in every street;
- Unique community livability, with a significant segment of the population walking to their activities in the neighborhood.



Campo de Ourique is organized in a rectilinear grid with well defined blocks implanted on a plateaus contrasting with the adjacent neighborhoods in all directions.

For this area's early development there was a strong contribution of the transport system, particularly in 1884 with the construction of a parking station for horse-pulled streetcars (Americanos) and later on with the construction of the main facilities of Carris (Lisbon's only bus and tramway Operator). Both facilities implied the stretching of the transportation network to the neighborhood thus attracting new residents.

### **Starting the study - Mobility Plan Objectives (phase A)**

In Portugal there is no specific national strategic document about urban mobility, therefore EU orientations are the best high level directives for mobility management. In 2001 the European Commission published a new Transport White Book called: "European transport policy for 2010: time to decide". In this document some guide lines were given for future development of the transport sector. Shifting the balance between modes of transport towards a more sustainable equilibrium and placing the users at the heart of transport policy are some of the general orientations stated in this document (European Commission, 2001).

The City Mobility Plan (CMP) is the best reference to establish mobility objectives for the neighborhood. In this document there is a specific section for neighborhood mobility which establishes guiding principles for mobility at this scale (Câmara Municipal de Lisboa, 2005). Recommendations for the increase of pedestrian mobility and other more sustainable transport modes can be found there: a better quality in pedestrian infrastructure is pointed as a decisive instrument in neighborhood attractiveness. Associated with pedestrian mobility, this document states that public parking in the neighborhoods has to be managed like a scarce good, regulating the supplied quantity and the corresponding access regimes; this has a clear influence in each area's attractiveness, automobile trip generation, car circulation but also, in a short-run, family motorization rates.

Public Transport must adapt to each neighborhood's needs, considering its demographic profile and motorization rates. Transport schedules must be compatible between transport modes, favoring multi-modality, which means to give priority for bus lines feeding subway stations or rail stations, along the same operating period.

In the CMP little is said about local traffic circulation, it only refers to excess speeds, pointing towards traffic calming schemes. This is clearly a specific vocation for neighborhood mobility plans.

The Neighborhood Mobility Objectives can be translated by the following three: Environment and Safety (promotion of sustainable transportation modes and the corresponding increase of community livability), Accessibility and Integration (parking and public transport management towards a better accessibility, and integration between all modes) and Economy and Efficiency (create better conditions for economic development and improve the transport system efficiency, responding to people's needs).

## Initial Observation and Boundary Definition (phase B)

The entire neighborhood was covered on foot; this allowed knowing the main buildings in the area as well as some of the mobility problems. Double parking and traffic congestion appeared to be two major problems in the neighborhood.

One of the most important things that we learned about in this field trip was the strong commercial activity in the neighborhood, with some busy local shopping streets. Commercial units range from small grocery stores to well known franchised clothing stores.

The study area boundary definition is very important in the case of Campo de Ourique because there are no defined limits for the neighborhood; this designation was adopted when this site wasn't even an urban area. The city of Lisbon is divided in 53 administrative zones (freguesias, parish) with different size, social and demographic characteristics; many of them were delimited for historic reasons and not for their homogeneity. The parish to which the neighborhood of Campo de Ourique belongs, encompasses two different areas: one features the main characteristics by which this neighborhood was chosen and the other is very different, recognised as a degraded and poor area of the city, now suffering several transformations for integration with the rest of the territory and following an urbanization plan developed by the Municipality.

Therefore, the first challenge was to select the study area in the parish. The main criterion was the representativeness of the attributes that characterize Campo de Ourique (see beginning of Chapter) but at the same time keeping most of the population and urbanized perimeter so that statistical data of the parish (National Institute of Statistic) could be associated with the study area.

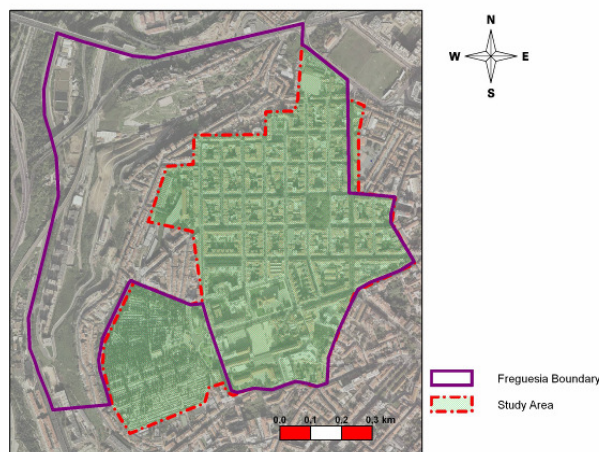


Figure 3. Delimitation of the Study Area

In Figure 3 one is able to observe the different urban shapes of both areas. Despite the fact that the contour lines are not represented, it is easy to notice that slopes are very different at the north-west side of the figure, when comparing with the rectilinear north-east and south-east side of the figure. That is one of the reasons why these two areas of the same parish developed so differently.

## Finding Problems and Opportunities (phases C and D)

During this work, we found that although phases C and D can be seen as separate stages, they are in reality so close together that it would be counterproductive to divide them in two chapters. Thus the data collected and corresponding analyses are shown directly connected in the section.

### *Collecting and Processing Municipality Data*

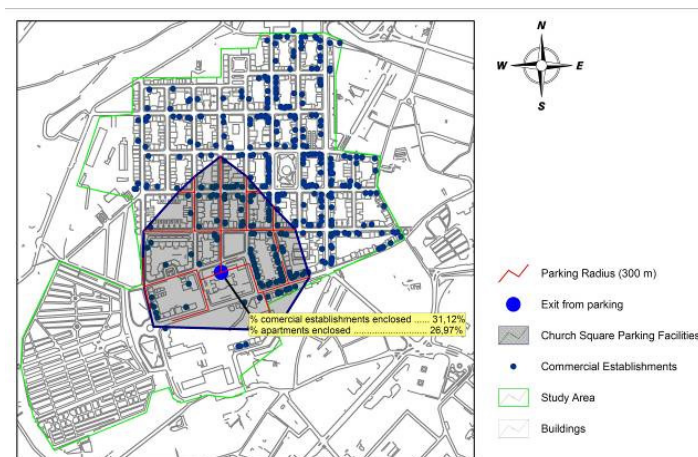
Having taken a first look at the neighborhood and having defined the exact area that was going to be studied, one should be ready to collect all available data and begin mobility analysis which will then lead to the identification of problems and opportunities.

From the municipality we obtained the City Mobility Plan (CMP), data from parking management and land use. The CMP is constituted by a diagnosis part and a proposals part, but these are based on a general study of the City not entering in great detail.

Lisbon's on-street Parking supply is managed by a Municipal company. This company's main task includes managing curb parking to non-residents through parking meters (8:00 to 20:00) and granting free parking permits in these areas for all residents (in their area of residence).

The alternative for on-street parking is private access parking. The CMP defines the minimum number of parking spaces in new buildings, but this policy has very slow impact in the old neighborhoods of the city. Concerning public access off-street parking facilities there is only one underground parking facility in the entire neighborhood, located under the church square in the south-west corner.

In *Figure 3* one can see the influence area of that parking, considering a maximum walking distance of 300 m. These limits were drawn starting from the exit of the parking and then following the street segments.



*Figure 3.* Enclosing area of the Church Square Parking

From this representation we may conclude that this parking does not serve the majority of commercial units, because only 31% of the shops are within its influence area. When we look into the coverage of apartments the percentage is even lower (27%).

When analyzing the on-street parking situation more broadly we need to have indicators of parking rotation in the neighborhood. This information may already exist if the parking management company does these studies periodically; otherwise data has to be obtained through field observation, as was the case of *Campo de Ourique* (see chapter 0). The parking company supplied a GIS base with all parking spaces and the number of resident parking permits attributed for all the neighborhoods in Lisbon (EMEL, 2003) so we could compare *Campo de Ourique* to the other areas of the City (Figure 4).

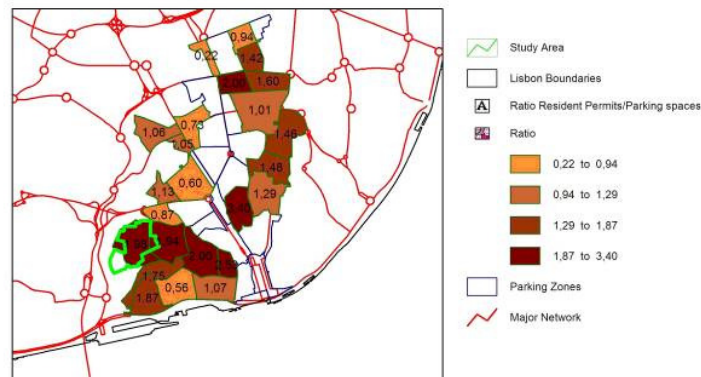


Figure 4. Ratio of resident permits per parking space (2003)

*Campo de Ourique* reached a high value for this indicator (1.98), clearly supporting the observed parking shortage. It seems that a large percentage of parking spaces are occupied by residents, but further conclusions had to be drawn from field observation.

Land Use GIS datasets were also obtained in the Municipality and this data is, in fact, very important to evaluate commercial activity in the neighborhood. The first studies of the area reveal that *Campo de Ourique* is a strong local shopping community that attracts visitors from outside of the neighborhood.

In order to assess commercial activity in the neighborhood an indicator of commercial density was developed. It was decided that the best method was to consider the number of shops by street segment and not by statistical unit, because we were interested in the impact of commercial activity in the street dynamics like parking, vehicle movement and pedestrian mobility. For each side of a city-block shops were added for both street faades and divided by its length. The results are shown in Figure 5.

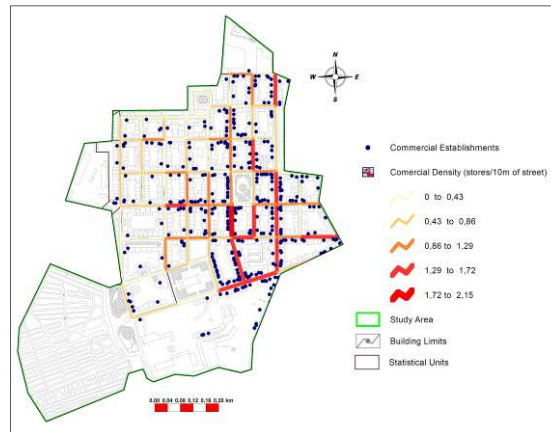


Figure 5. Commercial Density (Stores/10m of street)

One is able to see the concentration of commerce in the southeast area of the neighborhood, which confirms the field observations. In fact this is the area where there is more traffic, double parking and more pedestrian movement.

#### *Other sources of information*

From the public transport operators we received a map with all existing transport services and their corresponding theoretical schedules. This allowed analyzing transport coverage of the neighborhood and connection times to other transport modes and major stations. Although *Campo de Ourique* does not have a subway station, a good connection was found between the entire neighborhood and a nearby station with two bus lines running all day.

In Lisbon the local management information that can be obtained is very limited, which is one of the reasons why mobility plans on a neighborhood scale are so needed. In many cases, the parish council, does not have the skilled people to work these problems efficiently and definitely does not have the budget to apply serious actions towards mobility improvement. Usually they are only able to react to small problems and convey them to the municipal administration other than implementing pro active measures. The only contribution that a mobility plan may have from this institution is the perspective and opinions of people that know the neighborhood well; they may point out problems and opportunities that otherwise technicians could miss. This was not the case in *Campo de Ourique*.

From the National Statistics Institute we obtained data from the Census 2001. In Portugal many social and economic characteristics of the population are inquired in the census (10 years interval) as well as some of the commuting mobility information of worker and student population such as distance and time travelled and the modal split.

We were supplied with a GIS base containing the smallest statistical units available (city-block), allowing a good visualization and detail of the data. With the population and the area one was able to calculate the population density for every statistical unit (Figure 6).

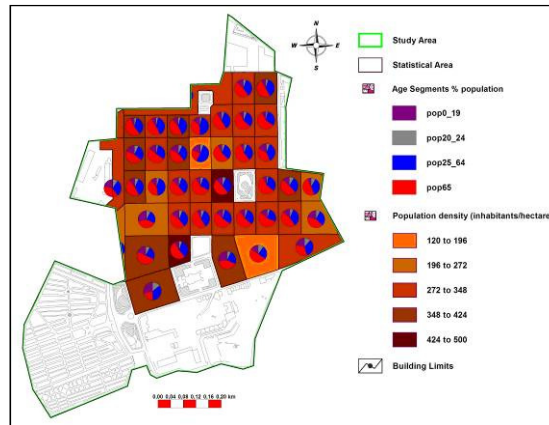


Figure 6. Spatial distribution of population density and age segment

One can observe that there is no special concentration of population in one part of the neighborhood, although differences between the units can be seen. From the pie charts with the age groups it's easy to notice the problem of aging; in most of the blocks the population over 65 years of age is dominant.

From the commuting mobility survey of workers and students we obtained the home to work modal split (Table 1), favorable to private vehicle (34%) as well as walking (30%), which confirms *Campo de Ourique* as a good neighborhood to enjoy walking, much to do with its shopping characteristics and a good sidewalk infra-structure.

Table 1. Modal Split for workers and students in commuter trip

BUS	Train	Private vehicle	Tram or Subway	Bicycle	Walking	School or Company bus	Other modes
24.91%	1.35%	34.33%	6.14%	1.02%	30.45%	1.18%	0.62%

However, mobility evolution has been favoring private car instead of pedestrian mobility (Table 2) 38% increase against a 31% decrease. Notice that school or Company bus lost about 50% in one decade, which is another bad sign for sustainable mobility in *Campo de Ourique*.

Table 2. Modal Split evolution for workers and students in commuter trip (1991-2001)

	Bus	Train	Private vehicle	Tram or Subway	or Bicycle	Walking	School or Company Bus	Other Modes
1991	n.a.	127	2365	n.a.	62	4209	239	57
2001	2369	128	3265	584	97	2896	112	59
Evolution	-	0.8%	38.10%	-	56.50%	-31.20%	-53.10%	3.5%

### *Systematic observation – Collecting field information*

In *Campo de Ourique* signalized intersections are managed by local controllers, which do not read traffic flows.

In this stage of the study, traffic diagnosis was built upon simple field observation covering all the main road system by foot, observing traffic flows and intersections. Congestion was found in an un-signalized intersection to the north and in the main shopping street. In the intersection significant queues were found in both morning (7:30 – 9:30) and afternoon peak hours (18:30 – 20:30), which appeared to be connected with school schedules.

In what concerns parking it was already mentioned that parking rotation information was not available from the Municipality. Because this is very important for parking diagnosis, it had to be included in our systematic observation; therefore, a patrol group was formed to collect data on parking duration and number of spaces that rotate during the busiest time of the day (10:00 – 14:00). Given the resource limitations, and the need to organize patrols in small intervals of time to check all the cars (in this case 10 minutes), the solution was to choose two sets of blocks, one in the commercial area of the neighborhood and another in a calmer area (few shops and traffic).

From the results of this operation we concluded that illegal corner parking is playing a major role in parking supply of the study area with 34% and 57% of the total number of places that changed occupancy. This reveals that there is not enough parking available for rotation; it must be reminded that the value of free resident parking permits attributed per parking space is very high (1.98 – Demand doubles the existing supply). This together with the ageing process that fills the streets with permanently parked cars (the percentage of vehicles constant during the patrol is above 70%) is causing great difficulty in visitors parking demand.

Although the busiest block has a higher parking rotation, this is not enough for the high demand in this commercial area. Illegal parking spaces in corners in the busiest area have a much higher rotation than in the calmer area with only 23% of places with the same car during the patrol against 83%.

The next phase of the study included the evaluation of public transport reliability; some local data collection was done to ascertain if schedules were obeyed. The conclusion was a good reliability in complying with the defined schedule for the two bus lines, both in peak and off peak period, with limited waiting time (10 minutes max).

### *Getting people's opinion*

The main objective in this point of the study was to get a general idea of people's opinion about mobility in the neighborhood. A small questionnaire was developed for residents, workers and visitors.

The survey was divided in a general part, for all the inquired, and a specific part for each of the population segments. People were asked to rate: parking, public transport, pedestrian mobility, automobile circulation and security in a scale from 1 (Bad) to 5 (Very Good) and they were also asked to give their opinions/ideas about mobility in the neighborhood.

Forty five people were surveyed, 15 in each population segment. The opinions expressed were registered, but brought nothing really new to the mobility diagnostic. The next figure shows the results of the classification for the five neighborhood characteristics.

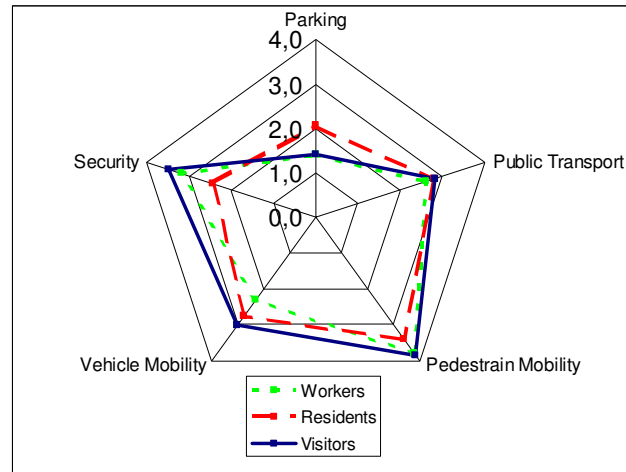


Figure 7. Mobility classification outcome

The results of this rating are interesting when analyzed from a psychological point of view. We have to consider that a quantitative classification of subjective elements is always dependent upon people's perception of the reality. For instance security was classified poorly by residents, however visitors gave it an excellent classification, this apparent contradiction is the result of a different level of knowledge of the neighborhood. Anyone who lives in a particular area of the city ends up knowing a great part of its criminal events, as few as they can be, and visitors lack that knowledge.

Parking classification is not so ambiguous, even so there are always some people that build conclusions based in things they heard or read. Residents rated it higher than visitors and workers, which is an expected result, because they have free parking permits, confirming field observation and other analysis.

### **Defining Integrated Transport Themes (phase E)**

Having identified some of the problems and opportunities existing in the neighborhood, the next step was to intertwine these diagnosis elements in order to reach Integrated Transport Themes (ITT) that would, in turn, be addressed in the various service delivery areas.

*ITT 1 – Create mobility conditions to improve accessibility to local commerce.*

It is important to maintain the commercial characteristics of *Campo de Ourique* this is what makes it different, gives its character. Together with the people and good community livability



the stores make this neighborhood a good place just to pass by and enjoy some outside walking in opposition to the new massive commercial surfaces.

Although this commercial activity in the neighborhood continues to be relatively strong and renowned, the fact is that with growing competition from the big shopping centers and also from other rehabilitated traditional shopping areas, the number of costumers has been decreasing in the last years. This trend should be reversed and for that to happen there must be a strong contribute from the neighborhood mobility plan, making it more attractive to go shopping in *Campo de Ourique*.

### *ITT2 – Attract new residents promoting and improving community Livability.*

The high prices of houses (for rent and purchase) associated with a certain degradation of urban facilities contribute to the aging process of Lisbon's central areas. Gradually apartments are being replaced by offices, increasing the economic dynamics but with some social cohesion and community livability costs.

The problem of this evolution from a transportation point of view is the increase of the distance traveled by people as they live further away from their working places. This creates the need for a large economic effort in supplying means of transportation for which the demand is concentrated in the peak hours of commuting.

This plan must engage in an effort of creating better conditions for people to live in *Campo de Ourique*. Although the attraction of residents depends greatly on house pricing, better mobility conditions in *Campo de Ourique* should have a significant difference when people are choosing a place to live.

### *ITT3 – Improve efficiency and sustainability in the transport system*

All mobility proposals made through this plan must converge towards the increase of sustainability in the transportation system, this in an economic and environmental perspective. This means complying with two of the mobility objectives defined in the beginning of the study - Environment and Safety, and Economy and Efficiency.

Having in consideration the problems and opportunities identified, this ITT means promoting the so called soft modes (pedestrian, bicycle, etc) since the bus lines have proved to be adequate for the existing demand.

## **Establishing Service Delivery Areas (phase F)**

Four Service Delivery Areas were identified for *Campo de Ourique*: parking, traffic management, pedestrian mobility and cycling, each with its specific goals and connected to the Integrated Transport Themes.

### *Parking*

Parking is very important to attract visitors to the neighborhood; competing Shopping centers take advantage of this vulnerability by providing almost unlimited parking to their customers. Thus parking is an essential element in ITT1. Moreover with great parking scarcity near the main shopping streets double parking appears as it provides a fast mean to gain access to shops, although imposing on others the cost of traffic capacity reduction. Notice that an increase in enforcement could solve this illegal parking but would hinder economic activity in the neighborhood. The solution is to better manage parking supply, truly integrating visitors in the system.

Resident street parking demand must be diminished in order to free some space to visitors, preferably reducing the number of cars owned per family and increasing the use of more sustainable transport modes. This reduction will also benefit residents as competition for parking during the night is reduced: currently people have to double park or even triple park their car. The number of resident parking permits per parking space should go below 1.5 (against the current 1.98)

Extending the underground parking influence area to the main commercial streets should provide an alternative for the inhabitants to park their cars, leaving some surface parking for the visitors. The percentage of commercial units and apartments with close access to underground parking must be at least higher than 50%.

Parking must be charged higher in order to benefit short stays rather than long stays which usually are associated to workers; these must be stimulated to use other transport modes.

### *Traffic management*

Traffic congestion is a problem in some streets in the neighborhood. Without an efficient traffic system it is difficult to attract more clients to the local shops (ITT1), especially in the entrances of the neighborhood.

These problems must be addressed also in the perspective of ITT2 and ITT3. With so difficult car accessibility to the neighborhood and the corresponding externalities produced by the vehicles people will think twice before moving to *Campo de Ourique* despite other qualities that the neighborhood may have. Regarding ITT3 it seems a contradiction to improve the circulation in the neighborhood, because car users will see their travel time improved, but the situation that has been reached is causing more damage than the possible increase in induced through traffic.

### *Pedestrian mobility*

Pedestrian mobility is essential to achieve the three ITT. Maintaining good walking infrastructure and providing good street furniture, with enjoyable stopping areas, will keep visitors coming to shop in the neighborhood. It is not a coincidence that the most thriving street shopping areas are those which provide such benefits (ITT1).

At the same time this is the most sustainable mode of transportation (ITT3). Indirectly a good pedestrian flow should increase the search for residence in the neighborhood, as this becomes safer and more pleasant to live in (ITT2).

Improving walking is not only a matter of public health; it's also an investment in commercial activity. In 2002 a major study was ordered to precede the construction of new pedestrian infrastructure in Kensington High Street, London (UK). This involved a visitor inquiry to find the contribution of public transport and walking to the shopping activity in this London Street comparing it to spending from people who arrive by car. The conclusion was that pedestrians contribute with 4 times more money than those who use their car (Moylan, 2004). The advantages of promoting walking are in fact very marked, a cost benefit-analysis of walking and cycling track networks in three Norwegian cities reached the conclusion that building these infra-structures is undoubtedly beneficial to society (Saelensminde, 2004).

Ken Livingston (Mayor of London) recognizes the importance of walking, having launched an ambitious project to make this city one of the most pedestrian friendly in the World until 2015. For that purpose a plan was made defining the best processes and methods to achieve those changes. This includes marketing campaigns, specific street interventions which improve pedestrian mobility, establishing rules for the new urbanizations in order to make them more pedestrian friendly, improve security and safety and finally to promote the coordination between all the institutions intervening in the Plan.

### *Bicycle*

Bicycle is not usually regarded as a transport mode in Lisbon, which possibly has to do with the city topography with steep slopes. On the contrary the neighborhood of Campo de Ourique is built in flat terrain having good conditions for Bicycle use.

This is undoubtedly one of the most sustainable transport modes (ITT3), and its utilization must be encouraged, contributing to an increase in the neighborhood attractiveness as a special place to live in Lisbon (ITT2).

Even though bicycle utilization is not very developed in Lisbon, it has been gaining momentum particularly by influence of the American and Northern European experiences. Several civil movements have been created in the last years both at local and global level in these countries. As an example we can refer to the "Critical Mass" movement created in U.S.A in 1992 that uses the internet as a mean to promote the use of the Bicycle mode (Blickstein and Hanson, 2001).

Although bicycle use doesn't necessarily have to be linked with the existence of a bike path, because people may circulate in the same road used by motorized vehicles, according to a USA survey (Jackson and Ruehr, 1998) most of the people classify bike paths as the best infra-structure to make their cycle trips. It was also demonstrated that the construction of this

type of network increases the number of commuters using the bicycle mode (Dill and Carr, 2003).

## **Building mobility proposals(phase G)**

In this phase specific proposals are made to achieve the various service delivery areas objectives. Not all of the proposals included in the Mobility Plan are shown in this paper. The ones that follow were chosen to give a general idea of the overall scope of action that neighborhood mobility plans may reach.

### *Parking Proposals*

Generally residents have priority in parking allocation, but that priority does not justify that all spaces must be taken by the inhabitants. In fact, doing so in a commercial neighborhood like *Campo de Ourique*, is only causing commercial activity to slow down and the number of vehicles owned by residents to increase.

Giving free unlimited parking permits for residents is a wrong policy, benefiting no one. Not even the residents benefit, because the increase in car ownership causes great pressure on demand for parking spaces, which is especially noticed at night, when most of the residents have arrived home.

With the objective of developing a new policy for resident parking permits attribution, research was made to find the current good practice policies in European and North American Cities. The results can be summarized in the following points (an example of a city that applies the following policy is York (UK):

- Parking permits are paid in most medium and large cities of Europe (during the literature review no city was found where permits are not paid);
- The number of permits is limited. That limit is variable from city to city (this limit is established by each Municipality DOT and is a function of estimated demand and available supply);
- The allocation unit is very often the household;
- Permit prices generally increase with the number of permits attributed to each household (frequently the first permit is for free and may not have correspondence with auto ownership, i.e. a person without a car may have a permit);
- The validation of a permit occurs every year;
- In some cities six months and three months permits are also attributed, adapting the system to some visitors and workers needs;

Based in these points we propose that parking permits should start being paid by residents. This will make an important contribution to the municipal parking company budget and at the

same time will introduce some control in parking space demand for residents, leaving more spaces available for visitors. This is a proposal that can only be implemented by the Municipality, but despite this fact, introducing this suggestion for *Campo de Ourique* mobility helps the city council to understand the problem and maybe consider this option as a global strategy.

Although this proposal is aiming to help solving parking shortage in the neighborhood, the truth is that there aren't enough on-street parking spaces for the potential demand. But from the moment that residents start paying for parking (at least for more than the first car in every household), subterranean parking will be more competitive and start to be a real alternative to street parking. In this plan we propose the construction of two new subterranean parking facilities that enclose the main commercial area of the neighborhood as well as the remaining residential areas: one in the North of the neighborhood and the other much more central located in the park.

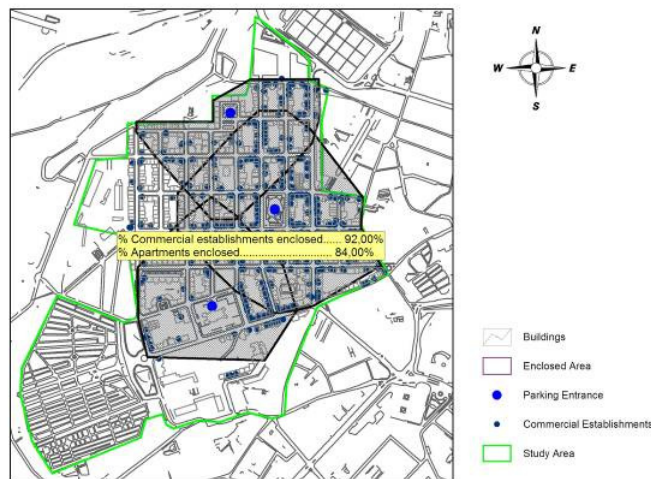


Figure 8. Enclosing area for all the subterranean parking facilities

With the new parking facilities the percentage of commercial establishments served would increase from 31% to 92% and the percentage of apartments served from 27% to 84%. The subterranean parking below the neighborhood park becomes the most important parking facility. Being next to the major part of commercial units it is expected that this proximity will bring more costumers to the local shops and at the same time give more parking capacity for the residents during the night.

### *Traffic Proposals*

A problem was identified in one of the intersections on the North side. This is an unsignalized T-Intersection between a long peripheral street and an entrance street to the neighborhood. To study this intersection, traffic counts were done for the morning peak period for all movements.

The Level of Service (LOS) was evaluated for each movement following HCM 2000 methodology (Transportation Research Board, 2000), see Figure 9. Movements 7 and 9 are those with the worst performance, because vehicles have to give priority to the flow from the

Major Street (left scheme in Figure 9). The result is the formation of a long queue in the Minor Street, causing a great delay to people who are trying to exit the neighborhood in the morning period (medium delay of 13 min/veh).

A Solution had to be found for this T-Intersection. The first option considered was its transformation to a signalized intersection, but lane constraints led to even worst results applying the signalized intersection methodology from HCM 2000. Failing this option, a closer observation of the area was needed no find another type of solution. From analysis made to the road system next to the intersection, another intersection was found with the same characteristics. The result is the existence of two intersections very close to one another with all movements allowed; this is leading to an inefficient entering and exiting flow in the neighborhood.

A solution is presented in which a loop is proposed around the block, making just one entrance and one exit to the neighborhood (see right scheme in Figure 9).

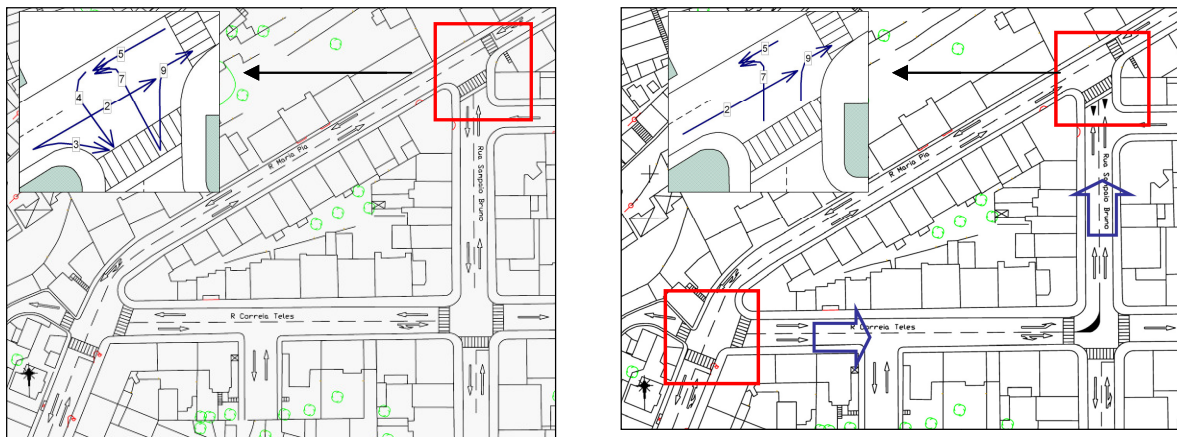


Figure 9. Solution proposed for entering and exiting the neighborhood

For the T intersection, the volumes are the same but now there is no left turn from the Major Street, this movement being transferred to the other intersection. In the overall, conflicts decrease improving both intersections performance; Movement 7 now has an average delay of 13 s/veh and movement 9 a delay of 20 s/veh.

### *Pedestrian Mobility Proposals*

Having in consideration the specific commercial characteristics of *Campo de Ourique*, it was decided that the best mean in which a mobility plan could help maintain and even increase shopping activity was through the search of potential nearby areas to provide new costumers with significant purchase power for the shops, leading then to the definition of specific streets inside the neighborhood where investment should be done to better guide pedestrians from those areas.

In the West there are no new clients to gain because this is a degraded part of the parish. In south and east there are other residential areas, which have their own local commerce; these

residents already visit *Campo de Ourique* to buy specific things. To the north of the neighborhood, next to the end of the main street, Ferreira Borges, there is a strong business area called *Amoreiras* constituted by tall office buildings that house a large number of the major companies established in Lisbon.

Despite the existence of some shopping centers in *Amoreiras*, *Campo de Ourique* has the opportunity to attract some of the people that come to work every day in this office area because it has a different character appealing to a more traditional way of shopping. This is a logical proximity for most of the residents in *Campo de Ourique*, but it's not so to workers in that business area.

The problem with the connection between both areas is a discouraging urban configuration, with narrow sidewalks and a great flow of vehicles entering the city.

From a close observation of that transition area a good walking passage was identified that allows to avoid those narrow sidewalks, making a much more direct and safe path to the neighborhood (Figure 10).

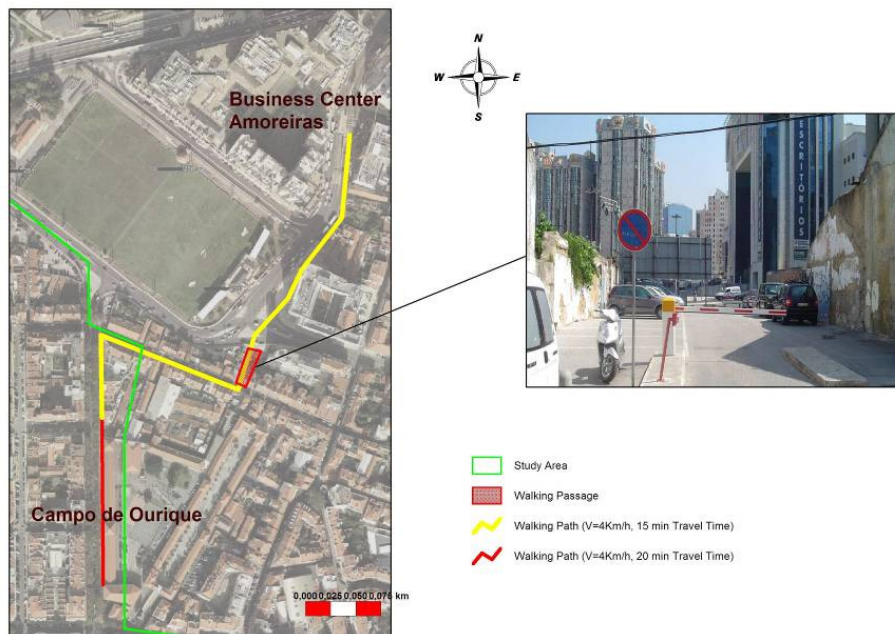


Figure 10. Walking path between Amoreiras and Campo de Ourique

This passage is being used for parking, but with a very low capacity (12-16 parking places). As part of a pedestrian path it can be much more useful for *Campo de Ourique*, building a true entrance to the neighborhood to attract more visitors.

In Figure 10 a path is marked starting in *Amoreiras* and going to *Campo de Ourique*. This line represents the length covered by foot in a time of 15 minutes and 20 minutes (total for both directions) considering a pedestrian speed of 4 Km/h. This interval is considered the maximum time that a person will consider walking in her lunch break (time period for which more workers consider walking around their working area).

Of course these distances are variable, depending much on people walking energy. The objective of Figure 10 is to show that a real continuity can be built between the two areas, attracting more visitors.

It is assumed in this proposal that an intervention will be made also in some of the commercial streets, like benches and flower vases to decorate the sidewalks. Some street signs with the direction of the stores are also desirable, improving pedestrian orientation.

### *Bicycle Proposals*

The initial idea for this set of proposals was to implement a bike path in the neighborhood, but we found that the street dimensions hinder this hypothesis. To build a bike path, parking had to disappear in both sides of some streets, which in the current situation is not possible as we saw before in the parking propositions. The alternative would be to allow bicycle circulation in the sidewalks, but this has a series of inconveniences:

- Sidewalks are typically designed to pedestrian speeds and their ability to avoid obstacles;
- Conflicts between pedestrian and cyclists are common. Pedestrian exiting a shop or just finishing parking their cars;
- Pedestrians many times have difficult to foresee cyclist directions;
- At the intersections motorists aren't expecting cyclists coming from the sidewalk.

A possible approach to the increase of the Bicycle use in *Campo de Ourique* may be the creation of better conditions for bike circulation in the road space. A campaign promoting bicycle use in the neighborhood could be made creating special signalisation in the main entrances alerting the drivers that they are entering a bicycle-friendly neighborhood. A sense of security and protection promoted by the municipal or parish council is significant in determining the bicycle attractiveness as a transport mode (Rietveld and Daniel, 2004).

As many as 80% of motorists involved in car/bicycle or pedestrian/car crashes report they did not see the cyclist or pedestrian. While this lack of cognition may be true in many cases, the motoring public must learn to regularly search for non-motorized traffic. Ultimately, increased bicycle use will increase motorist awareness. In Holland and in U.S. cities where bicycles are common, car/bicycle crashes are decreasing as use of bicycles increases (Florida Department of Transportation, 2000).

## **DISCUSSION OF THE RESULTS**

One may distinguish between two lines of analyses for the results of this investigation. The first concerns the adequacy of the proposed framework to the study of mobility at the



neighborhood scale. The second deals with the question of the added value of these plans for mobility management at a neighborhood scale.

Despite the fact that only one neighborhood is not enough to build solid conclusions about the proposed framework configuration, because neighborhood characteristics may vary a great deal, this ends up not being so problematic as the discussion regarding the extent to which real conclusions can be drawn about the value added by these plans, because not having implemented the proposals hinders the understanding of the whole process of making a real plan. The analysis of the dialog progression between local and city authorities that has to happen in the case of a real plan implementation process is also compromised; we were also not able to define who is to build the plan and how the funds will be allocated for the implementation of the proposals.

Nevertheless some tentative conclusions result from this work and those may constitute a good beginning for the future development of neighborhood mobility plans in Portugal.

The proposed framework seems to be adequate for the objective of analysing mobility in a neighborhood scale, even though, having seen the application of its structure to *Campo de Ourique*, some things have to be said about specific phases of the process.

Although mobility objectives are important for the definition of any mobility plan's strategies, at a neighborhood level these seem to play a much more formal role than one of real influence over the resulting proposals. In this aspect a good articulation between Integrated Transport Themes and Service Delivery Areas gains crucial importance in the proposals configuration.

The relevance of the City Mobility Plan (CMP) in influencing the neighborhood scale is very high. Both as source of information and in shaping the proposals of intervention, the CMP is permanently present throughout the whole process of making the plan, and this should be made very clear in the framework.

The Data Gathering and the Problems and Opportunities identification phases, like it has been said before, are difficult to separate, which is due to the fact that as the study proceeds it's easier to adapt the information gathering to the necessary analysis. In spite of this, the organization of some stable and unquestionable information sets, is absolutely vital to maintain its quality and to allow the comparison between the several neighborhoods of the city.

The use of the same indicators, established in the Problems and Opportunities phase, applied in the definition of specific targets for the Service Delivery Areas/Targets has somehow been reduced in importance by using few performance indicators. This is due to some data that was not obtained in the beginning: for instance, some systematic observation should have been done to the number of pedestrians travelling to shop in the neighborhood; this would allow to setting up specific goals for the pedestrian Service Delivery Area. This being related to commercial activity, an indicator of medium income per visitor at the local shops could also be interesting to establish a specific target for the neighborhood. Some of this limitations occurred because of the scholar nature of the study; not being a municipality initiative it is more difficult to proceed with the totality of the analysis that would be desirable to do.

In terms of the plan's effectiveness in improving mobility in the neighborhood, one is able to advance that, at least, mobility observation at a closer scale produced proposals that had never been considered before by either the parish or the city council. But these proposals vary a great deal in their feasibility level. The fact that they were not presented to the stakeholders, as indicated in the framework, is one more weakening factor for the evaluation of the applicability of this type of plans, although there is only one immediate difficult proposal to obtain people's acceptance which is the payment of parking permits by the residents.

The proposal that seems more promising to be easily accepted and also effective in achieving the desired outcome should be the traffic changes in the analyzed entrance of the neighborhood.

In this perspective the proposals for pedestrian mobility and bicycle use are much less supported by scientific confirmation of their effectiveness. There is no evidence enough that the creation of a better pedestrian entrance is able to increase the number of shoppers in the neighborhood. Even less evident would be the increase in bicycle use resulting from a marketing campaign, as we cannot prove that this type of operation diminishes the risk of accidents between cars and bicycles thus increasing the modal share of this transportation/leisure mode.

In closing, a Mobility Plan on a Local Scale promises finding solutions to local problems/opportunities, the detection of which is much more difficult when analyzing mobility from a city scale perspective. Some of these Problems/Opportunities have a simple and inexpensive solution, demanding only good technical observation of the study area

Ultimately, in order to find better adapted proposals to improve the neighborhood's mobility conditions, this work points to the importance of making Mobility Plans at this scale, guaranteeing that all proposals are supported with technical criteria and updated according to the best practices.

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