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D.2.3.1 – Final solution for

improved DRT service in the cities of Modena and Grosuplje

Version 3.0

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Abbreviations

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

1. Background

1.1. About the thematic solution

The OPTI-UP project focuses on optimising public transport (PT) networks operation in small and medium-sized cities in Central Europe by integrating urban planning with data-driven approaches and promoting environmentally friendly mobility solutions. The approach was tested through three pilot projects, each addressing a specific thematic solution. Each thematic solution comprised two solution variants, implemented within a pilot action (PA) area:

- Demand-responsive transport (DRT): Modena (Italy) variant and Grosuplje (Slovenia) variant,
- PT network optimisation: Paks (Hungary) variant and Osijek (Croatia) variant,
- Alternative fuel technologies: Pécs (Hungary) variant and Český Krumlov (Czech Republic) variant.

The final thematic solutions consolidate knowledge and lessons learned from data-driven decision-making in PT planning, the implementation of pilot actions, and feedback obtained through user surveys and stakeholder consultations. These consultations provided valuable recommendations for improving the solutions, scaling them up, and ensuring their replicability in areas facing similar public transport challenges.

The overarching aim of each thematic solution is to provide decision-makers with a practical tool to support the selection, planning, and implementation of appropriate measures, thereby enabling the gradual improvement of public transport systems in selected areas.

This final solution specifically delivers the **demand responsive transport (DRT) solution**. The DRT solution offers guidelines on when, where, and how to design and implement an efficient demand-responsive transport system. Its objective is to support the introduction or enhancement of DRT services in order to increase public transport efficiency, improve vehicle utilisation, and ultimately stimulate transport demand through analytically grounded and interdependent service development.

1.2. Structure of the DRT solution

The Demand-Responsive Transport (DRT) solution encompasses two distinct implementation variants: one carried out in Modena (Italy) and the other in Grosuplje (Slovenia). The final DRT solution integrates both variants by:

- Presenting a comprehensive, generalised approach to the selection, planning, and implementation of DRT services, ensuring a cohesive (common) framework; and
- Incorporating the specific approaches and outcomes of each variant, with references to their implementations as documented in the OPTI-UP pilot action reports.

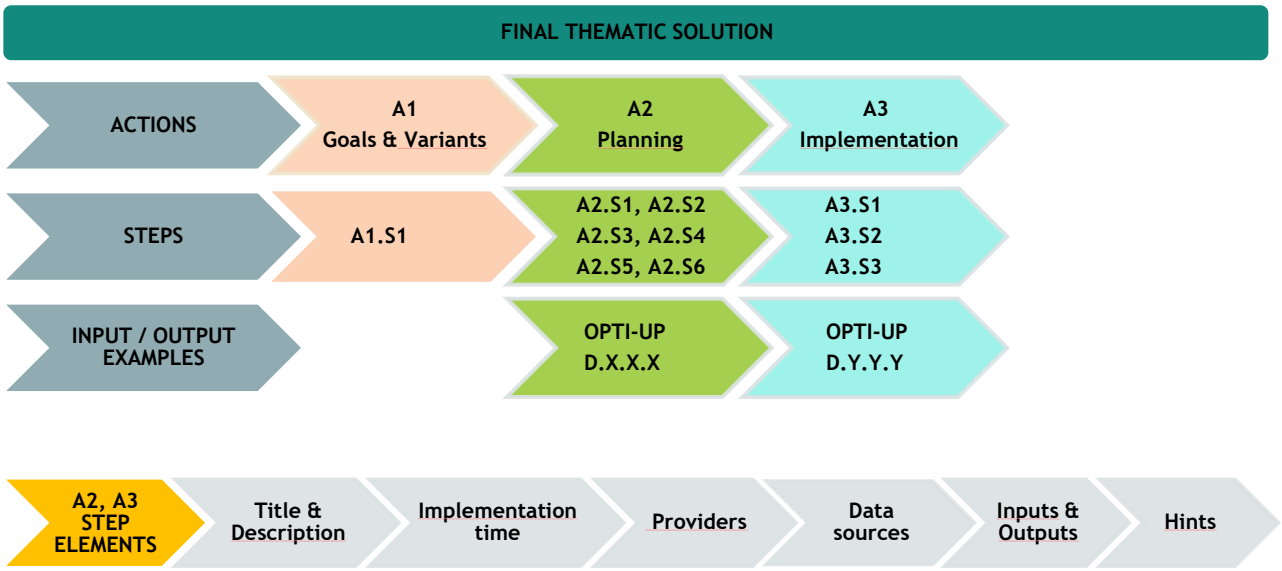
The DRT solution is structured around three core actions: **A1**, **A2**, and **A3**.

Action **A1** serves as a baseline action that provides guidance on assessing whether the DRT solution is relevant and beneficial for improving a specific public transport system. Step **A1.S1** defines the objectives of the DRT solution, establishes decision-making criteria, and outlines the proposed approaches for implementing the different solution variants.

Actions **A2** and **A3** focus on the planning and implementation phases of the solution, respectively.

All three actions are divided into sequential steps (e.g. A1.S1, A2.S1–A2.S6, and A3.S1–A3.S3). Each step provides practical guidance for carrying out specific activities within the respective action, enabling a step-by-step approach to selecting, planning, and implementing the solution.

Figure 1: Structure of final thematic solution



Each step within Actions A2 and A3 is described using a consistent set of key elements explained below:

- **Title & Description**: Describes the purpose of the step and the key activities involved (e.g. selecting a transport modelling tool, defining scenarios for solution simulation, conducting evaluations, or collecting target values).
- **Implementation Time**: Provides an indicative assessment of the duration of the step activity using qualitative categories such as short, medium, or long (e.g. a relatively long-term process compared to other steps).
- **Providers**: Identifies the entity responsible for carrying out the tasks (e.g. a public transport modelling expert) as well as the stakeholders involved in or contributing to the step (e.g. end users, consultants, authorities, unions, public transport operators, or public transport authorities).
- **Data Sources**: Lists potential sources of data, such as online databases, service providers, experts, equipment suppliers, national statistics offices, transport operators, or existing national or municipal transport models.
- **Inputs & Outputs**: Specifies the input data or external services required to perform the tasks (e.g. transport demand and supply data) and the expected outputs of the activity, such as documents, software or hardware tools (e.g. a transport modelling report, a transport model with scenario data, templates of terms of cooperation, or examples from pilot action areas provided in the appendix).
- **Hints & Tips**: Provides additional recommendations and lessons learned from the pilot actions (e.g. the importance of involving an experienced and reputable transport modeller to ensure efficiency and quality).

The identified **Inputs & Outputs** of each step may include references to documents that present concrete examples of the final DRT solution implementation, as demonstrated in the OPTI-UP project pilot actions in Modena (Italy) and Grosuplje (Slovenia), respectively.

Descriptions of actions **A1**, **A2**, and **A3** are presented in the tables outlining the final solution, structured according to key step elements. Each step is linked to concrete examples of solution variants (Modena or Grosuplje), where applicable. These examples are documented in the OPTI UP project deliverables and are clearly referenced using the corresponding deliverable codes (e.g., D.2.1.1).

1.3. Outline of DRT solution

The outline provides an overview of the actions and steps within the DRT solution.

Action	Step
Action A1: Decision on the solution variant	Step A1.S1: Description of goals, decision criteria, and main features of the solution
Action A2: Planning and fine-tuning the DRT service	Step A2.S1: Collection of initial data
	Step A2.S2: Building a transport model
	Step A2.S3: Simulation of the solution through transport model scenarios
	Step A2.S4: Definition of the final solution for the selected area
	Step A2.S5: Defining implementation of the final solution
	Step A2.S6: Definition of Key Performance Indicators
Action A3: Implementation of DRT services	Step A3.S1: Monitoring the implemented final DRT solution
	Step A3.S2: Evaluating the implemented final DRT solution
	Step A3.S3: Ensuring sustainability and planning the scale-up of the solution

2. DRT solution guidelines

2.1. A1: Selection of the variant solution

2.1.1. A1.S1: Description of the main features, goals and decision criteria

The OPTI-UP project provides two variants for developing and improving DRT services. One variant was implemented as a pilot action in **Modena** (Italy), and the other as a pilot action in **Grosuplje** (Slovenia).

The following table illustrates the main features of the setup and operation of the DRT service variants.

Table 1: Description of the main features of DRT service variant solutions

Modena	Grosuplje
• DRT Public transport (PT) operates in a rural area • The DRT service provides coverage for origins and destinations not served by the conventional public transport network • Coverage includes certain urban route end stops to support feeder connections with the scheduled public transport network • Introduction of an automated, booking-driven routing solution • Deployment of a smartphone application to simplify the booking process • App enables users to track vehicles in real time, receive arrival notifications, and manage bookings independently • Service monitoring is automated through systematic data collection enabled by the app • The application offers multiple scheduling options based on existing bookings, supporting higher levels of ride sharing and thereby service efficiency	• The solution is applied to the line where several scheduled departures score continuously low ridership (0% to 10%); these lines are designated as COMBINED lines • Scheduled departures with low ridership on COMBINED lines are operated as DRT departures, while the remaining departures are operated as regular services • All COMBINED lines remain operated according to the original schedule • DRT departures require prior registration and are operated only if at least one passenger has registered for the specific trip in defined time period before its scheduled departure • DRT trip is registered through a call centre or a dedicated web or mobile app – connected to a call centre • Registration for a DRT departure requires the specification of the departure time, origin and destination stops, and a contact phone number • The vehicle type (car or van) assigned to each trip is determined prior to departure, based on the number of DRT registrations • By default, DRT trips are operated using electric or other environmentally friendly vehicles • While DRT trips follow fixed routes, selected stops may be omitted for operational optimisation, as the driver has prior knowledge of all passenger boarding and alighting stops

The decision on which DRT variant to apply can be made based on the decision criteria presented below. The criteria are listed in order of priority, from highest to lowest.

Table 2: Goals of variant DRT service solution and decision criteria for its selection

Step element	DRT solution
Main goals	**Common goals:** • Reduction of operating costs **Specific goals:** **Modena**: • Increase use of DRT service • Improve integration of DRT service with conventional public transport service **Grosuplje**: • Increased occupancy of public transport (PT) vehicles • Reduction of empty PT vehicle runs • Reduction of pollutant emissions • Reduction in the number of D-licensed drivers required
Decision criteria for selection of the DRT solution	**Common decision criteria:** • Shortage of drivers **Specific decision criteria:** **Modena**: • An existing DRT service is in place, but it operates at a low service level • Decrease in planned kilometres resulting from lack of drivers • Access to the DRT service is exclusively available via the call centre • Reservations and routing are managed entirely based on operators' experience, without the support of technological systems **Grosuplje**: • An existing regular public transport (PT) network is in place • The PT network is located in a rural area with poor connections to local and regional points of interest and limited public transport transfer options • The line network is operated by conventional large buses, which are not environmentally friendly • The buses run regularly according to the predefined schedule. • Certain scheduled departures (trips) consistently exhibit low ridership levels (0% to 10%) • The habit of travelling by private car is deeply rooted

	• Smaller-capacity substitute vehicles (cars, vans, minibuses) are available • Electric vehicles are available • shortage of D-licensed drivers • The goal of reduction of transport induced environmental impact is included in local, regional or national policies

2.2. A2: Planning of DRT service

2.2.1. A2.S1: Collection of initial data

Activity/aim: This fundamental activity focuses on identifying and understanding the needs and observations of users, transport operators, and public transport authorities (PTAs) that have identified public transport (PT) issues. It involves the systematic collection of relevant data, enabling thorough analysis to validate the identified issues and explore potential PT solutions. Data are collected for the following purposes:

- Spatial and demographic analysis;
- Assessment of PT operational status;
- PT demand analysis;
- PT financial analysis;
- Transport modelling; and
- Users' feedback analysis.

Table 3: Collection of initial data for variant solutions

Step element	DRT solution
Task provider	The transport expert gathers data, performs analyses, prepares data reports, and develops a Local Plan for public transport development based on input data analyses.
Implementation time	Medium: 4-5 months
Involved Stakeholders	• Providers of data sources: PTA, PTO, Statistical offices, ministry of transport, municipality, citizens/users
Data sources	• National statistical offices, existing national, regional or municipality bodies (*national, regional or local transport models, transport plans, SUMP), online information*, transport operators (*transport operational data*), users' surveys, existing studies
Inputs	• Data collection model: - Spatial Demographic Data: ➢ Population trend (National statistical Office) ➢ Population structure by age and gender (National Statistical Office) ➢ Population density (National Statistical Office) - Public transport operational indicators: ➢ Fleet composition (PTO) ➢ Key operational statistics PT lines (PTO, PTA) - Public transport demand analysis: ➢ Demand trend in the past five years (PTO) ➢ Monthly demand (PTO) ➢ Hourly demand (PTO) ➢ Derived demand statistics (PTO)

	- Public transport financial indicators: ➢ Cost and revenue trend ➢ Cost and revenue structure • Users' needs survey questionnaire: **Modena**: D.1.3.1_Local Plan for the city of Modena, ch.2.2; **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje, ch.2.3
Outputs	• Presentation of data in a table of graphs (D.1.1.2_Unifed database of collected public transport systems, **Modena**: worksheet "Modena", **Grosuplje**: worksheet "Grosuplje") • Analysis of input data (D.1.1.1_ Comprehensive data report on existing public transport networks and best practices, find references to **Modena** and **Grosuplje** in the text) • Users' needs survey results: **Modena**: D.1.3.1_Local Plan for the city of Modena, ch.2.2; **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje, ch.2.3 • Local plan - list of PT actions and KPI-s for monitoring and assessment of the implemented solutions, ch.5, ch.8, ch.9 (**Modena**: D.1.3.1_Local Plan for the city of Modena, **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje)

Hints & tips: Taking into account user feedback on the current state of PT operations, as well as their suggestions for improvement and input on proposed solutions, is essential. This helps ensure greater acceptance of changes and reduces potential resistance to implementation.

2.2.2. A2.S2: Building of a transport model

Activity/aim: Transport modelling is the most efficient way to predict the impact of applying a DRT solution in the observed PT area, test the proposed KPIs, and select the most relevant indicators for evaluating the planned solution. This approach also provides insight into the baseline and target values needed for KPI evaluation, particularly where no historical KPI data are available.

A transport model can be developed entirely in dedicated transport modelling software or supported by external mathematical models and descriptive statistics for the final interpretation of model results. A typical four-step transport model consists of the following modelling steps:

- Trip generation[1]
- Trip distribution[2]
- Mode choice[3]
- Route assignment[4].

If a transport model already exists, it should be updated with the most recent data and, where necessary, enhanced with additional features to ensure it serves as an accurate baseline model for the specific DRT service analysis.

Table 4: Building a transport model

Step element	DRT solution
Task provider	The transport expert develops or updates the transport model using the collected data and adds the specific features required to model and evaluate the DRT solution.
Implementation time	• Short: 2 months (if only minor transport model updates are needed) • Medium: 6 months (where extensive analyses, e.g. on-field surveys are needed) • Long: 12 months (for building transport model from scratch)
Involved Stakeholders	External transport model and data providers (transport experts, PTO) for communication and explanation of implementation of the existing transport model
Data sources	• For building and updating the transport model: - PTA (transport model, PT offer, passenger demand), - PTO (vehicle operational data, passenger demand, AVM raw data, ticket validations), - Municipality (SUMP, transport model) - European Environment Agency – gas emission levels), - UITP (International Association of Public Transport). "Public Transport: Planning the Networks" • Reference articles for estimation of expected passenger number on DRT line in Grosuplje:

[1] How many trips originate and end in each transport model zone?
[2] Where are people travelling to and from?
[3] What transport mode do passengers chose for each trip?
[4] Which routes do travellers take, and what are the resulting traffic volumes on each transport network link?

	- Vuchic, Vukan R. (2005). "Urban Transit: Operations, Planning, and Economics"; ISBN: 978-0-471-72170-3 - Ceder, Avishai (2007). "Public Transit Planning and Operation: Theory, Modelling and Practice"; ISBN: 978-0750669241 - TRB – Transit Cooperative Research Program (TCRP) Report 95: "Traveller Response to Transportation System Changes" - Ortúzar, Juan de Dios & Willumsen, Luis G. (2011). "Modelling Transport" (4th ed.); ISBN: 978-0470760390
Inputs	• Transport and modelling and planning: - PTV VISUM (transport modelling software) - Existing transport model in VISUM: four-step travel demand model, providing PT data – PuT (OD matrix), bus and railway stops & network lines (shapefiles), zones, trips among zones, vehicle types, timetables etc for the DRT line. - Updated PT offer, including DRT • Specific data used for **Modena** DRT model: - passenger demand data of the existing DRT service • Specific data used for **Grosuplje** DRT model: - PT vehicle operating costs (50-seater bus, 20-seater bus, electric van, electric car) - PT vehicle polluting gas emissions (50-seater diesel bus, 20-seater diesel bus, electric van, electric car) - Data required to apply the basic formula for estimating passenger demand on a bus route (Q = P × R × M × A × F): ➢ Q = number of passengers on the line in a daily period ➢ P = population in the catchment area of the line ➢ R = proportion (share) of the population using transport daily (mobility rate) ➢ M = modal share (share of all trips made by bus) ➢ A = attractiveness of the line (quality of connection, directness, speed, comfort) ➢ F = frequency factor (higher frequency means higher usage
Outputs	• Baseline transport model VISUM (**Modena**: D.1.3.1_Local Plan for the city of Modena, ch.6.1, **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje, ch.6.1)

Hints & tips: The **Grosuplje** transport model is based on the national Slovenian transport model implemented in PTV VISUM that operates at a macro level. For the purposes of DRT service modelling, the national model was refined to a micro level through the redefinition of baseline model data. Based on this updated baseline model, short-term transport scenarios were developed and applied.

Transport modelling takes longer to implement when new features are added, especially when moving from macro- to micro-level models with more detailed data. Zoning is a critical step in transport modelling, as it enables the appropriate definition of the analytical framework and, consequently, determines the level of detail required in data collection for the simulation of potential scenarios.

2.2.3. A2.S3: Simulation of the solution through transport model scenarios

Activity/aim: To verify the expected impacts of the DRT solution and assess whether KPI targets can be achieved, implementation scenarios for the solution variant are developed and simulated in the transport model (e.g. VISUM).

The modelled scenarios measure changes in selected KPIs, such as passenger flow distribution, emissions, travelled kilometres, operating costs, and passenger volumes, by comparing the baseline state with the state after implementation of the modelled scenario.

Table 5: Simulation of scenarios of implementation of the solution

Step element	DRT solution
Task provider	The transport expert defines and runs the scenarios, analyses the results, assesses KPI changes, and evaluates whether the targets are achieved.
Implementation time	Short: 1 month
Involved Stakeholders	PTO, PTA, Municipality for intermediate verification of the results, in particular the observed anomalies.
Data sources	Baseline transport model implemented in the transport planning and traffic modelling software tool (**Modena** and **Grosuplje**: PTV VISUM)
Inputs	• PTV VISUM transport modelling tool • Baseline transport model VISUM (**Modena**: D.1.3.1_Local Plan for the city of Modena, ch.6.1 **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje, ch.6.1) • Proposed scenarios: (**Modena**: D.1.3.1_Local Plan for the city of Modena, ch.6.2 **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje, ch.6.2)
Outputs	• Results of transport model scenarios (**Modena**: D.1.3.1_Local Plan for the city of Modena, ch.6.2 **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje, ch.6.2)

Hints & tips: If the transport model used, as in the case of VISUM, does not provide a straightforward tool for simulating DRT services, one or more proxy scenarios should be identified to partially emulate the expected impacts of the applied solution. For example, a DRT service may reduce the number of scheduled trips operated, which can be represented through a scenario that reduces service frequency.

2.2.4. A2.S4: Definition of the final solution for the selected area

Activity/aim: Based on initial analyses of spatial and demographic data, public transport (PT) operational indicators, PT demand patterns, financial performance, and transport modelling results, the proposed Demand-Responsive Transport **(DRT) service solution** is **comprehensively defined** and tailored to the specific characteristics of the intervention area.

The final solution is developed to align with established transport goals and expected outcomes, decision-maker and funder priorities, available resources, service-provider operational capacities, and existing monitoring and evaluation capabilities.

The final solution is detailed in the **Final Solution Implementation Plan**, which outlines the service design, deployment strategy, and performance monitoring framework.

Table 6: Finetuning of the final solution

Step element	DRT solution
Task provider	A team of transport experts carries out the final analyses and proposes and fine-tunes the final solution in cooperation with the involved stakeholders.
Implementation time	Short: 3 months
Involved Stakeholders	• For discussion on the conditions of the solution to be feasible and acceptable: - Municipality where the solution will be implemented - PTA - organisation of PT in the observed area - PTO - providing experience, on-field knowledge and operational data - Ministry of transport to provide funding and permits (if applicable) - PT users (advisable)
Data sources	• Results of previous research and planning (desktop analyses, transport modelling, local plan) • Consultation meetings with the involved stakeholders • Results of the survey on PT users' needs (**Modena**: D.1.3.1_Local Plan for the city of Modena, ch.2.2; **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje, ch.2.3)
Inputs	• Results of transport modelling (mobility gaps), requirements of local communities, decision makers (strategic objectives), experience and knowledge of the operators - operational data (update on timetables, vehicles, vehicle occupancy data, costs of operation, staff, emissions) • Results of transport model scenarios (**Modena**: D.1.3.1_Local Plan for the city of Modena, ch.6.2 **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje, ch.6.2)
Outputs	• Description of DRT solution and expected impacts - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.1 & 2.2, **Grosuplje**: ch.3.1 & 3.2)

Hints & tips: Before implementing the final solution, a **Final Solution Implementation Plan** should be developed. This plan should outline all required activities, allocate resources, identify key stakeholders, assess potential risks, and establish a monitoring framework. A clear and detailed definition of the final solution enables effective assessment of system performance and operational efficiency after implementation. It also provides a solid basis for defining relevant Key Performance Indicators (KPIs), setting realistic target values, and systematically monitoring progress towards those targets. In **Grosuplje**, a detailed user survey on DRT operation was conducted to confirm the DRT solution baseline.

2.2.5. A2.S5: Definition of final solution implementation

Activity/aim: For the **implementation** of the final solution, all activities must be clearly defined, covering the entire process from planning, user communication, securing resources, permits, and funding, through deployment, to monitoring, evaluation, and promotion of results to users and stakeholders.

Activities should be systematically organised in a detailed time plan within the **Final Solution Implementation Plan**. The plan should also include stakeholder engagement, identify relevant actors and their roles, and assess potential risks related to delivering the solution, together with appropriate mitigation measures.

Table 7: Definition of implementation phases for the final solution

Step element	**DRT solution**
Task provider	Transport solution project manager suggests implementation phases and discusses with stakeholders their engagement and risks to implement the final solution
Implementation time	Short: 2 - 3 months
Involved Stakeholders	• For revision and feedback on the DRT implementation plan: - PTA (manager of PT in the study area) - Ministry of transport (permits and funding – if applicable) - PTO (definition of operational resources, capacities and operational procedures) - Transport expert (transport analytics)
Data sources	• Consultation meetings with the involved stakeholders on the basis of previous analytics and modelling
Inputs	• Revision and suggestions underpinned by former analytics and data (PT operational data, ridership / ticketing data, financial data, user surveys and feedback, PT routes, timetables, available fleet and staff etc.), knowledge of operational and formal procedures and capacities of operators
Outputs	• Final Solution Implementation Plan - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.1 & 2.2 & 2.3, **Grosuplje**: ch.3.1 & 3.2 & 3.3) • Plan of stakeholders' engagement - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.2.2, **Grosuplje**: ch.3.2.2) • Assessment of risks - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.2.3, **Grosuplje**: ch.3.2.3)

Hints & tips: Effective coordination of activities is essential for the successful implementation of the final solution. While it may be time-consuming in the initial stages, it significantly reduces the risk of failures and negative external influences, ultimately improving efficiency and saving time in later phases.

2.2.6. A2.S6: Definition of Key Performance Indicators

Activity/aim: Monitoring the implementation of a solution is crucial, and Key Performance Indicators (KPIs) are essential tools for tracking its performance.

Systematic monitoring allows for:

- tracking progress in implementing activities, enabling fine-tuning of the solution, correcting operational deviations, and responding to feedback from users and operators; and
- conducting regular, real-time assessments of performance against predefined target values expressed through the KPIs.

The definition of KPIs, along with the associated monitoring tools and data sources, is provided in the Final Solution Implementation Plan and used in the monitoring report.

Table 8: Definition of Key Performance Indicators for the final DRT solution

Step element	DRT solution
Task provider	Transport solution project manager in cooperation with transport expert (in **Modena** also with App provider) provides definition of KPIs for DRT solution performance monitoring
Implementation time	Short: 1 month
Involved Stakeholders	• Transport expert closely cooperates with the project manager (=transport solution operational manager) • Operational data providers (PTO, **Modena**: monitoring service linked to App)
Data sources	• Own previous analyses, modelling and reports • List of available input data for calculation of KPIs (passenger counts, ticketing data, timetables, delays, km, costs, revenues)
Inputs	• Users' survey needs feedback - **Modena**: D.1.3.1_Local Plan for the city of Modena, ch.2.2 **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje, ch.2.3 • Results of transport model scenarios (**Modena**: D.1.3.1_Local Plan for the city of Modena, ch.6.2 **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje, ch.6.2) • Expertise on KPIs from transport expert (interpretation of analytics and modelling & definition of baseline and target values) • List of available KPIs: **Modena**: D.1.3.1_Local Plan for the city of Modena, ch.9, **Grosuplje**: D.1.3.1_Local Plan for the city of Grosuplje, ch.9
Outputs	• List of applied KPIs (definition, data sources, baseline and target values) – D.2.2.1_Comprehensive evaluation report and recommendations for thematic solutions scaling up (**Modena**: 3.2.1, **Grosuplje**: 3.2.2): name, input data, calculation formula, data source, KPI calculation tool

Hints & tips: The time required to define KPIs may increase if the necessary input data are unavailable, requiring a more complex approach to KPI calculation. A Monitoring Tool should be developed before the

monitoring process begins. The tool supports real-time periodic monitoring, which is crucial for responding promptly to user and operator needs, managing deviations from expected solution behaviour, and improving overall solution performance.

Consider using tools capable of carrying out monitoring autonomously, so that no dedicated staff is required; however, always ensure the quality of the collected data is verified.

2.3. A3: Implementation of DRT service

2.3.1. A3.S1: Monitoring of the implemented DRT solution

Activity/aim: Monitoring the implementation and performance of the DRT solution begins when the service is launched. It is supported by a dedicated Monitoring Tool, which enables the collection of operational and other input data, as well as the periodic calculation of KPIs.

For **implementation** monitoring, the Monitoring Tool provides detailed information on when and how each implementation activity has been carried out.

For **performance** monitoring of the DRT service, the Monitoring Tool supports the collection of relevant operational data, such as date and time of departure, number of passengers, type of vehicle used, number of bookings, commendations and complaints. It also enables the continuous calculation of KPIs on a regular basis (e.g. weekly).

Table 9: Monitoring of the implemented DRT solution

Step element	DRT solution
Task provider	The transport expert collects data from the PTO or PTA, or via automatic app-linked monitoring software for real-time monitoring (**Modena**), keeps records, pre-processes data for the Monitoring Tool where needed, and performs real-time monitoring of implementation and performance.
Implementation time	Duration of the monitoring period (e.g. during pilot activity or long-term…)
Involved Stakeholders	• Providers of the operational data (PTO, PTA) • Municipality (input data on promotion) • Users (providing feedback)
Data sources	• Connection to the database server related to monitoring app, spreadsheet (via e-mail) by PTO – containing KPI input data • Municipality • Users
Inputs	• Final Solution Implementation Plan - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.1 & 2.2 & 2.3, **Grosuplje**: ch.3.1 & 3.2 & 3.3) • Users' feedback questionnaire (implemented online or in person) – available in D.2.2.1 – APPENDIX to Comprehensive evaluation report and recommendations for thematic solutions scaling up (**Modena**: ch.A.3, **Grosuplje**: ch.B.3) • Empty "Performance monitoring tool" for input data collection or dedicated monitoring software (**Modena**) and calculation model for calculation of KPIs from the operational data (Excel spreadsheet)

Outputs	• Final solution implementation monitoring tool (filled in) - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.3, **Grosuplje**: ch.3.3) • Users' feedback survey – collected data, stored in the spreadsheet for analysis • Calculated KPI-values on the weekly basis: in the "Performance monitoring tool" (Excel spreadsheet), stored for analysis

Hints & tips: For additional information in the *implementation* monitoring table, add a dedicated column with explanations of individual activities, including references to external materials, photos, or web resources. This will make subsequent reviews and reporting easier and more transparent.

2.3.2. A3.S2: Evaluation of the implemented DRT solution

Activity/aim: The evaluation of the implementation and performance of the DRT solution, including the final conclusions, is carried out through the analysis of monitoring results and the incorporation of stakeholder feedback and recommendations on the implementation.

The evaluation of the solution **implementation** provides a report on how and when the activities were carried out. More importantly, it identifies implementation difficulties, deviations, and mitigation measures, resulting in a final **SWOT analysis** of the implementation process.

The evaluation of solution **performance** presents weekly trends in KPI changes compared to the baseline values and assesses the achievement of target values during the observation period. Based on the KPI analysis, an overall assessment of the DRT solution is provided.

Table 10: Evaluation of the implemented DRT solution

Step element	DRT solution
Task provider	The transport expert analyses, evaluates, and reports on implemented activities and KPI monitoring, and cooperates with the **project manager** in stakeholder consultation. Together, they prepare the conclusions.
Implementation time	Short: 1 – 2 months after conclusion of monitoring
Involved Stakeholders	PTO, Municipality, PTA, passengers (for presentation of the results and getting feedback)
Data sources	• Collected data through monitoring of implementation and monitoring by using "Monitoring tools" and users' survey database (Excel, dedicated app)
Inputs	• Final solution implementation monitoring tool (filled in) - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.3, **Grosuplje**: ch.3.3) • Users' feedback survey – collected data, stored in the spreadsheet for analysis • Calculated KPI-values on the weekly basis: in the "Performance monitoring tool" (Excel spreadsheet), stored for analysis
Outputs	• Implementation monitoring **report**: - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.3, **Grosuplje**: ch.3.3) • Difficulties and deviations from the plan - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.5, **Grosuplje**: ch.3.4) • SWOT analysis of implementation - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.6, **Grosuplje**: ch.3.5) • Evaluation of performance – KPIs: D.2.2.1 – APPENDIX to Comprehensive evaluation report and recommendations for thematic solutions scaling up (**Modena**: ch.A.2, **Grosuplje**: ch.B.2)

	• Evaluation of users' feedback: D.2.2.1 – APPENDIX to Comprehensive evaluation report and recommendations for thematic solutions scaling up (**Modena**: ch.A.3, **Grosuplje**: ch.B.3) • Comprehensive conclusions on implementation and performance of DRT solution – D.2.2.1 – Comprehensive evaluation report and recommendations for thematic solutions scaling up (common SWOT analysis: ch.6.1.1; key results and reached expectations: **Modena**: 6.2.1.1, **Grosuplje**: 6.2.1.2; key common outcomes: 6.2.2.1)

Hints & tips: The evaluation report may also include a dedicated section on guidance for scaling up the solution and assessing its transferability to other areas. It may also include a roadmap for maintaining and further developing the applied solution.

2.3.3. A3.S3: Ensuring sustainability and planning of scaling up of the solution

Activity/aim: Planning improvements and scaling up the implemented DRT solution is a direct response to implementation and performance monitoring. Its aim is to improve efficiency and sustainability while supporting the solution's **scalability** and **transferability**. This process involves meeting financial, operational, and institutional conditions, as well as providing recommendations **to ensure the long-term sustainability** of the solution and its **scale-up** or further development. Scaling up may also include transferring the solution to other areas, particularly neighbouring municipalities and regions facing similar PT challenges.

Evaluation of implementation results is a prerequisite for planning modifications to the DRT solution. The resulting plan should provide clear guidance for future actions to ensure sustainability, specifying the measures to be implemented, responsible providers, and required resources.

Continuous performance monitoring of the implemented DRT solution provides essential input for improvements, upscaling, and replication. Plans for sustainability and scaling up should be developed in cooperation with relevant stakeholders, in order to incorporate practical insights into financial, operational, and organisational (institutional) conditions, as well as the available options for further development.

Table 11: Planning of scaling up of the solution

Step element	DRT solution
Task provider	The transport expert and project manager prepare conclusions from the implementation and performance analysis as input for stakeholder discussions, collect feedback on recommendations for scale-up and replicability, and prepare a report.
Implementation time	Short: 2 months (preparation of the discussion and reporting)
Involved Stakeholders	• Included in consultation process: - PTA (national transport model administrator, infrastructure provider formal procedures), - PTO (definition of operational resources, capacities and operational procedures), - Municipality (location of implementation of the solution and PT co-financer)
Data sources	• Results of own evaluation of the implemented solution
Inputs	• Implementation monitoring **report**: - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.3, **Grosuplje**: ch.3.3) • Difficulties and deviations from the plan - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.5, **Grosuplje**: ch.3.4) • SWOT analysis of implementation - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.6, **Grosuplje**: ch.3.5)

	• Evaluation of performance – KPIs: D.2.2.1 – APPENDIX to Comprehensive evaluation report and recommendations for thematic solutions scaling up (**Modena**: ch.A.2, **Grosuplje**: ch.B.2) • Evaluation of users' feedback: D.2.2.1 – APPENDIX to Comprehensive evaluation report and recommendations for thematic solutions scaling up (**Modena**: ch.A.3, **Grosuplje**: ch.B.3) • Presentation and questions for the stakeholders' consultation
Outputs	• Guidance for future actions for sustainability - D.2.1.1 Pilot action report Modena and Grosuplje project areas (**Modena**: ch.2.8, **Grosuplje**: ch.3.7) • Consultation of stakeholders: D.2.2.1 – APPENDIX to Comprehensive evaluation report and recommendations for thematic solutions scaling up (**Modena**: ch.A.4.3, **Grosuplje**: ch.B.4.3) • Common lessons learned and suggestions for replicability (measures, responsibilities, recommendations) - D.2.2.1 – Comprehensive evaluation report and recommendations for thematic solutions scaling up, ch.6.3

Hints & tips: Involvement of stakeholders, identified already during the planning phase of the solution, is crucial for ensuring the sustainability of the implemented solution as well as its potential for upscaling or replication. Stakeholders contribute diverse perspectives and help secure the necessary conditions for institutional support, financial and operational viability, and ultimately acceptance by end users. Scaling up the implemented DRT solution is often linked to transferability planning, as its successful operation may depend directly on achieving economies of scale.