UPPER
Unleashing the Potential of Public Transport in Europe

D4.5 Improved comfort, convenience, safety and attractiveness of transit services

WP4 Innovative solutions to increase the efficiency, reliability and attractiveness of PT

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EU-RES: Classified Information - restraint UE;
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Abstract

Deliverable D4.5 presents the findings and recommendations focused on providing citizens in the UPPER cities and regions with improved services and comfort at public transport stops, and improved on-demand services geared towards specific target groups. The document shows the process followed by the UPPER partners in supporting the cities to finalise the definition, then outline the development and finally move towards the implementation of the UPPER measures categorized under task 4.5. The consortium implemented a wide range of strategies in eliciting, gathering, analysing and providing feedback to the cities, ensuring consistent communication throughout the measure development process.

The deliverable offers valuable insights for policymakers, urban planners, and transport operators seeking to implement similar measures in their quest to create more sustainable cities.

Keywords

On-demand transport, demand-responsive services, integrated planning, differentiated target groups, multi-modal hubs, Public Transport interfaces, stop accessibility, Public Transport stop equipment, infrastructure greening, infrastructure building standards.

1. Introduction

1.1. Scope of the Document

This document was prepared in the UPPER task 4.5 which supports UPPER cities to develop measures to diagnose and improve facilities at public transport stops and to introduce and expand demand-responsive transport services. The document reference guides, tools and initiatives helpful for the stakeholders involved in the development of this type of measures. Likewise, it also carries out collaborative workshops to favour the exchange among cities and to identify good practices and recommendations to support the preparation of such measures.

This task builds on the work done in WP2, especially in tasks T2.2, where the scope and objectives of the measures were defined in detail, as well as in task T2.4, where the requirements to be fulfilled by each of them were detailed. This information forms the basis of the work carried out in this task, where these measures progress from being a concept/idea (WP2) to being fully developed (WP3, WP4, WP5) until they are ready to be demonstrated (under WP6).

This deliverable is a key outcome, first of all, for the UPPER consortium, since it details the steps undertaken by the demo sites to develop their measures and establishes the basis for their subsequent implementation and demonstration, which will take place under WP6. Secondly, it becomes a key outcome of the project for any professional (outside the UPPER consortium) willing to implement similar measures in their city, since it contains reference documents, guides and tools, high-level recommendations identified by experts in the field, and as already mentioned, step-by-step description on the process followed to develop measures of that type.

The lead author would like to thank to all UPPER sites' representatives and their local collaborators for their active contribution, interest and information provided with respect to the steps followed to develop and prepare their measures. Likewise, the lead author would like to thank the horizontal partners that were involved in the appraisal of the measures to maximise their impact and on the execution of the workshops to identify cross-cutting recommendations.

1.2. Intended audience

The intended audience of this document is all those professionals involved in the PT improvement and urban planning, including mobility managers in municipalities, public companies and private companies, transport operators and authorities.

In addition, the collection of reference documents, guides and tools are also recommended reading for professionals seeking to transform urban environments to favour public transport, to diagnose and improve the level of comfort and information provided to people at public transport stops, and those looking to develop and implement on-demand services which are integrated with scheduled public transport services.

1.3. Structure of the document

This document is divided into 6 sections, starting with a brief introduction. The second section details the methodologies used to conduct various activities within the task. This includes the systematic review methodology used to gather reference guides and tools, methodologies followed for conducting two collaborative workshops, and the process to support UPPER sites as they prepare their measures. Sections 3, 4, and 5 present the outcomes of the task. Section 3 provides a concise overview of the systematic review conducted by consortium members to identify tools, guidelines, and best practices from projects and other initiatives where measures similar to those in task 4.5 were proposed and implemented.

Section 4 describes the results of workshops conducted within the UPPER consortium where the cities developing measures grouped under task 4.5 discussed these specific measures, presenting challenges faced and modalities to overcome them, as well as a series of “points of attention” which have been drawn up by the horizontal and network partners in UPPER with the aim of helping the demo sites maximise the impact of their measures. As such, this section provides a series of cross-cutting recommendations useful for stakeholders interested in implementing similar measures.

Section 5 offers a detailed description of the steps taken by the demonstrator sites to develop and finalise the process of preparing their measures for subsequent implementation and demonstration. Each measure includes a step-by-step description of its preparation process, results achieved during each of the steps, challenges encountered, mitigation strategies employed, and next steps to conclude the preparation process.

The final section presents the conclusions drawn from the activities conducted in this task.

1.4. Measures included under Task 4.5

The following 9 UPPER measures have been included in Task 4.5. Their development was done with the goal of improving the level of comfort and convenience that PT users experience at public transport stops, and the development Demand-Responsive Transport solutions which are integrated with the “classic” scheduled services in the areas served.

Under the category of convenience at stops the following measures have been developed:

- VAL_08: Design and develop an innovative, inclusive and convenient stop for buses
- MAN_04: Attractive, accessible, secure, comfortable, multifunctional and clean PT stop
- LIS_06: To Improve the comfort, convenience and safety of PT Interfaces

Under the category of Demand-Responsive Transport/On-Demand services, the following measures have been developed:

- VAL_06: To improve the PT offer in peri-urban areas
- OSL_05: Adapt segmented demand responsive transport (DRT) solutions to a broader group
- OSL_08: Shifting DRT-reservations from pre-booking to on-demand as a means to increase capacity
- MAN_06: Concepts and instruments to improve mobility in peri-urban areas
- TES_07: Increase the accessibility to PT in low demanded areas of the city
- HAN_02: Sustainable Transport Chains – on-demand service Sprinti

2. Methodology

2.1. Supporting resources: A systematic review

A systematic review of reference projects and best practices (knowledge coming from inside or outside the consortium) has been carried out to identify relevant tools and guidelines that can support the cities in implementing the measures they have proposed. This exercise was conducted by UITP, using the knowledge on the topic of its membership base, as well as several horizontal partners in the project.

2.2. Measures support workshop series

To support the cities along the development stage of the mobility measures, to facilitate the information exchange among the cities and to take benefit of the know-how and knowledge of the horizontal partners of the UPPER's consortium, workshops were organised in both formats, in-person and online. The representatives of the UPPER cities participated in both formats.

The first workshop series, an in-person workshop organised during the third General Assembly meeting in Rome, was aimed at sharing learnt lessons and experiences among pilot sites. The second series, in a virtual format, was aimed in reviewing the mobility measures, arising points of attention related to the measures that could support cities' teams in the final steps of the development process.

Due to the heterogeneity of the measures developed under task 4.5, it was considered more appropriate to contribute to the workshops organised in Rome, rather than having a separate session solely for this task.

2.2.1. Workshop 1: Self-identified challenges and good practices

2.2.1.1. Data-driven mobility services

The aim was to foster an open reflection and discussion session whereby city representatives self-evaluate their progress in developing measures within a task. They presented their progress, with a focus on what they consider as enabling factors for measure development and on challenges faced. Project partners who develop measures in the same category, as well as issue-based advocacy organisations within the project were expected to have faced broadly similar challenges within their respective contexts. The UPPER General Assembly in Rome included several such parallel sessions held in parallel and meeting attendees could freely choose which session to attend. The measures related to On-Demand Services and DRT services were grouped together with MaaS related measures in a session facilitated by UITP.

2.2.1.2. Attractive PT interfaces and multimodal hubs

The measures related to PT stops and interfaces of task 4.5 were grouped together with the ones related to multimodal hubs in task 3.4 and addressed in a joint parallel session during the Rome General Assembly.

2.2.2. Workshop 2: Critical appraisal from partners. Points of attention for maximising measures' impact

The aim of the workshop series is to support cities in their tasks of developing UPPER measures, by challenging and improving their initial measure description (as presented in UPPER Deliverable 2.2 Annex) The process is structured around several steps that are common across all the UPPER tasks where measures are developed. Horizontal partners critically review the measures proposed by the cities, taking into account the various documents already produced in UPPER, including but not limited to the user personas and experience notebooks of D2.1, the SWOT analysis included in D2.2, or the supporting policy frameworks and policy requirements in D2.4. Based on the critical review of the measures the horizontal partners commonly agreed on a limited number of “Points of attention”, areas where they consider the cities and measures should be focusing more attention, and should be addressed moving into the implementation phase.

Online workshops were organised per WP, where the horizontal partners presented the points of attention they have identified, together with potential recommendations or examples of how these can be addressed. Cities had the opportunity to see in advance the points of attention referring to the measures they are developing and to respond to and actively engage with horizontal partners.

In order to remain consistent with the approach described in section 2.2 above, the measures under task 4.5 were distributed for critical appraisal under two online workshops. The measures related to PT stops and interfaces were appraised and discussed in the WP3 workshop, while the measures related to DRT and On-demand services were addressed under one of the two workshops that were organised under WP4.

Rupprecht Consult (RC), as WP3 leader, was the overall coordinator of the WP3 workshop. RC defined the main structure and contents of the workshop and, with the support from ETRA and POLIS, distributed the responsibilities for the workshop among the horizontal partners with resources in tasks T3.4 and T3.5. EUROCITIES and UITP led the event organisation, including the preparation of the required material, set-up of the agenda and moderation of the plenary sessions. IBV coordinated the appraisal of the measures and follow up with reviewers (IFP, ECF, UITP EUROCITIES, POLIS, EPF, ICLEI, ETRA, IBV and RC) to ensure timely and adequate identification of points of attention.

CERTH, as WP4 leader, was the overall coordinator of the WP4 workshops. CERTH defined the main structure and contents of the workshop and, with the support from EMTA, EIT Urban Mobility Foundation and ICLEI, distributed the responsibilities for the workshop among the horizontal partners with resources in tasks T4.2, T4.3 and T4.5. EMTA led the event organisation, including the preparation of the required material, set-up of the agenda and moderation of the plenary sessions. EIT Urban Mobility Foundation coordinated the appraisal of the measures and follow up with reviewers (IFP, IFPEN, FACTUAL, ECF, UITP, EMTA, EITUMF, EPF, ICLEI) to ensure timely and adequate identification of points of attention.

2.3. The Measures Support Leaders Group

UPPER WPs 3, 4 and 5 share the common goals of developing the UPPER tools and making sure that all the necessary steps have been taken in order to prepare the project’s 78 measures for implementation, which will be done in the framework of WP6. Having identified these common goals, the participating horizontal partners (WP and Task leaders decided from the very beginning to join forces. More specifically, aiming to ensure that all partners involved in the development of the measures, including cities and horizontal partners, are aware of their responsibilities and the corresponding timeline, they decided to formulate a group, entitled “Measures Support Leaders Group” (MSLG) which was created at the beginning of the duration of these Tasks, in M8. CERTH being the leader of WP4, under which most of the measures are prepared, was appointed leader of the MSLG. The group consisted of the leaders of the tasks under which the measures are developed (T3.4, T3.5, T4.2, T4.3, T4.4, T4.5, T5.2, T5.3, T5.4), while meetings were held in a monthly basis. Table 2 presents the UPPER partners forming the MSLG.

Table 1. Members of the Measures Support Leaders Group.

Task	Leader
T3.4 “Re-design the urban mobility space to promote the use of PT”	ETRA

T3.5 “Definition of new operational and policy-based measures and solutions regarding zonal and network-based UVAR and parking”	POLIS
T4.2 “New services for users and PT operators based on the existing mobility data collection and sharing”	IFPEN
T4.3 “Improved PT efficiency addressing specific needs and situations such as expected and unexpected events”	FACTUAL
T4.4 “Improved information and added-value services enhancing multimodality”	CERTH
T4.5 “Improved comfort, convenience, safety and attractiveness of transit services”	UITP
T5.2 “Incentivize PT offer and active modes in the living labs”	FACTUAL
T5.3 “Innovative strategies and solutions to improve public perception of PT”	FIT
T5.4 “Behaviour-change oriented mechanisms to promote the use of PT”	IBV

The aim of the group may be summarized as follows:

- To meet the goals foreseen in the Grant Agreement, in relation to the aforementioned tasks;
- To provide meaningful support to the cities’ representatives during the development of their measures;
- To ensure that all task leaders provide the same level of support to the cities developing measures under their task;
- For the cities to acquire a clear understanding of the steps needed to develop their measures and the support they will receive from task leaders (and other horizontal partners involved in the task);
- To monitor the progress of the measures’ preparation process and timely identify any challenges/delays.

To achieve all these, a template entitled Monitoring Template was created and used in order to monitor the progress of all measures’ development. The first draft was created by the group’s leader but was then circulated among all members to review it. Once it was finalized, each member of the MSLG had to fill it in for all the measures under their task. The aim of the template is to briefly present each measure and its expected outcomes (extensive measures’ descriptions are included in D2.2) and to identify all steps needed to develop the measures. For each step a responsible partner is assigned as well as specific deadline. In addition, each step should be accompanied by a monitoring indicator; this indicator is not related to the evaluation process but it refers to the main output of the step so that the step is considered completed. The fields to be defined for each step in the Monitoring template are shown in the figure below:

Steps to ready-to-demo measure

Steps	Description	Involved partners/externals	City contact person	Category of action	Deadline	Monitoring indicator	Comments
1	Define the step e.g., Definition of the area and the use cases	Define the partners responsible for this step	Email of the responsible person (Partner's name)	Choose from Data/Infrastructure/Legal/Safety/Social/ Technical/Software	Define the data when the step should be completed	Define what the output of the step will be e.g., Description of area and use cases	Include any clarifications etc.
2							
3							
4							
5							
LAUNCH OF THE DEMO (please fill in the date)							

Figure 1 Table of steps to be defined by Project partners in the Monitoring template.

Once the task leaders had filled the templates in, the templates were sent to the corresponding cities to review and finalize them. One monitoring template was created per measure. These templates were then utilized by each task leader to track the progress of the defined steps for the measures under their task. This was done through the following procedure: prior to each monthly MSLG meeting, each task leader contacted the partners responsible for the measures' development to ask about the progress of each measure under their task. A short but concrete presentation was then created and presented during the meeting in order to report the progress and any challenges or delays (if applicable).

The template of the monitoring template, along with the completed templates for the 9 measures prepared under Task 4.5 can be found in *Annex 1: Monitoring templates of T4.5 measures.*

3.Supporting resources: Reference tools and guides

In this section, the main documents and reference projects identified regarding the measures developed in Task 4.5 are listed. The UPPER cities and regions were provided with the information during their measure development process, and various UPPER partners, particularly horizontal partners, contributed to the list. As several of the tools and reference described below have multiple areas of focus, they have also been included in several other deliverables produced to document the support and development of UPPER measures, such as D3.4, D3.5, D4.2, D4.3, D4.4, D4.5, D5.2, D5.3 or D5.4. The members of the MSLG had access to the full list of measures and could contribute.

Table 2 Selected reference tools and materials

#	Tool name	Description	Language	Latest update	LINK
1	MORE project Option Appraisal Tool	MORE project developed design concepts that encourage street activity and reduce traffic dominance by considering the needs of all road users. Excel application for the appraisal of options for streetspace reallocation through street redesign. The tool compares options for streetspace allocation through street design, considering the needs of multiple street users and a range of policy objectives. The tool includes three independent assessment modules: Political and Technical Assessment ;Cost-Benefit Analysis; Multi-Criteria Analysis.	EN	2022	Description: https://morewebsite.wpenginepowered.com/results/appraisal-tool-for-assessing-and-prioritising-street-design-options Open access tool: https://discovery.ucl.ac.uk/id/eprint/10144317/
2	How to make stations lively hubs for citizens and public transport users: Trends	This study focuses on mobility hubs, which are multimodal stations and serve as entry points to public transport systems but also provide ancillary services and social activities. Beyond exchange of knowledge, best practices and recommendations, the aim of "Stations of the future" project is to provide operators and other relevant stakeholders industry ideas and inspiration of how to adapt stations in the future.	EN	2022	https://cms.uitp.org/wp/wp-content/uploads/2022/12/Stations-of-the-Future_FINAL.pdf
3	How to make stations lively hubs for citizens and public transport users: Solutions	This study identifies the needs and expectations of distinct groups of passengers, and to explore how stations can be made more welcoming and inclusive for all. The study used journey mapping to understand the main stages of the passenger experience at the station and to identify essential touchpoints for improvement	EN	2023	https://cms.uitp.org/wp/wp-content/uploads/2023/05/SoF-How-to-make-stations-lively-hubs-for-citizens-and-public-transport-users-Solutions.pdf
4	Mobility hubs: steering the shift towards integrated sustainable mobility	This paper will help you to understand the variety of hubs and the benefits of organising coherent networks of hubs. The focus on the newest types of mobility hubs will provide concrete examples along with recommendations, particularly for authorities and public transport operators, on how to play a driving role in the shift towards sustainable mobility.	EN	2023	https://cms.uitp.org/wp/wp-content/uploads/2023/06/Policy-Brief-Mobility-hubs-web.pdf
5	Better urban mobility playbook	This playbook is an update of the UITP report “Better Mobility in Urban Areas”, published 20 years ago. It highlights the various challenges cities are facing and offers solutions with concrete steps that can be applied to redeveloping more sustainable liveable, healthy and inclusive cities.	EN	2021	https://cms.uitp.org/wp/wp-content/uploads/2022/02/Report-BETTER-URBAN-MOBILITY-PLAYBOOK.pdf
6	Bus network planning: From the operators' perspective - Bus planning introductory chapter	This document outlines the critical role of bus network planning for the perspective of the public transport operators, emphasizing efficiency, customer satisfaction, and urban sustainability. It discusses the use of innovative tools and technologies to enhance service quality and support future network designs, aiming to improve city liveability and reduce carbon emissions.	EN	2022	https://cms.uitp.org/wp/wp-content/uploads/2022/10/Report-Bus-Network-planing-Oct22-web-2.pdf
7	New mobility and urban space: How cities can adapt?	This document explores the evolving urban landscape influenced by climate change, health concerns from poor air quality, and digital advancements. It emphasizes shifting mobility paradigms away from individual cars towards public transport and active mobility, and	EN	2020	https://cms.uitp.org/wp/wp-content/uploads/2020/05/Policy-Brief-New-mobility-services-and-urban-space.pdf

#	Tool name	Description	Language	Latest update	LINK
		addresses challenges and strategies for integrating new mobility services sustainably			
8	Visual branding eHUBS	This is a short, simple, and highly intuitive guide about the development of visual branding for mobility services. It focuses on electric HUBS or eHUBS, although the information it provides is applicable to any service related to urban mobility.	EN	2020	https://vb.nweurope.eu/media/11480/deliverable_31_branding_ehubs-min.pdf
9	CoMoUK: Mobility Hubs Guidance	Developed in collaboration with the EU's "SHARE-North" project, is aimed at city and regional authorities, consultants, and partners. It offers an introduction to mobility hubs and their advantages, along with advice on adapting hubs to local contexts through case studies. The guide directs readers to resources for turning hub concepts into reality, including branding, technical drawings, and impact monitoring.	EN	2019	https://uploads-ssl.webflow.com/6102564995f71c83fba14d54/618d29b3d06c81de72c38fdc_CoMoUK%20Mobility%20hub%20guidance%20_Oct%202019.pdf
10	Sustainable Urban Development Strategies	The "Handbook of Sustainable Urban Development Strategies" provides methodological support for integrated urban strategies aligned with EU cohesion policy. With six chapters, it covers key aspects: - Strategic Dimension: Emphasizes strategies as roadmaps for Sustainable Urban Development. - Territorial Focus: Explores aligning territorial needs with spatial scales, including urban-rural connections. - Governance: Covers planning, financing, and multi-level, participatory governance. - Cross-Sectoral Integration: Addresses overcoming sectoral divisions for policy coherence. - Funding and Finance: Explores funding sources, financial instruments for sustainability. - Monitoring: Guides effective progress tracking. The handbook provides suggestions, examples, and references, aiding local authorities, managing authorities, and stakeholders in strategy creation, implementation, and monitoring for Sustainable Urban Development.	EN, BG, ES, EL, IT, HU, PL, RO	2020	https://urban.jrc.ec.europa.eu/urbanstrategies/
11	Mind the Gap - Making the Multimodal Journey the Easy Journey	To enhance consumer choice and sustainable transport via the MDMS initiative, key principles should be incorporated: - Shared data among operators, managers, and intermediaries under fair conditions. - Strict identification and prohibition of unfair practices by operators or MDMS platforms. - Neutral, timely info on schedules, fares, and travel times for consumer preferences. - Transparent data-sharing costs not unfairly transferred to consumers. - MDMS platforms accountable for services, bolstering consumer rights during multimodal travel. This paper elaborates on these policy suggestions and outlines challenges for consumer MDMS benefits.	EN	2018	https://www.beuc.eu/sites/default/files/publications/BEUC-X-2023-032_Multimodal_Digital_Mobility_Services_initiative.pdf
12	NODES toolbox	The NODES Toolbox is a catalogue of integrated planning, design and management tools which aim at helping to build modern urban transport interchanges. In total 83 tools have been integrated in the final Toolbox. The NODES Toolbox is a true EU reference for interchange design, allowing every interchange stakeholder, to use the tools developed, to identify good practices elsewhere, and to understand the performance of others. The Toolbox will allow each interchange manager to make an informed decision, supporting him from the initial planning phase of an interchange, up to the actual management of the station, surrounding area, and information provision to the traveller and citizens in the catchment area.	EN	2015	NODES deliverable: "nodes-toolbox-ref-wp3_12"

#	Tool name	Description	Language	Latest update	LINK
13	SUMP Practitioner Briefing Social Impact Assessment: Tools, Methods and Approaches	The document introduces the concept of Social Impact Assessment (SIA). An overview of methods and tools is provided, which practitioners could use to plan and implement gender-and diversity-sensitive transport measures, with examples of how these methods have been applied in practice.	EN	2021	https://urban-mobility-observatory.transport.ec.europa.eu/document/download/f74b57a1-bad2-475f-a13f-dcd03de1e3da_en?filename=social_impact_assessment_practitioner_briefing.pdf
14	Padam Mobility case study of DRT in IDFM Paris Region	To stay as close as possible to the needs of its users and adapt to the size and diversity of its territories, Île-de-France Mobilités (Paris region public transport authority) began developing Demand-Responsive Transport (DRT) in the greater Paris area in 2018. The user experience is unified, the management of the DRT services is simplified and operating costs are controlled.	EN	2019	https://www.padam-mobility.com/en/cas-etudes/apporter-une-solution-de-mobilite-homogene-grace-au-transport-a-la-demande
15	Reconnect Rural areas with DRT	Rural mobility is a major issue. The gap between dense urban areas and the rest of the country, where more than one in three French people lives, is widening. Faced with the scarcity and remoteness of services and employment areas, rural areas are also poorly or hardly served by public transport.	EN	2024	https://www.padam-mobility.com/en/cas-etudes/mobilite-rurale-offrir-une-solution-de-deplacement-grace-au-tad
16	The rural mobility challenge for public transport: How combined mobility can help	Improving public transport is one of the most pressing needs for rural and peri-urban areas, allowing to foster economic development, improve social equity and better address the climate crisis.	EN	2022	https://www.uitp.org/publications/the-rural-mobility-challenge-for-public-transport-how-combined-mobility-can-help/
17	How to guarantee public transport inclusiveness considering aging, gender, disabilities and reduced Mobility	Public Transport and Shared Mobility EGUM Subgroup Topic 4A One of the most important issues of public transport nowadays is how to make it inclusive and accessible for people with all levels of abilities. A more user-oriented and practical approach would be to focus on the accessibility issues in each phase of a journey; from planning to arriving at one's destination.	EN	2024	https://transport.ec.europa.eu/document/download/d19bd3a5-d5c8-4de9-a248-a035078f223f_en?filename=EGUM%20Recommendations_PT%20Subgroup_Topic%204A.pdf
18	Understanding transport poverty	Transport poverty refers to a lack of adequate transport services necessary to access general services and work, or to the inability to pay for these transport services.	EN	2022	https://www.europarl.europa.eu/RegData/etudes/ATAG/2022/738181/EPRS_ATA(2022)738181_EN.pdf
19	Evaluating rural accessibility	Mismatches between calculated and perceived accessibility	EN	2024	https://www.smarta-net.eu/wp-content/uploads/2024/04/01_Keynote-speech-How-to-do-accessibility-evaluations-in-rural-areas-.pdf
20	Accessibility and mobility in peripheral areas: a national place-based policy	Rural and peripheral areas, however, defined, suffer from accessibility and mobility problems that challenge their liveability and potential for development.The article analyses and discusses how the strategy aims to address accessibility and mobility, in principle and in practice.	EN	2021	https://www.tandfonline.com/doi/abs/10.1080/09654313.2021.1894098
21	Improving railway passengers experience: two perspectives	The paper describes two perspectives to improve the passenger experience. The passenger satisfaction pyramid is introduced, consisting of the base of the pyramid (dissatisfiers) focusing on time well saved and the top of the pyramid (satisfiers) aiming at time well spent.	EN	2018	https://nielsvanoort.weblog.tudelft.nl/files/2018/06/Van-Hagen-Van-Oort-CASPT-Final-paper-2.pdf
22	Income Inequality, Social Inclusion and Mobility	Roundtable report 164: indicator examples: walking accessibility to the 10 closest transport stops within a threshold of 400 meters, percentage of job opportunities accessible through public transport relative to the most accessible area of the city, travel times and costs particularly for reaching jobs, accessibility to public transport stops taking into account the quality of urban furniture, safety and environment, connectivity provided by the system in each area considering the level of service (travel time, waiting time, reliability, comfort and transfers), a measure of attractiveness of the destinations based on number of trips attracted by purpose	EN	2017	https://www.itf-oecd.org/sites/default/files/docs/income-inequality-social-inclusion-mobility.pdf

#	Tool name	Description	Language	Latest update	LINK
23	Inclusive Mobility: An International Survey	The study discusses about initiatives and project that have been successfully implemented in other countries as well as lessons can be learnt from France.	EN	2014	https://www.mobiliteinclusive.com/wp-content/uploads/2015/11/inclusive_mobility_an_international_survey_chronos_english_version_2015.pdf
24	Study on the social dimension of the future EU transport system regarding users and passengers	This study on the social dimension of the future EU transport system maps the challenges and opportunities posed by the modernisation of the system to different groups of transport users in terms of affordability, reliability and accessibility.	EN	2022	https://transport.ec.europa.eu/transport-themes/social-issues-equality-and-attractiveness-transport-sector/studies/study-social-dimension-future-eu-transport-system-regarding-users-and-passengers_en
25	On-Demand Stops; Safety; Gender Balances	Best practice example: Paris region has added 1000 additional employees (human presence) across the entire network by 50%. Today there are over 80,000 video cameras operating in the Paris Region's transport system; 24/7 hotline to report an act of delinquency or a situation that puts a passenger at risk. On-demand stops for night buses in addition to their heightened human presence. This service, developed by Île-de-France Mobilités, allows one to get off their night bus between stops, putting them closer to your destination. These measures help to fight harassment in transport systems and as a result, this can increase gender balances and safety.	EN/FR	2023	https://www.francetvinfo.fr/economie/transports/transports-des-arrets-a-la-demande-pour-les-femmes-la-nuit_6031994.html
26	Multimodal Passenger Mobility Forum	Report from the expert group	EN	2023	https://transport.ec.europa.eu/document/download/7e8b0323-3491-4110-a471-e64207b9a271_en?filename=mpmf-report-2023.pdf
27	Re-thinking Mobility Poverty	The book was published as a follow-up to the HiReach project (High reach innovative mobility solutions to cope with transport poverty) and covers a variety of topics such as social skills, individual aptitudes, geographical factors, societal roots, and impacts (e.g., gender, age, low income).	EN	2020	https://www.taylorfrancis.com/books/oa-edit/10.4324/9780367333317/re-thinking-mobility-poverty-tobias-kuttler-massimo-moraglio
28	INDIMO Project Inclusive Digital Mobility Toolbox	The toolbox includes a set of recommendations, a manual for developing inclusive digital interfaces, and an interactive service evaluation tool. Polis was also involved in the project.	EN	2022	https://www.indimoproject.eu/indimo-digital-mobility-toolbox/
29	IMPACTS projects WiZGo app	Utilising technological tools e.g., mobile apps, websites and SM platforms to collect feedback in real-time and address immediate concerns or issues related to safety, accessibility and inclusion.	EN		https://www.impactsproject.com/
30	UMCASE: Creating mobility with people, for people	Creating mobility with people, for people. User involvement is mostly developed in the context of testing digital applications and innovative mobility solutions. However, this means that certain groups are left behind, as they may not have the knowledge, skills, interest or monetary capacity to access this technology.	EN	2022	https://engage.eiturbanmobility.eu/processes/umcase/f/57/posts/11
31	Transport accessibility for persons with disabilities	EPF Presentation, EESC public hearing, 23/06/2022	EN	2022	https://www.epf.eu/wp/wp-content/uploads/2022/06/EPF-presentation-EESC-public-hearing.pdf
32	nuMIDAS Project toolkit	The project (New Mobility Data and Solutions Toolkit) is a valuable resource for cities seeking to improve the efficiency and reliability of their public transport systems. Developed under the Horizon 2020 programme, nuMIDAS provides a comprehensive toolkit designed to support the development and implementation of new mobility solutions.	EN	2023	https://numidas.eu/

4.Measures support workshop series

4.1. Workshop session 1: In-person workshops in Rome

4.1.1. Attractive PT interfaces and multimodal hubs

4.1.1.1. Results

The multimodal hubs and PT interfaces workshop session had presentations from the cities of Mannheim and Lisbon. Mannheim presented their work developing measure MAN_04, with a particular focus on greening existing PT infrastructure. Especially interesting for other participants was the potential to install and add photovoltaic panels on the roofs of shelters in tram stops, taking advantage of the already-existing electricity installation required for light rail operation. Lisbon presented their work to facilitate the integration of the bike-sharing and public transport system, taking advantage of the complementarity of the modes – which in the framework of UPPER is advanced through measures LIS_06 and LIS_09. An important good practice was learning from previous experiences and improving upon systems that had been put in place previously.

4.1.1.2. Conclusions

Assessing the implications of measures on unprotected road users or those at risk of exclusion has been identified as an area where efforts must consistently be put in to ensure that all people can benefit from the measures implemented. This is specifically the case when changes to existing infrastructure are foreseen. Participants agreed such an approach must be consistent with the Mobility as a Right concept promoted by UPPER. Lisbon's experience in cooperating with the National Institute for Rehabilitation for the development of measure LIS_06 was identified as a good practice example in this regard.

Secondly, participants agreed on the need of a multi-disciplinary project team which can champion the desired interventions in a variety of contexts, ensuring cooperation and buy-in from various departments, units or other organisations.

4.1.2. Data-driven mobility services

4.1.2.1. Results

The data-driven mobility services session continued the discussion of the MaaS services session – since MaaS applications rely on a solid data architecture and integration – and combined DRT-related measures with MaaS related ones. The session included presentations of measures OSL_05, as well as LEU_03+04 and ROM_06 which are part of task 4.4.

OSL_05 presented their challenges as two-fold: one related to a low level of digital maturity among their current customer base, which the RAT service must continue to serve and expand their service offering; and a second reflecting the difficulty of accurately envisioning a driverless service and its operations. In terms of tackling these, Ruter mentioned the consistent engagement with the target group and responding to their needs by tailoring and testing products, such as a digital booking interface. In terms of driverless operation – the pilot measure envisions

preparing the user group for the use of automated vehicles which are piloted as part of the ULTIMO Project – Ruter provided insights into what the driver of a RAT vehicle currently does in terms of helping passengers to board, provide directions, conversation, etc. The team is currently experimenting with seeing how customers react with a driver providing less assistance and interaction than in previously, being as “passive” as possible.

4.1.2.2. Conclusions

The workshop raised the interesting point of digital skills and awareness, with interventions highlighting that even though it is very relevant to consider digital skills, they only represent part of the potential challenge and that the key is that the service operation is clear and intuitive to use. An intervention from Mannheim pointed out that even for tech-savvy user groups, persuading them to start using a DRT service may prove challenging if they are not sure when and how to access the service, where they need to go, where they are being dropped off, etc.

4.2. Workshop session 2: Online workshops

4.2.1. Recommendations per measures

Horizontal partners with effort booked under the various tasks were asked to critically review the measures proposed by the cities. The partners decided among themselves which measures to review based on their expertise, previous work, etc. In conducting the critical review of the measures, horizontal partners have taken into account the various documents already produced in UPPER, including but not limited to the user personas and experience notebooks of D2.1, the SWOT analysis included in D2.2, or the supporting policy frameworks and policy requirements in D2.4.

Based on the critical review of the measures under task 4.5, the horizontal partners commonly agreed on a limited number of “Points of attention”, areas where they consider the cities and measures should be focusing more attention and should be addressed moving into the implementation phase. The goal of these “Points of attention” is to extract common challenges that are shared in the design/development of several measures within the same measure category, rather than a checklist per measure.

4.2.1.1. PT stops

8 Points of attention categories were identified

Recap on points of attention appraisal – Public space design

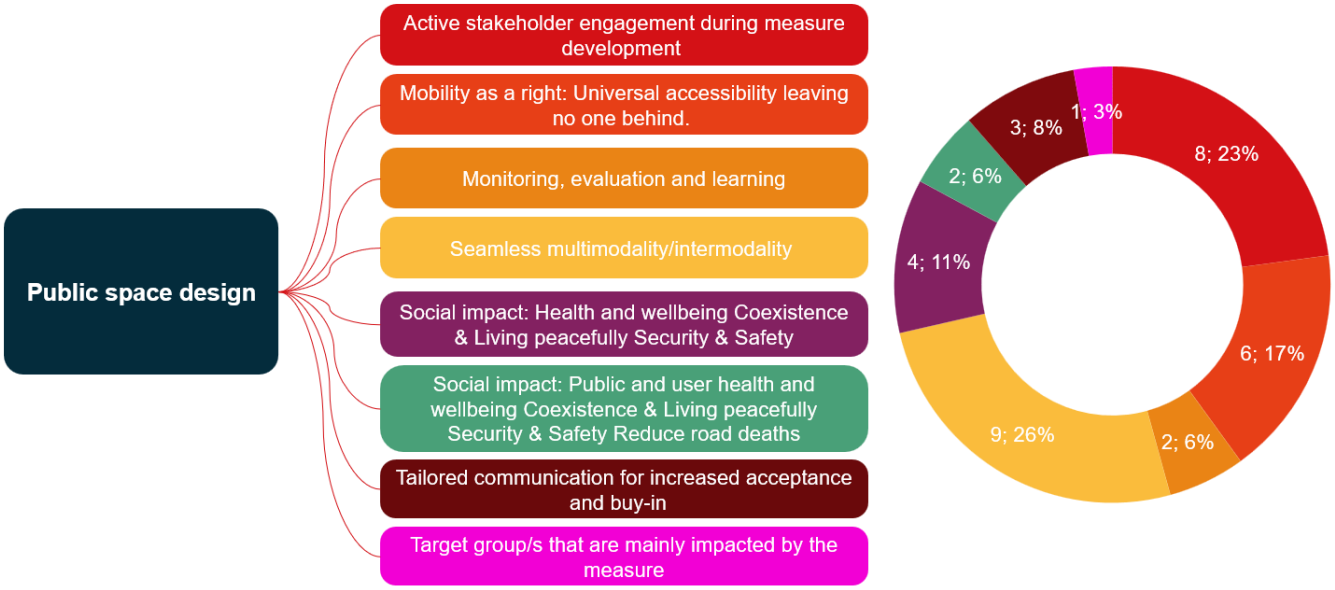

Figure 2 Points of attention categories for “Public space design” measures.

Based on the review of measures, the moderators from ECF and IFP agreed to summarise the points of attention that were identified during the review in the following three questions for the city representatives:

1. **Communication + stakeholder engagement:** How do you ensure that all relevant stakeholders, including local cyclist and pedestrian associations, are included in the planning process of the measures? Public space redesign, changing the status quo from space for cars to space for PT/active mobility, has often led to resistance/backlash. How will you handle this?
2. **Mobility as a right:** How do you ensure universal accessibility, considering the needs of different user groups? The Social Climate Fund will open funding opportunities targeted at users at risk of transport poverty, how could these opportunities be used based on the UPPER measures?
3. **Catchment area:** In your measure, are you considering the comfort and safety of the catchment area of the PT hub? Are you properly counting walking/cycling trip stages in multimodal trips when you collect data?

On the first question regarding communication and stakeholder engagement, the city of Valencia presented a possible solution consisting in the submission of citizen proposals through an engagement platform. Citizens can submit proposals for improvements in their neighbourhood, and a vote is organised on which proposals will be implemented. It was however suggested that formal organisations like *Valencia Camina* or *Valencia en Bici* (ConBici) should be included in the decision process and can help to organise engagement sessions. The city of Oslo reported on its engagement efforts with the cycling community, involving bike shops, online surveys among cyclists, and plans to involve cyclists' organisations as well.

On the second question on Mobility as a Right, the city of Oslo presented efforts to accommodate different types of bicycles in their plans and the different user profiles that they are linked to (e.g. cargo bikes to transport children, which are used more often by women). An avenue to investigate regarding the relatively high price of these bikes is tax or other financial incentives for bicycles provided by companies to their employees. UITP mentioned that cities need to make sure that public transport works to connect the city and provide access, rather than break up public spaces. Good examples where public transport can access pedestrian spaces are Seville and Bordeaux. An example of a measure where special attention to this point should be made is BRT separation from car traffic, which should still allow pedestrian crossing (this may be done by timing traffic lights, etc.). Unfortunately many BRT projects have two adjacent lanes of traffic making it very difficult access to the stations.

On the third question regarding the catchment area of public transport stops, Valencia reported that the city and operators are taking more attention to these areas - e.g. reducing crashes in these areas, dealing with potential conflicts between bike lanes and public transport passengers, using cameras to analyse bike trips. EUROCITIES recommended to collect data on "black spots" with high concentrations of crashes. In-depth information on this point can be found in the shared UPPER&SPINE workshop *"Streets for Life" – lower speed limits and better public transport available* on the project YouTube channel[1].

For Mannheim, their representatives reported on the collaboration between the city administration and the public transport operator to improve road safety and data collection in the catchment areas of public transport stops.

The specific points of attention raised during the appraisal exercise and the workshop process are the following.

Table 3 Task 4.5 Stops measures points of attention: comments and proposed solutions

Measure ID	Comment	Proposed solution
MAN_04	How will you ensure that the needs of all the reduced mobility or specific requirements groups are comprehensively addressed in the design of the measure?	Possibility of implementing participatory design workshops with representatives from all target groups to gather detailed feedback and ensure that their specific needs are met.
MAN_04	Good that the measure does not focus only on essential accessibility but also on thermic comfort. However other aspects should also be taken into consideration: ergonomic comfort, facilities for passengers and other modes.	Consider adding bike parking, charging points, toilets, for example.
MAN_04	The focus on bus stops and stations is good but far from enough. More attention should be given to the quality of the first and last mile of the trip.	Do an analysis of the accessibility, comfort and safety of the catchment area.
VAL_08	Will you engage with citizens especially those vulnerable to exclusion to give them a voice and hear about what they want?	Citizen engagement through workshops, surveys, focus groups, walk or ride along, could help you find out more about what the users actually want and also attract people who normally do not use PT
LIS_06	Include in the research team local NGOs representing people with mobility issues to have a real time and accurate response.	Take inspirations from the successful Oslo's 'Mind the gap' initiative

4.2.1.2. On-demand mobility services

The workshop held on the 30th of April 2024 was organised and ran by EMTA, featuring an initial presentation of the methodology and points of attention raised. General as well as specific remarks were made for the measures developed in tasks 4.2, 4.3 and 4.5, which were presented in plenary, followed by a more detailed discussion in breakout rooms per city.

General remarks:

- Accessibility and inclusion

[1] https://www.youtube.com/watch?v=dXEmx5aMGpY&t=1225s

- It's crucial to ensure that the price, digital tools, the need for a credit card, and the requirement of a smart phone are not barriers for some individuals to access public transportation.
- Gender lens should be applied on collected data to enhance services.
- More attention is needed on users' needs and understanding their mobility behaviours to better plan public transportation services.
- When replanning routes, the needs of pedestrians and cyclists must be taken into account. They can be involved in the replanning process. Engagement of local walking and persons with disabilities organisations.
- Ensure citizen engagement of non-digital users.

- Data collection, integration and storage
  - While surveys, questionnaires, focus groups and others are being conducted, how can we ensure the representativeness and quality of the data? Additionally, what are the resulting insights?
  - There is a need for user engagement, feedback collection, and consideration of user characteristics in data collection.
  - Integration of data into public transportation tools is essential.
  - Ensuring data privacy is essential.
- Communication and behavioural change
  - Discount periods, rewards must be applied.
  - Thorough understanding of target audiences is crucial to tailor the messaging.
  - There must be a mechanism to analyse how users respond to the incentives.
  - Engagement with new users other than the ones already commuting sustainably is crucial for the uptake of PT.

Specific remarks for DRT services in Valencia, Thessaloniki, Oslo, Mannheim:

- The DRT service must be accessible to vulnerable users for what automatization of the service already leaves out some user who don't have smart phones or credit cards. Both digital and old reservations should coexist.
- Users' characteristics, needs, mobility behaviours, perceptions of PT, different trip stages must be analysed before modelling routes and on-demand transport services.
- There must be a coherent communication plan to reach out to the intended target audiences.

4.2.2. High-level recommendations

Even though sometimes moderators had to solicit cities to speak out and share their experiences (either good or bad) the exercise helped city representatives to reflect on the many selected points of attention identified as common importance during the appraisal phase. It also generated exchange among city representatives as well as horizontal

partners to propose recommendations and solutions moving to the implementation phase. Due to the limited time of the workshop and the broad themes some aspects were not fully addressed so it would be interesting to check the measures development in future U-Transfer workshops. Similarly, because many of workshop topics were often complemented measures in other UPPER tasks, it would be helpful to group them by city or theme to better understand the bigger picture.

Engaging new users, particularly those not already commuting sustainably, will be a key focus. Cities must create outreach programmes to attract these users, ensuring that the messaging resonates with their needs and encourages a shift towards public transportation.

For cities like Valencia, Thessaloniki, Oslo, and Mannheim, where Demand Responsive Transport (DRT) services are planned, accessibility will be a priority. Recognising that automation can exclude vulnerable users who may not have smartphones or credit cards, the city will ensure that both digital and traditional reservation systems coexist. This dual approach will make DRT services accessible to a broader range of users. Modelling routes and on-demand transport services, cities will analyse users' characteristics, needs, mobility behaviours, and perceptions of public transportation. This analysis will help in designing services that are truly responsive to the needs of the community. A coherent communication plan will be developed to reach the intended target audiences effectively.

Cities must further develop strategies to address environmental impacts, focusing on reducing CO2 emissions, energy use, and improving air quality. Additionally, more thought will be given to rewarding sustainable commuters, encouraging more people to choose eco-friendly transportation options. Further input will be sought to design public transportation systems that align with environmental goals, ensuring that the city's transportation network contributes positively to the environment.

By addressing these points of attention, the city aims to create a more inclusive, responsive, and sustainable public transportation system that meets the needs of all its residents.

In future activities, we can also allow more opportunities for the cities to ask questions or specific feedback to the horizontal partners in case they need support with any aspects of their implementations. It is therefore important to continue the dialogue between the cities and the horizontal partners, who can provide such insights and support.

Lastly, it can be challenging to engage people in an online setting. As some participants seemed less willing to provide input during the breakout sessions, we can consider creative ways to make future workshops more engaging and attractive.

5.Measures preparation process

5.1. Valencia

5.1.1. VAL_06: "To improve the PT offer in peri-urban areas"

5.1.1.1. Description of the measure and main outcomes expected

This measure aims to improve the accessibility to public transport in peri-urban areas of Valencia, which are currently poorly served by traditional bus services. The measure proposes the creation of an automated Demand-Responsive Transport (DRT) system (mobile application/web service for booking and tracking DRT services) to cater to the needs of people living in these areas with low accessibility to public transport. This measure aims to promote social inclusion

by ensuring equitable access to essential services and opportunities for all Valencia residents, regardless of their location.

This measure will deliver:

- An automated Demand Responsive Transport (DRT) system (Mobile application & Interactive Voice Response - IVR) for booking and tracking the DRT service.
- Communication campaign to promote the use of the DRT service among target users.

5.1.1.2. Preparation of the measure

Definition of the area and the use cases of the DRT service

EMT wishes to carry out a DRT pilot to cover peri-urban areas with low demand of PT and where there is no regular bus service. The area selected for the pilot is located in the maritime area, next to the Nautical Club, an area where demand is low and normally concentrated in specific time slots, coinciding with the entrance or exit from work.

The DRT service offered by EMT does not contemplate the creation of an on-demand route. Instead, the DRT service consists of establishing, within a fixed EMT route, a series of stops to which the bus only deviates upon express request of a user . This service must be able to be requested by any user interested in getting on the bus in the defined area, without the service request mechanism being a barrier. To solve that, three different service request mechanisms have been defined:

- Mobile APP/ Web service: Targeted at users with mobile phone and internet connection.
- IVR service (call service): Targeted at users with mobile phone but with no internet connection or low digital skills.
- Physical button in the stop: Targeted at users without mobile phone. This is beyond the scope of UPPER project, but their Use Case is also to be considered.

Based on that, the following use cases have been defined.

Request the DRT service though a mobile with internet connection	
ID	VAL06_UC01
Description	A user who works at the Nautical Club has just finished work and is heading to the bus stop to catch the bus back home. The user knows that there is no fixed route that passes through this stop; instead, they must request the on-demand bus service (DRT). The user has a mobile phone and good digital skills. They open the DRT service app and follow the steps to request the on-demand bus. The app confirms whether there is a bus available to pick them up and sends a notification with the estimated waiting time until the bus arrives. If the waiting time is too long for the user, they can cancel the request. Similarly, if the assigned bus cannot fulfil the request for any reason, the user is informed, and the bus assignment process restarts.

Request the DRT service though a mobile without internet connection	
ID	VAL06_UC02
Description	A user who visits the Nautical Club for leisure is heading to the bus stop to catch the bus back home. The user knows they need to request the DRT service but has limited digital skills and prefers not to download the DRT service APP. Instead, the user chooses to request the service via phone call. They call the provided number and follow the Interactive Voice Response instructions to request the on-demand bus. The user receives an SMS confirming if there is a bus available to pick them up, along with an estimated wait time until the bus arrives.

Request the DRT service without a mobile *(Development beyond the scope of UPPER project)*	
ID	VAL06_UC03
Description	A user who usually goes to the Nautical Club to work, wants to catch the bus back home. The user knows that there is a bus stop in front of the Nautical Club that offers an on-demand bus service. The user goes to the stop, but does not have a mobile phone to request the service. The user approaches the button located at the stop, specifically for requesting the DRT service. This button connects the user to an Interactive Voice Response system, which provides guidance for making the request.

Definition of technical requirements and architecture.

After some bilateral discussions between ETRA (which develops the APP and the DRT management system for the PTO) and the DRT service provider (EMT), a list of technical requirements was defined for serving properly the abovementioned use cases. The technical requirements are presented in the table below.

Table 4 DRT system (Table of requirements)

ID	Technical Requirements	Category
VAL06_TR01	The solution must provide a mobile app that allow users to book a ride and provide accurate vehicle location updates	Usability
VAL06_TR02	The solution must include an Interactive Voice Response (IVR) system that enables users to book a ride via a phone call when they do not have internet access on their devices	Usability
VAL06_TR04	The mobile app should be intuitive and have an easy-to-navigate interface for users to book a ride and track vehicles	Usability
VAL06_TR05	A booked ride through the mobile app should be automatically cancelled when the user has subsequently moved away from the stop	Usability
VAL06_TR06	The mobile app should allow users to cancel a booked ride easily	Usability
VAL06_TR07	The mobile app should display a map showing the real-time location of the vehicle and the corresponding route depicted	Security
VAL06_TR08	The mobile app should request permissions to access the device's GPS and notification system	Data
VAL06_TR09	The users should be able to select the stop, route and headsign when booking a new ride through the mobile app	Data
VAL06_TR10	Both the mobile app and the IVR system will not need registration and login to be used	Usability
VAL06_TR11	The IVR system should offer multiple language options for voice prompts that allow users to be comfortable when they book a ride	Usability
VAL06_TR12	The IVR system must send an automated SMS notification after the call is finished	Usability
VAL06_TR13	The IVR system SMS content must be the ride confirmation and the vehicle arrival time, or a not availability service message	Usability

VAL06_TR14	The users should be able to select the stop and headsign when booking a new ride through the IVR system	Data
VAL06_TR15	The most proper vehicle associated to a ride must be selected by an EMT operator using a GUI	Usability
VAL06_TR16	The GUI used by an EMT operator should show the available vehicles to be selected	Data
VAL06_TR17	The EMT operator should be able to select a vehicle on the GUI and activate the notification to the vehicle driver	Usability
VAL06_TR18	The GUI should show if the driver has accepted or rejected the trip deviation	Usability
VAL06_TR19	EMT must provide the corresponding actions to let the driver to receive the notification of trip deviation or cancellation	Usability
VAL06_TR20	The drivers must be able to accept or reject the deviation trip request	Usability
VAL06_TR21	The solution must efficiently match users with available vehicles based on proximity and route optimisation	Usability
VAL06_TR22	The application must be able to run on mobile phones operating in Android OS and iOS.	Compatibility

Based on the technical requirements established and the use cases described, ETRA proceeded with the definition of the architecture for the DRT system. The flowchart for the DRT system is detailed below:

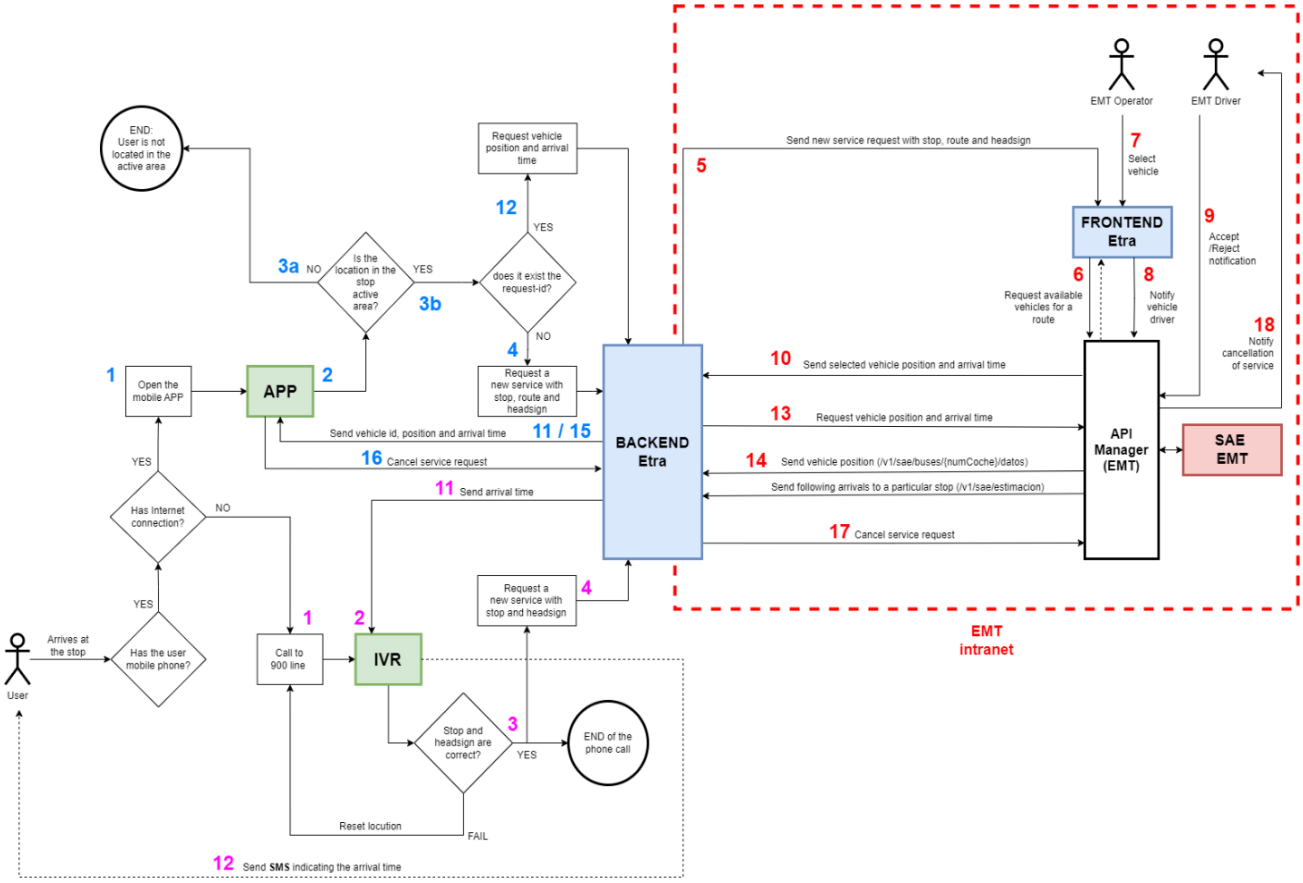

Figure 3 - DRT system architecture

USE CASES – Mobile APP (UC01):

- (1) A user wants to request an on-demand bus service (DRT). To do so, the user opens the mobile APP, which offers a list of routes with off-route stops.
- (2) The user selects the route, the route direction and the bus stop of interest (among the possible ones) in the mobile APP, and then requests the service.
- (3a) The APP checks that the user's position is close to the stop. If it is not close, the user is notified that he/she must be next to the stop with the mobile device to be able to request this service. (3b) If this is the case, the system searches for the next available bus for the selected route.
- (4) If it doesn't exist a current service for the user, it is requested a new one with the stop, route and headsign selected.
- (12) If it exists a current service requested, the app itself requests the vehicle position and arrival time every 20s – 30s, to be displayed.
- (5) At the EMT side, a frontend app receives the request of a new service.
- (6) That frontend app displays the available vehicles provided by the EMT API.
- (7) An EMT operator selects a vehicle and accepts the service on the frontend app, and this sends a notification to the vehicle selected.
- (8) The fronted app sends a notification to the driver. If no bus is found to be available, it notifies the user that there is no service available at that time.
- (9) If the notification arrives to a vehicle, the driver accepts or rejects it.
- (10)(11) The vehicle position selected and the current arrival time is sent to the user of the app.
- (12)(13) As long as the user does not cancel the service, the mobile APP will show the position of the assigned bus on a map. This position will be provided by the system of EMT.
- (14) The system of EMT returns the vehicle position and arrival time via API.

- (15) The app updates the vehicle position and arrival time.
- (16) The user can cancel a service request when moving away from the stop, either by walking or by getting on the bus itself.
- (17) The service is cancelled via the API of EMT.
- (18) The system of EMT notifies the service cancellation to the EMT driver, either because the user has already got on the bus or because the user has moved away from the stop.

USE CASES – IVR (UC02):

- (1) If the user does not have Internet connection, he/she can call a phone number to request a new DRT service, in a similar way as he/she would do using the app.
- (2) The IVR system will request the stop where the user is located and the headsign where he/she wishes to go.
- (3) The information given by the user is validated and if so, the call ends.
- (4) The IVR system will request a new DRT service to the EMT system.
- (5) At the EMT side, the frontend app receives the request of a new service. In this case, coming from the IVR system.
- (6) Again, the EMT system provides with the available vehicles and the frontend app displays them to the EMT operator.
- (7) The EMT operator selects the vehicle and accepts the service on the frontend app.
- (8) Finally, the frontend sends a notification to the selected vehicle's driver.
- (9)(10) If the driver accepts the notification of a new DRT service, the EMT system returns the arrival time to the IVR system.
- (9) If the driver rejects the notification, the EMT operator will select other vehicle and again the new driver will accept or reject the new DRT service.
- (11) The IVR system receives the arrival time of the EMT vehicle.
- (12) The IVR system sends a SMS message to the user who did the call requesting a new DRT service with the arrival time.

Mobile application/ web service development

At this stage of the project, the APP and the IVR service to request the DRT service have been properly developed, following the technical requirements defined at the beginning of the measure preparation. The figures below show the APP developed.

Mobile APP screen captures:

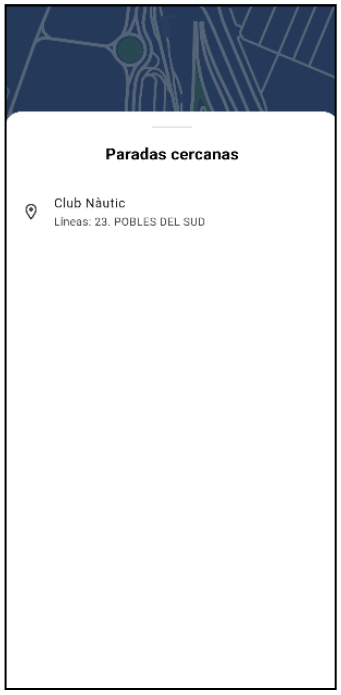

Figure 4 - Nearest available stops

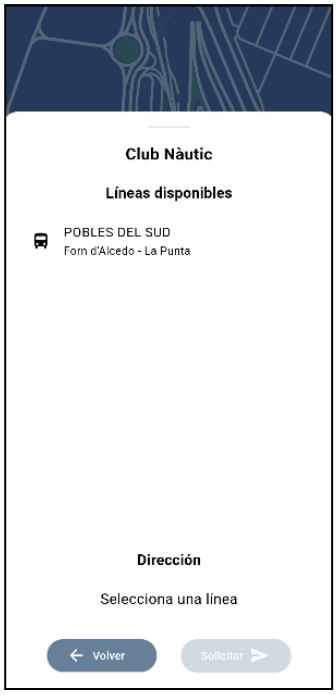

Figure 5 - Bus line selection after selecting the stop

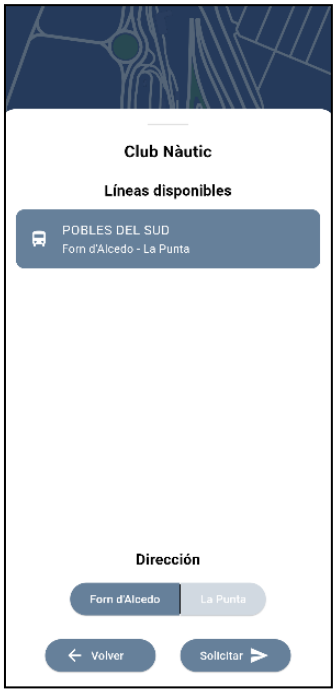

Figure 6 - Headsign selection after selecting the bus line

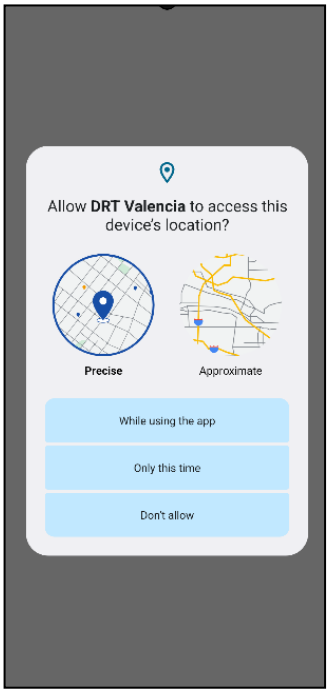

Figure 7 - Allowing access to location services

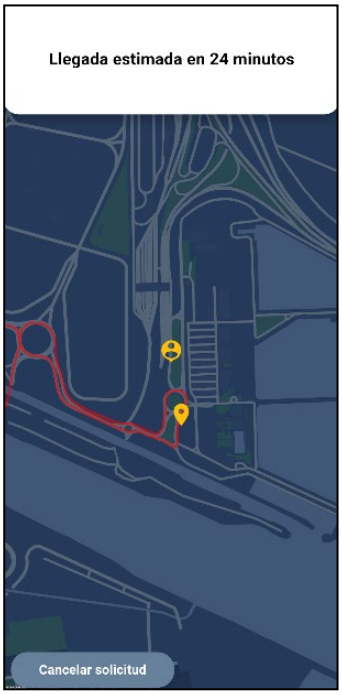

Figure 8 - Estimated arrival time displayed

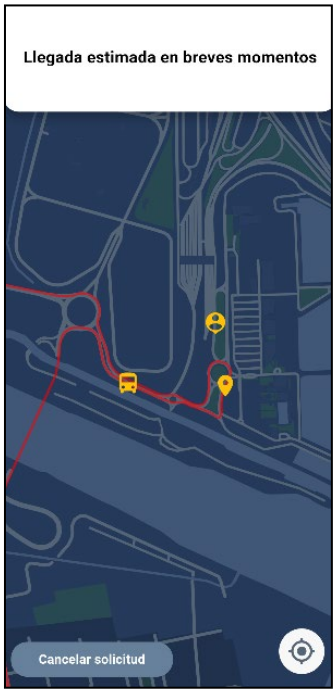

Figure 9 - The selected bus is arriving

IVR - SMS received by the user with the arrival time:

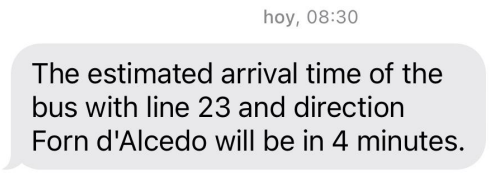

Figure 10: Model of SMS with estimated arrival time

5.1.1.3. Challenges & Mitigations

No challenges were identified, the measure preparation went according to the plan.

5.1.1.4. Next steps towards implementation

The next steps towards implementation include:

- Training EMT staff for running the service.
- Launch a communication campaign to inform about the new DRT service and promote its usage and train target users on how to use it.

5.1.2. VAL_08: design and develop an innovative, inclusive and convenient stop for buses

5.1.2.1. Description of the measure and main outcomes expected

The objective of this measure is to design and test an innovative, intelligent and inclusive bus stop that guarantees user satisfaction and greater public perception regarding the PT, and which also facilitates the accessibility and mobility around the bus stop and the immediate surroundings and the safe access to the bus vehicle itself. The design of the PT stop will go through a co-creation process to ensure that it meets the needs of citizens (in terms of accessibility, attractiveness, safety and inclusion). The new bus stop will incorporate a set of services and benefits to guarantee accessibility, both physical and cognitive, for all users, including those with disabilities or special needs. In addition, once the measure is prepared, it will be tested and validated through the Urban Sandbox.

This measure will focus on:

- Designing a prototype of innovative intelligent and inclusive bus stop, emphasizing the inclusion of elements that improve the user experience during waiting times.
- Designing the area surrounding the bus stop by setting guidelines adapted to pedestrian and bikes routes tailored to the specific needs of the BRT stops planned for Blasco Ibañez Avenue.

The pedestrian mobility study will be used to determine the capacity and pedestrian routes, plan the works that will be carried out later with Next Generation funds (outside the scope of UPPER), enable changes in mobility at certain points on Av. Blasco Ibáñez and study possible improvements to bus stops.

5.1.2.2. Preparation of the measure

The following steps have been followed to prepare the measure:

Step 1: Defining the context of action

This measure is framed within the context of the Blasco Ibáñez Avenue redesign project (which includes the creation of a BRT lane). Relevant information conditioning the configuration of the bus stops to be deployed in the corridor has been collected.

With respect to the bus stop:

- The current design of the bus stops is relatively new (EMT started the renovation of the bus stops in 2021).

Figure 11 New bus shelter

- The new bus stops are modular and configurable, both in length and in the arrangement of the elements and accessories. For the BRT, bus stops up to 15 meters should be considered.

Figure 12 New bus shelter of 15m

- The new bus stops have recently (with the support of Next Generation funds) been incorporating certain elements aimed at making them more accessible, inclusive, safe and comfortable. Examples of that are:
  - Inclusion of information panels in Braille to enable blind people to identify the bus stop and bus lines. Inclusion of NaviLens technology in bus stops, a pioneering and universal signage system which helps visually impaired people to orient themselves around the bus stop with the help of their mobile phone.
  - Installation of a tactile pavement indicator that allows visually impaired people to easily move around the bus shelters.
  - Illumination of the bus stops with clear white LED lights for greater visibility and safety for users of the service at night (near future).

With respect to the bus stop surroundings (specially addressing the specific needs of the urban spaces necessary for each type of user in the surroundings of the BRT stops planned for Blasco Ibañez Avenue):

- The configuration of the bike lane, with respect to the bus stop, conditions the design of the bus stop and its surroundings. There will be two main typologies in the renovated Blasco Ibañez:
  - Bicycle lane in front of the bus stop: configuration of bike line before and after the bus stop running along the roadway with segregation of the physical characteristics of the median markers and/or separating borders. When the bike lane approaches the bus stop it experiences a raised area. As a result, the width of the bus stop platform has been increased. The stop environment must include horizontal and vertical signage to warn bike lane users about the proximity of the bus stop.
  - Bicycle lane behind the bus stop: This type of bicycle lane configuration passes behind the bus stop, it is at the level of the sidewalk delimited by a painted band that can vary in width depending on whether it is unidirectional or bidirectional. The stop environment should include horizontal and vertical signage to warn bike lane users about the proximity of the bus stop. It should also include a pedestrian crossing so that pedestrians can access the bus stop area.
- A road safety study has been taken into account for the analysis and diagnosis of bus stops with a bicycle lane in front of and behind the stop.

Step 2: User needs identification

The aim of this step was to identify user needs in terms of accessibility, safety, inclusivity, attractiveness and innovative features of the new bus stop, addressing specially those users with disabilities or special needs.

The “Serious Game” methodology, proposed by KUL, was followed to identify the needs of certain vulnerable groups, including elder people, people with reduced mobility, people with certain disabilities (visual, audit…).

The two Serious Games conducted, which resulted in the identification of specific needs of vulnerable users:

To reduce the excessive heat and/or sun incidence, especially during summer:

- Increase the shaded area around and within the bus stop, especially during peak hours.
- Dimension the stop according to the usual volume of passengers at that specific stop.
- Installation of water misters for situations of extreme heat.
- Reassess the location of the PT stops to evaluate if by moving the stop few meters, the shade provided by a building can be used in favour of PT users waiting at the stop.

Regarding the provision of information at the stop:

- The information, in addition to being displayed visually, should also be presented audibly (both, non-disabled users and users with visual impairments would appreciate it).
- The current screens should be improved (by increasing their size or brightness) since there are times when the sunlight affects the screen, and the displayed information cannot be properly appreciated.
- There should be a quick information button either on the buses themselves or at the bus stops, or acoustic announcements (like in the metro) about incidents, delays or route changes.

To facilitate the access to the bus (in case of disabilities, stroller…):

- Distribute the different type of users along the different bus doors (one door –with ramp- for people with reduced mobility; one door for people with trolleys and baggage, one door for people with no difficulties for the access, etc.) and indicate that “priority use” in the floor at the bus stop, so that people can wait for the bus in that specific area (depending on their particular needs) and access in a quicker way through a dedicated and prepared door.
- Enable the access to the bus through any door (currently, only the one next to the driver is accessible) and make it possible to validate the ticket at any door as well.

To increase safety perception while waiting at the bus stop at nighttime:

- Installing an emergency button at bus stops, particularly in certain neighbourhoods. This button would silently trigger a surveillance camera, enabling security personnel to monitor any issues and call the police if needed. The presence of a surveillance camera alone could act as a deterrent.
- Having a camera and a tele-assistance button for individuals to contact in case of feeling unsafe or endangered.

To overcome potential difficulties at the bus stop when you are alone:

- Implementation of a teleassistance button at bus stops, enabling individuals to easily contact the EMT control system for various non-emergency purposes. This dedicated button would provide assistance with ticketing, bus route inquiries, and other non-urgent matters, distinct from the emergency button meant for dangerous situations.

To increase safety and comfort in raining days:

- The shelter is prone to leaks, especially now due to the new flat roof design. In addition, people often take refuge under the bus stop using umbrellas, which causes the pavement to be slippery. To counteract this, it is proposed to use a rougher type of pavement in the bus stop to minimize the risk of accidents and falls.

Regarding the provision of information:

- There is a lack of information about transfers at bus stops and onboard. It is suggested to provide information about available connections both at the stops and on the bus (visual and auditive information), as in the metro.

Regarding the provision of updated information about changes in the service:

- Information about changes in lines or services (e.g. Fallas) should be provided not only on the EMT website but also at the actual bus stops.

Step 3: Organisation of a Hackathon to co-design solutions

To proceed with the design of an innovative, intelligent and inclusive bus stop, it was decided to organise a Hackathon (taking profit of the Open Innovation Days organised by Y4PT in the context of UPPER project). This was seen as a good opportunity to bring together young people with creative minds to think about how the future bus stops should look like and which elements could be incorporated into the bus stop to improve the use of the stop and access to the bus.

The Hackathon was organised jointly by EMT, VAL, IBV, UPV, ETRA and Y4PT. There were in total 13 hackers (participants), 4 members of the jury, 12 mentors and 2 VIP speakers.

The challenge

In overall the problem to be solved is the gap between Mobility as a Service (MaaS) and Mobility as a Right (MaaR) to ensure an innovative, inclusive and convenient user experience at bus stops, taking into account the following aspects:

- Mobility infrastructure : To design and develop an innovative, inclusive and convenient stop for buses
  - *What should the new EMT design standards look like?*
- Data-driven mobility service: To provide the citizens with clear and accessible information before and during the trip.
  - *Which kind of visualizations of information could be useful for pt users?*
  - *How can it be shared? -for example at digital screens in the bus stops*
  - *Which kind of data sets do you think might be the most important?*
- Human-centred design: from an open challenge (EU mission for 100 climate-neutral and smart cities by 2030) to a collective solution based on people's needs; taking into account solutions offered by students and SMEs.
  - *How could the gender gap in the user experience at EMT stops be reduced?*

    - *How can we improve security and safety perception in EMT stops?*
    - *How can we improve the physical, cognitive and social accessibility?*
- IoT design: To improve safety and comfort user experience based on advanced technology.
    - *How can perception systems be used on PT stops to improve safety and comfort?*
    - *Which IoT solutions can turn PT stops into smart hubs?*
    - *Which connectivity elements and new services to improve the users' experience?*

The results of the Hackathon

Four groups participated in the Hackathon. A wide variety of material was facilitated to the participants to facilitate the generation of ideas, including: road layout, renders and plans of the current bus stop (recently updated), mobility ordinances and dispositions, results of the "serious games", mobility maps in PERSONA format and access to the open data portal.

The solutions proposed were varied and covered great part of the needs identified by the vulnerable users as well. Here below the four projects proposed are briefly presented:

- **NUCLANSA: "User-intuitive safety-focused accessible bus stop shelter" (1st place – winner)**
  A new user-intuitive and safety-focused concept of bus stop. A novel shelter design, built-in with:
    - An embedded display with real time information of traffic, routes, diversion notifications and alternative routes.
    - A luminous warning sign embedded in the stop to: 1) Warn the driver to make the stop; 2) Warn the driver to put the ramp in place (NFC).
    - A traffic light for bicycles in the vicinity of the bus stop, to warn bikes and scooters when passengers are about to get off the bus.
- **SUBE QUE TE LLEVO: "Bus stop-focused trip planner mobile app for people with reduced mobility" (2nd place)**
  An innovative trip planner mobile app for people with reduced mobility (built-in with door-to-door and on demand public transport services). A module (real time passenger information systems) is embedded in current bus stop shelters for improving accessibility.
- **PLOU POC: "Climate-resilient green roof modular bus stop shelter" (3rd place – ex aequo)**
  A new climate-resilient concept of bus stop: a xeriscaping green roof modular shelter, plus a reward-scheme trip planner mobile app for planting trees in deforested areas inside the city.
- **CAT (Crowd Aware Transit): "Bus stop-focused trip planner mobile app for notifying users about how crowded bus routes are" (3rd place – ex aequo)**
  A trip planner mobile app for notifying users about how crowded bus routes are and letting them choose the best route available. A module (real time passenger information systems) is embedded in current bus stop shelters for improving the travel experience.

Step 4: Analysis of the Hackathon results and identification of relevant innovations

While the four project raised high interest among the jury members, special attention was paid to those innovations better aligned with the scope of this measure and more feasible to be tested within the scope of the UPPER project. Innovations being considered for the bus stop prototype are:

- The new bus stops are designed to accommodate digital displays (70-inch LCD screens) on one of their side panels. The forthcoming integration of these displays—funded by Next Generation funds—presents an opportunity to test the following innovation: an embedded screen providing real-time information on bus routes, arrival times, connections with other transportation modes, traffic conditions, alerts, incidents, diversions, and alternative routes. A total of 4 digital displays will be deployed in the avenue for testing purpose.
- Integration of a traffic light for bicycles and scooters in the vicinity of the bus stop to warn users of the cycle lane of the arrival of a bus and therefore of the upcoming alighting of passengers.

- A voice assistance system will be installed for blind people at bus shelters in those that have information screens displaying estimated waiting times. These screens will be equipped with a system called *Ciberpass*, which provides the information shown on the screens through voice narration using a remote control that blind people have in the city of Valencia. This system allows blind people to have full autonomy when using public transportation.

Step 5: Study of pedestrian and cyclist mobility flows around bus stops

This step aims to support the design of the Blasco Ibañez bus stops surroundings. To this aim, this step is going to carry out a road safety study and an analysis of the mobility flows (pedestrians and bikes) around the bus stops, including those with bike lanes in front of and behind the stop.

This study will allow to better understand the variability in the pedestrians and bicycle flows per day, hours, seasonality and vacation periods due to the university and the healthcare centre surroundings.

The study of pedestrian and cyclist mobility flows around a single demonstrative bus stop in Blasco Ibáñez Avenue environment will be subcontracted (study to be initiated in September 2024) and will include the use of traffic cameras (CCTV) and image analysis software.

Technical requirements of the subcontracting process

1. Study of the scenarios adapted to a bus stop on Blasco Ibáñez Avenue: Study of the two possible alternatives for the configuration of a bike lane next to a bus stop to determine the optimal solution taking into account the configuration of the space of a stop on Blasco Ibáñez Avenue and another road with similar characteristics, taking into account its actual location, the elements of urban furniture and nearby vehicular fords.
2. Analysis of alternatives:
   - Define, based on the different intensities of bicycle and pedestrian passage, as well as their trajectories, the different thresholds that determine the need or not to place a traffic light device to stop bicycles to facilitate and improve the accessibility of users to the bus.
   - Study of intensities based on variability per day, hours, seasonality and vacation periods due to the university environment.
   - Determine and define the function of the intensity of the passage of all road users, the type of regulation, the traffic light cycle, green times, lag, etc., as well as the devices to be implemented (traffic lights, loops, bands or light panels). . …)
3. Justification of the solution adopted: Advantages and disadvantages of each scenario for the different alternatives.
4. Generation of detailed plans with the rearrangement of the elements and the distances necessary to improve accessibility to the stop with the implementation of the selected alternative

This process requires the definition of technical and administrative specifications and the contract for the drafting of the mobile project on the road to the bus stops, including the final supervision of the project. (Step initiated and in process).

5.1.2.3. Challenges & Mitigations

The main challenge is the evaluation of mobility flows around bus stops due to the **high pedestrian density.** As mitigation strategy, video analytics will be used to accurately capture large volumes of pedestrians Additional data collectors will be used, if necessary.

Some delays have been experienced in the subcontracting of the mobility study, mainly due to:

- The EMT is drafting its 2025-2030 Master Plan, which analyses new mobility habits with an impact on the BRT area, as well as mobility parameters with a clearly representative approach to citizens / public transport users movements.
- The mobility study requires a comprehensive requirements' gathering due to the degree of novelty of the technology to be applied.

As mitigation strategy, transparent communication has been implemented between the EMT and Valencia City Hall with the aim of clearly defining the purpose and the scope of the study.

5.1.2.4. Next steps towards implementation

The next steps necessary to proceed with the implementation of the measure include:

- Award the contract for the mobility study (scheduled for the middle of September). The mobility study will result in a set of guidelines and recommendations.
- Finalise the development of the innovations to be integrated in the bus stop prototype.

5.2. Oslo

5.2.1. OSL_05: Adapt segmented demand responsive transport (DRT) solutions to a broader group

5.2.1.1. Description of the measure and main outcomes expected

This measure seeks to find ways of integrating the Ruter age-friendly service with a projected, new DRT-service, no longer being limited to a particular age group. Instead of funding these services separately, our aim is to enable synergies and reduce costs by integrating the two. Relevant issues to uncover include (1) how to design a new "open to all" service which still takes into account the needs of the elderly, and (2) how can we support this particular target group onto a fully digital service. Additionally, the measure aims to cooperate with the ULTIMO project to learn how we can prepare and assist elderly onto the future, autonomous DRT vehicles.

The measure does not include a full-scale launch of an "open to all" service, but is an essential preparation for such a launch.

Measure outputs:

- Testing of original target group's (elderly) adaptability to general DRT service (open to all customers), in terms of:
  - Ordering process (digital, rather than by phone)
  - Travelling (with a wider group of passengers, not only those within their own age segment)
  - Assistance (how much assistance is required from the driver/host, and which needs must be covered when we introduce autonomous vehicles)

Figure 13 Ruter age friendly transportation.

5.2.1.2. Preparation of the measure

Ruter's current service for age-friendly transport is for users who are 67 years or older and need door-to-door transport. A minibus picks up the customer at home and drives them to and from their desired destination within the applicable districts in Oslo. The trip can be booked directly or up to a week in advance, either via the app or by phone. You can also book a trip based on arrival time. On the journey, you will meet helpful drivers, and there is space for walkers, wheelchairs, and other aids on board. All customers need to travel is a regular senior ticket. It is not possible to buy a ticket on board the minibus, so tickets must be purchased in advance using the Ruter app or with a travel card.

The service has been in operation for several years, but to gain an even deeper understanding of customers' experiences, expectations, pain points, etc., we have systematically approached this by:

- Initially documenting all lessons from the current DRT system, which formed the basis for the further analyses we conducted. This was supplemented by our experiences during the Serious Game, held in Oslo in August 2023. The lessons learned here also provided valuable input. After completing these two steps, we proceeded with various new analyses.
- In-depth interviews with existing users through the analysis institute Epinion. This included 21 telephone interviews with users of Ruter's age-friendly transport. The purpose was to evaluate the service, where we examined users' travel needs and purposes, their use of and relationship to the service, and their reactions to potential changes to the service (including digital user interfaces, self-driving cars).
- Interviews with city district employees to supplement users' viewpoints with those of district employees. This particularly covered the needs of users we do not reach in other surveys.
- Onboard examination of the travel experience. We were passengers on Ruter's age-friendly transport for one day, observing and interviewing passengers and the driver. The purpose of this was to supplement previous interviews with observations of actual customer journeys on board.

Preliminary key learning points are as follows:

- The target group is positive about carpooling with other target groups if it does not compromise the capacity and availability of the original service.
- Customers do not really need to plan a trip far in advance. For many, it is just as important to be able to act on impulse, depending on their condition that day. In other words, direct bookings are interesting if customers are guaranteed a trip when needed.
- The driver on board provides a sense of security for the target group, but a host could fulfill the same role.
- A large portion of the target group sees self-driving as a natural development (they have already lost the postman and staffed checkouts in stores).
- It is clearly necessary to have an option for non-digital users for bookings, changes, messages, information, etc.
- There will be a need for clear audiovisual communication (during boarding and alighting).
- For some, using age-friendly transport is stigmatizing because they do not consider themselves part of the target group even though they are over 67. Integrating the service with one that is open to everyone will make it more attractive and relevant to many.

Figure 14 Serious Game in Oslo.

5.2.1.3. Challenges & Mitigations

This measure meets two main challenges: one concerning testing and the other concerning technical app solutions.

- The plan from the beginning has been to take advantage of the work being done on the ULTIMO project, which involves the introduction of self-driving vehicles in a limited area of Oslo. It has been desirable to use one of these vehicles in the testing of OSL05 because the original project timelines matched well. Since the start, there have been some delays in the introduction of the vehicles (permits, approvals, etc.), which

ultimately affects our ability to allow our target group to come on board. The solution is therefore to simulate a self-driving service by reducing the driver's visibility, helpfulness, etc., in the test. If there are any changes in ULTIMO's progress, we can quickly arrange a test as originally planned.

- Bookings for Ruter's age-friendly transport are currently made through a separate app (RuterBestilling) - not Ruter's main app for travel search and ticket purchases. Our new fully digital DRT service will be offered through the Ruter app, so in the future, it is reasonable to think that all existing segmented services will also be found here. The challenge is that all existing users of Ruter's age-friendly transport are influenced by the under-prioritized and somewhat deficient RuterBestilling. Perhaps several are negative towards digital bookings due to a poor digital interface here. Thus, it becomes a trade-off to determine whether we should prioritize improving RuterBestilling or make the necessary investments to move the customers of age-friendly transport into the Ruter app.

Figure 15 ULTIMO autonomous vehicle.

5.2.1.4. Next steps towards implementation

The next steps involve planning and preparing testing onboard vehicles with our target group (67+). This could be either onboard self-driving vehicles with ULTIMO or onboard our own soon-to-be-launched fully digital booking service called "Hent." For this, we plan to recruit core users, as well as relatives and others in professions that work closely with the target group (employees at nursing homes, etc.).

Another important step is to determine how realistic it is to get our users (67+) onto a fully digital service. We know that many will still need to be able to call the customer centre, but we want to get a more concrete figure on the proportion of people this applies to. This will significantly impact how the customer centre should be staffed and, not least, how and to what extent apps should be designed to meet their needs.

Figure 16 Use of RuterBestilling.

References[2]:

5.2.2. OSL_08: Shifting DRT-reservations from pre-booking to on-demand as a means to increase capacity

5.2.2.1. Description of the measure and main outcomes expected

Introduction

This measure aims to explore methods for enhancing and gaining experience in same-day and on-demand ordering for Ruter age-friendly transport (RAT). We will attempt to acquire the necessary skills and experience to operate on-demand DRT systems, whilst also taking into account the unique needs of RAT users. Key issues to investigate include (1) the impact of reserving vehicles for on-demand/same day on productivity, (2) the effect of on-demand/same day on trip aggregation, and (3) determining the number of vehicles needed for on-demand/same day to observe systemic effects, among other considerations.

Measure outputs:

- Increased number of vehicles reserved for on-demand/same day ordering.
- Increased flexibility for end users.

[2] https://ruter.no/reise/bestillingstransport/aldersvennlig-transport/

https://www.oslo.kommune.no/helse-og-omsorg/tilbud-og-veiledning-for-eldre/aldersvennlig-oslo/

https://www.digdir.no/rikets-digitale-tilstand/tema-digitalt-utanforskap/3568

- Reduced pre-booking rate for RAT.
- Operational experience with partial on-demand DRT systems.

Case description

Ruter Age-Friendly Transport (RAT) has evolved since its launch in 2017 and has become a well-liked and valued transportation service for the elderly. Over time, the demand for this service has increased, stretching its capacity thin. A known consequence of DRT systems operating at maximum capacity is the increase in pre-booking, and RAT is no exception. The service is typically booked days in advance, negatively impacting productivity. The most effective DRT systems are usually on-demand only.

This upcoming fall, RAT plans to significantly expand its service area to four new city districts, increasing the fleet from 16 to 27 vehicles. Past experiences indicate that it takes time for the service to meet the anticipated demand when expanding to new districts. This presents us with a “window of opportunity” to experiment with new solutions and approaches on a large scale without affecting capacity.

Why is on-demand ride planning relevant for Ruter?

On-demand ride planning, particularly in the context of paratransit and elderly transportation provides a level of service quality that surpasses traditional fixed-line public transport, offering unprecedented convenience and flexibility.

This is important for Ruter, which aims to substantially reduce private car use in the long term. Achieving this goal requires offering competitive mobility solutions. We believe that demand-responsive transit, combined with on-demand ride planning, has the potential to become a viable alternative to private car ownership, providing an attractive, flexible, and sustainable transportation option by:

1) Optimising Routing and Scheduling

On-demand route planning can decrease the number of empty trips compared to pre-booked planning, resulting in better vehicle productivity

2) Reducing costs and environmental impacts

By reducing unnecessary trips and improving vehicle utilization, on-demand systems lower operational costs and emission.

3) Facilitating ride sharing:

Encouraging shared rides maximises vehicle occupancy, increasing the overall capacity in the system.

5.2.2.2. Preparation of the measure

Project structure for phase 1

Phase one of the project involved identifying a suitable structure and methodology. RAT is a service that involves many different people across the Ruter organisation, and to implement this measure, it was necessary to find suitable partners. For this initial phase, we decided that a small project group would be appropriate. It consisted of one representative from operations, one from digital development, and one from business development. Additionally, a handful of other individuals were consulted as needed but were not part of the core project group.

The project group ensures progress through circa monthly working sessions. This measure is also actively discussed in our weekly meetings with our planning system provider.

Methodology for phase 1

As mentioned in the introduction section, part of the goal of this measure is to reserve vehicles for on-demand booking this fall. The Age-Friendly team lacks proprietary knowledge on this subject, so we needed to begin the project with a phase of data collection and experience formation.

Consequently, the project group decided to establish baseline data levels for vehicles reserved for on-demand booking. It was also necessary to investigate how this change would affect different parts of the organisation.

Therefore, we decided that phase 1 would involve reserving two vehicles in the age-friendly service specifically for on-demand/same-day booking. The decision to include same-day booking rather than strictly on-demand booking will be further discussed in section 3.1. These two vehicles were alternated between "On" and "Off" on-demand booking status on a weekly basis. This approach was taken to create a reliable baseline of data.

Project structure for phase 2

Phase 2 of this project will involve reserving a minimum of five vehicles for on-demand booking this coming fall. The project structure for this phase is not yet fully determined. Project partners from phase 1 will remain involved, but it will be necessary to include more personnel, particularly from customer service. This aspect will be further discussed in the section on next steps.

5.2.2.3. Challenges & Mitigations

Practical challenges and mitigations from phase 1

At the beginning of phase 1, two vehicles were manually selected at the start of each shift during "On" weeks. This approach proved unsuitable as it relied on staff remembering to designate vehicles for on-demand service each morning. Given the large size of Ruter and the many employees involved, consistent communication was challenging, leading to instances where vehicles were not properly designated. This inconsistency negatively affected the quality of data and made data extraction time-consuming and labour-intensive.

To address this, the project group decided to consistently use the same two vehicles each week. This change reduced the number of manual actions needed to implement phase 1. However, this approach also impacted data quality since RAT vehicles have static shift starting locations spread across the city. For example, selecting vehicles on the far west side could skew the data. To mitigate this, we chose two vehicles with starting locations centrally located in the city. While not a perfect solution, this adjustment significantly improved data quality and streamlined the data extraction process, making it less time-consuming.

For phase 1, the project group allowed both same-day and on-demand booking for two main reasons. First, our planning and booking systems were not fully equipped to handle true on-demand bookings, especially for phone reservations via customer service. Second, restricting these vehicles to on-demand only would have posed significant communication challenges with customer service staff. This approach also provided the necessary experience for the next phase of the project.

In phase 2, we will exclusively allow on-demand bookings, eliminating same-day bookings. By late August, our planning system will transition to a new technology stack that will better support on-demand functionality, making it more user-friendly and tailored to our needs.

Although these two vehicles were reserved for on-demand/same-day bookings, they remained part of a dynamic planning system largely dominated by pre-ordered rides. Unlike vehicles allowing pre-booking, the on-demand vehicles often had open slots in their shifts, especially in the mornings. Since route planning is dynamic, rides are often reassigned to other vehicles in cases of delays or deviations. Consequently, the two on-demand vehicles often absorbed rides that would otherwise have been delayed. This meant that some completed rides were not truly on-demand but were pre-booked rides dynamically reassigned. The project group reviewed this issue and decided not to alter the planning system's functionality, concluding that leaving the system unchanged provided a more accurate representation.

An important aspect of phase 1 was data extraction and analysis. However, our current reporting systems for RAT lacked the flexibility and efficiency needed for this project, making it difficult to extract data on specific vehicles. While it was possible, the process was time-consuming and inefficient. As a result, significant effort has been put into developing a new reporting structure in PowerBI, providing the necessary functionality and flexibility for this and future projects (see figure 1 below).

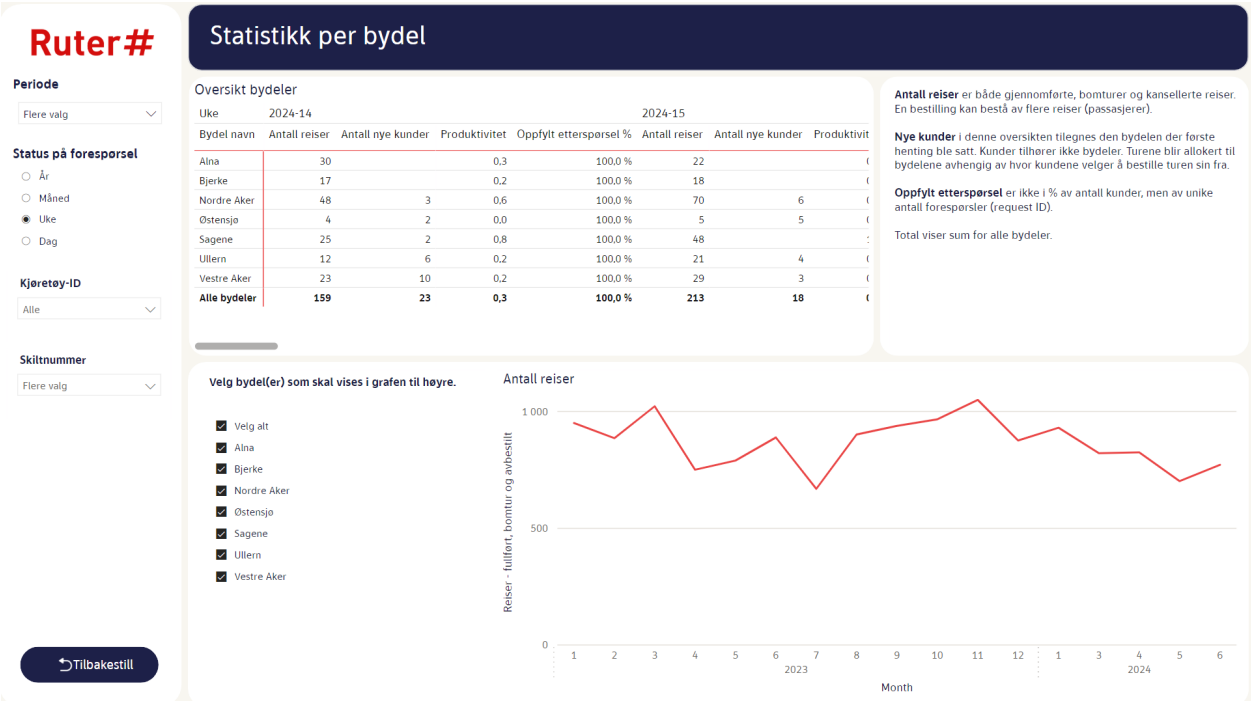

Figure 17 Updated PowerBI report

Results from phase 1

Since early April 2024, we have reserved two vehicles for on-demand/same-day booking. On-demand booking is available during even-numbered weeks (e.g., weeks 14, 16), while it is unavailable during odd-numbered weeks (e.g., weeks 15, 17). The data for weeks 14, 18, and 20 are skewed due to several bank holidays.

Figure 18 below displays the number of on-demand bookings for vehicles 242 and 243 from April through June.

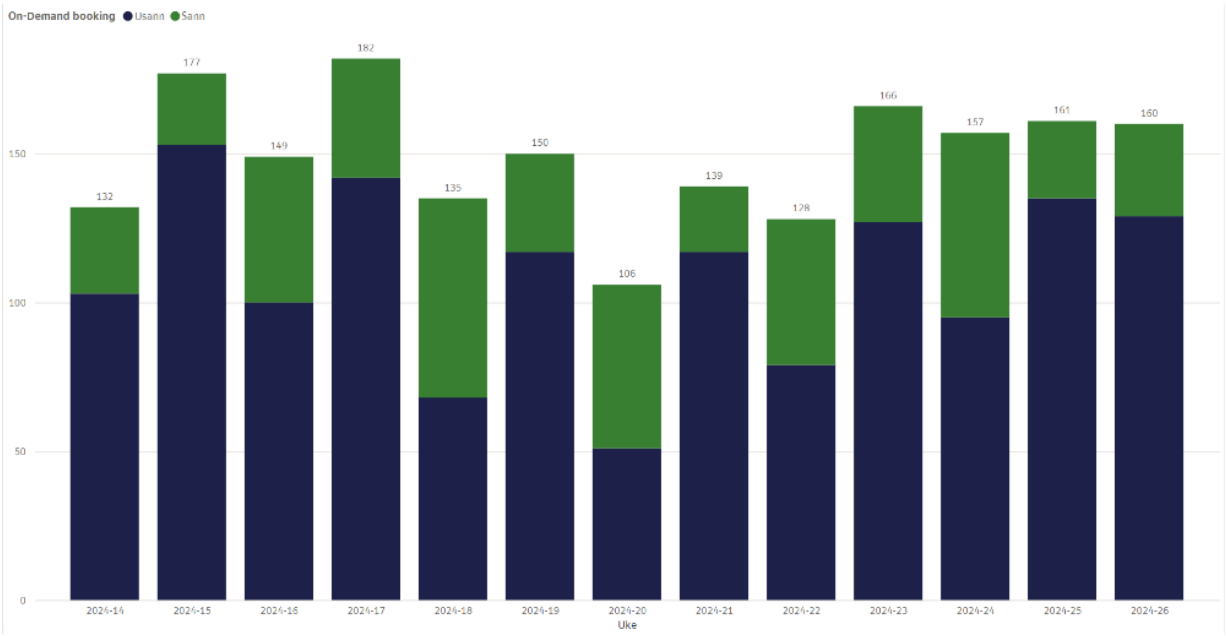

Figure 18 Proportion of on-demand booking

The data shows that the proportion of on-demand bookings during even-numbered weeks is 35.8%. In contrast, the proportion for odd-numbered weeks, which serves as the baseline for this project, is significantly lower at 18.24%.

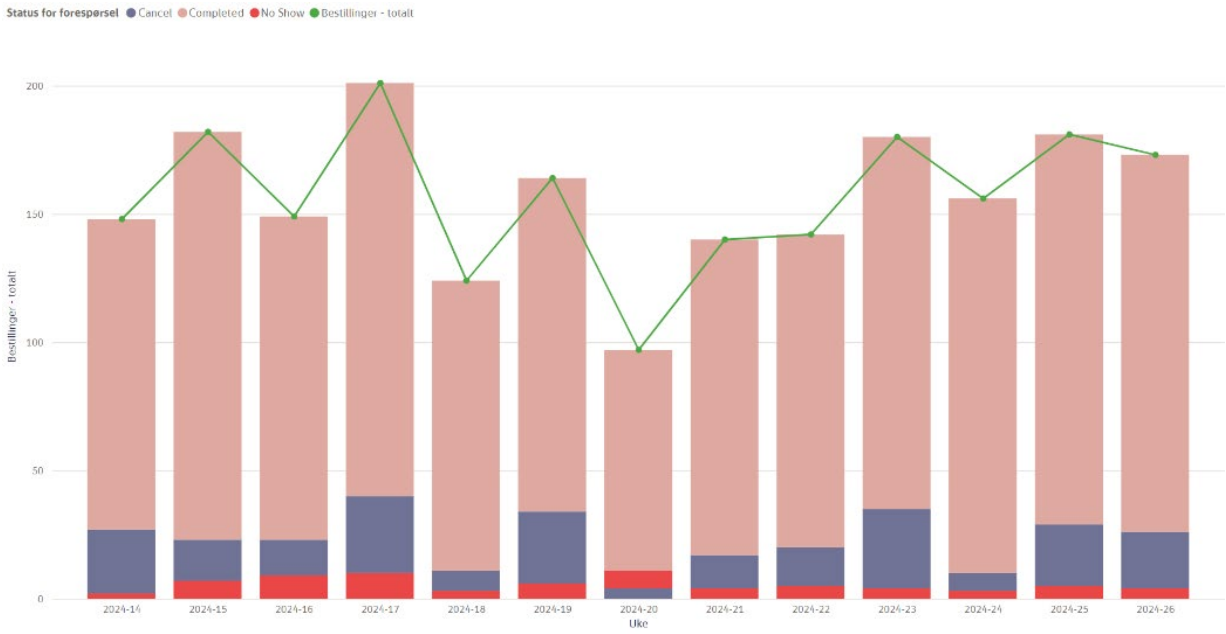

Figure 19 Total number of bookings for vehicles 242 and 243

The total number of bookings for vehicles 242 and 243 during on-demand weeks was 967, compared to 998 during non-on-demand weeks. This represents a decrease of approximately 3.21% in total bookings during on-demand weeks.

5.2.2.4. Next steps towards implementation

During phase 1, it has become evident that implementing on-demand booking for RAT is more complex than initially anticipated, requiring coordination across many parts of Ruter. In the coming months, we will focus on expanding the project team and involving the necessary stakeholders to ensure continued progress. A key priority is to further involve customer service to establish routines that allow for on-demand booking via phone. We will start by identifying a suitable project partner to join the core team, followed by organising a workshop on the subject. This workshop will help us develop a structure that accommodates on-demand booking while considering the needs of our elderly user base.

A new tech stack for our planning system will be implemented in late August. After its deployment, we will experiment and test how on-demand booking functions within this new system. This phase of testing will be discussed with the project group and is expected to begin in late September.

Once these steps are completed, we will be ready to implement phase 2 of this measure, which involves a full roll-out of at least five vehicles reserved exclusively for on-demand booking. The estimated timeline for phase 2 implementation is mid to late October.

References[3]

5.3. Mannheim

5.3.1. MAN_04: attractive, accessible, secure, comfortable, multifunctional and clean PT stop

5.3.1.1. Description of the measure and main outcomes expected

Mannheim and rnv are committed to making public transport easily accessible, safe, clean, and pleasant. We regularly refurbish and upgrade PT stops to ensure barrier-free access for people with reduced mobility, including those using wheelchairs, wheeled walkers, and strollers. Due to limited additional resources, rnv is looking for innovative solutions to enhance PT stops beyond legal and practical requirements. The goal of the measure is to draft, discuss, and pilot new components to improve the overall attractiveness and functionality of PT stops, focusing on three sub-measures.

The first sub-measure, MAN_04_01, involves introducing additional digital services at PT stops to enhance user experience and passenger information. The second sub-measure, MAN_04_02, addresses climate change-related adaptations, e.g. by adding greenery and shading to reduce direct sunlight and heat during the summer. The third

[3] *https://ridewithvia.com/resources/what-is-microtransit*

https://solidstudio.io/blog/demandresponsive-transport-what-is-it

https://asiamobiliti.com/understanding-demand-responsive-transit-drt/

sub-measure, MAN_04_03, aims to develop a comprehensive building standard for rnv's tramway PT-stops, ensuring best practices in accessibility, comfort, and multifunctionality while streamlining planning and construction processes.

The expected outputs of these sub-measures include the development and piloting of concepts for digitalized PT stops; addresses climate change-related adaptations like greening and shading; the establishment of platform building standards to be applied in future projects. Preparation of the measure

5.3.1.2. Preparation of the measure

The project began with the selection of suitable pilot locations, hence public transportation stops where the measure can be carried out. Following this, a user needs assessment was conducted internally, which included gathering insights from a serious game to compile a detailed list of desired features for the public transport stops.

Main areas of convergent or divergent ideas from Serious Game Mannheim

- Digital passenger information must be easily visible and should also be available (in specific cases) inside buildings. The rail replacement service could also be displayed in the building on the screen of the digital passenger information, as well as the corresponding direction of travel.
- Traffic lights should not have long waiting times at PT stops where there is no direct access.
- The entrance area at the stop where access to the tram is easier and provides more space should be marked accordingly.
- The PT stop environment is very important for passengers' comfort and sense of security. Bakers, kiosks and a lively environment have a positive effect on the passengers' feeling of safety and comfort.
- The greening of PT stops is defined as one of the most important cross-aspect measures. Furthermore, cleanliness is defined as the least important aspect.

Regarding **MAN_04_01** *(additional digital services)*, research on best-practice among other PT-operators was conducted and potential technical solutions were identified. Internally, relevant use-cases and functionality were gathered and prioritized. A first test run is currently being conducted at the Mannheim central train station (s. figure 20). Due to a large-scale renovation scheme currently going on along the main railway line between Mannheim and Frankfurt, a complex rail replacement concept including the detour of some lines and the cancellation and bus replacement of many others. This situation required dynamic information which currently are provided through mobile screens. This test does not feature interactive functions yet but just the dynamic display of real-time information.

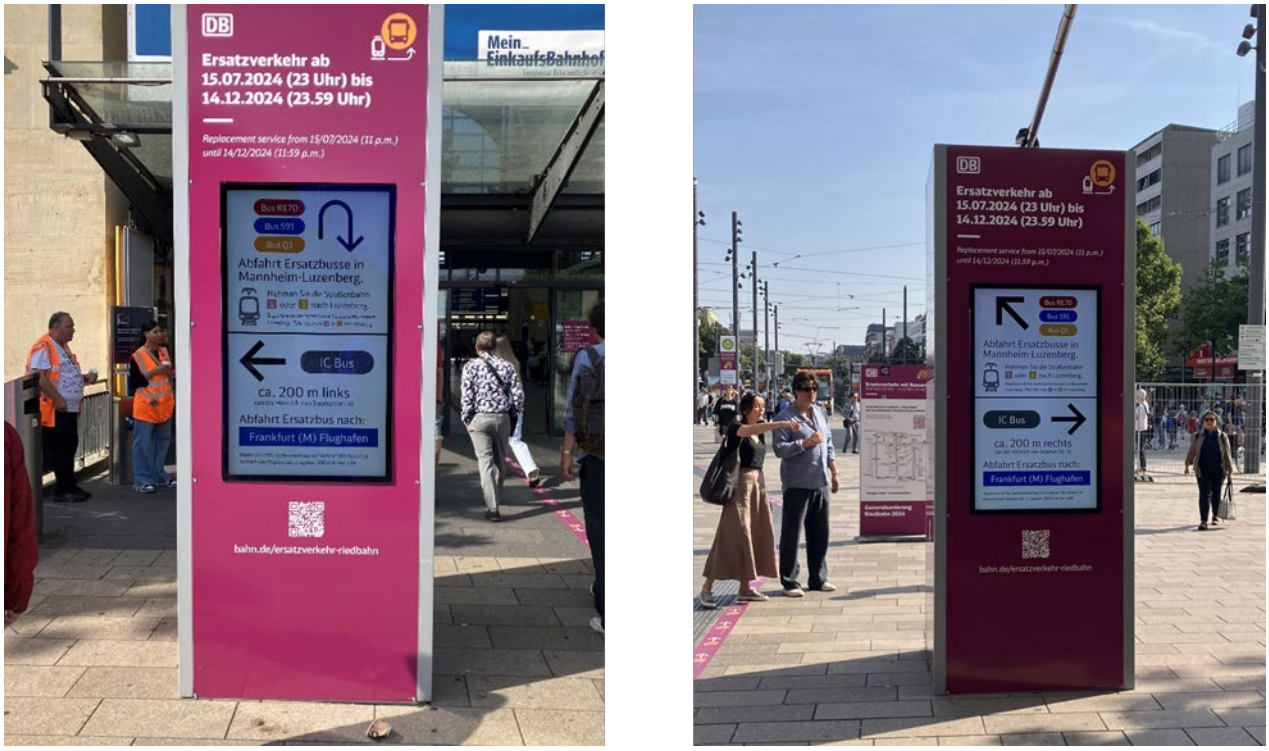

Figure 20 Test-run of dynamic, digital passenger information

MAN_04_02 *(climate change-related adaptations)* focuses on the development of conceptual solutions for various climate change-related adaptations e.g., what can be greened was successful. Hence, the completion of diverse greening projects in the Mannheim were carried out.

MAN_04_02_01 (Masts): Thanks to the impetus provided by the prototypes masts that were greened, 72 masts in Mannheim have already been greened (s. figure 21). Once these have reached their target growth height, approx. 350m² of greenery could be created.

Figure 21 Picture of mast with greening elements at Mannheim Castle

MAN_04_02_02 (PT stop): Various greening measures have been included in the planning of the modernization of the PT stop "*Platz der Freundschaft*" in Mannheim (s. figure 22). These include the optimisation of the platform width to create a green strip, vertical greening of the fence system and the integration of a climbing element for plants. The planning for the planting is currently in progress.

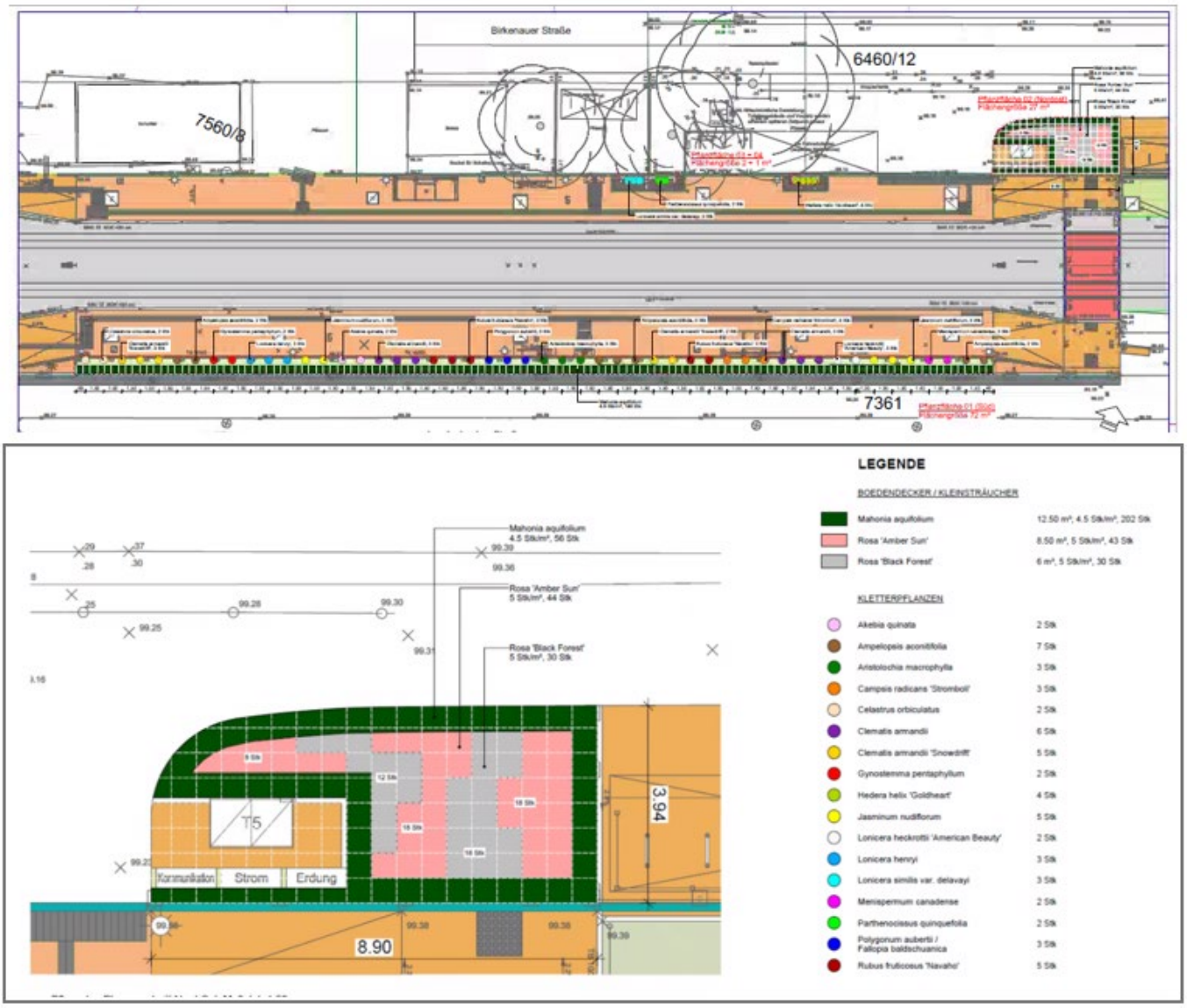

Figure 22 Planting plan ”Platz der Freundschaft” Mannheim

Sub-measure **MAN_04_03 (***building standard)* started with the identification of all relevant stakeholders involved in the design and construction of public transport stops to ensure a holistic view beyond the initial planning processes. Once the initial outline of the scope and focus of the standard had been decided, specialized working groups started to work on different topics, ranging from technical and legal aspects to construction methods and materials. The concept therefore involves following aspects: Abbreviations and definitions, platforms (requirements for accessibility, quality of stay, distances between stops, principles & testing of performance), transfer points, platform heights, inclinations, platform lengths/widths/accesses, stopping positions), Actual guidance systems, drainage, railway structure, platform equipment, passenger shelter, traffic signs, passenger information, rubbish bins, barriers, lighting, control cabinets, empty pipework, earthing, redesign of existing platforms, greening, documentation.

Extracts from the standard platform concept

Arrangement of the side platforms:

The arrangement of the platforms must be adapted to the local, spatial and operational conditions. As a rule, the platforms at the operating stations should be arranged parallel and at the same height (s. figure 23).

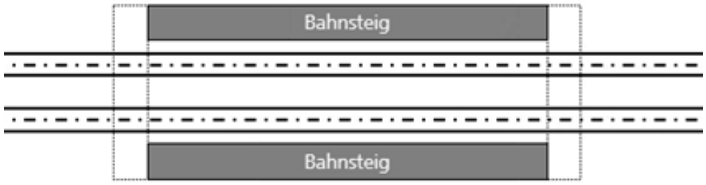

Figure 23 Illustration shows arrangement of platforms.

At complex junctions in the BOStrab area, priority for the railway cannot be guaranteed (s. figure 24).

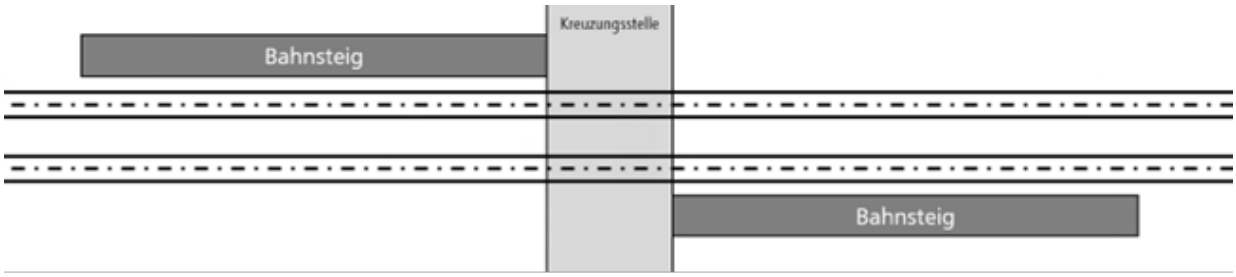

Figure 24 Illustration shows complex junctions in the BOStrab area

At railway junctions, optimised platform arrangements should be examined. For example, a star-shaped arrangement of platforms at track triangles should be examined (s. figure 25).

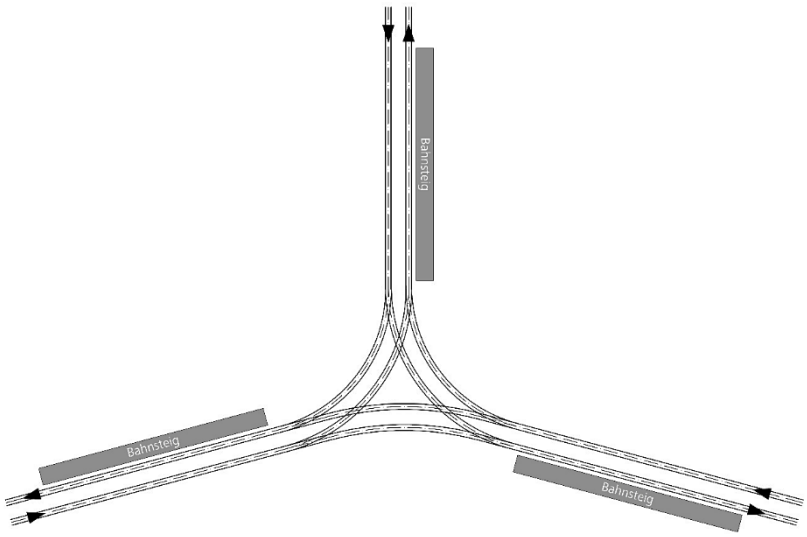

Figure 25 Illustration star-shaped Arrangement of Plattform

Stopping positions:

The stopping position defines the point at which the head of the vehicle comes to a halt at the start of the platform (s. figure 26). Ensuring an unrestricted view for the driver of danger points and signals directly in front of the stopping position.

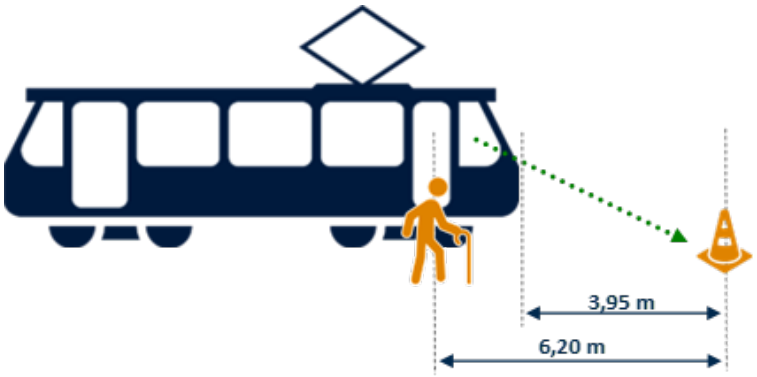

Figure 26 Illustration shows the recommended minimum distance from vehicle to the danger point

The recommended minimum distance from the danger point to the centre of the communication field is 6.20 m. This results in the stopping position (top of the vehicle) for the most unfavourable vehicle type, which is 3.95 m in front of the danger point, as shown in the following illustration.

5.3.1.3. Challenges & Mitigations

The Implementation of additional digital services at PT stops (MAN_04_01) poses significant challenges due to numerous technical and financial hurdles and barriers, complicating the integration and deployment process. At this point it is unclear if the initial scope of the digital services can be implemented within the scheduled timeframe. This is due to the significant rise in cost estimates over the last year (e.g. hardware, required software adjustments but especially construction/ wiring/ installation). Together with recent budget constraints the cost-benefit ratio of the project decreased. To counter these developments, the topic will be brought up in front of the steering committee to either ensure full support for the project, or, as a worst case, to put the implementation on hold.

5.3.1.4. Next steps towards implementation

(MAN_04_01, additional digital services) Next, the project focuses on identifying and acquiring necessary equipment and interfaces, notably including interactive screens for enhanced user engagement. After that, the procurement process is initiated with the publication of tenders, outlining specific criteria for the awarding of contracts. Detailed requirements for the backend of software systems for digitalized stops are going to be specified, ensuring seamless integration and functionality. The development of this solution includes the integration of existing systems and data into the new outlet. Those changes will be carried out by the rnv IT-team itself. On top of that, some form of content management system is needed, to stage the information provided and configure the user interface. This will be either done by adapting existing CMS to the new requirements through our service provider, or by procuring a CMS for this specific purpose. Once equipment is procured, installation should follow, ensuring that all materials are operational and meet required standards. Safety assessments are rigorously conducted to verify that all installed equipment is secure and meets safety regulations, prioritizing user well-being. The procurement process will therefore be part of the implementation process.

(MAN_04_02, climate change-related adaptations)) After the successful implementation on the pilot sides, the gained experience will be utilized to roll-out further greening measures throughout our public transport network. Planning the first façade greening at a railway substation until the end of 2024.

(MAN_04_03, building standard) Over the next moths, the building standard for platforms will be finalized.

5.3.2. MAN_06: concepts and instruments to improve mobility in peri-urban areas

5.3.2.1. Description of the measure and main outcomes expected

This measure aims at the development of concepts and the testing of instruments to improve mobility in peri-urban areas for various user groups. The overall objective is to improve the availability and quality of mobility services in peri-urban areas through improved PT services and an additional focus of connecting PT services with additional mobility options.

Measure outputs:

- Concept for improved integrated bus & on-demand services in peri-urban areas of Mannheim
- Implementation and testing of improved integrated bus & on-demand services in peri-urban areas of Mannheim
- Feasibility study on PT services beyond administrative boundaries between Mannheim's peri-urban areas and neighbouring communities
- Incorporation of the connected mobility concept developed in MAN_07 with a focus on the specific peri-urban context and its challenges.

5.3.2.2. Preparation of the measure

Concept & Implementation

First, the area and potential use cases for the service were defined through an evaluation of the geographical surroundings as well the existing PT services. Mannheim is located at the heart of the Rhine-Neckar metropolitan area in between the cities of Ludwigshafen and Heidelberg. Also, Mannheim is located on the border of the three federal states Hesse to the north (s. figure 27, purple area), Rhineland-Palatinate to the west (green areas) and Baden-Württemberg (blue area).

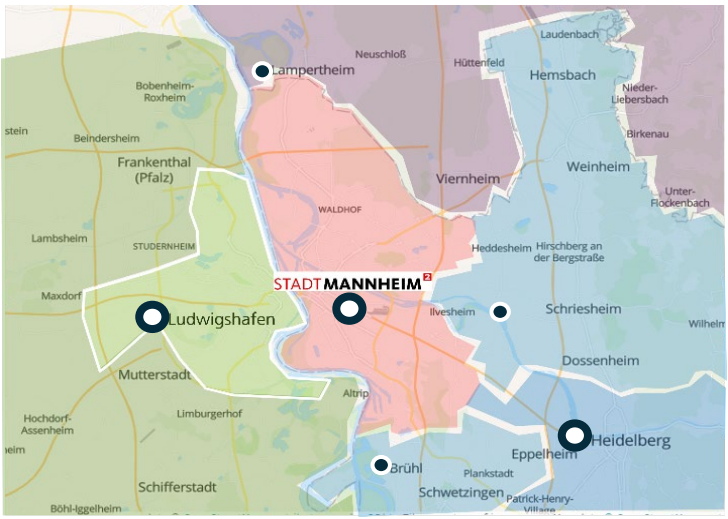

Figure 27 Map of Mannheim city limits and neighbouring counties.

Source: OpenStreetMap contributors, own figure

The general focus for this measure are peri-urban areas within the city of Mannheim (s. figure 28, shaded areas) as well as neighbouring counties for the part of the feasibility study. Those areas were chosen not only by their geographical distance to the centre, but also with regards to the availability of PT-services in the area, considering its quality (frequency, no. of lines, possible directions/ connections, travel time etc.). This stage revealed several areas within the city, that did not provide any PT offer at all or no offer for the most part of the day.

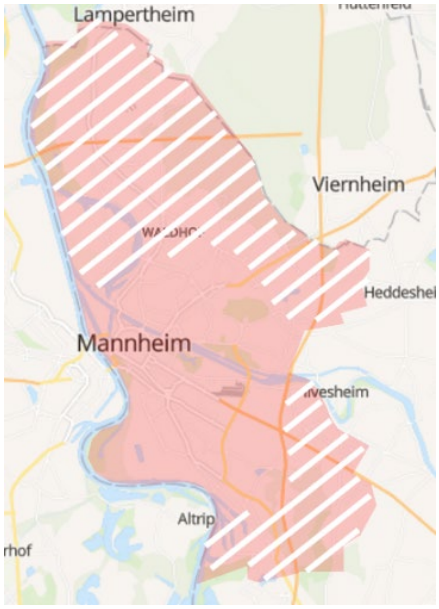

Figure 28 Map of Mannheim's peri-urban areas
Source: OpenStreetMap contributors, own figure

These areas were than further analysed and subsequently divided into two main categories: low density residential areas (s. figure 29 orange) and industrial zones (blue). This differentiation was necessary, as mobility patterns and behaviour vary strongly between those categories of (peri-) urban areas.

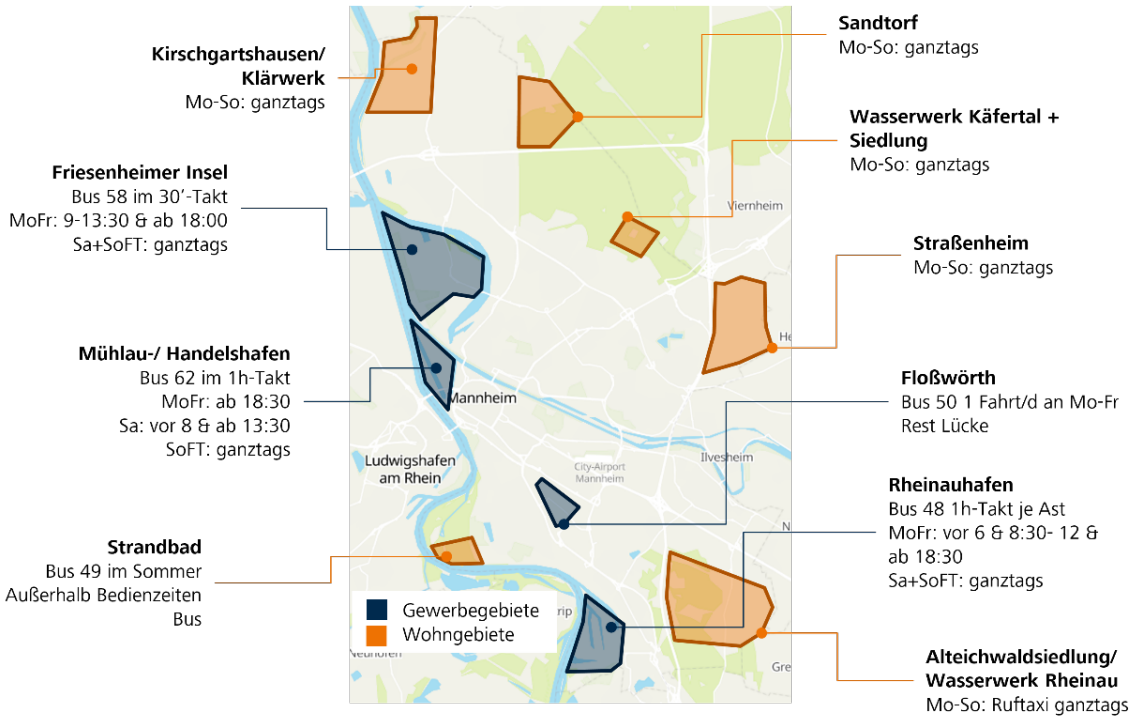

Figure 29 Areas with (times of) no PT-service
Source: OpenStreetMap contributors, own figure

Regarding the strategic alignment of the new transport service, it was clear to rnv that this service must complement the existing, high-capacity lines with about half a million passengers per day in total. The new service was to complement the existing public transport network and offer in Mannheim in terms of time and space and to take over the coverage in low-demand areas and on low frequented relations.

Specifically, three use cases were outlined:

1. As a feeder to main public transport lines on the 'first/last mile', from the bus stop to the destination or at home to the S-Bahn & tram
2. For small-scale direct journeys, routes within a district not covered by the line offer or between them for shopping, doctor's appointments, etc.
3. As a faster alternative to transfer connections via the city centre on less popular tangential routes

On this basis, rnv has developed five objectives for the new service:

I. Improving the availability and access to public transport for all target groups
II. Contribution to environmental and climate protection
III. Increase in the number of users and intensity of use in public transport
IV. High efficiency & quality of on-demand service
V. Efficiency in operation & handling of potentials

Data collection & Online Survey

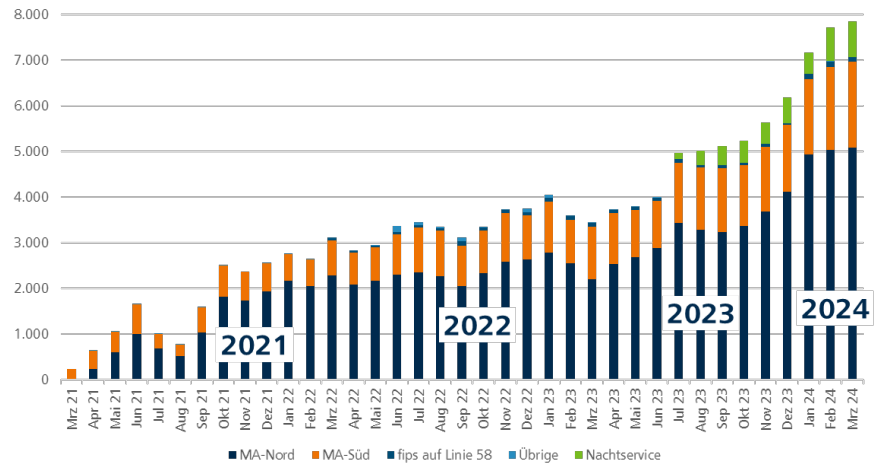

Figure 30 On-demand passenger numbers per month per service

For the analysis and design of the new integrated services, a variety of data sources were identified and utilised. Most importantly, there are more than three service years of data from the on-demand-services in Mannheim, providing amongst others a detailed picture of the geographical and temporal demand for such a service or validated approximations on the percentage of each use case.

Another relevant source of data is the passenger counts of the fixed bus lines. As rnv has equipped almost 100 % of its fleet with automatic passenger count systems, very detailed data is available on historic passenger numbers on the fixed line services. The analysis shows for example a potential in several fixed line tours, mostly on weekends and during off-peak hours, with very low passenger counts, that could be taken on by the on-demand service with regard to cost efficiency. Other insights highlight the relevance of fast, tangential connections, bypassing the time needed go into the city centre or next major interchange, to reach the connection and move on to a destination in a peri-urban area.

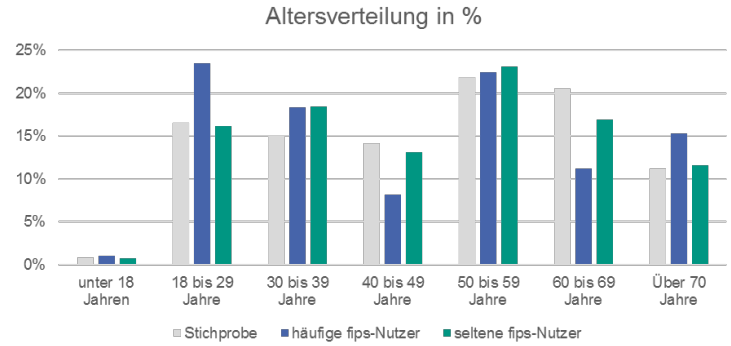

Figure 31 Age distribution among on-demand users

Finally, an online user survey and qualitative interviews were conducted within a mixed method approach. Receiving more than 600 usable replies, the results showed a wide spread in age distribution both among regular (blue) as well as among occasional users (green). Most notably, the age group of 70 and above makes up 15% of regular users,

showcasing once success with regards to goal one, “improving the availability and access to public transport for *all target groups*”.

The retrospective analyses of all the data above showed two central aspects, that summarize the overall effect of the new on-demand service.

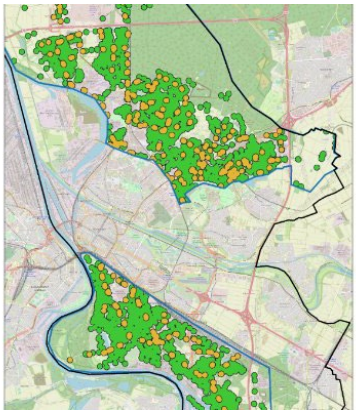

Figure 32 Visualisation of PT availability with on-demand service

- Getting anywhere, at any time: the on-demand service serves as a temporal and spatial completion of public transport. This can be seen in the historic data with regards to actual rides taken, places and time of demand, etc. But this is also true for the passenger perspective, as the survey and the interviews showed. With the on-demand service available (and know), users feel they have an ‘always available’ mobility option, lowering the need for an own car.
- Mobility for everybody: the on-demand service enables participation for people with limited mobility such as senior citizens, people with impaired mobility or people who cannot drive themselves. This is clearly shown by the number of people with disabilities among passengers. While their percentage is less than 4% on fixed line services, it is around 15% within the on-demand service. As the overall percentage is 12% among Mannheim’s inhabitants, the on-demand-service clearly provides mobility for people, who did not have the option available to them before.

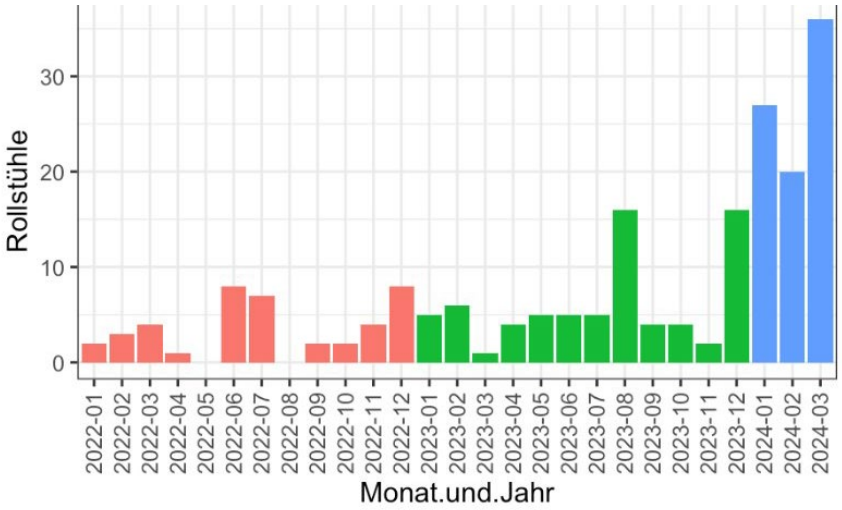

Figure 33 No. of wheelchair bookings per month

Growing Database & use-cases nighttime traffic

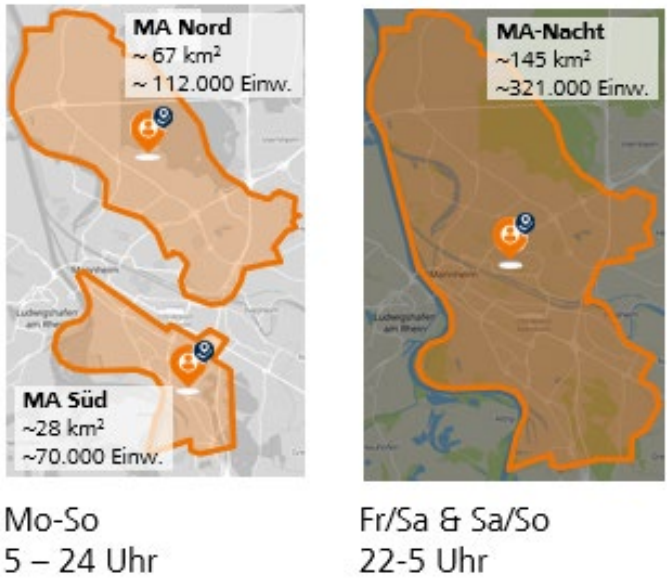

Figure 34 DRT operating areas and hours

Currently, fips operates in daytime traffic in Mannheim in the North and South service areas seven days a week between 5 a.m. and 12 p.m. The northern service area covers approx. 67 km² with 112,000 inhabitants in eleven city districts. The southern service area covers approx. 28 km² with approx. 70,000 inhabitants in nine districts. On the nights from Friday to Saturday, Saturday to Sunday and before public holidays, the fips night service can be booked in the entire city of Mannheim between 10 p.m. and 5 a.m.

The expansion of the service areas and the introduction of night traffic have met with a great response from passengers, as seen by the growth in the number of users. Technically, the introduction of combined information - as a transitional solution until integration by VRN - was an important step that has significantly simplified the use of fips in combination with rnv scheduled services. Technically, more and more detailed evaluations could be created based on the successively growing data base. Since then, this basis has enabled continuous fine adjustments to the offer and the system. As a result of these optimisations, the proportion of shared journeys has been significantly increased over time from approximately 5% in the early phase of operation to almost 40% in recent months. Furthermore, the proportion of empty kilometres has been greatly reduced and the number of passengers served per vehicle-hour has been increased. The flexibility of the system and the advantages of integrated operation have been tested through a variety of additional applications.

On the one hand, these are use cases in regular public transport, such as e.g. short-term or planned replacement services, the takeover of individual scheduled services, the service of individual stops during construction work or the regular addition of line 58.

5.3.2.3. Challenges & Mitigations

Implementing the project will potentially face specific, technical challenges such as accurately interpreting user data for effective service design or navigating complex integration with existing PT systems. The major challenge of the integrated concept will be ensuring a successful start with the passengers through effective communication and information. As the data analysis also showed, new PT-services take some effort and time to become known to users.

5.3.2.4. Next steps towards implementation

Once the groundwork is finished, a new connected concept including fixed line as well as flexible public transport offers will be developed and discussed with key stakeholders such as the city of Mannheim and the regional transportation authority. Once the concept is approved, preparation of the implementation will start, including a communication strategy to inform residents and PT users about the upcoming changes or necessary adaptations to the infrastructure. Furthermore, key results of this measure will also be transferred to MAN_07 to be incorporated into the connected mobility concept, which will be part of the implementation phase of the related measure.

5.4. Lisbon

5.4.1. LIS_06: To Improve the comfort, convenience and safety of PT Interfaces

5.4.1.1. Description of the measure and main outcomes expected

In the scope of UPPER, a characterisation and diagnostic of the conditions of (at least) the most relevant metropolitan PT interfaces and stations will be done. This characterisation and diagnostic will focus on:

- universal accessibility, trying to identify obstacles to movements of people with mobility issues;
- comfort, trying to identify how to make interfaces more appealing to users;
- convenience, trying to assess if there are ways to improve efficiency when reaching and leaving the interfaces, and when moving inside, specially between modes;
- safety and security, trying to identify problems that may lead to users being injured or molested or afraid of being injured or molested

This measure will deliver:

- A report with the characterisation and diagnostic of the PT interfaces with regards to accessibility and inclusion; comfort and attractiveness; convenience and efficiency; and safety and security;
- A list of measures of improvement;
- Eventually, some of these measures will be implemented and the conditions of some PT interfaces will be improved.

5.4.1.2. Preparation of the measure

Case description

In Lisbon metropolitan area there are roughly 15,000 entries in the public transport network. Of these, the vast majority are, of course, simple bus stops. Most bus and tram stops are owned by municipalities. Larger interfaces are owned by companies, such as Metropolitano de Lisboa (owns Lisbon metro stations), Infraestruturas de Portugal (owns train stations) or Transtejo (owns boat stations). Mega interfaces can function as a coherent hub from the user perspective, but be managed by several entities. For instance, an interface that encompasses train, metro, boat and buses, will have Infraestruturas de Portugal, Metropolitano de Lisboa, Transtejo and the municipality as managers, each taking care of their bit, aligning operations for the final user benefit.

To start this UPPER measure, TML generated a list of all relevant interfaces in Lisbon metropolitan area. This was done by defining a scoring method, mostly based on the number of PT modes existing in the interface and balanced by type of mode. The result showed that 259 out of the 15.000 were the most relevant. The selection of these, came from the use of the definition published in Law n.º 140/2019, that refers that an interface should be considered "*an infrastructure, equipped with facilities such as registration desks, waiting rooms or ticket offices, staffed, managed or owned by a public or private entity, the respective management and operation of which may be included in a public service contract, where parking or stops of vehicles used for public passenger transport services, boarding and disembarking of passengers, as well as connections between these services*".

A hierarchy with 5 different grades was then produced, from highly complex (very large interface) to basic (bus stop). All 259 interfaces were ranked according to these grades, distributed by levels 2 to 5, with level 1 being general bus stops.

A cada interface será atribuída uma pontuação que resulta da soma das seguintes parcelas conforme os serviços de transporte presentes:

- Comboio: 3
- Barco: 3
- Metro: 2
- Terminal TCR: 2
- Paragem TCR: 1

Quadro 2.3 – Proposta de método de hierarquia de interfaces e pontos de confluência

Pontuação	Hierarquia	Exemplo: Interface do Campo Grande
0-1	1	
2-3	2	Pontuação = 5
4-5	3	[Metro (2) + Terminal TCR (2) + Paragem TCR (1)]
6-7	4	Hierarquia = 3
8-9	5	

Figure 35 Interface hierarchy

In the scope of the SUMP (LIS_03), the most relevant of these interfaces (105) were selected for characterisation by field work, which took place during May 2024.

At the same time, TML started another study in a partnership with the European Investment Bank (EIB). This study is out of the scope of UPPER, but it strongly correlates in terms of objectives. The goal is to identify improvement needs on interfaces and design investment plans. In the scope of this project, ongoing, municipalities were asked to provide info on bus and tram stops, and Metropolitano de Lisboa (metro stations), Infraestruturas de Portugal (train stations) and Transtejo (boat stations) were asked the same in regarding to the interfaces they own and operate in. The result will be a major database that will incorporate all 15.000 interfaces in Lisbon metropolitan area. Info for each interface will include ID, coordinates, address, manager, transport modes, operators, and several physical attributes (shelter, bench, light, services...) and a large array of other info will be added as time goes by.

UPPER LIS_06 will start from the referred work to further increase the analysis, looking into universal accessibility, comfort and safety of the interfaces. The work in this measure complements that on the SUMP (LIS_03) which is mostly focused on the efficiency of the interfaces from the mobility point of view (where people can change modes, how fast can people change modes, what trips can be incorporated in the interfaces...), and the scope of the work with EIB is mostly focused on investments needs

For the work on LIS_06, TML agreed on a partnership with the National Institute for Rehabilitation, with competences in the field of improving the quality of life of people with different mobility needs.

TML has already defined the terms of reference for the work, and launched the tender to acquire external help with the initiative. The goal is to minimize the limitations that people with disabilities feel when accessing the public transport system in the Lisbon metropolitan area, providing them with greater autonomy, and increasing personal and professional fulfilment and socialization.

The TML tender will include:

- Deepen the knowledge of the transport authority and mobility stakeholders about the specific needs of people with disabilities when accessing and using public transport services;
- Diagnose the accessibility of people with disabilities to public transport services in the Lisbon metropolitan area, in all modes;
- Characterise the main access problems, identifying specific measures, by area and type of disability, to resolve them;
- Contribute to ensuring the coherence of policies and measures, through the direct involvement of people with disabilities, transport operators, infrastructure managers, municipalities, universities or other partners in building solutions.

The project, called “Study on accessibility and transport for people with disabilities in the Lisbon metropolitan area”, should also contribute to creating a cohesive and participated network, guaranteeing Public Participation of different actors in the region with different views and different perspectives of knowledge, including associations representing people with disabilities, which help to overcome accessibility problems and identify innovative solutions to solve them.

5.4.1.3. Challenges & Mitigations

The biggest challenge so far has been to clearly integrate the 3 different scopes of the 3 different streams of work which touch upon the topic of stops and their role in the mobility system: UPPER LIS_03 SUMP, EIB, UPPER LIS_06 Interfaces. The challenge also comprises making the 3 workstreams benefit from the work being done by the others, without duplicating efforts.

These challenges have been mitigated through close coordination of TML management team, that manages well the specific teams allocated to each of the 3 tasks. Bilateral meetings between the teams have been conducted, and results being share amongst the teams, for mutual benefit.

5.4.1.4. Next steps towards implementation

UPPER LIS_03 SUMP has an allocated team within TML, helped by an external consultant team to focus on sustainable mobility planning

The EIB study has also an allocated team within TML, and a hired external consultancy team to run the study.

UPPER LIS_06 Interfaces has another allocated team within TML, and will have an external consultancy team as well. TML has already defined the terms of reference for the work, has launched the tender, the contract is expected to be signed in the next months, and have the work starting in the 1st trimester of 2025

5.5. Thessaloniki

5.5.1. TES_07: Increase the accessibility to PT in low demanded areas of the city

5.5.1.1. Description of the measure and main outcomes expected

Thessaloniki's measure 07 designs and develops a physical and a digital DRT service that will operate in the framework of the UPPER project within the city of Thessaloniki, for serving a peri-urban area, called Panorama. The service will be deployed through co-operation with the largest taxi company of Thessaloniki, i.e. Taxiway. The aim of the measure is to improve public transport accessibility in low density areas, and to increase public transport ridership.

5.5.1.2. Preparation of the measure

Description of the area and the DRT use cases

The DRT service that will be developed by CERTH/HIT, within the framework of the UPPER project will serve the Municipal Unity of Panorama, which is part of the Pylaia-Chortiatis Municipality. Panorama is peri-urban, located in the eastern part of Thessaloniki's metropolitan area. Panorama is a really sprawled area (the population density in Pylaia-Chortiatis Municipality is 470/km^2, while in the Municipality of Thessaloniki is 17000/km^2)[4], which is unofficially divided into 2 districts:

- Chorio District: in this area all the activities (e.g. super-markets, athletic and other extracurricular activities for children, cafes) are concentrated;
- Nomos District: this area is purely residential and its residents can only access basic services by car.

Despite the fact that the residents of Panorama are mostly of high income (the average household income in Panorama is around 25000€, while the average value for Thessaloniki's metropolitan area is around 16000€)[5], it was decided to focus on this area, as one of the main objectives of the UPPER project is to increase public transport modal share, and currently Panorama is a highly car-dependent area. Except for the high levels of car usage, there were some additional reasons for opting to serve the Panorama area:

- Unstable demand for public transport within the Panorama area, which results in a service of high-cost for the public authorities. Currently the Panorama area is served by 2 bus lines, which are carrying out approximately 1,270,000 vehicle kilometers annually. The cost of each vehicle kilometer for the public authorities is 1.72€, resulting in a total annual cost of more than 2 million € (for a service that it is not meeting users' expectations as it is identified in the users' survey subsection).
- Accessibility issues for those residents of the Nomos District that do not have access to a private vehicle. These accessibility issues are significantly linked with the aforementioned high car-dependency in the Panorama area. Based on a survey that was conducted in UPPER, 86.5% of the Panorama residents have access to a private car, and more than 70% of its residents mostly use their private car for their trips. Yet, considering the Mobility as a Right Concept (MaaR) it is essential to provide an attractive alternative also to those that do not have access to private car usage.
- Lack of connection with the metro system that is expecting to start operating by the end of 2024.

[4] https://www.statistics.gr/en/2021-census-res-pop-results

[5] https://urbanlab.pkm.gov.gr/portal/apps/webappviewer/index.html?id=14ad78a2bc034d0eb23a58e6d75f6f4f

Due to the above, two different use cases have been defined for the DRT service: a) connection of Nomos District with Chorio District (Figure 36), b) connection of the whole Panorama area with the Nea Elvetia metro station, which is the closest metro station in Panorama (Figure 37). Yet, for the future, the ambition is to go beyond these two use cases and extending the DRT service to the whole Pylaia-Chortiatis Municipality. Discussions have already started with the Municipal authorities, which are very interested in operating and extending the service.

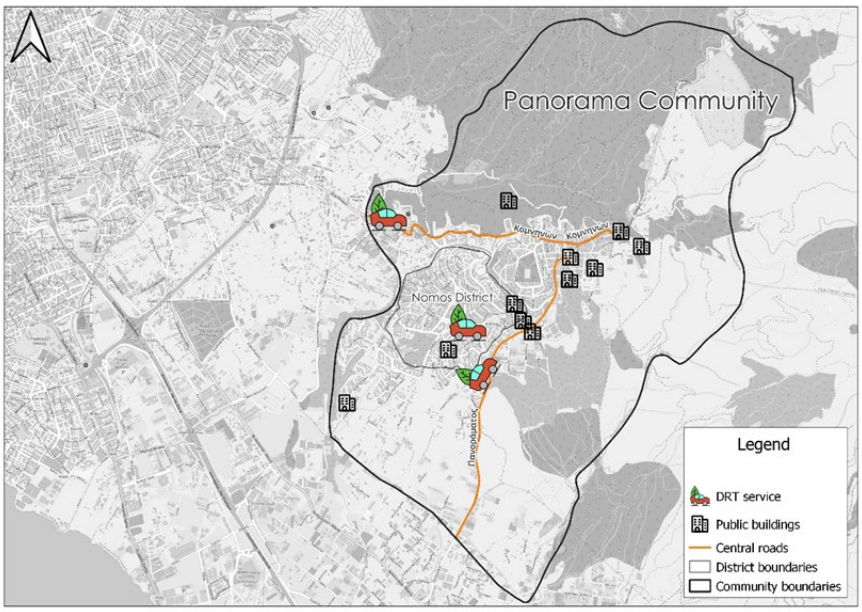

Figure 36. Use case 1 – Connection of Nomos District with Chorio District.

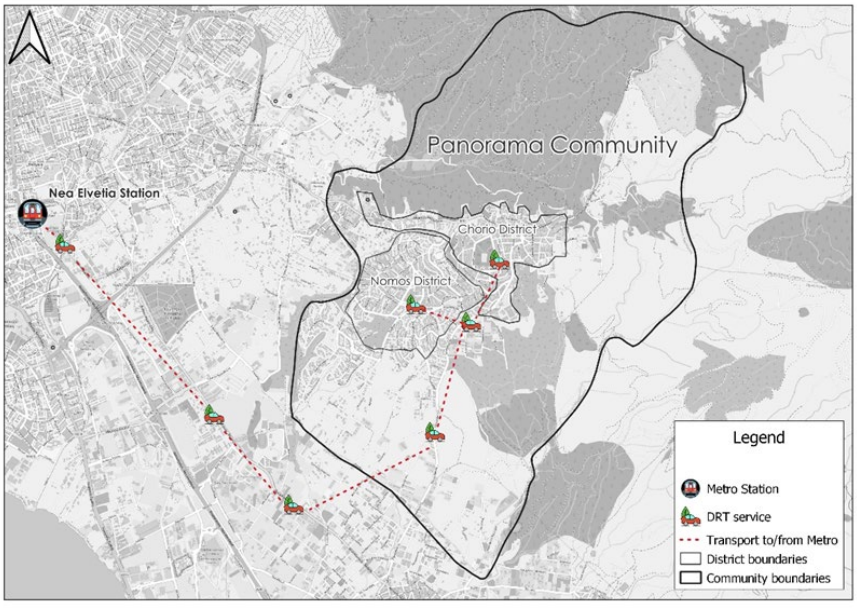

Figure 37. Use case 2 – Connection of the whole Panorama area with the Nea Elvetia metro station.

Users' survey

With the aim to engage the users already from the initial phases of the DRT system design, a survey was carried out, targeting specifically residents of Panorama. A questionnaire survey was designed in a digital form and the survey was disseminated through various channels, including social media and local authorities web channels. Finally, 89

completed questionnaires were received, which is a reasonable sample considering that the survey was not addressed to the citizens of the whole city, but specifically to the citizens of Panorama.

The analysis shows that approximately 75% of the participants mostly use a car for their trips within Panorama and approximately 70% of the participants use a car for connecting with Thessaloniki's city centre. The respective percentages for public transport are 6.7% and 21.3%. These percentages justify the above-mentioned statement, that Panorama is a highly car-dependent area. Tables 6-9 present the reasons for the existing transport mode selection for trips within the Municipality of Panorama and for trips from Panorama to Thessaloniki's city centre. It is noted that the lower the average score, the higher is the importance of the factor (since the score expresses the rank in which the factors were placed by the respondents). It becomes understood that the car usage in both cases is preferred mainly due to reduced travel times and increased flexibility and comfort. At the same time, an important factor for many users is the lack of adequate public transport services, indicating that the DRT service could be really beneficial for the Panorama area. On the other hand, public buses are preferred for increased safety, and due to the low cost, when it comes to the connection with the city centre.

Table 5. The reasons why people use car to get around within the Panorama Municipality.

Rank	Factor	Average score within ranking of reasons	Standard deviation
1	Faster	2.22	1.220
2	More flexible	3.10	1.498
3	More comfortable	3.13	1.770
4	Lack of PT options	3.49	1.951
5	Safer	4.65	1.464
6	Cheaper	5.37	1.515
7	More environmentally friendly	6.13	1.370
8	No car access	7.91	0.376

Table 6. The reasons why people use bus to get around within the Panorama Municipality.

Rank	Factor	Average score within ranking of reasons	Standard deviation
1	Safer	3.17	1.169
2	Faster	3.33	2.422
3	More environmentally friendly	3.83	1.941
4	No car access	3.83	3.061
5	Cheaper	4.00	1.789
6	Lack of PT options	4.33	2.422
7	More flexible	6.67	1.506
8	More comfortable	6.83	1.169

Table 7. The reasons why people use car to travel from their Municipality to the centre of Thessaloniki.

Rank	Factor	Average score within ranking of reasons	Standard deviation
1	Faster	2.13	1.276
2	More comfortable	3.25	1.875
3	More flexible	3.30	1.593
4	Lack of PT options	3.60	2.068
5	Safer	4.57	1.422
6	Cheaper	5.27	1.619
7	More environmentally friendly	6.08	1.324
8	No car access	7.79	0.765

Table 8. The reasons why people use bus to travel from their Municipality to the centre of Thessaloniki.

Rank	Factor	Average score within ranking of reasons	Standard deviation
1	Cheaper	2.47	1.429
2	Safer	3.79	0.855
3	More environmentally friendly	3.95	1.900
4	Lack of PT options	3.95	2.172
5	Faster	4.68	2.605
6	No car access	4.89	2.961
7	More flexible	6.05	1.682
8	More comfortable	6.21	1.873

Also, the respondents showed a high willingness to use the DRT service, especially if it is competitive against private car, in terms of travel times. Additionally, in the framework of UPPER Task 2.3, 12 people participated in two serious game sessions for getting deeper in challenges and possible solutions for the operation of the DRT service. The results of these serios game sessions are included in Deliverable 2.3.

Digital service use cases

In the framework of this measure, a completely new mobile app will be developed for supporting the DRT service operation. The app will have two main actors, namely the passengers and the taxi drivers. After reviewing the state of practice and considering the end-users feedback (as provided in the survey and the serious game), it was decided that through the app, the users will be able to:

- request a single trip or a regular trip (e.g., every Monday at 17.00)
- see her/his bookings both past and coming ones

- edit their active reservations (e.g., change time or cancel the trip)
- see pick-up/drop-off points for each trip (or origin/destination if the trip details have not yet been defined by the operator).

Technical requirements and architecture

To support the use cases and ensure the efficient operation of the DRT service, a system where the digital service provider interacts seamlessly with both the users and the transport provider needs to be developed. The architecture of this system is illustrated in Figure 38.

Initially, the digital service provider collects the trip requests from users, which include the origin, destination, and desired time for the trip. These requests are processed every 24 hours to cluster users based on the spatiotemporal attributes of their requests. The processing results are then communicated to the taxi centre, which assigns each trip to a taxi driver. Once the assignment is completed, the taxi centre informs the digital service provider about the ID of the taxi for each trip, the trip price (based on trip length and the number of passengers), and the available balance of the passenger.

Payments will be made directly to the transport provider offices, and not through the digital service. CERTH will receive updates on the available balance of each customer via a dedicated platform for the transport provider. The transport provider through this dedicated platform will inform CERTH at the moment the end-user makes a top-up of their balance. The reception of the balance updates will be made for two main reasons: a) to display the balance in the application UI, b) to verify the available balance before assigning a trip to the transport provider. This ensures that there are sufficient funds for the requested trip, maintaining a seamless experience for both the user and the provider.

Subsequently, the digital service provider informs the user about the acceptance of their request and the price. The user can then either accept or decline the trip. If accepted, the user receives information about the meeting point and the exact time. Users can cancel their trips at any time. In case of cancellations, user clustering does not change. However, the app will offer a "Feeling Lucky" option, allowing users to make a last-minute trip request, which will only be served if a cancellation has freed up a seat. Finally, passengers will receive a notification 5 minutes prior to the taxi's arrival to ensure they are at the meeting point on time.

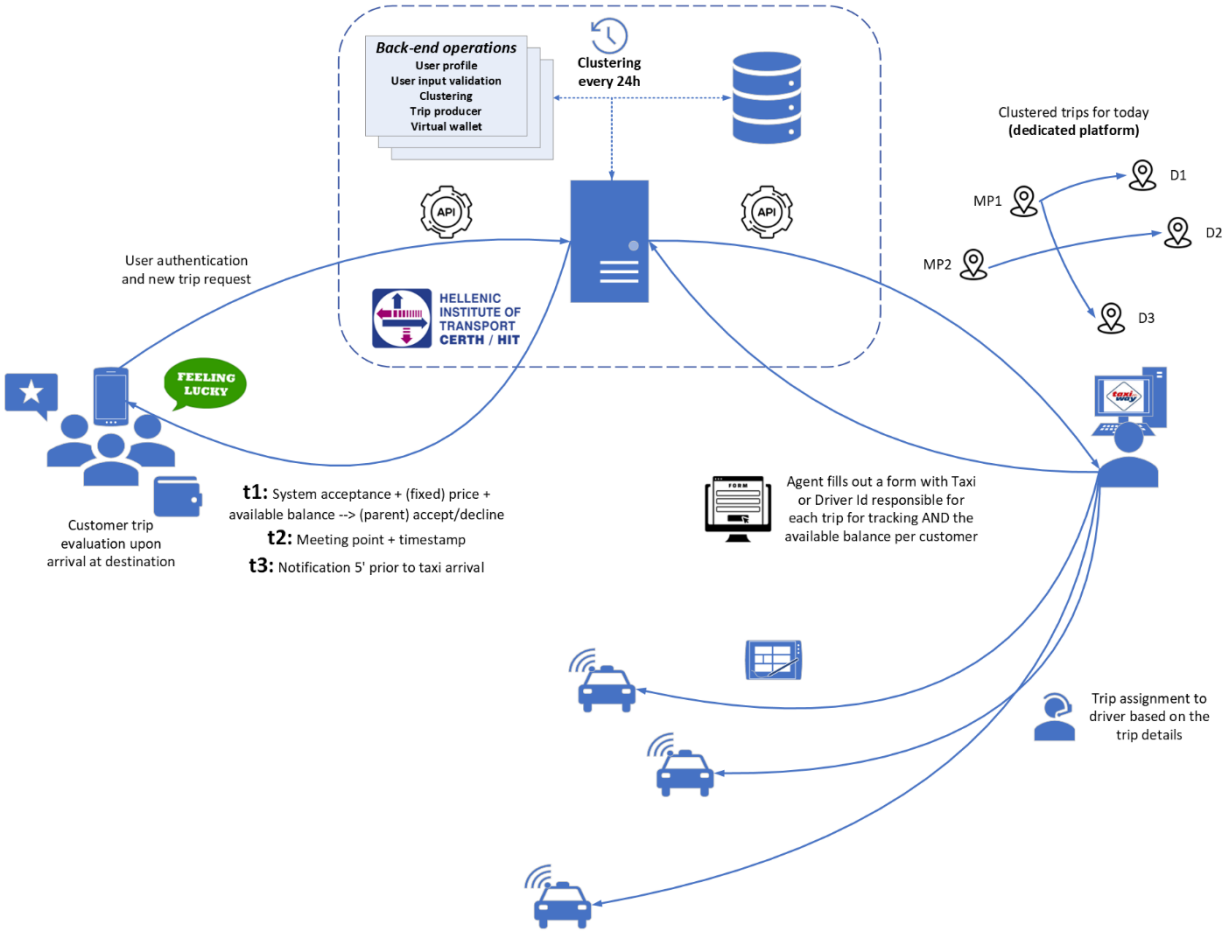

Figure 38. DRT service architecture.

For the detailed description of the digital service, except for the system architecture, a list of requirements has been drafted to guide the development of the service. The requirements are as follows:

- The transport provider must provide the digital service with the same ID of the taxi/driver that the digital service already has in a database to track them or at least provide guidance with their matching.
- The transport provider must provide the digital service provider with the available balance of each customer via the dedicated platform at the moment the end user makes a top-up of their balance. The respective charge per trip will be deducted from the customer's balance upon arrival at the destination point.
- The same customer ID must be agreed upon between the digital service and the transport provider to communicate for payments without using any other sensitive identification data.
- In case of trip cancellation by a user, there is no change in today's clustering, but the planning is updated in the dedicated platform that the taxi centre handles.
- If the "Feeling Lucky" button is pressed, then the system searches if there is empty room for the person(s) in the already clustered and allocated trips to fit them in.
- User registration, along with the respective contract signing, must take place in person. Based on that, the digital service provider will insert in its database the respective pairs of parents-children with their emails, passwords, and their roles. Each pair will be assigned a common ID to identify that they belong to the same family for payment reasons.

- There will be two main roles (with different privileges) in the mobile app based on the signed-in email (child and parent). The child will have restricted access, and the parent will have full access, being able to track the child's activity (actual start and end of the trip). There will also be a separate section where the parent can insert the specific child's restrictions.
- Payments will be processed directly with the transport provider by deducting the respective trip cost from the user's available balance, simultaneously updating the respective balance in the digital service.
- Regarding the trip end events, when the user is an adult, they just click in their app. However, in the case of an unaccompanied child, the taxi driver must inform the digital service provider (using a dedicated platform) about that event. Otherwise, the taxi centre will press the respective button in their dedicated platform after confirming the arrival(s) with the driver.

5.5.1.3. Challenges & Mitigations

The system described above is quite challenging and requires various sub-systems and interfaces to work effectively for an optimal user experience. Main challenges regarding the development are: a) the dynamic operation which can handle requests made shortly before the trip execution time, b) ensuring that parents can oversee their children's activities and monitor their trips, c) controlling the user's balance since payments will be made directly to the transport provider and not through the digital service provider. All these challenges have been considered in the design of the digital service as described above. On the non-technological side, a challenge exists regarding legal issues that need to be overcome. Specifically, there is no regulatory context for a taxi to serve different passengers at once and split the fare; thus, in cooperation with the taxi company, a contract will be formed that will next be signed between the taxi company and each pilot user separately.

5.5.1.4. Next steps towards implementation

The next steps for the implementation of the DRT service, include the following:

- definition of the terms of the contract between the taxi company and the pilot users (discussions with the taxi company have started for defining the form of the contract)
- development of the digital service, including the users' app and all interfaces (this is currently work in progress)
- testing of the digital service
- informing the drivers of the Taxiway fleet, regarding the particular characteristics of the specific service
- recruitment of users, through co-operation with the local authority, which is interested in communicating this DRT service.

5.6. Hannover region

5.6.1. HAN_02: Sustainable Transport Chains – on-demand service Sprinti

5.6.1.1. Description of the measure and main outcomes expected

In 2021, sprinti on-demand transport was introduced in the Hannover region as part of the federal funding programme ‘Model Region Hannover: Turning Points in Mobility’ (MoHaWiV). The sprinti pilot followed in three test municipalities from 2021 to 2023. In autumn 2023, sprinti was then expanded in two stages to cover the entire tariff zone C, i.e. the entire outer ring road of the Hannover Region.

Within this measure, a "lessons learned" brochure will be created based on the expansion of the sprinti service. Experiences and lessons learnt from the project will be collected and evaluated. The lessons learned brochure intends to serve as a blueprint for other cities, especially the ones in UPPER, to implement their own on-demand systems. The Focus is on the follow-up financing after the funding within the “Model Region for Public Transport” ends.

5.6.1.2. Preparation of the measure.

Case description

Sprinti is a flexible on-demand transport service in the Hanover region. Following its expansion to the entire fare zone C, sprinti serves 12 municipalities with around 120 fully flexible minibuses. Journeys within the municipality are unlimited, journeys from one municipality across the border to another municipality are currently only available in special exceptions. In 2024, there is an average of 90,000 journeys per month, which corresponds to around 4,000 journeys per day. On peak days, there have already been around 5,000 journeys per day. In June 2024, a total of 113,000 passengers travelled on the sprinti. The vehicles are barrier-free, meaning that people with mobility impairments also have access to the sprinti system.

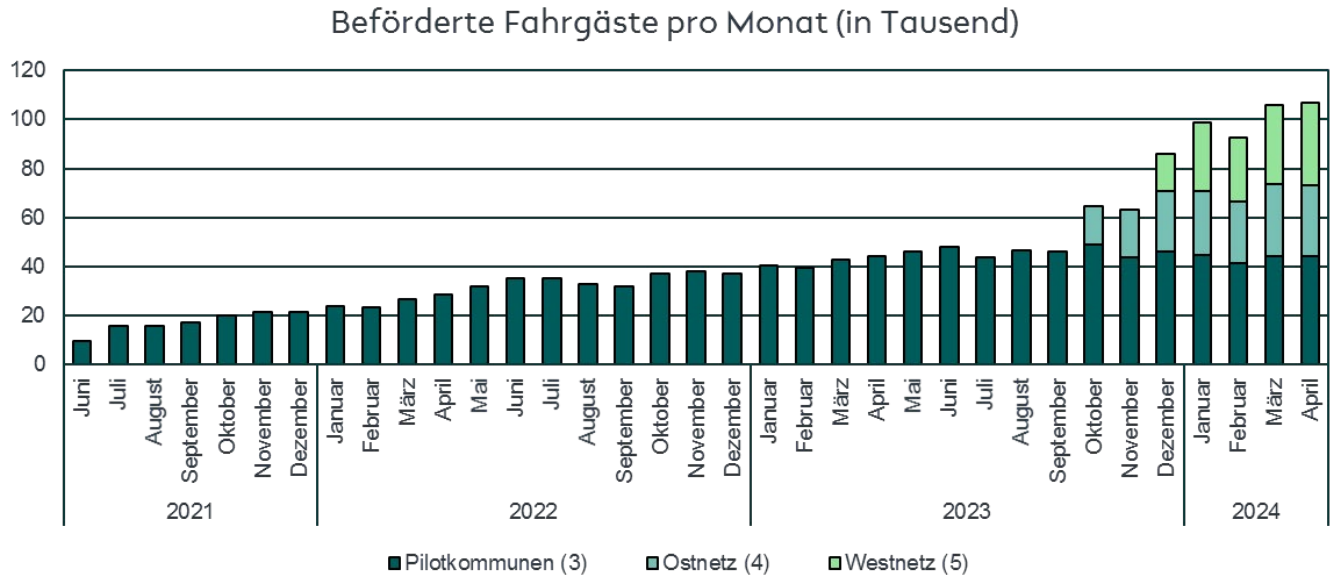

Figure 39 Passengers transported per month (in thousands) since the launch of Sprinti.

The test municipalities are coloured dark, the eastern municipalities light blue and the western municipalities of fare zone C green. Copyright: ÜSTRA/ VIA/ Region Hannover

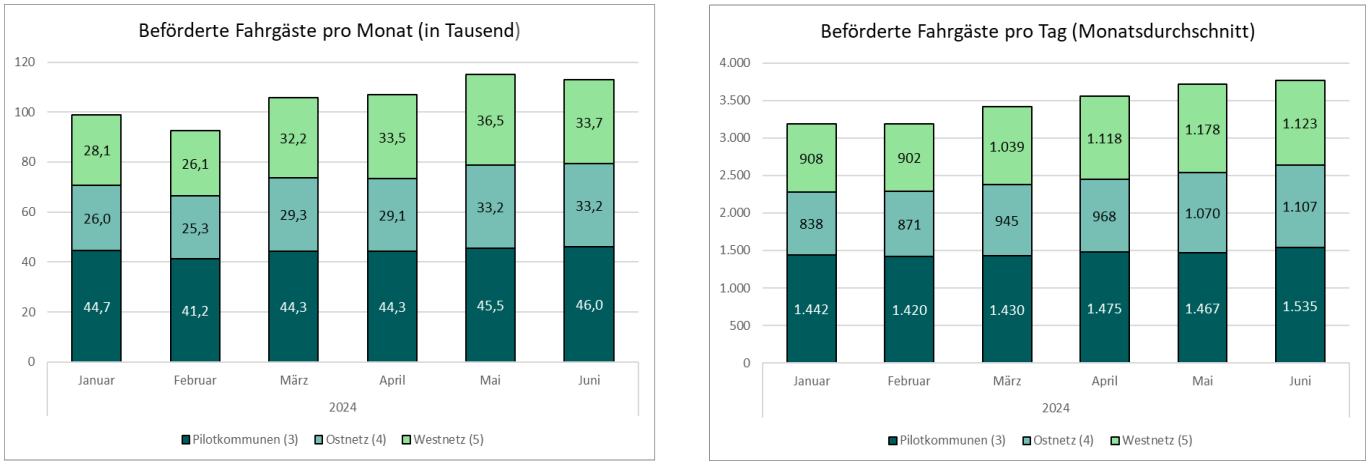

Figure 40 Passenger development over the last 6 months

There has been an increase in passenger numbers in all three areas. Copyright: ÜSTRA/ VIA/ Region Hannover

The service can be accessed only following a booking. Bookings can be made via a smartphone app or by telephone. Almost 99% of bookings are made via smartphone. The journeys can be booked spontaneously or in advance. A start and destination address must be entered for the booking. Based on the booking request, the passenger receives various mobility offers. If a parallel, regular service is running within a certain time, no sprinti journey can be booked. This ensures that the regular PT services are sufficiently utilised and remain profitable. They should not be completely replaced by the sprinti. Within 20 minutes of making a booking, the passenger is picked up from an existing or virtual stop within 150 metres of the current location. The same applies for the destination.

Sprinti is fully integrated into the existing tariff system. Tickets and monthly travelcards that can be used for regular services and the city railway are also valid on the sprinti. There is no convenience charge for using the sprinti. This also means that this service can be used with the ‘Deutschlandticket’ and, following its introduction, also with the digital tariff.

The sprinti operates regularly from Monday to Thursday from 5.30 a.m. until 1.00 a.m. the following day. On Fridays, the service is extended until 4.00 am the following day. On Saturdays, the sprinti runs from 7.30 a.m. to 4.00 a.m. the following day and starts again on Sunday at 8.00 a.m. until 1.00 a.m. the following day. In some municipalities, the sprinti also starts at 5.00 a.m. during the week. The sprinti also offers a connection guarantee, as all ÜSTRA/GVH vehicles run in coordination with each other.

With the size of the service area and the number of vehicles, sprinti is the largest on-demand system in Germany and enables flexible and individualised mobility in the surrounding area.

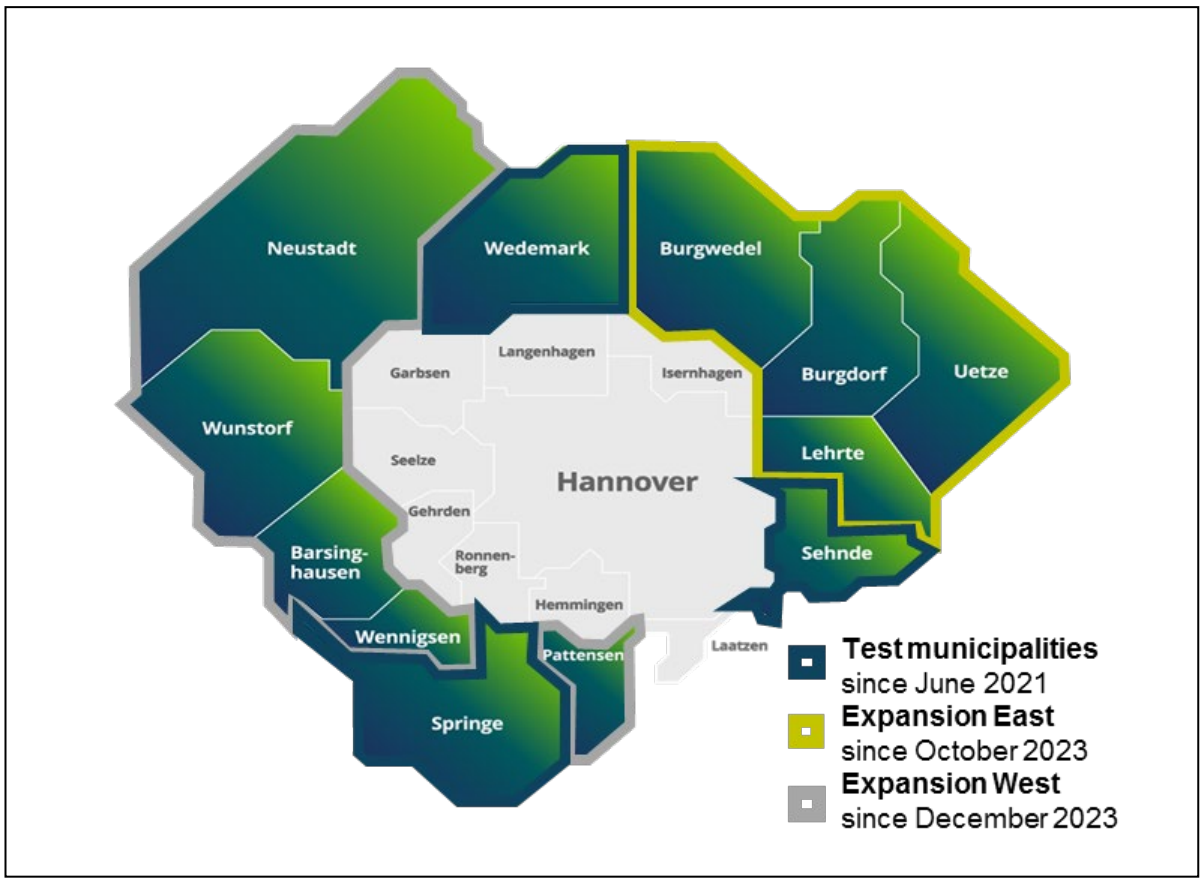

Figure 41 Overview of the municipalities within which the sprinti operates.

Copyright: Hannover Region/ ÜSTRA

The graphic above shows when the sprinti was available in the individual municipalities. It was launched in the three test municipalities of Wedemark, Sehnde and Springe. The eastern municipalities were then added in autumn 2023 and the western municipalities in winter 2023. The introduction of the system was accompanied by a ‘roadshow’ in each of the municipalities. The vehicles were on site at a specific location and could be viewed in advance. Information stands provided information about the new service. The roadshows were intended to break down possible barriers and fears about the new system and at the same time mark the launch in the respective municipality.

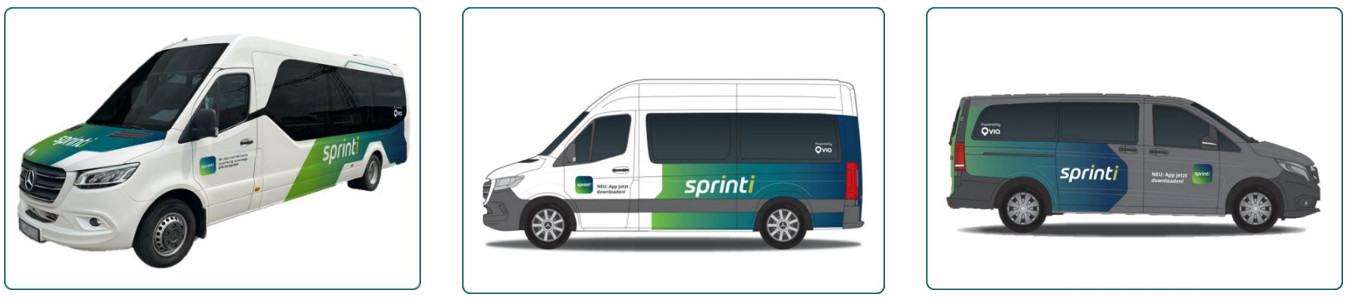

Figure 42 Sprinti vehicles: Large 18 seats; medium 6 seats and small 5 seats.

Copyright: Hannover Region/ ÜSTRA

Creation of 5 Challenges

- Successful expansion with roadshows in the individual municipalities

  The expansion of the service had to be well prepared. This included close coordination with the stakeholders within the Hannover Region, ÜSTRA and the stakeholders in the individual municipalities. Communication with politicians also had to be organised. It was also important to ensure that sufficient vehicles and drivers were available for the expansion.

- Personnel deficit

  The recruitment and employment of sufficient driving personnel continues to be a difficult issue in the operation of sprinti. Drivers are employed by both the transport company and the service provider.

- Start multi-purpose use

  With sprinti multi-purpose use, some of the vehicles are made available exclusively for the employees of a company for a certain period of time. This could be one of the hospitals, for example. At the start of the work shift, the hospital employees then have priority for sprinti bookings and can arrive flexibly without their own car.

- Communication: Sprinti only picks-up when there is no alternative public transport

  Sometimes there are challenges in communicating that the sprinti can only be booked if there is no regular PT operating in parallel. It must be carefully explained and communicated why this is the case.

- E-mobility

  Electromobility is a major topic at sprinti. The aim is to electrify the entire fleet, but there are currently only petrol vehicles.

First Draft of Table of Contents for lessons learned Paper

- Introduction
- Background and vision
- Conception and preparation of an on-demand service
- Marketing/communication to successfully promote the brand
- Realisation and evaluation
- Challenges/successes
- What are the next steps?

5.6.1.3. Challenges & Mitigations

Funding

The sprinti is currently being funded as part of the PT model region programme. As this funding ends at the end of 2024, follow-up funding had to be researched from 2023. The hope was to be able to further develop the project with additional funding. However, as there is currently no funding that would also support ongoing operations, a new solution had to be found. The sprinti will now be financed by the Hannover Region budget for the next three years. However, as these sums are immense, another solution must be found in the long term. For smaller towns and municipalities, such a solution is unaffordable.

Operating quality

The sprinti has a very high level of operating quality. In order to maintain this level and fulfil as many journey requests as possible in the prescribed time, many adjustments have to be made. In order to maintain the quality of service, the sprinti should not become a taxi and therefore more expensive. Likewise, no comfort surcharge should be charged. One possible solution is more drivers and therefore more vehicles that can maintain this high standard.

Personnel deficit

As mentioned earlier in the text, we currently have too few drivers and therefore too few vehicles. As mentioned, the quality of service suffers as a result. Especially during the holiday period, some work shifts cannot be filled because too many drivers are on holiday. To prevent overlaps in the future and to ensure that all shifts are always staffed, there is now a kind of 'holiday clock' that monitors the availability of sufficient drivers at all times.

Multi-purpose mode

The multiple purpose already mentioned has only just started. It is therefore currently still very expensive to operate. One reason for this is that too few partners are making use of the offer. One solution is better recruitment of partners who can then compensate for the operating costs. A concept for this is currently being developed within the model region project.

5.6.1.4. Next steps towards implementation

Currently, the data on sprinti usage is already collected in a dashboard and analysed on a monthly and quarterly basis. The next step is to collate and interpret these analyses.

References[6]

6.Conclusion

This document reports the activities performed within the task T4.5 of the UPPER project to support living labs of the project and twining cities to develop mobility measures aimed at improving comfort and convenience of users at stops and via innovative Demand Responsive services. The task partners supported cities in the development of:

[6] https://ridewithvia.com/news/via-selected-to-operate-new-on-demand-public-transit-service-sprinti-in-hannover-germany

https://www.uestra.de/aktuelles/aktuelle-meldungen/sprinti-anschluss-neun-weiterer-kommunen/

https://ridewithvia.com/news/green-light-sprinti-on-demand-project-will-be-expanded

- 3 measures aimed at diagnosing the current levels of accessibility, information available and ease of use of public transport at stops within the network. Some of these propose a diagnosis and categorization of the interfaces, while others are aiming to test and pilot ways of improving customer experience;
- 6 measures aimed at expanding scheduled public transport services via targeted on-demand transport services which are geared towards serving a specific area of the metropolitan area or a target group. These range from expanding and adapting services currently in operation and understanding the key factors of success so far, to developing new services to be put into operation and tested during the lifetime of UPPER.

The deliverable serves as a valuable resource for both the UPPER consortium and external professionals, since it includes reference guides, tools, high-level recommendations, and a detailed process description for developing similar measures in other cities. Key replicable outcomes include:

- **Prioritising accessibility**: Public transport should be accessible to all, regardless of financial circumstances or technological access. Cities should explore non-digital options.
- **Stakeholder Engagement and Communication**: Cities need to ensure that all relevant parties, including local organisations and affected communities, are involved in planning and decision-making processes. Citizen engagement should extend to non-digital users.
- **Travel behaviour analysis**: Understanding user characteristics, needs, perceptions, and travel behaviour is crucial for designing truly responsive public transport services.
- **Formation of Multi-Disciplinary Teams**: The involvement of multi-disciplinary teams is essential to support interventions across various contexts. They are crucial to secure buy-in from the organisations active in the city, as well as from multiple departments within the same organisation.

The measures' monitoring procedure was overall efficient. The task leader was responsible for contacting cities and asking about each measure's progress based on the steps defined (by cities) in the monitoring template. Such iterative interaction between responsible task leader and cities and among task leaders decreased the complexity of the monitoring process, while providing support to the cities in their measure development tasks.

Annex 1: Monitoring templates of T4.5 measures

Monitoring template for Measure VAL_06 “To improve the PT offer in peri-urban areas”

Objectives of the measure

- Improve the accessibility to public transportation for residents and VRUs in peri-urban areas.
- Automatize the DRT system to ensure efficient and cost-effective operation.

Description of the measure

This measure aims to improve the accessibility to public transport in peri-urban areas of Valencia, which are currently poorly served by traditional bus services. The measure proposes the creation of an automatized Demand Responsive Transport (DRT) system to cater to the needs of vulnerable users, such as the elderly or low-income families, and inhabitants in general of these neighbourhoods. The DRT system will be expanded to cover a wider range of user needs beyond just people with disabilities, and it will operate more efficiently and cost-effectively with automatization. This measure seeks to promote social inclusion by ensuring that all residents of Valencia have access to essential services and opportunities, regardless of where they live.

Sub-measures description:

- **VAL_06_01:** DRT service to guarantee public transport access in peri-urban areas
- **VAL_06_02:** Innovative tools for PT users

Measure outputs:

- Develop an automatized Demand Responsive Transport (DRT) system.
- Mobile application/ web service for DRT service booking and tracking.
- Targeted communication campaign to promote the use of the DRT service among target users.

Related UPPER tools:

- **U-NEED:** To identify peri-urban areas of highest interest.
- **U-GOV:** To collect needs and requirements from people living in these bad-connected peri-urban areas (from VRUs and inhabitants in general)

Steps to ready-to-demo measure

Steps	Description	Involved partners/ externals	Category of action	Deadline	Monitoring indicator	Comments
1	Definition of the area and the use cases of the physical service	EMT	Social	December 2023	Area selected	
2	Collection of data regarding the users – definition of the target groups	EMT/ETRA	Data	March 2024	Data collected: target groups needs and mobility patterns	
3	Data analysis	EMT/ETRA	Data	April 2024	Target groups needs and mobility patterns identified	
4	Definition of use cases for the digital service	EMT	Social	April 2024	Use case(s) defined	
5	Definition of technical requirements and architecture	EMT/ETRA	Technical	May 2024	Technical requirements and software architecture defined	
6	Mobile application/web service development	ETRA	Software	July 2024	Mobile app and web service developed and tested	
7	Training of staff for running the service (drivers/booking/monitoring/dispatch)	EMT	Social/ Technical		EMT personnel trained	Out of the preparation process. Part of WP6
8	Communication plan for launch/incentives to promote use	EMT	Social		Target users informed about the service	Out of the preparation process. Part of WP6
9	System for monitoring feedback and performance of the system	EMT	Data		Users rating, perceptions, and evaluation of the new services/measures implemented	Out of the preparation process. Part of WP6
LAUNCH OF THE DEMO (Q1 2025)						

Monitoring template for Measure VAL_08: design and develop an innovative, inclusive and convenient stop for buses

Objectives of the measure

- Develop an innovative, smart, and inclusive bus stop.
- Enhance user satisfaction by designing attractive and user-centric PT stops.
- Improve feeling of safety in waiting areas.
- Make PT stops accessible for all users, both physically and cognitively.
- Make PT stops energy efficient and eco-friendly.

Description of the measure

The measure aims to design and test an innovative, intelligent, and inclusive bus stop to enhance user satisfaction and public perception of public transport. It focuses on creating a prototype that improves accessibility, safety, and user experience, particularly for individuals with disabilities or special needs. The design will undergo a co-creation process and be validated through an Urban Sandbox to ensure it meets diverse user needs. This measure will also evaluate the mobility flows of pedestrians and cyclists around bus stops (especially focused on those located in Blasco Ibañez, where a BRT lane will be created) with the aim of elaborating a set of guidelines on how to design the bus stop surrounding to improve accessibility, safety and optimise people flows.

Measure outputs:

- Report on the analysis of the users' needs in terms of accessibility, safety, inclusiveness, attractiveness and innovation features for the new bus stop, including feedback from users with disabilities or special needs.
- Study of mobility patterns in the vicinity of the bus stops located in Blasco Ibañez Avenue, and guidelines on how to optimise the flow of people around EMT bus stops.
- Prototype of innovative intelligent and inclusive bus stop, emphasizing the inclusion of elements that improve the user experience during waiting times.

Related UPPER tools:

U-GOV, to collect feedback from users during the demo phase.

Steps to ready-to-demo measure

Steps	Description	Involved partners/ externals	Category of action	Deadline	Monitoring indicator	Comments
1	Defining the context of action	EMT/City council	Technical	April 2024	Information from the context of action collected	
2	User needs identification	IBV/EMT	Social	December 2023	Report from workshops with users with special needs	
3	Organisation of a Hackathon to co-design solutions	IBV	Social/Technical	June 2024	Report from hackathon	
4	Analysis of the Hackathon results and identification of relevant innovations to be added to the prototype	EMT/IBV	Technical	July 2024	Selection of innovations to be incorporated in the bus stop prototype	
5	Prepare the tender for the study of pedestrian and cyclist mobility flows around bus stops	EMT/City Council, depending on ownership of public space	Legal	September 2024	Tender published, criteria for award of tender	
6	Development of innovations	EMT/ City council	Technical/ Software/ Infrastructure	December 2024	Innovations developed and ready to be integrated in the bus stop prototype	
LAUNCH OF THE DEMO (Q1 2025)						

Monitoring template for Measure OSL_05: Adapt segmented demand responsive transport (DRT) solutions to a broader group

Objectives of the measure

- Merging existing age friendly service with new, classic DRT open-to-all service
- Investigating and testing target user needs in terms of:
  - Engaging solely with a digital interface
  - Meeting their demand with automated vehicles
- Making our future DRT-offer more economically sustainable, by:
  - Increasing efficiency of DRT-vehicles and drivers
  - Transforming it to a fully digital service

Description of the measure

This measure seeks to find ways of integrating our age-friendly service with a projected, new DRT-service, no longer being limited to a particular age group. Instead of funding these services separately, our aim is to enable synergies and reduce costs by integrating the two. Relevant issues to uncover include (1) how to design a new "open to all" service which still takes into account the needs of the elderly, and (2) how can we support this particular target group onto a fully digital service. Additionally, the measure aims to cooperate with the ULTIMO project to learn how we can prepare and assist elderly onto the future, autonomous DRT vehicles.

The measure does not include a full-scale launch of an "open to all" service, but will be an essential preparation for such a launch.

Measure outputs:

Testing of original target group's (elderly) adaptability to general DRT service (open to all customers), in terms of:

- Ordering process (digital, rather than by phone)
- Travelling (with a wider group of passengers, not only those within their own age segment)
- Assistance (how much assistance is required from the driver/host, and which needs must be covered when we introduce autonomous vehicles)

Related UPPER tools: U-GOV

UPPER

Steps to ready-to-demo measure

Steps	Description	Involved partners/ externals	Category of action	Deadline	Monitoring indicator	Comments
1	Identify lessons from current DRT service	Ruter	Technical	31/12/23	Hypotheses for testing	Completed.
2	Integrate feedback from serious games	Ruter	Social	31/12/23	Conclusions from serious game	Completed and incorporated into knowledge summary.
3	Assess user needs (incl. expanded target group; city district representatives etc.)	Ruter/city districts/city council dept.	Social	30/4/24	Survey and interviews	Qualitative study among existing user group and interviews with city districts have been conducted and finalized.
4	Knowledge summary and hypotheses for testing	Ruter	Social	30/6/24	Report	
5	Demo (examination of booking and travel experience	Ruter	Technical/ software/ social	31/8/24	Report	
6	*Define pain points and service change requirements*	*Ruter*	*Software/ social/ technical/ infrastructure*	*30/11/24*	*Recommendation on improvements and necessary measures*	Part of WP6

Monitoring template for Measure OSL_08: "Shifting DRT-reservations from pre-booking to on-demand as a means to increase capacity

Objectives of the measure

- Investigate the effect of on-demand and same day ordering on productivity and capacity of age friendly transport.
- Increase the number of vehicles reserved for same day/on-demand ordering.
- Reduce the pre-booking rate of RAT

Description of the measure

This measure aims to explore methods for enhancing and gaining experience in same-day and on-demand ordering for Ruter age-friendly transport (RAT). We will attempt to acquire the necessary skills and experience to operate on-demand DRT systems, whilst also taking into account the unique needs of RAT users. Key issues to investigate include (1) the impact of reserving vehicles for on-demand/same day on productivity, (2) the effect of on-demand/same day on trip aggregation, and (3) determining the number of vehicles needed for on-demand/same day to observe systemic effects, among other considerations.

Measure outputs:

This measure will deliver:

- Increased number of vehicles reserved for on-demand/same day ordering.
- Increased flexibility for end users.
- Reduced pre-booking rate for RAT.
- Operational experience with partial on-demand DRT systems.

Related UPPER tools:

U-GOV

This tool could help gain a better understanding of our target group's expectations, serving as a platform/facilitator for interaction, involvement, and discussions.

UPPER

Steps to ready-to-demo measure

Steps	Description	Involved partners/ externals	Category of action	Deadline	Monitoring indicator	Comments
1	Develop operational framework for test phase.	Ruter	Technical/ social	31/4/2024	Testing with vehicles in operation begins.	Completed.
2	Iteration, testing and experimentation with different service parameters (Number of vehicles, booking rules, etc.)	Ruter	Technical	31/07/2024	Report.	Completed.
3	Continued testing and experimentation with different service parameters, and development operational framework for demo phase based upon previous insights.	Ruter	Technical	15/09/2024	Operational framework ready. Expanded report.	Completed
LAUNCH OF THE DEMO (30/09/2024)						

Monitoring template for Measure MAN_04: attractive, accessible, secure, comfortable, multifunctional and clean PT stop

Objectives of the measure

- Piloting digitalized PT-stop
- Developing and piloting climate-resilience measures (greening/ shading/ un-sealing) for PT-stops
- Accelerating climate-resilience measures (greening/ shading/ un-sealing) for PT-infrastructure
- Develop a building standard for accessible, comfortable, multifunctional und climate resilient light rail platforms.

Description of the measure

The aim of this measure is to draft, discuss and pilot additional components/ elements at PT stops to improve the overall attractivity and functionality.

Sub-measures:

1. MAN_04_01: This sub measure will focus on bringing additional digital services to the stops.
2. MAN_04_02: This sub-measure will focus on climate-change related adaption of PT stops and PT infrastructure, such as the greening and shading to reduce direct sunlight and heat in the summer, or the un-sealing of formerly paved areas to cope with heavy rainfall.
3. MAN_04_03: This sub-measure will focus on the development of a comprehensive platform building standards for all of rnv's future construction projects to fasten planning and construction processes while ensuring best-practices regarding accessibility, comfortability, and multifunctionality to be carried on.

Measure outputs:

- concept for digitalized PT-stop
- Piloting of digitalized PT-stop
- concept for greening/ shading/ un-sealing measures of PT-stops and PT-infrastructure
- Implementation of greening/ shading/ un-sealing measures of PT-stops and PT-infrastructure
- Development of a platform building standard.

Related UPPER tools: N/A

Steps to ready-to-demo measure

Steps	Description	Involved partners/ externals	Category of action	Deadline	Monitoring indicator	Comments
1	Select location(s) for the pilot	rnv/ City of Mannheim	Infrastructure/ legal	01/03/2024	Pilot stops selected	
2	User needs assessment	City of Mannheim/ rnv	Data	01/09/2023	Report from serious game, list of what is desired in a pt-stop	Assessment completed and operationalized for implementation
3	Equipment needed for new stop, interfaces	rnv/ City/ MKB	Infrastructure	01/06/2024	Interactive screen needed	
4	Greening/ shading/ unsealing of paved surfaces	Infrastructure Planning Department/ rnv/ MKB	Technical/ infrastructure	01/06/2024	Climate resilience measures that can feasibly be implemented at chosen location	
5	Tender for equipment, including software for screens if needed	Rnv, MKB	Legal	01/08/2024	Tender published, criteria for award of tender. Requirements for the backend of the software for digitalised stops.	
6	Installation of equipment	Rnv/ MKB	Infrastructure	01/01/2025	All materials in working order	Out of the preparation process. Part of WP6
7	Safety assessment	Rnv/ MKB	Safety	01/02/2025	All equipment safe	Out of the preparation process. Part of WP6
8	Communication/ information of users	Rnv/ City of Mannheim	Social	01/03/2025	Potential users informed	Out of the preparation process. Part of WP6
LAUNCH OF THE DEMO (Q1 2025)						

Monitoring template for Measure MAN_06: concepts and instruments to improve mobility in peri-urban areas

Objectives of the measure

- Improve mobility and PT in peri-urban areas
- Improve tangential connections between districts

Description of the measure

This measure aims at the development of concepts and the testing of instruments to improve mobility in those peri-urban areas for various user groups. The overall objective is to improve the availability and quality of mobility services in peri-urban areas through improved PT services and an additional focus of connecting PT services with additional mobility options.

Measure outputs:

- Concept for improved bus & on-demand services in peri-urban areas of Mannheim
- Implementation and testing of improved bus & on-demand services in peri-urban areas of Mannheim
- Concept for connected mobility services focusing on the specific peri-urban context and challenges
- Concept for improved PT services beyond administrative boundaries between peri-urban areas and neighbouring sub-urban communities

Related UPPER tools: N/A

Steps to ready-to-demo measure

Steps	Description	Involved partners/ externals	Category of action	Deadline	Monitoring indicator	Comments
1	Definition of the area and the use cases of the physical service – evaluation of current PT services to identify needs for feeder services	rnv	Social	01/12/2023	Areas / neighbourhoods selected for potential service use	Areas of focus selected in peripheral Mannheim
2	Collection of data about the desired use cases from potential users	rnv/ city of Mannheim	Data	01/06/2024	Data collection conducted and finalized	
3	Data analysis – of inputs from potential users	rnv/ Mannheim and other cities in the area of operation	Data	01/09/2024	Report of requests/ requirements for service	
4	Selection of type of service desired, including its features (booking app, phone, type of pricing model, ticket-level integration with other PT services)	rnv	Technical	01/12/2024	Criteria and service requirements listed	
5	Integration concept developed (Routing & Booking)	rnv/VRN	Software	01/03/2025	New fixed line services and OD services are planned	Out of the preparation process. Part of WP6
6	Guidelines/ planning for hub adaptation	rnv	Infrastructure/ technical	01/03/2025	Guidelines/ planning for hub adaptation Finalized, Input for MAN_07	Out of the preparation process. Part of WP6
7	Information and communication to residents and current PT users	rnv	Social	01/08/2025	Number of communication actions undertaken (social media, ads in target neighbourhood or hub, etc.)	Out of the preparation process. Part of WP6
LAUNCH OF THE DEMO (Q1 2025)						

Monitoring template for Measure LIS_06 “To Improve the comfort, convenience and safety of PT Interfaces”

Objectives of the measure

- Study the increase of accessibility, inclusion, comfort, attractiveness, convenience, safety and security at PT interfaces, stations, and stops, type by type.
- Work with stakeholders on possibilities of implementation of some measures.

Description of the measure

In the scope of UPPER, a characterisation and diagnostic of the conditions of (at least) the most relevant metropolitan PT interfaces and stations will be done. This characterisation and diagnostic will focus on:

- universal accessibility, trying to identify obstacles to movements of people with mobility issues;
- comfort, trying to identify how to make interfaces more appealing to users;
- convenience, trying to assess if there are ways to improve efficiency when reaching and leaving the interfaces, and when moving inside, specially between modes;
- safety and security, trying to identify problems that may lead to users being injured or molested or afraid of being injured or molested

Measure outputs:

This measure will deliver:

- A report with the characterisation and diagnostic of the PT interfaces with regards to accessibility and inclusion; comfort and attractiveness; convenience and efficiency; and safety and security;
- A list of measures of improvement;
- Eventually, some of these measures will be implemented and the conditions of some PT interfaces will be improved.

Related UPPER tools:

- **U-SIM.plan:** This tool will be used to analyse the importance of the different interfaces, to identify which interfaces are more relevant to be included in the diagnose, which will have greater impact in the PT network in case of improvement, and how many people will be positively affected by the measure.
- U-GOV: TML will evaluate the possibility of using U-GOV as a tool to get feedback from public and stakeholders on the improvement of interface conditions.

Steps to ready-to-demo measure

Steps	Description	Involved partners/ externals	Category of action	Deadline	Monitoring indicator	Comments
1	List all interfaces in Lisbon metropolitan area	TML, EIB	Data	31st March 2024	Interface listed and database created	
2	Group interfaces in 3 to 5 categories (interfaces, stations, bus stops…)	TML, EIB	Technical	30st April 2024	Interface categories defined	
3	Get definition of 3 to 5 scenarios of intervention (minimum requirements, nice to have…)	TML, EIB	Technical	30st April 2024	Scenarios of intervention defined	
4	Identify and consult stakeholders (interface owners, users, managers…)	TML, INR, EIB, user groups	Social	31st July 2024	Stakeholders identified and consulted	
5	Write Terms of Reference for an interface accessibility diagnosis study	TML, INR	Technical	31st August 2024	Report on solutions and measures proposed	
LAUNCH OF THE DEMO (31st August 2024)						

Monitoring template for Measure TES_07 “Increase the accessibility to PT in low demanded areas of the city”

Objectives of the measure

- Improve PT accessibility at low density areas.
- Increase PT ridership.
- Improve accessibility to/from metro stations.
- Enhance social inclusion.

Description of the measure

A DRT service will be designed, connecting the “Nomos” area, which is a part of Panorama, to various points of interest, such as the Panorama Athletics Centre, and to the new terminal metro station Nea Elvetia of Thessaloniki’s Metro line which will commence operation in 2024. The service will be deployed through co-operation with the largest taxi company of Thessaloniki, i.e. Taxiway. The currently available PT services for the selected area are considered insufficient.

Measure outputs:

This measure will deliver:

- A physical service of DRT.
- A supporting application for trip booking.

Related UPPER tools:

U-NEED: Will be used together with CERTH tools to optimise a DRT service. Data analytics and a big data visualisation tool will help to understand the multimodal transport demand and how people move around the city, so as to adapt DRT offer accordingly.

Steps to ready-to-demo measure

Steps	Description	Involved partners/ externals	Category of action	Deadline	Monitoring indicator	Comments
1	Definition of the area and the use cases of the physical service	CERTH, TheTA	Social	January 2023	Description of area and use cases	Peri-urban area called "Panorama", as well as the two specific uses cases
2	Collection of data (through a serious game and users' survey)	CERTH, TheTA	Data	31/1/2023	Completion of the survey, creation of databases and reporting of activities and	Serious game and questionnaire survey to residents of Panorama
3	Data analysis	CERTH	Data	31/1/2024	Statistical outputs and implications	Completed
4	Definition of use cases for the digital service	CERTH, TheTA	Technical	31/1/2023	Description of use cases	10 use cases for the digital service (i.e. app) have been defined and described.
5	Definition of technical requirements and architecture	CERTH	Technical	31/3/2024	List of requirements and figure (flowchart) depicting the architecture	Multiple feedback loops with developers' team.
6	Contract/Agreement with taxi association	CERTH/ Taxiway	Legal	30/6/2024	Agreement achieved	Completed
7	Development of the digital service (app)	CERTH	Software	31/7/2024	Test and operation of the app	Completed
8	Training of taxi drivers	CERTH / Taxiway	Safety/social	31/8/2024	Drivers selected and trained	Completed
9	Testing of the demo (app and the rest of the necessary features)	CERTH, TheTa	Technical	31/08/24	All set for the demo	Completed

Monitoring template for Measure HAN_02: “Sustainable Transport Chains – on-demand service Sprinti”

Objectives of the measure

Evaluate the on demand based PT Service in smaller towns and dispersed communities in the suburban and rural area of Hannover region and to look at the difficulties and successes of the service and provide a lessons learned paper of an on-demand service for other cities and regions in Europe. The focus in the lessons learned paper is on follow-up financing after 2024 and multi-use by the Sprinti.

Description of the measure

As part of the national funding for the "Model Region for Public Transport" (timeframe 2022-2024) the Sprinti will be rolled-out in the entire tariff zone C, i.e. the outermost ring of the Region Hannover. Within this measure, we want to create a "lessons learned" brochure based on the expansion of the Sprinti service. We will collect the experiences and lessons learnt from the project, bring them together and evaluate them. The lessons learned brochure intends to serve as a blueprint for other cities, especially the ones in UPPER, to implement their own on-demand systems. The Focus is on the follow-up financing after the funding within the “Model Region for Public Transport” ends.

Measure outputs:

- Experiences from Sprinti pilot and its expansion in the form of a lessons learned brochure for successful development of on-demand systems
- Exchange on financing options for On Demand Services (in Germany), e.g. measuring the impacts of using the vehicles for multiple purposes (e.g. sustainable mobility options for companies/ employees, factory transportation, service for schools, etc.)
- Preliminary planning concept for the automation of on-demand services

Related UPPER tools: U-GOV

Steps to ready-to-demo measure

Steps	Description	Involved partners/ externals	Category of action	Deadline	Monitoring indicator	Comments
1	Identify lessons from initial sprinti pilot	Region Hannover	Infrastructure	2024	Report/information from Sprinti Pilot available	
2	Creating a table of contents for lessons learned paper (including Transferability to other countries and funding opportunities	Region Hannover	Technical	06/2024	Successful creation of table of content	
3	Definition of use cases for sprinti data	Region Hannover/ operating companies/ Sprinti service provider	Data	08/2024		Collection of Data within the first year of service expansion
4	Definition of challenges and potential answers for lessons learned paper	Region Hannover	Technical	08/2024	Creation of 5 Challenges and Solutions	
5	Analysis of current data to services in the additional areas	Region/ operating companies	Data	Autumn/ winter 2024	Route/ service design in expanded operational area	Collection of Data within the first year of service expansion
LAUNCH OF THE DEMO (Winter 2024 in whole tariff zone C)						