
Sustainable Urban Mobility Plan for the City of Braga

Final Proposal

Summary



designing cities,
managing **mobility**

Sustainable Urban Mobility Plan for the City of Braga

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FINAL PROPOSAL

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WRITTEN PARTS

Intervention Strategy and Proposal

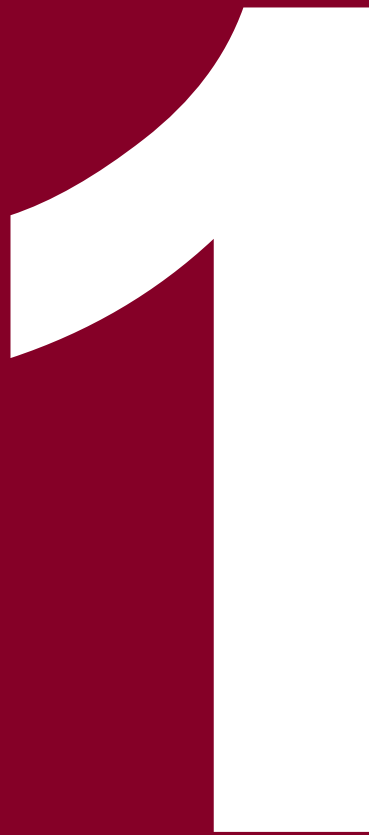
DRAWINGS

- VII.1. The walkable city / The cyclable city (soft modes)
- VII.2. Promoting public transport
- VII.3. Optimizing the road system
- VII.4. The city's structuring network
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What is the SUMP?



In recent decades, there has been a growing change in mobility patterns as a result of the intensification of motorization rates, leading to a progressive deterioration in people's quality of life in the areas with the largest urban agglomerations. The growing need to make the most of time motivates opinion on establishing new mobility criteria and methodologies, reducing the dependence on time and energy associated with travel, introducing sustainable mobility patterns and establishing soft and active modes of travel as a priority.

In addition, it is well known that urban occupancy densities play a decisive role in travel patterns and the need to make journeys. Higher occupancy densities can help make public transport more viable, but they can also encourage shorter journeys, with a clear benefit for the use of soft and active modes.

No less relevant to the mobility choices made by citizens, but also to the policies to be developed by decision-makers, is the fact that the current national and international economic and social situation is leading to new choices in mobility management strategy, promoting "new" forms of mobility, which tend to be more sustainable and fit in with the aims of promoting energy efficiency, humanizing the territory and improving public health. These goals, which are partly present in Portugal 2020, will be reinforced under the current EU support framework, known as Portugal 2030.

Moreover, the Regional Operational Programs also clearly highlight the need to promote mobility planning, making funding in this area conditional only on the measures and actions recommended in these plans and which make it possible to reduce the weight that the transport and mobility sector still has in the context of global greenhouse gas emissions.

In fact, investment priority 4.5 of Portugal 2020, related to sustainable urban mobility, is anchored in a low-carbon strategy, including the promotion of sustainable multimodal urban mobility, focused on measures directed at the mobility system with the aim of reducing greenhouse gas emissions, as well as reducing energy intensity in terms of mobility. The central objective is to increase the use of public transport and soft, pedestrian and cycling modes, particularly for urban trips associated with everyday mobility, a strategy that will continue under the next framework of European structural and investment funds.

The aim is to find sustainable mobility solutions to solve problems related to car traffic, parking and public transport, not ignoring issues related to the promotion of soft modes, namely pedestrian and cycling, which will enable the adoption of more friendly mobility management policies, thus making cities more humanized.

Creating and/or improving pedestrian circulation platforms, defining standard profiles for redesigning priority roads into inclusive, comfortable and safe streets, planning a network of cycle paths by drawing up a network *master plan* that makes it possible to interconnect the existing network, regulating car parking, coordinating public transport, regulating loading and unloading, properly organizing road traffic on a macro scale, are some of the measures resulting from the development of this plan.

The Sustainable Urban Mobility Plan (SUMP) for the City of Braga is a document that is both strategic and guiding, which serves as an instrument for action and awareness-raising, encouraging coordination between the different travel platforms and the different modes of transport, the implementation of an integrated mobility system in a rational manner, with minimal investment and operating costs. It will also make it possible to rationalize the use of individual motorized transport and, at the same time, guarantee adequate mobility for the population, promoting social inclusion, competitiveness and, at its core, the quality of urban life and the preservation of the historical, built and environmental heritage.

In this sense, this plan is defined as a reference tool to support decision-making by the municipality within the scope of its competencies with regard to transport and mobility. As a strategic document, it is not meant to be regulatory, but it does produce guidelines that can be integrated into municipal regulations in the areas of planning and managing mobility, transport and public space.

The Scope of the Sustainable Urban Mobility Plan for the City of Braga and its Terms of Reference



Mobility is an increasingly important issue in the debate on land occupation and transformation, and there is also growing consensus that it plays a decisive role in the effective and efficient performance of the human construction that takes place on this territory. This plan arises from the need to translate a holistic view of mobility into a highly territorialized perspective that is attentive to the social and land use reality of the municipality.

Thus, there is an urgent need to accompany the physical and social transformations of the territory from a strategic perspective and broadened to the new paradigms of sustainable urban mobility. Based on this need, a set of objectives have been defined, namely:

- To achieve and build an integrated and related vision of the territory, in which land use and occupation, ways of life, the human condition, seasonality, transportation and travel modes and resources intersect and interact in a coherent way, allowing a reading of reality that facilitates the ability to propose a way forward;
- Rationalize and make the most of resources and methods already in place, promoting a transversal approach to this issue, whether general and territorial, or specific and sectoral;
- Reading and critically interpreting the reality in place, understanding the territory and designing sets of actions that encourage civic growth and education/awareness-raising among the population;
- Define fields of action that are structured into a coherent and related series of actions that help to mitigate the ecological footprint, improve quality of life, reduce GHG emissions and correct ways and habits that are now accepted as dissonant;
- Incorporate and understand the theme of home-work and home-school, which has been characterized by the use of individual car transport, and enable rational ways to reduce commuting and successive flows of cars that do not favor the sharing of vehicles, financial efforts and the overload of infrastructures installed in the territory;
- Design an urban communication and information plan that goes far beyond directional signage and traffic signs and encompasses alternative and complementary forms of mobility communication. A plan that raises awareness and educates the population, particularly the younger ones, and makes it possible to establish an assertive and coherent medium-term communication framework;
- Promoting interoperability between modes of transport and redesigning the public space with regard to circulation in the name of greater comfort in the use of public space;

- Critically interpreting the economic activity installed in the territory, understanding its needs, links to supranational connections, the need for traffic fluidity, rationalization of logistical activity, so that the abrasive flows of heavy traffic can be rethought and improved;
- Conceive of soft modes of mobility as a multiple and integral expression of urban life, when commuting to work, occasional trips, shopping, leisure, etc;
- Integrate and relate studies, projects and plans already drawn up or underway;
- Focus analytically and prepositively on the transversal themes of mobility, framing the specific reality of each of the modes and how they can complement each other, whether through an integrated ticketing system, the implementation of intermodal platforms, the provision of multimodal parking, and mobility services as a service (MAAS).

In this sense, the Sustainable Urban Mobility Plan for the City of Braga (PMUSCB) is a strategic document that includes a set of operational measures aimed at responding to the main objectives/needs mentioned by Braga City Council in its terms of reference.

According to the specifications, the preparation of the PMUSCB is organized into three phases, as shown in the following figure:

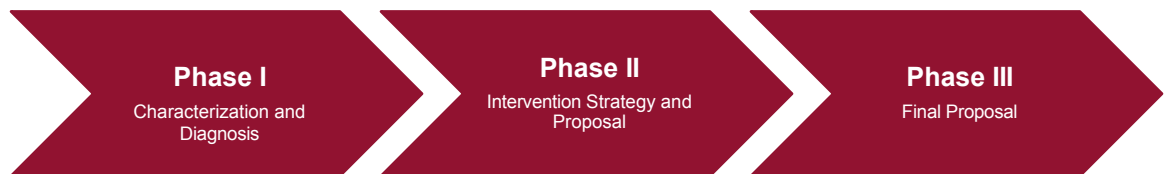


Figure 1 - Phasing scheme and process for drawing up the PMUSCB

- **Phase I - Characterization and Diagnosis:** the main objective was to understand the functioning of the transport system and the mobility model, encompassing all modes of transport and their articulation, reflecting their relationship with land use and considering their impact on the quality of the urban environment.
- **Phase II - Strategy and Intervention Proposal:** the aim is to identify the elements that make it possible to define the future vision in terms of mobility, explaining the specific objectives to be achieved, the strategy and the action and implementation plans. This phase includes the action program and the management process.

- **Phase III - Final Proposal:** This phase includes the integration of the previous phases, with the inclusion of the changes deemed necessary by the municipal deliberations and the opinions of external entities.

Vision, Mission, Strategy and Objectives

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The basic principles of this Sustainable Urban Mobility Plan for the City of Braga (PMUSCB) are the promotion of sustainability, i.e. the balance between the economic, environmental and social vectors, but also the quality of the urban environment and the territorial cohesion of the Municipality of Braga, mobility being one of the factors that most conditions or enhances the quality of life of citizens.

Thus, considering the latest best practices in sustainable urban mobility, the reference documents in this area and the aim of making Braga a benchmark municipality in this area, while also unequivocally subscribing to the balance between the values of economic, environmental and social sustainability, the vision of this plan is to achieve **A CITY AND A MUNICIPALITY TENDENTIALLY "ZERO CARBON"**, whose mission is related to **IMPROVING CITIZENS' QUALITY OF LIFE**.

To fulfill this vision, tangible actions are included, such as those aimed at transport systems and their infrastructures and services, and intangible ones, such as strengthening a mobility culture based on raising awareness and training to change behavior, and a set of strategic, transversal, systemic and specific objectives has been defined.

Therefore, it is considered essential, in the first place, to give priority to the **pedestrian** mode, in order to promote sociability, the local and traditional economy, thus promoting the city and its experience, this being the primary mode of transport for all citizens.

The second priority of mobility policies is to improve **public transport** by improving its territorial and temporal coverage, user convenience and providing more and better information to the public, not forgetting energy efficiency by opting for vehicles with reduced pollutant emissions.

Thirdly, it is essential to highlight **cycling**, as it is a sustainable mode of travel that is more conducive to longer distances than pedestrian travel, especially because of the speed it achieves. The potential for cycling is highest for urban trips of up to 5 or 7 kilometers, and since a high percentage of journeys by individual transport are shorter than this distance, cycling is the most favourable mode of travel.

Equally fundamental is the promotion of integration between the various modes of transport - **intermodality** - in other words, complementarity between different modes through travel chains, whereby citizens use the mode that, considering their specific characteristics, is best suited to each journey.

On the other hand, it is important to **reduce the need to use individual motor vehicles and rationalize their use** by creating conditions for sustainable travel, as mentioned above. At this point, it is also important to consider the management of parking and

logistics operations, which is a highly important tool because it is felt directly and immediately by the car user.

One of the elements that has become extremely important is **the integration of mobility and land use**, since this is the only way to optimize the reduction of travel needs and distances, promoting the use of sustainable modes.

Taking into account the above, as well as the analysis produced in the characterization and diagnosis phase, five strategic objectives, three cross-cutting objectives and one systemic objective and their respective specific objectives were defined, which are systematized below.

Objetivos para a elaboração da Estratégia de Intervenção

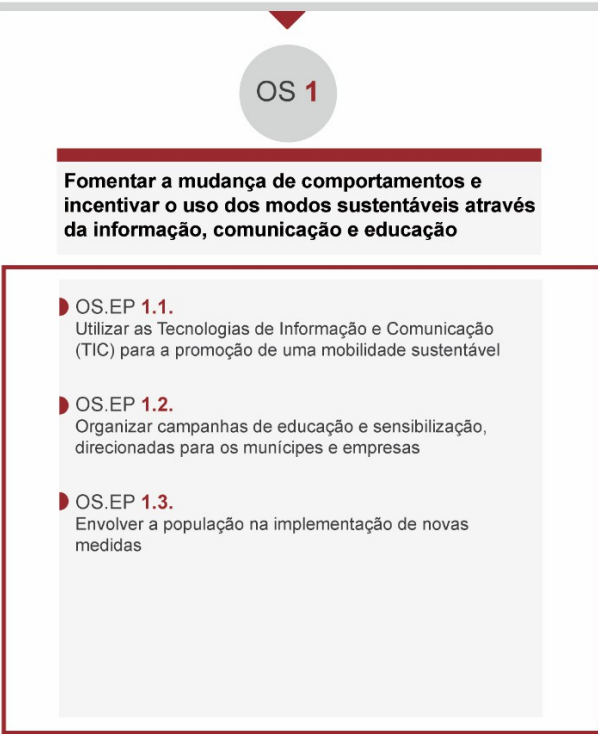
OE. OBJETIVOS ESTRATÉGICOS



OT. OBJETIVOS TRANSVERSAIS



OS. OBJETIVO SISTÉMICO



Action proposals

4

PROPOSALS				
VISION	THEMATIC FRAMEWORK	STRUCTURING LINES	PROPOSALS FOR ACTION	
THE WALKABLE CITY	Pedestrian network	Predominantly pedestrian areas	Revisiting the Historic Center in its many facets and themes	
			Revisiting the urban design of Campo da Vinha and its surroundings	
	Quality of pedestrian circulation	Pedestrian-friendly areas	Revisiting the urban design of Largo da Estação and its surroundings	
			Promote the area of pedestrian circulation	
			Qualifying the design around schools	
			Re-establish neighborhood units - the blocks	
		Attraction measures for walking	Implement mobility and tactical urban planning measures	
			Promote the development of squares into exclusively or partially pedestrianized areas	
			Introduce pedestrian-oriented directional and information signs	
			Disseminate the pedestrian metro-minute map on various media	
		Friendly pedestrian circulation	Promoting accessibility and mobility for All throughout the urban environment - "I'm coming!" project	
			Implementing and disseminating accessible tourism routes in the city of Braga	
PROMOTING PUBLIC TRANSPORT	Infrastructure and rolling stock	Efficiency	Implement dedicated public transport corridors on the most popular routes	
			Define solutions for an own-channel transportation system	
	Service		Gradually replace the public road transport fleet with more sustainable vehicles	
		Benefits	Increase the number of cabs and promote the introduction of more sustainable vehicles	
			Improve the comfort, accessibility and information conditions of bus stops, taking universal accessibility into account	
			Implement real-time information systems at key stops on the public road transport network	
		Efficiency	Optimizing Braga's urban transport network	
			Extending the <i>School/BUS</i> service	
			Implement a flexible transport system	
		Benefits	Improving the frequency of urban transport	
			Create the City Card, extending the advantages and benefits granted to public transport users	
THE CYCLABLE CITY	Cycling network	Urban cycle routes and areas	Implementing the city's cycling network	
			Implement measures to promote cycle-friendly areas and ensure permeability between blocks	
	Cycling systems	Interurban cycle routes	Improve the pedestrian and cycling axis of the East River	
			Implement cycling routes linking the city to its outskirts and areas of economic activity	
			Promote the continuity of inter-municipal cycling routes	
		Implement a system of public bicycles and other shared soft modes	Selecting, sizing and implementing public bicycle parking stations	
			Select the right type of public bicycle	
			Define the technological systems for the management, information, payment and operation of public bicycles	
			Implement a control and service center for public bicycle users	
			Implement a public bicycle maintenance and redistribution center	
		Attraction measures for cycling	Provide for the shared electric scooter system and its regulation	
OPTIMIZING THE ROAD SYSTEM	Road network	Road structure	Implement a new road hierarchy	
			Building bypasses and new structural accesses to upgrade urban centers	
	Parking	Qualification and safety	Increasing traffic flow at the Infias junction	
			Completing Braga's urban structuring road network	
			Reversing urban fractures - Avenida Padre Júlio Fragata - Avenida Frei Bartolomeu dos Mártires - Avenida Dr. Francisco Salgado Zenha - Avenida Miguel Torga axis	
			Reversing urban fractures - Avenida Imaculada Conceição - Avenida João XXI - Avenida João Paulo II axis	
			Reversing urban fractures - Rua de Caires axis	
			Reversing urban fractures - Avenida António Macedo axis	
			Apply traffic calming measures	
			Revisiting the regulation of the Historic Center's Conditional Access Zone	
		Rational use of cars	Regulating tourist transport in Braga city center	
			Implementing real-time information systems	
THE INTEGRATION OF MODES	Intermodality	Infrastructure	Promote and publicize the <i>car pooling</i> system	
			Evaluate the possibility of creating a <i>car sharing</i> and/or <i>scooter sharing</i> system	
	Operability		Increasing the number of electric charging stations	
			Revisiting the policy of charging for parking on public roads	
			Define a coherent pricing policy for the city's parking spaces	
			Reinforce measures to combat illegal parking	
			Implement deterrent parking at the main entrances to the city	
			Reinforcing the role of parking lots in deterring parking on public roads	
		Regulations	Regulating loading and unloading operations and the circulation of heavy vehicles	
		Logistics operations	Revisiting the distribution of loading and unloading bays	
			Promote the use of less polluting vehicles for the distribution of goods	
			Create a platform and micro logistics system for the Historic Center's Conditional Access Zone	
THE DYNAMICS OF MOBILITY PLANNING	Mobility planning	Plans	Establishing the Braga Intermodal Platform	
			Upgrading Braga's Central Bus Station	
	Awareness-raising and culture of mobility	Studies	Creating an interface at the University of Minho	
			Creating a high-speed rail network interface	
			Create the mobility center and other intermodal information points in the city of Braga	
			Implement a multimodal integrated ticketing system	
			Create an <i>app</i> and <i>website</i> to disseminate information on modes of transport	
			Promote the integration of bicycles into public transport	
			Develop an Accessibility Promotion Plan for people with reduced mobility	
			Draw up a Municipal Road Safety Plan	
			Integrating proximity urbanism into territorial planning instruments	
			Carry out a detailed study of circulation, signage and parking for the city	
INTRODUCING A NEW CULTURE OF MOBILITY	Awareness-raising and culture of mobility	Developing civic awareness for sustainable mobility	Develop awareness and education actions	
			Develop training actions	

In order to improve the quality of life of the population of the city of Braga, there is an urgent need to implement changes in urban organization and management and thus open up new ways of planning sustainable urban mobility.

The city of Braga has intrinsic characteristics that have determined its human settlement, the development and distribution of its vital functions and, consequently, its current urban design. Its compact nature is an advantage when it comes to defining a sustainable urban mobility model that promotes the transfer to more efficient and sustainable modes of transport, the humanization of public space and the improvement of quality of life.

Braga's public space has seen the prioritization of the car in recent decades, whether for short or long journeys, and its consequent problems, such as high levels of air pollution, traffic noise, road accidents or motorization rates.

In this way, the strategy defined for a more sustainable, equitable and healthy city involves the articulation between mobility and public space, through the promotion of pedestrian accessibility throughout the urban environment, the suitability of routes or areas for cycling, the use of different modes of transport in increasingly long and complex movements and also the city's ability to provide good conditions to become more comfortable and greener, not only for those who live, but also for those who work or visit Braga.

As far as the city of Braga is concerned, the "foundation of the Roman city of Bracara Augusta was part of the political and administrative organization of Hispania, which followed the end of the Cantabrian wars, constituting one of the three urban centers created by Augustus in the Northwest Peninsula" (Martins et al., 2013, p.19), making it an important administrative and commercial center of the Roman Empire.

The Roman era was marked by the construction of the Bracara Augusta urban center as a planned and regular urban space. From this urban center there are 5 connecting routes - route XVI connecting to Olisipo (Lisbon), routes XVII and XVIII connecting to Asturica Augusta (Astorga, Spain) via Aquae Flaviae (Chaves) and the Serra do Gerês, respectively, route XIX connecting to Lucus Augusti (Lugo, Spain) and later to Asturica Augusta, and also route XX per loca marítima to Asturica Augusta (Ribeiro, 2009/2010).

The development of its current urban structure is associated with the implementation of the medieval nucleus that was built, in part, on the Roman grid, and which projects within the built medieval wall. This nucleus has the Cathedral as its key building, projecting streets such as Rua Principal, Rua dos Judeus and Rua dos Sapateiros. By reusing the road axes of Roman times, the medieval city is marked by winding roads and more irregular blocks, making the road structure not very hierarchical and with narrow streets. Thus, the wall came to define Braga's medieval urban form, and its core is still recognizable today.

Outside the walls, the same Roman axes fostered occupation outside the walls, growing into the suburban space through the urbanization of roads until the modern age, and thus the development of nuclei that gave rise to areas of future expansion such as São Vítor, São Vicente and Maximinos began (Ribeiro, 2009/2010).

As a result of the city's expansion until the end of the 19th century, the consolidated traditional city developed, taking on an identity structure of the city and presenting a physical and functional centrality. Based on Renaissance principles and influenced by Archbishop D. Diogo de Sousa, the urban form of the traditional consolidated city presents a different design and relationship between buildings and public space, with a less dense and less marked structure, presenting more wide and green spaces associated with the monumental and religious nature (Oliveira et al., 1982).

These urban forms, the medieval core and the consolidated traditional city, largely constitute the delimitation of Braga's Historic Center, which needs to be revisited from various points of view, facets and themes. Considering the reduction in car use within the historic center, the aim is to promote greater pedestrianization of this area, which should be achieved by enhancing and expanding the predominantly pedestrian and/or urban coexistence area, in two ways: regulatory and urban design.

With the expansion of the current predominantly pedestrian and/or urban coexistence area, it is intended that the entire medieval core, of high historical and heritage interest, will be largely integrated into the pedestrian access zone. At the same time, it is essential to review the policy of access to the predominantly pedestrian area by motorized vehicles, redefining car access with the safeguarding of commercial and logistics operations or access by residents.

On the other hand, in terms of urban design, it is essential to act at the level of public space so that the spaces to be conquered by the automobile are removed from the road character still present in many places, but also endowed with characteristics of universal access for all citizens to this unique territory.

Also with regard to this enlarged historic center, in order to create an area for enhancing pedestrian circulation, it is considered essential to improve axes that are important for connecting to the historic center, both because of their functional nature, such as the axis connecting the Railway Station, the Central Bus Station and the Municipal Market, and because of their historical and heritage nature, such as the axes connecting the points of interest on the Roman route.

In addition to the existing requalification of part of these axes, the creation of a zone 30 around the predominantly pedestrian area, in which the maximum speed allowed will be 30km/h, will provide better conditions for pedestrian circulation in this identity structure of the city, which has a physical and functional centrality.

In this predominantly pedestrian area, in association with the functional axes connecting to mobility points, it is important to revisit the urban design of Campo da Vinha and Largo da Estação,

in order to promote their dignification and also the historical continuity with the adjacent reality, increasing the pedestrian access conditions of these spaces and the humanization of the public space.

The Roman axes that fostered the growth of suburban space through the urbanization of roads until the modern age, led to what we can characterize as a radiocentric plan established with the peripheral growth and urbanization of the roads bordering the urban center until the 20th century.

The urban expansion of the 20th century ended up being based on the west-east transit axis - the highway - which determined the effective expansion of the land on the bank of the River Este and promoted the creation of new centers that generated commuting in the municipality, such as important facilities and areas of economic activity, but also allowing for a change in the urban elements.

With the democratization of the automobile, the main roads have allowed the urban fabric of the city of Braga to densify and consolidate, but on the other hand, given their importance for automobile circulation, they have defined the way in which access to the city center and the distribution of flows are processed, giving rise to urban fractures between the various units of the territory.

Thus, the main accesses that have been created make it possible to define an urban structuring road network, becoming the city's main channels for automobile circulation. It is necessary to free the roads inside the blocks from excessive automobile circulation for new uses, re-establishing neighborhood units, redistributing public space, making it more friendly to vulnerable users, increasing the possibilities for socialization and humanization.

In the interior spaces of these blocks, it is proposed to create traffic-calmed areas, essentially made up of zones 30 or coexistence zones, either in the context of residential spaces or in the context of multifunctional spaces such as those surrounding school facilities, extending the concept of the "(Con)Viver no Bairro" project to other blocks. These spaces will be humanized, friendly spaces for soft and active modes of travel, in a safe, comfortable and pleasant way, reducing greenhouse gas and noise pollution levels by managing road traffic and parking.

Given the multiplicity of existing functions and their pedestrian flows, in areas such as the Gulbenkian block, the André Soares School block and the remaining area of the Europa Tower block, similar measures are already planned, which in the future should take place in the central blocks of the city of Braga - São Lázaro, Fujacal, D. Maria II School, Carlos Amarante School, Court, Braga Tennis Club.

The issue of accessibility and mobility for All is intrinsically related to the requalification and humanization of public space, and requires an assertive transformation of pedestrian channels in order to benefit soft modes and, consequently, promote their use for Everyone's daily journeys, to the detriment of the car.

With the aim of eliminating architectural barriers to ensure a freer and more comfortable pedestrian space, with optimum conditions for pedestrian mobility that correspond to the essential precepts of inclusive mobility, the "Eu Já Passo Aqui!" project was created.

In all the main measures to be taken into account to promote a more walkable city, guaranteeing the safety of pedestrian movements is essential, since pedestrians are the most vulnerable users of public roads.

Its compact nature, with distances that are reflected in relatively short travel times and which encourage the use of soft modes, along with the existing slope, which is compatible with cycling, are indicators that make it feasible to implement measures to change residents' travel habits and encourage cycling throughout the city.

Taking into account the existing cycling network projects, within the scope of the Municipal Master Plan and the Sustainable Urban Mobility Action Plan, the strategy defined for cycling routes in the city of Braga is based on its closed urban forms that create neighborhood units, making it possible to define these units as cycling-friendly areas and to define cycling channels in what is the urban structuring network that delimits these units.

Thus, the physical definition of cycle routes should, whenever possible, make use of circulation channels dedicated exclusively to cycling, considering the main axes of the urban fabric surrounding the neighborhood units, and within these blocks, channels can be defined that are shared with the car or axes with filtered permeability.

The definition of permeable routes will favor the cycling city over the car city, namely by allowing cycling on one-way streets, in the opposite direction to car traffic, the use of interior spaces of buildings and gardens to create shorter routes and also by adopting a more sensible cycle path profile that is comfortable and safe for cyclists and other users of the public space.

In order to adopt a more cycle-friendly city, the municipality of Braga has set up a series of immediate measures dedicated to promoting safer routes, defining routes with a maximum permitted speed of 30km/h, in a strategy to connect schools to each other, to the city center, to existing cycle routes and to some major and intermodal facilities.

Braga City Council has defined as relevant interventions to be carried out in the short term the requalification of the Encosta - Lamações bypass and its extension to effectively connect it to the University of Minho, but also to adjacent structuring roads such as Avenida António Palha and Avenida Robert Smith, providing a logical expansion of the network.

At the same time, work is planned on essential routes, such as Avenida 31 de Janeiro, which is essential for the north-south connection of the network and the various crossroads linking to schools, facilities and the historic center, as well as the existing Rio Este cycle path.

As far as the cycling strategy is concerned, it is important to ensure that the Ecovia do Rio Este is a real alternative for a more sustainable modal shift, reducing the existing "modal conflict" between pedestrians and cyclists by creating two segregated channels. The provision of a dedicated channel for cycling on this axis will allow it to be presented as a structuring axis for the west-east connection in the city of Braga, in addition to its recreational aspect.

In order to benefit the attractiveness and attraction of new cyclists, the implementation of a public bicycle system is considered relevant, as it will increase the percentage of cyclists using bicycles as a means of transport for commuting.

The pilot phase of the system could focus on the area surrounding the historic area of the city of Braga, covering the area to the north of the Rodovia axis and to the west of Avenida Padre Júlio Fragata, since, in addition to concentrating the largest number of facilities and services that generate travel and presenting a relatively comfortable terrain for the diffusion of cycling, the urban fractures created by the road infrastructure do not yet allow for safe and friendly circulation.

Considering the aim of reducing the use of individual motorized transport in urban commuting, it is essential to associate soft modes with a public transport network that enables the integration of more sustainable modes of transport, offering good accessibility throughout the city.

One of the main challenges in managing the public transport network in the municipality of Braga is to increase commercial speed, increasing its attractiveness compared to individual transport. One of the most common solutions is the integration of exclusive lanes for public transport, with the aim of promoting a fast, efficient, comfortable and affordable service.

It is therefore planned to provide the city of Braga with a set of corridors dedicated to public transport on the city's roads where there is the greatest demand for the service, whether they are bus corridors or high-capacity corridors.

As a solution to improve the sustainability of the transport system and the link with other modes of travel, particularly soft modes, high-capacity own-channel transport systems have emerged as a reliable alternative for connecting the different points of the city along the most popular roads, since the various constraints on road traffic affect not only the use of individual transport, but also collective road transport.

In addition to a transport system on its own channel in the city, it is considered that, given the existing flows between the municipality of Braga and the municipality of Guimarães, the implementation of a system along the same lines at inter-city level would be advantageous, since despite their proximity and interdependence, their rail connection requires transfers and a minimum journey time of more than an hour, increasing dependence on the private car.

With regard to transport, Law no. 52/2015 of June 9, which approved the Legal Framework for the Public Passenger Transport Service, encouraged public entities to change their approach to public transport, increasing their control over the public passenger transport service made available to the population.

The assumption of competencies by Braga City Council in relation to municipal public passenger transport services was seen as fundamental to the pursuit of the municipal public interest, and it must be coordinated with the Cávado CIM, the competent transport authority in relation to inter-municipal public passenger transport services, thus becoming the Municipal Transport Authority.

The municipality has taken on as one of its most important duties the reassessment of the public transport offer and, consequently, its response to the population's mobility needs, taking into account the minimum levels of service regulated by the Legal Framework. At the same time, the Municipal Transport Authority aims to achieve efficiency in the provision of transport, both for the entities involved, by minimizing costs and ensuring their financial balance, and for users, by redefining and evaluating fares.

In this sense, as an opportunity that arises in connection with the challenges posed by the Legal Regime, it should be noted that the Urban Quadrilateral is in the process of drawing up the "Integrated Ticketing" project for implementation in the territory of the Urban Quadrilateral.

In this way, the Braga Municipal Transport Authority is able to outline proposals for improving mobility, redesigning the network with the possible inclusion of other complementary modes such as flexible transport services, cabs or school transport, as well as optimizing the fare system and system costs, which are essential for defining the transport service's financing model.

The strategy defined by the municipality is based on a coherent and integral vision that translates into the implementation of sustainable urban mobility that is universally accessible and supportive, using a systemic and qualitative change in the modal split, favoring the use of public transport.

With a road network that criss-crosses the city, creating urban fractures and presenting several points of conflict between modes of transport, the definition of a road hierarchy and a structuring network for the city makes it possible to define the axes where car traffic can have a greater influence and thus also define the axes where car traffic should not be promoted, but rather the circulation of soft modes.

In addition, in order to reduce car traffic on existing roads within the urban perimeter and redirect traffic to roads with a higher road hierarchy, it is necessary to build bypasses and new structuring accesses to upgrade urban centers, in order to benefit the "street" function on roads that currently have a "road" function in areas of urban density, safeguarding the experience of central areas.

Changing the profile of axes such as the Braga ring road, completing the Cávado bypass, working on the Infias junction and improving the intersection of the Fojo bypass and the Encosta bypass are examples of interventions that would change the function of these roads and reduce the amount of through traffic in Braga's urban core, increasing the quality of the urban environment and making them more suitable for prioritizing more sustainable modes of transport.

In terms of the local road network, the current road circulation schemes that allow through traffic in neighborhood units should also be avoided, so that these predominantly residential or multifunctional spaces, which include structuring equipment such as educational and teaching establishments, can see the speeds and circulation of motor vehicles reduced, making them friendly areas for soft modes.

The parking system should not be seen as an infrastructure independent of a territory's transport network, since increasing the number of spaces to meet demand leads to an exponential increase in road traffic to levels that are unaffordable for the environmental capacity of urban areas and their infrastructures, with irremediable damage to the quality of life of their citizens, aggravating the already complex problems of mobility management.

Therefore, given the existing parking supply in the city of Braga, the introduction of a coherent and competitive parking policy, with tariffs and a deterrent parking offer at the main entrances to the city, is an important tool to dissuade motor vehicles from entering the city center.

In the process of modal shift and the increase in public transport users, transport interfaces have become increasingly important in the urban fabric of cities, boosted not only by the interconnection between the different modes of transport, but also by the other aspects and functions they perform in the city.

Thus, in order to maximize the potential use of the transport system in the municipality of Braga, we identified the need to create a new intermodal platform around the Railway Station, and also to upgrade the Central Bus Station, allowing for greater diversification of services and structuring of the different modes of transport.

All these measures, when combined with a strong policy of introducing a new culture of mobility in society, will make it possible to retain, to a certain extent, the circulation and crossing of cars in the city, which, in addition to and in conjunction with a public transport network, improved in terms of frequencies, fares and integrated ticketing, new or upgraded interfaces

with a shared public bicycle system, will make it possible to reduce the pressure still exerted by the car in the city, gradually changing the current modal split.

Mobility is an unavoidable topic in the debate on land occupation and transformation, and there is also increasing consensus that it plays a decisive role in the effective and efficient performance of the human construction that is taking place on this territory. It is, in fact, a structuring factor for economic activity, fundamental for the comfort and daily life of the population and is transversal to all urban planning, requiring a global and integrated vision of the territory in order for it to be understood and enhanced.

For all these reasons, considering the aim of building and achieving an integrated and related vision of the territory, where land occupation and use, ways of life, urban condition, transportation and travel modes and resources intersect and interact in a clear and coherent reading of reality and the ability to propose a path to follow, a set of actions was defined, adjusted to the specificities of Braga's urban space.

Although the proposals were drawn up for the city of Braga, they could not fail to incorporate European and international trends in sustainable urban mobility, which have changed and evolved at a dizzying pace, in a clear sign of the combination of a territory-history with the modernity that the issue in question requires today.

The proposals summarized above in the table, despite being presented in a sectoral manner considering the main mobility issues, have a relationship and articulation that is clear in the sectoral and summary plans attached to the full document, due to the greater ease with which the spatialization of the various elements makes it possible to read them quickly. Some of these proposals, although presented sector by sector, are to be applied simultaneously as they constitute the content of a joint intervention program for certain areas or for the city.

Thus, through flexible and transversal actions, it will be possible to reappropriate public space, enhancing existing urban space and its recovery, restructuring the functions of the city and its blocks, as well as the uses of public spaces and streets, through a sustainable and efficient urban mobility system.

The following proposals are therefore divided into major themes - the walkable city, the promotion of public transport, the cyclable city, the optimization of the road system, the balance of urban logistics actions, the dynamics of mobility planning and the introduction of a new mobility culture.



4.1. THE WALKABLE CITY

Walking is a fundamental element in the mobility chain and in the daily activities of the population, and its importance cannot be overlooked or underestimated in the overall framework of interconnection between the different modes of travel. In fact, its importance in mobility dynamics is easily and intuitively recognizable, since almost all journeys, regardless of motivation and the associated origin-destination pair, include a pedestrian route, either simply or in combination with other modes of travel.

Thus, the strategy to promote and enhance the decarbonization of mobility, based on the humanization of public space and improving the quality of life of those who live in and visit the city of Braga, advocates a qualitative increase in pedestrian circulation. This goal can be achieved by reinforcing measures that promote the attractiveness of walking in public spaces, prioritizing the principles of friendly pedestrian circulation, universal accessibility, and also safety in pedestrian circulation throughout the urban environment.

In the urban fabric of the city of Braga, there is an unequivocal prioritization of the automobile in mobility policies and strategies and in the way of "making a city", based on the conventional model, and this vicissitude is visible in the oversizing of the automobile channel and in the space allocated to parking, to the detriment of the pedestrian component. In this way, it is essential to make an unequivocal commitment to formalizing comprehensive and humanized spaces, in which pedestrian circulation is the first hierarchical level in the multimodal chain, prioritizing it over other road users.

As the nerve center of the city of Braga, where various urban functions and experiences take place, the Historic Centre is an anchor area for promoting pedestrian mobility and humanizing public space. The narrow profile of most of the streets that make up the Historic Center makes it difficult to implement pedestrian circulation channels, with dimensions adjusted to the benefit of universal accessibility. As such, pedestrian channels are often inadequate in size, and this is exacerbated by the use of uncomfortable and irregular materials.

Despite the municipality's concern to preserve its historical and architectural heritage by defining a predominantly pedestrian area in its medieval core, this noble and multifunctional space still has an urban design that sometimes compromises the continuity of pedestrian flows with their interruption by streets with car traffic or some obstacles.

Thus, the proposal for the historic center in its multiple facets involves expanding the predominantly pedestrian and/or urban coexistence area, covering the following blocks:

- the block bounded by Largo de São Paulo Orósio, Rua Dom Frei Caetano Brandão, Rua Dom Afonso Henriques, Rua do Anjo, Largo de Santiago and Rua do Alcaide;
- the block bounded by Rua da Misericórdia, Praça do Município, Rua de Santo António, Praça Conde de Agrolongo and Rua Dom Frei Caetano Brandão;
- the block bounded by Rua dos Biscainhos, Rua Dom Frei Caetano Brandão, Rua de Santiago, Rua do Matadouro, Campo das Carvalheiras and Avenida São Miguel O Anjo.

Cycling should be allowed on the axes to be pedestrianized between these blocks, without restricting the pedestrian mode, in order to promote its competitiveness in relation to individual motorized transport, defining designated spaces so as not to create any kind of conflict between pedestrians and bicycles. Likewise, it is necessary to intervene in the area that has already been defined in order to mitigate the problems that exist on the pedestrian routes - the state of the ground, abusive parking or the circulation of the tourist train and *Yellow Bus* - but it is also important to revisit the regulation of the Car Access Zone in order to improve the compatibility of its regulations with the current objectives for the area.

Located in the historic center and on the edge of what is defined as a predominantly pedestrian area, the aim is to make Praça Conde de Agrolongo, known as Campo da Vinha, noble by re-establishing its social and recreational functions, paying attention to its symbolism and historicity, but also taking into account its ecological, political and commercial functions. In order to give this space back its prominence, pedestrian circulation should be encouraged, with a reduction in the presence of cars in the surrounding area, making it necessary to redefine the directions of circulation, giving priority to public road transport and cycling, gaining competitiveness over individual transport in the connection to the center.

In the redevelopment of Campo da Vinha, it is essential to eliminate architectural barriers such as the various unevennesses and stair connections, the existing obstacles on the pedestrian path, such as flower boxes and others, making it accessible to All and allowing use by All with more inclusive urban furniture. In addition, in order to eliminate any type of abusive and prolonged parking, it is necessary to reorganize access and, consequently, loading and unloading logistics operations.

Regarding the Braga Railway Station interface as a place, despite the latent potential for urban living, permanence and enjoyment of public space, Largo da Estação and its surroundings present problems that do not allow its full enjoyment, related, roughly speaking, to the accentuated provision of public space directed to the car, which results in the discontinuity and disqualification of existing pedestrian routes.

In this sense, the aim is to promote the development of the area around the railway station into an area of privilege for pedestrian and cycling mobility, minimizing the interference of road traffic and maximizing the humanization of the public space. Braga railway station should become a transport interface capable of making the modal shift between public transport and soft modes of travel, in order to increase the sustainability of the local mobility system.

In order to increase the space dedicated to pedestrians, urban design should be reformulated, the road capacity of the surrounding axes reduced and traffic calming measures introduced. Other measures should also be taken into consideration, such as the implementation of street furniture that meets the needs of the population and the incorporation of vegetation to help mitigate temperatures. Similarly, public transport should be combined with cycling, expanding the possibilities for private bicycle parking and making public bicycles or other micro-mobility available.

In the surroundings of the medieval core, it is possible to observe a series of routes which, due to their functional and heritage nature, are important pedestrian flow axes that should present optimal conditions for pedestrian circulation and humanization of the public space, through the definition of comfortable and accessible routes, limiting the space of the car only to what is strictly necessary.

In order to reduce the pressure of car traffic in this area, in the ring around the predominantly pedestrian area, it is planned to create a zone 30 and some axes, in which the maximum speed allowed will be 30km/h, which will allow the promotion of pedestrian circulation, making it possible to obtain a cohesive and continuous network of pedestrian enhancement.

But it is also important to formalize comprehensive and humanized spaces in the discontinuous urban fabric outside the historic center, the result of fragmented urban growth that fosters poor connectivity between neighbourhoods and between sectors of the city. In order to re-establish cohesion and bring the fragmented city closer together in blocks that are often closed in on themselves, it is necessary, on the one hand, to make the connection between the various urban forms possible through more sustainable modes of travel, and on the other, to give each neighborhood unit some autonomy, in order to reduce the number of journeys by individual transport, introducing functions that allow them to meet basic daily needs.

Therefore, in order to safeguard the urban experience of these residential areas, the definition of zones 30 or coexistence zones is established as one of the measures to boost dynamics within the blocks, and should be accompanied by a review of current urban planning, maximizing land use through multifunctionality. In this way, the spaces are given various functions with the main aim of reducing dependence on the consolidated city or other economic areas that encourage the use of individual transport.

Taking into account the morphology and urban dynamics that exist or are to be developed in the blocks, it is important to ensure that they are equipped with a good pedestrian circulation network that ensures the main connections between the centers that generate trips and residential areas, guaranteeing the principles of connectivity and suitability, universal accessibility, road safety, personal safety, legibility, comfort and attractiveness. When road profiles do not allow for the definition of a comfortable and safe pedestrian circulation channel, taking into account the necessary and regulatory dimensions, coexistence zones should be established.

Thus, in these areas, delimited by structural roads, it is also important to promote the elimination of through traffic, so that pedestrian circulation is promoted in accordance with the functionalities of the roads and not just a reduction in the speed of cars and the volume of traffic.

Although the priorities for intervention and investment are initially focused on eliminating urban and architectural barriers in the different pilot zones, there are interventions that could be developed in subsequent phases, in the medium and long term, by locating spaces with potential reconversion of uses - new squares, recreational areas or green zones - new parking management and revision of road traffic directions, among others.

In this sense, the concept established by the (Com)Viver no Bairro" project should be expanded, where the implementation of proposals and interventions planned for the Montélios area, the Makro area, the area around the Europa Tower and the Quinta da Fonte area will result in these neighborhoods becoming more suitable for pedestrian mobility and the active use of bicycles, as alternative modes of travel, through restrictions on car traffic speeds and the redefinition of an urban design that favors soft modes and reduces the prominence of cars in public spaces.

In addition, given the particular sensitivity of the areas surrounding educational establishments and sports facilities, both due to the regularity and volume of the associated flows and the age group associated with the respective journeys, it is imperative to define a differentiated action for the purposes of mobility management in their surroundings. In this way, the aim is to urbanize the surroundings of these commuting hubs, with these areas becoming top priority places for urban (re)design geared towards pedestrian and cycling mobility and the humanization of public space, with a view to promoting the safety of the school, academic and sports community.

Similarly, the strategy for reversing the culture of car use and promoting more sustainable mobility habits in the younger generations should include the development of the "school route" concept. By defining safe routes, accompanied by training and awareness campaigns, the aim is to promote reflection and change in mobility patterns, reducing the use of the car as a mode of transport for commuting to and from school. Given the specific nature of the action, the aim is to involve the whole school community.

community, from parents to shopkeepers, in order to promote a safe environment that encourages children to walk to schools and sports facilities.

Closely associated with revisiting the historic center is the need to humanize its squares which, with the presence of a large number of establishments - cafés, bars, restaurants and other businesses - attract a large number of people and, consequently, enhance the experience of this public space, both day and night.

In order to increase the space dedicated to pedestrians and the possibility of creating new dynamics, the elimination of parking in these places should be achieved not only through signage, but also by reformulating the urban design. In order to unify the spaces and eliminate the barrier effect, the reconfiguration of traffic directions or the elimination of part of them should also be considered. In this way, the interference of motorized vehicles will be reduced and the quality of the public space will increase. The humanization of these public spaces should also take into account the implementation of urban furniture suited to the needs of the population and the incorporation of vegetation that allows temperatures to be tempered, in order to make them spaces to stay and spaces to walk.

Following on from the creation of a coherent and continuous pedestrian network, the issue of accessibility is intrinsically related to the requalification of public space, particularly in the channels intended for pedestrian circulation - sidewalks and footpaths - and an assertive transformation of these channels is of the utmost importance in order to benefit soft modes in the city of Braga and, consequently, promote their use for everyone's daily commute. Therefore, in order to promote sustainable urban mobility, namely by increasing pedestrian travel, it is essential to guarantee universal accessibility, not only in terms of public space but also in terms of buildings.

As far as public space is concerned, existing pedestrian routes must be free of urban and architectural barriers or furniture, allowing the creation of an accessible route, street furniture must be *designed* to be placed in an "infrastructure channel" complementary to the accessible corridor, promoting the continuity of pedestrian routes. Whenever possible, it is recommended that higher values be used, so that the two channels can be created in a comfortable way that can adapt to new realities and the demands of urban design.

In the interconnections between the pedestrian routes that make up the network, an effective relationship between sidewalks and crosswalks should be envisaged, with raised crosswalks or sidewalks with lowered kerbs in the crossing areas along the entire length of the crosswalk, but also the implementation of tactile directional and hazard paving, warning pedestrians of the proximity and cross-sectional dimension of the crossing.

In response to the need to provide Braga with optimum conditions for pedestrian mobility that correspond to the essential precepts of inclusive mobility, the "Eu Já Passo Aqui!" project was created. To

In addition to eliminating architectural barriers to ensure a freer, more comfortable and inclusive pedestrian space, this project aims to implement other measures such as humanizing public space, traffic calming measures, reducing the space dedicated to cars, prioritizing public transport and providing good conditions for cycling. In this way, since this is a long-term task, Braga City Council should, after implementing the current program, define other priority connection axes, thus promoting accessibility and universal mobility throughout the urban environment.

In this context, it is important to implement and disseminate accessible tourism routes, defined with the aim of providing the public space with conditions that encourage fully inclusive travel to the main tourist attractions in the city of Braga. Universal accessibility and mobility extends to all activities that can cause people to move around the space, i.e. for all daily activities, but also for leisure, tourist or recreational activities. The project, made up of the Roman, Medieval and Baroque itineraries, aims to ensure that, even when it comes to tourism, barriers that make it difficult or impossible for some citizens to enjoy certain points of interest do not exist or are minimized.

Also considering the major infrastructures as a barrier to soft mode flows, there are several obstacles created for pedestrians by car traffic routes and also by the railway, with several level changes with underpasses and pedestrian bridges that need to be eliminated or improved.

Therefore, in order to promote friendly pedestrian circulation in the city of Braga, if it is possible to create continuous, comfortable and safe solutions, pedestrian routes should be promoted at the same level. However, if this is not possible, it is essential to upgrade and improve pedestrian connections, both underground and overhead, through upgrading actions for greater comfort and to bring them into line with current legislation and technical standards for universal accessibility and mobility. Likewise, it is also necessary to promote comfortable and direct pedestrian routes to these types of passages, so that there is a natural propensity to use these passages instead of informal and unsafe routes on car or even rail traffic routes.

Still in the context of "territorial fractioning", it is possible to observe a number of informal pedestrian routes, in situations of connection between the various neighborhoods, lawns around residential blocks, traffic islands or separators and other situations, which allow us to see that the continuous passage means that there is a defined pattern on the floor. Desirable pedestrian routes reveal the real needs of pedestrians and the weaknesses of the pedestrian network, making it essential to consider and improve them in the pedestrian strategy.

Thus, the improvement of desirable pedestrian routes should take place in two ways: the formalization of informal routes already defined by the continuous passage, in order to make them more comfortable for people.

use, but also the future consideration of routes of desire for the design of spaces that are between natural destinations in a given area.

The quality of a place, particularly for walking, is to a large extent linked to climatic characteristics, and meticulous assessment and detailing is required that takes into account the region's climate, guaranteeing positive climatic factors for those who walk. In this context, it is proposed that the pedestrian infrastructure be accompanied by the implementation of green corridors that promote the thermal and environmental comfort of these routes.

In addition to the necessary reinforcement of green elements throughout the urban fabric, the structuring of a network of high-capacity green corridors should take place on axes with a generous profile and should take into account the inclusion of the ecological corridor of the East River, given its relevant characteristics in terms of biophysical integration and landscape setting, as well as accessibility, as it is an axis of excellence that allows the west-east connection of the city, connecting urban areas of great functional importance.

Developing and linking urban ecological corridors to the city's pedestrian circulation network is therefore a fundamental measure to boost pedestrian movements in urban areas. However, it is important to consider the complexity of this implementation so as not to compromise the space intended for pedestrian circulation, paying attention to the correct dimensioning of sidewalks and other pedestrian areas, the creation of meeting points in the streets and the possibility of afforesting squares and plazas, placing the vegetation in its own infrastructure channel and ensuring its maintenance.

In pursuit of the goal of promoting a walkable city, other actions are needed to increase the quality of pedestrian circulation in the urban environment, such as the introduction of pedestrian safety measures, the upgrading and maintenance of canal spaces, the construction of sidewalks in linear settlement areas, the implementation of tactical urban planning measures, the provision of directional signs and information and urban furniture for pedestrians to rest and stay, or the dissemination of a pedestrian metro-minute map on various media. In this way, it will be possible to promote a universal and continuous infrastructure that enhances the different dynamics of pedestrian movement and also the humanization of public space.

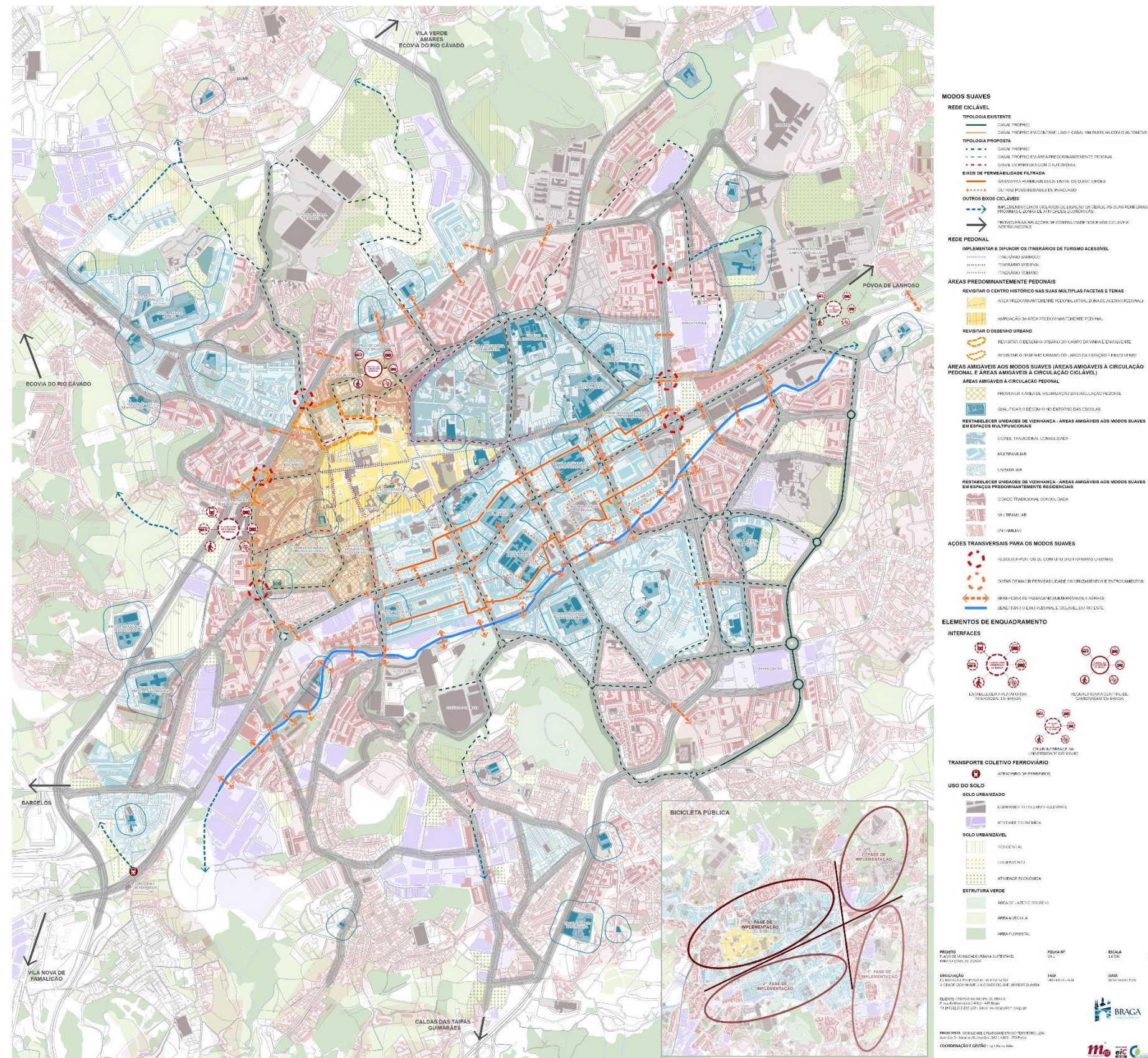


Figure 3. The walkable city

4.2. PROMOTING PUBLIC TRANSPORT

The current paradigm of sustainable mobility has led to the emergence of new concepts and strategic lines as a way of responding to the growing and demanding needs of the different users of transport systems. In this urban planning dynamic, the strategic importance of intermodality in the process of "*making a city*" is highlighted, insofar as the entire mobility and transport system must be understood in a logic of complementarity, rather than from a competitive and sectoral perspective, which tends to favor the automobile in the mobility chain.

In this regard, public transport networks are a fundamental element of the urban mobility system, playing an essential role in improving energy efficiency and the sustainability of territories. In fact, from a more operational perspective, public transport is unequivocally the alternative par excellence to the use of individual transport, and its intrinsic potential in articulating with the various existing modal options is also highlighted, with a particular focus on soft mobility.

To this end, it is understood that the strategy to be defined and implemented by the municipality of Braga should focus on promoting a territorially equitable and universally accessible offer of road and rail public transport services, with a view to boosting intra- and inter-city relations.

In addition, there is a need to strengthen the operational conditions of the different public transport services, both in terms of infrastructure and supply, so that complementary solutions should be adopted between the different modes present in users' travel chains. Similarly, there is a need to promote the standardization of ticketing systems, in order to speed up the transfer between the various modes of transport available to different users.

In this regard, it is inseparable to refer to the functional disarticulation of public transport currently operating in the city of Braga, with the main road and rail public transport interfaces - Braga Railway Station and the Bus Terminal - being physically disconnected.

In fact, despite their relative proximity, pedestrian access between the two interfaces requires a journey of more than fifteen minutes. In addition, there are numerous weaknesses in terms of accessibility and mobility for all along this route, and it is essential to devise an intervention strategy aimed at the functional and infrastructural blending of the two aforementioned centralities.

In view of the above, the intervention strategy advocated in this Mobility Plan contemplates the materialization of the Braga Intermodal Platform, comprising the vertical integration of all modes of travel at a single point in the city.

To this end, there is a need to enable the transfer of competences associated with the current Bus Terminal to the new multimodal infrastructure, particularly in terms of inter-municipal, inter-regional and express network services, functionally freeing up the current interface for smaller-scale services. It should not be seen as a second, complementary infrastructure, but rather as a space that brings together various services, both physically, with the integration of multifunctional services, and in terms of the transport services on offer, making it a primary level interface.

Despite the unequivocal importance of public transport, the platform should also ensure, in a coordinated and efficient way, intermodality between pedestrian, cycling, cab services and other similar technological platforms, without neglecting individual transport through a quick connection to the existing and/or future parking lots in its surroundings, promoting *Park&Ride* and the consequent use of road and rail public transport. In this sense, its surroundings should be prioritized, being able to provide an effective transfer to the pedestrian mode, through a coherent, safe and comfortable pedestrian network, integrating the Braga Intermodal Platform into the paradigm of "*Accessibility and Mobility for All*", a topic of growing relevance in municipal policies.

Likewise, with regard to interconnection with other modes of travel, this platform should contain an adequate number of cycle parks, boosting the use of the *Bike&Ride* system and *bikesharing* points.

There is also a need to implement adequate support infrastructure for road public transport users, namely waiting support structures and real-time information systems, to provide a service that is better able to respond to a population with greater and more complex mobility needs. In this regard, it is important to invest in the inclusion of technological platforms which, in addition to the automatic purchase of transport tickets, enable journey planning and integrated user information systems.

In addition, the Braga Intermodal Platform should also play a decisive role in urban organization, particularly with regard to its integration into the surrounding area, and it is essential to focus on incorporating other urban values, giving it levels of attractiveness that go beyond the trivial offer of the transport service. Indeed, the future interface should not only be seen as a mere hub in the mobility system, but its function as a social place should also be valued, with a concentration of infrastructures and commercial, cultural and leisure facilities, and even employment, which, due to its attractiveness, should create a new urban centrality and a public space of excellence.

In fact, the urban and functional integration of the Interface that is to be created should be based on the guiding principles of the *Transit Oriented Development* (TOD) concept, based on the aim of integrating transport planning with the use and occupation of urban land, promoting the humanization of the surrounding space. Therefore, the implementation of this proposal should also include the provision of continuity spaces related to both the interface and the urban environment in which it is located.

In addition, there is a need to upgrade Braga's Central Bus Station, with a view to adapting it to new requirements, providing it with better and more modern conditions for its different users, whether physical or technological. The aim is to improve the passenger support infrastructure, particularly in the waiting areas, by replacing the support furniture and lighting, offering better comfort conditions for users of the interface.

This measure is related to the need to humanize this transport infrastructure, increasing its level of attractiveness, promoting the inclusion of technological platforms that, in addition to the automatic purchase of transport tickets, enable journey planning and integrated user information systems. In addition, it is essential to fully adapt the space for people with limited mobility, integrating the Braga Bus Station into the "Accessibility and Mobility for All" paradigm, following the best practices of municipal policies.

As previously mentioned, this infrastructure could be used, from a functional point of view, as a secondary level interface, becoming a structuring hub for urban services, promoting the relocation of the remaining service scales to the future Braga Intermodal Platform, to be built at the city's current railway station. The logical rationale behind this measure is the need to mitigate the impact associated with heavy road flows within the consolidated urban fabric, restricting long-term parking and channeling maintenance services to the proposed intermodal platform or, ideally, to the future Braga Material and Workshop Park.

Still on the subject of transport interfaces, the present mobility strategy for the city of Braga advocates the creation of a new transport interface at the eastern end of the urban perimeter, to be implemented around the Gualtar Campus of the University of Minho. In fact, it is understood that the coordinated and efficient integration of public road transport and other modes of transport in an area with high demand for the municipal public road transport service, and high potential for the use of more sustainable modes of travel, will bring important added value to the management of mobility in the city, adapting the distribution of demand flows to the actual needs of users.

As previously reinforced, the future University of Minho Interface, as a secondary level interface, should provide a point of sale for transport tickets and information, with a

extended opening hours, but also waiting areas and commercial spaces. The waiting rooms should offer good user comfort, with adequate lighting and additional support services. With regard to interconnection with other modes of travel, this platform should contain an adequate number of cycle parks and public bike sharing points (*bikesharing*), a cab rank, relocating the existing one in the surrounding area, and also a parking lot that promotes *Park&Ride*.

Likewise, and given that Braga is one of the key links in the future Porto-Vigo high-speed corridor, as set out in the National Investment Plan, it is inevitable that an interface with the High-Speed Rail Network will be defined to improve accessibility and the integration of this municipality into the future structuring axis of the Atlantic belt of the north-west of the Iberian Peninsula.

In this regard, it is also important to promote the streamlining of the articulation between the different interfaces at their multiple levels, highlighting the preponderance of the relationship between the future Braga Intermodal Platform and the High Speed Rail Network Interface. In this regard, it is understood that this link should be based on the provision of high-frequency transport services, ideally in a dedicated corridor, without neglecting the provision of a cycling network.

For the purposes of materializing this proposal, the location for implementing this interface is closely related to the route considered for the High Speed Rail Network, demarcated in the Municipal Master Plan (2017). Due to the scope of the associated competencies, it is understood that the investment should be assumed by the Central Administration, with the municipality remaining a strategic partner in its implementation.

In addition to strengthening the physical infrastructure associated with intermodality points, this proposal aims to encourage public transport to become more competitive with individual transport, thus boosting modal shift and improving the quality of the urban environment. In effect, the plan is to provide the urban perimeter of the city of Braga with a set of corridors dedicated to public transport, to be built on the roads where there is the greatest demand for the service.

To this end, in cases where the geometry of the road makes this technically possible, it is recommended to implement bus lanes or high-capacity lanes, in order to structure a coherent network of lanes dedicated to public transport. On the other hand, on roads where the road profile does not allow for immediate implementation, but where there are a significant number of services (high frequencies) and stops with a significant volume of entries and exits, conditions should be created to define them. The process could involve eliminating side parking, narrowing the lanes, which often appear to be oversized, or possibly eliminating directions of car traffic in favor of public transport.

The process of materializing this proposal should focus, in the first phase of implementation, on the connection between the future Braga Intermodal Platform and the Minho Center shopping mall, followed, in a secondary phase, by the articulation between the recommended intermodal center and Braga Hospital, with an intermediate connection to the University of Minho's Gualtar Campus.

In addition to these strategic connections, this proposal also includes the connection between the peripheral parking lot associated with E.Leclerc and the Gualtar agglomeration, on the EN103 axis, including the extension to Nova Arcada, extending the reach of the high-capacity corridor network to the far north and east of the consolidated urban perimeter of the city of Braga. Finally, and at a later stage in the materialization of the recommended network, the preponderance associated with extending the service to the future Braga High Speed Rail Network Interface, to the Apeadeiro de Ferreiros and to the peripheral parks recommended at the southern end of the city, associated with the Avenida Miguel Torga axis, is pointed out.

In fact, it is understood that the implementation of the set of high-capacity corridors envisaged would bring important added value to the urban mobility model, establishing public road-rail transport as a central element in the local mobility chain. In this regard, the impact associated with increasing the commercial speed of transport services is noteworthy, promoting a significant reduction in user travel times, increasing the competitiveness of collective public transport compared to individual transport, this being an absolutely decisive factor in the pursuit of the goal of mitigating the impact exerted by the latter on the city center.

Following the same rational logic, it is understood that the concept of corridors dedicated to public transport services could also be extended to the strategic inter-city link to Guimarães, providing a high-performance operational model in terms of passenger transport capacity and speed, but also reliability and safety.

In fact, and despite the high investment cost associated with it, the implementation of a high-capacity inter-city transport system - of the *Bus Rapid Transit* (BRT) or *Light Rail Transit* (LRT) type - would result in invaluable improvements in travel time savings for public transport users, with equal increases in terms of the environment and safety in its operation. In fact, the construction of an independent channel for a transport system linking Braga and Guimarães should take special account of the latent demand from the main logistics axes, without neglecting, at the same time, the relationship between the different university centers in Braga and Guimarães.

As far as the urban public transport network is concerned, this intervention strategy includes revisiting the operating model for the next five years. In fact, it is important to define the lines and their respective numbers in a more simplified way, as this is one of the key points in increasing the understanding of the network by different users, with potential added value in its use.

In this regard, it is understood that, for the purposes of optimizing the number of lines, those with different identification numbers and with a route with reduced variations could become variants or parts of a main line, promoting a reduction in the number of lines. In addition, and with a view to strengthening the permeability of the operational model, examples include the need to promote the extension of the existing tunnel on Avenida Padre Júlio Fragata or the definition of two directions on Rua dos Biscainhos, in order to mitigate the constraints on the operation of collective road transport services, namely on lines 7, 24, 31, 66 or 74.

In addition, and in line with other proposals such as the implementation of corridors dedicated to road public transport, the possibility of increasing the number of daily frequencies of lines with a relatively excessive waiting time and journey should be studied.

Within the logic of deterrent parks to be implemented at the city's entrances, the timetables of the network's stops should be readjusted in order to increase the current number of frequencies and, consequently, reduce waiting times between circulations. In fact, the increase in frequencies should also be adjusted to the time distribution of demand, and in these periods waiting times should ideally not exceed fifteen minutes, in line with the aim of boosting intermodality.

This adaptation should preferably focus on the lines with the shortest journey times, in order to reduce the total journey time, making the *Park&Ride* system competitive and attractive and reducing the use of individual motorized transport for journeys from the outskirts to the city center.

Similarly, and in line with the Transport Authority of the Cávado Intermunicipal Community, the strategic importance associated with formalizing flexible transport services is highlighted, particularly in areas of the municipality that lack regular public road transport services.

In fact, in the context of the analysis and definition of the Municipal Transport Authority's future strategy, the areas of S. Mamede d'Este (Rola), Mosteiro de Tibães, Figueiredo, Moinhos (Adaúfe), Póvoa and Ruilhe were defined as areas susceptible to the implementation of flexible transportation. Due to their low population density and subsequent associated demand, these areas may not be economically viable for regular transport services, and it is essential to adopt solutions that respond efficiently to local needs and demand. In this sense, and given the natural decrease in the supply of public transport services compared to more central areas of the municipality, the focus should be on enhancing a flexible transport service that adapts to users' mobility needs when accessing health, education or cultural services.

To this end, it is understood that its operationalization should preferably be structured around a strategic partnership between the municipality and other entities, such as the following

transport, cab companies or car rental companies, leveraging positive synergies between knowledge of local needs and *know-how* in providing transport services.

The operational model advocated in the above-mentioned study includes the allocation of urban services to the operation of the flexible service, consisting of slight changes to regular routes to meet needs, associated with existing reserves. If the latter is not possible, the flexible service could be guaranteed by municipal vehicles, and this process, regardless of the solution to be adopted, would be supported by a single technological platform, under the management of the Cávado Intermunicipal Community, with subsequent transfer of powers to a central reservations office in each of its member municipalities.

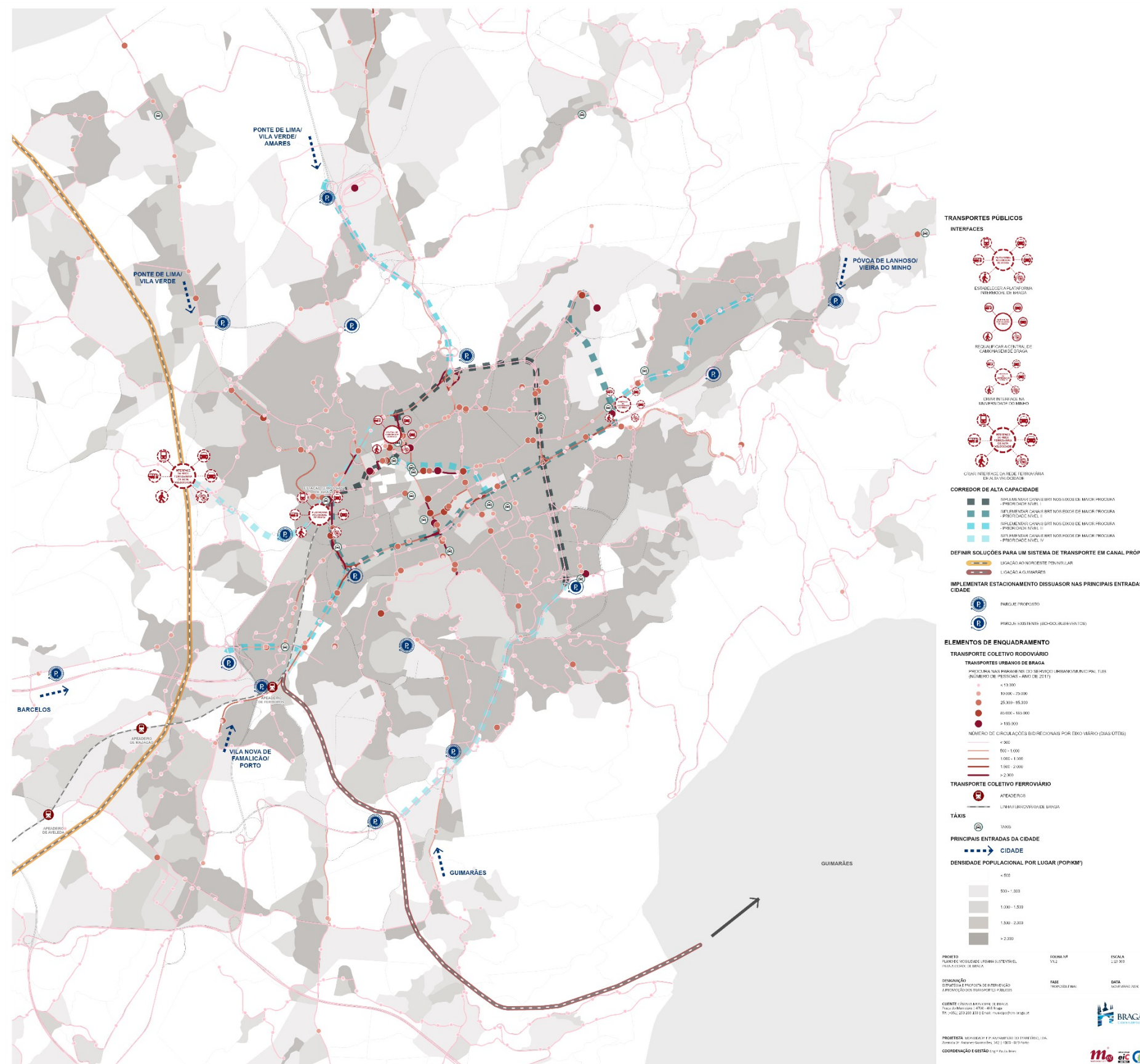


Figure 4: Promoting public transport

4.3. THE CYCLABLE CITY

The use of bicycles as an everyday mode of transport represents a considerable asset in the urban mobility system, both from the point of view of territorial enhancement and from the user's individual perspective, contributing to the reduction of road congestion, the mitigation of sedentary lifestyles and the reduction of atmospheric and noise pollution.

The city of Braga is compact in nature, with distances that are reflected in relatively short travel times that encourage cycling. The significant number of roads with a gradient compatible with cycling and the percentage of commuter trips made within the urban perimeter are relevant indicators that make it feasible to implement measures to promote cycling and change commuting habits.

The lack of dedicated bicycle connections to most of the hubs that generate trips is one of the factors that contribute to the existence of a frankly residual percentage of trips made by bicycle, along with the perceived danger of traveling by car, exposure to air and noise pollution or long travel distances.

In this context, the strategy for the cycling structure focuses on the implementation of a structuring network defined on the main urban axes, thus making it necessary to intervene on the axes and their surroundings, which sometimes involves significant changes in urban design and also additional measures such as the creation of alternative routes or the elimination of through traffic.

The definition of the cycling network is based on the intention of circumscribing the channel spaces where there is the greatest potential for cycling, selecting the axes that will increase the accessibility of this mode of transport to the most important travel hubs and residential areas, using the minimum distances, taking advantage of the channels with the greatest flow and which allow for faster travel. In this way, the gradual implementation of the city's cycling network aims to respond to the population's daily commuting needs, encompassing existing and planned routes.

The proposed cycling structure has two main components: the axis definition and the area definition. With regard to the type of cycling network, on the main road axes, where road capacity is greater, the type of cycling route should preferably guarantee the physical segregation of the channel dedicated to cyclists. Thus, most of the cycle routes defined in the structuring network surround urban areas that are friendly to soft modes, zones 30 and coexistence zones,

It should be defined in its own channel, and connections between blocks should be promoted, as well as to nearby suburbs, in a safe and comfortable way.

The bicycle channel in the now enlarged predominantly pedestrian area arises from the need to make this area of the city more permeable, without creating any potential conflicts between pedestrian and cycling modes. In this way, the definition of these own channels takes place on the axes proposed for the increase in the predominantly pedestrian area - Rua Dom Frei Caetano Brandão, Rua Dom Afonso Henriques, Rua do Anjo or Rua do Alcaide - making it possible to re-profile these roads to allow the continuity of pedestrian circulation and the segregation of the bicycle on these axes. In order to ensure coherence and maintain the architectural and urban value of this area, the demarcation of the cycle channel, whether shared with pedestrians or cars, should be as unobtrusive as possible, seeking to integrate it into the sidewalk in harmony with the architectural setting.

The main problems in defining cycle routes center on the volume of traffic on many of the roads, the speeds used and the number of intersections on the roads needed to define a cycle route network that is suitable and accessible to all, and which will attract future users. The excess of parking on public roads and the distribution of the different channel spaces are also factors that create constraints for the definition of cycle routes in the consolidated city.

In this way, it is effectively necessary to define a strategy to resolve the existing points of conflict and to provide greater permeability to the intersections and junctions of roads that act as urban fractures, in order to reduce the existing car pressure and allow the permeability of cycling. The implementation of cycling routes that require possible re-profiling of the road and respective adjustments to parking spaces, sidewalks and traffic lanes is a more time-consuming and impacting proposal, but one that is essential for comfort and safety on the routes connecting the various urban units of the city of Braga.

As far as the interior of neighborhood units is concerned, where traffic calming measures must be fully disseminated, the circulation of bicycles is encouraged, shared with other vehicles, and the main routes can be marked to give greater legitimacy to these journeys.

In this way, the proposed cycling structure in the city of Braga will be linked to the other proposed actions, which will be fundamental to the construction of cycle-friendly areas, such as zones 30 and coexistence zones. The promotion of areas with characteristics that are more friendly to the circulation of soft modes allows the bicycle user to have continuous routes throughout the city, allowing for greater competitiveness in the choice of routes and also a safer environment.

Among the wide range of measures that can be used to achieve this goal, urban design will be the one that best makes it possible to achieve healthy cohabitation between modes. In fact, the redesign of roads makes it possible to redistribute public space, carefully marking out the space for cars and limiting their circulation to lower speeds. The process of creating these friendly urban areas should begin in the areas that are the main generators of commuting, such as the consolidated area around the historic center and the blocks around the highway that concentrate both educational and public administration facilities.

Although it doesn't require any work, sharing the channel between bicycles and cars is demanding in terms of road safety, given the need for complementary interventions to strictly reduce car speeds. Granting greater visibility and speeding up the process of promoting cycling in the city of Braga, this measure is recommended only within blocks that have characteristics that could be used to define urban areas that are friendly to soft modes, and also in existing streets around the historic center where their profile does not allow for the definition of a dedicated channel for cycling, given the effective need to define accessible pedestrian routes.

With regard to the competitiveness that the bicycle must offer in relation to the car, and in order to guarantee permeability between blocks, there are several aspects that can favor the cycling city over the car city, namely by allowing cycling on one-way streets, in the opposite direction to car traffic, the use of interior spaces of buildings and gardens to create shorter routes and also by adopting a more sensible cycle path profile that is comfortable and safe for the cyclist and other users of the public space. In this way, the definition of competitive axes and filtered permeability will allow the axes with the greatest conflict between modes of travel to be used only as permeability points for the different areas and not as structuring axes in the definition of the city's cycling network.

In addition, where there are staircases or isolated steps, another measure intended to facilitate movement between the topographical changes in the city, metal rails should be applied to make it easier to transport the bicycle by hand. Finally, it should also be noted that Braga City Council currently intends to implement BikeBoxes on some roads, in order to increase the advantage of cycling on these roads, as well as promoting the safety of bicycle users at intersections.

In the urban context, there is a need to benefit the pedestrian route shared with cycling, which follows the banks of the River Este, taking on a recreational character, despite being a southwest-northeast axis in Braga's city center. The "modal conflict" that exists due to the sharing of modes is a cause for concern for the municipality, posing risks to the integrity of both pedestrians and cyclists, making it necessary to segregate them. At the same time, the ecological structure that the River Este represents within the urban space of the city of Braga makes it possible to constitute an axis that will allow for

a quick connection to Braga's main economic activities and facilities, while also allowing users to enjoy a full communion with nature in urban territory.

In order to improve the East River axis and consequently promote better safety conditions for the different users, it is intended to implement different modal channels on the different banks of the East River, upgrading the existing channel for pedestrian use and creating a segregated channel for cycling. Similarly, constraints relating to the crossing of the ecovia with the various cross roads that intersect it should be minimized. The definition of a dedicated channel for cycling could be carried out in the space available on the banks of the River Este, parallel to the existing channel or, in sections where this is not technically possible, it could be defined in cycle paths and, in some cases, redirected to the roads spatially adjacent to this water line.

At the same time, the existing environmental and landscape framework on this pedestrian and cycling route should be reinforced in order to increase the natural component of these routes and, consequently, the visibility and attractiveness of soft modes in the daily travel needs of residents, since, in parallel, conflicts with individual motorized transport are reduced, giving soft modes a greater competitive advantage over other modes.

In addition to the cycling structure defined for the city, there is a need to promote safe and comfortable connections between the city and the nearby outskirts, making them more suitable for cycling. These routes should be implemented between the points of origin and destination where there is a more significant volume of trips, fostering connections not only to existing urban agglomerations, but also to economic areas and, preferably, presenting different route possibilities from the roads used by cars.

In this way, this network will promote the use of cycling when traveling near settlements and connecting to the consolidated city, but it will also allow the city-periphery connection to be made using more sustainable modes of transport, promoting intermodality and reducing the use of individual transport. Considering that these roads have a profile that benefits cars, this measure is complementary to the proposal for a program to build sidewalks in linear settlement areas, increasing street characteristics to the detriment of road characteristics.

In addition to the aforementioned cycling structures, it is essential to establish inter-municipal connection routes, defining axes between these contiguous territories, but which have different management entities. As projects for the inter-municipal cycle network, the links set out in the Portugal Ciclável 2030 program (public disclosure report, September 2018), to Vila Verde, Caldas das Taipas and Amares, should be considered. In this context, together with the municipality of Amares, the municipality of Braga has developed the Itinerário XVII project for application to the Environmental Fund, which will make it possible to establish a cycle route segregated from other modes of travel.

In addition to the links considered in Portugal Ciclável 2030, it is also important to promote the connection of the urban cycling network, not only to Póvoa de Lanhoso, but also to the Ecovia do Cávado, the latter of which, in addition to linking the municipality of Braga to the municipalities of Amares, Barcelos, Esposende, Terras de Bouro and Vila Verde, will be an infrastructure that integrates the entire territory and promotes an increase in the quality of life of users.

From the perspective of mobility as a service, the aim is to introduce a system of shared public bicycles, promoting the provision of cycling infrastructure that allows this mode of travel to become a real alternative to individual motorized transport. To make this a reality, it is essential to select, size and implement public bicycle parking points, and the model should be selected according to demand, available space, the urban landscape and the (minimal) visual impact on the urban environment.

For better management of public space and with a lower investment than a traditional bike-sharing system, the public bicycle system with a virtual station, based on a check-in and check-out system in a mobile application and physically defined cycle parks is the most advantageous for the city of Braga. Public bicycles should be made available at localized points at regular and convenient intervals and, whenever possible, with the capacity to generate use throughout the day, particularly in mixed-use areas that feed the system with users over an extended period of time.

According to the *Institute for Transportation & Development*, for a public bicycle system to be efficient, there should be 10 to 30 bicycles per 1,000 inhabitants and, ideally, one station every 300 meters - 10 to 16 stations per square kilometer. The number of bicycles available per point should be adjusted according to demand, but on average each point should have around five bicycles and five free spaces, so that there is always parking capacity. The implementation of the public bike-sharing system will have to take into account the definition of a technological system for management, information, payment and operation and the creation of a control and service center for users, as well as maintenance and redistribution of the bikes.

In order to boost the effective use of the public bike-sharing system, its implementation must be closely associated with the expansion of the urban cycling network, since it must be in a comfortable and safe condition. Thus, the first phase could begin in the central area of the city, around the historic center, and the following phases should only take place when the permeability conditions at the different intersections or junctions, as well as the improvement of the crossings, are in place, along with the resolution of the existing points of conflict between the various modes of transport.

Regarding the type of bicycle to be made available, conventional or electric bicycles, the possible availability of electric bicycles should be carefully analyzed. The so-called electric bicycles, with propulsion support, could be included in the public bicycle system not only

motivated by orographic characteristics, but also by their demographics and distance from urban agglomerations.

Thus, although they are more expensive than conventional bicycles and the journeys can be made using intermodality, they could be made available as a way of encouraging the older population with greater difficulties in using bicycles to travel by bike or for longer journeys. In fact, the option of implementing docks with a simplified and dematerialized structure constitutes a lower financial burden, resources that can later be allocated to the purchase of electric bicycles.

With the advent of technology, other forms of travel have proliferated and gained popularity, making it possible to replace cars with micromobility that emits less GHG, such as shared electric scooter systems. When applying this micromobility system, various constraints can arise when there is no definition of parking and circulation locations, such as accidents with pedestrians on sidewalks, accidents with users when they don't wear helmets, undue occupation of public space and a lack of supervision and regulation.

In the collaboration agreement between the municipality of Braga and the existing or future operators, the rules and conditions to which the installation and operation of the shared electric scooter system is subject were defined and established, which is presented as the basis for the future municipal regulations regarding bicycle and scooter sharing systems.

In order to boost the use of the scooter-sharing system, the municipality has defined a set of points where scooters are made available, the "hotspots", seeking to follow a logic of proximity to the main hubs that generate travel and their integration with cycle paths, the coexisting road network and bicycle parking. In order to promote the correct use of public space, virtual stations have been set up where, despite the use of a mobile application to use the scooters, the points of availability are defined with vertical signs and road markings, as envisaged for the public bike-sharing system.

After the monitoring and experience of the current operation, the future regulations of Braga City Council should define in the municipal license of each operator, a determining the maximum number of vehicles that can be made available per operator, identified with their own numbering and in series. For better management of the system by the city council, operators should share information about their system, such as the average use per hour and point, the average duration of journeys and the points of origin and destination.

The regulation should establish the authorized sharing zones and respective parking points, but also the definition of axes where circulation is not allowed, such as tunnels, access junctions or road axes which, due to their nature and speed, are not advisable for the circulation of these bicycles. In this context, reference should also be made to the "red zones", defined in order to safeguard the safety of vulnerable users, where there will be a reduction in the number of cyclists.

the maximum speed of the scooter in its vicinity and the locking of the wheels inside areas marked as "prohibited circulation". As with the public bicycle, the municipality should define phases of expansion by zone, so that the introduction is gradual and accompanies the permeability and safety measures to be implemented in the city.

In order to promote cycling mobility in a coherent and effective way, it is proposed to implement infrastructures to support the use of bicycles that create parking areas, but also rest and information areas, at entry points to the cycling network or other places that allow users to enjoy the intrinsic value of the territories. Thus, these infrastructures, which include elements such as cycle parks, drinking fountains, bins, places to stay, places to change clothes or information points (MUPI), should complement the cycling network in what are structuring facilities, interfaces and public transport stops, but should also exist next to residential, commercial or service areas.

As far as cycle parking is concerned, an adequate number of cycle parks should be provided, taking into account criteria such as location, design, installation, number of spaces provided and associated costs. The types of cycle park to be implemented should suit a variety of bicycle sizes, shapes and accessories, with the recommended formats being "inverted U", "*post&ring*" and "*wheelwell - secure*".

Faced with a future increase in the use of cycling, it is possible and advisable to increase the number of bicycle parking spaces, taking into account the sizing parameters for cycle parks, both short and long term, in residential areas, cultural and recreational spaces, schools and higher education institutions, sports facilities, commercial spaces or transport interchanges.

These measures are also complemented by a series of actions aimed at increasing the attractiveness of cycling, such as the introduction of biophysical elements and directional signs and information aimed at cyclists, the creation and dissemination of the cycling network map, the implementation of a project to encourage cycling in the academic community and the promotion of a mobile application to encourage everyday cycling.

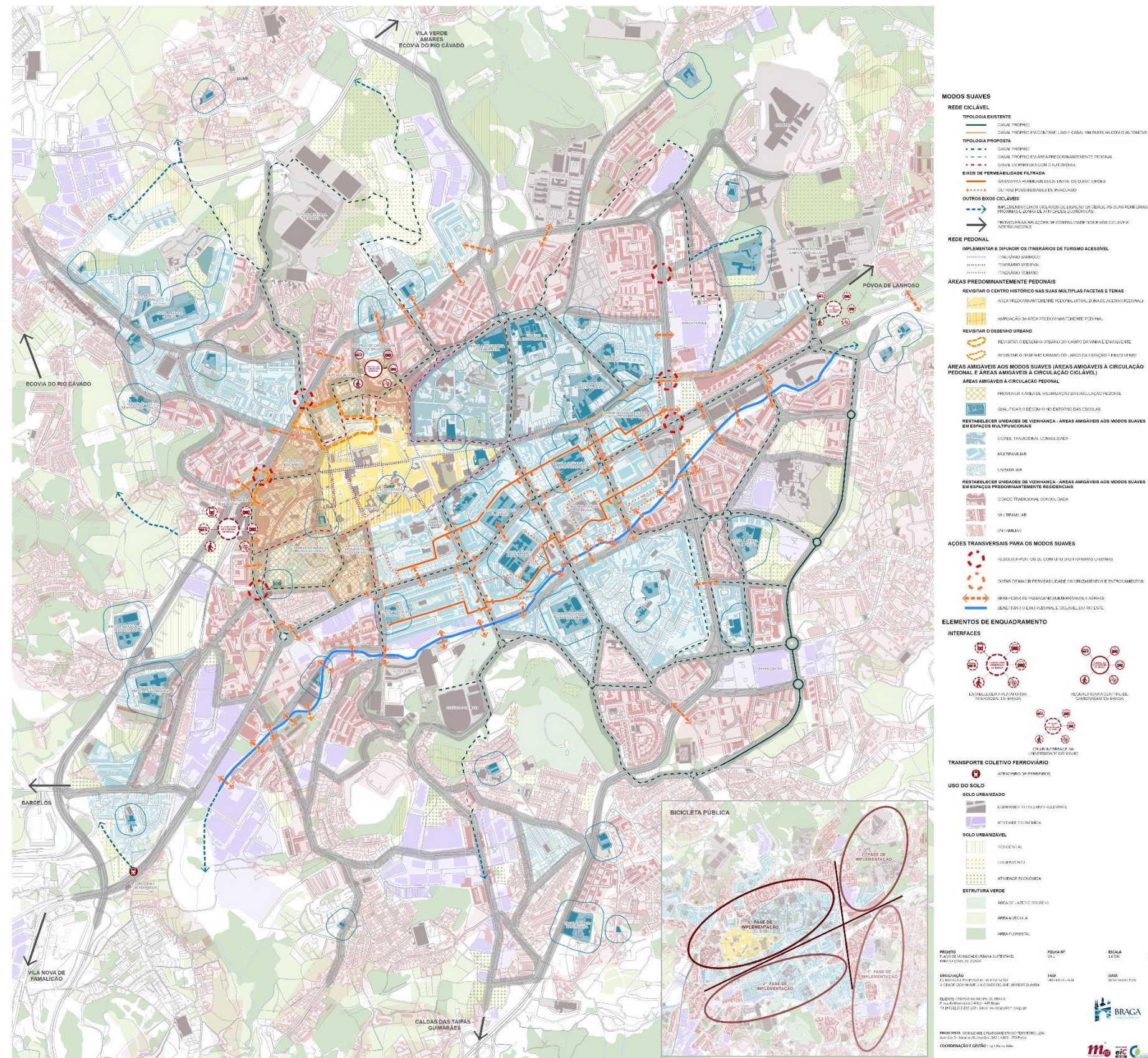


Figure 5: The cycling city

4.4. OPTIMIZING THE ROAD SYSTEM

The restructuring of road accessibility is one of the central pillars of strategic urban planning, insofar as the road infrastructure is effectively the mobility matrix par excellence. However, the fact that mobility policies, implemented over the last few decades, have been limited to interventions and investments for the benefit, almost exclusively, of individual motorized transport, has led to numerous vicissitudes that are detrimental to the promotion of the urban environment, the resolution of which is currently seen as a priority on the agenda of Portuguese cities and towns.

In fact, the urban expansion model that characterizes the overwhelming majority of national cities, and in which Braga is no exception, indicates a territorial appropriation of peripheral areas, consolidating new agglomerations and centralities with the capacity to attract and generate trips. In fact, the increase in the distances required to satisfy various needs, together with the increase in their frequency and density, has led to a generalized increase in car use.

However, their massification and unregulated proliferation in public spaces has proved to be harmful to traditional urban dynamics, and is directly responsible for spatial fragmentation, with the construction of new roads as a response to growing demand, the saturation of road capacity and the increase in emissions of polluting gases, with an obvious and unequivocal influence on the decline of urban spaces, which is antagonistic to the aims of sustainable territories.

As such, there is an urgent need to reinvent the paradigm of urban thinking, opening up a new window of opportunity for effective intermodal integration in the city of Braga, in which a differentiated approach is advocated.

The diagnosis developed in the previous phase of this Mobility Plan reflects the existence of the typical problems of the mass use of individual motorized transport. In fact, the current road model has a negative influence on the urban mobility system, which is evidenced by the fact that the hierarchy set out in the Territorial Management Instruments does not actually reflect the road performance model of the municipality's network.

This vicissitude is particularly evident on the most hierarchically relevant roads, unequivocally conditioning any strategies for regulating current road flows, and complicit with the monopolization of the car in the urban landscape. This fact is clearly relevant to the aim of safeguarding the central areas of the city of Braga, particularly with regard to the impact of through traffic associated with north-south and east-west flows, which is a particularly important issue in the recommended road accessibility model.

This situation is particularly serious, especially when related to the road accident records measured on the roads that make up the urban perimeter, where the current road profiles pose problems that urgently need to be resolved, since they have a negative impact on the safety of the different users of the canal space.

In addition, there are also a number of road arteries in the urban fabric which, in practice, are veritable "urban highways", with traffic volumes, road profiles and speeds that are totally incompatible with local life. Due to their privileged location on the local perimeter, these roads are fragmented barriers in the urban environment, a prime example being the axis made up of Avenida Padre Júlio Fragata, Avenida Frei Bartolomeu dos Mártires, Avenida Dr. Francisco Salgado Zenha and Avenida Miguel Torga, and their "humanization" is a priority issue in terms of urban mobility.

In fact, the importance of introducing traffic calming measures is unanimously acknowledged, and it is urgent that they be implemented in the shortest possible time, adopting a set of solutions that will undoubtedly involve reformulations in their geometric design, cross-sectional profile and signage.

This measure stands out as a central strategy in urban mobility management policies, mitigating the negative impact of through traffic, which is totally disconnected from the dynamics inherent to the local scale, valuing the "street" function on roads that currently have a "road" function. The objective to be achieved is fundamentally based on enhancing and safeguarding territorial humanization in the central areas of the city of Braga, to the benefit of the use of more sustainable modal alternatives, valuing the contribution of urban requalification centred on the person to the detriment of the car.

In this sense, the set of actions listed in this chapter, with a view to optimizing Braga's road system, are based on promoting the rationalization of the use of individual motorized transport and encouraging the rebalancing of the modal split, to the benefit of more sustainable mobility alternatives.

In pursuit of this goal, there is a need to increase the structural coherence of the road network and to direct traffic flows, including flows inherent to urban logistics, to the most appropriate routes, safeguarding urban settlements from the intrusive presence of vehicles. To this end, we stress the importance of implementing the set of planned roads, integrated into the municipal Territorial Management Instruments, which are crucial to the implementation of the new hierarchical model of road accessibility in the municipality.

In fact, it is assumed that the materialization of the strategic axes proposed, with particular relevance to the completion of the Cávado Bypass, the latter being essential in the road correlation of the parishes located in the north of the municipality to the existing structuring network, namely

to the A3 and A11. Its implementation will also have an important impact on road accessibility on an inter-municipal scale, making it possible to connect the municipalities of Amares and Terras de Bouro, representing, particularly for the latter, a fundamental axis in strategic connections, both to the city of Braga and to the set of main routes previously listed.

In fact, the filling in of the existing section will connect it to the freeway junction via the EN14 bypass in Ferreiros, and to the various business areas in the municipality of Braga, especially Adaúfe and Palmeira (Pitancinhos), promoting links with the structural road network and, consequently, with the main sea ports, logistics platforms and airport on the northwest coast of the Iberian Peninsula.

Similarly, the importance of implementing the Northeast Bypass and the EN103 Bypass, which, together with the implementation of the Cávado Bypass, will form the northern ring road to the city of Braga, decisively mitigating the impacts associated with east-west crossing flows. In addition to benefiting supra-municipal road connections, the completion of the axes listed is particularly strategic for the purposes of safeguarding and humanizing the consolidated urban fabric of the city of Braga, especially in reducing road density on the axes that flow directly into the most sensitive urban fabric, which currently have road loads that are out of line with the intended urban and human scale.

In addition to the implementation of the North Circular, it is also important to highlight the importance of the intervention at the Infias junction, since, despite its inclusion in the jurisdiction of Infraestruturas de Portugal, its optimization will allow traffic to flow more easily in the directions with the greatest flow. In fact, this proposal arises from the need to mitigate the negative impacts associated with road congestion, which is closely correlated with through traffic. There is a pressing need to rethink the geometric profile of this specific point in the road network, with the aim of decomplexifying the flows leaving the consolidated urban perimeter, while promoting the inclusion of barriers in the direction of entry.

In this regard, and without neglecting the relevance of this intervention, it is understood that the optimization of road traffic in the city of Braga should undoubtedly include the introduction of additional measures that contribute to the inversion of the current modal pyramid, where the car assumes an unequivocal supremacy.

Likewise, it is important to note the existence of a series of "*missing links*", linked to the local access road matrix, which condition the territorial urban reading, particularly relevant for the purposes of closing off the urban fabric. This problem is especially visible in the more recent areas of urban expansion, bordering the consolidated urban core of the city of Braga, where there are a number of road discontinuities, spatially dispersed and functionally framed in informal *cul-de-sacs*, which need to be rectified.

Despite the robust set of proposals to be implemented, it is important to note that, rather than increasing accessibility levels for individual motorized transport, they should be structured around the urban and environmental enhancement of the city of Braga. In fact, it is assumed that the reduction in flows on the local road network will bring invaluable added value to the urban mobility model, boosting the predisposition to make daily journeys using alternative modes of travel to road transport, with a special focus on public transport networks and soft mobility.

With the implementation of this set of new connections, it is important to emphasize that the old roads will have to be upgraded in parallel, so that they can be adapted to the new functions that are planned and which, although they already exist, do not present the ideal conditions of safety and enjoyment for citizens.

In this regard, there is a need to promote the urban redevelopment of the urban sections of the "Axis of Avenues" that converge on the local urban perimeter. In addition to regulating abusive parking, the focus should be on creating pockets for public transport stops and improving the quality of public space, particularly in terms of sidewalks.

In this planning logic, the relevance of readjusting road hierarchies in traffic management is raised, through functional *downsizing* on the roads that make up the neighborhoods/blocks of urban agglomerations, with a view to changing traffic priorities, particularly on local roads with high traffic volumes. This measure is particularly relevant on the roads on the consolidated perimeter of the city of Braga, which currently have road loads that are out of line with the urban and human scale.

In this context, the need to ensure the structural coherence of the network is reinforced, either by reallocating the main traffic flows to the appropriate routes, or by redeveloping the public space with a focus on soft modes of travel and public transport.

The aim is to relocate through traffic, both intra-urban and supra-urban, to the roads outside the urban perimeter, where the main routes into the local urban perimeter will converge, mitigating road flows within the main residential settlements. At the same time, a strategic set of structuring road axes is safeguarded, which are fundamental in redistributing local flows and linking them to the hierarchically superior network, guaranteeing the necessary and indispensable road flow capacity, without harming local urban dynamics.

In fact, the definition of a structuring road network should formalize a strategic set of mobility axes par excellence for the city of Braga, based on the main arteries and road connections. These roads should concentrate all modes of travel,

including the road public transport network, and are fundamental in connecting and distributing the flows coming from the hierarchically superior routes.

Since motorized mobility is an important component in urban dynamics, the objective of defining the structuring road network presupposes not only the colloquial and traditional prioritization or improvement of the automobile, but its effective integration into the overall mobility system of the city of Braga.

In fact, understanding the importance of the automobile and its inherent added value in terms of modal competitiveness, the underlying objective of the present proposal is to establish a set of arteries in the local territory, where the potential of the automobile is maximized, without compromising the design of sustainable mobility and the quality of the urban environment.

Since circulation speeds between modes are necessarily heterogeneous, the roads that make up the proposed network must be protected by a set of special measures to protect the most vulnerable modes, especially pedestrians and cyclists. In this regard, it is absolutely imperative to implement traffic calming measures and segregate the different channel spaces, reducing the possible friction inherent in intermodal conflict, resulting from the coexistence of the different modes in the public space.

At the same time, and as part of a holistic vision for mobility management in the city of Braga, we point out the need to revisit the general circulation scheme in its historic core, in order to articulate the distribution of road flows with the pedestrian zone proposed in the corresponding chapter.

The purpose of the proposed changes to the road system is to discourage through traffic within the city's consolidated network by increasing the length of routes for individual motorized transport, in a rationale that is the opposite of the minimum paths recommended for soft mobility. Given the technical specificity and resulting impacts, it is considered particularly essential to evaluate the implementation of this measure in a traffic study, in order to analyze in detail the possible repercussions on mobility dynamics, creating conditions for the development of a more fluid, efficient and safe circulation system.

In the proposed zones 30 and coexistence zones, in addition to the implicit spatial improvement geared towards sustainable modes, the aim is to dissuade traffic from crossing the urban perimeter, protecting zoning and the local urban experience. In this regard, consideration should be given to including road signs that only allow residents to enter the various access roads to the urban centers, channeling through traffic to the peripheral structuring roads.

Taking into account the aforementioned holistic urban planning strategy, this road organization proposal is designed to restructure the spaces adjacent to the roads to be included in the structuring network, valuing them not only as transit spaces, but fundamentally as socially dynamic areas. On the other hand, the aim is to

these road axes contribute to the protection and enhancement of soft mobility improvement zones, channeling road traffic to the structuring axes and reducing the weight of road flows within the blocks, areas where it is recommended to formalize a residence or coexistence zone, in accordance with the guidelines of the Highway Code and the Traffic Signs Regulations.

In fact, this action plan is a central strategy in urban mobility management policies, mitigating the negative impact of through-traffic, particularly flows associated with logistics, which are totally disconnected from the dynamics inherent in local urban life.

The objective to be achieved is fundamentally based on enhancing and safeguarding the territorial humanization of Braga's neighbourhoods/blocks, to the benefit of the use of more sustainable modal alternatives, valuing the contribution of urban requalification centred on the person to the detriment of the car.

Thus, a new road hierarchy is proposed, considering the materialization of the set of proposed roads, in the design of a structured and functional road network, assigning different functions according to the strategic relevance of each road axis in the intended road accessibility model. The proposed hierarchy is structured into six hierarchical levels, as follows:

- **Higher Level Roads:** these are the roads par excellence, part of the fundamental and complementary national network and associated with medium and long-distance journeys, playing a fundamental role in the inter-city accessibility of the municipal territory;
- **Via Coletora (Collector Road):** provides the main connections across the municipality, peripheral to the urban perimeter, integrating the road corridors connecting to the fundamental and complementary national network;
- **Main distributor road:** this includes the distribution of the largest traffic flows in an urban context, as well as the peripheral connections to the neighboring agglomerations and municipalities, articulating the territorial structuring road relations;
- **Secondary distributor road:** provides proximity distribution and flows from the different urban sectors, channeling them to higher-level roads;
- **Local Distributor Route:** structures the distribution of road flows on a neighborhood scale, supporting the dynamics of local access, and is made up of roads with some road flow capacity, although soft modes play a leading role in the space-channel;

- **Local Access Road:** connects road access to nearby buildings, and should have an urban design and privileged conditions to protect and encourage the use of soft modes.

Notwithstanding the hierarchy defined in the Municipal Master Plan¹, it is understood that the formalization of two new intermediate categories, corresponding to the collector road and the main distributor road, which will support the traffic coming from and going to the regional roads and adjacent peripheral settlements, is particularly important in structuring the recommended road model.

Its definition is particularly pertinent as a strategy for the territorial improvement of central urban areas, with a special focus on the Historic Center and its adjoining territory. In addition, it is understood that the road hierarchy should incorporate a more intuitive interpretation, assigning distinct and specific functions to the different roads, according to the functional structure they play in intra- and inter-urban travel.

Braga's Conditional Automobile Access Zone (ZAAC) should also be rethought and readjusted, due to the existence of numerous deficiencies in the control of automobile access to this area, requiring the implementation of regulatory measures to discipline traffic and parking within the perimeter covered. To this end, it is proposed, in a gradual and evolutionary way, to increase the restrictions on the current operation of the ZAAC, taking into account certain criteria, namely opening hours and loading and unloading logistics operations, including reformulation of the authorization system, which will now be controlled by license plate reading, and it is also necessary to act on the currently existing crossings, where the respective assigned entrances/exits are not respected.

In this sense, the implementation of the new hierarchy should take place at the same time as the upgrading of the existing routes to be included in the proposed road matrix, promoting the readjustment of the infrastructural characteristics and the respective road profile to their functional purpose. In this regard, it is important to mention the strategic importance of implementing the previously listed urban structuring road network, as well as the need to make the central axes functionally compatible with the local urban fabric, promoting its humanization.

In fact, understanding the importance of the automobile and its inherent added value in terms of modal competitiveness, it is recommended that road capacity be provided to support the existing volume of traffic, ensuring good operational performance. In this regard, the interventions should also be aimed at enhancing the road transition between the different hierarchical levels, in order to give greater legibility to the intended road model and promote the coherence of its structuring.

¹ Road Network, Transport and Mobility Characterization Plan, Braga Municipal Master Plan, 2014

In turn, parking is now recognized as one of the main components of any urban mobility management policy, and its correct organization can help regulate and rationalize the use of private cars.

As mentioned above, the car is the main mode of travel for the population living in Braga, which in turn conditions circulation in public spaces and, inherently, puts pressure on parking demand. In this sense, it is essential that parking policies encourage less car use and create more favorable conditions for a more balanced modal split, with special emphasis on the use of public transport and soft modes.

The definition of parking tariffs, as well as their temporary limitation, contribute to an effective reduction in the number of vehicles parked for long periods of time and, consequently, induce an increase in vehicle turnover, which allows areas with a high attraction for commuters to have a constant supply of spaces. Therefore, the city's parking policy should promote increased turnover in areas of high demand, with the definition of priced parking on public roads, in order to transfer it to parking lots.

To this end, the intervention strategy outlined in this Mobility Plan aims to implement coherent parking zones, adopting differentiated tariffs, in order to incorporate an effective parking pricing policy into the mobility management paradigm in the city of Braga, defining uniform criteria for each proposed area. To this end, it is proposed to define three levels of parking zones or axes: green, orange and red, in which a progressively increasing price scale is implemented, starting from green to orange and culminating in red. Thus, we will have:

- **Green Zone** (low-turnover zone or axis): this zone also includes deterrent parks, with the lowest tariffs or tending to be free of charge, which should have two options: price for parking only and price for the Park&Ride system, constituting possible long-term parking zones;
- **Orange Zone** (medium rotation zone or axis): close to the main facilities, services and commerce, spatially more distant from the predominantly pedestrian areas and the historic center, it has lower occupancy rates and, consequently, lower tariffs compared to the Red Zone;
- **Red Zone** (high-turnover zone or axis): close to the main facilities, services and commerce and with very high occupancy rates, presenting the highest tariff and promoting turnover.

In the aforementioned operational paradigm, the parking lots will be included in the respective on-street parking zone of the surrounding streets. However, the tariff applied to the

should always be lower than those charged for on-street parking in the same zone, in order to discourage parking in the latter. In this way, the tariff for a parking lot located in the red zone should be lower than that charged on the public highway in the same zone, but more expensive than a parking lot located in the orange zone.

However, car parks with the same characteristics and within the same zone should have equivalent prices. Therefore, despite the exceptions previously described, which should be materialized in a logic of coherence to make it easier for the user to interpret them, ideally and as an overall criterion, the price should be established according to the zone in which the parking lot is located.

In addition, and taking into account the mobility system envisaged for the Historic Center, it is proposed that in the Conditional Automobile Access Zone, exclusive offer zones be established for residents and merchants with establishments (the parking policy within these places should cover other types of users, such as resident entities or carers), with parking being allowed in the sector where the lot is located.

At the same time, in order to make the parking policy coherent and effective and redirect public space towards sustainable modes of travel, it is essential to promote parking lots with lower rates than parking on public roads. In this way, the parking strategy for the city of Braga should also be based on the promotion of dissuasive parking, with the definition of dissuasive parks, including the formalization of support parks for the existing interfaces recommended in this intervention strategy.

As far as the existing parking lots are concerned, they should be upgraded, including the promotion of a more appropriate design, given the fact that most of them do not have horizontal signs to demarcate and regulate the supply. Considering the spatial distribution of the parking lots, the majority are located in the immediate surroundings of the Historic Centre, decisively conditioning the aim of mitigating the impact of road flows on the consolidated urban fabric. Thus, gradually and in close connection with the promotion of an efficient public transport and cycling network, it is proposed to relocate the offer to the recommended deterrent ring, outside the Braga ring road, spatially connected to the main access axes.

Both in the Historic Centre and in the outer urban rings, in the areas intended for residents, the formalization of proximity parking pockets should be promoted, so that the necessary supply for them is reallocated to the spaces intended for this purpose, freeing up public space for the balanced coexistence of the various modes of travel in the mobility system of the city of Braga.

In addition, in order to mitigate the pressure exerted by the demand for parking on traffic routes, intelligent solutions should be introduced that make it possible to understand the patterns and

motorists' behavior, so that traffic flow can be optimized and congestion reduced, as is the case with *Smart Parking*.

Using technological devices, the *Smart Parking* system, through the installation of sensors in previously marked spaces or smart cameras strategically placed in the surroundings, provides real-time information on the occupation of parking spaces. To this end, at the main entrances to the city, it is proposed to install a series of information panels on the parking spaces available in the surrounding area.

These actions should be accompanied by the reinforcement of measures to combat illegal parking, both through the implementation of physical barriers and through control and enforcement, as well as by revisiting the Braga Municipal Regulatory Code. Similarly, the criteria for sizing parking spaces could also be redefined in the Municipal Master Plan Regulations.

On the other hand, electric mobility is a reality in Braga's urban space, and the municipality was part of the initial group of 25 Portuguese municipalities that took part in the implementation of the national pilot electric vehicle charging network. Although electric mobility is not, under any circumstances, an effective solution to the problems associated with urban mobility, since the infrastructure and space requirements of an electric vehicle are equivalent to those of a traditional vehicle, it is one of the main vehicles promoting sustainable mobility.

It is therefore proposed to increase the number of electric charging stations in the city of Braga, by making it compulsory to install charging points for electric vehicles when licensing new homes or new developments, and also by making electric charging stations available in the proposed deterrent parking lots. In this regard, it is recommended that the charging stations made available in parking lots should be semi-quick charging and on public roads they should be fast charging.

As a result, the aim is to create conditions that provide greater humanization and enjoyment of the public space, as part of an integrated strategy for the territorial enhancement of the city of Braga.

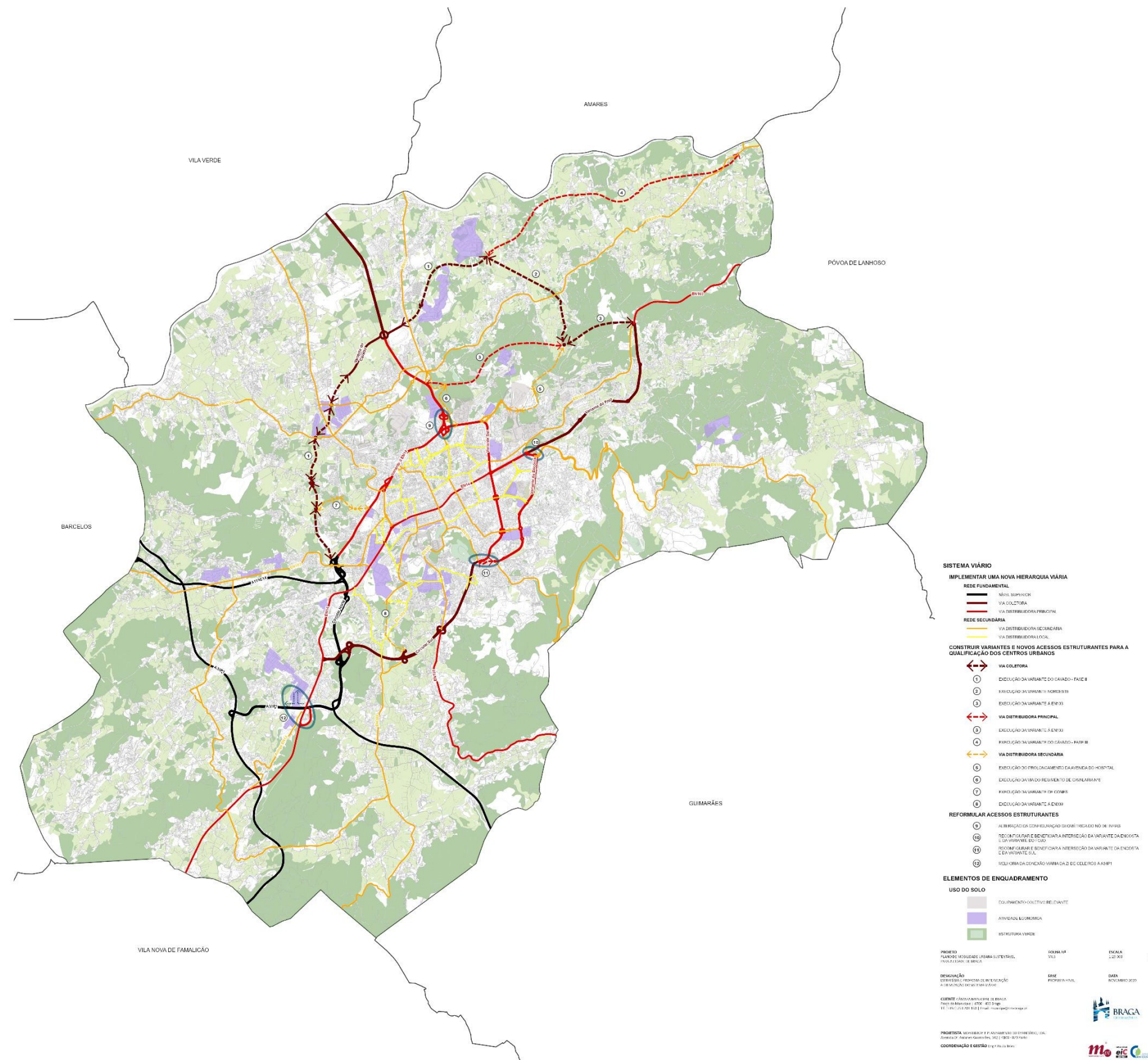


Figure 6. Optimizing the road system

4.5. THE BALANCE OF URBAN LOGISTICS ACTIONS

The management of urban logistics is undoubtedly one of the major medium/long-term challenges for the mobility strategy to be implemented in the city of Braga, insofar as this, regardless of the scale of action, has a very significant impact on local dynamics. In this regard, it is important to note the enormous weight of the industrial apparatus in land occupation, whether to the north or south of the city's consolidated urban perimeter, requiring a differentiated and integrated approach, where mobility is bound to make an important contribution.

In fact, and in terms of territorial planning, there are numerous vicissitudes in integrating logistics organization into urban management policies, and this factor is aggravated by the chronic difficulty in associating existing companies in the territory with the process of participation in territorial management policies. In addition, and in terms of regulation, there is no specific municipal regulation on logistics operations, which is included in the Regulatory Code of the Municipality of Braga, and it is urgent to readjust the timetables and the circulation scheme for logistics flows, mitigating their impact on the local urban fabric.

In pursuit of this goal, it is necessary to increase the structural coherence of the road network and direct traffic flows, including flows inherent to urban logistics, to the most suitable routes, safeguarding the city from the intrusive presence of road traffic, thus making it necessary to revisit a heavy goods traffic scheme.

In this regard, it is important to implement restrictions on the unruly circulation of heavy vehicles in urban areas, restricting the flow of heavy logistics in spaces whose humanization is in need of greater improvement. In this regard, it is also important to regulate tourist transport in the city center, defining a set of parameters to relieve the pressure generated by the growing supply of this type of transport, as well as the routes or areas where tourist circuits, stops and terminals for vehicles dedicated to this service can be defined.

In fact, this proposal focuses on the link between the road hierarchization model previously explained and the regulation of heavy logistics flows in the city of Braga. To this end, it is suggested that the circulation of heavy vehicles be completely restricted on the roads within the urban perimeters of the main centralities, avoiding indiscriminate crossing of the urban core of the city of Braga.

From a more global perspective, and adapted to the municipality's context, it is understood that heavy logistical flows should be restricted, whenever possible, in the two lower hierarchical classifications

(Local Distributor Road and Local Access Road), directing heavy logistics flows to urban structuring roads.

However, it should be noted that this restriction should not apply to vehicles used for inspection, maintenance of public infrastructure, public cleaning, collection of solid urban waste, or vehicles used by the security forces and civil protection services, for the time strictly necessary. Similarly, there is a need to introduce exceptions for vehicles that require special authorization from Braga City Council, such as vehicles used for urbanization works and in real estate.

Similarly, there is an urgent need to enhance parking management and logistics operations in urban planning dynamics, as instruments that make it possible to reallocate public space to soft transport modes and public transport.

In this sense, considering that the Historic Center is the area with the highest concentration of commercial activity in the city of Braga, there is a need to increase micro-logistics to support loading/unloading, by creating local infrastructures for second-line handling and storage in the commercial establishments themselves. In addition, it is important to promote a micro-logistics system to support local commerce, namely by investing in systems for distributing goods/purchases to the micro-logistics center to be created and to the parking spaces on the outskirts of the Historic Centre, using environmentally sustainable means of transport adapted to local circumstances, offering a new shopping experience to different users.

Thus, the strategy for managing urban logistics in the city of Braga should be based on creating a point of balance which, while not restricting the supply capacities of economic activities, makes it possible to reduce the impact of the distribution of goods on the public space and promote the quality of the urban environment, providing greater humanization and enjoyment of the public space.

4.6. THE DYNAMICS OF MOBILITY PLANNING

Since the territory is one of the most important mobility platforms, as it concentrates and interconnects the different modal options, it is important to implement measures that ensure a close strategic correlation between mobility dynamics and land use.

In this regard, and while recognizing the slowness and complexity of the process of reversing the negative consequences of the massification of the diffuse city and suburban growth, inherent in the process of expansion of the city of Braga, there is an urgent need to implement measures that induce urban regeneration, promoting a proximity urbanism that enhances the humanization of spaces and the increase of conditions for walking in an urban environment.

In fact, it is understood that proximity urbanism is a central aspect for enabling sustainable mobility and, as such, it is proposed that it be configured as a neuralgic element of the existing territorial management instruments in the municipality of Braga. In effect, the focus should be on greater urban and population density, complemented by the implementation of mixed uses, in order to promote the satisfaction of mobility needs within a short radius of action, preferably using soft modes.

Therefore, the implementation of corrective measures should focus on reviewing current urban planning, encouraging the proliferation of local shops and services and minimizing the need to use individual motorized transport, through an articulated set of global actions, of which the following stand out:

- Restricting urban sprawl and promoting an increase in density by protecting developable land and rural land, particularly in cases where population growth does not justify expanding the urban area;
- Promote urban design, density and diversity of land uses, combining residential functions with facilities and services based on a coherent pedestrian network connected to public transport networks;
- Prevent the gentrification of urban centers by promoting urban regeneration plans that protect the neighborhood and street model, including strategic programs to promote and foster small local businesses;
- Promote functional mixing so that blocks can, whenever possible, meet the needs of residents without them necessarily having to move outside;

- Implement measures to reduce the number of journeys, particularly home-work journeys, through measures to help reconcile family life.

Likewise, and with a view to reversing the dominant car modal share, there is a need to promote the development and monitoring of plans aimed at improving soft mobility, such as the Accessibility Promotion Plan.

Although the municipality has some projects related to universal accessibility and mobility - the "Eu Já Passo Aqui!" project and the "UMOB Braga" project - which have solved some of the city's problems, it is still necessary to expand this work and strengthen the strategy for universal accessibility, so that it is possible to change mentalities and foster a new perspective on public space. As an opportunity to strategically consolidate the issue of universal accessibility and mobility, the Accessibility Promotion Plan has emerged with the aim of designing a more planned and participatory territory, as opposed to one-off measures.

Drawing up an Accessibility Promotion Plan essentially consists of cross-referencing the urban and architectural diagnosis of the territory in terms of universal accessibility needs, with regard to public space, buildings, transport, infoaccessibility, communication and design. This interdisciplinary approach is the key to the Accessibility Promotion Plan achieving its objectives, and a simple and effective methodology is needed to act systematically, monitoring all the phases and actions by the different sectors under study.

In addition, and understanding the importance of the car in today's mobility chains, it is important to implement strategies that promote the rationalization of its use and, in particular, that consolidate the sharing of road space and road safety between the different modes of travel.

In view of the above, and with a view to promoting road safety in the municipality of Braga, it is proposed to revisit the Municipal Road Safety Plan, to be developed in line with the assumptions set out in the National Strategic Road Safety Plan - PENSE 2020, without forgetting, of course, the guidelines expressed in the guide for drawing up Municipal Road Safety Plans.

The intervention strategy should include a set of strategic guidelines that contribute to the effective reduction of accidents in the municipality, promoting safety for all users of public spaces. In order to reduce road accidents, there are already proposals indicated for the same reason, such as improving and/or upgrading the geometry of roads or intersections, adapting them to their primary function and to the appropriate traffic speeds, implementing traffic calming measures, appropriate signage or creating specific zones.

reduced speed and a reduction in the flow of cars, by discouraging the use of private cars and promoting sustainable modes.

Equally important is the need to develop a circulation, signposting and parking study for the city that acts as an instrument to rescue public space from cars, enabling the creation of detailed scenarios for the correct and effective implementation of traffic reorganization measures.

Strategically part of an integrated policy to promote intermodality, this type of study makes it possible to assess the impact of a range of measures that can include improving the efficiency of the traffic system, such as traffic light management or the construction of a bypass, but also assessing the impact of multimodality measures, evaluating the modal shift to public transport and soft modes.

It is important to know the impacts of implementing a set of measures to readjust the municipal road network, such as the construction or upgrading of sections of the road network, since, inherently, there may be the suppression or alteration of traffic directions and the geometry of intersections. This type of study is also important in terms of gauging the traffic load and service levels that occur mainly during peak hours, enabling quantitative knowledge of the performance of the structuring road mobility axes.

The redefinition of the current circulation scheme in the city of Braga could provide significant improvements in the fluidity of road traffic and, essentially, make it possible to benefit the redistribution of public space among other modes of transport, namely by introducing one-way streets. Any changes made to the circulation system will necessarily require the redefinition of its vertical and horizontal signage, making it possible to guide car users more effectively.

In addition to assessing the dynamics of road traffic, it will be necessary to evaluate the parking policy, based on a model of individual transport demand, and its benefits in certain areas of the city. Mobility management policies can be measured and simulated according to certain attributes, such as setting parking prices differently according to demand in a given area or road axis.

4.7. A INTRODUCTION OF A NEW CULTURE MOBILITY

Awareness-raising and training actions on Accessibility, Mobility and Sustainability, through practical and simple approaches to territories and modes of transport, aim to promote a new culture of sustainability, safety, order, accessibility and mobility for all, particularly in the attention and recognition of people with reduced mobility.

The development of civic awareness for sustainable mobility, through the planning and development of awareness-raising and training actions, could serve as a "motor" for all users to gradually use different modes of travel, favoring the most efficient, most inclusive and most environmentally friendly.

The introduction of a new culture of mobility involves the development of different actions that promote a change of direction towards a more efficient, more inclusive and more sustainable municipality. Awareness-raising and training actions on Accessibility, Mobility and Sustainability, through practical and simple approaches to territories and modes of transport, aim to promote a new culture of sustainability, safety, order, accessibility and mobility for all, namely in the attention and recognition of people with reduced mobility.

The development of civic awareness of sustainable mobility, through the planning and development of awareness-raising and training actions, could serve as an "engine" so that, gradually, all users use different modes of transport for their journeys, giving priority to the most efficient, most inclusive and most environmentally friendly.

The introduction of a new mobility culture involves the development of different actions that promote a change of direction towards a more efficient, more inclusive and friendlier municipality, bringing together residents and visitors, partners - municipal, inter-municipal and even national - public and private operators, and also the entire school community.

In a logic of integrated planning and intervention, it is considered essential to combine the development and implementation of good projects on the ground with the involvement of the population in the process, informing them and making them aware of existing problems, fostering a gradual change in behavior and modal patterns. In this way, it is considered urgent to initiate a cultural change in mobility in the city of Braga, increasing the scope of the set of proposals in this plan.

In fact, the biggest challenge in introducing a new culture of mobility involves inducing a shaping and multiplying effect of new mentalities and behaviors on the part of the different actors in the public space, from the youngest to the oldest.

The aim is to develop a new culture in the use of territories, acting as a tool to help integrate new concepts and practices into municipal planning. In effect, the focus is on raising awareness and promoting good practices, improving planning, design and monitoring of territories, and encouraging the creation of a new culture of accessibility, mobility and sustainability, which are materialized, by way of example, in the following actions:

- Awareness-raising actions to promote travel by soft modes, integrated into teaching how to use them in the city in a healthy coexistence with drivers and other users of the public space;
- Awareness-raising actions on traffic and road safety, in line with the current highway code, among others;
- Classroom training sessions on the implementation of sustainable urban mobility projects that promote intermodality, walking, cycling and public transport, to the detriment of private car use;
- Participation in national and international best practices in the areas of sustainable urban mobility, through participation and integration in strategic networks, absorbing all the *know-how* resulting from best practices already implemented, in all areas of interest in planning, urban design, architecture and mobility management, as is already the case with integration in the CIVITAS, URBACT, BEACON or FASTTRACK networks.

Given the awareness of the ability to induce a change in attitudes, conveyed by awareness-raising and training actions, as well as by the other actions in the plan, the accessibility and mobility policy that the municipality of Braga has been developing could be strengthened, changing mentalities, educating citizens, and consequently paving the way for a new perspective on the territory.

In fact, the aim is for this learning dynamic to cover, on the one hand, a wide range of decision-makers, namely politicians/authorities: Mayors, Councillors and Parish Council Presidents, and, on the other hand, all the municipal technicians who, directly or indirectly, carry out actions arising from the strategic decisions inherent in the SUMP, promoting a more effective approach. Thus, the main objective is to capture attention, induce new experiences in order to generate a feeling of inclusion in the people who take part and their more active participation in the life of a city that is increasingly sustainable and increasingly for everyone.

4.8. EXECUTION SCHEDULE

STRATEGY	PROPOSALS FOR ACTION	TIMING											EXPECTED COSTS	
		Short Term		Medium Term			Long term					Extra Plan	Value	
		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032			
THE WALKABLE CITY	Revisiting the Historic Center in its many facets and themes												180€/m²	
	Revisiting the urban design of Campo da Vinha and its surroundings												200€/m²	
	Revisiting the urban design of Largo da Estação and its surroundings												200€/m²	
	Promote the area of pedestrian circulation												200€/m²	
	Qualifying the design around schools												200€/m²	
	Re-establish neighborhood units - the blocks												200€/m²	
	Implement mobility and tactical urban planning measures												No quantification	
	Promote the development of squares into exclusively or partially pedestrianized areas												200€/m²	
	Introduce pedestrian-oriented directional and information signs												Plate: 100€/unit. Post: 400€/unit.	
	Disseminate and distribute the metro-minute pedestrian map on various media												€5,000 for 5,000 units.	
	Promoting accessibility and mobility for All throughout the urban environment - "I'm coming!" project												180€/m²	
	Implementing and disseminating accessible tourism routes in the city of Braga												180€/m²	
	Improving underpasses and overpasses												350€/m²	
	Improve desirable pedestrian routes												80€/m²	
	Develop the urban ecological corridor to support pedestrian circulation												150€/m²	
	Provide urban furniture for pedestrians to stay and rest												Bench: €2,000/unit. Paper bin: 400€/unit. Drinking fountain: 500€/unit.	
	Implementing the school route												180€/m²	
	Promote quality maintenance of sidewalks												150€/m²	
	Establish a sidewalk construction program in linear settlement areas - from the road to the street												150€/m²	
	Introduce general pedestrian safety measures												180€/m²	
PROMOTING PUBLIC TRANSPORT	Implement dedicated public transport corridors on the most popular routes												100€/m²	
	Define solutions for an own-channel transportation system												BRT infrastructure +/- 7 to 9 M€/km LRT/Surface rail infrastructure +/- 18 to 20 M€/km Metro infrastructure +/- 70 to 85 M€/km High Speed Rail Line +/-15 to 20 M€/km	
	Gradually replace the public road transport fleet with more sustainable vehicles												Electric minibus €165,000 Electric bus €450,000	
	Increasing the number of cabs and promoting the introduction of more sustainable vehicles												Low Range Electric Light Vehicle - +/- 25.000€ to 30.000€ Medium Range Electric Light Vehicle - +/- 30.000€ to 40.000€ High Range Electric Light Vehicle - +/- 40.000€ to 75.000€	
	Improve the comfort, accessibility and information at bus stops, taking universal accessibility into account												Shelters, infrastructure and access platform - €6,000	
	Implement real-time information systems at key road transport stops												7,500€/unit. Presupposes the existence of operating support	
	Optimizing Braga's urban transport network												No quantification	
	Extending the <i>School Bus</i> service												No quantification	
	Implement a flexible transport system												No quantification	
	Improving the frequency of urban transport												No quantification	
	Create the City Card, extending the advantages and benefits granted to public transport users												No quantification	
	Revisiting public transport fare policy, with a view to reducing prices												Study 20.000€	

						TEMPORALIDADE							EXPECTED COSTS
STRATEGY	PROPOSALS FOR ACTION	Short	Deadline		Medium Term				Long term			Extra Plan	Value
		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032		
THE CYCLABLE CITY	Implementing the city's cycling network												180€/m²
	Implement measures to promote cycle-friendly areas and ensure permeability between blocks												200€/m²
	Improve the pedestrian and cycling axis of the East River												200€/m²
	Implement cycling routes linking the city to its outskirts and areas of economic activity												180€/m²
	Promote the continuity of inter-municipal cycling routes												180€/m²
	Implement a public bicycle system												300 to 350 parking spots / 1,250 to 1,500 conventional bicycles: €1,350,000 conventional bicycles + signage for parking spots Plus maintenance and annual fees
	Provide for the shared electric scooter system and its regulation												Study 20.000€ System operation by operators
	Provide supportive street furniture												Bench: €2,000/unit. Paper bin: 400€/unit. Drinking fountain: 500€/unit. Cyclopark: 140€/unit.
	Develop the urban ecological corridor to support cycling												150€/m2
	Introduce directional and information signs aimed at cyclists												Plate. 100€/unit. Post: 400€/unit.
	Create and disseminate the cycling network map on various media												€5,000 for 5,000 units.
	Collaborate with U. Minho to implement a project to encourage the use of bicycles in the academic community												No quantification
	Promoting a mobile application to encourage everyday cycling												No quantification
OPTIMIZING THE ROAD SYSTEM	Implement a new road hierarchy												No quantification
	Building bypasses and new structural accesses to upgrade urban centers												350€/m²
	Completing the urban structuring road network in the city of Braga												No quantification
	Increasing traffic flow at the Infias junction												200€/m²
	Reversing urban fractures - Avenida Padre Júlio Fragata - Avenida Frei Bartolomeu dos Mártires - Avenida Dr. Francisco Salgado Zenha - Avenida Miguel Torga												200€/m²
	Reversing urban fractures - Avenida Imaculada Conceição - Avenida João XXI - Avenida João Paulo II axis												200€/m²
	Reversing urban fractures - Rua de Caires axis												200€/m²
	Reversing urban fractures - Avenida António Macedo axis												200€/m²
	Apply traffic calming measures												Track raising €5,000 (76m²) Speed bumps €2,700 (7m) Illuminated markers €4,000 (per crosswalk) Beacons €1,5000 (15m)
	Revisiting the regulation of the Historic Center's Conditional Access Zone												Study 20.000€ Management Center 80.000€ 3 Access Points 75.000€
	Regulating tourist transport in Braga city center												20.000€
	Implementing real-time information systems												750.000€
	Promote and publicize the <i>car pooling</i> system												5.000€ per year
	Evaluate the possibility of creating a <i>car sharing</i> and/or <i>scooter sharing</i> system												Study 20.000€
	Increasing the number of electric charging stations												15.000€ per post
	Revisiting the policy of charging for parking on public roads												Parking study 75.000€
	Define a coherent pricing policy for parking spaces in the city												Parking study 75.000€
	Reinforce measures to combat illegal parking												No quantification
	Implement deterrent parking at the main entrances to the city												Surface 2.000€ per place Silo 10.000€ per place Underground 15.000€ per place Mechanical Park €20,000 per seat Plus operating costs.
	Reinforcing the role of parking lots in deterring parking on public roads												No quantification
	Regulating loading and unloading operations and the circulation of heavy vehicles												Study for regulation 10.000€
	Revisiting the distribution of loading and unloading bays												Study 75.000€
	Promote the use of less polluting vehicles for the distribution of goods												Electric goods vehicle 22,000€ to 58,000€ Electric quadricycle 20,000€

	Create a platform and micro-logistics system for the Conditional Access Zone in the Historic Center																		Infrastructure and equipment 290.000€ Operating costs (including staff, vehicle rental and energy) 200.000€ per year
STRATEGY	PROPOSALS FOR ACTION	TIMING										EXPECTED COSTS							
		Short Term		Medium Term			Long term					Extra Plan		Value					
		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032								
THE INTEGRATION OF MODES	Establishing the Braga Intermodal Platform															Contract 7.5 M€			
	Upgrading Braga's Central Bus Station															10% of the value for study and project			
	Creating an interface at the University of Minho															4 M€			
	Creating a high-speed rail network interface															1,5 M€			
	Create the mobility center and other intermodal information points in the city of Braga															10% of the total value for study and project			
																15 M€			
	Implement a multimodal integrated ticketing system															10% of the value for study and project			
	Create an app and website to disseminate information on modes of transport															175.000€			
THE DYNAMICS OF MOBILITY PLANNING	Promoting the integration of bicycles into public transport															Feasibility: depends on the evaluation of the existing equipment, namely the SAE (operation support system) and the box office of the various operators.			
	Develop an Accessibility Promotion Plan for people with reduced mobility															15.000€			
	Draw up a Municipal Road Safety Plan															No quantification			
	Integrate proximity urbanism into territorial planning instruments															75.000€			
INTRODUCING A NEW CULTURE OF MOBILITY	Carry out a detailed Circulation, Signage and Parking Study for the city															30.000€			
	Develop awareness and education actions															No quantification			
	Develop training actions															75.000€			
																15.000€ per year			
																15.000€ per year			

Management process

5

5.1. GOVERNANCE

According to Carmo (2013), "governance is a process of building public value in a network. It requires: motivation and legitimacy of decisions outside formal and hierarchical circuits; balance and representativeness of the actors; and accountability in the form of objective responsibility."

The implementation of a territorial governance model must take into account the scale of the actions and the power with which they are directly related.

According to Dallabrida, the territorial dimensions of action and power are subdivided into three distinct instances (Figure 1): the state instance, the public-private instance and the business instance, each of which is connected to specific governance dynamics. Territorial governance is directly correlated with public and private entities, with which the state body is associated through government policies and the business body through corporate governance.

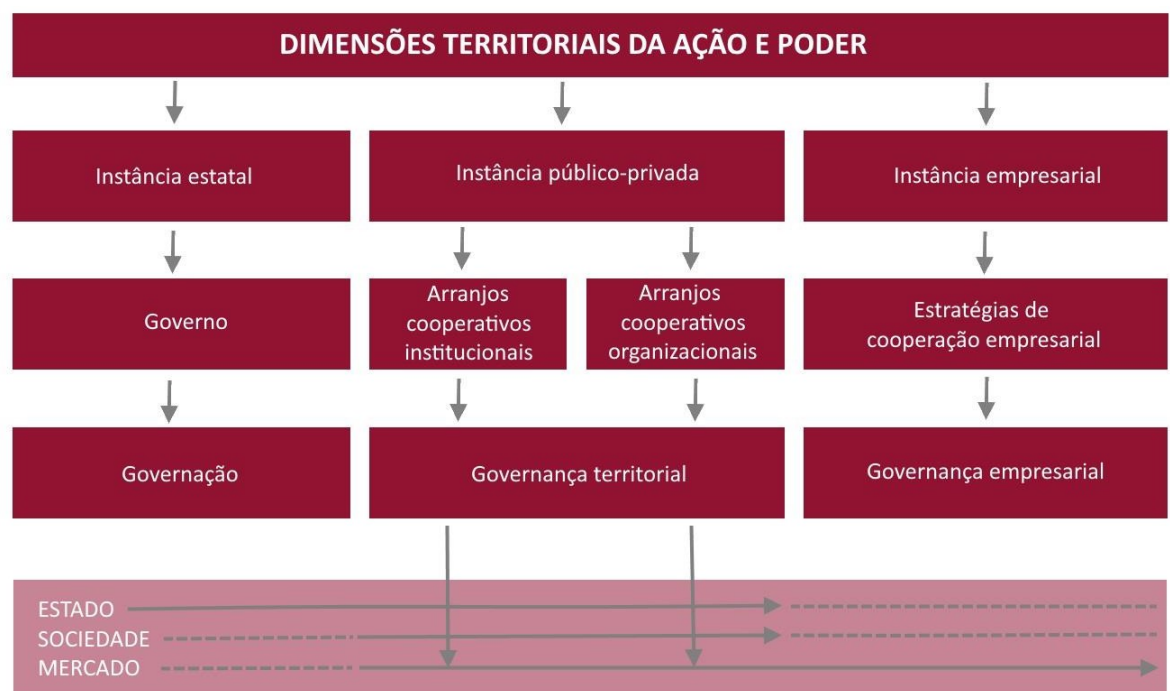


Figure 7. Contextualization of territorial governance practices

Source: Dallabrida, 2015

The entire governance process should be based on "the balance and representativeness of the actors involved, guaranteeing the legitimacy of the decision, building relationship mechanisms, defining the territoriality of action, designing engines of trust and motivation, defining the objects of deliberation, creating accountability schemes, promoting collective learning tools and enshrining forms of participation" (Carmo, 2014).

The implementation of this plan should be a natural continuation of its drafting process. The city council's efforts should now be directed towards coordinating and monitoring its implementation according to the action program and proposals outlined, with any revisions and updates supported by monitoring mechanisms.

It is therefore proposed that the governance model be organized into two levels of coordination, political and technical, with a view to simplification, prioritizing the definition and allocation of responsibilities for the exercise of political and technical guidance functions, and valuing the involvement of partners.

Strong and assertive coordination is essential for the success of this plan, which is why it is proposed to create three structures that complement each other but have different roles in the plan's implementation process, as shown in the following model:

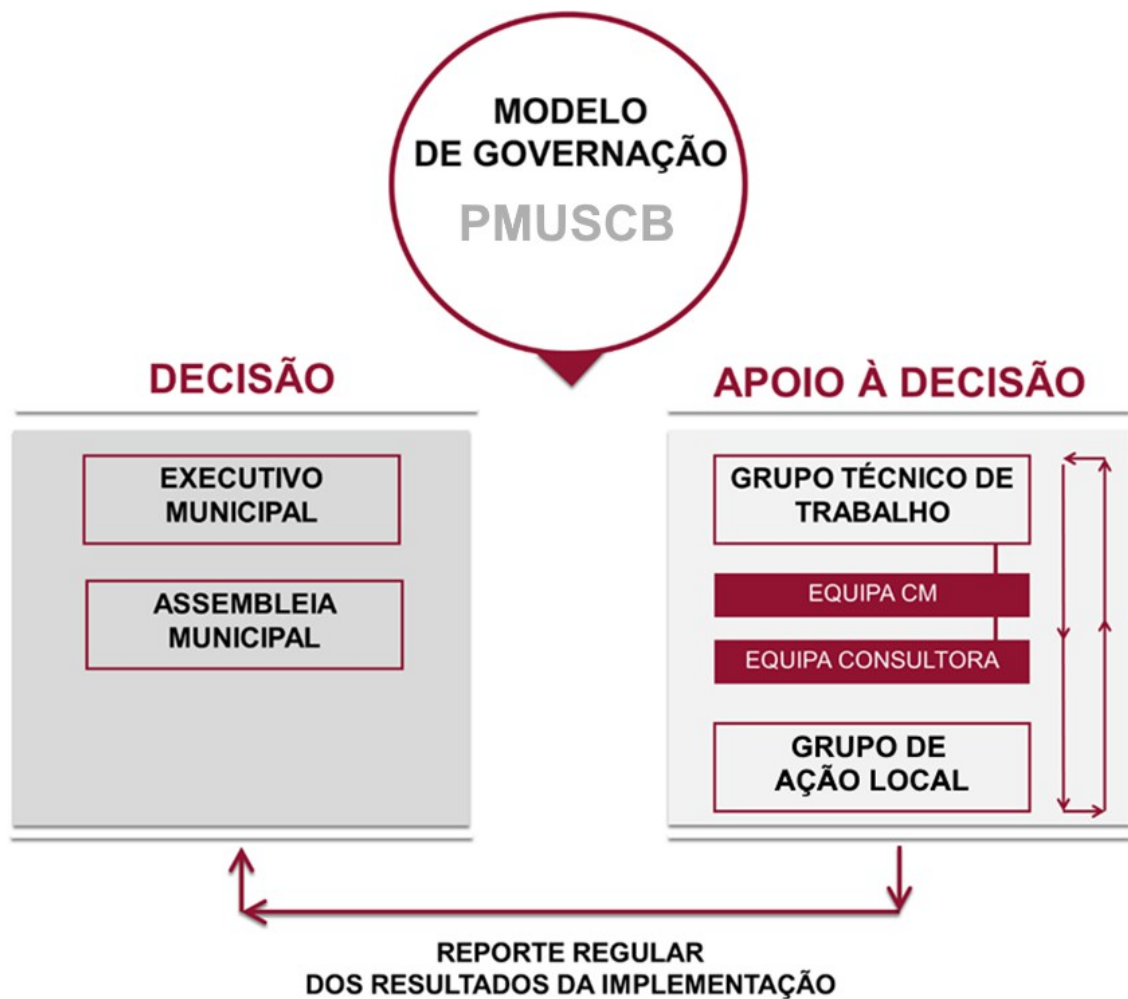


Figure 8. Outline of the PMUSCB Governance Model

Source: mpt®, 2018

Table 1. PMUSCB governance model

POLITICAL AND TECHNICAL STRUCTURES	COMPOSITION	FUNCTION
Executive Committee	<ul style="list-style-type: none"> President Councillors 	<ul style="list-style-type: none"> - Validate the main objectives and lines of action of the PMUSCB; - Politically validate the main results and any adaptations to the plan; - To constitute a political intermediary so that the guidelines of the plan are adopted at the level of each competent authority, within its scope of political decision-making
Technical Working Group (GTT)	<ul style="list-style-type: none"> Specialized Technical Team, Municipal Working Group and External Consultants 	<ul style="list-style-type: none"> - Liaison between the technical team and the various levels of governance: - Checking the information produced under the plan and accompanying the design team in the various actions; - Proposing and leading any adjustments to the plan.
Local Action Group for Sustainable Urban Mobility in Braga (GAL)	<ul style="list-style-type: none"> CMB CCDR-N CIM Cávado Urban Quadrilateral TUB Bragaciclável University of Minho ACAPO PSP GNR Municipal Police 	<ul style="list-style-type: none"> - Accompany the development of the plan, passing on their experience and information; - Issuing opinions (to the competent authorities); - Participate in the implementation of the plan through the development of proposals.

The political involvement and participation of all the relevant actors in the organization of mobility are determining factors for the successful implementation of the PMUSCB. Thus, the set of main players involved in the development of the plan should include Braga City Council, with its executive and municipal technicians; external entities that directly or indirectly contribute to the improvement and organization of mobility (transport operators, infrastructure managers and central and regional administration bodies); and the population in general.

5.2. MONITORING

The monitoring of the plan consists of adopting a methodology to evaluate and guide the implementation of the SBCP at certain intervals. Monitoring is therefore an instrument for follow-up, management, decision support and communication.

The basic function of monitoring is to ensure the implementation of the actions defined and to assess their effectiveness in the different areas of intervention, as well as the achievement of the objectives, a situation that will only be possible if the effects of the implementation of these actions are assessed. This evaluation should be carried out by checking a set of indicators that will make it possible to assess and correct trajectories that are not following the intended course.

According to the Guide for the preparation of the PMT (IMTT, 2011), which also fits in well with the PMUSCB, monitoring and evaluation must be carried out in a transparent manner and, for this purpose, a Technical Working Group must be set up whose mission will be to develop the following actions:

- Implement a set of monitoring tools, with the support of the Local Action Group, namely by establishing a set of indicators, validated by the Executive Committee;
- Evaluate the results obtained in relation to the objectives set out in the plan (both quantitative and qualitative);
- Consult the population in order to assess the changes in behavior that have occurred and their opinions on the proposals implemented;
- Proposing and leading the implementation of any corrective measures and adaptations to the plan;
- To report regularly to the Executive Board on the main conclusions of this process;
- Produce progress reports.

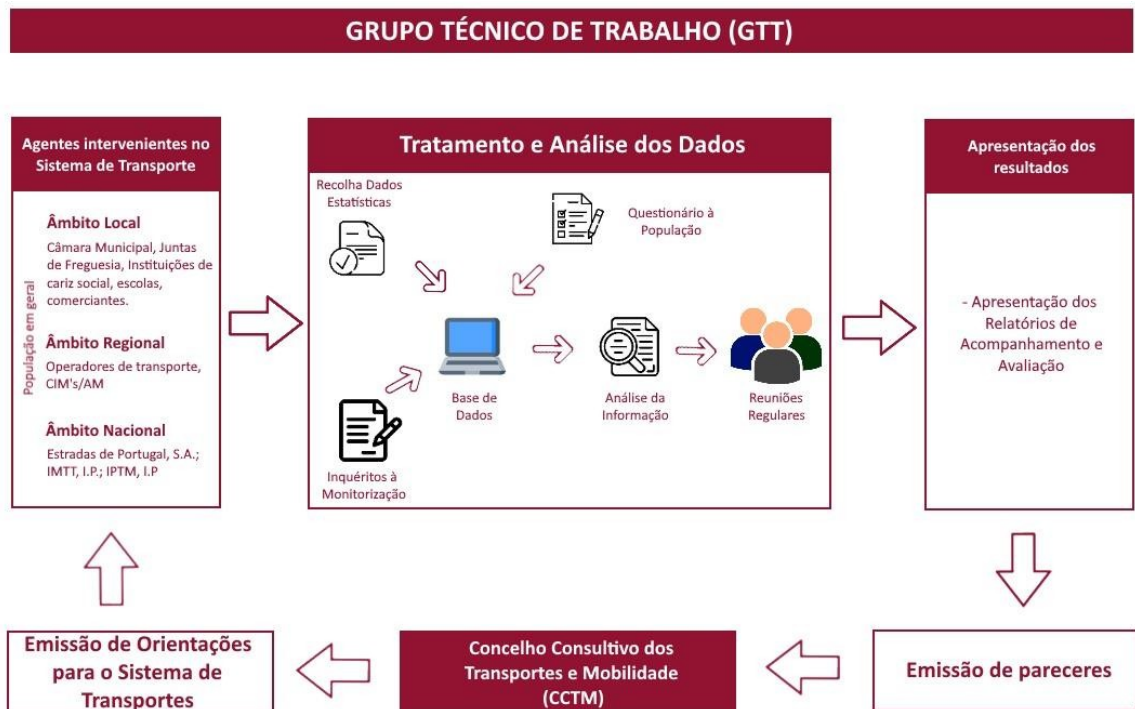


Figure 9. Mértola Sustainable Mobility Study

Source: Guia para a Elaboração de Planos de Mobilidade e Transportes, IMTT, March 2011 with reference to the Project Sustainable Mobility (APA) - Mértola Municipality, IDE-FCSH/UNL, 2007

The operationalization of the monitoring process will have to be based on a regular supply of information and a systematic accumulation of historical data to support ongoing evaluation and thus lead to the adoption of policies and proposals that are more adjusted to the local reality, as well as better dissemination and control of the plan's results.

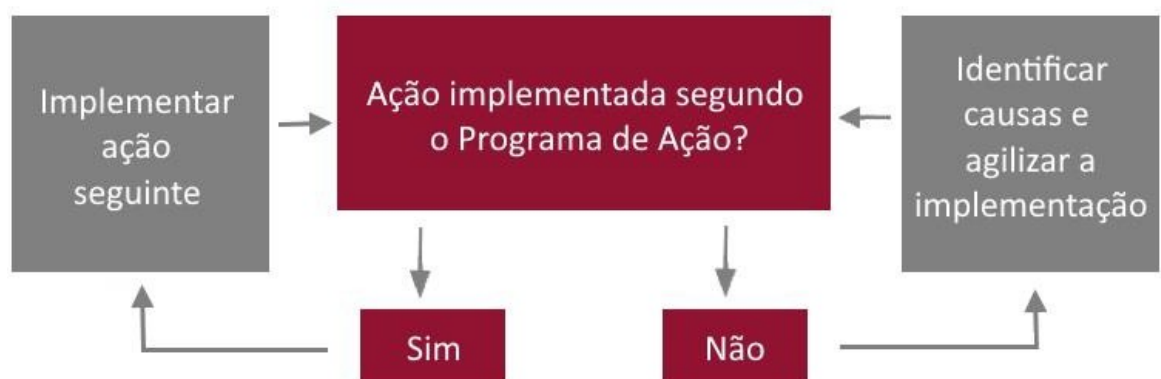


Figure 10. Monitoring the implementation of actions

Source: Guia para a Elaboração de Planos de Mobilidade e Transportes, IMTT, March 2011

The existence of appropriate information is a critical factor in this process, and it is necessary to create mechanisms for its collection, production, regular updating, circulation and sharing. The

The costs and organizational difficulties of these procedures are often difficult to overcome.

One solution could be to set up a local mobility observatory, involving various stakeholders/transport operators and involving them in the collection effort. Some of the necessary information is already compiled by the various players, and all that is needed is the establishment of protocols for acquiring and processing this information.

The monitoring process presupposes the creation of a set of indicators relating to the different themes of the Plan, which should measure the implementation of the proposed actions and the effects of these actions in terms of the plan's objectives. The collection and storage of data should lead to an analysis and synthesis of the results, with the aim of drawing conclusions and not merely creating a database.

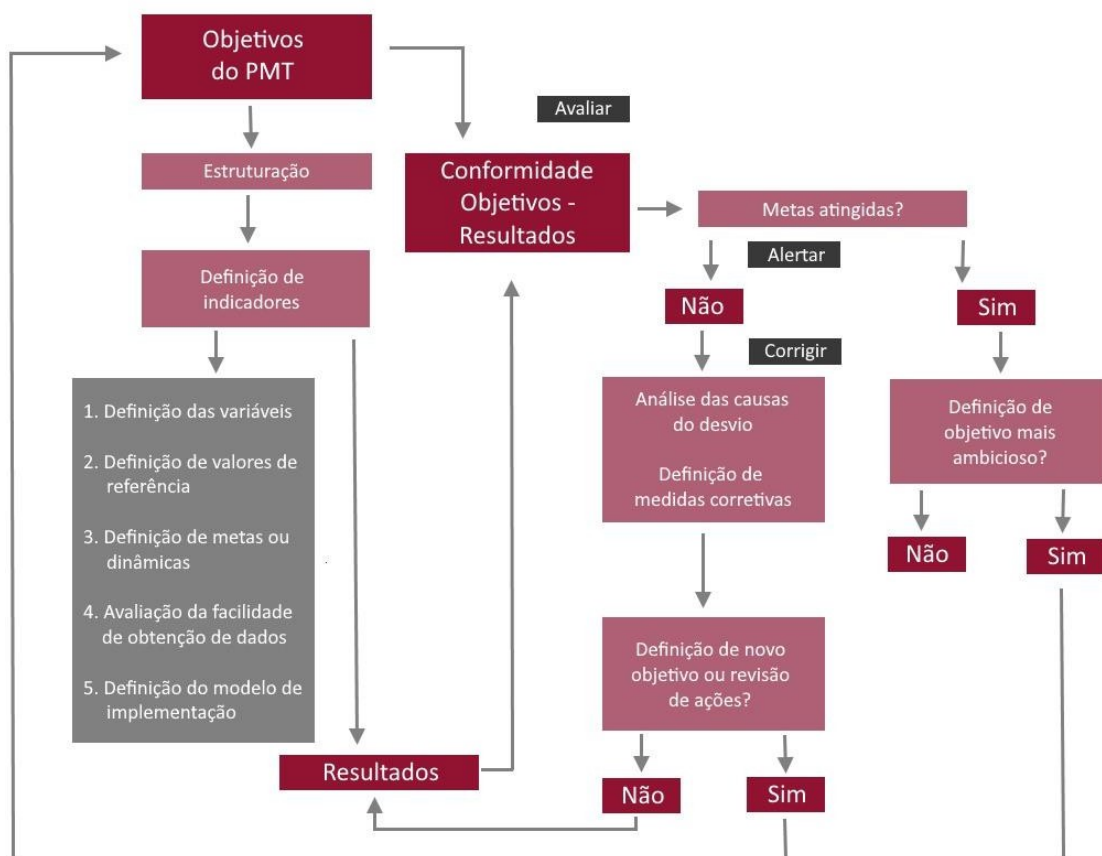


Figure 11. Monitoring the achievement of objectives

Source: Guia para a Elaboração de Planos de Mobilidade e Transportes, IMTT, March 2011

Within the scope of Management and Decision Support, it is necessary to identify possible adaptations and/or corrections that may be necessary, depending on the developments detected. At this stage, the need for additional studies may be identified in order to delve deeper into certain issues or to carry out expert opinions on the implementation of certain measures. For example, an action may prove to be insufficient to achieve a certain objective, or even produce undesirable and unexpected effects.

The information obtained during monitoring also makes it possible to inform the population about the implementation of the study, making it possible to gather reactions and understand how the different interventions are perceived. The population's participation in the implementation phase should only focus on the structuring interventions, otherwise the implementation period will be too long and the planned actions will not be carried out on time.

Therefore, as is the case with the PMOT, the PMUSCB should be constantly evaluated by drawing up Urban Mobility Status Reports (REMU), which should be presented to the Municipal Assembly every two years, and which should include an assessment of the evolution of the indicators associated with each proposed target.

It is recommended that the Plan be reviewed and updated after 10 years or when the aforementioned reports identify levels of implementation and an evolution in the underlying environmental, economic, social and cultural conditions that could lead to a change in the model defined.

The **monitoring indicators** to be considered within the scope of the PMUSCB seek to define the expected impact following the implementation of the proposals and are presented below:

Table 2. Indicators and targets to be achieved by 2032

INDICATOR	REFERENCE		TARGET (2032)
	YEAR	VALUE	
Encouraging sustainable modes of travel			
Predominantly pedestrian areas (m²)	2018	245.000	360.000
Cycle network length (km)		18	90
Number of bike-sharing stations (units)		0	150
Changing the modal split of commuting by the resident population			
Trips made by bicycle (%)	2011	0,2	10
Journeys made on foot (%)		17	25
Travel by public transport (%)		16	26
Travel by individual motorized transport (%)		67	39
Improving the quality of the urban environment			
CO2 emissions associated with the transport sector (tons/year)	2015	200.529	170.450
Reducing the impact of individual transportation			
The municipality's motorization rate (cars/1,000 inhabitants)	2017	580	435
Number of occupants per vehicle (pax)	2012	1,5	2
Reducing road accidents			
Reduction in the number of accidents per year (%)	2016	559	50%
Reduction in the number of fatalities (%)		3	100%

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