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D.1.3.1 Local plan for the city of Modena

Final version

October 2025

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Abbreviations

AF	Application form
DRT	Demand-responsive transport
KPI	Key Performance Indicator
PT	Public transport

1. Introduction

This document is a plan for the development of public transport in the city of Modena, following the principles that led to the creation of the OPTI-UP project.

The Modena Local Plan is based on:

- A comprehensive strategy for a sustainable and efficient public transport (PT) network in Central Europe, which includes a list of goals, measures, KPIs, stakeholders, etc. (D.1.3.2), and an analysis of PT needs in Modena through the collection of PT demand, operations, and policy data, as presented in the *Comprehensive Data Report on Existing Public Transport Networks and Best Practices* (D.1.1.1);
- Urban plans already defined by the Municipality of Modena, such as the SUMP (Sustainable Urban Mobility Plan), and at the regional level, such as the PRIT (Regional Integrated Transport Plan);
- A Unified database of collected public transport data (D.1.1.2);
- The Modena transport model, developed from existing base models (D.1.2.1).

This document facilitates the implementation, but also evaluation, of public transport planning as well as future pilot projects, including the OPTI-UP pilot project in Modena.

Through collaboration with associated partners (AP) and knowledge sharing with other stakeholders, this Local Plan aims to promote Modena's urban development objectives and serve as a model for other European cities.

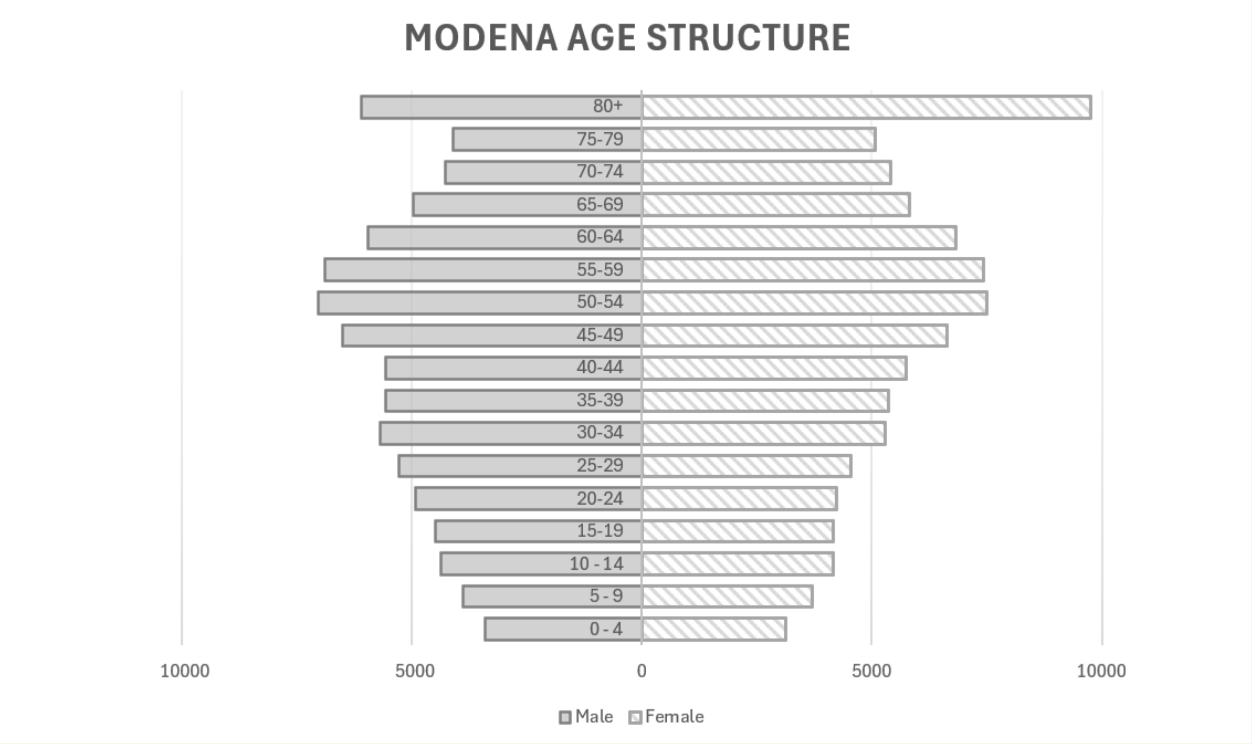
2. Background and Context

This chapter outlines the background and context in which the Local Plan operates. It summarizes the main findings from the **territorial, demographic, and transport** analyses—with a specific focus on public transport supply and usage—and provides a **review of objectives** set by **higher-level policies and plans** on mobility. Together, these results establish the knowledge base for the strategic choices developed in the following chapters.

2.1. Context overview

The information presented in this chapter constitutes a core set of baseline inputs relevant to the development of the Local Plan and derives from the in-depth analysis carried out by Opti-Up in Deliverable D.1.1.1.

Modena is one of the main commercial centres in Emilia Romagna. It is in the Po Valley and has a population of 185,009 inhabitants; the entire province of Emilia-Romagna has 706,972 inhabitants and the country has 58,989,749 inhabitants (data updated to 2024). The demographic rate of the city of Modena is generally in continuous decline. It has the oldest median age among the six case study areas but also the highest population density, thanks to its geographical position, one of the most industrialized areas in Italy.

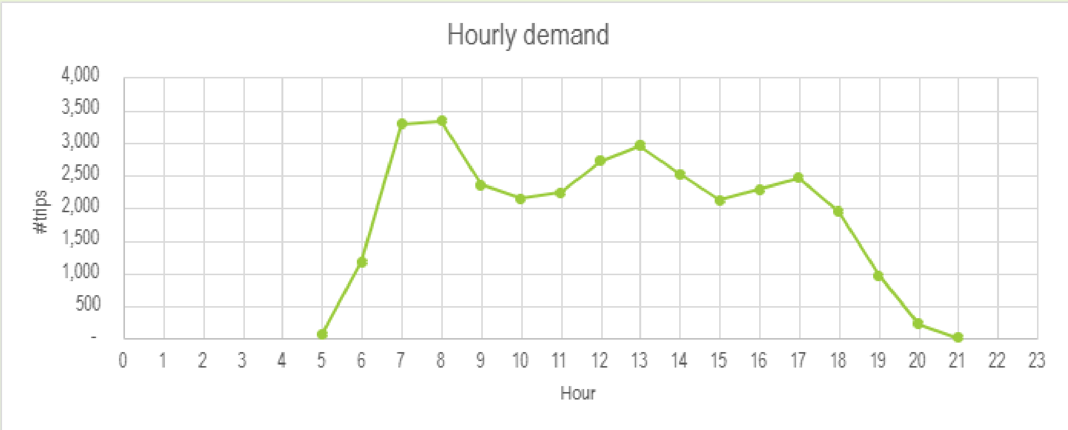


The history of PT in Modena started in the 19th Century and many changes were witnessed by citizenship. The tramway was settled but dismantled after the Second World War due to high maintenance costs. It's the main reason that led to a brand-new trolley network that is still functioning.

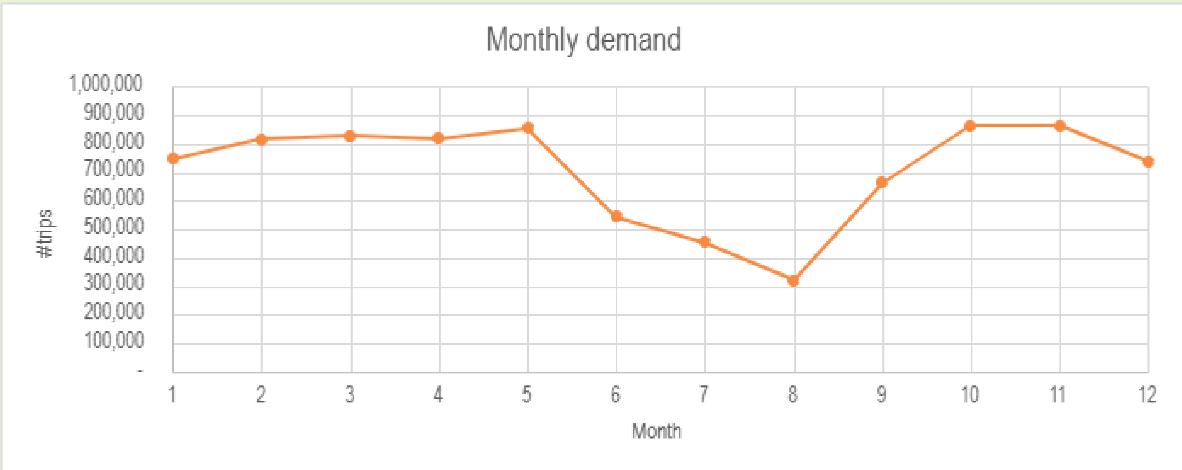
Trolleybuses are nowadays the only PT vehicle type allowed to pass through the Old Town city center, but thanks to technology, many of them are now IMC trolleybuses. The average age of the fleet is reducing in general, mainly thanks to the Italian Piano Strategico Nazionale per la Mobilità Sostenibile (PSNMS), and old Diesel buses are being replaced with CNG buses. By the end of 2026 it is also planned to put into service the first hydrogen bus in the city.

Regarding the least dense zone of the city, a new DRT service was implemented in 2004 to replace the old PT network, trying to optimize the overall PT service, reducing operational cost.

The transport demand, reprocessed based on validation data collected onboard urban public transport vehicles, is presented here for a typical winter weekday. The analysis reveals that the service is predominantly used for home-to-work and home-to-school travel, with a pronounced peak in the morning between 7:00 and 8:00 AM, and a secondary peak around 1:00 PM, corresponding primarily to the travel patterns of high school students. A third peak, observed around 5:00 PM, indicates a different user segment, more closely associated with standard work-related commuting schedules.



The predominance of school-related ridership is further confirmed by the subsequent graph, which shows a significant drop in passenger numbers during the summer period, coinciding with school closures. This seasonal variation highlights the strong correlation between public transport usage and the academic calendar.



It is important to note that the significant decline in public transport ridership observed during the summer period is not solely attributable to the absence of school-related travel demand. A substantial contributing factor is the seasonal reduction in service offered, as public transport frequencies are typically lowered during the summer months. This operational adjustment, driven primarily by the need to contain costs, results in a less attractive service offering, thereby discouraging use even among non-school-related passengers.

Recognizing this issue, the Municipality of Modena has, in recent years, initiated efforts to reassess and improve summer service levels, aiming to slightly increase frequencies and maintain a more consistent level of service throughout the year. These adjustments are intended to better accommodate the mobility needs of users not tied to the academic calendar, such as workers, tourists, and other residents, and to support broader goals of modal shift and sustainable urban mobility.

This strategic reconsideration reflects a growing awareness of the importance of maintaining public transport attractiveness year-round, not only to serve existing demand but also to foster long-term behavioural change and reduce dependency on private vehicles.

2.1. National and regional mobility Plans goals

The goals and measures defined within a local public transport plan should not be developed in isolation. Instead, they must align with the broader strategic objectives established at European, national, regional, and local levels. For small and medium-sized cities, this alignment is especially important: it ensures consistency with overarching policy directions, facilitates access to funding and technical support, and enhances the strategic coherence of local actions.

A comprehensive understanding of these higher-level frameworks allows cities to build their local strategies on a robust foundation, ensuring that local choices actively contribute to shared goals such as climate neutrality, improved public health, digitalization, and social equity in transport systems.

National Level

PSNMS

The Strategic National Plan for Sustainable Mobility (PSNMS) was established under Article 1, paragraphs 613–615 of Law 232/2016 (Budget Law 2017) and formalized by the DPCM No. 1360 of April 24, 2019. It was developed by the Ministry of Infrastructure and Transport (MIT), in collaboration with the Ministry of Economy and Finance (MEF), the Ministry of Economic Development (MISE), and the Ministry for the Environment (MATTM).

The plan's primary objective is the renewal of the public transport bus fleet, particularly for local and regional services. At the time of its inception, the average age of Italian buses was around 11 years, compared to the European average of 7 years. This renewal is essential not only for improving service quality but also for reducing environmental impact.

The PSNMS aims to:

Improve air quality by replacing older, polluting vehicles with modern, low-emission alternatives.

Promote innovative technologies, including electric, hybrid, and alternative fuel vehicles, in line with EU regulations and international climate agreements.

Support sustainable urban mobility, contributing to the reduction of greenhouse gas emissions and enhancing the overall efficiency of public transport systems.

To achieve these goals, the plan allocates a total of €3.7 billion in state funding, distributed over several years. These resources are directed primarily to metropolitan cities and municipalities with populations exceeding 100,000, where the need for fleet modernization is most urgent

Regional Level

PRIT

The PRIT 2025 (Piano Regionale Integrato dei Trasporti) of Emilia-Romagna outlines a strategic vision for developing a sustainable, efficient, and inclusive regional transport system. Its core mission is to support a territorial model that balances environmental, social, economic, and governance priorities, aligning mobility policies with broader goals of sustainability and quality of life.

From an environmental perspective, PRIT 2025 aims to reduce the negative impacts of mobility on ecosystems and public health. This includes cutting greenhouse gas emissions, minimizing energy and land consumption, and mitigating urban landscape degradation. The plan promotes cleaner transport modes and encourages a shift away from private motorized vehicles toward collective and non-motorized mobility options.

On the social front, the plan seeks to enhance accessibility across the region, ensuring that citizens can easily reach workplaces, educational institutions, recreational areas, and essential services. It emphasizes the integration of different transport modes, the reduction of unnecessary travel through digital services and remote work, and the improvement of safety and inclusivity for all users.

Economically, PRIT 2025 supports the development of transport networks and services that boost regional competitiveness. By improving efficiency and reducing sectoral costs, the plan aims to create a more dynamic and open market for mobility services, fostering innovation and economic growth.

A key element of the plan is its participatory approach, which promotes transparent governance and active involvement of all stakeholders—citizens, institutions, and businesses. PRIT 2025 recognizes that sustainable development requires shared responsibility and coordinated action across sectors.

One of the foundational principles of PRIT 2025 is the hierarchical organization of transport networks and services, which ensures that infrastructure and mobility offerings are structured efficiently. This principle guides the development of both urban and interurban mobility systems, with a strong focus on enhancing public transport and integrating various modes of travel.

PRIT 2025 also emphasizes modal integration, fare coordination, and user-friendly information systems to simplify travel and encourage public transport use. Investments and actions are tailored to the hierarchical structure of the network and aligned with urban planning strategies, ensuring coherent and effective development.

Ultimately, PRIT 2025 represents a comprehensive and forward-looking approach to mobility, aiming to create a transport system that is sustainable, inclusive, and responsive to the evolving needs of Emilia-Romagna's citizens and economy.

As a regional planning instrument, the PRIT does not focus on individual municipalities but rather defines overarching objectives at a supra-municipal level. Nevertheless, among the key actions that directly involve the Municipality of Modena are the renewal of public transport fleets across provincial territories and the enhancement of regional rail services along major corridors. Specifically, the plan calls for an increase in service frequency along the Via Emilia axis and identifies the need to double the railway tracks on the Modena–Carpi–Mantua route, in order to establish a viable alternative to private vehicle use.

PAIR

The PAIR 2030 (Piano Aria Integrato Regionale) of Emilia-Romagna is a strategic environmental plan aimed at improving air quality across the region. Building on the foundations of its predecessor, PAIR 2030 aligns with European and national regulations to achieve air quality standards that protect human health and the environment. Its primary goal is to reach these standards as quickly as possible, maintain good air quality where it already exists, and improve it where it falls short.

The plan operates within a complex regulatory framework and emphasizes strong integration with other sectoral policies—particularly those related to climate change mitigation, sustainable mobility, and urban planning. PAIR 2030 is closely aligned with broader regional and national strategies, such as the Pact for Work and Climate and the Regional Agenda 2030 for Sustainable Development, reinforcing its role in the ecological transition.

A key driver behind the plan is the ongoing infringement procedure against Italy (Case C-644/18), initiated by the European Commission due to persistent exceedances of PM10 pollution limits in several areas. The European Court of Justice ruled in 2020 that Italy had failed to comply with Directive 2008/50/EC, citing systematic and continuous violations from 2008 to 2017—many of which are still unresolved. PAIR 2030 is therefore not only a strategic necessity but also a legal obligation.

To address these challenges, the plan promotes a wide range of measures aimed at reducing emissions of atmospheric pollutants. One of the most impactful areas of intervention is public transport, which plays a central role in reducing CO_2 emissions from private vehicles. PAIR 2030 supports the expansion and modernization of public transport services, recognizing their potential to shift mobility patterns toward more sustainable modes.

This includes investments in fleet renewal, supported by various national and regional funding mechanisms. These efforts are lowering the average age of vehicles and phasing out the most polluting ones in favour of cleaner technologies, such as electric buses and low-emission vehicles. Funding sources include the Ministry of Ecological Transition, the Strategic National Plan for Sustainable Mobility, and complementary resources from Italy's PNRR (National Recovery and Resilience Plan).

PAIR 2030 also contributes to the European Union’s broader environmental goals, such as the Zero Pollution Action Plan and the Fit for 55 packages, which aims to reduce greenhouse gas emissions by 55% by 2030 on the path to climate neutrality.

In addition to transport, the plan integrates actions across agriculture, industry, energy, and urban development, promoting cross-sectoral collaboration to reduce emissions. It encourages local authorities to adopt coordinated strategies and supports public awareness campaigns to foster behavioral change.

Local Level

SUMP

The Sustainable Urban Mobility Plan (SUMP) of Modena integrates and builds upon the objectives of previous regional and national mobility and environmental plans. It establishes two overarching strategic goals that guide the city's mobility transformation toward 2030 and beyond.

Environmental Quality

The first core objective is to improve both local and global environmental conditions, with a particular focus on reducing the population’s exposure to harmful pollutants. In alignment with the PAIR 2020 (Regional Air Plan of Emilia-Romagna), the SUMP sets a target to reduce greenhouse gas emissions from traffic by at least 40% by 2030, with the ambition to reach minimum emission levels by 2050, consistent with the Paris Agreement (COP21). This goal is pursued through modal shift strategies, promotion of active mobility, and the enhancement of public transport systems.

Road Safety

The second strategic goal is to significantly reduce road traffic accidents, with a 50% reduction target by 2030, in line with European and national safety policies. Particular attention is given to vulnerable road users—such as children, the elderly, pedestrians, and cyclists—through the adoption of the “Vision Zero” approach, which aims to eliminate traffic fatalities in the long term.

Supporting Objectives

To achieve these macro-goals, the SUMP defines a set of operational objectives derived from stakeholder consultations. These include:

Public Transport Optimization: Enhancing the modal balance by improving intermodal integration between road and rail transport.

Urban and Transport Planning Integration: Strengthening coordination between transport service planning and urban development strategies.

Accessibility Improvements: Expanding and improving access to local public transport services.

The plan also envisions a renewed public transport system, featuring:

Development of intermodal hubs to facilitate seamless transfers.

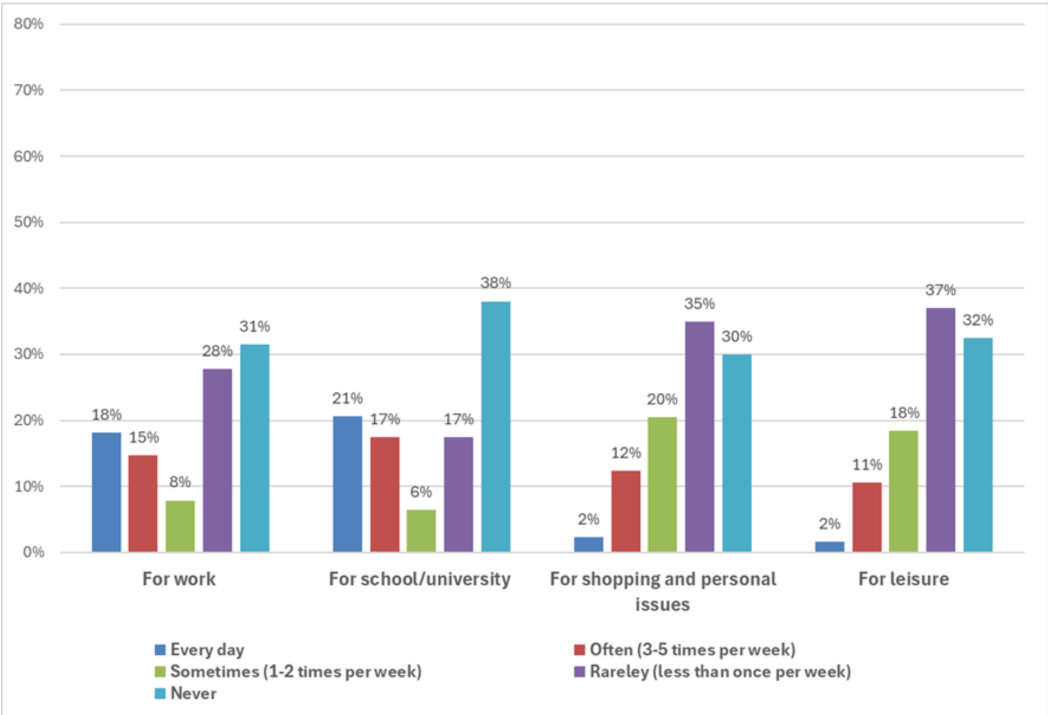
Implementation of high-frequency transit lines and a hierarchical reorganization of urban routes.

Upgrading of bus stops and infrastructure, and fleet renewal through regional and national funding programs, prioritizing low-emission and electric vehicles.

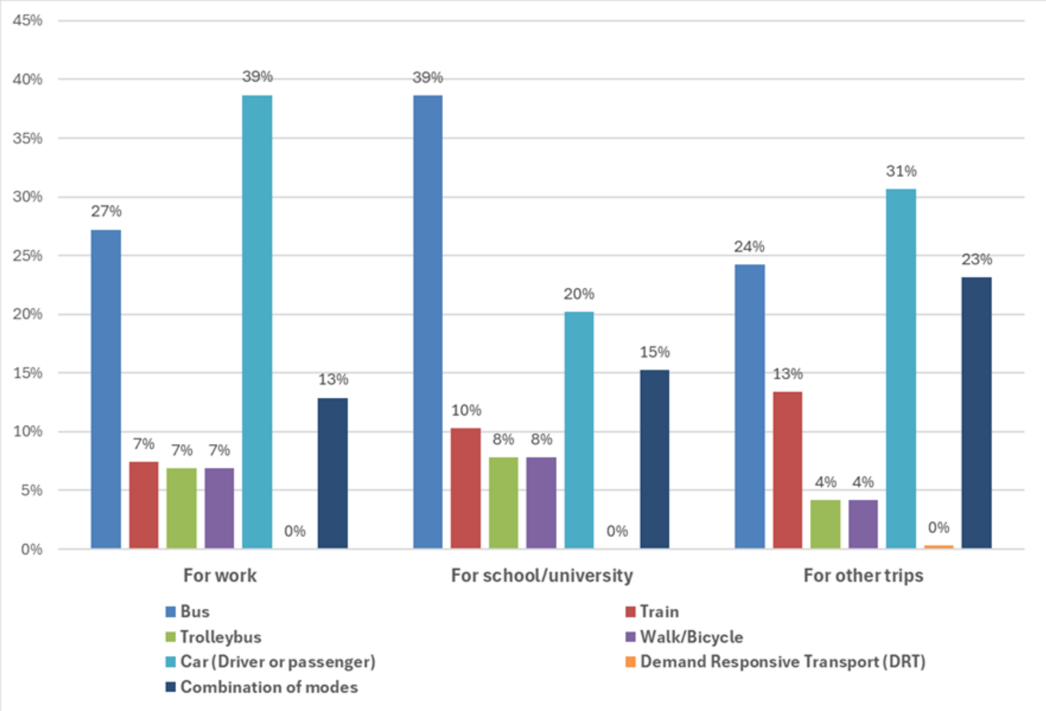
2.2. Results of survey

The goal of the survey is to find out what the current level of citizen satisfaction is, considering various aspects, such as the coverage of the transportation system relative to the city, reliability of schedules, vehicle capacity, and cleanliness, and what can be improved. Users' input can serve Transportation operators as well as the Public Administration or Municipalities, Regions that manage public transportation, as a basis for future improvements and to create a public transportation system that is more efficient, comfortable, accessible for all, and takes into account the real needs of citizens.

How often do you use the Public Transport?

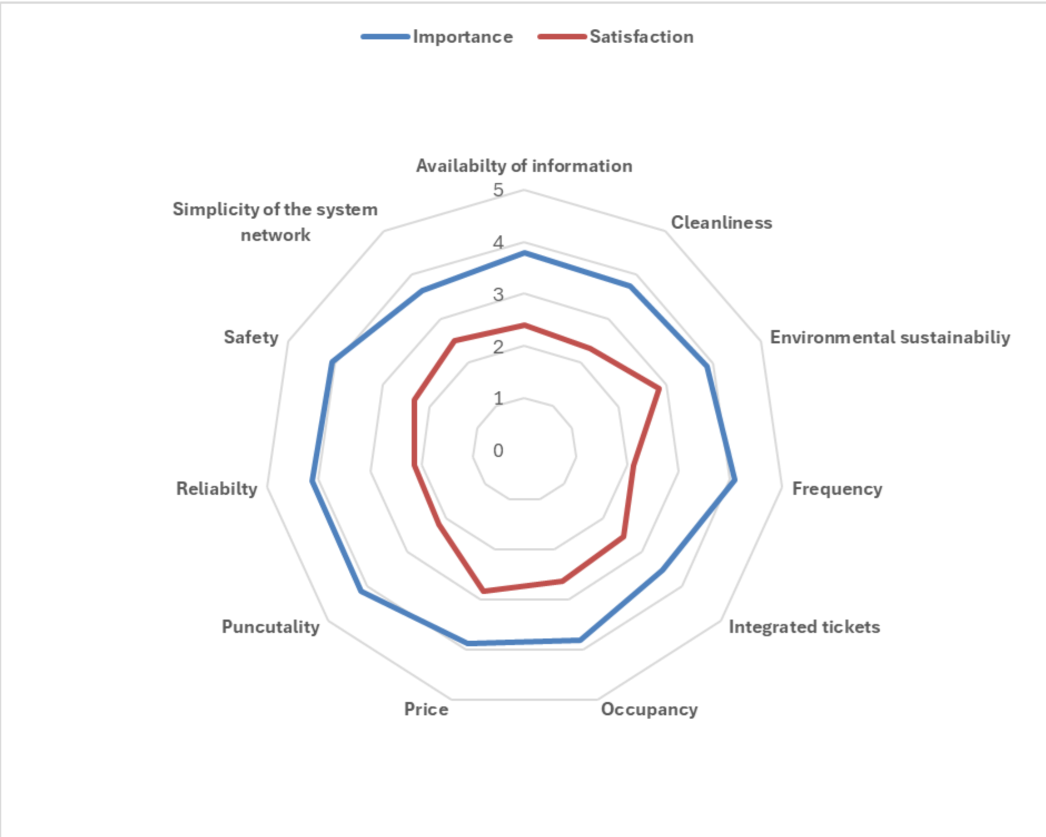


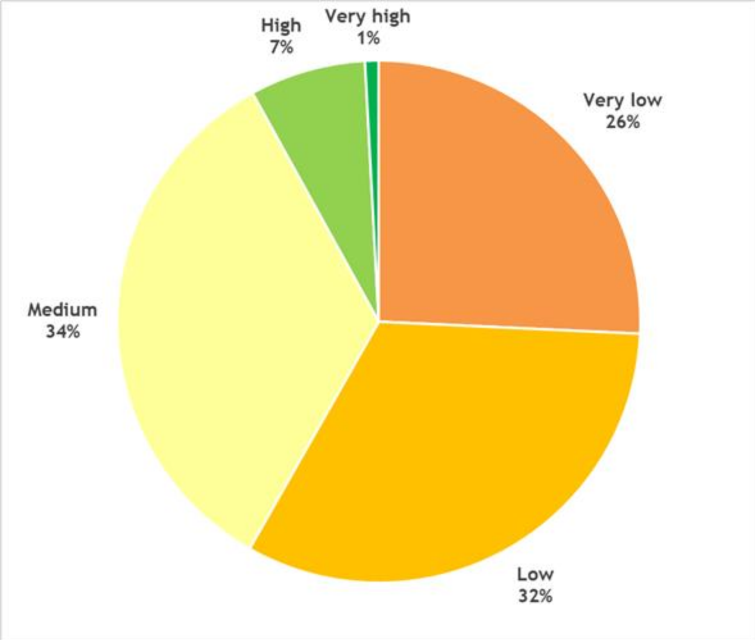
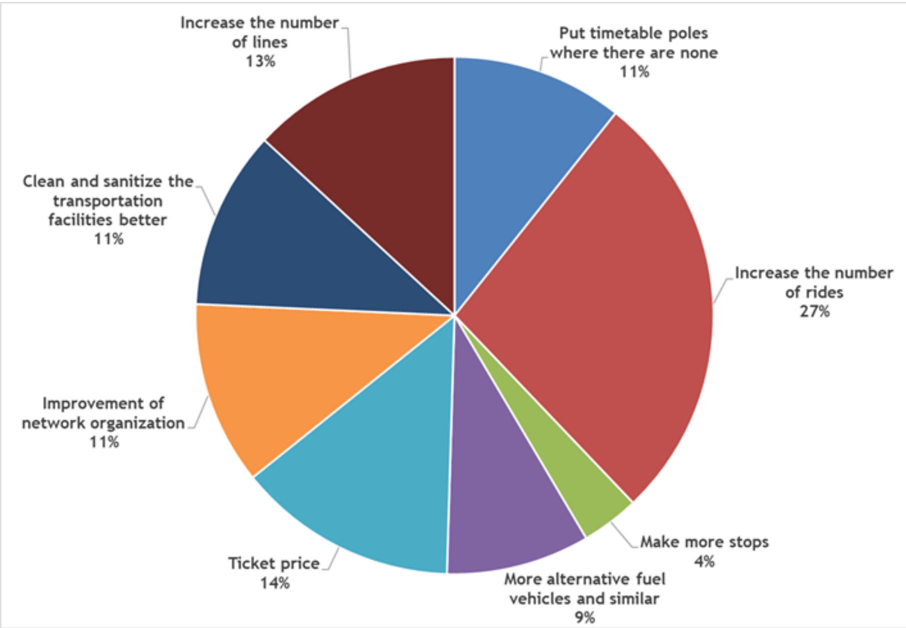
Which mode of transport do you use most often?



Grade the satisfaction and the importance of the following characteristics about the public transport.

[Grades from 1= very low to 5= very high]



Rate your satisfaction with the public transportation you use most frequently?	
What would you suggest improving the public transport? (max 3) *	
What improvements would you suggest that were not mentioned in the previous question?	Late day service Better integration interurban / urban services Give more importance to non-student users and their needs

The survey highlighted that reliability, punctuality, and high frequency are the most important features for a reliable public transport service for Modena city users. Frequency may be so important according to the answers also because at the moment the urban service is witnessing a shortage of drivers that has led the local authority to reduce the average number of daily trips for several different lines. This is even more evident in question 6, where over 300 answers consider increasing the number of trips as the best solution to improve PT service.

In Modena PT is not seen as a real alternative to private cars, but a good number of answers stated that the urban service is used at least once a week. This is the obvious result of having promoted the survey at the most crowded bus stops.

The rate of satisfaction is clearly related to this current problem with drivers shortage, but it is important to say that we can't define the sample of the survey, while according to the last customer satisfaction survey carried out from the PTA, with a statistical significance, the rate given to the service is above 7 out of 10.

3. SWOT and Best Practice Analysis

The following chapter is structured in two parts: the first regarding the SWOT Analysis and the second one regarding the selection of Best Practices that could be useful for the Local Plan and Pilot Action.

3.3. SWOT Analysis

The SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) is a strategic tool that helps small and medium-sized cities assess their current public transport landscape and develop a forward-looking plan for improvement. This methodology enables the city of Modena to systematically evaluate its transport systems from economic, environmental, and social perspectives, ensuring a balanced and sustainable approach to future development. The analysis incorporates and summarizes all findings from the previous qualitative and quantitative work and is enhanced by engagement with stakeholders.

According to deliverable D.1.1.1., the city is classified as medium-sized but exhibits a high population density, particularly in areas adjacent to the city centre. Moreover, most key trip attractors—excluding major hospital facilities located in peripheral zones and certain university departments—are concentrated in the central area or in industrial zones situated in its immediate vicinity.

The current urban public transport system primarily serves the function of connecting sparsely populated suburban districts with the city centre. Within the central area, the network forms a grid-like structure that enables access to nearly all destinations with, at most, a single transfer at one of the main intermodal hubs, such as the central bus terminal or the railway station.

This network configuration results in a high total vehicle-kilometres output but lacks adequate service frequency. The routes are often long and circuitous, leading to a system that is spatially extensive but insufficiently reliable to be considered a viable alternative to private transport. Public transport is perceived as a fallback option, primarily used by individuals without access to private vehicles. This perception is corroborated by the findings of the previously presented user survey and by operational performance indicators, such as the average commercial speed of the lines.

Another critical issue is the absence of evening services, which is particularly detrimental during weekends. This gap affects younger demographics, especially considering the growing number of university students from other regions of Italy, who are less likely to own a private vehicle.

Given the long-standing presence of alternative mobility services—such as bike sharing and scooter sharing—there is a pressing need to integrate these modes into the public transport ecosystem. These services should be recognized and promoted as effective last-mile solutions, enabling the rationalization and streamlining of certain urban bus routes.

In this context, Demand Responsive Transport (DRT) systems, if properly designed and promoted, can serve as a valuable asset for optimizing the traditional public transport offer. By reducing the vehicle-kilometres per trip in the fixed-route network, DRT can facilitate increased service frequency or extended operating hours, while acting as a feeder service to the main transit corridors.

In any case, the primary threat to public transport systems lies in the continuous escalation of operating costs and the inability at the national level to enhance the competitiveness of employment within the public transport sector. This has resulted in a severe shortage of drivers and an inadequate level of funding, which is insufficient even to sustain the current service standards.

Table 1: SWOT definition

Strengths	What is currently working well in your LPT system, or what characteristics of your city support a good LPT service?
Weaknesses	What is NOT working well in your LPT system, or what characteristics of your city make it difficult to provide a good LPT service?
Opportunities	Are there any future developments in your city (not necessarily related to transport) that could improve the LPT service?
Threats	Are there any future developments in your city that could negatively impact the LPT service?

Strengths (S)
Existing infrastructure may be sufficient for basic transport needs.
Main POIs in the city centre
Well distributed industrial areas nearby the urban area
Good coverage of the Municipality with current PT network

Integration between urban, suburban and railway
Weaknesses (W)
Lower ridership levels make it harder to sustain frequent services.
Dependence on private cars due to cultural habits or lack of awareness.
Limited availability of late-night or weekend services.
Lack of monitoring tools to better plan PT network
Low wages for drivers make this job not appealing for younger people
PT reserved lanes are few
Opportunities (O)
Introduction of eco-friendly solutions (electric buses, bike-sharing integration).
Government or EU funding for sustainable mobility initiatives.
Collaboration with local businesses to support public transport use.
Development of smart mobility apps for real-time information and route optimization.
Less dependency from private car for younger generation
Widening Limited Traffic Zone in the city centre (restricted zones for private cars)
New PT network redesign according to SUMP strategy
Threats (T)
Rising operational costs (fuel, maintenance, wages).
Demographic challenges (aging population might need more accessible services).
Economic downturns that could reduce public funding.
Rising cost of life bring people to leave city centre

3.4. Best Practices

In this section, a selection of best practices is presented. They are the most valuable insights can be drawn in relation to the pilot action planned for this project. The case studies are all allocated in Emilia Romagna region where the same regulatory framework applies and the territories share similar geographical and socio-economical characteristics.

The case of Castelfranco Emilia is particularly relevant due to the implementation of a comprehensive monitoring system for key performance indicators (KPIs) related to the Demand Responsive Transport (DRT) service. This provides a useful reference for identifying which indicators should be monitored in our context.

The Bologna case is noteworthy for its stakeholder engagement strategy, as well as for the development and promotion of a dedicated mobile application for service management and user booking. Although the pilot project was more oriented toward tourism-related needs, the app configuration process offers valuable insights for our objectives.

In the case of Piacenza, the DRT service is not designed as a complementary mode to the fixed-route network, but rather as a standalone solution during off-peak hours when demand is lower but still present. This approach represents a cost-effective method to ensure service continuity during evening hours. The outcomes of this pilot could inform future considerations for the Modena area, especially considering survey results indicating a demand for services beyond 9:00 PM, the current end of service.

Finally, the Rimini case stands out for the high flexibility of its app-based DRT service, which operates during the summer season to connect peripheral areas with the coastal zone. This service is not only targeted at tourists but also provides a viable mobility option for residents, encouraging modal shift from private cars during peak traffic periods in the summer.

Table 2: Best Practices

Best Practice	City	Relevance to Actions
Rumobil (Interreg CE project)	Castelfranco Emilia (MO), Italy	Starting point to our DRT improvement Evaluation of relevant KPIs
ColBus (SMACKER Interreg CE project)	Bologna, Italy	Implementation of a new reservation app Stakeholders' involvement
TuoBus	Piacenza, Italy	Integration between PT and DRT New target for a DRT service
Shuttlemare	Rimini, Italy	Potential to change mobility habits Complementarity to PT

4. Vision and Goals

The vision represents the overarching, long-term aspiration for the evolution of the local transport system. It provides a unifying direction that guides decision-making and serves as a reference point for all subsequent planning choices. Defining a clear and shared vision helps ensure coherence in the strategy, aligning individual measures with a broader transformative goal.

The goals translate this vision into concrete ambitions, outlining what the local public transport plan aims to achieve through its intervention measures. These goals encompass mobility, social, economic, and environmental aspects. The integration of goals referring to different dimensions is a crucial moment in the planning process, as it is often necessary to pursue conflicting goals simultaneously.

In this chapter the city of Modena lists its vision and goals based on:

- The results of the SWOT Analysis
- The results of the survey on LPT
- The political view

4.5. Vision

In Modena the vision is that planning mobility is a way to reach a more general benefit for the citizenship and the city users in terms of quality of life. This quality can be divided in two main categories: air quality and safety. Reducing the dependence of private cars can reduce GHG emission, give space to people and make roads and streets safer. Public Transportation has a pivotal role in this sense and bring new solutions to integrate it with other means of transport, to build a reliable service, to connect different part of the city can lead to a social equity and to an environmentally sustainable future for us all.

4.6. Goals

The following Goals are related to at least one of the four main dimensions:

- Mobility

- Economic
- Social
- Environmental

As outlined in the vision section of this chapter, the goals of a local plan do not necessarily have to be directly related to mobility or public transport. Instead, they should aim at a tangible improvement in the overall quality of life within the city. While mobility is certainly a key component, the plan must also address broader dimensions such as environmental sustainability, economic viability, and social benefits.

Table 3: List and descriptions of Local Plan's Goals

Goal	Description
- Improve the accessibility and connectivity of local public transport **(Mobility/Social)**	Provide a PT service that can cover all the hamlets of the municipality providing an access to the service in least populated zones, reconsidering a new hierarchy for PT lines. Improving the circulation of people and goods within the city territory through interventions that facilitate access to the area from the outside and that allow easy access to places, functions, and services within the territory
- Increase the number of public transport passengers **(Mobility/Economic)**	Providing an improved service has the main goal to get new users on the PT system. A virtuous circle that can give new economical resource to keep a higher quality of the service. Improving the effectiveness and efficiency of public transport (TPL) through increased service offerings, punctuality, and commercial speed, renewal of vehicles, implementation of prioritization systems along strategic roads, etc.
- Improve Air quality **(Environmental)**	Reducing emissions of pollutants in the atmosphere (PM10, PM2.5, NO2, and ozone precursors) generated by transportation and harmful to human health through an integrated set of measures aimed at reducing car usage and traffic congestion, mitigating vehicle speeds, renewing the private and public vehicle fleet with lower environmental impact vehicles, etc
- Optimize operational cost **(Economic)**	Optimizing the investment of public resources in the field of mobility (works, measures, initiatives, etc.) according to the criterion of the best cost/benefit ratio of the intervention, also related to PT services
- Redefine public spaces **(Social/Environmental)**	Improving urban planning to ensure the quality, usability, and safety of spaces, extending traffic-calmed areas (zone 30) in a manner compatible and consistent with the increased territorial coverage of public transport services, etc
- Reduce road accidents **(Social/Economic)**	Improving the service levels of infrastructure (quality of design and maintenance), promoting a culture of road safety at all levels (administrators, planners, designers, road users, citizens), experimenting with new tools, technologies, and solutions to improve safety standards and information collection, improving the use of municipal police personnel, etc
- Reduce acoustic pollution **(Environmental)**	Reducing noise emissions generated by transportation through incentives for devices and motorization that are less noisy for private and public vehicles, expanding traffic-calmed areas (zone 30, etc.), creating

	'environmental islands,' etc., prioritizing the protection of the most sensitive areas (schools/healthcare facilities/residential areas), etc

4.7. Goals coherence analysis

The local objectives selected in this section must be consistent with the objectives defined at European level, as well as with national/regional objectives. The following table shows a verification of the consistency of the Local Plan objectives and indicates the level of consistency according to the following scale:

■ ■	Strong Coherence
■	Coherence
□	Weak coherence

Local Plan's Goal	European Strategies Priority	National Strategies on mobility and transport	National Strategies on Energy/Environment	Regional/Local Strategies on mobility and transport	Regional/Local Strategies on Energy/Environment
- Improve the accessibility and connectivity of local public transport (Mobility/Social)	1	■ ■	■ ■	■ ■	■
- Increase the number of public transport passengers (Mobility/Economic)	1 - 2	■ ■	■ ■	■ ■	■ ■
- Improve Air quality (Environmental)	5	■	■ ■	■ ■	■ ■
- Optimize PT operational cost (Economic)	2	■	■	■ ■	■
- Redefine public spaces	1 - 3 - 6	■ ■	■ ■	■ ■	■ ■

(Social/Environmental)					
- Reduce road accidents (Social/Economic)	1 - 4	■■	■	■■	■
- Reduce acoustic pollution (Environmental)	5	■	■■	■	■■

5. Actions

This chapter introduces the first structured outline of possible actions that the city of Modena may undertake to achieve its vision and goals. These actions are grounded in the results of the SWOT analysis and developed through participatory dialogue involving technical experts, political representatives, citizens, and relevant stakeholders.

At this stage, the actions are presented in a general and strategic form. They represent a preliminary list of intervention measures that address identified needs and opportunities and reflect the city's ambitions in improving its public transport system.

However, these proposed actions are not final. They will undergo a validation process through scenario-based assessments and modelling tools. This process will help refine the actions, add technical and financial detail, and establish a hierarchy of priorities based on impact, feasibility, and consistency with the overall strategy. In this way, the initial list becomes a foundation for informed decision-making in the subsequent phases of the plan.

Table 4: List of actions

Action	Brief description	Goal
Promote digitalisation and smart mobility	Give better information through the use of smartphone apps and improve integration of different means of transport introducing sharing mobility	1,2
Improve share of zero emission vehicle in PT fleet	Renew bus fleet with electric or no emission vehicle, greener and quieter than the ones already in use	2,3,7
Widen 30 zones along the city	Introducing new 30 zones bring to quitter zone, improving safety and giving more liveable spaces for citizen. Improvement to intersections and roads should be considered	3,5,6,7
Introduce a new parking plan	A new parking plan would reduce the use of private car if not strictly necessary. New fares and new parking areas should bring more people to use PT	2,4,5

Increase number of reserved lanes for PT	Consider introducing restriction to private cars on selected roads and streets would be beneficial for PT, improving reliability, punctuality, and commercial speed	2,3,4,5
Introduce PT service until late	The introduction of a public transport service operating at least until midnight aims to meet the mobility needs of evening-shift workers and younger users	1,2
enhance DRT use in the city	Introduce a new reservation app	1,4
Redefine PT Network prioritizing lines	Considering a new PT network according to SUMP strategies introducing BRT lines	1,2,4

6. Actions and Traffic Models Scenarios

The use of transport and land use models support evidence-based decision-making and guide the prioritization of interventions. This methodology incorporates—specifically, the classic four-step transport model (e.g. VISUM) and land use-transport interaction (LUTI) models. These tools allowed the city of Modena to move beyond static, prescriptive planning toward a dynamic, scenario-based approach aligned with European best practices and Sustainable Urban Mobility Plan (SUMP) guidelines.

By simulating future mobility and land use conditions under varying assumptions, models enable local decision makers to assess the likely impacts of different policies or actions—such as new transit lines, fare adjustments, or urban development strategies—on accessibility, modal shift, environmental outcomes, and social equity.

The following table summarize the main scenario that have been tested within the OPTI-UP project.

Table 5: List of actions and models scenario results

Action	Description of model results
Enhance DRT use in the city	By increasing the number of stops, the service experiences a rise in daily passengers, with an increase of over 50%. The model is based on the maximum number of daily users recorded, so it can be considered that on an average day, the increase will not be as noticeable. The increase in the number of passengers also results in more time spent on board with other users, leading to a slight rise in the detour factor — a coefficient that accounts for how much the actual route deviates from the optimal one for the user
Improve DRT service efficiency	In this second scenario, the current situation was compared by increasing the number of roads available to the driver. The result is a reduction in the average distance of about 6% and a decrease in the average travel time of nearly 10%. This was intended to simulate the improvements brought by the navigation app, as well as by the expansion of the road network.

Redefine PT network prioritising some lines	Redefining the public transport network leads to a significant increase in the number of veh*km,, but also in the number of passengers. In both cases, the reason is the sharp rise in the frequency of the lines that have been upgraded to BRT. The same scenario was also evaluated using the LUTI model, keeping the same potential network but introducing restrictions on vehicular traffic. The results also show, in this case, an increase in the number of passengers transported
New Parking fares within the central area of the city	The extension of paid parking areas leads to a slight reduction in overall car usage. However, in the zones directly affected, it brings significant benefits in terms of increased use of more sustainable transport modes, as better illustrated in the following paragraph.
Implementation of a new business in the industrial area and increase of residential offer	The increase in job opportunities leads to a general rise in travel volume in the area — around 12% for each of the evaluated transport modes. However, the area becomes more attractive primarily as a destination rather than as an origin, indicating that its industrial nature does not result in new residents.

6.1. Overview of scenarios in VISUM and LUTI

The selection of scenarios for simulation using the PTV VISUM (short-term) and MARS (long-term) models was primarily guided by the strategic objectives outlined in Modena's SUMP. These objectives reflect the municipality's vision for future urban mobility and were used as a reference framework for scenario development.

In the VISUM model, a new public transport (PT) network was proposed, featuring four Bus Rapid Transit (BRT) lines and ten conventional bus lines, replacing the current network of approximately fifteen urban lines. This restructuring aligns with the municipality's ambition to implement high-frequency, high-connectivity services targeting key urban areas. However, given the substantial investment required, it is essential to assess whether such a transformation can effectively induce a significant modal shift.

Additionally, a dedicated VISUM model was developed to simulate DRT, which is the focus of Modena's pilot action. VISUM 's integrated DRT module enabled the evaluation of operational improvements and user benefits associated with the introduction of a new app for service management and ride booking. While direct user behaviour changes cannot be precisely modelled, the expected operational enhancements, such as improved routing and scheduling, can be represented within the simulation.

To support the app's navigation functionality for drivers, the model was adjusted to allow DRT vehicles access to a broader set of road segments, enabling more flexible origin-destination connections. Initially, the impact of reducing the booking lead time was considered, aiming to increase the number of users served. However, analysis revealed that most users currently book rides several days in advance, rendering this change less impactful in practice.

The second phase of DRT modelling focused on expanding service coverage by increasing the number of active stops. New stops were strategically introduced to facilitate intermodal connections between DRT and conventional PT lines, thereby enhancing the feeder role of the DRT system.

For long-term scenario analysis using the MARS LUTI (Land Use Transport Interaction) model, several interventions consistent with the SUMP and local urban plans were considered. These included the BRT scenario and a revised parking strategy involving expanded paid parking areas and increased tariffs. These two measures were analysed both independently and in combination with the proposed BRT network to assess their cumulative impact on urban mobility.

Furthermore, an additional scenario was developed to evaluate the effects of a major industrial development expected to generate thousands of new jobs. This development represents one of the most significant urban transformations anticipated in Modena in the coming years. The model was used to analyse potential changes in travel demand and spatial dynamics in the affected area.

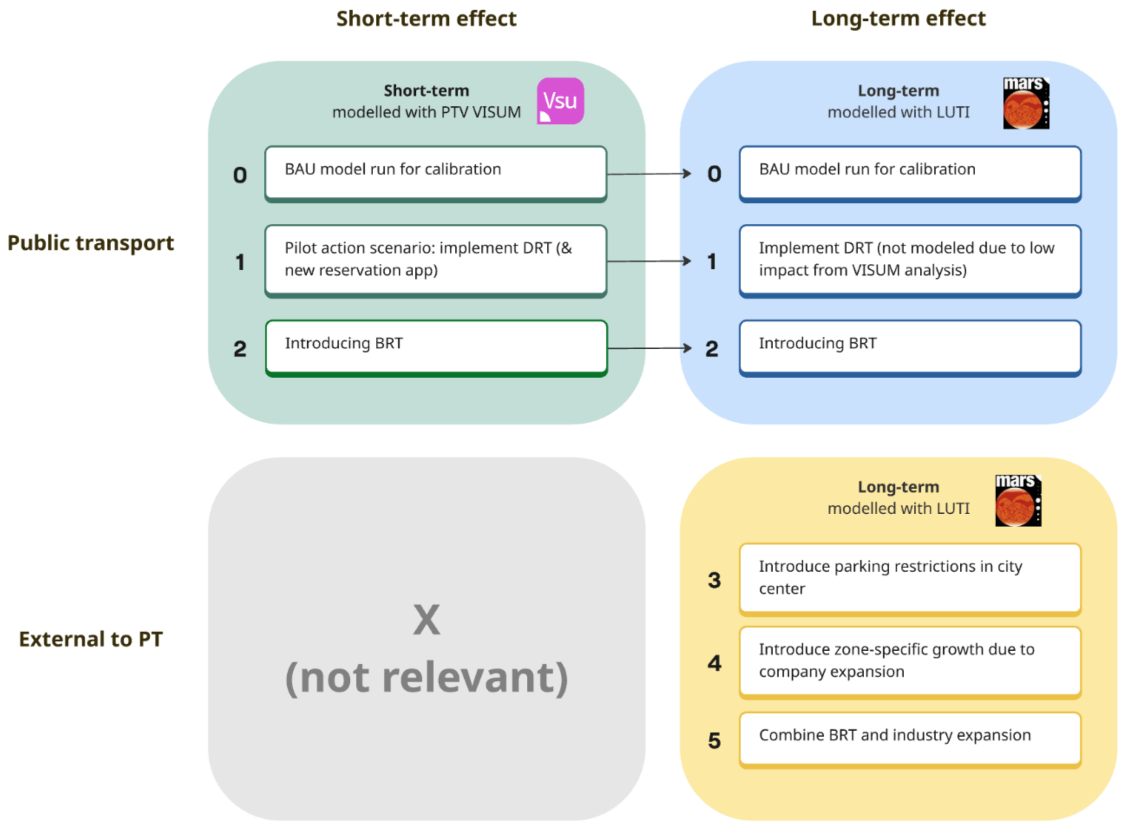


Figure 1: Scenario identification for the case study area of Modena

6.2. VISUM model of short-term scenarios

6.2.1. Scenario ST1 - Implement DRT and new reservation app (Pilot action Scenario)

The implementation of a smartphone application designed for end-users represents the key innovation proposed within the pilot action. This initiative addresses the longstanding structure of the DRT service in Modena, which has remained unchanged for over two decades. Despite its historical significance, the current operational framework is complex and increasingly outdated. Leveraging modern digital technologies, the new app aims to streamline service regulations, enhance accessibility, and ultimately encourage greater user engagement—particularly in light of the recent decline in service utilization. Importantly, the application is not limited to booking functionalities; it introduces a transformative shift in operational procedures by integrating a navigation system for drivers. This feature supports route optimization and real-time guidance, contributing to improved service efficiency and user satisfaction. The app thus serves as both a user interface and a logistical tool, marking a significant step forward in the modernization of the DRT system.

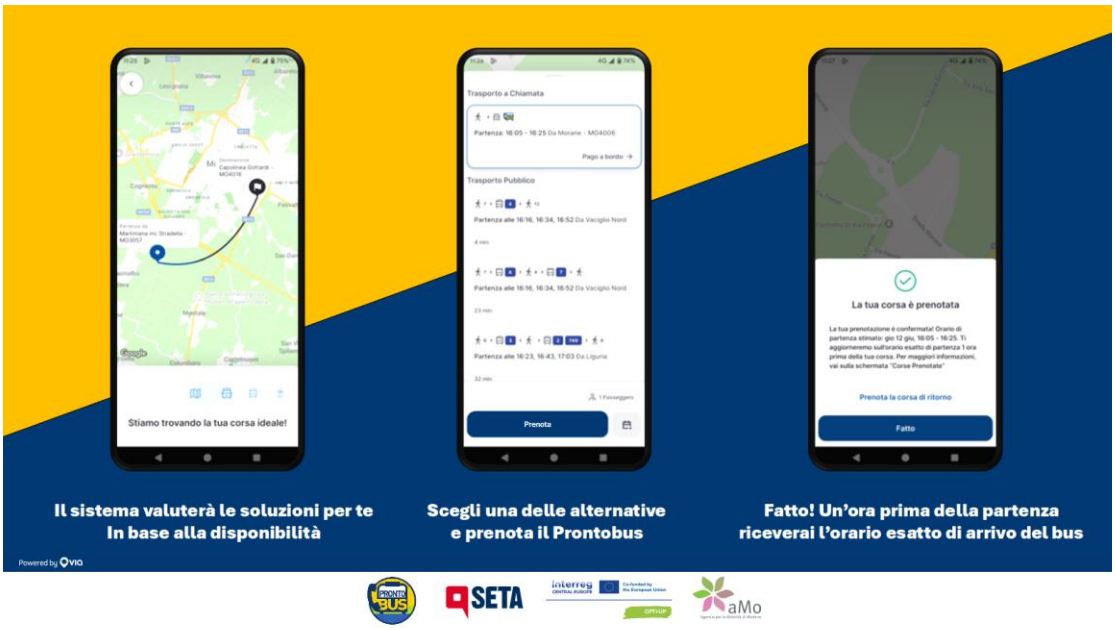


Figure 2: Informational leaflet detailing the primary procedures for booking through the dedicated mobile application.

As outlined in the introduction, the implementation of a scenario involving the integration of a mobile application into the DRT service is far from a straightforward or trivial matter. For this reason, with the support of external consultancy, we initially considered utilizing the dedicated DRT module within VISUM. This module enables the association of Origin-Destination (O-D) matrices with individual stop pairs, thereby overcoming the traditional zone-based approach typical of transport modelling.

We hypothesized that, through the integrated navigation system, the service could more effectively identify optimal routes connecting various origins and destinations. The objective of the scenario modelling is to assess the potential operational benefits of the mobile application. Consequently, the scenario includes a road network with a broader selection of streets than those currently authorized, allowing for greater flexibility in route planning.

Furthermore, thanks to an optimized algorithm that suggests time slots to users to maximize potential bookings, the number of available stops can be increased (Figure 3). These new stops coincide with existing urban transit stops, thereby enhancing the DRT system's role as a feeder service.

The scenario enabled an assessment of whether the increased service supply would compromise the quality of service provided. The results indicate that service quality remains unaffected, as no significant detours are introduced that would delay current users' journeys. At the same time, the total number of daily passengers is expected to increase, demonstrating that the system can accommodate higher demand without negatively impacting existing service standards.

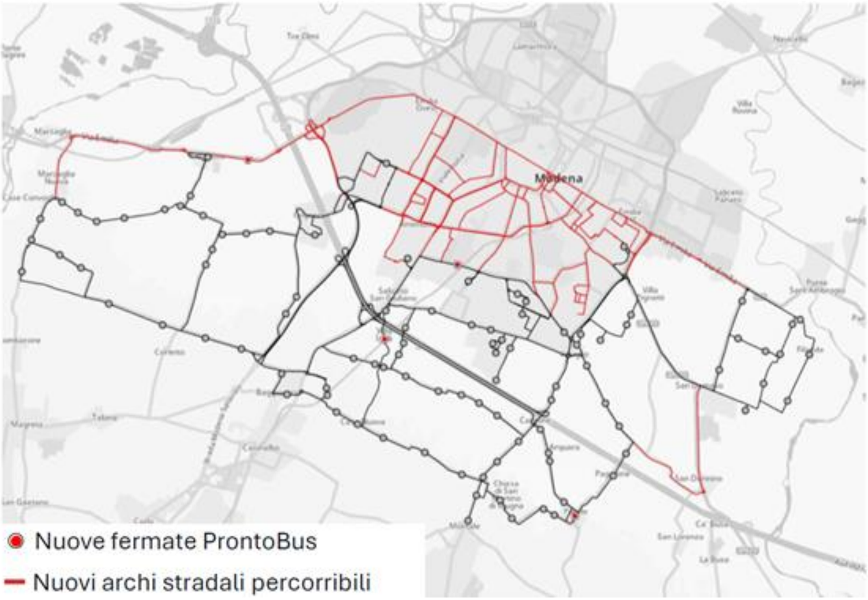


Figure 3: Screenshot of VISUM DRT scenario with added roads and bus stops

The results related to the described scenario are shown in Table 1 and can be summarized as follows.

The addition of new stops leads to a 57% increase in daily passengers, although the total remains relatively low at 50 passengers (a round-trip user is counted twice). This increase in ridership is well managed by the system, which is still able to guarantee 100% of requests are fulfilled.

This outcome is mainly due to the greater shared use of the vehicle employed for the service. Other quantitative data show that the average daily distance travelled rises to approximately 274 km, compared to the initial 150 km, and the detour factor increases by 52%, indicating that the route taken deviates more from the optimal (i.e., fastest) route for users.

The increase in ridership also affects the average speed, which drops from 54 km/h to 43 km/h, but the use of additional roads compared to the previous scenario still results in average travel times of 7.5 minutes, a figure that remains stable compared to the baseline scenario.

Moreover, to specifically assess the benefits derived from the expansion of the road network accessible to the service and thus the effectiveness of the navigation system, a comparative analysis of selected KPIs was conducted against the baseline scenario. In this evaluation, demand was held constant, meaning the same set of bookings was used across both scenarios. The results, summarized in the last column in Table 6, highlight a general improvement in service performance and user experience, attributable to the enhanced routing capabilities.

Table 6: DRT scenario outcomes

	BAU scenario	DRT expansion	DRT expansion (holding demand unchanged)
Daily passengers	33	50	33
Fulfilled request	100%	100%	100%
Average trip duration (min)	7.3	7.5	6.7
Average trip distance (km)	6.5	5.4	6.1

Average trip speed (km/h)	54.2	43	55.7
Average daily distance travelled by DRT (km)	149.2	274	140.2

6.2.2. Scenario ST2 - Reorganize PT network with BRT lines

The second scenario tested in VISUM involves the design and simulation of a new urban public transport network, intended to replace the existing system. The proposed network consists of four high-frequency BRT lines, strategically covering the city's most relevant and densely populated areas. In addition to these core lines, ten complementary routes operating at lower frequencies are included to ensure comprehensive coverage across the entire urbanized territory of the municipality. This configuration aims to balance efficiency with accessibility, offering a multimodal solution tailored to diverse mobility needs.

Although DRT services remain part of the overall mobility strategy, they were excluded from the VISUM model in this phase due to their relatively low demand compared to conventional public transport. The focus of the simulation was to evaluate the performance and coverage of the fixed-route network under the new configuration, assessing its potential to improve service quality, reduce travel times, and increase ridership. The scenario provides a foundation for further analysis of integrated transport solutions, including the future incorporation of DRT services as feeder systems or complementary modes within a broader multimodal framework.

Figure 4: Screenshot of VISUM Overall new PT network scenario (BRT in red) (TTA elaboration)

To develop this model, several assumptions were necessary. For instance, new service frequencies were introduced as input data, and a higher average speed was assigned to public transport vehicles due to the increased use of dedicated lanes. These assumptions reflect the expected operational improvements associated with the redesigned network.

To evaluate the scenario’s effectiveness, the results were compared against those of the baseline scenario. The comparison focused on KPIs such as the average number of passengers transported daily and the variation in modal shift. This allowed for a quantitative assessment of the impact of the proposed changes on overall mobility patterns.

Additionally, multiple sub-scenarios were developed to analyse the optimal terminal locations for the new BRT lines. Based on the data obtained from these simulations, the configuration deemed most effective, both in terms of coverage and operational efficiency, is the one presented in the Figure 5. This configuration was selected for its ability to maximize accessibility while maintaining service quality, and it serves as a reference for future planning and implementation phases.

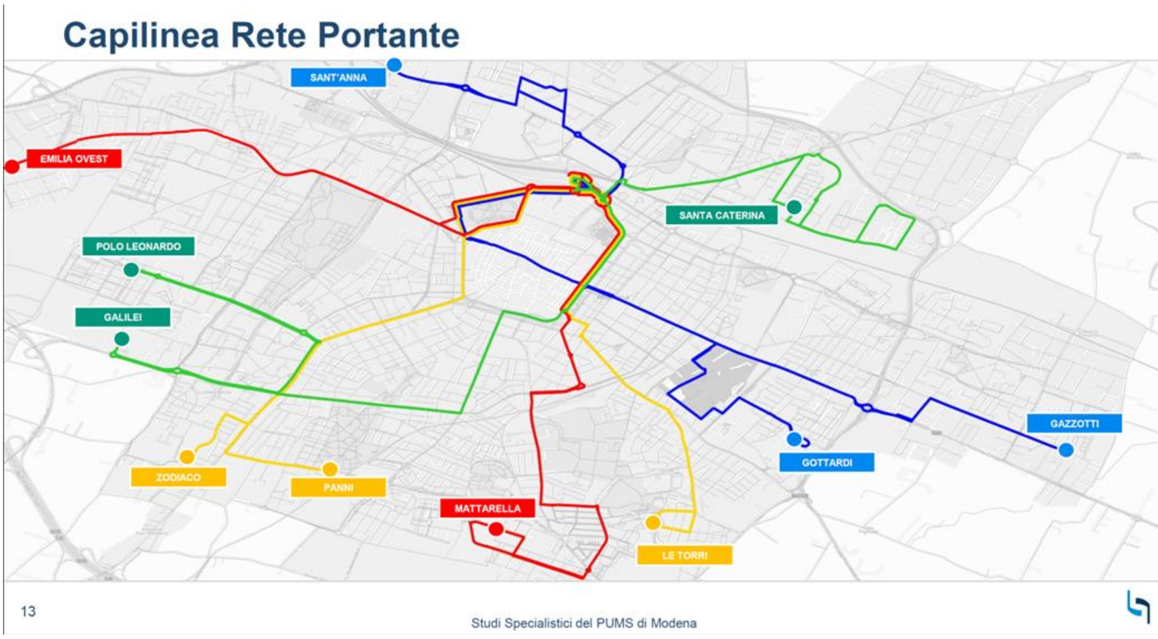


Figure 5: Screenshot of new BRT lines (TTA elaboration)

In the final version of the scenario, as previously illustrated, the results indicate an estimated 85% increase in the number of trips, which corresponds to a 45% rise in passenger-kilometres. It is further estimated that 52% of passengers will be transported by the four BRT lines, while the remaining demand will be covered by the other transit services.

Regarding modal split, the baseline scenario estimates that 6% of trips are made using public transport, whereas the BRT-enhanced configuration reaches 12.2%. The modal split considers only public and private transport modes, as defined within the model, with specific cost functions assigned to each.

Average travel time also undergoes significant changes, decreasing from the current 17 minutes to 9.3 minutes. Thanks to the implementation of BRT lines, the average service speed increases from approximately 14 km/h to 18 km/h.

These positive outcomes are also attributable to a substantial increase in vehicle-kilometres produced, rising from 4,646,334 veh-km to 5,987,141 veh-km (+28.9%).

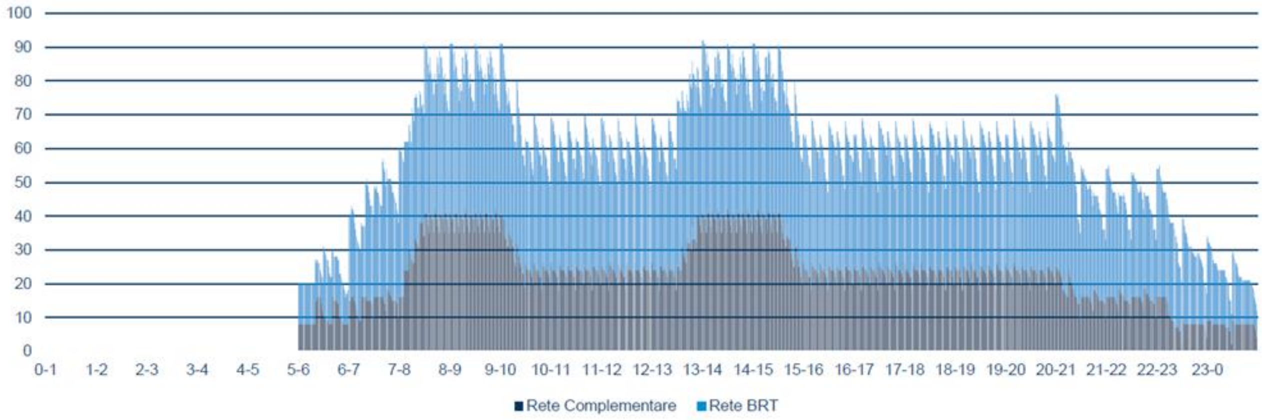


Figure 6: Number of trips in a typical working day distributed per minute (TTA elaboration)

6.3. LUTI model of long-term scenarios

6.3.1. LUTI Scenario LT1 - Pilot action scenario DRT implementation

The pilot action scenario is not modelled in LUTI due to very low ridership numbers that do not align with the aggregated strategic nature of MARS.

6.3.2. LUTI Scenario LT2 - Reorganize PT network with BRT lines

Scenario LT2 is based on the ST2 scenario looking at a reorganized PT network with BRT lines. The VISUM transport model containing the relevant scenario (ST2) is no longer available to the Modena team. As a result, the origin-destination (OD) matrices reflecting the updated public transport (PT) network, including the Bus Rapid Transit (BRT) lines, are not accessible. We therefore adopted a simplified assumption for representing the BRT improvements. The zones along the BRT corridors were assigned reduced headways of 10 minutes (off-peak) and 6 minutes (peak). Corresponding changes in overall travel times were applied proportionally to the change in headway times. We assumed an average share of 46% of bus lanes separated from other traffic with a bus speed of 40km/h.

The results indicate a notable shift in mode choice. The bus modal share increases by 3.0 to 3.7 p.p in Scenario LT2 compared to the BAU (see Figure 7). This growth primarily comes at the expense of walking and cycling, which both decrease by approximately 1.2 to 1.5 p.p.. Car use remains relatively stable, showing only a slight decline of up to 0.8 p.p. in LT2.

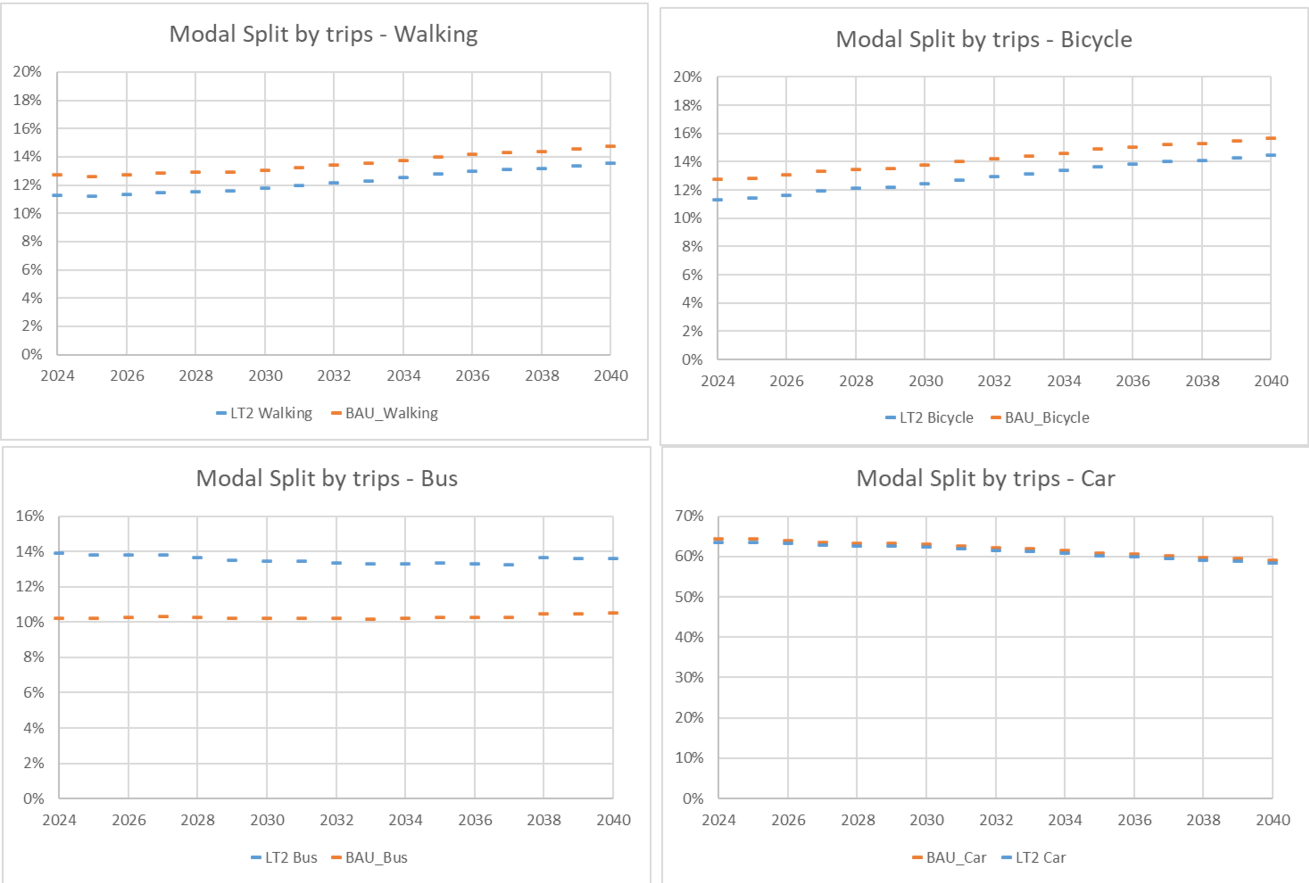


Figure 7: Results Modal Split comparison between BAU scenario and LT2

Passenger-kilometres travelled by bus (see Figure 8) increase substantially in Scenario LT2, rising from 0.53 million km in 2024 under the BAU scenario to 3.24 million km in 2024 in LT2. Over time, this value remains relatively stable in LT2, with a slight increase in the middle of the period and a minor decrease toward the end of the simulation. In contrast, under the BAU scenario, bus passenger-kilometres increase only slightly, reaching 0.65 million km by 2040.

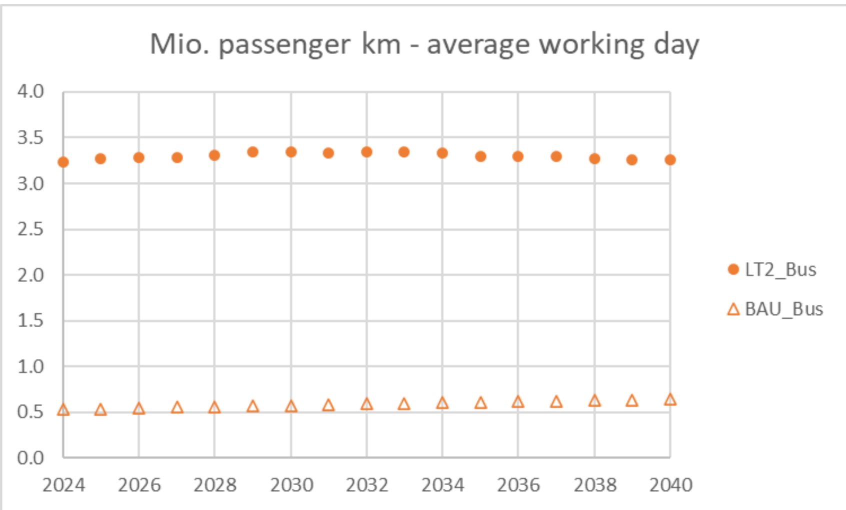


Figure 8: Bus passenger-kilometres in scenario BAU and LT2

6.3.3. LUTI Scenario LT3 – Introduction of new parking management plan

In Modena, car parking is currently free of charge in most areas, except within the city centre, where the Limited Traffic Zone (LTZ) applies. Access to the LTZ is restricted to residents and specific vehicle categories such as police, taxis, and commercial vans.

According to the city's Sustainable Urban Mobility Plan (SUMP), Modena intends to extend the LTZ by approximately 40%, as illustrated in Figure 9. The existing LTZ is shown in yellow, while the blue and green areas indicate the planned extensions. As part of the same policy package, the SUMP also proposes the development of new free interchange parking facilities located near the city's periphery (see Figure 10).

ZTL attuale (giallo) e proposta di prima estensione ZTL (verde)

Figure 9: Planned extension of traffic limited zone (SUMP Modena 2030 – Municipality of Modena)

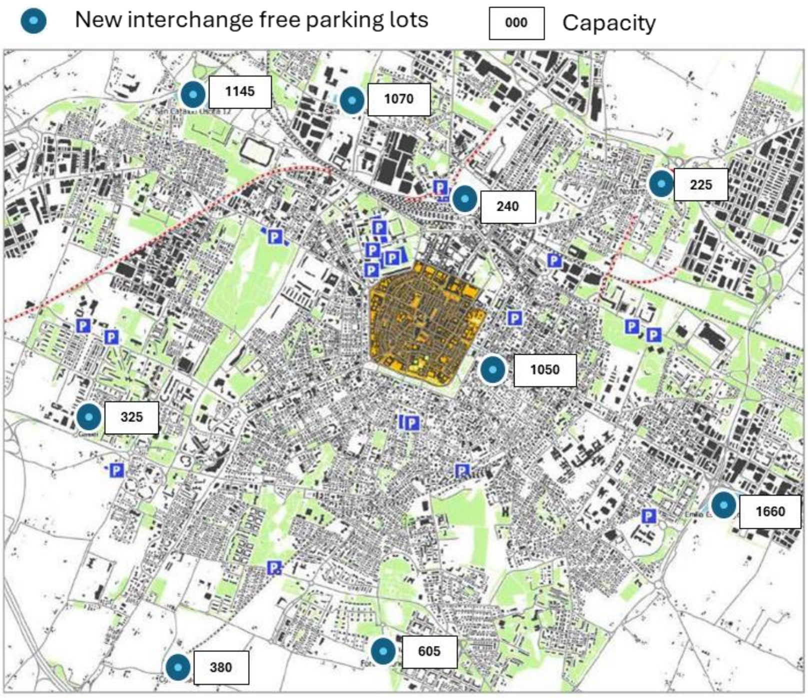


Figure 10: Plan for new free parking lots (SUMP Modena 2030 – Municipality of Modena)

The SUMP further outlines an increase in parking fares within the extended LTZ area, though it does not yet specify a detailed pricing scheme. This strategic direction forms the basis of Scenario LT3, which analyses the potential impacts of these parking management measures.

Currently, only Zone 27 has paid parking, with a flat rate of €8 per stay. In scenario LT3, the paid parking zones are expanded beyond the current LTZ, with price levels varying by distance from the city centre, as shown in Figure 11. The scenario is divided into two sub-variants:

- LT3a, which includes the base pricing scheme and an extension to other zones
- LT3b, featuring a higher pricing level

The analysis also distinguishes between short-term and long-term parking, assuming a distribution of 20% short-term and 80% long-term parking spaces. Both peak and off-peak periods were modelled.

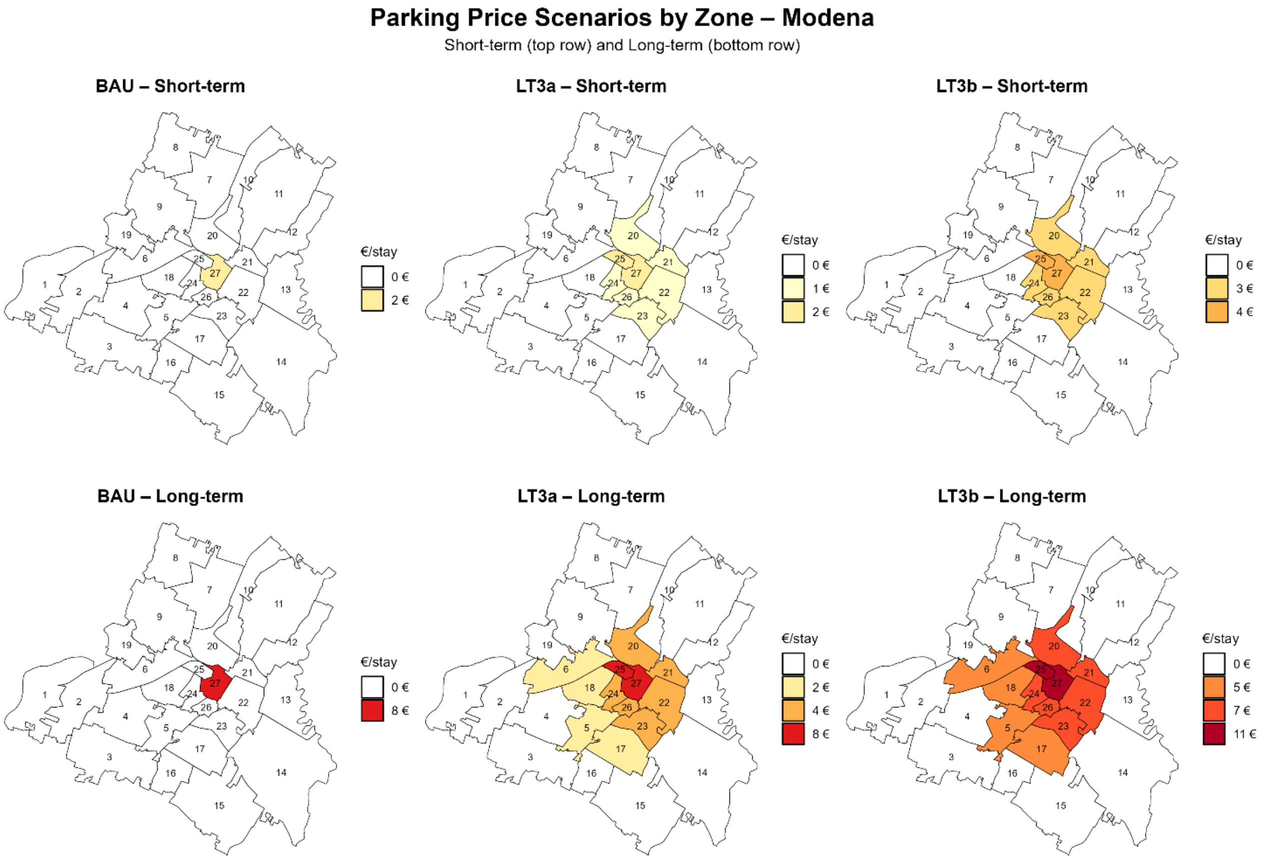


Figure 11: Parking scheme differentiated for LUTI zones and short-term and long-term parking - scenarios BAU, LT3a and LT3b

The results of Scenario LT3 for Modal Split are presented in Figure 12 and Table 7. The simulation indicates that the revised parking scheme has a noticeable impact on mode choice at the citywide level. The modal share of car trips decreases, while the shares of other, more sustainable modes increase correspondingly.

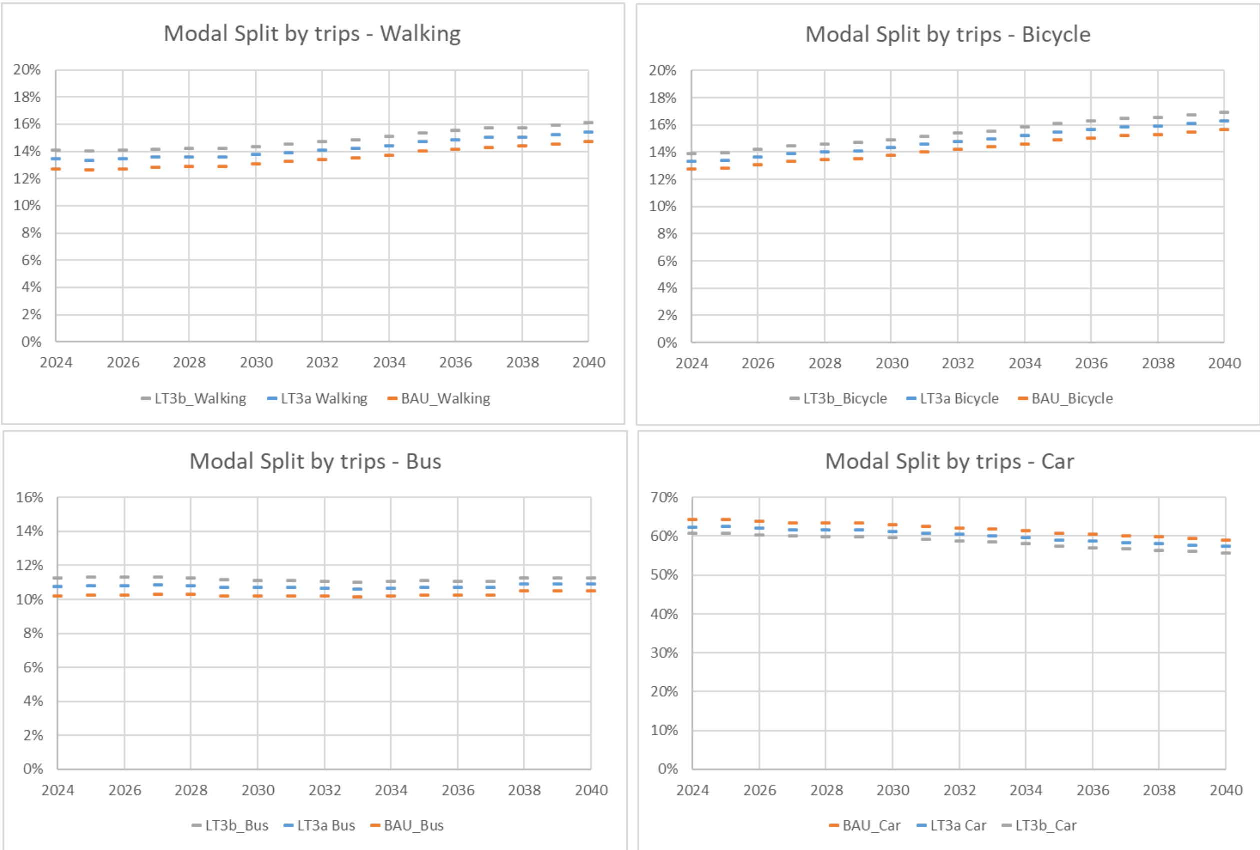


Figure 12: Modal split results LT3 per mode compared to BAU

When comparing results for the year 2040, the walking modal split rises from 14.7% in the BAU scenario to 15.4% in LT3a and 16.1% in LT3b. Conversely, the car modal split declines from 59.1% in BAU to 57.3% in LT3a and 55.7% in LT3b. These results suggest that extending paid parking and introducing differentiated pricing can effectively encourage a shift away from private car use towards more sustainable transport modes.

Table 7: Modal split results for the year 2040 - Scenario LT3 compared to BAU

Mode	BAU 2040	LT3a 2040	LT3b 2040
Walking	14.7%	15.4%	16.1%
Bicycle	15.7%	16.3%	17.0%
Bus	10.5%	10.9%	11.2%
Car	59.1%	57.3%	55.7%

A closer look at the affected zones reveals distinct spatial shifts in travel behaviour, as shown in Table 8. In Scenario LT3a, for instance, Zone 27 (the central area where parking is already paid) shows an increase in trips across all modes. This effect can be explained by the relative change in attractiveness between zones: as neighbouring areas are newly subject to paid parking, the centre becomes comparatively more attractive. As an example, Table 8 presents results for Zone 25, one of the newly included areas in the extended paid parking zone. Here, the number of car trips decreases by approximately 40% compared to the BAU scenario, illustrating the strong sensitivity of travel behaviour to parking costs.

In Scenario LT3b, where parking prices are set higher, this effect becomes even more pronounced. Trips to Zone 27 then decrease compared to BAU, indicating that a further price increase can effectively reduce car travel to the city centre, despite the smaller difference in parking costs between central and surrounding zones.

Table 8: Changes in no. of trips to zone 27 and zone 25 for the final year 2040 – comparison of BAU with LT3a and LT3b

	LT3a		LT3b	
Mode	Zone 27 (center)	Zone 25 (extension)	Zone 27 (center)	Zone 25 (extension)
Walking	2.91%	2.69%	4.15%	5.58%
Bicycle	1.15%	1.49%	3.11%	4.48%
Bus	2.08%	2.82%	3.76%	5.28%
Car	12.61%	-40.83%	-4.11%	-52.37%

6.3.4. LUTI Scenario LT4 - Industrial expansion

Scenario LT2 incorporates the planned industrial expansion as a land use change and evaluates its impact on mobility indicators. To ensure consistency with the built-in land use model in MARS, the additional workplaces and dwellings from the development project were introduced at the initial time step of the simulation.

The city of Modena plans new developments for industrial use and to a limited extent for residential use. Until the end of 2026, an area in LUTI zone 20, see Figure 13, should offer 40,000 sqm additional industrial land use (of which 50% are located on already used land). The area will offer +2,3000 workplaces and +28 residential flats as well as additional parking space for 400 cars (non-paid).

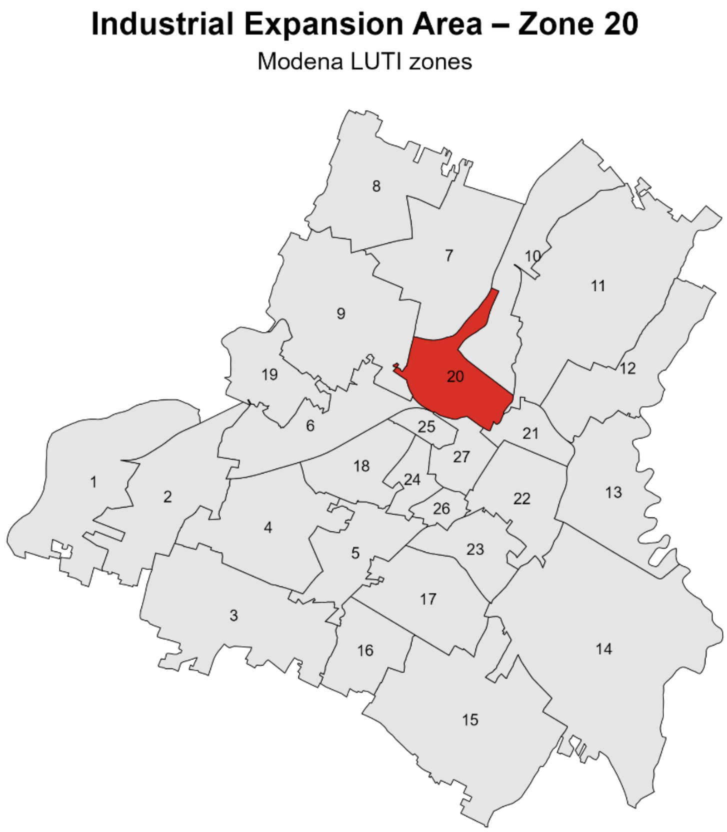


Figure 13: Map of Modena with LUTI zones showing the area of industrial expansion in zone 20

At the citywide level, changes in travel behaviour are minimal — the modal split varies by less than ±0.02 percentage points, and therefore, detailed results are not presented separately.

A closer look at the affected area, zone 20, reveals more noticeable changes. Trips to zone 20 increase by approximately 13% compared to the BAU scenario, which aligns with the corresponding 13% increase in workplaces. This rise is distributed relatively evenly across all transport modes, with increases between 12-13%. Trips originating from zone 20 show a smaller overall increase of about 2%. Within this, walking trips increase by 6.7%, cycling trips by 3.5%, while bus trips decrease slightly by 3% and car trips remain nearly unchanged, with a marginal 0.6% increase. The overall modal split of zone 20 shows a small increase in walking and bus use and small decrease in car use.

Table 9: Changes in Modal Split and no. of trips to and from zone 20

	Modal split of zone 20		LT4 compared to BAU 2040	
Mode	BAU 2040	LT4 2040	Change no. of trips zone 20 as destination	Change no. of trips zone 20 as origin
Walking	8.9%	9.0%	+13.07%	+6.65%
Bicycle	12.5%	12.5%	+12.25%	+3.52%
Bus	10.5%	10.6%	+12.73%	-2.89%
Car	68.1%	68.0%	+12.93%	+0.55%

6.3.5. LUTI Scenario LT5 - Combination of BRT and industrial expansion

Scenario LT5 combines the industrial expansion scenario (LT4) with the BRT improvement scenario (LT2) to assess how enhanced bus services influence mobility patterns in the new industrial zone. As shown in Table 10, the modal split in zone 20 changes significantly, with a marked increase in bus use. While in LT4 the growth in bus trips was roughly proportional to the increase in workplaces, LT5 shows a stronger response: bus trips to zone 20 are 30% higher than in the BAU scenario, and trips originating from the zone are 37% higher. This increase is accompanied by a corresponding decline in other modes—particularly walking and cycling—compared to LT4. Overall, trips to and from zone 20 increase by 4.9%, while this value was 6.3% in scenario LT4.

Table 10: Changes in Modal Split and no. of trips to and from zone 20, comparing LT4 with LT5 and LT5 with BAU

	Modal split of zone 20		**LT5 compared to BAU 2040**	
Mode	LT4 2040	LT5 2040	Change no. of trips zone 20 as destination	Change no. of trips zone 20 as origin
Walking	9.0%	8.0%	+0.99%	-6.17%
Bicycle	12.5%	11.3%	+4.74%	-9.40%
Bus	10.6%	13.2%	+30.29%	+37.16%
Car	68.0%	67.4%	+9.59%	-0.89%

6.4. Conclusion of scenario modelling

Summary of scenario modelling results

As seen, the scenarios modelled in Visum involve DRT, the focus of the pilot action, and the introduction of a new public transport network using BRT. Both aim to improve accessibility to public transport for all citizens in Modena. However, the network redesign also targets greater system efficiency to encourage a real modal shift. These goals are aligned with the actual costs of implementing such scenarios. The BRT service is ambitious and requires significant investment, along with a necessary redefinition of urban spaces to accommodate the new infrastructure and ensure dedicated lanes that enable higher commercial speeds and a more punctual service.

The LUTI model, integrating mobility and urban planning changes, was instrumental in evaluating the introduction of BRT in Modena. It helped identify areas with the highest potential benefit and assessed the expected modal shift. The BRT was incorporated into a comprehensive scenario aligned with the city's SUMP and Local Plan goals, combining public transport network redesign with car use restrictions—such as expanded low-emission zones, increased paid parking areas, and higher parking fees. Additionally, due to the planned redevelopment of a large industrial zone expected to attract more employees in an area previously dominated by small-scale manufacturing, the model assessed whether existing transport services are adequate to prevent a significant rise in private car usage and ensure sustainable mobility in the newly developed area.

Connections with Local Goals and Visions set in Chapter 4

As defined in the vision, public transport must play a key role in addressing the challenges of creating a more environmentally sustainable city, reducing emissions and private vehicle traffic. Each scenario supports this goal by offering a more efficient public transport service that encourages citizens to shift from private cars. System improvements—such as increased accessibility through DRT or dedicated lanes and higher commercial speeds for BRT—must be complemented by restrictions on car use. These restrictions can also serve as funding sources for service enhancements, for example through revenues from paid parking. A balanced approach combining service efficiency and demand management is essential to promote modal shift and ensure the long-term sustainability of the urban mobility system.

Limitations in Scenario Definition, Modelling, and Results Analysis

The DRT model was developed exclusively in Visum due to the limited impact it may have in terms of transport-land use interaction, also considering the current number of daily users. The model in Visum, on the other hand, used a specific internal tool within the software, but it was mainly developed to improve the operational process and less to estimate demand growth. In this sense, also considering the rather low number of users, due to the very purpose of the service, the risk of overestimating potential demand is high. However, the system's objective in this case is also to support the operator in better covering the service area while reducing operational costs, and in this regard, the pilot results will used to validate the model's results. For the BRT model, in some cases the scenario definition required certain input choices, which may consequently lead to result distortions. In particular, having to consider the commercial speed of the service a priori, without knowing what spaces will actually be available for these lines within the city, necessarily involves a degree of uncertainty. For a scenario that entails significant funding needs and changes to the urban environment, it is clear that such a model is only the first step toward a more in-depth study, which evidently could not be the subject of this European project.

How the Modelling Action Informs the Selection of Local Actions

The modelling action provides valuable evidence to guide the selection of local actions by offering quantitative insights into the potential impacts of introducing DRT services on accessibility. In particular, the modelling outcomes support the assessment of feasibility, operational efficiency, and expected impacts, enabling decision-makers to prioritise actions that are both cost-effective and capable of delivering long-term environmental and mobility benefits. However, the final selection of local actions is not based solely on model results; it is a comprehensive process that also considers operational, temporal, and financial constraints. The modelling therefore serves as a key decision-support tool, helping to compare the relative performance of different options and to establish priorities for future mobility strategies.

7. Stakeholders

In this chapter were identified key stakeholders from various sectors and regions.

Stakeholder engagement is emphasized through regular meetings, networking opportunities, experience sharing, and study tours, with reports compiled to document best practices and lessons learned.

Table 11: List of stakeholders

Stakeholder	Type	Role	Importance	Influence
Emilia-Romagna Region	Local Authority	Main financier of the PT service	Very Important	High
Municipality of Modena	Local Authority	Provider of resources, impact on implementation of PT development actions	Very Important	Very High
SETA Spa	Public transport Operator	Supervisor of the DRT system and PTO for the municipality of Modena	Very Important	Very High
Holacheck	Sub-contractor of public transport Operator	In charge to manage DRT service and reservation	Medium	Low
Users Committee	Association of users	Used to have observations and suggestion in the planning and monitoring phases for relevant actions	Medium	Medium
High Schools	Public interest	Used to have observations and suggestion in the planning and monitoring phases for relevant actions	Medium	Medium

8. Action Plan

For each Action proposed in Chapter 5 and validated by the activities summarized in chapter 6, a table with the following information are defined: Resources, Timeline, Stakeholders, expected impacts, Risks and mitigation.

Table 12: Actions descriptions

Actions	Resources	Timeline	Stakeholders	Expected impact	Risk
Action 1	Low	July 2025	Municipality, PTO, OPTI-UP	Increase users of the existing DRT service	New bus stops don't give new opportunity to users. Lack of service PT service in summer give less chance to transfer to the latter
Action 2	Low	July 2025	Municipality, PTO, OPTI-UP	Improve the efficiency of DRT service in terms of km travelled per person.	Not easy to use. Driver and Call centre not eager to change work habits
Action 3	Very High	2030 (SUMP deadline)	Emilia-Romagna region, PTO, Municipality, main Citizens associations, Association of businesses	High frequency lines that can be reliable service along all day, reducing private car usage	Can't be implemented due to lack of financial resources
Action 4	Medium	2030 (SUMP deadline)	Municipality, main Citizens associations, Association of businesses	Introduce way to reduce private car use, new financial resources to improve PT service	Risky decision for an administration, that may not consider implementing it anytime soon. Private company takes revenues from parking
Action 5	Medium	2027	Municipality, Business involved, PTO	Industrial growing in an already existing industrial zones, bringing new residential offer nearby. No cost for the	Not considering an appealing residential area may bring to just increase traffic flows in the zones, without residents

			public administration	

9. Monitoring and KPIs

A constant monitoring is important to ensure that local plans proceed as planned, with predefined reporting deadlines for each action (action proposed in Chapter 5.)

In this chapter a scheme of KPI's and their main features is proposed.

Table 13: Local Plan KPIs

KPI	Action	Brief description	Unit	Target
K_1	1,2	Number of people per single DRT Trip		1.5
K_2	1,2	Total number of reservations during the period / number of reservations made in the same period of previous year	% of total actual reservation	> 100%
K_3	1,2	Number of no show / number of no show made in the same period of previous year		
K_4	1,2	Ratio total hours travelled /total hours of service	%	> 50%
K_5	1,2	Number of reservations via app	% of total reservations	> 10%
K_6	3	Daily total number of passengers		+ 40%
K_7	3	Modal split variation	%	12%
K_8	3	PT average commercial speed		> 20 km/h
K_9	4	Paid Parking areas		+50%

9.5. Description of data sources & tool for KPIs

Table 14: Identification of data sources & tools for KPIs data

KPI	Data list	Methodology	Data source	Data tool
K_1	Bookings registered	Weekly trend	App	Spreadsheet
K_2	Bookings registered	Weekly comparison	App	Spreadsheet
K_3	Bookings registered	End of pilot period	App	Spreadsheet
K_4	Number of travelled kms per day	End of pilot period	App	Spreadsheet
K_5	Booking registered	Weekly trend	App	Spreadsheet
K_6	List of people boarding per day	Monthly trend	AVM/CCTV	Spreadsheet
K_7	Survey	Annual trend	Survey	Spreadsheet
K_8	List of trips done	Average daily trend	AVM	Spreadsheet
K_9	Square meters of parking areas	Annual trend	Municipality data on land use	Spreadsheet