



Strategic planning approach for DRT services in Sustainable Urban Mobility Plans (SUMP)

Methodological approach

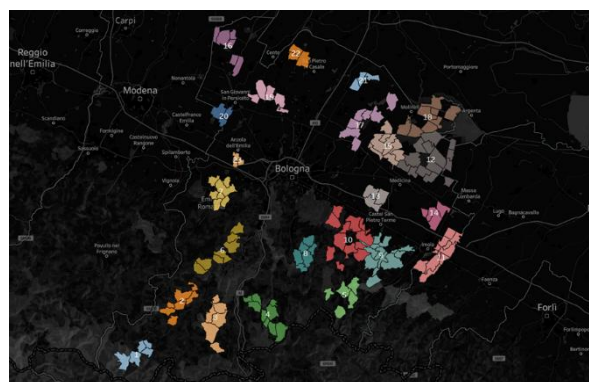
How to Integrate DRT in a public transport network in a MaaS logic, through better strategic and tactical planning? - Planning DRT services in Sustainable Urban Mobility Plans (SUMP), from demand analysis to the definition of service levels

Summary

The approach offers an overview of planning instruments - functional to be aligned with the SUMP approach - tested in the Bologna Metropolitan Area to identify potential DRT systems to be integrated in the existing network in a MaaS logic. It's composed by:

- Methodologies for the analysis of potential demand and for the definition of service levels in low demand areas;
- Hypotheses on DRT service and remuneration models according to demand characteristics.

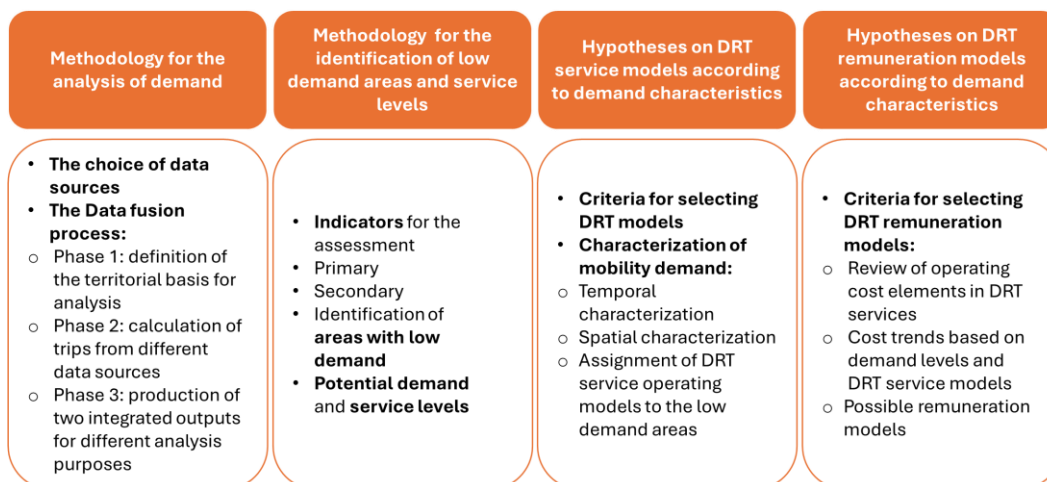
DREAM_PACE pilot areas: Bologna Metropolitan Area (IT)



Ref. DREAM_PACE deliverables:

[D1.2.3 Co-designed solutions blueprint of integrated DRT implemented / tested through pilot activities](#)

Flowchart





Introduction

The analytical approach presented here, developed within the DREAM PACE project, aims *exploring possible integrations between mobility demand analysis methodologies and urban and metropolitan strategic planning tools*, such as the SUMP (Sustainable Urban Mobility Plan) for the case of the Metropolitan City of Bologna.

The methodology for the analysis of mobility demand presented in the first two chapters represents and holistic and integrated approach, which adopts a data fusion logic to combine different information sources in a coherent and complementary manner.

The aim is to provide as accurate, detailed, and representative a picture as possible of mobility behaviour at the metropolitan level, leveraging the specific strengths of each source while mitigating the shortcomings that each individual dataset may have when used on its own.

The integration process has made it possible to accurately map the mobility of residents and city users, track journeys that cannot be detected using traditional methods, and associate each journey chain with comprehensive information on the reason for travel and mode of transport for different categories of users, thus providing a detailed and innovative insight into mobility demand in the area.

The third and fourth chapter present an operational model for the organization of DRT services in relation to the characteristics of demand in the identified areas, and integrate preliminary hypotheses on service remuneration models, consistent with the operating conditions and expected demand.

The document is completed by two annexes, describing the different phases of the testing of the proposed approach within the institutional and planning framework of the Metropolitan City of Bologna.



1 - A methodology for the analysis of demand

The choice of data sources

The analysis of mobility demand presented in this document is based on a **holistic and integrated approach**, which adopts a *data fusion* logic to combine different information sources in a coherent and complementary manner.

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The integration process makes possible to **accurately map the mobility of residents and city users, track journeys that cannot be detected using traditional methods, and associate each journey chain with comprehensive information on the reason for travel and mode of transport** for different categories of users, thus providing a detailed and innovative insight into mobility demand in the area.

To this end, the following main information sets can be used:

- **Ad hoc mobility surveys**, designed for example to provide useful data for updating the metropolitan SUMP, which made it possible to obtain accurate information on the origin, destination, motivation, and mode of transport of residents' journeys, differentiated by macro-area of residence and type category (combination of gender, age, occupation);
- **Socio-demographic data**, essential for characterizing the reference populations in terms of density, territorial distribution, and employment levels, in order to correlate mobility behaviors with settlement contexts;
- **Big Data derived from the mobile radio network**, used to quantify and spatialize mobility flows on a metropolitan scale, distinguishing between residents and city users and analyzing the exchange and crossing components of trips;
- **Floating Car Data**, used to integrate analyses of vehicle components and enrich the information derived from telephone big data.

This integration will generate a **multi-level knowledge base**, capable of comprehensively and dynamically representing the evolution of mobility and effectively supporting the assessments.

Each source is here described based on its main functional characteristics (such as updating, sample size, time and space detail, modal information, and availability of trip motivation) with a brief specification of its role in the data integration process and in the construction of the information base used for demand analysis.

Socio-economic data

Structured and official source of socio-demographic information are usually made available by national and/or regional statistical offices. Their strength lies in general in **their almost total coverage of the population and workforce**, with a level of detail that allows for disaggregated analysis by socio-demographic profiles such as gender and age, as well as detailed spatial distribution down to the census cell level. In addition, in some cases¹ it is possible to obtain updated data **on the employment rate by municipality**, which would be beneficial for defining the potential demand for systematic mobility.

From a functional point of view, those data can have some limitations: first, census-based updates other than demographic can have usually longer updating times, therefore short-term developments,

¹ See, for Italy the Metropolitan Statistical Atlas
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especially at the sub-municipal level (new residential/productive settlements), cannot be estimated. In the data fusion process, these data support in defining the statistical and territorial framework.

Strengths	Need for integration with other sources
- Allow for detailed characterization of territories at the municipal and sub-municipal level (census cells). - Provides a constantly updated demographic reference - The territorial structure allows for maximum spatial granularity, useful for aggregating and correlating with other data sources - Allow expansion to the universe of all sample data sources used in data fusion	- The most detailed territorial subdivisions are only updated on a long time horizon (e.g. 10 years) - Uneven availability may limit analysis at the micro-territorial level - No spatially disaggregated information is available on specific data (e.g. employment type/NACE codes)

Table 1 Strengths and critical elements of socio-economic data within the data fusion process (Source: DREAM_PACE elaborations on GO-Mobility analysis)

SUMPs surveys

As example, the survey conducted in 2023 to update the PUMS for the Bologna Metropolitan Area is a valuable source of data for the analytical representation of mobility demand. Aimed exclusively at **the resident population aged between 14 and 85**, the survey made it possible to identify daily travel chains in terms of origin, destination, main means of transport used and reason, with a level of detail broken down into 24 hourly bands.

Strengths	Need for integration with other sources
- Provides a representative estimate of mobility on an average weekday - Includes time details of trips for each time slot - Allows analysis of users' socio-demographic profiles - Collects information on the reason for the trip (work, study, shopping, etc.) - Provides the mode of transport used (car, bus, train, bicycle, etc.) - Allows for a distinction between trips within the municipality and between different municipalities	- Territorial granularity can be limited to macro-zones - Refers exclusively to residents in some cases with age restrictions (e.g. citizens aged over 14) - Sample data declared via questionnaire, not measured directly on actual behavior

Table 2 Strengths and weaknesses of the PUMS survey within the data fusion process (Source: DREAM_PACE elaborations on GO-Mobility analysis)



The reasons for travel were grouped into five categories: **work, shopping, social activities, study, and other reasons**, thus providing a detailed and qualitative overview of mobility needs.

From a territorial point of view, the segmentation of the survey into **16 aggregated zones** of the Metropolitan City of Bologna allowed for refined municipal or supra-municipal analysis. This level of granularity can particularly useful for estimating **self-contained flows at the municipal level**, which are not fully represented in the data from the mobile radio network due to the intrinsic characteristics of the data.

For this reason, the survey played a fundamental role in the **data fusion** process, contributing to the **construction of origin-destination matrices** and the **modal and motivational attribution** of trips, compensating for the typical shortcomings of big data on these qualitative aspects.

Mobile network data (telephone big data)

Big data from mobile networks is the quantitative core of mobility analysis in metropolitan areas, constituting the most extensive and representative source of observation, thanks to a **sample covering ap-proximately 30% of the population**. This type of data makes it possible to detect not only the movements of residents, but also those of temporary residents (e.g., university students) and city users, i.e., those who gravitate towards the area for work, study, or other services without officially and/or permanently residing there.

Strengths	Need for integration with other sources
- Includes non-residents, domiciled persons, and city users in the mapping, providing a comprehensive representation of mobility - The only source capable of detecting and quantifying movements across the territory - Offers a particularly accurate estimate of inter-municipal and exchange movements - Represents all city users, even outside the main metropolitan centers (airport, stations, trade fair, etc.) - Guarantees extended time coverage over 3 months (May, July, November) and 4 types of days (weekdays, Saturdays, Sundays, events) - It allows specific analyses to be carried out during special events (stadium, concerts) - Territorial subdivision into zones, constructed in line with analytical objectives - Hourly details available - Provides socio-demographic characterization of users (residence, age, citizenship) and travel (type, regularity, cardinality, AV)	- Does not provide information on the reason for and mode of transport - Does not detect movements within the individual zones of the territorial subdivision adopted

Table 3 Strengths and critical elements of mobile network data within the data fusion process (Source: GO-Mobility analysis)



The added value of mobile radio data lies in its ability to represent all *city users'* movements, not only those observable through access points such as stations, airports, or exhibition centers, but across the entire territory, contributing to a robust and integrated reconstruction of the actual movement chain of this rather significant component of demand in a key area of the country such as the metropolitan city of Bologna.

Another strength of this source is its **high temporal resolution**, which allows **mobility to be observed on an hourly and daily basis**, providing a dynamic snapshot of travel behavior and travel patterns. Among other things, this makes it possible to **measure seasonal fluctuations** by continuously monitoring monthly changes in demand and ensuring an up-to-date representation of mobility needs throughout the year.

Compared to other sources, mobile radio data is irreplaceable for observing all extraterritorial exchanges between the metropolitan city and the rest of the territory, and for mapping crossings (i.e., flows that affect the metropolitan city without originating or terminating within its territory). Furthermore, thanks to the high degree of representativeness of the sample, it is particularly accurate in providing a detailed view of dynamics at the municipal or sub-municipal level, consistently with the functional logic of mobility. On the other hand, by its very nature, it does not allow for the analysis of mobility within each of the zones defined for data extraction.

In the data fusion process, mobile radio data therefore provided the main basis for quantifying the origin/destination matrices of non-residents, with a degree of granularity and representativeness that is essential for calibrating and integrating other sources with reference to the mobility of residents in the metropolitan city.

Floating car data

Floating Car Data (FCD) is a valuable source for the dynamic analysis of the mobility system, particularly in relation to private car travel, as it consists of anonymized GPS data from connected vehicle fleets (including taxis, commercial vehicles, and shared vehicles), which track the routes actually traveled on the road network and provide granular information on travel times, average speeds, and hourly congestion profiles. shared vehicles), which track the routes actually taken on the road network and provide granular information on travel times, average speeds, and hourly congestion profiles.



Strengths	Need for integration with other sources
- Detects all types of vehicle movements passing through the metropolitan area (including interchanges and crossings) - They offer high spatial granularity, down to GPS coordinates, which is useful for road infrastructure analysis - They provide data with minute-by-minute granularity, enabling dynamic analysis in near real time - Enables accurate measurement of average speeds, distances traveled, and travel times, which are key indicators for evaluating network performance - They provide information on the vehicle's area of residence (based on the place of overnight stay), which is useful for statistical expansion to the reference universe	- They cover only car travel, excluding other forms of mobility - They do not provide information about the user, the driver, or any passengers - It is not possible to associate the reasons for the trip with the movements

Table 4 Strengths and weaknesses of Floating Car Data within the data fusion process (Source: GO-Mobility analysis)

One of the strengths of this source lies in its ability to accurately measure private transport mobility dynamics. This level of detail is otherwise difficult to obtain through surveys based on traditional methods. Thanks to this spatial and temporal granularity, it is possible to calculate key indicators such as average travel times, average speeds along road sections, and hourly, daily, or seasonal variations in network performance. Furthermore, compared to traditional sources, this type of data offers a broader sampling in terms of both quantity and statistical reliability.

In the data fusion process, FCDs were used to enrich and refine the interpretation of data from other sources, especially with regard to metrics of mutual exchange between adjacent areas, which is crucial for maximizing potential and compensating for the inherent shortcomings of telephone data in the case of continuous residential settlements or areas with poor coverage.

The data fusion process

As mentioned above, in order to ensure that the analysis was as robust, consistent, and representative as possible of mobility demand in the metropolitan city of Bologna, a *data fusion* approach was adopted based on the structured and methodological integration of the aforementioned data sources. This process made it possible to **combine the strengths of the different information bases, while compensating for the inherent limitations of each** and creating a common knowledge base.

The aim was to harmonize the spatial, temporal, and conceptual dimensions of the different sources, ensuring a cross-sectional and layered reading of mobility phenomena, capable of representing the main components of urban and metropolitan mobility: internal, exchange, and crossing trips. This section summarizes the main activities that make up this process.

Phase 1: definition of the territorial basis for analysis

The first phase of the data fusion process involved defining a coherent and sufficiently granular territorial basis to support integration between heterogeneous sources. The construction of an ad hoc



zoning system ensured the **spatial standardization necessary to make data from different sources, with different structures and resolutions, comparable.**

Construction of an ad hoc zoning within the metropolitan city

The first step in the integration process was to define a coherent, detailed, and homogeneous territorial zoning, necessary to ensure spatial compatibility between the different data sources. As example, the territory of the metropolitan city of Bologna was divided into 1,050 zones, constituting the basic unit for subsequent analyses.

Aggregation and standardization of socioeconomic data on a zonal basis

The relevant socioeconomic indicators were calculated for each of the identified zones, based on data provided by the national statistical office ISTAT (population census) and the Metropolitan Atlas. This work required the harmonization of sources with different resolutions and structures.

Recomposition by cross-sociodemographic profiles

For each area, the resident population was broken down by age group, gender, and employment status, so as to allow for a detailed and multifactorial reading of mobility behaviors. This level of detail proved particularly useful for comparing user characteristics with the data observed on trips and for subsequent sample expansion and user segmentation exercises.

Phase 2: calculation of trips from different data sources

The second phase of the data fusion process is dedicated to reconstructing trips from different sources and is divided into two parallel macro-activities, each focusing on a different subset of the population and a different analytical perspective. On the one hand, trips leaving home and returning home are estimated for residents only, integrating PUMS (sample) survey data with socio-demographic data. On the other hand, the overall movements of all users, residents and non-residents, are calculated from telephone big data, integrated and refined thanks to the contribution of FCD data.

This dual approach allows us to make the most of the wealth of information available, balancing behavioral detail and sample size.

Calculation of trips leaving home and returning home for residents only

1. Calculation of movements based on the SUMP survey and socio-demographic data:

In Bologna, the survey carried out in 2023, targeting residents of the metropolitan city, is used to estimate the average number of inter-municipal and intra-municipal trips made by each user category, broken down by gender, age group, employment status, and origin/destination relationships in the 16 survey areas.

2. Normalization with respect to the actual population of each zone:

The mobility indicators derived from the survey are compared to the resident population at the time of the survey to obtain 'mobility rates' that can also be used in time projections.

3. Disaggregation by mode and reason for travel:

Once the total volume of trips for each 'key' user profile combination has been defined, the trips are further broken down by reason (work, study, shopping, etc.) and main mode of transport, based on the distributions observed in the survey.

4. Estimation of trips with detailed zoning:

The mobility rates are finally applied to the updated resident population, reconstructed for each of the 1,050 analysis zones. The result is a travel matrix that combines high spatial granularity and socio-demographic detail.



It is important to note that the matrix obtained has asymmetrical zoning, with greater spatial detail on the origin (1,050 zones) for departures from home and on the destination for returns.

Calculation of total movements from telephone big data and FCD

1. Extraction of movements measured by the mobile network for all user profiles:

Telephone data is used to quantify the total number of daily movements across the entire metropolitan area, distinguishing between residents, city users, and non-residents, and classifying users according to age, origin, and mobility components (internal, exchange, crossing).

2. Verification and enrichment of data using Floating Car Data:

FCD data is used to correct any distortions, such as "bounces" due to accuracy and coverage limitations of data from the mobile network. This eliminates false trips that do not correspond to actual routes, improving the quality and consistency of the information flow, particularly on short inter-municipal routes and in high-density urban areas.

Phase 3: production of two integrated outputs for different analysis purposes

The third phase involved the construction of the outputs resulting from the integration process between the sources, obtained for different analytical purposes, differentiating the level of territorial and informational detail and thus allowing a two-pronged approach: one broader and more systemic, the other focused on areas with less intense demand.

Creation of a database for comprehensive mobility analysis

This first output aims to provide an overview of mobility behaviors and is designed to support general assessments of the structure and intensity of mobility demand, regardless of user residence:

Broad spectrum of population covered: the database includes trips made by all types of users, residents and non-residents, including city users and through traffic, as detected by the mobile radio network;

Zoning consistent with telephone data: the information is aggregated into areas, consistent with the zoning used for extracting data from the mobile network;

Focus on volumes: the dataset does not contain details on the reason for or mode of transport, but focuses on quantities, distribution, and the socio-demographic profiles of users.

Creation of a database for specific analyses of areas with low demand

The second output was designed to enable targeted analysis of areas characterized by more discontinuous or dispersed mobility demand, such as peripheral areas, and was created to support the definition of the level of public transport service in these areas, providing a more granular reading of residents' mobility behavior:

Disaggregated information on origin and return: the database focuses on the home-based movements of residents only, with the possibility of clearly distinguishing between departures and returns for each socio-demographic profile;

Highly detailed zoning for a detailed understanding of the territory: the territorial basis consists of the socioeconomic zones defined in the first phase, making it possible to achieve a high level of spatial granularity;

Details on modes of transport and reasons for travel: the dataset includes information on the reason for travel (work, study, shopping, etc.) and the mode used (car, public transport, bicycle, etc.), which is essential for assessing service needs and the effectiveness of the existing offer.

The overall result is an integrated knowledge system that, in a way that is unprecedented on a metropolitan scale, allows for a coherent and flexible reading of the different components of mobility



demand: from the most systematic to the occasional, from local to cross-city trips, from the dynamics of residents to those of city users.

Focus: the of the intra-zone travel component

A crucial step that cuts across the entire methodological process is the ***estimation of the intra-zone component of mobility***, i.e., the part of travel that takes place within the same zone. As these are internal movements that cannot be directly detected from telephone data, this component would risk remaining "invisible" if not adequately estimated, compromising the robustness and representativeness of the final analyses. To fill this gap and ensure a complete and reliable picture of mobility, a specific methodological process is proposed, structured in several stages:

- firstly, a transcoding matrix is constructed between the two main zoning systems adopted: telephone zoning (approximately 200 zones for Bologna), used to extract data from the mobile network, and more granular zoning (1,050 zones), used for socio-economic analyses related to the territory and potential demand. This operation made information from different sources compatible with each other.
- subsequently, based on SUMP mobility survey data, a gravitational model is calibrated to estimate the share of *self-contained* trips for each municipality, distinguishing appropriately between trips within the city and those within other municipalities in the metropolitan area, to take into account the different dynamics;
- the model should then be applied to the zoning, to reconstruct internal origin/destination relationships with the highest possible level of detail;
- finally, the percentage share of intra-zone trips for each zone of the telephone zoning is estimated, maintaining the average proportion of trips starting and ending in the same area relative to the total generated and attracted by each zone.



2 - A methodology for the identification of low demand areas and service levels

This chapter aims at providing a **methodological and operational framework to support the identification of effective solutions for the planning of public transport services** (including DRT services), with reference to the organization of service areas and their articulation according to demand.

The approach falls within the guidelines established by the Resolution No. 48/2017 by the Italian Transport Authority (ART) and aims to provide elements consistent with the requirement of an **assessment of the most suitable modes and types of transport to meet low demand**, taking into account economic, environmental, and contextual variables, as well as the principles of modal integration and sustainability.

In order to outline a coherent and objective picture, the chapter integrates two complementary analyses:

- the **definition of low demand areas**, defined as the least densely served areas or those with the most fragile demand levels;
- **the definition of a methodology for calculating potential demand and service levels**, in order to understand the geographical and temporal distribution of mobility needs, drawing on the detailed information provided in the previous chapters and with a specific focus on low demand areas.

About the first point, the information sources used (including territorial, socio-demographic, and local public transport supply and demand databases) are illustrated, as well as the related indicators to be calculated.

The methodology proposed for calculating potential demand and service levels in low demand areas is designed to be clear and replicable, so that it can be reused in subsequent phases of planning, updating, or verification of DRT services.

A methodology for identifying 'low-demand' areas²

Based on the above, the identification of areas with low demand is a key step in the local public transport service planning process, especially in relation to the need to ensure a minimum level of accessibility even in less dense or more fragile areas from a socio-demographic and economic point of view. The analysis of these areas must be conducted on the basis of **objective indicators** capable of providing a coherent representation of the territorial characteristics and potential mobility.

The orographic, temporal, subjective, or socio-economic characteristics of a territorial area determine the presence of areas in which potential mobility is modest, spatially dispersed, or rare over time, and can therefore be defined as "low demand." Specifically, this phenomenon is closely related to factors such as:

- the **physical conformation of the territories**, such as orography, population distribution and density, degree of urbanization, and accessibility;
- the **social and demographic structure of the population**, with particular reference to 'vulnerable' groups such as minors, the elderly and the disabled;

² in accordance with Italian law DM 157/2018
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- **economic conditions**, which influence the degree of inclusion and autonomy in travel.

When these factors reach critical levels, the generative potential of mobility is low, resulting in limited transport demand that is unevenly distributed in space and/or time. In such contexts, even in the presence of low demand, there is still a need to ensure adequate, integrated, and sustainable mobility solutions, in line with the principles of equity and territorial cohesion.

Therefore, the identification of areas with low demand in the metropolitan area of Bologna was carried out by examining the five territorial and socio-economic indicators. The following paragraphs detail the indicators established by the ministerial decree, accompanied by the relevant thresholds, information sources, and calculation methods.

Indicators for the assessment of areas with low demand

The indicators for calculating areas with low demand have been created with the aim of providing parameters capable of **objectively and comparably describing the territorial, socio-demographic, and economic characteristics of the various areas of the basin**. These indicators make it possible to assess the presence of structural conditions that hinder or limit the potential demand for collective mobility, providing a useful information base for defining priorities for action, designing coherent services, and planning service areas.

This indicators for the analysis, can be divided in two categories:

- **primary indicators**, which represent the structural factors most directly linked to the generation and concentration of public transport demand;
- **secondary indicators**, which supplement the analysis by providing additional contextual elements useful for territorial interpretation and calibration of the assessment.

'Primary' indicators

Primary indicators represent the fundamental structural factors for identifying areas with low demand, as they directly describe the generative capacity of mobility, the demographic composition of the population, and the degree of remoteness of the territories:

- **Generative potential**: a municipality is considered to have low demand if it generates a total number of daily trips of less than 3,000 according to data provided by ISTAT. This value represents an indicative threshold for identifying areas with low mobility density and therefore limited demand for public transport services;
- **Demographic composition of the population**: a municipality is considered to have fragile demand characteristics if more than 10% of the population belongs to the school age group (5-24 years) or if more than 10% consists of residents over the age of 70³. These groups are typically associated with greater dependence on public transport or specific forms of mobility;
- **Degree of peripherality**: municipalities with a degree of peripherality 'D' (*intermediate*), 'E' (*peripheral*) or 'F' (*ultra-peripheral*) are considered to be indicators of low demand. This classification⁴ is based on the functional distance from the main centers and the availability of essential services, indirectly reflecting the difficulty of access to mobility opportunities.

³ Source: Resident population as of December 31, 2023, according to ISTAT

⁴ Source: Metropolitan Statistical Atlas based on ISTAT data "Map of Internal Areas"

(https://www.cittametropolitana.bo.it/atlantemetropolitano/territorio/Mappe_Abitazioni/mappe_aree_interne/ta_belle_aree_interne/mappe_aree_interne)



Secondary indicators

Alongside the primary indicators, which represent the main structural reference factors for identifying areas with low demand, the methodology provides for the integration of **secondary indicators** capable of capturing additional elements of territorial complexity. Although these indicators alone are not sufficient to define an area as low demand, they help to refine the knowledge base and better interpret the local dynamics that influence potential mobility and access to services. In particular, two relevant aspects are considered:

- **Altitude range:** the difference between the maximum and minimum altitude above sea level in the municipal area is a useful indicator of the degree of orographic complexity of the territory. Values above 600 meters suggest a rugged morphology, which can constitute a natural obstacle to mobility, continuity of access, and rationalization of public transport services.
- **Territorial dispersion:** this indicator measures the fragmentation of the settlement fabric within the municipality, through the average distance between the municipal center and its hamlets or districts, weighed up by the population residing in the hamlets themselves. Situations where the average distance exceeds 1.5 km are considered critical, as this leads to greater difficulty in providing service coverage and a potential increase in operating costs to ensure widespread accessibility.

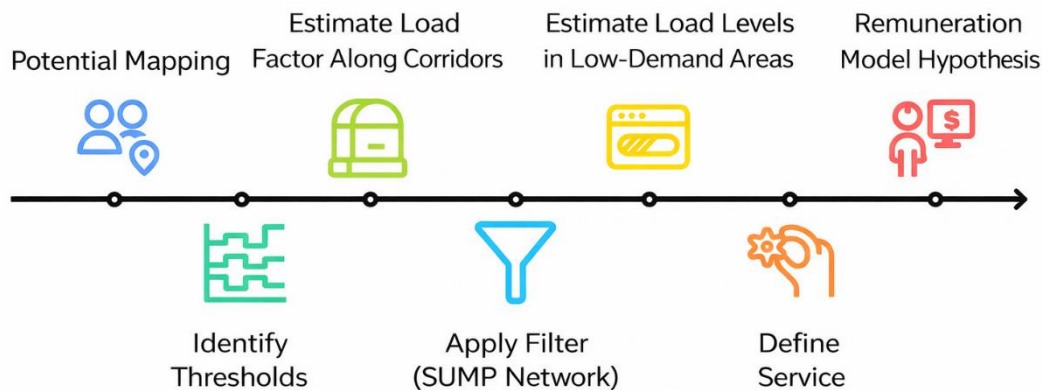
To address the limited availability of data on the precise location of settlements, the indicator relating to territorial dispersion was calculated using the **degree of urbanization** provided by The national statistical institute and Eurostat for each municipality⁵. In particular, municipalities classified in **class 3**, corresponding to so-called 'rural or sparsely populated areas', were identified as critical, as they are more exposed to conditions of settlement isolation and difficulties in providing services.

Calculating potential demand and defining service levels

The effectiveness of planning choices depends on the ability to accurately identify the characteristics of demand in different segments of the territory, and in particular to recognize areas and relationships where demand is low, discontinuous, or concentrated in specific periods or times. It is precisely in these contexts that it is crucial to identify flexible, integrated, and sustainable service modes that can guarantee accessibility while minimizing costs and externalities.

To allow for an objective and replicable classification of low demand areas, the national legislation in Italy defines a methodological framework based on measurable technical criteria and territorial and mobility data. This section therefore describes the methodology used to **calculate potential demand and define service levels in areas with low demand** applied in the metropolitan area of Bologna, as well as the choices made to ensure consistency with regulatory references and adaptability to the local context.

⁵ Source: ISTAT (<https://www.istat.it/classificazione/principali-statistiche-geografiche-sui-comuni/>)
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Figure

Figure 1 Graphical representation of the proposed methodology for calculating potential demand and defining service levels in areas with low demand (Source: GO-Mobility)

The identification and characterization of areas with low demand is carried out through a replicable methodological process, divided into several phases but readable as a logical and operational sequence (see figure 8).

1. **Mapping of generative and attractive potential:** each area of the territory is analyzed in terms of the density of trips generated and attracted (in relation to the surface area), in order to construct a synthetic parameter of "potential demand";
2. **Identification of classification thresholds:** areas with very low potential demand (e.g., less than 2-5 movements/km²) are distinguished from those with **high movement intensity** (e.g., over 60-80 movements/km²), corresponding to the main corridors of the public transport network. Intermediate areas are subject to specific assessment;
3. **Estimation of load along the main corridors:** by calculating passenger*km, the expected volumes on board the services are assessed and compared with the available capacity (*load factor*) to estimate the number of trips required and the compatibility of the service with high-capacity (e.g., rail) or lighter (bus) modes;
4. **Application of the filter to the existing network:** areas with low demand are reanalyzed in light of the public transport network provided for in the PUMS (Metropolitan Urban Transport Plan) of the metropolitan city of Bologna to assess its actual coverage and the frequencies offered. At this stage, areas served by the network provided for in the PUMS are excluded from the analysis;
5. **Simulation of load levels in areas with low demand by type of relationship:** for each area with low demand, the expected number of passengers traveling to the main city, to other municipalities, and within the same area is calculated. This defines the demand for calibrating the service;
6. **Definition of the implementation and flexibility of the DRT service:**
 - **Operation:** a threshold is identified below which the service will not be activated (e.g., on routes where fewer than five passengers per trip are estimated);
 - **Flexibility:** spatial and temporal criteria are applied to decide whether the service should be fixed, regular, on demand, or on variable routes, depending on the concentration of demand.



7. ***Hypothesis for a DRT service remuneration model:*** the methodology concludes with a preliminary indication for defining the economic model for the service, taking into account the estimated demand and the selected operating methods.



3 - Hypotheses on DRT service models according to demand characteristics

Once areas with low demand have been identified, the next step is to define **the most suitable DRT service model** for each local context. As specified several times in the various phases of the project, demand-responsive transport (DRT) services are not a single, standardized solution, but ***can be configured in different operating modes, depending on a variety of factors:***

- the settlement and morphological structure of the territory,
- the spatial and temporal distribution of mobility demand,
- the degree of integration with the planned TPM network,
- the management and contractual complexity compatible with the context.

The objective of this phase is therefore to adapt the service to local specificities in order to maximize operational effectiveness, ensure adequate coverage of mobility needs, and optimize economic and financial sustainability. To do this, a **classification logic based on the integrated analysis of estimated demand (quantitative and qualitative) and the suitability of the different DRT models to the configuration of the areas** has been adopted.

This document is part of a broader process developed within the DREAM_PACE project, which analyzed:

- the main organizational and contractual models of DRT;
- the characteristics of flexible services in terms of economic and financial sustainability;
- demand levels in the context of the analyzed FUA (e.g. Metropolitan City of Bologna).

The objective of this chapter and the following is to build on the application of the methodology for identifying areas with low demand, to propose a range of operating models that are consistent with both the territorial constraints investigated and the requirements of effectiveness, equity, and sustainability.

Criteria for selecting the DRT model for each area

This section summarizes the **four DRT service operating models** considered in this document, illustrating their main functional characteristics and consistency with different territorial, settlement, and organizational scenarios. As is well known, **DRT configurations are not uniform solutions** but must be carefully selected on the basis of an integrated set of factors, including:

- **the geographical extent and territorial characteristics** of the area to be served: large areas with poor accessibility require greater operational flexibility, while compact areas or those with good road access are more suited to structured routes;
- **estimated demand and the prevailing direction of travel**: areas with mobility directed towards a single hub justify fixed route models, while the presence of widespread or polycentric demand points towards more dynamic solutions;
- the level of **integration with existing local public transport**, in particular with the TPM network provided for in the SUMP: in some areas, DRT can play a feeder role to the main lines, while in others it can act as a direct service to the centers of attraction. Integration also includes tariff, information, and contractual aspects.

In ascending order of flexibility, DRT service configurations are:



1. **Basic route service with fixed stops:** predefined route with on-demand activation. This is suitable for contexts with demand directed towards a single axis and a linear mobility structure;
2. **Basic route service with deviations and fixed stops:** the main route is guaranteed, but occasional deviations are allowed on request to serve secondary or less frequented areas. The model is designed for areas with a larger center and smaller, scattered settlements, ensuring a good compromise between territorial coverage and operational regularity;
3. **Free route service between a predefined set of points:** there is no fixed route: the service connects, on request, a defined set of pre-established stops. It offers high flexibility and is particularly suitable for areas with scattered settlements, where it is important to guarantee access to essential services from multiple points. However, it requires advanced booking systems and effective communication;
4. **Free itinerary service between any set of points:** the highest level of flexibility, where the origin and destination are freely defined by the user within the area served. It is applicable in areas with fragmented demand, accessible and widespread road networks, and where a highly customized response to mobility needs is required. However, the unit cost is higher and operational management is more complex.

As mentioned above, the selection of the most suitable operating model for each area with low demand is based on a joint analysis of two key dimensions of mobility demand:

- **temporal variability**, i.e., the regularity or irregularity of trips throughout the day: from peaks at school or work times to a more distributed and less predictable demand;
- **spatial variability**, i.e., the distribution of mobility flows across the territory: from situations with demand concentrated along main routes to contexts characterized by widespread settlements and multiple polarization.

The intersection of these two axes allows us to construct a **logical grid of correspondence** between the demand profile and the DRT service models.

Temporal/spatial variability	Concentrated demand (e.g., linear axis, single hub)	Dispersed demand (spread-out settlements)
Regular demand (school/work hours)	Model 1-2 With fixed timetables	Model 3-4 With pre-established times
Variable request (irregular during the day)	Model 2 By appointment	Model 4 By reservation

Table 5 Correspondence between DRT service operating models and spatial and temporal characteristics of demand (Source: GO-Mobility calculations)

The grid is not a rigid classification, but an **interpretative map** useful for guiding operational choices, taking into account local characteristics and objectives of accessibility, sustainability, and ease of management. In particular:

- in the presence of **concentrated and regular demand**, simple and structured models (fixed routes) can be adopted;
- where demand is **spatially dispersed**, it is necessary to introduce a greater degree of flexibility, both in terms of routes and booking methods;



- in contexts with **distributed and variable demand**, the service must be able to adapt dynamically, with highly customized solutions (free itineraries).

This matrix is the link between the analysis of estimated demand and the definition of the operating models proposed for the individual areas, through the territorial and functional characterization of the identified areas with low demand.

Characterization of mobility demand: spatial and temporal structure

This section analyzes mobility demand in the low demand areas identified, with the aim of defining in a robust and concise manner the factors that influence the choice of DRT service operating models. In particular, two fundamental dimensions are explored in depth:

- the **temporal structure of demand**, i.e., the distribution of trips throughout the average working day and the presence or absence of systematic patterns attributable to regular and recurring needs (work, school, services);
- the **spatial structure of demand**, i.e., the territorial configuration of trips, the degree of concentration along main axes or dominant hubs, and the presence of scattered or polycentric settlements.

These dimensions are key to interpreting which operational model is most suitable in each context and have been constructed on the basis of the integration of mobility data, sub-municipal zoning, and analysis of travel relationships. The following sub-sections provide a separate reading of the two components:

The intersection between these two dimensions will guide the assignment of operational models to areas with low demand. It should be noted that, before proceeding with the temporal and spatial characterization of demand, a fundamental preliminary activity was carried out, consisting of calculating the total volume of demand generated and attracted for each of the areas with low demand identified. For each area, demand can be divided according to two macro-types of territorial relationship:

- **movements to and from the main city of the metropolitan area (e.g. Bologna)**, the main attraction center and hub of the metropolitan area;
- **movements to and from other municipalities**, which include both intra-municipal and interprovincial relations.

Temporal characterization

As mentioned above, the temporal distribution of trips is a determining factor in the design of DRT services, since the degree of concentration of demand throughout the day makes it possible to distinguish between contexts where it is preferable to plan fixed-time trips and situations where it is more efficient to adopt flexible, on-demand models. In general, if demand is **concentrated in specific time slots**, such as morning and afternoon peaks linked to school or work, it is advisable to plan fixed-time trips using higher-capacity vehicles. On the other hand, if journeys are **more spread out and irregular**, a reservation-based service is preferable, as this allows for the optimization of shifts and better calibration of supply, even with smaller vehicles.

To support this assessment, a specific analysis must be carried out on each of the identified low demand areas, broken down according to the type of relationship (to/from the main city and to/from other municipalities). The activities to be carried out are:

- analysis of **the hourly distribution** of demand generated and attracted by each area during an average weekday;
- **calculation of the hourly share** of the daily total, useful for identifying peak times;



- **identification, for each area/relationship combination**, of the time slot with the highest load:
- in the morning (until 12 noon), the peak is almost always concentrated between 7:00 and 9:00 a.m.;
- in the afternoon (after 12:00), the values are more distributed, but often concentrate around 1:00 p.m.

Finally, for each combination of low demand area/relationship type, the **sum of the demand shares concentrated** in the two main time slots (morning + afternoon) will be calculated in order to measure the overall degree of time concentration. This information can be translated into a simple operational rule for choosing the service model:

- if the concentrated share represents **at least 30%** of demand to/from the main city and **at least 20%** of demand to/from other municipalities, a **fixed-time service** is recommended;
- otherwise, it is preferable to opt for a **reservation-based service**, which is better suited to managing fragmented and distributed flows.

It is important to emphasize that the thresholds identified (30% for connections with the main city, 20% for others) are an operational reference criterion but **can be adjusted according to specific local needs, service objectives, or management constraints**. A change in these parameters may in fact lead to different design solutions, guiding the choice between more structured and more flexible models, in line with the territorial context and expected levels of demand.

Spatial characterization

Alongside the temporal dimension, the **spatial structure of demand** is also a key factor in choosing the most suitable operating model in areas with low demand. In particular, the distribution of trips across the territory can vary from highly polarized scenarios to more widespread and fragmented contexts. As mentioned above, if demand is **concentrated in a limited geographical area**, it is preferable to structure the service on **fixed routes**, capable of ensuring regularity and operational efficiency. Conversely, in the presence of a **more dispersed territorial distribution**, flexible configurations may be more effective, with **targeted deviations** or **free routes**, capable of reaching a scattered and less predictable demand.

To assess the degree of territorial concentration, a detailed analysis must be carried out for each of the identified low demand areas, according to the following steps:

- for each elementary zone (sub-municipal), the **share of demand** generated/attracted is calculated in relation to the total for the entire area;
- for each area, the **zone with the highest potential** is identified, i.e., the zone with the highest concentration of trips;
- the **share of surface area** occupied by each zone is then calculated in relation to the total area of low demand;
- finally, for each area, the **ratio between the share of demand and the share of surface area** is estimated: a summary indicator of the relative density of demand.

This ratio can be used as an objective criterion to distinguish between highly polarized contexts and areas with widespread demand:

- **if the ratio exceeds the threshold value of 5**, the adoption of a **fixed route model** is recommended, as a significant part of the demand is located in a small portion of the territory;
- otherwise, it is possible to adopt **models with deviations** or **free routes**, capable of flexibly covering a more distributed demand.

Again, the threshold identified is a technical reference point, but it can be **adjusted according to the characteristics of the territory**, the availability of infrastructure, and strategies for integration with existing public transport.



Assignment of DRT service operating models to the low demand areas

Once the analysis of the spatial and temporal characteristics of demand in the 23 areas with low demand had been completed, it is possible to assign the **DRT service model most consistent** with the specific characteristics of each context.

Each combination was associated with a **DRT operating model**, with an indication of the **hourly management mode** (fixed timetables or flexible booking). The results of the analysis are summarized in the following exemplary table, which shows the following for each area:

- the **numerical ID** (in line with the reference map);
- the **demand profile**, divided into temporal and spatial components;
- the **proposed DRT operating model**;
- and the related **hourly management**.

AREA ID	TREND TIME	TREND SPATIAL	MODEL DRT MANAGEMENT	MANAGEMENT SCHEDULES
1	Variable	Concentrated	Model 2	By appointment
2	Variable	Dispersed	Model 4	By appointment
3	Variable	Scattered	Model 4	By appointment
4	Regular	Concentrated	Model 1-2	Pre-set
5	Variable	Missing	Model 4	By appointment
6	Variable	Dispersed	Model 4	By appointment
7	Variable	Concentrated	Model 2	By appointment
8	Variable	Dispersed	Model 4	Upon reservation
9	Regular	Scattered	Model 3-4	Pre-established

Table 6 Hypothesis of operational models for DRT services in areas with low demand based on the temporal and spatial characteristics of demand (Source: GO-Mobility analysis)



4 - Hypotheses on DRT remuneration models according to demand characteristics

This chapter addresses the issue of remuneration for DRT services in light of the demand characteristics that emerged in the analysis, with the aim of constructing a coherent framework between the operating model and the contractual arrangements. The proposed approach is based on three fundamental assumptions:

- **the assumptions of DRT service operating models**, introduced in the previous section, which vary from structured configurations with fixed routes to completely flexible schemes, generate different cost structures, degrees of uncertainty, and control requirements;
- **the intensity of demand**, assessed in terms of potential mobility volumes, directly affects vehicle saturation and economic efficiency in management;
- **the choice of remuneration model** has a direct impact on economic sustainability, incentives for the operator, and the level of oversight required by the public administration.

The rest of this chapter briefly analyzes the main cost factors of DRT services, the possible alternative remuneration models to the standard cost method, and a logical grid for assigning each remuneration model to the low demand areas depending on the configuration of the service and the level of demand observed.

Criteria for selecting the DRT service remuneration model based on demand levels and the operating model

This section outlines the rationale for choosing the most appropriate remuneration model for DRT services in each area with low demand. It begins with a review of the main operating cost factors, summarizes alternative remuneration models to the standard method, and illustrates possible criteria for allocating remuneration according to the operational types of service.

Review of operating cost elements in DRT services

DRT services have a complex operating cost structure, strongly influenced by both the operating model adopted and the geographical configuration in which the service is provided. In general, costs can be divided into two main categories: **fixed costs** and **variable costs**, to which are added some semi-fixed components linked to the expected level of demand and the technology used.

Fixed costs

Fixed costs are independent of the actual number of activated trips and belong to five macro-families:

- **Analysis and study**: these are costs associated with higher-level surveys and assessments and are generally absorbed by existing dedicated structures;
- **Permanent staff**: drivers and operators at the operations center, who are needed to ensure service availability even during periods of low demand or to cover extended hours;
- **Fleet and maintenance**: costs related to the purchase or leasing of vehicles, as well as scheduled maintenance, insurance, and parking;
- **Enabling technologies**: digital infrastructure for service management (e.g., booking platform, app, operational interface), which involves an initial cost and license/management fees even in the absence of high volumes;
- **General expenses**: administrative, coordination, insurance, and logistics costs.



Variable costs

Variable costs increase as operational activity increases and include three macro categories:

- **Operation and consumption:** direct expenses for fuel, vehicle consumption, maintenance related to use and environmental impact, but also additional costs related to extraordinary trips, shifts or services activated only on request;
- **Technology and information systems:** such as SMS notifications, real-time tracking, dedicated interfaces for users with specific needs;
- **Inefficiency costs:** canceled trips, downtime between bookings, and empty mileage.

Cost trends based on demand levels and the DRT service model

The cost structure of DRT services is strongly influenced by two key factors: the **operating model adopted** (from the most structured to the most flexible) and the **level of demand in the area served**. The different operating models, classified according to the increasing flexibility of the network, have different degrees of management complexity, service saturation, and fixed and variable costs.

Model 1 (basic route service with fixed stops) guarantees the greatest stability in terms of unit costs, especially when demand is high and regular, and can benefit from the standard calculation method (ref. Ministerial Decree 157/2018). However, when demand is low, operating costs are likely to exceed revenues, making the service inefficient.

Model 2 (service with limited deviations from a fixed route) increases the degree of territorial coverage and requires a variable component in the remuneration model. The impact of additional kilometers can be managed with adjustments, but in low-demand contexts, service productivity may decrease significantly.

Model 3 (free routes between fixed points) is well suited to average and distributed demand, optimizing routes on a dynamic basis. However, variability in demand can negatively affect vehicle saturation, especially during off-peak hours.

Model 4 (completely free routes) is the most flexible, but involves high management complexity and a heavy load on information systems, ICT platforms, and dispatching mechanisms. When applied in low-demand areas, it requires significant operational and technological oversight relative to the actual number of users served.

The following **Error. L'origine riferimento non è stata trovata.** table summarizes the behavior of operating costs as a function of the level of demand for each DRT operating model.



Demand	Model 1	Model 2	Model 3	Model 4
High	Stable and predictable	Higher for greater mileage	Average predictable operating costs	High costs due to technological complexity and dispatching
Average	Partially stable with variable share	High incidence of variable costs	Stable costs, with variability in demand	High fixed costs and unpredictable variability
Low	Overhead costs exceed revenues	High costs relative to productivity	High operating costs compared to demand	High ICT and operating costs for minimal demand

Table 7 Cost trends based on demand levels and DRT service model

Each DRT service configuration involves a different balance between fixed and variable costs, which makes it necessary to define a **remuneration model that is appropriately calibrated** to the demand profile of each area.

Remuneration models for DRT services alternative to the standard cost method

The current 'kilometric' remuneration model, defined at regulatory level in Italy by the Ministerial Decree 157/2018, does not provide a standard cost system applicable to demand-responsive transport (DRT) services, explicitly excluding them from the methods provided for traditional modes of transport. In the absence of a single national methodological framework, alternative approaches have been explored for determining the economic consideration that takes into account the inherent limitations of applying the kilometer model to DRT services.

One of the most significant references is the Lombardy Regional Council Resolution No. X/4927/2016, which introduced the concept of '**equivalent mileage**'. This method allows the availability time and level of service guaranteed by the operator to be converted into a parameter that can be compared with traditional scheduled services. This approach takes into account:

- the hourly availability of the vehicle (OREus);
- the average commercial speed;

correction coefficients (c1 and c2) that reflect the operational complexity and risk of the service.

According to this approach, for example, models with greater flexibility (free routes between any points) are associated with a higher coefficient to recognize higher unit costs and lower predictability. Among the possible developments of the Lombardy model, the following can be envisaged:

- the introduction of fixed components linked to service availability (territorial coverage, operational continuity, booking system);
- a variable component that takes into account the volume of activity (driving hours, activations, kilometers traveled, users transported);
- the adoption of incentive coefficients for the use of digital tools, operational efficiency, or the achievement of certain levels of demand.

This approach allows for greater adherence to the specific characteristics of DRTs compared to the traditional €/km model, which is inadequate for services subject to high operational variability.



However, it should be noted that none of the models analyzed is without its drawbacks: there is always a trade-off between administrative simplicity, fair remuneration, and incentives for efficiency.

Remuneration model	Description	Items considered	Strengths	Critical issues
€/km traveled	Payment based on actual kilometers traveled	Kilometers traveled	Easy to calculate; linked to actual activity	Not suitable for flexible or low-demand services
€/hour of service	Remuneration based on vehicle and staff availability time	Driving hours or hours of availability	Rewards territorial coverage; easy to plan	Risk of inefficiencies if demand is highly variable
Equivalent mileage (kmeq)	Hours are converted into equivalent kilometers using coefficients (c1, c2)	Active hours * correction coefficients	Comparable with traditional services; adaptable	Requires fine calibration of coefficients
Fixed + variable mixed model	Guaranteed fixed part + variable part linked to volumes or performance	Fixed quota + km / users / trips	Balances economic stability and incentives for efficiency	More complex contracts to manage
Based on objectives (KPIs)	Remuneration linked to the achievement of qualitative or quantitative targets	Performance indicators (e.g., users)	Stimulates quality and innovation	Requires a structured monitoring system

Table 8 Comparative summary of remuneration models applicable to DRT services (Source: GO-Mobility analysis)

Possible remuneration models based on demand levels and DRT service model

The following tables summarize the considerations developed in the previous paragraphs, cross-referencing demand level (high, medium, low) and DRT operating model (1 to 4) to identify the most appropriate remuneration methods. Each cell shows the suggested model and a brief explanatory note clarifying the underlying logic. The considerations proposed take into account:

- the operating cost structure associated with each model depending on service usage and expected saturation;
- the possible configurations of alternative remuneration models to standard costs for DR services.

As it can be seen, in **high-demand** contexts, it is possible to apply kilometer-based models or models with variable components linked to quality and productivity. At the same time, in presence of **average demand**, hybrid solutions emerge that balance a fixed component of coverage with incentive elements. Finally, for **low levels of demand**, models based on service availability, independent of actual use, are preferred to ensure coverage and accessibility.

**Model 1 - Basic route service with fixed stops:**

Level of demand	Remuneration model	Notes
High	Classic mileage with bonus/penalty	The service structure is similar to that of a regular local public transport line, making the mileage criterion consistent with the service provided, while the high regularity allows for the introduction of quality adjustments.
Med	Kmeq + fixed daily rate	The partial fluctuation in demand requires a fixed component to guarantee supply, accompanied by a valuation in equivalent kilometers for the part actually performed.
Low	Mixed fixed/variable	The mixed fixed/variable model ensures service availability in low-demand contexts through a fixed service provision fee, accompanied by a variable component that recognizes the actual activation of trips, maintaining consistency with the PSOs.

Table 9 Assumed remuneration model for DRT services for type 1 operating model based on demand levels (Source: GO-Mobility analysis)

Model 2 - Basic route service with deviations and fixed stops:

Demand level	Remuneration model	Notes
High	Kmeq + correction for deviations	The Kmeq system ensures consistency with regular public transport and facilitates integration with existing systems; the corrective factor reflects the additional costs associated with flexibility.
Med	Fixed fee + €/km with minimum threshold	Economic balance is protected with a fixed base, while still remunerating the actual kilometers traveled, with minimum thresholds to avoid diseconomies.
Low	Fixed fee only on availability	The fixed component guarantees the sustainability of the minimum offer without generating distortions linked to low kilometer productivity.

Table 10 Assumed remuneration model for DRT services for the type 2 operating model based on demand levels (Source: GO-Mobility analysis)



Model 3 - Service with free itineraries between a predefined set of points:

Demand level	Remuneration model	Notes
High	Kmeq or hourly rate	Despite a structured organization, revenues remain at average levels, requiring a model that values continuous availability rather than productivity.
Medium	Fixed hourly rate independent of activation + qualitative KPIs	The fixed rate guarantees minimum availability without overestimating actual usage, with possible quality bonuses.
Low	Fixed hourly/daily rate	The only way to ensure sustainability in these contexts is remuneration based on availability, independent of actual demand.

Table 11 Assumed remuneration model for DRT services for type 3 operating model based on demand levels (Source: GO-Mobility analysis)

Model 4 - Service with free routes between any set of points:

Demand level	Remuneration model	Notes
High	€ per hour of availability + qualitative KPIs	Remuneration per hour of availability allows alignment with actual usage, while operational KPIs monitor service quality
Medium	€ per hour of availability + €/activation	The €/activation logic reflects the variability of the service and mitigates downtime costs.
Low	Fixed hourly rate independent of activation + quality KPIs	The fixed fee guarantees minimum availability without overestimating actual usage, with possible quality bonuses

Table 12 Assumed remuneration model for DRT services for the type 4 operating model based on demand levels (Source: GO-Mobility analysis)

This grid therefore allows contracting authorities to orient their choices towards models consistent with specific territorial and operational characteristics, representing a useful tool also during the tender phase or when updating contracts.

Characterization of demand levels

In order to consistently guide the choice of remuneration model for DRT services, it is essential to have a concise but robust classification of **the level of mobility demand** that each low demand area is potentially capable of generating. To this end, an operational methodology is adopted that **classifies** the daily generative potential of areas **from a qualitative/quantitative perspective**.

The process can be divided into three main steps:

- **Association of generative potential at the zone level:** depending on the zoning model available, for each zone into a number of daily trips generated can be estimated, focusing on low demand area;



- **Calculation of the average per area:** for each area, an average value of normalized generative potential per surface area (in trips per km²) must be estimated to ensure comparability between territories that differ in size and population density;
- **Classification into demand bands:** based on the average value obtained, each area is assigned to one of the following classes:
 - o **High Demand:** over 30 trips/km²;
 - o **Medium demand:** between 15 and 30 trips/km²;
 - o **Low demand:** less than 15 trips/km².

This classification provides an immediate indication of the **potential suitability** of each territorial context **for local public transport** and represents an **objective criterion** for consistently matching operating models and related remuneration mechanisms to the actual conditions of demand for services.

Assignment of DRT service remuneration models to low demand areas

Based on the operating model identified for each area and the estimated level of potential demand, a specific remuneration model can be assigned to each 'low demand' territorial context, consistent with the operational characteristics and dynamics highlighted in the previous paragraphs. The exemplary table summarizes the results of this process, highlighting for each area:

- the numerical identifier,
- the selected operating model,
- the estimated level of demand (high, medium, low),
- and the most suitable remuneration model, possibly proposed as an alternative.

AREA ID	OPERATING MODEL	DEMAND LEVEL	DRT REMUNERATION MODEL
1	Model 2-By reservation	Average	Fixed fee + €/km with minimum threshold
2	Model 4-Upon reservation	Low	Fixed hourly rate independent of activation + qualitative KPIs
3	Model 4-Upon reservation	Low	Fixed hourly rate independent of activation + qualitative KPIs
4	Model 4-Upon reservation	Low	Fixed hourly rate independent of activation + qualitative KPIs
5	Model 1-2-Pre-established	Med	Kmeq + fixed daily rate OR Fixed rate + €/km with minimum threshold
6	Model 2-Upon reservation	Low	Fixed rate only, subject to availability
7	Model 4-Upon reservation	High	€ per hour of availability + €/activation
8	Model 4-Upon reservation	Low	Fixed hourly rate independent of activation + qualitative KPIs
9	Model 2 - Upon reservation	Average	Fixed rate + €/km with minimum threshold

Table 13 Exemplary assignment of DRT service remuneration models (Source: GO-Mobility analysis)



Annexes

- D1.2.3 Annex 4_DREAM_PACE_Bologna pilot_action B_EN
- D1.2.3 Annex 4_DREAM_PACE_Bologna pilot_action D_EN