Interreg CENTRAL EUROPE

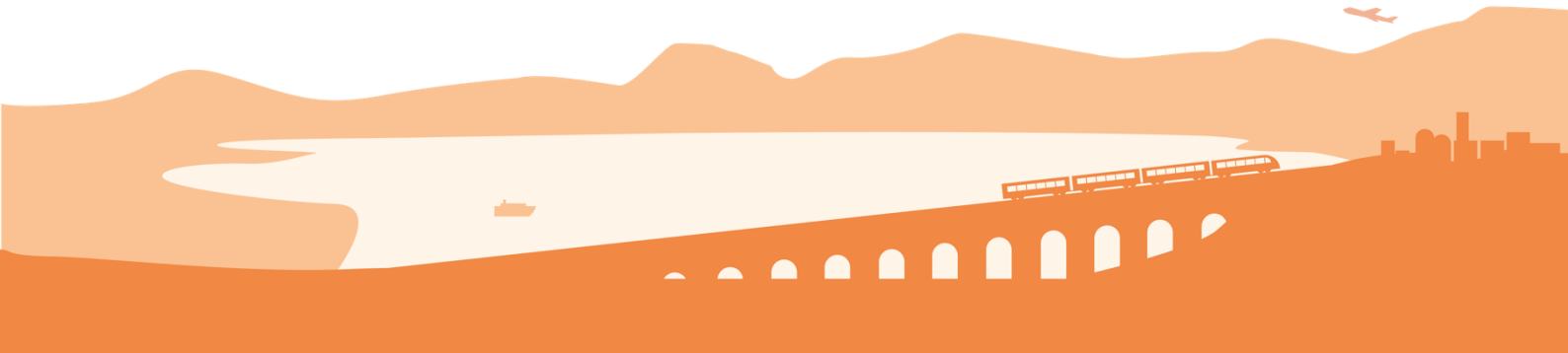
Co-funded by the European Union

DREAM_PACE

D2.1.2 State of the art report on digital and operational approaches for DRT in the pilot areas

Final Version

01 2024



Authors and log change of the document

Partner No.	Partner Acronym	Name of the author	Action	Version
4	Mobilissimus	Nikolett Csörgő Rita Petrovácz	1st version of the document	1
2	Redmint	Gabriele Grea	Review of the template	2
8	AustriaTech	Florian Kressler	Review of the template	2
6	DYVOLVE	Saša Bart	Review of the template	2
4	Mobilissimus	Nikolett Csörgő András Ekés	Compiling the document based on survey answers	3
2	Redmint	Gabriele Grea	Compiling the document based on survey answers	4
1	DYVOLVE	Saša Bart	Review of the document	5
4	Mobilissimus	Nikolett Csörgő András Ekés	Final version	Proposed final
2	Redmint	Gabriele Grea	Final version	Proposed final
1	SRM	Chiara Lepori Marco Amadori	Edited approved version for official release	Final

Contents

1. Executive summary

The territory of Central Europe is characterised by uneven transport connections and mobility opportunities, across and within regions, between urbanised contexts, and rural and peripheral areas.

The project's common challenge is to improve accessibility and connectivity in CE peripheral and rural areas through better integration of public transport networks with Demand Responsive Transport (DRT) services, building on joint development and implementation of governance, planning, digital and operational innovations.

DREAM_PACE will develop innovative DRT concepts complementing regional mobility networks.

The project will improve DRT planning and delivery capacities of public authorities and operators.

A new generation of DRT services will become functional and integral part of regional mobility networks, enhancing accessibility for citizens, territorial cohesion, and social inclusion. Integration is the key to the DREAM_PACE innovative approach, as DRT services are mostly developed as stand-alone solutions to specific needs, the potential of scalable strategies and solutions is widely underestimated.

Project Partners (thereafter PP) will jointly develop a strategy for DRT in Sustainable Urban Mobility Plans to be adopted at EU level, co-design, test and implement innovative DRT solutions enhancing mobility networks. Strategies and solutions will foster a better integration of DRT and public transport (Bologna, Pavia, Budapest areas), support a higher coordination among existing DT initiatives (Osttirol, Baden-Württemberg) and experiment new integrated approaches for DRT "green fields" (Split-Dalmatia County).

DREAM_PACE will exploit the potential of integrated planning and digital and operational innovations for a common strategy and develop innovative DRT modular solutions. The project implementation builds on transnational cooperation to guarantee an adequate responsiveness and adaptability of project results to specific characteristics of mobility ecosystems across CE rural and peripheral areas.

This document serves as a comprehensive report on the diagnosis of Demand-Responsive Transport (DRT) digital and operational approaches in the six pilot areas of the DREAM_PACE project.

The analysis focuses on key aspects such as territory and mobility context, existing services (public transport and DRT services), and operational models, aiming to identify gaps and specificities. The findings will be shared with relevant stakeholders primarily within the Living Labs frameworks at local level, as they represent the basis for drafting scenarios for the development and enhancement of DRT services within the co-design process. Moreover, the results of this analysis covering the six pilot areas will be re-elaborated in the communication process and disseminated through media channels to advocate for a more integrated approach to DRT.

The six pilot areas are described - in chapters from 3 to 8 - through several characteristics, such as operational aspects, technological components, integration with public transport, and challenges faced at operational and technological levels for DRT development.

Notably, territories such as the Oltrepò Pavese area (PP Autoguidovie), Budapest (BKK), Osttirol (RMO), and Split-Dalmatia County (SDC) are active in DREAM_PACE pilots dedicated to the implementation or enhancement of DRT services focusing on operational and digitalization aspects, with the support of all partners.

At the same time, all territories are engaged in governance and planning improvements, focusing on strategic planning, recommendations on data governance and integration, business planning and tendering

procedures. While in Bologna Metropolitan City (SRM), Budapest, Oltrepò Pavese (AG) and Split-Dalmatia County (SDC) pilots the efforts will be concentrated in better integrating DRT and public transport in a MaaS logic, Osttirol and Stuttgart areas focus on the development of coordinated DRT networks enhancing accessibility in peripheral and rural regions.

Overall, the document emphasizes the diversity of approaches and the collaborative efforts to address challenges and promote the integration of DRT into broader transportation systems.

The conclusions of this report on the state of the art on digital and operational approaches for DRT in the DREAM_PACE pilot areas provide useful takeaways that will be the primary input on which the next step of the DREAM_PACE Living Labs, i.e. the development of the future scenarios, will build on.

Furthermore, chapter 10 contains the references of the document, while the Annex provides the template of the Survey used for collecting the information related to the pilot areas that are elaborated in the document.

2. Methodology for the development of the the state of the art report

This document is based on information collected through an online survey conducted among pilot areas' DREAM_PACE partners by Mobilissimus and Redmint, in collaboration with SRM and AustriaTech.

The survey – which full text is available in the Annex - was structured into three main blocks, covering:

- Territory and Mobility Context;
- Governance and Planning;
- Operational Models and Digitalization of Services.

While governance and planning aspects are detailed in the DREAM_PACE deliverable D1.1.2 "State of the art report on governance structures and planning processes for DRT in the pilot areas", this document addresses the territory and mobility context and the operational models and digitalization of services in the six pilot areas.

The section on territory and mobility context delves into inquiries about existing services, both in regular public transport and DRT. It further details the socio-economic and cultural trends, relevant flows, and details about local public transport services, including traditional, flexible, and shared services. The survey encompasses existing DRT services, their coverage areas, and the key challenges.

The section related to the operational models and digitalization services focuses on characterizing existing DRT services operationally, outlining concepts and scheduling. Emphasis is placed on technological components, also including those planned in the DREAM_PACE project. This involves evaluating the level of digitalization, existing digital components, trip request processes, payment methods, and potential user feedback mechanisms. The integration with local public transport is also addressed.

Finally, it is noted that the survey also investigates challenges and criticalities in planning and implementing DRT services, such as procuring appropriately sized vehicles, harmonizing the service with local public transport networks, and ensuring a secure operational environment (e.g., areas with limited internet connectivity).

The document analyses the survey results for each pilot area.

3. Metropolitan city of Bologna

3.1. Territory and mobility context

3.1.1. Territory and existing services

The Metropolitan City of Bologna (55 municipalities, 1Mio inhabitants) is located in the Emilia-Romagna region. Its capital is the city of Bologna (400k inhabitants).

Mobility is based on bus public transport service (36M km/year, 96M pax/year) including DRT, Metropolitan rail service (5M km/year, 13M pax/year), and Free-floating Bike/Car-sharing services.

To have a comprehensive overview on the territory and mobility context and to better understand the current situation, the main socioeconomic and cultural trends that affect mobility in the pilot area are crucial from the pilot area development point of view.

The motorization rate increased in the last 10 years, from 62,4 cars/100 inhabitants (2012) to 68 cars/100 inhabitants (2022). At the same time, the number of inhabitants increased by 2,1% in the last 10 years in the Metropolitan area. While the number of students increased on the total population (+8% from 2016 to 2022), a progressive population aging was observed in the last 10 years.

Regarding the territory aspects, the Metropolitan area includes as mentioned 55 municipalities, the percentage of people living in the main city of Bologna compared to the inhabitants in the Metropolitan area have remained steady in the last 10 years (38,4%). In the same timeframe, a decrease in the number of active enterprises (-2,4%) in the Metropolitan city has been observed, while the number of employed persons increased by 18%[1].

Considering local traffic patterns, the main travel destinations are the followings:

- Bologna city center;
- Bologna main train station;
- Bologna bus station;
- Bologna airport;
- Bologna Fair center (when active).

Apart from these main transport hubs, secondary destinations - such as hospitals in the city and industries in the surroundings of Bologna and the Metropolitan area - are also frequent destinations.

The main mobility flows are from residential units to/from these main destinations.

In the pilot area, namely in the Metropolitan area, there are several existing local public transport, such as buses, trolleybuses, regional buses, suburban buses and even regional railway and long-distance buses. Inhabitants can also use existing flexible solutions, like taxi, DRT services, bike-sharing, shared e-scooters, shared e-bikes. Uber is also known and active in Bologna, operated by car-hire with driver services. Despite the presence of a wide range of services, there are some criticalities/challenges to cope with, such as the congestion peaks. There is high traffic on some public transport lines, challenging to guarantee the night service in the outskirts. Some municipalities (in the mountain/hilly areas) with low demand cannot be served with dense schedule. It is also challenging to provide access to the industries in the surroundings of the main Bologna city. For the shared services, the main challenge is to guarantee a proper number of transport means (especially the cars and the e-cars).

[1] More statistics of the Bologna Metropolitan area are available at https://inumeridibolognametropolitana.it/dati-statistici

3.1.2. DRT services on the territory

There are existing DRT services in the Metropolitan area of Bologna that serve rural areas, namely:

- Terre d'Acqua;
- Terre di Pianura;
- Borgo Panigale;
- Dozza;
- Ponte Rivabella.

All together they them compose the Prontobus service, which operates with a predefined time and route and is carried out only following a telephone reservation[2].The service applies the public transport fares; the reservation has no additional costs, except for the phone call to a landline number located in Bologna. Depending on the served area, the reservation must be made at least 35 / 60 minutes in advance of the bus passage time at the desired stop.

The main criticality of those services is the high cost compared with the number of transported passengers. DREAM_PACE activities will also support the future enhancement of these existing services.

3.2. Operational models and digitalization of services

3.2.1. Characterization of the existing DRT services from an operational point of view

The existing DRT services operate as extensions of existing public transport lines in the whole operation-time or in a specific time interval of the operation-time, e.g. off-peak hours. The DRT services operate on a fixed route with predetermined initial and/or final terminals, as well as designated intermediate stops with set departure times. The DRT vehicles can stop at public transport stop points along the selected designated route if passengers have a trip request. On of the objectives to be achieved by the DREAM_PACE project is that the governance and planning aspects will also include the possibility of implementing DRT services more flexible than the existing ones (in detail, Bologna focuses on governance and planning of integrated DRT-public transport in a MaaS logic).

3.2.2. What technological components characterize the existing services, and which functionalities are enabled in existing services

The existing DRT services operate with partly digital elements (e.g. online booking). They also operate with appropriate vehicles and DRT vehicle devices, which enable seamless communication between the driver and the communication center (Travel Dispatch Center). Moreover, they are outfitted with position-determination systems to precisely track their location. The governance and planning scheme, developed in the DREAM_PACE project, will also include an increase of the digital components in the future DRT services, while also optimizing the use of funding resources.

In detail, the Travel Dispatch Center allows to:

[2] https://www.tper.it/percorsi-orari/prontobus

- handle the order management process. It can accept or reject the requested transport based on various factors (e.g. user's location, coverage area, safety considerations etc.);
- perform data statistics and analysis for the DRT fleet. It collects and analyses data on passengers, drivers, vehicles, warehouses, and other relevant metrics to provide valuable insights into the service's performance, such as passenger demographics, usage patterns, profitability, and overall service effectiveness.

The governance and planning, developed in the DREAM_PACE project, will also include the endowing of the future DRT with a Travel Dispatch Center providing the following functions:

- provide real-time travel information to both service users and drivers;
- handle the order management process;
- optimize routes and schedule reservations efficiently;
- monitor the DRT service, by tracking vehicle locations, performance, and adherence to schedules;
- perform data statistics and analysis for the DRT fleet.

The passengers can indicate a trip request for the existing DRT services via phone calls, via Web Pages and (exceptionally) at the driver. The governance and planning, developed in the DREAM_PACE project, will also include an introduction of a new mobile application for the users.

The Communication Framework for the existing DRT service consists of Mobile Communication, which facilitates real-time communication between drivers and operators. This includes phone calls, SMS notifications, and mobile applications for tracking and updates. The governance and planning, developed in the DREAM_PACE project, could also include the IoT in a future DRT service.

The marketing activities are carried out together with the existing transport providers, with an high level of integration. The governance and planning, developed in the DREAM_PACE project, will include a CRM and Data Analytics.

Regarding the Passenger Information Systems, the Navigation is available via the commonly used apps (e.g. Google maps), while the Ticketing and Fare System is embedded in the public transport app (i.e. Roger). The governance and planning, developed in the DREAM_PACE project, will be included into a MaaS system developed and implemented in the Metropolitan City of Bologna (Governance), which also means the future integration between navigation systems and ticketing. As regards the fare system, it is the same for the DRT service as of the traditional public transport, using the same tickets/passes. The fare system is planned to be integrated in the MaaS system in the future.

The public transport operator collects the user feedback, opinions, comments and suggestions as in the traditional public transport. The newly developed governance and planning will include the possibility of collecting user feedback, gathering opinions, comments, and suggestions from passengers or users also through an application, in the future also through a MaaS app.

3.2.3. Levels of integration with public transport, if relevant

The DRT service is integrated into the local public transport by using the same or part of its stops (stop table, timetables, bus shelter or platform etc.). At present, DRT services are operated by the incumbent and are fully harmonized with the traditional public transport service.

The newly developed governance and planning will include the integration of DRT services in a common passenger information framework, with an integrated ticketing and tariff system (MaaS) and the full integration of DRT with the suburban, regional public transport (railway, bus).

Based on the existing public service contract, the local public transport operator operates the existing DRT service. The possibility of having different public transport and DRT operators while guaranteeing anyway the integration of DRT with the public transport will be also investigated.

3.2.4. Main challenges and criticalities at operational and technological level for DRT development

At moment, there are no particular difficulties/barriers in providing/purchasing the needed alternative-sized vehicle for the DRT service, because DRT vehicles are provided based on the current public service contract – which means that the public transport operator guarantees the needed vehicle. The transport service operator guarantees the human resources too.

Regarding the challenges/difficulties in providing a secure operational environment for the DRT service in urban, pre-urban or rural areas, there could be difficulties for the real-time communications in some areas where there is a poor internet connection, especially in the mountains/hills. There is also a high need of appropriate communication campaigns to advertise the DRT services.

4. Pavia - Oltrepò

4.1. Territory and mobility context

4.1.1. Territory and existing services

In the Pavia region, Oltrepò is a mainly hilly rural area, composed by about 30 small municipalities; Stradella (main urban municipality of the area) is the main destination of travel from other municipalities, for work reasons - thanks to the considerable development of all production sectors (especially logistics), for study reasons - thanks to the presence of secondary schools, and for leisure and shopping reasons - thanks to the presence of some commercial activities and an important market on a bi-weekly basis.

The main socioeconomic trends in the Oltrepò territory are the ageing of population and the depopulation of rural and mountain areas, only partially counterbalanced by the immigration of workers and families from foreign countries to fulfil the needs of the industry, logistics and agriculture sectors.

The urban sprawl is a significant feature of the territory, and the car dependency is very high, with a motorisation rate of approximately 600 cars per thousand inhabitants.

4.1.2. DRT services on the territory

DRT service is currently organized with free itineraries between a predefined set of 256 stops, available in the following service hours: in the school period, from Monday to Friday 9.30-11.30 / 16.30-18.30; Saturday 6.00-10.00 / 12.00-14.00 / 17.00-19.00; in the non-school/summer period, Monday to Saturday 6.00-10.00 / 12.00-14.00 / 17.00-19.00. During the booking phase, the passenger can choose the departure stop, the arrival stop and the desired departure or arrival time; the management system accepts the request and organizes the trip according to the availability of the buses for the requested stops and departure/arrival time.

In the same area, in addition to the DRT service, there are some fixed lines to reach other destinations outside the area (e.g. line 132 Stradella-Voghera; line 95 Castel S. Giovanni-Stradella-Pavia-Milano Famagosta), where interchange with the DRT service in possible.

4.2. Operational models and digitalization of services

4.2.1. Characterization of the existing DRT services from an operational point of view

The existing DRT service in Pavia is specifically designed to transport passengers from a desired pick-up location to a single destination known as the Point of Interest (POI). This POI can be any location or facility that attracts passenger demand, such as railway station, shopping center, market, hospital. The DRT service operates dynamically, responding to passenger request in real time, with flexible routes and a predefined network of stops and with variable driving schedules based on the specific needs of passengers. The driving time and routes of the vehicles can change every trip, adapting to the varying demands of passengers.

4.2.2. What technological components characterize the existing services, and which functionalities are enabled in existing services

The existing DRT service operates with partly digital element (e.g. online booking).

Regarding the digital components of the existing DRT service, it operates with a Travel Dispatch Center (TDC). It also operates with the appropriate vehicle/fleet and DRT vehicle device, which enables seamless communication between the driver and the communication center (TDC). Moreover, they are outfitted with position-determination systems to precisely track their location. A Customer application is also available.

The Travel Dispatch Center allows to monitor the DRT service, by tracking vehicle locations, performance, and adherence to schedules. It also allows to perform data statistics and analysis for the DRT fleet. It collects and analyses data on passengers, drivers, vehicles, warehouses, and other relevant metrics to provide valuable insights into the service's performance, such as passenger demographics, usage patterns, profitability, and overall service effectiveness.

The passengers can indicate a trip request via phone calls or via mobile application.

The Communication Framework for the existing DRT service consists of Mobile Communication, which facilitates real-time communication between drivers, operators, and passengers. This includes phone calls, SMS notifications, and mobile applications for booking, tracking, and updates.

The Marketing Framework for the existing DRT service consists of Digital Advertising, which utilizes online platforms, social media, and targeted advertising campaigns to promote transportation services, attract passengers, and increase ridership.

The Passenger Information Systems for the existing DRT service consists of Navigation Systems, which offers digital maps, navigation, and routing guidance to help passengers plan their journeys, locate stops or stations, and navigate through transportation networks.

Passengers can use the existing DRT service with standard tickets or weekly, monthly, and annual passes.

The process of collecting user feedback is through digital feedback in the application. Passengers can send report or complaints via email, and the operator runs surveys periodically.

Within the framework of the DREAM_PACE project, new digital tools in the application will be identified in order to facilitate the integration of DRT with the local public transport:

- Timetables of bus and railway lines with interchange at the DRT stops;
- Possibility of booking DRT service in connection with bus line service;
- Points of interest near the DRT stops (public services, touristic attractions, cycling routes, etc.).

Also planned to introduce hotspots at the three main stops, where passengers can use the service even without reservation on the scheduled routes. Installation of totems in hotspots is also outlined to check the places available on incoming vehicles and book the service.

4.2.3. Levels of integration with public transport, if relevant

The DRT service is integrated with the suburban, regional public transport (railway, bus) since mains stops are in common. The local public transport operator operates the existing DRT service, based on the public service contract. The management of interchanges between DRT and fixed line services are carried out through algorithm of optimization the travels. There is an interchange option between DRT and public transport services at the main stops (e.g. Stradella railway station, Broni railway station, Stradella bus hub).

The dialogue with the Local Mobility Authority (regulatory body) to enhance the integration of DRT services in the local public transport network and increase the awareness of all stakeholders in the implementation and operation of this type of services is an important phase of the development of DRT services.

4.2.4. Main challenges and criticalities at operational and technological level for DRT development

There are not difficulties in providing the alternative-sized vehicle type or fleet for the DRT service, same rules and regulations can be applied as in the traditional service vehicle's needs.

Anyway, it is noted that the DRT service is not fully harmonized yet with the existing public transport service.

In terms of challenges in providing a secure operational environment for the DRT service in urban, pre-urban or rural areas, the lack of internet connection can be a problem in some areas.

Regarding the user behaviour, it is possible that passengers from trips are excluded for a given time in case of notorious non-cancellation of trips.

5. Split-Dalmatia County

5.1. Territory and mobility context

5.1.1. Territory and existing services

The Split-Dalmatia County is the second most populous county in Croatia with 423.849 inhabitants, after the City of Zagreb with 768.054. The majority of the population, almost 80%, resides in 16 cities of the County (almost 40% in the city of Split), while the remaining population lives in 39 municipalities and 382 settlements of the County.

In the age structure of the population (data from 2021), the majority consists of the age group 15-64 years (63%), while the percentage of the age group up to 15 years is 15%, and the percentage of the age group 65 years and above is 22%. The unbalanced distribution of young and old population further confirms the trend of population aging.

The total number of daily commuters in the County according to the 2021 census was 81.510, constituting approximately one-fifth of the total number of individuals aged 15 and above, 71,7% of which are workers. Of the total number of commuting workers, 74,2% work in a different city or municipality within the County, 21,9% worked in a different settlement within the same city/municipality, and 3,9% in a different county or abroad.

There are four business zones in the area. The main relevant flows are between business zones and residential areas where workers leave. In addition to business zones, POIs include healthcare facilities and shopping centers.

Some residents do not have means of transportation and it is difficult for them to travel to workplaces or health institutions.

The main challenges for the existing public transport network are related to reliability, low frequency and partial coverage of the territory.

5.1.2. DRT services on the territory

There are no existing DRT services in the Split-Dalmatia County.

5.2. Operational models and digitalization of services

5.2.1. Characterization of the existing DRT services from an operational point of view

The DRT service is currently in the planning phase and to be implemented as the test service during DREAM_PACE project. In operational terms, DRT can be organized in the form of a public service obligation (PSO) contract and be part of integrated public transport services on a broader scale.

Anticipated benefits of the DRT service include an optimized and flexible concept for sparsely populated areas in the SDC, reduced transportation costs, minimal empty rides, improved mobility in rural areas, and the introduction of technological innovations.

In the pilot phase, the use of digital innovations for DRT services and improvement of mobility in rural areas and social inclusion will be also taken into consideration. The pilot service will operate in the Split-Dalmatia County area with a flexible schedule according to the plans.

5.2.2. What technological components characterize the existing services, and which functionalities are enabled in existing services

The future DRT service will be operated with the appropriate fleet and DRT vehicle device, which will enable seamless communication between the driver and the communication center (Travel Dispatch Center). They will be also outfitted with position-determination systems to precisely track their location.

The future DRT service in the Split-Dalmatia County pilot area will need to have Travel Dispatch Center operated by DRT service provider with all the following options:

- providing real-time travel information to both service users and drivers;
- handling the order management process. It can accept or reject the requested transport based on various factors (e.g. user's location, coverage area, safety considerations etc.);
- optimizing routes and schedule reservations efficiently. It assigns vehicles to specific routes based on real-time demand and dynamically adjusts routes based on new requests. TDC aims to minimize delays and improve the overall efficiency of the service. It also provides users with estimated travel times;
- monitoring the DRT service, by tracking vehicle locations, performance, and adherence to schedules;
- performing data statistics and analysis for the DRT fleet. It collects and analyses data on passengers, drivers, vehicles, warehouses, and other relevant metrics to provide valuable insights into the service's performance, such as passenger demographics, usage patterns, profitability, and overall service effectiveness.

The passengers will be able to indicate a trip request via phone calls and via mobile application(s).

The Communication Framework, the Marketing Framework, the Passenger Information System, and the Payment System will be analysed and determined in a later phase of the project.

Regarding the future payment system, counties and local authorities set the basic conditions in the tender and determine the subsidy amounts they are willing to offer for the provision of the service. Service providers submit their proposals and preferences in response to the tenders, and individual ticket prices for the DRT service are defined.

Regarding the user feedback, gathering opinions, comments, and suggestions from passengers or users, they will be collected through mobile app and/or Travel Dispatch Center

5.2.3. Levels of integration with public transport, if relevant

DRT service is currently in the planning phase, and to be implemented as the test service during the DREAM_PACE project. The DRT service is planned to be organized as a complement to the existing line passenger transport. According to existing legal regulations, DRT is conducted in areas where there is no organized public transport and is characterized by low transportation demand (rural and sparsely populated areas). It can be part of an integrated system, and the service is provided based on provisions at the local or regional level.

5.2.4. Main challenges and criticalities at operational and technological level for DRT development

In terms of operational difficulties in ensuring the appropriate human resources for the DRT service, the DRT service provider should ensure the adequate readiness of drivers in order to provide the service.

As far as the harmonization with the public transport service is concerned, moderate difficulties are expected in ensuring DRT service operations not in collision with public transport bus lines (as DRT will use part of the line during same time period).

The DRT service will be tendered as a full-service, including the following elements:

- vehicles;
- drivers;
- software;
- mobile application.

Ensuring fast and reliable internet connectivity for vehicles/passengers during testing periods can cause some challenges in the operation. Other difficulty, that is more related to user behaviour, is the raising awareness and the ensure the right user behaviour. Possible solutions should be implemented in the application - through back-end and front-end controls and financial penalties.

6. Budapest

6.1. Territory and mobility context

6.1.1. Territory and existing services

The pilot area (located in district XVI of the Budapest city) has a high motorisation rate (481,9 cars/1000 inhabitants). It experienced a slight decrease in population, but a newly built housing estate project should foster a future growth.

The pilot area is typically populated by upper- to middle-class families. There are no traffic attracting facilities in the pilot area (only a kindergarten), so traffic within the area is negligible, mainly characterised by car traffic using core network.

Public transport is not available within 500 metres of the pilot area. However, the area is surrounded by bus and suburban railway stations. Shared e-scooters are available in the pilot area, but in very limited quantities.

6.1.2. DRT services on the territory

Currently, BKK is operating 11 Demand Responsive Transport (DRT) lines in Budapest, mainly in the peripheral areas: 10 day bus lines (the first line was launched in 2013) and 1 night bus line (since 2006). These services run on demand between certain stops and at certain times, but the route is always fixed. BKK will develop the existing DRT system as "more flexible" with increase of the degree of flexibility by innovative, IT supported solutions.

In detail, within the DREAM_PACE project, a new flexible demand responsive transport service without fixed route () will be tested in Budapest, also equipped with and innovative IT system, connecting the selected area to the main suburban railway station.

Figure 1: DRT microbus in Budapest [Ssource: BKK, for SMACKER project]

6.2. Operational models and digitalization of services

6.2.1. Characterization of the existing DRT services from an operational point of view

The existing DRT service operates as an extension of an existing public transport line in the whole operation-time or in a specific time interval of the operation-time, e.g. in off-peak hours. The DRT service operates on a fixed route with predetermined initial and/or final terminals, as well as designated intermediate stops with set departure times. The DRT vehicle can stop at any location or at stop points along the selected designated route if passengers have a trip request, irrespective of whether there is an established intermediate stop at that spot.

The schedules of the existing services are fixed, while in the DREAM_PACE project a new DRT service will be introduced in a new territory, operating with a flexible schedule.

6.2.2. What technological components characterize the existing services, and which functionalities are enabled in existing services

The existing DRT service if fully digitalized, the expected change in the project is implementing the new territory in the application and the digitalization of the more flexible solution.

The existing DRT service operates with the appropriate vehicle/fleet and DRT vehicle device, which enables seamless communication between the driver and the communication center (Travel Dispatch Center - TDC). Moreover, they are outfitted with position-determination systems to precisely track their location.

The TDC allows to handle the order management process. It can accept or reject the requested transport based on various factors (e.g. user's location, coverage area, safety considerations etc.).

The passengers can indicate a trip request via phone calls, via Web Pages and at the driver.

The Communication Framework for the existing service consists of Mobile Communication, which facilitates real-time communication between drivers, operators, and passengers. This includes phone calls, SMS notifications, and mobile applications for booking, tracking, and updates.

The marketing activities are carried out together with the existing transport providers, with high level of integration.

The Passenger Information Systems for the existing DRT service consist of Real-Time Passenger Information, which provides up-to-date information on vehicle schedules, arrival times, delays, and service disruptions through various channels such as digital signage, mobile apps, websites, and SMS alerts.

Regarding the payment system, the DRT is part of the regular public transport ticketing system, the service can be used with the same tickets and passes.

Passengers can give feedback about the DRT service to Customer Services (in person, by phone, online). There is no dedicated DRT Customer Service, it works in line with the public transport Customer Service.

6.2.3. Levels of integration with public transport, if relevant

The DRT service is integrated into the local public transport by using the same or part of its stops (stop tables, timetables, bus shelter or platform etc.). In the DREAM_PACE project, new stops/points will be designated in the pilot area.

6.2.4. Main challenges and criticalities at operational and technological level for DRT development

For the planned DRT service, the operator can provide the vehicles from the existing fleet. In general, BKK has alternative-sized vehicles for the DRT service; only in case more alternative-sized vehicles would be needed, there could be a challenge due to lack of resources. So far, other challenges are not known.

7. Osstirol

7.1. Territory and mobility context

7.1.1. Territory and existing services

In Osttirol, important trends impacting transportation include fewer people using public transit due to depopulation and an aging population that requires specialized services.

The presence of scattered production and business sites influence commuting, and increased car use contributes to traffic and pollution. Urban sprawl has made commuting longer, affecting public transit feasibility. Cultural preferences and environmental awareness are crucial considerations for any new transportation initiatives in the region. The success of innovative initiatives depends on addressing these trends with tailored and adaptable solutions.

The main travel flows include commuting from residential areas to production and business sites, traveling from homes to train stations, and between urban and suburban areas due to urban sprawl. With an aging population, there is a growing need for specialized transport to essential services for the elderly. Additionally, understanding flows related to leisure and recreational activities is crucial. By focusing on these travel patterns, targeted solutions can be designed to improve mobility and accessibility in the region.

Existing traditional services face challenges, notably due to limited operating hours with no regional public transport from 7 pm to 5 am. Additionally, irregular timetables, insufficient last-mile connectivity, and inadequate route coverage impact accessibility. The services may struggle to adapt to the diverse needs of the community, especially the aging population. Overcoming these challenges is crucial for improving the reliability and effectiveness of transportation services in the region.

It is noted that shared services don't cover the entire region, requiring residents in unserved areas to find alternative transportation. The services operate on a reservation-only basis, which might not suit spontaneous travel needs. Additionally, the absence of digital infrastructure limits accessibility and real-time information. Communication barriers may affect those unfamiliar with traditional booking methods. Ensuring scalability for a growing user base and expanding coverage is crucial for the shared service to meet evolving community needs effectively.

7.1.2. DRT services on the territory

The DRT service in Osttirol encounters specific challenges. These include limited service coverage, where certain areas may lack access to the service. Users must book the service in advance through a phone call, potentially causing inconvenience for those with spontaneous travel needs. Efficient scheduling and coordination of DRT services pose challenges, and maintaining cost-effectiveness while offering flexibility remains a crucial consideration. Additionally, enhancing communication and community awareness is vital to encourage greater utilization. Integrating DRT with existing transportation options and adapting to technological limitations or demographic changes are also key challenges for ensuring an effective and accessible transportation service in the region.

Figure 2: Existing DRT service in Osttirol [Source: RMO]

7.2. Operational models and digitalization of services

7.2.1. Characterization of the existing DRT services from an operational point of view

The DRT service operates on a fixed route with predetermined initial and/or final terminals, as well as designated intermediate stops with set departure times. The DRT vehicle can stop at any location or stop points along the selected designated route if passengers have a trip request, irrespective of whether there is an established intermediate stop at that spot. The DRT service operates within a specific geographical area or zone with or without predefined initial and final terminals within this zone, but there are some predefined intermediate stops as reference points for the DRT vehicle's route, ensuring a structured and efficient path while serving passenger requests.

Passenger requests from a location that is relatively far from the designated stops will not be rejected based on the distance from an intermediate stop: the request will be fulfilled if it falls within the boundaries of the defined zone.

The schedule of the existing service is flexible.

7.2.2. What technological components characterize the existing services, and which functionalities are enabled in existing services

The existing DRT service operates without digital elements, it is not accessible through mobile apps or online platforms.

The existing DRT service operates with a Travel Dispatch Center (TDC), which allows to:

- handle the order management process. It can accept or reject the requested transport based on various factors (e.g. user's location, coverage area, safety considerations etc.);

- optimize routes and schedule reservations efficiently. It assigns vehicles to specific routes based on real-time demand and dynamically adjusts routes based on new requests. TDC aims to minimize delays and improve the overall efficiency of the service. It also provides users with estimated travel times.

The passengers can indicate a trip request via phone calls. While the existing DRT services in Defereggental and Pustertal offer valuable transportation options for residents, the reliance on phone bookings might pose a convenience challenge for tourists. It is important to note that tourists, being unfamiliar with the local phone system or facing potential language barriers, might find this method less user-friendly. Therefore, there is room for improvement in making the DRT services more accessible and convenient for the tourist population.

The Communication Framework for the existing DRT service consists of Mobile Communication, which facilitates real-time communication between drivers, operators, and passengers. This includes phone calls, SMS notifications, and mobile applications for booking, tracking, and updates.

The marketing activities are carried out together with the existing transport providers (high level of integration).

The Passenger Information System consists of Ticketing and Fare Systems, which means that digital ticketing and fare collection frameworks enable passengers to purchase tickets, manage payments, and access fare information through online platforms, mobile apps, or smart cards.

The existing Demand-Responsive Transportation (DRT) service operates on a payment system that primarily involves cash transactions (passengers pay for the service with cash). Additionally, the DRT system accepts other forms of payment, including various transport passes. This includes weekly and monthly transport passes, providing passengers with flexibility in choosing their preferred payment method.

Given the absence of a robust digital infrastructure, the process of collecting user feedback for the existing and/or planned Demand-Responsive Transportation (DRT) service takes place via phone call.

In the future, digitalisation of the DRT service is planned. This approach aims to co-finance and optimize the existing DRT service in the region. By supporting the integrating advanced information technology, the goal is to enhance the efficiency, accessibility, and overall quality of the DRT service in Osttirol.

7.2.3. Levels of integration with public transport, if relevant

The DRT service is a standalone solution, operated by VVT, the regional transport service providers. There is no connection to the local or regional PT service or network.

7.2.4. Main challenges and criticalities at operational and technological level for DRT development

It is difficult to find funds for optimising the existing DRT services.

Regarding the difficulties in ensuring the appropriate human resources for the DRT service, it is challenging to convince drivers to adapt to the unique demands of an untraditional DRT service, including flexible routing and managing an onboard booking system. It is necessary to provide specialised training to drivers for handling dynamic routing, diverse passenger needs, and effectively managing the onboard booking system. Based on these, there are difficulties in recruiting new drivers willing to work in a service with dynamic routing and onboard booking management. It is also important to ensure that drivers are technologically proficient to handle onboard systems, respond to dynamic routing changes, and assist passengers in using the booking system.

Regarding the harmonization of the DRT service and the public transport service, it can be stated that balancing demand fluctuations between the DRT service and existing services may pose difficulties in resource allocation and optimisation.

Regarding the challenges in providing a secure operational environment for the DRT service in urban, pre-urban or rural areas, there are several challenges to face with, such as in some areas the limited internet connection may cause problems in ensuring real-time communication between the DRT system, drivers, and passengers. It is also important to identify and secure safe locations for new bus stops in urban, pre-urban, or rural areas to ensure passenger safety during pick-ups and drop-offs and to conduct thorough safety assessments for new routes to mitigate potential hazards, especially in rural areas where road conditions may be less predictable.

It is necessary to address the lack of infrastructure, such as well-lit areas and proper signage, in certain regions to enhance safety for passengers and drivers, and to establish effective coordination with local emergency services in urban, pre-urban, or rural areas to ensure swift responses in case of accidents or emergencies.

It is essential to implement appropriate security measures for passengers, especially in areas where safety concerns may be heightened, and to navigate DRT vehicles effectively in rural areas where roads may be less developed, lacking clear markings or signage. Addressing safety concerns related to night operations, such as limited visibility and potential security risks, in areas with low population density is also challenging.

All in all, effective education and marketing are essential to promoting the advantages and ease of use of the DRT service. Developing and maintaining DRT services require financial resources, finding a sustainable business model that covers costs and ensures long-term viability can be challenging.

8. Stuttgart region

8.1. Territory and mobility context

8.1.1. Territory and existing services

The Stuttgart Region (3654 km²) is in general a highly populated area with 2.780.000 inhabitants, 635.000 of which residents in the main city, and includes 14 towns with more than 10.000 inhabitants.

However, significant portions of its territory are characterised by scattered settlements and rural areas.

The town of Calw (24.000 inhabitants), selected as pilot site for the DREAM_PACE project, is located in the black forest, and attracts a lot of hiking tourism. Furthermore, a famous German author (Hermann Hesse) had his origins in the small town. Therefore, Calw is a destination for cultural tourists as well.

Transporting people from the town into the mountains is an important aspect of mobility. In 2025 the Herman-Hesse-Train will start to run and connect Calw with its neighbour city called Weil der Stadt.

Although there is a traffic flow from Calw to the next metropol Stuttgart, no direct train connection exists. Calw isn't in fact currently connected with Stuttgart through frequent services such as the "Metropolexpress", therefore quicker connections at least with surrounding urban agglomerations are being considered in the planning process.

The existing e-Carsharing system offers a sustainable option to tourists and citizens, although the offer is limited.

Together with the lack of a direct connection to Stuttgart, the main criticalities of the existing transport network are related to the accessibility to the railway stations poorly served by buses at night, and to the connectivity among the several small towns in the area.

One of the challenges for the Stuttgart Region is represented by the fact that in several areas the time gaps in public transport services can be up to 6 hours (in one third of the populated areas this gap is between 3 and 6 hours), making it difficult to adequately serve the potential demand. Moreover, as mentioned, in 29% of the territory there is no night service available, and in weekends and holidays only 36% of the area benefits from at least the minimum standard of service provision.

8.1.2. DRT services on the territory

The criticalities reported highlight the potential role of DRT services in the Stuttgart Region as option to provide quality accessibility to underserved territories. However, the fact that some of the DRT services (around 20%) are not listed in the local mobility app, and 68% can only be booked by phone one or in some cases two hours before, represent a relevant barrier to their full adoption.

In the selected area around there are active 13 DRT services organised by the local transport authority VGC and connecting small towns, to be booked by phone at least one hour in advance.

Among the main criticalities there are the punctuality of the services, and the fact that passengers without a booking cannot access the service, even if seats are available.

Furthermore, a call-car service is available as a supplement to local public transport in the evening and at night. The offer applies in the Calw district to the centers of Calw (including Bad Liebenzell), Nagold and Altensteig, and is aimed specifically at young people (but open to all age groups). The call car takes its passengers to meeting points in the city in the evening and back to their homes at night.

8.2. Operational models and digitalization of services

8.2.1. Characterization of the existing DRT services from an operational point of view

The DRT service operates as an extension of an existing PT line in the whole operation-time or in a specific time interval of the operation-time, e.g. off-peak hours.

The DRT service operates on a fixed route with predetermined initial and/or final terminals, as well as designated intermediate stops with set departure times. The DRT vehicle can stop at any location or at stop points along the selected designated route if passengers have a trip request, irrespective of whether there is an established intermediate stop at that spot.

The DRT service operates within a specific geographical area or zone with or without predefined initial and final terminals within this zone, but there are some predefined intermediate stops as reference points for the DRT vehicle's route, ensuring a structured and efficient path while serving passenger requests.

Passenger requests from a location that is relatively far from the designated stops will not be rejected based on the distance from an intermediate stop: the request will be fulfilled if it falls within the boundaries of the defined zone.

The existing DRT services operate dynamically, responding to passenger requests in real time, fully flexible routes and a predefined network of stops and with variable driving schedules based on the specific needs of passengers. The driving time and routes of the vehicles can change every trip, adapting to the varying demands of passengers. Based on the results of the DREAM_PACE pilot, possible new DRT areas can be identified.

8.2.2. What technological components characterize the existing services, and which functionalities are enabled in existing services

The existing DRT services operate with partly digital elements (e.g. online booking), the possible improvements will be discussed in the framework of the pilot activities.

Furthermore, the existing DRT services operate with a Travel Dispatch Center (TDC), that allows to handle the order management process. It can accept or reject the requested transport based on various factors (e.g. user's location, coverage area, safety considerations etc.). It also allows to monitor the DRT services, by tracking vehicle locations, performance, and adherence to schedules. An enhanced data collection is a possible outcome of the project.

In the current scenario, passengers can indicate trip requests through traditional channels such as phone calls or web pages. DREAM_PACE project envisions a shift towards offering different and expanded options for ordering DRT services, this suggests a commitment to enhancing accessibility and flexibility for passengers in their journey planning.

The Communication Framework consist of Radio Communication, which provides a means of communication between drivers, dispatchers and control centers. It allows for efficient coordination and response during operations.

The marketing activities are carried out together with the existing transport providers, with high level of integration. It is important to stress out the importance of raising awareness in the pilot in order to actively engage the community.

The Passenger Information Systems for the existing DRT services consists of Ticketing and Fare Systems, which means that digital ticketing and fare collection frameworks enable passengers to purchase tickets,

manage payments, and access fare information through online platforms, mobile apps, or smart cards. The future improvements should cover wider dissemination of information to passengers.

Regarding the payment method, tickets for the DRT service can be bought via the usual ways (online booking, ticketing machine, at the driver with cash). The introduction of alternative payment options, possibly through mobile pay or PayPal would be useful, demonstrating a commitment to modernizing payment processes and accommodating diverse passenger preferences.

Collecting user feedback is currently facilitated through the public transport operator website. The aim is to improve this process, suggesting a dedication to actively seeking and incorporating passenger opinions, comments and suggestions.

8.2.3. Levels of integration with public transport, if relevant

In terms of integration of the DRT and the public transport services, these systems have an integrated ticketing and tariff system. The local public transport operator operates the DRT system as well, based on the public service contract. The harmonization of the two systems went well as DRT service uses the existing infrastructure elements.

It is aimed to implement a central mobility management center, at which all mobility services are coordinated. Especially sharing and on-demand services and vehicles will also be stored at this center. The center is planned to become an information hub on mobility for passengers. Furthermore, it is aimed to integrate all public transport providers in the region but also establish cooperations with public transport operator in the neighbouring regions.

The main goal is to improve and widen the DRT network within the region to connect different forms of mobility (trains, buses) with each other and provide an attractive solution for the inhabitants in the mostly rural area.

8.2.4. Main challenges and criticalities at operational and technological level for DRT development

There is no need to purchase/procure any new vehicle for the DRT service because it can be provided from the existing vehicle fleet. Regarding the difficulties in ensuring the appropriate human resources for the DRT service, there is a general need for more drivers. It isas also a bit challenging to integrate the DRT service into the vehicle duties since drivers must be on hold during possible duty hours.

The communication between passengers and the transport operator VGC could be more direct and more flexible to be able to provide a variety of alternative routes for the DRT.

The details of the future DRT services will be determined in the pilot meetings.

9. Conclusions

The report builds on the knowledge gathered in the DREAM_PACE deliverable D2.1.1 “Analysis report on DRT digital and operational innovations in CE Regions and engaged areas” and through the first round of Living Lab meetings held in the 6 pilot areas, organized according to the online service around the three blocks “Territory and Mobility Context”, “Governance and Planning”, and “Operational Models and Digitalization of Services”.

This document serves as a comprehensive report on the state of the art of Demand-Responsive Transport (DRT) digital and operational approaches in the six pilot areas of the DREAM_PACE project.

Following the methodology elaborated in D3.1.1 “Methodological background for the design of DRT integrated solutions”, the results of this report represent the primary input on which the next step of the DREAM_PACE LLs, i.e. the development of the future scenarios, will build.

Most of the existing DRT services (Bologna Metropolitan Area, Osttirol, Budapest and Calw) operate on a fixed route with predetermined initial and/or final terminals, as well as designated intermediate stops with set departure times.

In Bologna, Budapest and Calw the services also operate as extensions of existing PT lines in the whole operation-time or in a specific time interval of the operation-time, e.g. off-peak hours. In Pavia and Osttirol the DRT services operate within a specific geographical area or zone, ensuring a structured and efficient path while serving passenger requests.

Furthermore, in Pavia the services operate dynamically, with fully flexible routes and a predefined network of stops and with variable driving schedules based on the specific needs of passengers. The driving time and routes of the vehicles can change every trip, adapting to the varying demands of passengers.

As result of DREAM_PACE activities, there is a general idea of allowing the service to become more flexible, in terms of schedule as well as of booking (reducing booking times, allowing real time booking and use of the service without it).

Digitalisation is another crucial aspect: besides Budapest (full digitalisation of DRT), in the other cases the service is either operating with partly digital elements (e.g. online booking) or not yet digitalised. Improve digitalisation can be considered as a common goal of the project across pilot areas, including the to-be-established service in Split Dalmatia Country, where the tendering procedure is expected to foster the collaboration between public transport operators and digital platform providers.

Phone booking is a common feature at the moment: in general, its cancellation is not an option in order to guarantee inclusiveness and accompany the digital transition, but in several cases limiting its relevance and fostering digital booking is a strategic aim in order to enhance DRT.

The digitalisation trends include also the communication between drivers, operators and passengers in order to make the service more reliable and through real time information.

There is a common agreement on the advantages of the integration between DRT and public transport in terms of stops and tariffs. However, this has reached different stages of maturity across the pilot areas, from no integration (Osttirol) to full (Calw and Bologna) where the tariff system is adopted. The scenario is substantially different concerning those deep integration factors (digitalisation, operation and schedules, booking and intermodality) which constitute one of the main aims of the project.

Across DREAM_PACE pilot areas, DRT services are provided by public transport operators (PTOs): this at the moment seems to be a cornerstone of the approach, therefore PTOs will remain among the main players in the field, required to embrace and promote innovation elements able to bring DRT to the next level in strong synergy with the existing mobility networks.

10. References

1) Balázs Horváth; István Prileszky; János Tóth: Flexible Transport I - General characteristics, Urban Transport magazine, pages 215-220 (2009).

2) Balázs Horváth: Place and role of flexible transport systems in the mobility chain (2007): https://docplayer.hu/31829713-Rugalmas-kozlekedesi-rendszerek-helye-szerepe-a-mobilitasi-lancban.html, 2021.11.20.

3) Balázs Horváth; István Prileszky; János Tóth: Flexible Transport I – Business model, Urban Transport magazine, pages 90-94 (2007).

4) Balázs Horváth; István Prileszky; János Tóth: Flexible Transport II. – Technologies of collective systems, Urban Transport magazine, pages 267-273 (2006).

5) Interreg SHAREPLACE project results, web page: https://programme2014-20.interreg-central.eu/Content.Node/SHAREPLACE.html

6) DREAM_PACE D2.1.1 “Analysis report on DRT digital and operational innovations in CE” (2023).

7) SHAREPLACE workshop on “Digitalizing mobility services in SHAREPLACE regions: planning, governance, technology” - Barriers and Conditions for Digitization (2020).

11. Annex: Text of the Survey

1. General information

- Name: _____
- Email address: _____
- Organisation: _____
- Name of the pilot area: _____
- Estimated number of population of the pilot area: _____

2. Territory and mobility context

Territory and existing services

- Please provide a short description on the main socioeconomic and cultural trends affecting mobility in the pilot area that are crucial from the pilot's development point of view (including motorization, depopulation, aging, urban sprawl etc.)
    - FREE TEXT BOX
- What are the main relevant flows in the pilot area? (please consider the area that will be affected by pilot activities) Which travel destinations are the most frequented for trips (e.g., between a residential area and the train station)?

  FREE TEXT BOX
- What kind of transport services are available in the pilot area? [please select one or more of the following options]
    - Traditional PT services: Local PT – bus/trolley bus, Local PT – tram, Local PT - , Regional bus, Suburban or Regional Railway, Long-distance bus,
    - Flexible services: Uber, Taxi, DRT services
    - Shared services: Carpooling, Carsharing, Bikesharing, Shared e-scooter, Shared e-Bike
    - Other services [please detail]:……
- What are the criticalities/challenges for the existing traditional services in the pilot area?

  FREE TEXT BOX
- If there are any existing shared services, what are the criticalities/challenges? ?

  FREE TEXT BOX

DRT services on the territory

- Are there existing DRT services in the pilot area or its surroundings? [please select one of the following options]
    - Yes, active
    - Under development (outside the DREAM_PACE project)

- Yes, planned, but not implemented (outside the DREAM_PACE project)
- *No*

- What kind of area(s) does the existing DRT service serve? *[please select one or more of the following options]*
  - *Whole functional urban area (FUA)*
  - *Whole urban area*
  - *A part of the city*
  - *The inner city*
  - *Suburban area*
  - *Rural area*
  - *A housing estate within the city*
  - *A newly built (residential) area*
  - *An industrial / workplace / campus area*
  - *A touristic area*
  - *Other [please explain]:*
- *What are the criticalities/challenges for the existing DRT service(s)?*

  FREE TEXT BOX
- *The development of DRT service in the DREAM_PACE project is related to [please select one of the following options]:*
  - *Improvement of an existing DRT service*
  - *Introduction of a brand-new DRT service*

3. Operational models and digitalization of services

Characterization of the existing DRT services from an operational point of view:

- What is the main operation concept for the existing DRT service(s): [please select one or more of the following options]
  - The DRT service operates as an extension of an existing PT line in the whole operation-time or in a specific time interval of the operation-time e.g. off-peak hours.
  - The DRT service operates on a fixed route with predetermined initial and/or final terminals, as well as designated intermediate stops with set departure times. The DRT vehicle can stop at any location or at stops, stop points along the selected designated route if passengers have a trip request, irrespective of whether there is an established intermediate stop at that spot.
  - The DRT service operates within a specific geographical area or zone with or without predefined initial and final terminals within this zone, but there are some predefined intermediate stops as reference points for the DRT vehicle's route, ensuring a structured and efficient path while serving passenger requests. Passenger requests from a location that is relatively far from the designated stops, will not be rejected based on the distance from

an intermediate stop. The request will be fulfilled if it falls within the boundaries of the defined zone.

- The DRT service is specifically designed to transport passengers from a desired pick-up location to a single destination known as the Point of Interest (POI). The POI can be any location or facility that attracts passenger demand. (e. g. railway station, shopping center, market, hospital etc.)
- The DRT service(s) operates dynamically, responding to passenger requests in real time, fully flexible routes and a predefined network of stops and with variable driving schedules based on the specific needs of passengers. The driving time and routes of the vehicles can change every trip , adapting to the varying demands of passengers.
- The DRT service provider decides if they cover the whole trip in the designated area or only take the passenger to the best public transport stop in the way to their destination. The system operates by having virtual bus stops in the service area.
- Other [please explain]:.....

- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
  - FREE TEXT BOX

- The schedule of the existing service is: [please select one of the following options]
  - fixed,
  - flexible,
  - [please describe]: .....
- The schedule of the service to be introduced by DREAM_PACE will be [please select one of the following options]
- fixed,
- flexible,
- [please describe]: .....

  - **<u>What technological components characterize the existing services, and which functionalities are enabled in existing services:</u>**

- Please indicate the level of digitalization of the existing DRT service(s): [please select one of the following options]
  - Our existing DRT service operates without any digital elements.
  - Our existing DRT service operates with partly digital elements (e.g., online booking).
  - Our existing DRT service is fully digitalized.

- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
    - FREE TEXT BOX

- What are the digital components for the existing service? [please select one of the following options]
    - The existing DRT service operates with a Travel Dispatch Center – TDC.
    - The existing DRT service operates with the appropriate vehicle/fleet and DRT vehicle device, which enables seamless communication between the driver and the communication center (TDC). Moreover, they are outfitted with position-determination systems to precisely track their location.
    - Other [please explain]:…….
- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
    - FREE TEXT BOX

- The Travel Dispatch Center allows to: [please select one or more of the following options]
    - provide real-time travel information to both service users and drivers
    - handle the order management process. It can accept or reject the requested transport based on various factors (e.g. user's location, coverage area, safety considerations etc.)
    - optimize routes and schedule reservations efficiently. It assigns vehicles to specific routes based on real-time demand and dynamically adjusts routes based on new requests. TDC aims to minimize delays and improve the overall efficiency of the service. It also provides users with estimated travel times.
    - monitor the DRT service, by tracking vehicle locations, performance, and adherence to schedules.
    - perform data statistics and analysis for the DRT fleet. It collects and analyses data on passengers, drivers, vehicles, warehouses, and other relevant metrics to provide valuable insights into the service's performance, such as passenger demographics, usage patterns, profitability, and overall service effectiveness.

- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
    - FREE TEXT BOX

- The passengers can indicate a trip request: [please select one or more of the following options]
    - via phone calls.
    - via mobile application(s).
    - via Web Pages.
    - via SMS
    - via digital display totems
    - at the driver
    - via on site dispatcher (e.g., in a terminus or bus station)
    - other [please detail]:……..

- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
    - FREE TEXT BOX
- The Communication Framework for the existing DRT service consists of: [please select one of the following options]
    - Mobile Communication, which facilitates real-time communication between drivers, operators, and passengers. This includes phone calls, SMS notifications, and mobile applications for booking, tracking, and updates.
    - Radio Communication, which provides a means of communication between drivers, dispatchers, and control centers. It allows for efficient coordination and response during operations.
    - Internet of Things (IoT), which connects various devices and sensors within vehicles and infrastructure, enabling data exchange, remote monitoring, and control. It enhances communication and allows intelligent transportation systems.
    - Other [please detail]: ……
- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
    - FREE TEXT BOX
- The Marketing Framework for the existing DRTservice consists of: [please select one of the following options]
    - The marketing activities are carried out together with the existing transport providers (high level of integration)
    - Digital Advertising, which utilizes online platforms, social media, and targeted advertising campaigns to promote transportation services, attract passengers, and increase ridership.
    - Customer Relationship Management (CRM), which manages customer interactions, track passenger preferences and behaviour, and enable personalized marketing and communication strategies.
    - Data Analytics, which analyses large volumes of data collected from various sources to identify trends, patterns, and passenger preferences.
    - Other [please detail]: ……
- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
    - FREE TEXT BOX
- The Passenger Information Systems for the existing DRTservice consists of: [please select one of the following options]
    - Real-Time Passenger Information, which provides up-to-date information on vehicle schedules, arrival times, delays, and service disruptions through various channels such as digital signage, mobile apps, websites, and SMS alerts.
    - Navigation Systems, which offers digital maps, navigation, and routing guidance to help passengers plan their journeys, locate stops or stations, and navigate through transportation networks.
    - Ticketing and Fare Systems, which means that digital ticketing and fare collection frameworks enable passengers to purchase tickets, manage payments, and access fare information through online platforms, mobile apps, or smart cards.
    - Other [please detail]: ……..

- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
    - FREE TEXT BOX
- How payment is carried out for the existing DRT service? Tickets, such as weekly and monthly transport passes are accepted?
    - FREE TEXT BOX
- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
    - FREE TEXT BOX
- Please describe shortly the process of collecting user feedback, gathering opinions, comments, and suggestions from passengers or users of the existing DRT service?
    - FREE TEXT BOX
- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
    - FREE TEXT BOX

- **Levels of integration with PT, if relevant:**

- What is the level of integration of the existing DRT service with the local or regional public transport? [please select one of the following options]
    - The DRT service is a standalone solution. There is no connection to the local or regional PT service or network.
    - The DRT service is integrated into the local PT by using the same or part of its stops (stop table, timetables, bus shelter or platform etc.)
    - The DRT service and the local PT service have an integrated, common passenger information framework.
    - The DRT service and the local PT service have an integrated ticketing and tariff system.
    - The DRT service is integrated with the surburban, regional PT (railway, bus) since mains stops are in common.
    - Other [please explain]: ……
- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
    - FREE TEXT BOX
- Who operates the existing and/or the planned DRT service? [please select one of the following options]
    - The local Public Transport Operator , based on the public service contract.
    - A private transport operator, based on a designated service contract.
    - A city-owned transport operator
    - The city itself
    - Other [please detail]:……

- What is the expected change to be introduced by DREAM_PACE? (please fill in if there is a change planned or expected, even if the solution is not clearly defined yet)
    - FREE TEXT BOX

- **<u>Main challenges and criticalities at operational and technological level for DRT development:</u>**

- Are there any difficulties/barriers in providing/purchasing the needed alternative-sized vehicle for the DRT service that is already functioning/needs to be enhanced or developed/planned to be introduced? [please select one of the following options]
    - No, there are no difficulties in providing the alternative-sized vehicle type or fleet for the DRT service, same rules and regulations can be applied as in the traditional service vehicle's needs.
    - No, there is no need to purchase/procure any new vehicle for the DRT service because we can provide it from our existing vehicle-fleet.
    - No, there is no need to purchase/procure any new vehicle for the DRT service because we can provide it based on the current public service contract (any vehicle need is guaranteed by the PTO).
    - No, it is not difficult to provide the needed amount of vehicles for a new/improved DRT service, because: ……..
    - Yes, it is difficult to procure/purchase any unforeseen types of vehicles because of our difficult procurement regulations and practice.
    - Yes, it is difficult, because [please detail]:…….
- Are there any operational difficulties (to be foreseen) in ensuring the appropriate human resources for the DRT service? How is the willingness of drivers to participate/work in such an untraditional service in terms of driving circumstances, routing, and managing the booking system onboard?
    - FREE TEXT BOX
- How difficult is/was to ensure the harmonizing of the DRT service with the existing service if it is harmonized at all?
    - FREE TEXT BOX
- How difficult is/was to integrate the DRT service into the vehicle duties?
    - FREE TEXT BOX
- Are there any challenges or difficulties (to be foreseen) in providing a secure operational environment for the DRT service in urban, pre-urban or rural areas? Lack of internet connection, difficulties in finding safety positions for new bus stops or safe new routes, etc.?
    - FREE TEXT BOX
- Are there any other criticalities/challenges for the DRT services not mentioned above (e.g., further development needs to influence user behaviour – e.g., excluding passengers from trips for a given time in case of notorious non-cancellation of trips)?
    - FREE TEXT BOX