UPPER

Unleashing the Potential of Public Transport in Europe

D4.4 Transition to Multimodal Digital Transport Services (MDMS) and user-friendly multimodal nodes

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

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Author(s)	Organisation
Annie Kortsari	CERTH-HIT
Andreas Nikiforiadis	CERTH-HIT
Lambros Mitropoulos	CERTH-HIT
Katerina Fotiou	CERTH-HIT

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EU-RES: Classified Information - restraint UE;
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List of abbreviations and acronyms

Abbreviation/Acronym	Meaning
API	Application Programming Interface
CFV(s)	Conventionally Fuel Vehicle(s)
D	Deliverable
DSRM	Data Sharing & Service Repository for MaaS
EFM	Electronic Fare Management
ETA	Estimated Time of Arrival
EU	European Union

GBFS	General Bikeshare Feed Specification
GDPR	General Data Protection Regulation
GIS	Geographic Information System
GTFS	General Transit Feed Specification
IDFM	Ile de France Mobilite
ITS	Intelligent Transport Services
MaaS	Mobility as a Service
MDTS	Multimodal Digital Transport Services
MSLG	Measures Support Leaders Group
MSP	Mobility Service Provider
NFC	Near-field communication
OPG	Olympic and Paralympic Games
OTP	OpenTripPlanner
P&R	Park and Ride
POC	Proof of Concept
POI	Point of Interest
PT	Public Transport
PTA(s)	Public Transport Authorities(s)
PTO(s)	Public Transport Operator(s)
RT	Real-time
SP	Stated Preference
SUMP	Sustainable Urban Mobility Plan
TfL	Transport for London

TSP	Transport Service Provider
UDM	Universal Design Manual
UIL	Universal Interface Language
UVAR	Urban Vehicle Access Regulations
VGP	Versailles Grand Parc
WP	Work Package

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Abstract

This deliverable outlines the background of developing the UPPER measures related to Multimodal Digital Transport Services (MDTS) and MaaS (Task 4.4). All the actions that contributed to the development of the measures are described here, as for example the MaaS workshops' results and the results of the systematic review of reference projects and tools. The focus, however, is on the detailed description of the steps carried out related to the development of the measures leading to their (future) demonstration in WP6. In addition, the challenges addressed during the process of developing the measures and corresponding mitigation actions are also presented in this document. This deliverable may be used as evidence of the measures' progress and as significant input for the coming demonstration activities under WP6.

Keywords

Mobility as a Service (MaaS); Multimodal Digital Transport Services (MDTS); Multimodality.

1. Introduction

1.1. Scope of the Document

The present document D4.4 “Transition to Multimodal Digital Transport Services (MDTS) and user-friendly multimodal nodes” has been prepared in the framework of WP4 “Innovative solutions to increase the efficiency, reliability and attractiveness of PT” and specifically, it is the outcome of Task 4.4 “Improved information and added-value services enhancing multimodality”.

The specific WP is one of the 3 WPs, namely WP3, WP4 and WP5 that have a twofold goal:

- To develop the 7 UPPER tools foreseen in the framework of the Project and
- To take all the necessary steps towards the preparation of the 78 push and pull measures foreseen in the Project.

The main goal of WP4 is to support the local ecosystems in creating innovative solutions to increase the efficiency, reliability and attractiveness of PT as a part of the proposed measures and developing such solutions and tools for supporting the UPPER measures in the living labs in a standardized and integrated manner. The goal of Task 4.4 is to deal with measures having to do with improved information and added-value services enhancing multimodality.

More specifically, this task identified 13 out of the 78 measures that were relevant to its topic. Next, the cities in which these measures will be implemented, were supported towards the preparation of these measures. This support included the identification of similar previous initiatives, and the lessons learned through them. Moreover, the cities were supported in the process of identifying the correct steps towards the measures’ preparation, as well as in the actual realization of these steps. Guidance was provided when challenges were met and the next steps towards the implementation were identified and planned.

The present document gains input from the work done in WP2, in the framework of which the goal, scope and content of each measure was defined. D4.4 is one of the nine documents (D3.4-D3.5, D4.2-D4.5, D5.2-D5.4) reporting on the work done in view of the preparation of the measures. These reports pave the way to the implementation of the measures to take place in the framework of WP6 and the evaluation of the measures to take place in the framework of WP7.

1.2. Intended audience

D4.4 is an official deliverable of the UPPER Project. As such, the main audience addressed is the Project’s coordinator (UITP) and Technical Manager (ETRA) and once approved by them, the European Commission and specifically, the appointed Project Officer.

Internally to the project, the report is addressed to the cities representatives who will use it as a guide for the next steps towards the implementation of the measures and to the Local Evaluation Managers, who will also use it once the evaluation process starts.

This document is also addressed to the general public meaning that readers outside the project or the EU Commission will be able to use it as reference for developing measures related to Multimodal Digital Transport Services (MDTS) and Mobility as a Service (MaaS).

1.3. Structure of the document

The document is structured in 7 different chapters.

The present Chapter 1 includes introductory points and reference to the main goals of the project, the WP and the report.

Chapter 2 describes the methodology implemented and specifically the supporting resources used, the workshops organized the formulation of the Measures Support Leaders Group.

Chapter 3 reports on the first item of the methodology and specifically on the supporting resources used. Those are presented in a systematic way, connecting past projects to the relevant UPPER Measures.

Chapter 4 focuses on the workshops that were organized in order to further support the cities. The first one was organized in the framework of the 3rd consortium meeting held in Rome, while the second one was organized online. Both workshops dealt with MaaS.

Chapter 5 includes the descriptions of the 13 measures and the steps taken towards their preparation. More specifically, the descriptions include description of the measure and main outcome expected, description of the preparation of the measure, challenges met and mitigation measures taken, as well as the next steps for the implementation.

Finally, Chapter 6 is dedicated to the main conclusions drawn and chapter 7 presents the bibliography.

1.4. Measures included under Task 4.4

Below is the list of the measures included under T4.4. All UPPER measures have been categorized based on their scope and the measures presented in this document belong to the following “high-level category”:

- *Multimodality (Operational and Digital Integration of mobility services)*

1. **VAL_05** “New Multimodal Digital Mobility Services (MDMS) with a focus on accessibility and inclusion”
2. **ROM_06** “Innovative features into the MDMS system according to the mobility patterns and needs of users’ groups”
3. **IDF_04** “Added-value services in multimodal nodes to integrate active modes with PT”
4. **IDF_05** “Promote the use of the PT service by visitors in large events”
5. **MAN_05** “Modernize and increase the attractiveness of digital sales channels and private sector partnerships”
6. **LIS_07** “To create a new Multimodal Digital Mobility Services (MDMS)”
7. **BUD_04** “To improve the route planner to increase user satisfaction”
8. **BUD_05** “New services to increase accessibility and convenience of PT”
9. **LEU_03+04** “To increase visibility and ease of use of public transport by offering improved information on public transport, parking and shared mobility options”
10. **TES_01** “Optimum transfers on P&R areas based on real-time data”
11. **TES_05** “To enhance the information provided through adapted services for different groups of passengers”

12. **HAN_01** “Digital infrastructure”

13. **HAN_04** “Mobility dashboard solution”

2. Methodology

As previously mentioned, the goal of Task 4.4 was to support the cities in the preparation of the measures included under its topic umbrella. The methodology implemented to achieve this goal, included three different axes of support, that run in parallel throughout the whole course of the task’s duration. These steps included the provision and explanation of supporting material, the organization of workshops for the exchange of ideas and know-how and finally the formulation of the Measures Support Leaders Group that supported the cities representatives all the way, towards the preparation of the measures. More information on each one of the these supporting axes is provided in the sections that follow.

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 guides that can support the cities in implementing certain types of measures (linked to MaaS for T4.4). The results of the review are presented in Chapter 3.

2.2. Measures support workshop series

EMTA organized a series of workshops on MaaS to foster collaboration among cities and tap into the wealth of knowledge of horizontal partners. Matching this higher-level and policy focused insight with the more concrete needs and strategies of the cities working on MaaS-related measures can make a valuable contribution to the UPPER project’s overall success. In addition to pointing to concrete aspects of attention for each MaaS-related UPPER measure and providing a forum for the different cities working on these measures to discuss common issues, challenges and remedies, the second (online) workshop allowed for a discussion of needs and demands of different mobility participants. This was achieved by looking at MaaS and MaaS-success-factors from the perspective of pedestrian, cyclist, and public transport passengers, supported with input by the European Cyclist Federation (ECF), the International Federation of Pedestrians and the European Passenger Federation (EPF).

2.3. The Measures Support Leaders Group

As mentioned above, WPs 3,4 and 5 share common goals; to develop the UPPER tools and to make sure that all the necessary steps have been taken in order to get the 78 measures ready for implementation, in the framework of WP6. Having identified from the very beginning his common goal, 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 1 below 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 an 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 Figure 1 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 monitoring templates for the 13 measures prepared under Task 4.4 can be found in *ANNEX A:* **Monitoring templates for all measures under Task 4.4.**

3.Supporting resources: Reference tools and guides

This section aims to provide a comprehensive review of relevant sources, past projects and best practices that align with the measures of T4.4 particularly in enhancing user-centric MaaS, accessibility and inclusion. MDTS are currently being implemented unevenly across globe and the EU, hindered by the absence of cohesive legal and market frameworks necessary for their broader success. While many cities are developing Mobility as a Service (MaaS) applications, the legal frameworks supporting these developments vary significantly across Member States. Persistent challenges include limited cooperation between mobility operators and MDTS providers, lengthy and complex negotiations for licensing and distribution agreements, a lack of common standards and interfaces, unclear passenger liability, and unresolved issues related to fare revenue sharing (European Commission, 2023). Reviewing recent projects, tools and studies provided useful insight during the development of UPPER measures. Key resources from the review are presented in Table 2 below:

Table 2. Supporting resources related to measures under Task 4.4.

Resource	Description
	The EMPOWER project aimed to significantly reduce the use of conventionally fuelled vehicles (CFVs) in cities by promoting sustainable mobility behaviours. It developed

EMPOWER – EU Project (*CORDIS* | *EMPOWER*, 2018)	a toolkit for industry, policymakers, and employers to implement cost-effective, evidence-based interventions using innovative mobility services. EMPOWER sought to shift trips to alternative modes, promote sharing, reduce overall demand through remote access, and mitigate undesirable CFV impacts by adjusting travel times and routes. The project involved multidisciplinary research, living lab experiments, and city demonstrators. Key outputs included the EMPOWER Toolkit, which provided new mobility services, behavioural insights, organizational models, and evaluation methods. The project aimed to impact at least one million people.
IMOVE – EU Project (*CORDIS* | *IMOVE*, 2019)	The IMOVE project aimed to revolutionize MaaS by integrating mobile and sharing economy trends with advancements in Intelligent Transport Systems (ITS). It sought to create seamless, combined mobility packages as alternatives to car ownership. Learning from previous European MaaS initiatives, IMOVE focused on developing innovative business models and technology solutions to scale up MaaS deployment across Europe. IMOVE's key innovations included real-time data collection on user needs, seamless interoperability among MaaS systems, and novel business models for profitable service operation. These solutions were tested in five European Living Labs, ensuring broad stakeholder engagement and impact.
MyCorridor – EU Project (*CORDIS* | *MyCorridor*, 2020)	MyCorridor project aimed at facilitating sustainable travel through MaaS. It integrated multiple transport services into a single platform, emphasizing user-centric design. The MyCorridor solution was considered from the beginning to support the MaaS concept by providing distinct features such as the development of an innovative platform and novel business schemes, introducing the Mobility Services Aggregator concept across the whole EU. In this way, MyCorridor aimed to enable a paradigm shift for car users, by driving the “vehicle world” towards MaaS. One of the basis of the MyCorridor project, from its very beginning, has been the TM2.0 platform (i.e. as an enabler of MaaS), and, therefore, the starting point in this respect, were those mobility services related to the interactive TM vision of the “vehicle world”. It, therefore, aimed to extend the current capability of TM2.0 by integrating in a single platform pan-European data sets, able to offer urban and interurban services that are multimodal, seamless, flexible, reliable, user-friendly, all-inclusive, cost-effective and environmentally sustainable. Overall, MyCorridor aimed to develop the technological & business platform to enable technologies, applications, business models, legal & operational schemes & travel behaviour adaptation & promotion strategies to facilitate sustainable travel in urban & interurban areas & across borders by replacing private vehicle ownership by private vehicle use, as just one element in an integrated/multi-modal MaaS chain.
INDIMO – EU Project (Bulanowski et al., 2023; *CORDIS* | *INDIMO*, 2022; *Indimo - Inclusive Digital Mobility Solutions*, 2022)	INDIMO project developed a comprehensive view of digital mobility and logistics services by considering the needs, requirements, and concerns of service operators, system developers, policymakers, and users. Special emphasis was placed on vulnerable groups at risk of exclusion, such as elderly individuals, ethnic minorities, rural residents, people with lower incomes, reduced mobility, or limited digital skills. Its main output is the INDIMO Inclusive Digital Mobility Toolbox, which is an interactive set of 5 online tools, intended for a practical use and available in six different languages. It offers access to the INDIMO methodologies and the research documentation, including templates and examples of their use. The INDIMO toolbox includes for example a set of recommendations, a manual for developing inclusive digital interfaces, and an interactive service evaluation tool. INDIMO Toolbox provides recommendations and advice to: • Design digital transport solutions that are better tailored to citizens’ needs, especially those of users who experience barriers in using digital services, by means of the UDM – Universal Design manual. • Design universally understandable interfaces between transport end-users and the digital mobility system, through the UIL – Universal interface language manual.

	• Ensure data protection and cybersecurity in digital transport solutions, by means of the CSG – Cybersecurity and privacy assessment guidelines. • Evaluate the compliance of digital mobility solutions and services with the universal design principles, through the online SET – Service evaluation tool. • Identify, select and filter a list of recommendations derived from our research with end users in the INDIMO Recommendations browsable list.
UMCASE - EIT Urban Mobility Project (*EIT | UMCASE*, 2022)	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. Additionally, user involvement and co-creation are still often forgotten when developing non-digital public transport solutions. Thus, UMCASE shifted the attention of policy-makers and mobility experts to those who often don't have a voice, providing cities a method to improve their transport solutions and tailoring them to individual needs.
UbiGo – Application (Sweden) ("Fluidtime | UbiGo," n.d.)	UbiGo is the world's first MaaS app with Level 3 integration of transport services. The mobility app UbiGo combines public transport, car sharing, rental car services and taxi in one app. The MaaS service is based on a flexible monthly subscription with an account shared by all members of a household. Every end user searches and books routes via the app. For the payment the customer chooses a mobility subscription that is linked to a mobility account, e.g. of the family. Offering these via subscriptions has proven to be crucial for user acceptance. Additionally, it emphasizes ease of use and accessibility, with a user-centric approach to improve public transport experience.
Whim – Application (Finland)	MaaS Global is the company behind the Whim app, which allows users to view all available travel options in one app. The company, founded in Finland in 2015, is considered the world's first Mobility-as-a-Service (MaaS) company and Whim the first commercial MaaS service developed. Whim liberates people from timetables, fixed routes, parking worries and the high costs of owning a car. Born out of a need to be spontaneous, it gives people access to a huge variety of transport options. Whim offers mobility as a service by combining different modes of transport – public transportation, city bikes, e-scooters, ferry tickets, taxis and affordable rental cars – in one app. The application is available in the following countries: Austria (Vienna), Belgium (Antwerp), Finland (Helsinki & Turku), Japan (Tokyo), Singapore and UK (West Midlands).
Transport for London initiatives (London) (Transport for London, n.d.)	TfL has implemented a lot of initiatives to make London's transport network more accessible using digital services as well. From planning your journey; getting help from staff at stations and on buses, about discounted ravel across the network, wheelchair spaces and priority seats, assisted transport services and door-to-door services. These initiatives also include step-free access, real-time travel information, and a travel mentoring services. A dedicated journey planner[1] has been developed and is available through its official website as well.
Simplifying European Ticketing (*Report*) (Worth, 2024)	This report focuses on the four components a passenger needs from a Multimodal Digital Mobility Service (MDMS). These are: ***1. Trip Planning***: MDMS users need a straightforward and reliable method for route planning is required. The route is planned using digital data, either accessed directly by the customer through digital platforms (such as a web browser, smartphone, or ticket machine) or facilitated by an intermediary (such as a ticket office salesperson or travel agency). Frequent criticisms regarding booking process include the absence of timetables in digital planners, which may exclude certain modes of transport, specific operators, or a combination of both. Additionally, data may not be available for future dates or fail to reflect updates during network disruptions. According to the report, these issues may stem from three potential causes. First, probable a lack of a legal framework that mandates the publication of planning data in the required format

[1] https://tfl.gov.uk/plan-a-journey/

	and within the necessary timeframe. Second, if such a framework is in place, maybe transport operators and governmental organizations do not meet their legal obligations, or other implementation issues exist. Third, if the data is available, maybe current travel planners do not utilize it effectively. ***2. Trip Purchase***: After planning a trip, the end user should be able to view the corresponding price and also to compare it with alternative options for the same route, including trips involving different modes of transport or other operators within the same mode as their original preference. Common issue faced during this stage is the absence of pricing information for some transport operators on third party platforms demonstrating that this aspect can only be solved legislatively – often an adequate legal framework is missing. Transport operators should be obliged to provide third parties with valid data. ***3. Disruption Information***: Once a trip has been purchased, information about disruptions needs to be conveyed to the customer. The challenge here is that real-time data for some operators and modes is incomplete and/or disruption information is not shared with third party platforms.
Mobility as a Service (MaaS) Planning and Implementation: Challenges and Lessons Learned (*Study*) (Mitropoulos et al., 2023)	In the framework of IP4MaaS project, six MaaS demonstrations were deployed. This paper aims to describe the planning and implementation process of the MaaS pilot in Athens to provide a guideline for stakeholders. Most of the lessons learned through the IP4MaaS Athens demo application are valid in almost all geographical contexts and therefore, the knowledge gained may be transferred to multiple case studies dealing with the development and testing of MaaS applications. Key lessons learned may be summarized by the following: • The absence of an existing digital ticket solution during the demo was considered a drawback as it is a key issue for integrating various travel entitlements of the TSPs into the MaaS scheme. • Regarding the journey planning for bikes, information on bike availability and battery level should be provided to travellers through the MaaS app. • Provision of real-time information was not available in this demo, which is considered a drawback in the implementation of a MaaS scheme. Provision of real-time information and reporting of incidents along a planned journey, especially regarding PT, is considered an essential parameter for travellers, in order for them to control their trips, and search for alternatives. • Irrelevant to the number of companies participating and to the geographical context in which the system will be used, individual systems must be open and integrable. Restricted systems comprise a contradiction in the framework of the MaaS scheme development. • Successful stakeholder engagement in the early stages results in a higher acceptance for MaaS. • Incentives that were provided for promoting MaaS were positively assessed by potential users, and they urged their maintenance within the MaaS platform. Although such incentives are welcome at the beginning of a MaaS scheme, when the number of users increases it is probably not feasible to maintain them. • Users do not like to use complex systems, and they prefer to use them in their own language.

The table above does not present an exhaustive list of literature but highlights key points intended to provide a solid overview. While it may not cover every detail, it includes essential elements that offer valuable insight into the topic of measures of Task 4.4.

The review of the relevant literature presented in this chapter combined with the workshops described in the next chapter were important parallel actions with the development of the measures.

4.Organization of workshops

The following sections briefly summarize the manner in which the workshop on MaaS during the Rome General Assembly in January 2024 and the MaaS online workshop in June 2024 were conducted. It also provides an overview of the key insights produced in these workshops and during the thorough review of the respective measure descriptions by the horizontal partners involved in the facilitation of the workshops.

4.1.1. Workshop 1: MaaS workshop in Rome

In January, the UPPER consortium gathered in Rome for the third General Assembly meeting of the project. This enabled CERTH and EMTA to organize an in-person workshop with those cities involved in the MaaS measures of T4.4 and horizontal stakeholders with subject matter expertise. Cities and horizontal partners discussed how overall challenges in public transport and mobility can be effectively addressed with better information and digital service provision á la MaaS and what capabilities such service require to become effective and useful.

The workshop included two presentations delivered by the local project teams of Hannover and Thessaloniki. Hannover's measure concerns a redevelopment of the tariff system to match the requirements of machine readability that forms the basis for digital ticketing in MaaS applications. In Thessaloniki, an existing customer interface is to be expanded with additional features and transport modes, making it a mobility platform that is able to serve the vast majority of mobility needs of its customers within its interface. The following summarizes the essence of these presentations and subsequent discussions.

Key points from the presentation and discussion of Hanover's measure:
Hannover is dedicated to simplifying digital access to public transport, eliminating ticket zones, and ensuring fair billing practices. The city addresses several challenges in this development:

1. Non-discrimination: Regular meetings with licensing authorities ensure fair pricing and continuous evaluation prevents bias towards any demographic, including smartphone users.
2. Streamlined Processes: Dedicated support has expedited the typically lengthy tendering and contracting procedures, enabling quicker implementation of MaaS solutions.
3. Stakeholder Engagement: Ongoing consultations with transport operators and local authorities have fostered collaboration, ensuring alignment of interests and effective decision-making.
4. System Reliability: A thorough pre-test phase and meticulous multi-stage tendering process for the CiBo system have ensured its seamless operation, critical for delivering reliable service.

Also, the tariff logic was thoroughly addressed, with flexibility and fairness in pricing becoming most important. One can think of allowing passengers to bring along extra persons, bikes, or even pets. This flexibility extends to pricing, offering clear limits for single journeys, daily passes, and monthly subscriptions, ensuring that public transport remains affordable and accessible to everyone A notable feature is Hannover's commitment to families, providing a substantial 70% discount for children, making commuting more affordable for parents. Hannover also considers distance when setting prices, charging based on how far you travel. They've made it simple to understand by setting a clear starting price for each trip, so passengers know exactly what to expect. Furthermore, Hannover integrates these pricing strategies seamlessly across its various transport modes. his makes getting around the city easier and more eco-friendly. By sharing their ideas at the workshop, Hannover helps other cities in Europe plan better ways to improve urban travel for everyone.

Key points from the presentation and discussion of Thessaloniki's measure:

Thessaloniki is aiming to improve how people get around the city, with the goal of increasing the use of public transport for all types of journey motives, reducing a default reliance on private cars. The plan includes creating a new digital service that integrates real-time information into an existing MaaS interface. This will make it easier for commuters to switch between different modes of transport seamlessly.

The main goal is to increase the use of public transport. By providing accurate and up-to-date information on a multitude of transport modes through this one app, the idea is that the now easily available information on alternatives – that has not existed in this form before – will pull people out of habitual choices and into the often very viable alternative journey on buses and trains. With this a secondary goal of traffic congestion reduction is addressed as well: Getting those commuters with journeys that are viable and competitive on public transport may elevate some of the worst traffic congestion, to the benefit of those that are currently still captive car drivers with limited alternatives.

4.1.2. Workshop 2: Mobility as a Service (MaaS)

The MaaS workshop was held on 6 June 2024. It started with three pitches to establish three different points of view on MaaS from the perspective of passengers, pedestrians and cyclists. As the goal of MaaS is the facilitation of a true multimodal lifestyle, a MaaS customer will experience all these perspectives in its mobility lifestyle.

The European Passengers Federation (EPF) shared what passengers expect and require from a MaaS service and what challenges passengers still face when travelling across the multitude of public transport modes in their cities and regions. Affordability, reliability and accessibility, all addressed in an overall and smooth coordination of the metropolitan public transport system across the different PT modes were described as the overarching principles that impact a passenger's experience of public transport. An increasing trend of sustainability consciousness amongst passengers was also mentioned. Subsequent discussions focused on expanding MaaS services across all public transport modes, ideally interlinking with neighbouring regions and ensuring seamless connections from start to finish. The importance of accurate static information on services, real-time data on disruptions as well as alternative journeys is identified as a key driver to build trust and keep operations efficient for operators and acceptable for passengers.

Afterwards, the International Federation of Pedestrians (IPF) talked about the potential of MaaS with regard to improving urban spaces, which automatically encourages non-motorized mobility. They emphasized the crucial role of walkability in the urban realm and the importance of walkability in the surrounding of public transport stops as integral driver for the attractiveness of public transport services. Issues such as pedestrian safety, air quality improvement, and the concept of "Walking as a Service" (WaaS) that leverages infrastructure, weather and personal preference data to make walking a viable and pleasant choice for all, including those with mobility impairments.

The European Cyclists Federation (ECF) discussed integrating cycling into MaaS. They highlighted the need for safe cycling infrastructure, discussed the potential of cycling in reducing travel times in the first and last miles and raised the challenging question of bike transport on public transit vehicles. It became clear that the interchange from bicycle into the public transport system is the main driver of friction for a multimodal journey. Integration of cycling infrastructure and bike parking facilities at public transport stops reduce the amount of friction experienced in such interchanges and manifests the complementarity of cycling and public transport in a very visible manner, encouraging multimodal behaviour. The subsequent discussion also addressed barriers like affordability and geographic limitations of shared-bike schemes and the need to consider bike sharing not as a mere mobility option but as a necessary and integrated part of an urban mobility system that creates overall value beyond the rental revenue.

The final part of the workshop entailed an overall and open discussion on drivers of MaaS development. It touched on the specific measures required to successfully include walking and cycling in MaaS, how ticket sales and passenger information must go hand in hand in a MaaS service and how a positive impact of MaaS services on a city's transport strategy and policies beyond mobility can be achieved.

4.1.3. Recommendations for the cities implementing MaaS measures

The following presents recommendations as identified during the workshops and measure review process in preparation of the workshop as follows: Firstly, an excerpt from the substantial list of specific points of attention that were provided to all or specific MaaS measures is provided as indication of the feedback provided to cities. The complete list of "Points of attention" identified for T4.4 measures can be found in *ANNEX B*: Points of attention for measures under Task 4.4 in the context of the 2nd MaaS Workshop. Secondly a list of high-level recommendations is provided that is relevant to all cities in UPPER and any following city that intends to build on the UPPER measures in the future.

Excerpt from specific points of attention raised during the workshop process

To ensure the success of MaaS, cities need to focus on making these services complementary to public transport rather than competing with it. Understanding where shared services can enhance public transport is essential. Integrating private operators into public MaaS requires finding the right organizational structure. The system should be inclusive, addressing financial and digital barriers, and offering information and ticketing options that everyone can use. Effective communication and engagement with all user groups, including vulnerable populations, are crucial. Lastly, monitoring the impact on modal split will ensure that MaaS enhances overall mobility without diverting users from public transport, walking, or cycling.

Measure VAL_05 drew attention on ensuring MaaS solutions are inclusive, addressing diverse mobility needs and financial and technological accessibility, and to engage local communities and vulnerable groups for input. Effective communication is crucial to raise awareness and promote widespread adoption among all citizens. Measure ROM_06 adds by emphasizing the need to ensure having a representative sample participating in pilots.

IDF_05 on the other hand mentions that encouraging public transport use requires addressing factors like affordability, frequency, safety, and accessibility. Consider offering integrated fares that include first-last mile services.

OSL_08 mentioned the importance of a comprehensive overview of travel options, neutral rankings based on key criteria, and the ability to purchase tickets for the entire journey in a single transaction. Also provide real-time information and assistance during trips, especially in case of disruptions or missed connections.

MAN_05 draw attention on another important point of attention, namely to consider people who have difficulties using digital services, such as those with visual impairments, the elderly, and those who cannot afford smartphones. These groups risk being left behind and need alternative solutions to ensure inclusivity. LIS_07 also emphasizes the need of equal access to MaaS platforms. Budapest mentioned the importance of consistent information across all channels (stop, app, website) to enhance reliability and trustworthiness.

LEU_03+04 drew attention on the importance of the use of different brands for managing city transport problems like roadworks, and for promoting positive activities that encourage more people to use public transport. This can help avoid confusion and build trust among commuters. Also, make sure the plan to involve citizens includes everyone in the community, whether they live here or are just visiting. By reaching out to different groups and gathering their feedback, we can make sure our transportation plans meet everyone's needs.

Thessaloniki adds to it by mentioning that it is crucial to determine ownership and development responsibilities for the MaaS app. Define clear access conditions and pricing schemes for the new DRT service, ensuring accessibility for existing pass holders.

Hannover recommends using the mobility dashboard in Hannover to encourage people to use P&R facilities effectively. Follow LIS_07 standards for sharing data reliably. Collaborate with initiatives like the European Parking Association and NAPCORE to improve how parking data is handled. Plan out technologies to track passenger flow and occupancy and create a roadmap for future technology needs.

High-level recommendations for all UPPER cities and the UPPER workstreams on knowledge building and transferability

The following list summarizes the overall findings on requirements for successful MaaS development. The list is intended as a collection of aspects rather than a ranking and may be of different value to a city depending on its geography, the status quo of its infrastructure as well as culture and governance regime.

- Ensure data on type and status of pedestrian pathways are seamlessly integrated into MaaS platforms.
- Design any new infrastructure to be universally accessible, considering the needs of people with disabilities.
- Improve safety measures along pedestrian routes, including well-lit paths and clear signage.
- Enhance the quality and attractiveness of public spaces to encourage walking.
- Provide real-time updates on pedestrian routes, including information on disruptions and alternative paths.
- Incorporate pedestrian preferences and feedback into MaaS planning to improve user experience.
- Design user-friendly interfaces that cater to pedestrians of all ages and abilities.
- Ensure MaaS solutions prioritize pedestrian needs, such as shorter travel times and comfortable walking environments
- Seamlessly integrate cycling options with other modes of transport in MaaS.
- Provide safe cycling infrastructure, such as dedicated bike lanes and secure parking facilities.
- Enhance perceived safety with features like safe bike parking and the ability to take bikes on public transport.
- Ensure cycling options are accessible and inclusive for all users, including children and the elderly.
- Provide dynamic information on cycling routes and parking availability.
- Encourage cycling through MaaS by offering convenient and safe cycling routes.
- Implement incentives for cycling, such as financial support or tax benefits.
- Integrate public transport options seamlessly within MaaS to promote sustainable travel.
- Improve ticketing processes with options for group tickets and real-time information updates.
- Provide preferred payment methods and ensure accessibility for all users, including tourists.
- Ensure passenger safety and provide protection in case of disruptions.
- Design MaaS platforms to be user-friendly and accessible for all passengers, including those in rural areas.
- Safeguard passenger data while using it to enhance MaaS services.
- Ensure transparency in how user data is used and protected.

5. Measures preparation process

This chapter presents the work done for the measures' preparation in each demo site. First, for each measure, a brief description of its scope is given. More details regarding measures' description may be found in Deliverable 2.2 "Diagnosis of PT in living labs, measures refinement and expected impact" (UPPER, 2023). After this short description, all the work done for the measures' preparation by the responsible partners is thoroughly presented; surveys conducted, data collection, technical activities etc. are included. Then, challenges and mitigations for each measure are described; here any foreseen delays are also claimed and justified. Finally, the next steps towards measures' implementation are presented.

5.1. Valencia

5.1.1. VAL_05: New Multimodal Digital Mobility Services (MDMS) with a focus on accessibility and inclusion

5.1.1.1. Description of the measure and main outcomes expected

Valencia is working on a new MaaS solution (called "Ciudades Conectadas") in coordination with 5 other cities in Spain. This will be the first integrated MaaS application for Valencia. So far, the main functionalities have already been defined. However, under VAL_05 new features considering Mobility as a Right concept will be added. End users (PT users or potential PT users) will be involved in the definition of relevant new functionalities for the MaaS in order to cover the needs of certain users' groups with special needs (people with mobility issues, people with intellectual issues, Gender perspectives).

5.1.1.2. Preparation of the measure

1. **Sign agreement with the company responsible for the development:**

Although this step is out of the scope of the UPPER project, it is the pre-requirement to start working on the measure. The "Ciudades Conectadas" MaaS project was officially launched in January 2023. INDRA was the company awarded to develop such project.

2. **Definition of requirements and Use Cases**

During the first phases of the project, a number of requirements were identified, and specific use cases were defined for groups of people with special needs.

In terms of requirements:

- The traveller mobile application will serve as the travellers' search engine, providing a single access point to services and a valid digital identity for all associated travel services. It will be a comprehensive mobile system for travellers seeking the best user experience.
- User-Friendly Interface: With a 'Mobile First' design approach, our web and mobile applications will be 'responsive,' ensuring a consistent user experience across all devices: desktop computers, laptops, tablets, and smartphones. The layout and size of elements will adapt based on the screen resolution. We will provide

the best customer experience regardless of the means of access to the service, using User Experience methodology for the conceptualization of solutions.

- Accessible and Usable Interface: All web applications available to customers will be aligned with processes that define operations, user experience, accessibility, and consistent behaviours tailored to needs, providing the best user experience to the customer regardless of the technology.

In terms of Use Cases, a specific Use Case (Table 3) was defined for the use of the MaaS of a person with reduced mobility (RPM):

Table 3. Use case of the new MaaS feature considering users with reduced mobility.

USE CASE	
Set up the trip planner by establishing accessible route preferences for people with reduced mobility (PRM) by modes of transportation and route criteria.	
PRECONDITION	Customer registered in the mobile app
POSTCONDITION	The customer has planned the trip with PRM profile
DESCRIPTION	A registered customer wants to make their first trip through the platform, having activated the accessibility option for people with reduced mobility (PRM)
PROFILE Laura Guitérrez (Example)	
PRIMARY ACTOR	Customer App Mobile. PRM.
DESCRIPTION	A 43-year-old woman who works and lives in Gijón city. Digital new user.
HABITS AND BEHAVIOURS	Laura usually uses a private vehicle as a passenger to get to work. On days when she doesn't go by car, she prefers to use the bus instead of the metro due to its easy access at stops and for people with reduced mobility.

1. Laura accesses her profile and activates the accessibility option for people with reduces mobility (PRM) so that the trip planner considers it when composing the routes, taking into account the location of elevators, accessible itineraries for PRM, ramps, etc.
2. She selects that her preferences are to travel by bus and metro.
3. She indicates that her preferred route will be the fastest one.

CUSTOMIZABLE INFORMATION	
PRM	Activate optimal travel options for PRM mobility.

4. Laura checks the trip planner for possible routes from her home to work. The platform shows her the information for the desired trip as the first option, based on her preferences. In the suggested route, the planner selects a bus with a ramp for PRM access.

TYPE	**1ª trip**	**2ª trip**	**3ª trip**
+ faster (18 min)	(2 min)	(15 min)	(1 min)

The mobile app will be able to select any transportation modes that match the user's set preferences and also provide a route from A to B with a journey tailored to their characteristics or preferences.

5.1.1.3. Challenges & Mitigations

The development of this measure is closely linked to the progress of the MaaS 'Connected Cities' project. This has led to delays in the development of this measure, which is ahead of the initial plans.

Although the functionalities to be developed have been clarified, the consecutive development and integration of these functionalities into MaaS will not be ready until March 2025. After that, the MaaS application will be delivered for testing.

5.1.1.4. Next steps towards implementation

The next steps of this measure are to develop the defined functionalities and integrate them into the MaaS app. Once the integration is completed (March 2025), the application will undergo a testing period, until it is finally launched in its full version at the end of 2025.

5.2. Rome

5.2.1. ROM_06: Innovative features into the MDMS system according to the mobility patterns and needs of users' groups

5.2.1.1. Description of the measure and main outcomes expected

Within the measure ROM_06, Roma Capitale (RC) and Roma Servizi per la Mobilità (RSM) follow the steps for the implementation of the core system of the MaaS in Rome. This measure is connected to the ROM_07, which expects to upgrade the ITS infrastructure of the Mobility Agency RSM. The ROM_06 measure is linked and dependent on the National framework called "Mobility as a Service for Italy (Maas4Italy)", managed by the Ministry for Infrastructures and Transport (MIT) and the Department for Digital Transformation (DTD).

Rules and policies have been established to ensure a regulated environment, and interconnections with the regional platform (RAP – Regional Access Point) and the national platform (NAP – National Access Point) have expanded the range of transport options. The goal is to offer accessible and convenient mobility services for residents, commuters, and tourists in Rome.

An open platform called "Data Sharing & Service Repository for MaaS" (DSRM) was developed in the framework of the MaaS for Italy project to ensure the sharing of standardised mobility data and interoperability between Local Authorities, Transport Operators and MaaS Operators.

The measure delivered the following outputs:

- Involvement of at least 1.000 users for the first phase trial (initially at national level the expectation was to have 10.000 nation-wide, therefore 1.000 was considered a good target for the first phase in Rome);
- Identification of the MaaS Operators providing the apps to be used for the trial;
- Definition and creation of the MaaS Integration Platform of Roma Capitale (that fulfils the role of RAP – Regional Access Point for the Lazio Region);
- Integration of standardized data from the Transport Operators with the NAP and DSRM.

5.2.1.2. Preparation of the measure

The preparatory phases of the Rome pilot for the MaaS4Italy project followed a structured path that can be divided into several key steps.

1. **Creation of the local governance:**

Roma Capitale has the role of "policy maker" to approve and enable the incentive schemes for citizens; to safeguard citizens' needs and set guidelines for social inclusion; and to support the principles of fair competition delivered by all mobility operators.

RSM has been appointed as the territorial MaaS Integrator and RAP, responsible for the technological infrastructure and transport data management, to coordinate the technical integration and standardization of data from Transport Operators (e.g., LPT, Sharing Mobility operators) towards the NAP and DSRM and to analyse the data on users' habits and satisfaction levels.

2. **Involvement of Transport and MaaS Operators:**

Roma Capitale launched a call for expressions of interest and 13 private MaaS Operators in addition to ATAC (the main PTO in Rome) have been selected. Out of the 13 private operators, 8 participated in the MaaS4Italy trial due to technical feasibility. Moreover, collaboration agreements for the MaaS initiative were signed between RSM and 18 mobility operators.

3. **Data collection and standardization:**

RSM set up the common database (RAP – Regional Access Point) populated with data provided by LPT, sharing mobility etc).

The RAP collects updated data regarding:

- 3 public transport operators (2 local and 1 regional); in the future also the data from Trenitalia will be available;
- 8 sharing mobility operators (electric scooters, cars, bicycles, motor scooters);
- 2 taxi operators.

Data are provided by public transport operators in GTFS (static data standard) and GTFS-RT (dynamic data standard) and in GBFS (dynamic data standard) by sharing mobility operators; then static data are converted to NeTEx L1 and L2 standard and sent to the NAP. Following the brand-new Italian indications for data standardisation, NeTEx L3 and L4 and SIRI data conversion will be made available soon on the RAP. Data are stored on a dedicated PostgreSQL database, part of RSM Platform's Data Lake.

4. **MaaS for Italy apps trial – functionalities:**

- Integrated apps provided by MaaS Operators for all citizen transportation needs;
- Integrated multimodal travel planner that showcases the best travel options based on client's preferences;
- Real time information regarding the arrival times of public transport vehicles and the position and status of shared mobility vehicles;
- In-app payment for the planned trip and the option to purchase transportation services in bundles.

5. **Users' engagement for the trial:**

The following activities have been carried out to engage citizens in participating in the MaaS4Italy trial:

- publishing the registration survey on RSM's website, while ensuring GDPR compliance in data collection;
- contacting approximately 12,000 users part of RSM's database;
- informing 389 Mobility Managers via e-mail about the MaaS4Italy pilot and inviting them to promote the participation among their colleagues;
- contacting the main Italian hospitality association, Federalberghi, to ensure higher reach of tourists;
- 1570 users have registered their candidacy and have been selected for the trial.

These preparatory phases helped setting up a solid base for the first trial in Rome (July 1st - November 30th, 2023), involving various stakeholders and ensuring that the technological infrastructure and human resources were ready to support the trial of the MaaS4Italy project.

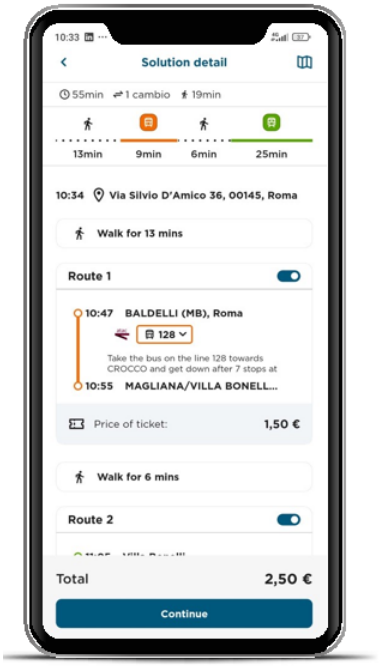

Figure 2. One of the MaaS Operator travel planner app.

The MaaS trial in Rome (July - November 2023) involved citizens and local transport operators. The trial involved the use of single apps for planning, booking, and paying for journey(s), with the aim of improving the efficiency and sustainability of urban transport. The Capitoline Council (policy maker) defined the governance of the system, with RSM as MaaS Integrator, responsible for the technological infrastructure and transport data management.

6. **Incentives for citizens :**

Incentives were offered (Table 4) to encourage the use of MaaS services during the trial period, according to the following table. These incentives were intended to stimulate adoption and gather useful feedback to improve the system.

Table 4. Incentives scheme for MaaS trial in Rome.

Incentive types	Method of access	Value
Cashback	MaaS trip involving 2 means of transport	30% of the travel cost
Cashback	MaaS trip involving 3 or more means of transport	40% of the travel cost
No incentives	Trip involving only 1 mean of transport	0 €

During the last month of the trial, an enhancement to the incentives scheme was adopted: MaaS trip + evaluation of the travel experience = 50% cashback. RSM supervised the process, issued, and managed the incentives and handled the communication activities.

The trial phase in Rome ended on 30 November 2023. About 1,500 citizens participated in the trial of the MaaS4Italy project in Rome. This project allowed users to plan and book trips combining various means of transport, such as buses, taxis, and shared mobility services. Participants benefited from incentives, including a 50% cashback on the cost of trips purchased through MaaS Operators' apps, up to a maximum of 50 euros.

Regarding the Maas4Italy intervention in the year 2024, plans have been outlined for the future, to be included in the proposal for the continuation of the MaaS initiative. These include the strategy to involve a larger audience by making the use of the service more efficient and ensuring further promotional activities.

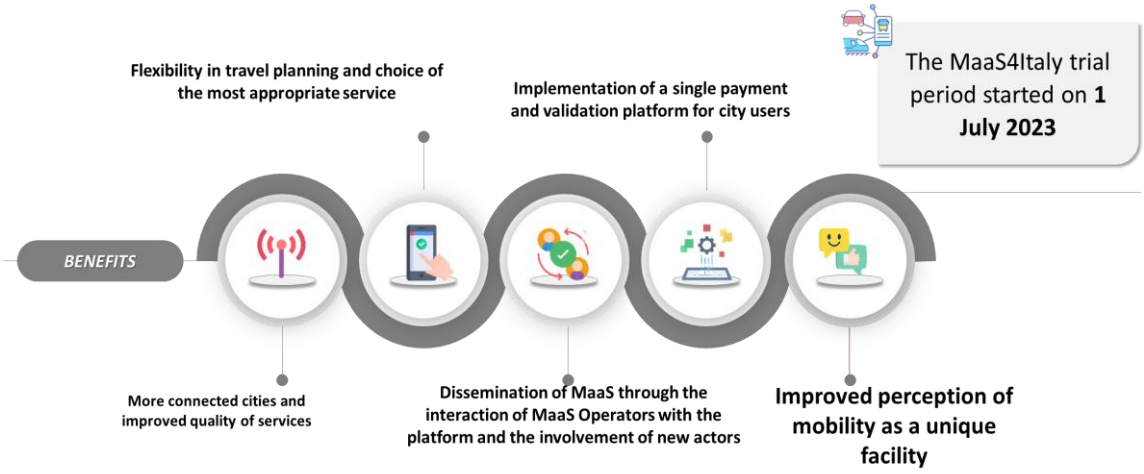

Figure 3. Features of the 1st MaaS trial in Rome.

Figure 4. Status of the measure as of November 30, 2023.

5.2.1.3. Challenges & Mitigations

The MaaS4Italy trial in Rome encountered several challenges that can be divided into three main categories: technological, operational, and socio-cultural.

1. **Technological challenges:**

- Platform integration: A significant problem was the integration of the different digital platforms used by the various transport operators. The need for a unified infrastructure for data sharing and interoperability between different transport systems has been a complex challenge.
- Data security: Protecting sensitive user data and ensuring privacy were crucial issues. Implementing adequate security systems to prevent breaches and ensure user trust was a challenging task.

2. **Operational challenges:**

- Coordination between transport operators: Coordinating activities between various public and private transport operators has been complicated, especially in ensuring that all follow uniform standards and adopt compatible technologies.
- Incentive management: Implementing and managing user incentives, such as cashback, required careful management of resources and transactions, as well as ensuring the transparency and efficiency of the process.

3. **Socio-cultural challenges:**

- User adoption: Convincing citizens to change their mobility habits and adopt new digital tools to plan and pay for their trips required a great deal of educational and promotional effort. Resistance to change from citizens accustomed to using the private car.

- Accessibility and inclusiveness: Ensuring that the MaaS system is accessible to all segments of the population, including the elderly and people with disabilities, was essential to the success of the trial. Ensuring that digital solutions are user-friendly for all was a critical but difficult objective to achieve.

5.2.1.4. Next steps towards implementation

RC and RSM have drawn up a proposal to continue the experimental phase of MaaS to the national authority managing MaaS for Italy, with a series of initiatives to improve the quality of the service:

- New types of structured and differentiated incentives for different types of users (LPT subscribers with a particular focus on regional commute, participants at events, etc.);
- Active involvement of corporate and university Mobility Managers to facilitate the creation of a Corporate MaaS solution;
- Initiatives aimed at intercepting the travel demand of tourists and participants in major events organised in the city of Rome;
- The use of data made available by Trenitalia that will be sent to the Maas Integration Platform.

This proposal for a second phase of experimentation was incorporated within the new draft of the Operational Plan that RSM, on 30 May 2024, submitted to the Department for Digital Transformation of the Presidency of the Council of Ministers for the relevant assessments.

The expected activities, originally planned in September 2024, are:

- Further development of the available services;
- Integration of all the PT operators on the platform.

These steps will be outlined more precisely after September 2024, following the decision on the proposal submitted to the National decision Bodies, as the MaaS in Rome must be integrated nationwide and more agreements with operators are in the pipeline.

5.3. Versailles Grand Parc – Île de France

5.3.1. IDF_04: Added-value services in multimodal nodes to integrate active modes with PT

5.3.1.1. Description of the measure and main outcomes expected

The measure consists in strengthening the visibility of new micro-mobility services and encouraging the use of active modes such as walking and biking. Stations for bike and e-scooters rental in strategic points of the territory such as train stations, around main bus lines and residential districts, will be integrated in the MaaS application and promoted as alternative for the first and last mile. To this end, this alternative mobility service will be integrated in the MaaS

application developed by Instant System, which will bring more consistency in the comprehension of the sustainable mobility offer for the users, more visibility to the service, and will facilitate its use and bring more users.

5.3.1.2. Preparation of the measure

1. **Agreement with Ile de France Mobilités (IDFM)**

A Proof of Concept (POC) of the feature to be implemented in Ile de France Mobilités (IDFM) app has been developed and presented to the regional Public Transport authority, IDFM. To date no formal agreement has been reached due to their lack of capacity to dedicate to the project. Most of the developments to be achieved in this measure depends on the approval and engagement of IDFM. The discussions should start again after the Olympic and Paralympic Games (OPG) period, consequently, the majority of the technical developments will be undertaken in 2025.

2. **Agreement with micro-mobility providers**

Commercial discussions with TIER for a full MaaS integration are currently ongoing. TIER is the mobility service provider (MSP) providing the kick-scooter sharing service in Versailles Grand Parc, as well as shared bikes in Paris. The commercial discussions aim at setting the terms of the commercial relations between TIER and Instant System, as Instant System will become distributor of the TIER service through their MSP Marketplace. It means that not only the real-time information of the available scooters, but also the booking, payment, and after-sale service, will be operated through the Instant System's Market Place platform. Since the company merged with DOTT, another MSP, at the beginning of 2024, the discussions are still at preliminary stage, regular meetings and e-mail exchanges took place, but no formal outcome has been reached until now.

The development of the MSP Marketplace has started, to be ready for the future integration of TIER. This involves the development of a new network and a specific architecture, which will be able to be deployed in any MaaS application (ongoing).

Instant System has begun to develop a Marketplace integrating various mobility services and enabling real-time data to be collected on the location of vehicles and their autonomy (free-floating bicycles and scooters), availability (places available in a car-sharing service, etc.) and the number of vehicles on the road. They can also be used to reserve, pay for and unlock a scooter or bike, or activate a shared car. These mobility services enhance the interactive map, route search and mobility use patterns. The Marketplace is designed to supply host applications (such as IDFM) with integrated mobility services.

The Instant System team is developing the Marketplace in the form of a Software Development Kit (SDK). The Marketplace SDK breaks down into a Data module and a UI (User Interface) module:

- The Data module is used to return data in a well-defined format. It is used when information from the Marketplace needs to be integrated with data from the host application. For example, the display of current bookings can combine Emy bookings and native bookings.
- The UI module enables full screen display. This module retrieves data from the Data module and builds the UI on top of it.

In Figure 5 below are presented a few mock-ups of the integration of the Marketplace SDK into the Ile-de-France Mobilités application, also developed by Instant System. In yellow and red are illustrated the new functionalities with are not yet developed (POC).

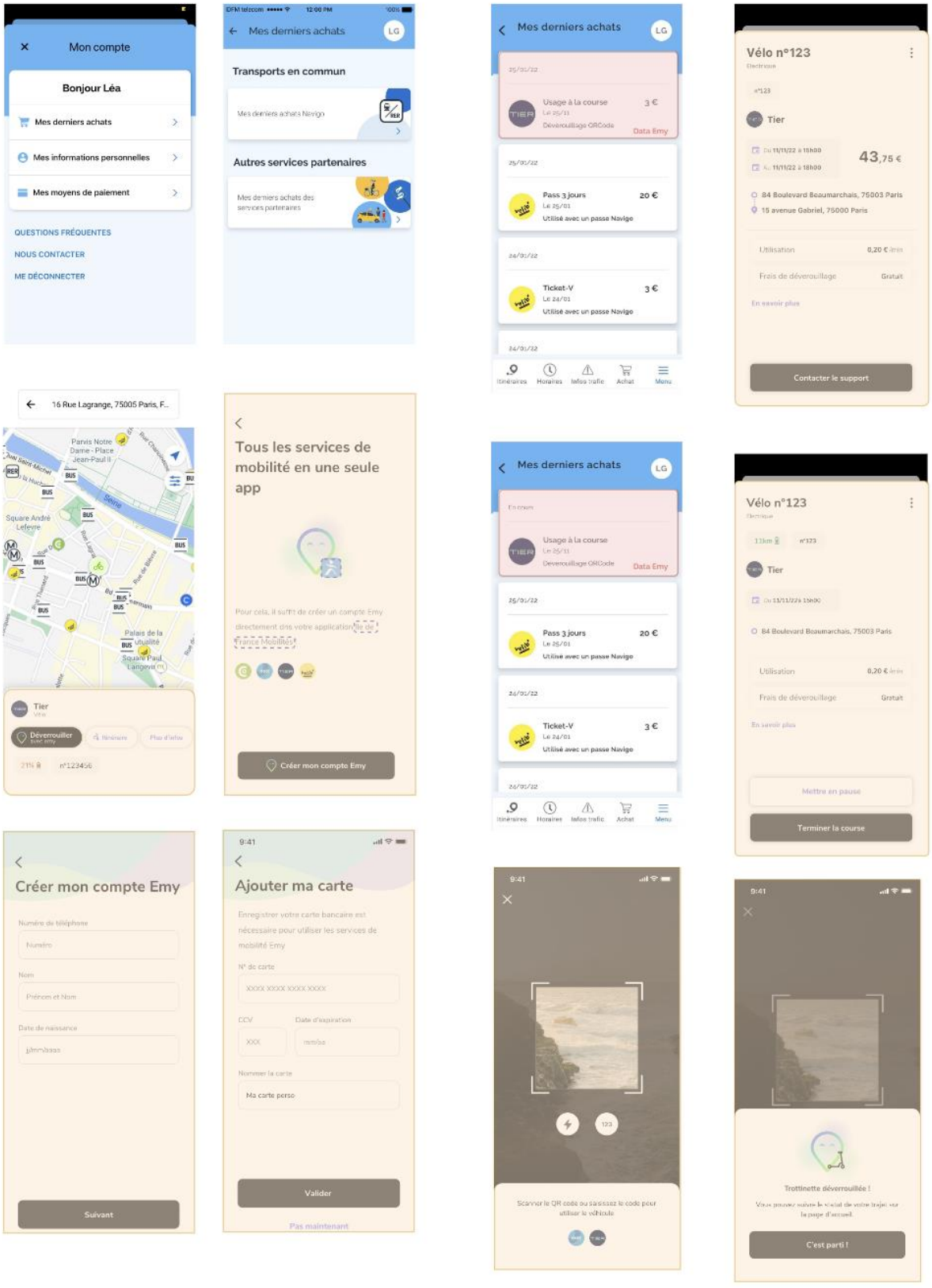

Figure 5. Mock-ups of the integration of the Marketplace SDK into the Ile-de-France Mobilités application.

5.3.1.3. Challenges & Mitigations

The major challenge is linked to the timeframe of the measure implementation, which is exactly during the Olympic and Paralympic Games in Paris, involving the PTA Ile de France Mobilités' teams at 100% of their capacities. The majority of the developments to be achieved in this measure depends on the approval and engagement of IDFM. The discussions should start again after the OPG period, from September 2024. Consequently, the majority of the technical development will be undertaken in 2025.

As mitigation measure, IS already presented a POC to IDFM, with a timeline implying the involvement of IDFM after the end of the OPG. A formal agreement is still to be reached as already mentioned in section 5.3.1.2. In Figure 6 below is the extract of the sent proposal with the proposed timeline, taking in consideration the OPG.

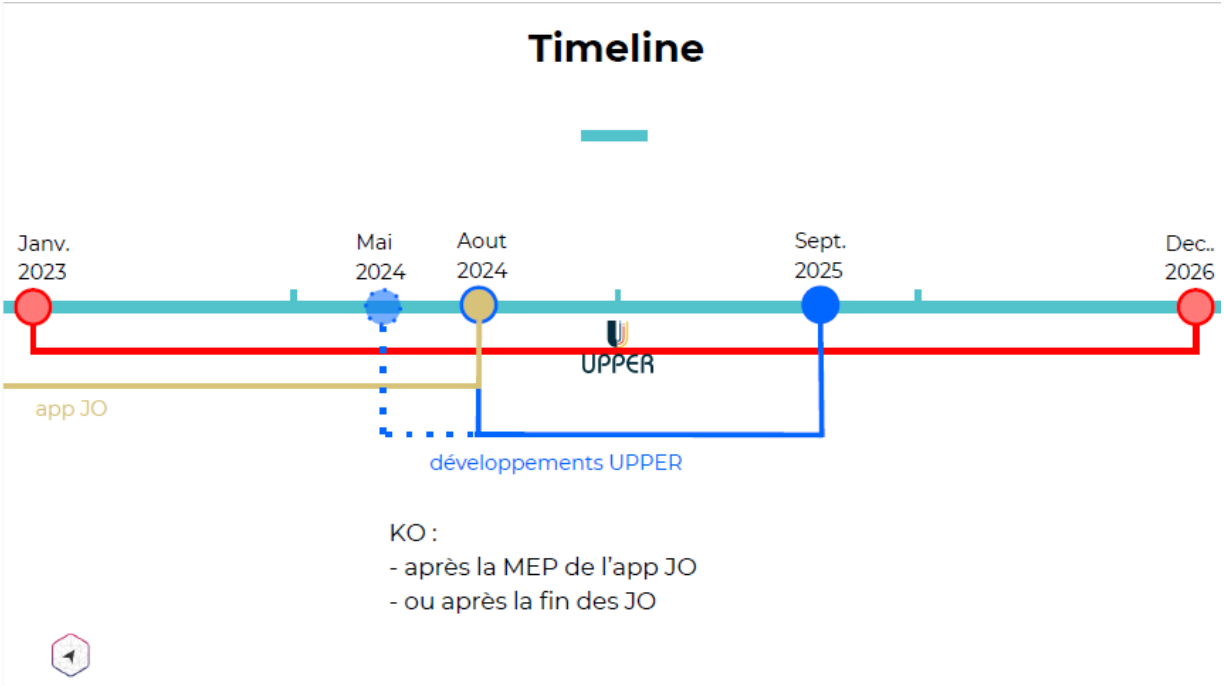

Figure 6. Timeline proposed to IDFM.

5.3.1.4. Next steps towards implementation

1. **Data collection (assets)**

Not started. Collection of the data source (API) for real-time passenger information, booking and payment. Data analysis.

2. **Definition of technical requirements**

Not started. Definition of the technical requirements for the development of the MSP Marketplace feature, and its integration into IDFM app.

3. **Development of new features of IDFM**

The development of the MSP Marketplace has started, to be ready for the future integration of TIER. This involves the development of a new network and a specific architecture, which will be able to be deployed in any MaaS application (ongoing). This step also involves the integration of TIER from information to payment (level3) (not started).

4. **Integration of new features of IDFM**

The integration of the MSP Marketplace into IDFM has not yet started. See part 4.3.1.2 for the description of the feature to be integrated.

5. **Testing of the upgraded IDFM**

Not started. Testing phase by beta-testers in the “IDFM lab” version.

5.3.2. IDF_05: Promote the use of the PT service by visitors in large events

5.3.2.1. Description of the measure and main outcomes expected

This measure aims at promoting active mobility trips during the Olympic Games. The main objective of this measure is to help cities involved in the Olympic games to regulate the traffic and ease the transfer of participants from/to events locations. To that aim, the major purpose will be to experiment a dedicated MaaS application offering a multimodal journey planner with PT and other active modes, as well as accessibility services.

5.3.2.2. Preparation of the measure

1. **Definition of the area and the use cases**

The area of the experimentation analysis has been defined; the study will focus on the access to the OG sites in the area of Versailles Grand Parc. The aim will be to assess the added value of an app dedicated to major events, for the implementation of the specific mobility strategy deployed by the PTAs and the municipalities, to ensure safety and prevent congestions.

Versailles Grand Parc will host several trials, in one major site: the Château de Versailles. The site is huge and has several entrees depending on the trials, which are:

- Equine trials (27/07-06/08)
- Pentathlon (08-11/08)

VGP will also be impacted by the trials happening in Saint Quentin en Yvelynes, where two OG site are located; the Velodrome, and the BMX stadium, whose trials will generate traffic in VGP. The road cycling circuit will even cross the whole territory of VPG.

What’s more, some trials happening at the Parc Des Prince in Paris are ending at the same time than trials in VGP on specific days, which risks generating massive affluence in specific metro stations when the visitors will be transiting after the trials.

Given these above listed trials, critical PT sites that have been identified for the analysis are shown in Table 5 below:

Table 5. Critical PT sites identified for the analysis.

Critical stops	Days
Saint-Cyr station (trials in Château de Versailles)	27/07-06/08 and 08-11/08
Metro Javel	30/07, 2,3 and 10/08 (same-time ending trials in Parc Des Princes)

2. **Definition of the indicators to monitor**

A list of indicators for the assessment, specific to the assessment needs of VGP, has been identified. Indicators will be measured on IS side for what regards the use of the application, and VGP will collect indicators for a cross-analysis, such as pedestrian counting stations in critical sites, and at OPG Navettes.

On the app side, the goal will be to measure:

- The successful use of the app,
- The role of the app in regulating the affluence in critical lines/stops by proposing alternative itineraries,
- The role of the app in anticipating the traffic flows and the affluence in specific sites.

The indicators list must be validated by IDFM before starting data collection.

3. **Development of the digital services (app)**

Transport Public Paris 2024 – the application for the visitors to the OPG

The application Transport Public Paris2024 has been developed and launched in April 2024. Like the IDFM app, it consists in a journey planner integrating all PT modes in Paris and Ile de France, the Velib (Public bike sharing), theoretic and real-time passenger information and disruptions, and the e-boutique for the purchase and validation of the transport tickets in IDF (Top-up reload, and NFC validation, with the possibility to store the M-ticket on several device (watch…)). What's more, the Paris 2024 app includes specific M-tickets for the OPG event (Paris2024 day passes), and specific features to help cities ensure safe travels during the event. Thus, the algorithm's mission is to share visitor flows to avoid saturation of certain lines or to adapt routes based on possible incidents. Below are described the main features of the Transport Public Paris 2024 app.

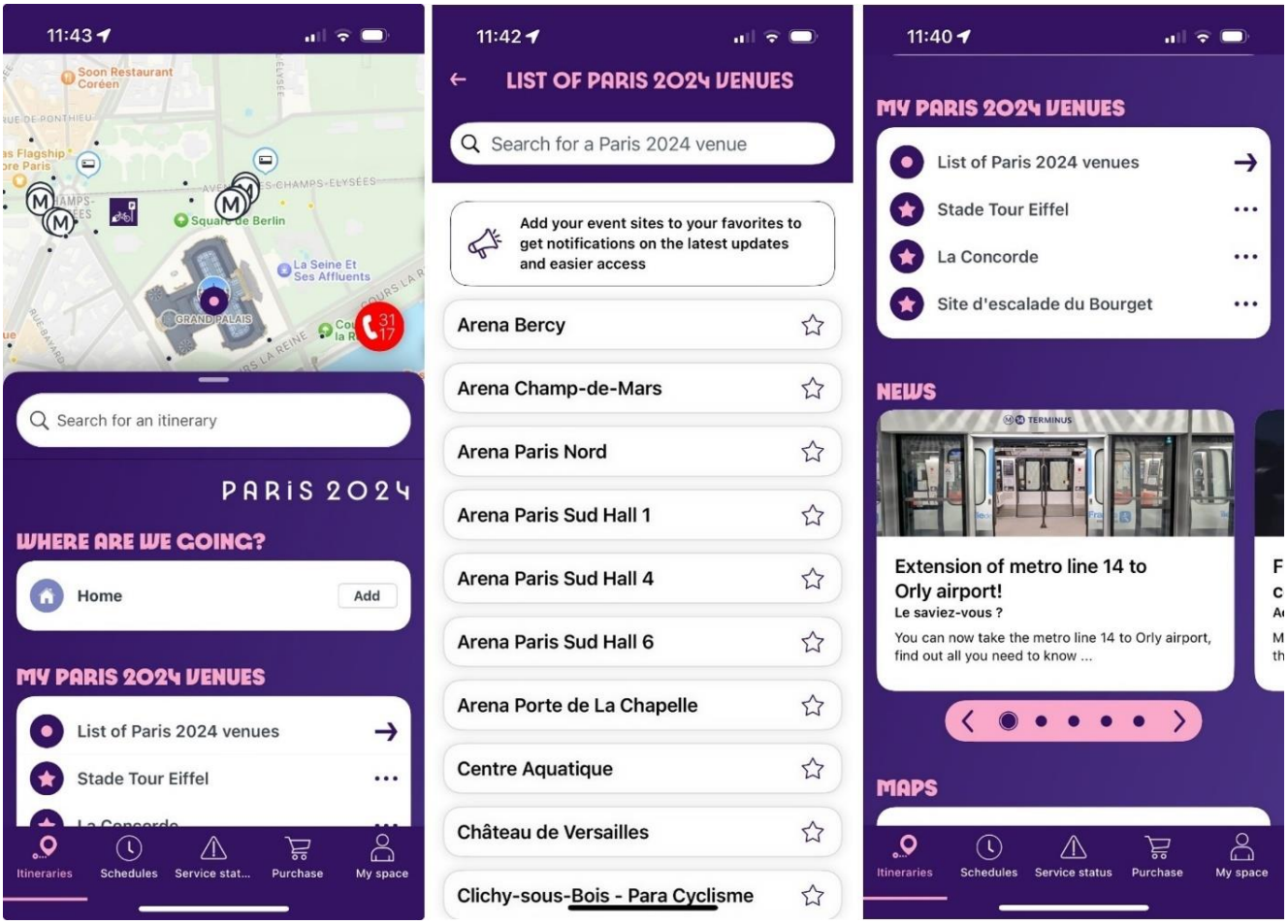

Figure 7. User interface of the Transport Public Paris2024 application.

The home page (Itineraries section) includes:

- the interactive map with PT and Points of Interest (POI) related to the OPG,
- a journey planner,
- the Favourites section “My Paris 2024 Venues” allowing personalisation through the selection of OPJ Paris 2024 venues,
- a news section,
- the network maps.

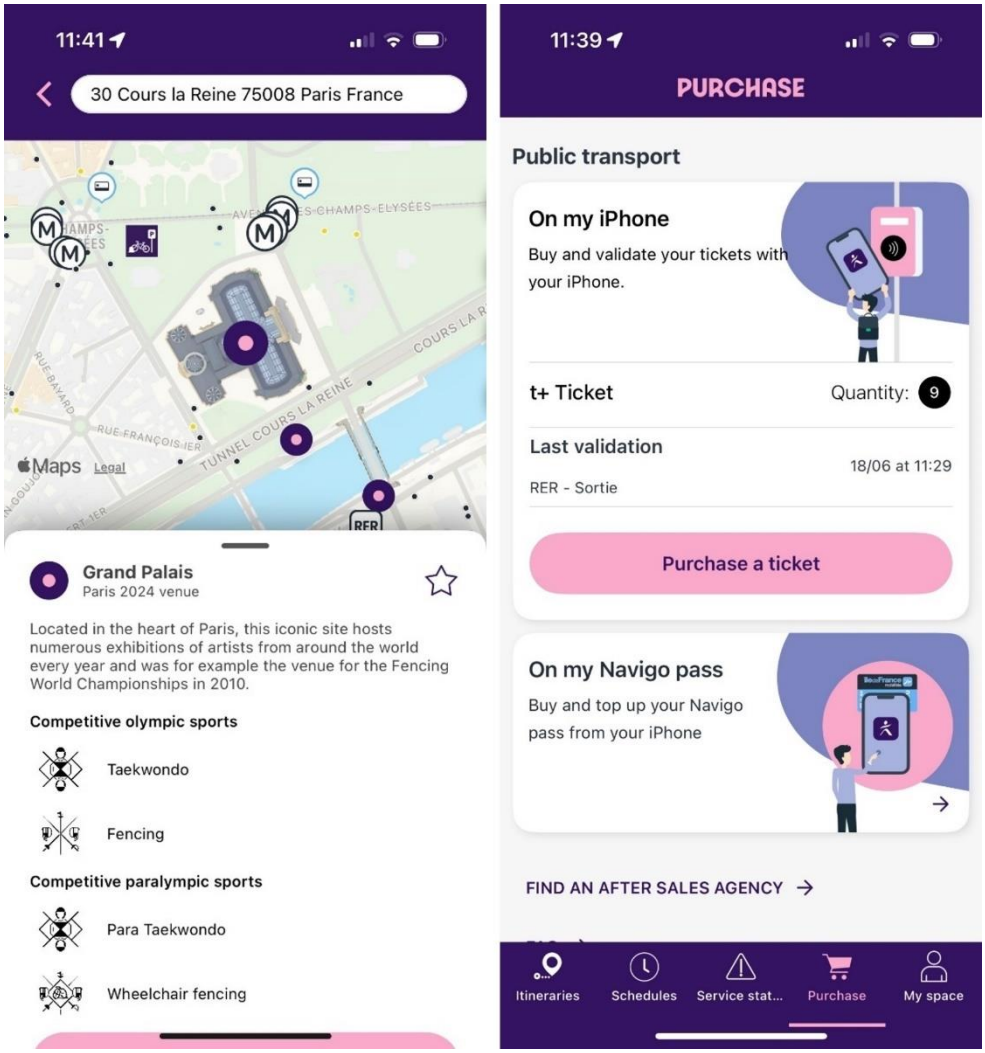

Figure 8. Interactive map and Purchase page in the app.

The interactive map shows the OPG venues and POI “around me”, as well as the PT stops and tickets selling points. The points of interest include touristic information and specific information about the sports competing in these places, as well as redirecting links to external related content.

The Purchase section allows to buy PT tickets: the IDF t+ transport ticket and specific Paris2024 tickets, can be bought directly in the app, whether stored and validated with the NFC technology (both on android and iOS devices) or via top-up loading on the physical Navigo card.

Identified improvement of accessibility for visual impaired

Context

Ile de France Mobilités takes measures for visually impaired users in order to facilitate them the access to the public transport on the whole network. In this sense, they require specific assistance in the MaaS app for this population. Thus they conducted an innovative experimentation by integrating Ezymob's SDK IV, providing specific guidance to visual impaired people in the metro, through vibration of the smartphone indicating the right direction, when the metro door is open or when a seat is empty. In parallel to this experimentation, Instant System conducted a study for IDFM to identify complementary improvements for the general accessibility of the apps to visually impaired people.

Outcome

Below are listed the identified developments to improve in-app visually impaired accessibility:

- Improvement of the guidance for all transport modes (adjustment of the alerts to the right trip steps thanks to GPS positions ; use of the guidance without network),
- Improvement of vocalisation, to enable the reading of all PT lines by the device talkback/voiceover.
- Addition of a vocalisation in-app, via a button reading the main trips steps only (next station and imminent arrival).
- Follow up of the trip steps and push notifications when the app is in background (with talkback/voiceover reading optimisation).

These developments have not been prioritised by IDFM for the moment, the priority being given to the preparation and running of the applications during the Olympic Games, although they are still in the backlog for the improvement of the main IDFM app.

4. **Testing**

The testing phase has started, since the Transport Public Paris 2024 app is publicly released on the playstore and apple store. However, the major timeline for the testing will be from 26 July until 8 September, during the OPG, for the collection of significant indicators.

5.3.2.3. Challenges & Mitigations

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

5.3.2.4. Next steps towards implementation

The analysis conducted thanks to this experimentation will enable to draw feedbacks and lessons learnt as regards the use of a dedicated MaaS app for big events, in terms of PT promotion towards punctual visitors, safety and regulation of affluence, and implementation tool of specific mobility plans in this sense. The outcomes of this measure will feed the U-KNOW tool and serve as best practice tool for the replication by PTAs, PTOs, or event organisers, in the frame of other major event, may it be sport events or music festivals. In the frame of UPPER other cities deployed actions with specific mobility plans for major events, such as Rome for Sport events[2], and Lisbon for music festivals[3], and best practice sharing will feed knowledge in this regard.

[2] https://www.upperprojecteu.eu/event/when-in-rome-lifting-the-pressure-that-sports-games-place-on-cities-is-both-possible-and-mandatory/

[3] https://www.upperprojecteu.eu/news/public-transport-rocks-in-lisbon/

5.4. Mannheim

5.4.1. MAN_05: Modernize and increase the attractiveness of digital sales channels and private sector partnerships

5.4.1.1. Description of the measure and main outcomes expected

The measure involves the upgrade of Rhein-Neckar-Verkehr's (rnv) sales, billing, and accounting systems to support the nationwide €49 monthly public transport ticket (Deutschlandticket, D-Ticket) based on the VDV-KA standard. This upgrade will ensure interoperability, secure digital ticket inspection, and facilitate the transition from conventional to digital ticketing. The main expected results are the implementation of an Electronic Fare Management (EFM) module compatible with the VDV-KA standard and an increase in the share of digital monthly and annual tickets compared to conventional tickets.

5.4.1.2. Preparation of the measure

RNV has taken thorough processes to successfully implement the D-Ticket as an e-ticket. By digitizing and integrating the system on a centralized platform and introducing standardized barcodes readable across all devices, passengers can now enjoy seamless, flexible access to public transportation in the region and throughout Germany.

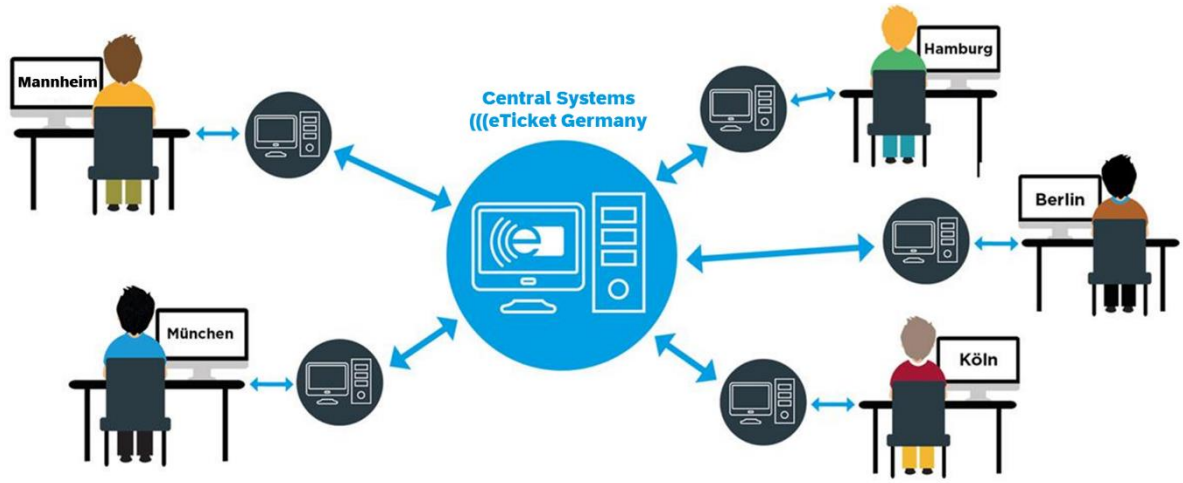

Figure 9. Scheme of centralized D-Ticket platform in accordance with VDV-KA standard[4].

The preparation of the measure involved a series of steps, each of which contributed to the seamless implementation of the upgraded D-Ticket sales, billing, and accounting systems.

Firstly, a comprehensive analysis of the existing business processes was carried out to identify areas for improvement or adaption along the system upgrade. At the same time, market research was conducted to identify available technical solutions that could meet the VDV-KA system requirements as well as integrate successfully with rnv's existing sales and ticketing IT-systems. Key results showed that there are several companies on the market, that offer sales and aftersales software solutions feasible for the German PT-industry. All companies offer implementations

[4] Source: Own illustration based on VDV eTicket Service GmbH & Co. KG https://www.vdv.de/der-weg-zur-einheitlichen-fahrkarte-eticket.aspx

in accordance with VDV-KA standard. The limiting factor found during market research, was the level of compatibility with systems in place. Even though the EFM-module is a very important component in PT-ticketing, there are a variety of subsystems and parallel systems that need to interact. Those include especially all sales systems, ranging from mobile printers in busses to vending machines at stops to digital channels like apps and the online store. This groundwork was essential to ensure that the chosen solutions could be integrated seamlessly and without disruption.

Based on the results of the market research, the procurement specifications including technical requirements regarding compatibility were detailed out. The specifications were refined and validated through stakeholder consultation, which promoted consensus on the system requirements and specifications. After the requirements were in place, data collection was undertaken from the existing sales, billing, and settlement systems.

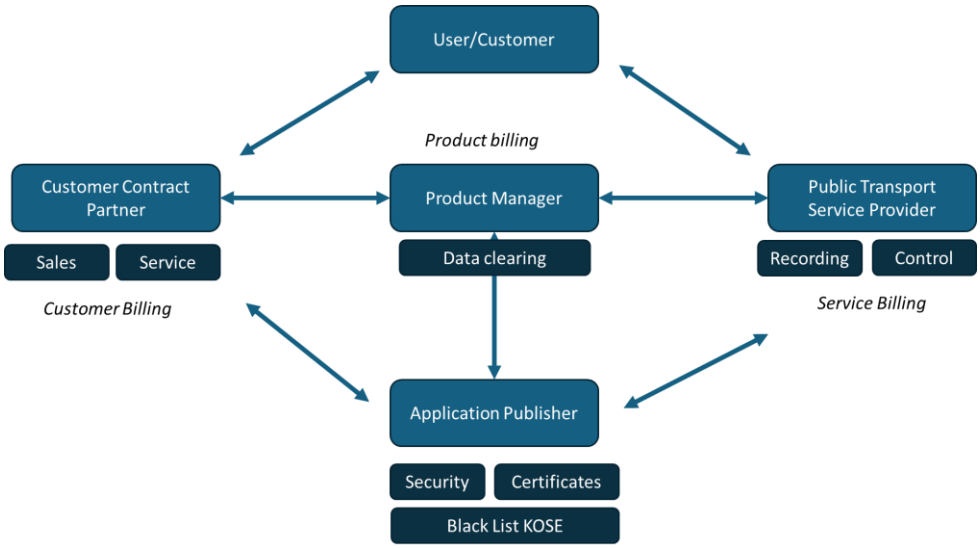

Figure 10. Scheme of roles & functions in line with the VDV-KA standard[5].

The new Electronic Fare Management system, according to VDV-KA standards, features multiple processes, that not only have to be in-line with the standard, but on technical level need to ensure the integrity and security of the (personal) data processed:

- Issuing Chip Cards: Load necessary security keys, and issue tickets that can be used multiple times.
- Issuing Barcodes: Provide barcodes on paper or through an app, valid for one month.
- Controlling Chip Cards: Authenticate tickets with security modules, with detailed checks starting in 2026.
- Controlling Barcodes: Verify tickets by comparing passenger data with ID documents to prevent misuse.

[5] Source: Own illustration based on VDV eTicket Service GmbH & Co. KG https://www.eticket-deutschland.de/magazin/das-rollenmodell-beim-elektronischen-fahrgeldmanagement/

Figure 11. Chip Card and barcode.

With the requirements clearly defined, the procurement process began. The goal was to find the best supplier to provide the software solution, complete necessary adjustments and to support the implementation and successful migration at rnv.

Hence, rnv was able to implement the technical and operational processes relating to the issuing of authorizations on chip cards, static barcodes, and their verification for the D-Ticket. Therefore, processes comply with the requirements of the VDV-KA. This included adjustments to our sales background system and our digital applications „Abo-Online“ and „Handy-Ticket“. Those adjustments now allow rnv to provide VDV-KA QR-codes as a ticket, enabling rnv's ticket inspectors to verify the validity of a ticket instantly, no matter where the ticket was originally sold.

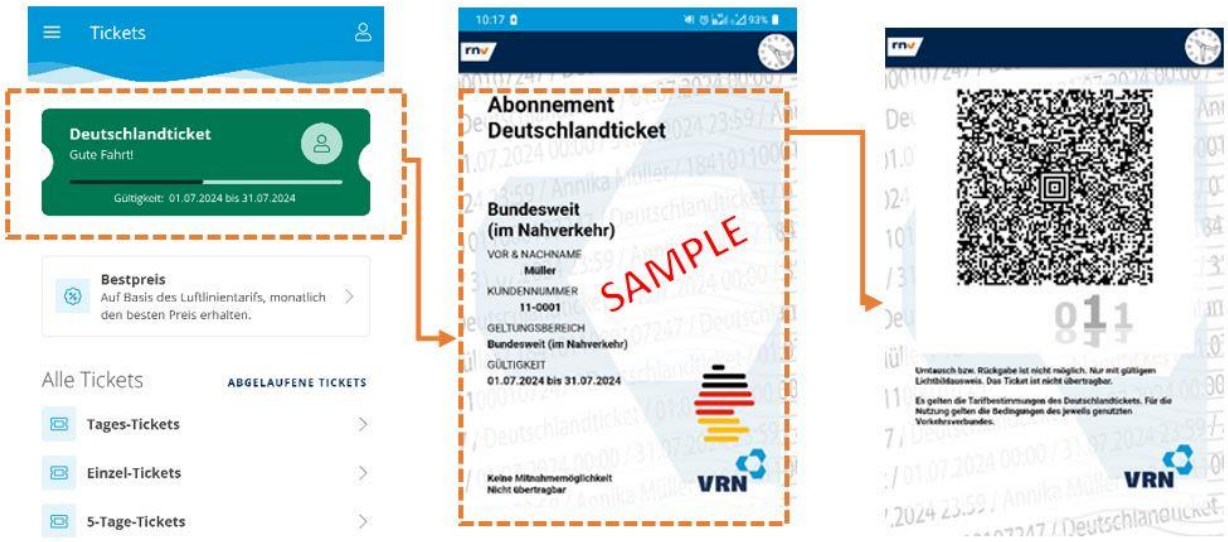

Figure 12. Screenshots of the rnv/ VRN app ticket view with the CDC-KA conform QR-code.

To also technically enable rnv's ticket inspectors, the verification system also had to be upgraded to be able to read and interpret VDV-KA QR-codes. This includes checking the validity of the ticket itself through verifying the certificate contained as well as checking the available blacklist for blocked/ stolen tickets. This process can now be concluded within seconds during ticket inspections. Technically this is implemented through a barcode scanner for tickets in the app as well as an NFC reader for tickets on chip cards. In order to give out those standardized chip cards, rnv also procured so-called Reader/Writer Devices that can issue and store these authorizations to the chip card at the point of sale.

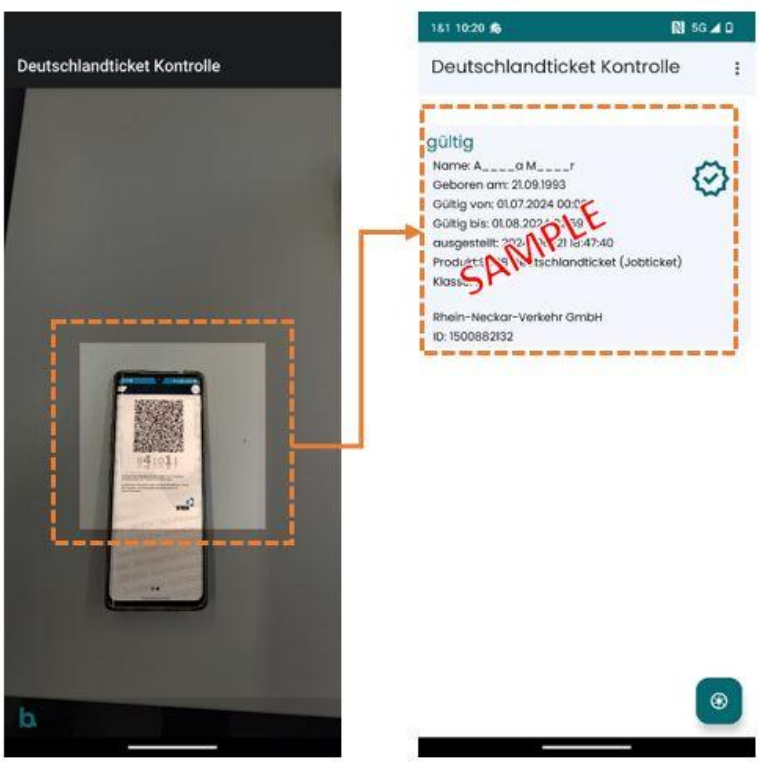

Figure 13. Screenshots of the ticket inspection view of a valid VDV-KA conform QR-code ticket.

The new EFM module was integrated in the existing sales, billing, and settlement systems, while maintaining the highest level of data confidentiality. Central aspects of the implementation, including the issuing of VDV-KA conform tickets as chip cards & barcodes, are already operational.

5.4.1.3. Challenges & Mitigations

There have been only minor challenges during the preparation of this measure. With the goal clearly set by the introduction of the D-Ticket as well as with a standardized technology based on the VDV-KA, no larger challenges regarding content of this measure occurred. However, fluctuation in staff at rnv as well as lengthy procurement procedures resulted in some delays. The delays in an early phase of the preparation were mitigated through bringing on additional staff to support colleagues in the development and testing of the IT-solution. Hence the overall project is still within the timeline.

One other aspect that arose during implementation, was the rising numbers of fraud connected to the D-Ticket. While cases of fraud based on the current lack of (technical) design consistency will be avoided through the EFM-module, with its nationwide validity and millions of users, there will always be cases of fraud. Therefore, additional defensive measures outlined by the VDV as standard organization had to be considered even when the implementation was already ongoing.

5.4.1.4. Next steps towards implementation

The implementation of the systems´ upgrades and enhancements so far were a success. The implementation of the secure digital ticket verification is currently being tested to ensure reliable functionality as well as interoperability. This last step will bring the project to a successful conclusion and pave the way for a fully digital, interoperable, and secure ticketing system. After all steps are finalized, the measure preparation is finalized, and the new functionality will be

taken into operation across all sales channels. From 2025 onwards, all monthly and yearly tickets issued by rnv will be VDV-KA conform and fully compatible across Germany.

Figure 14. News article on 50.000 yearly pass passengers migrating from analogue to digital ticketing.

First insights from sales show the potential of this measure. The updated digital sales channels are already used by an additional 50,000 passengers (Figure 14). Among other things, customers can order the D-Ticket via rnv's "Abo-Online" web platform and have it displayed digitally in the rnv/VRN mobile ticket app. The proportion of mobile ticket subscriptions increased to currently 20% and is expected to grow significantly more over the coming years.

5.5. Lisbon

5.5.1. LIS_07: To create a new Multimodal Digital Mobility Services (MDMS)

5.5.1.1. Description of the measure and main outcomes expected

Transportes Metropolitanos de Lisboa (TML) has been studying the global state of the art of a MaaS/MDMS platform in general, and its application in the Lisbon metropolitan area. Under this measure, developments were envisaged with implementation carried out in different stages, aiming at the integration and unification of the different transport services on a single platform, offering simpler access to mobility, with real-time passenger information and access to different integrated mobility services, both existing as well as those to be developed.

Currently, there are some MaaS platforms in use, belonging to different companies, but with very limited functionalities, serving only to provide information about their transport services or to load passes for transport network users.

TML, as the authority responsible for managing the ticketing system in the Lisbon metropolitan area, intends to develop a comprehensive MaaS service that will serve all transport users in an integrated and metropolitan way. This service will promote simpler and more agile access to mobility, contributing to greater adoption of public transport, a significant increase in demand and decarbonization of cities, with the consequent reduction of emissions through the adoption of more sustainable mobility to the detriment of individual transport.

5.5.1.2. Preparation of the measure

TML designed a MaaS platform of a metropolitan nature, with the official brand of the navigation system®, a system where all transport operators operating in the 18 municipalities of the Lisbon metropolitan area cooperate. The platform consists of a mobile application, available for Android and iOS, for information and consumption of mobility services that incorporate the following features:

a. Customer Registration and Authentication.

b. Reserved area:

   i. User Account.

   ii. Online Ticket Office.

   iii. Interactions.

c. Transport Network and Services.

d. Ticketing System.

e. Online Counter.

f. Auto News and Fines Management.

g. Online Surveys.

h. Travel Planner.

i. Visitor/Tourist.

j. TML Services.

k. Institutional Information.

l. Other Features.

The Mobile Application is intended to run on smartphones, tablets or similar equipment, using Back-End Micro-Services. Its implementation must be carried out using a modular development pattern.

Aiming for a balanced distribution of functions, the implementation of the Application must follow an MVP (Model – View – Presenter) type pattern, in which the business logic and data management, interaction and usage logic functions are compartmentalized into blocks well defined:

- View - Receives the actions triggered through the user interface and updates it accordingly, through the mediation, in cascade, of the remaining modules. Unlike the MVC pattern, this interface is passive, receiving all the information ready to render, meaning there is no connection between the View and Model blocks.
- Presenter - Interprets the actions triggered by users, uses the Model to process them and returns the information for the user to view, to be rendered by the Vision.
- Model - Implements the business rules associated with the functions required by the Presenter, using external services if necessary.

It is intended that the implementations, on Android and iOS, are as identical as possible, both in terms of architecture and development patterns, as well as the nomenclature of Classes, Methods and Fields.

Taking into account the implementation and evolution planned for the Mobile Application (using the smartphone's internal devices, such as GPS, camera, NFC, Bluetooth, etc.) development will be carried out in the development environments and languages native to each operating system (Android and iOS). The architecture of the application is presented in Figure 15.

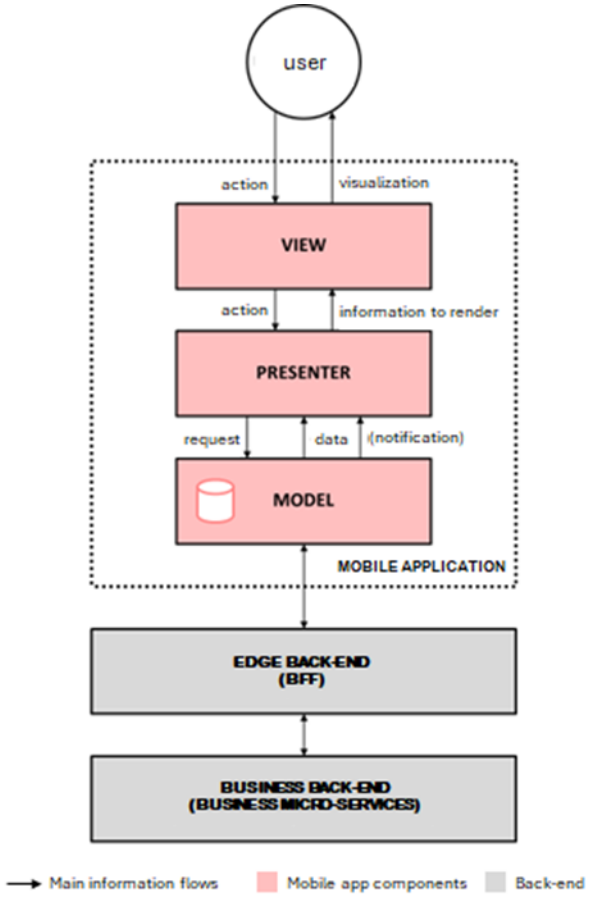

Figure 15. Architecture of the Mobile Application.

The development of the Application complied with the following requirements shown in Table 6:

Table 6. Requirements of the application.

Requirement	Description
Operating System	Android and iOS
Programming language	Android: Kotlin or Java. iOS: Swift.
Development platform	Android: Android Studio. iOS: Xcode.

Having identified the requirements, a development and implementation plan was defined with an evolutionary perspective in three main phases and a new subsequent phase.

Phase 1: Reading and loading prepaid passes and titles onto personalized Calypso cards, activating access to discounts that grant free access to young students, allowing the pass to be loaded at no cost and access to useful information about transport (cards, discounts, transport tickets, timetables, routing to the passenger support area, location of stores and in-person service points, trip planner, FAQs and news).

Phase 2: Access to the registered area with information on trips made, card request, updating customer information, adding favourites, receiving notices and alerts. Network map with real-time timetable information. Provision of information in more languages, information dedicated to the visitor.

Phase 3: Card virtualization. App starts to function as support for validating the title. Connection to a CRM with a record of customer interactions.

Phase 4: Possibility of loading cards for occasional use.

In April 2024, TML concluded the first phase of development and in May of the same year, it began Phase 0, of internal testing, launching the possibility of extended testing to a set of 991 Beta Testers who tested the application and gave their feedback. contributions.

Currently, Phase 1 has been completed with very positive results. In the first month, 7 thousand people used the Navigator App and in June the number rose to 20 thousand.

5.5.1.3. Challenges & Mitigations

To mitigate some of the challenges, testing of the app was launched to a group of Beta Testers to whom a satisfaction survey was subsequently launched. 374 responses were obtained, of which 76% would give a score above four, on a scale of zero to five; 96% considered the app to be very intuitive and 70% indicated that the app lived up to expectations.

A brainstorming session was also held using the design thinking method with some beta testers to discuss identified improvement points and envision the next phases of evolution.

In this session, some new aspects were identified to be incorporated as improvements for Phase 1 and rethinking some developments in Phase 2, to implement in 2025. One of the changes to Phase 2, still under analysis, could be the dismissal of a dedicated planner, as it is concluded that users already use official planners, perhaps requiring a redirect instead of incorporating a planner into the application itself.

One of the solutions to be developed that seems to be more suited to users' needs will be the construction of a dedicated network map with information on all modes of transport in real time that pass through a given stop/station/terminal, as this was one of the services with greater representation in terms of needs to be served, identified in the brainstorming session.

TML has collected information from some providers of MaaS applications and services, such as Moovit, CityMapper, Trafi, Transit, InstantSystems and HenseCom. Some of these MaaS application providers and service providers are very advanced in route planning, as they incorporate the entire PT network and some new innovative mobility services, allowing for good route planning, but they do not yet sell tickets or services. Other applications, such as UBER and BOLT were also contacted. They have a different strategy, as they started to provide a mobility service (ridehailing or shared services), using the platform to sell it, and are building the route planner and aggregating other services, thus providing less interesting route planning, but already selling services.

Figure 16. App store and Play Store promotion.

5.5.1.4. Next steps towards implementation

The navegante® App is already on the market. Other developments include debugging, usability improvements and communication campaigns to extend its use to a greater number of people.

5.6. Budapest

5.6.1. BUD_04: To improve the route planner to increase the user satisfaction

5.6.1.1. Description of the measure and main outcomes expected

The OTP travel planning engine was integrated into the FUTÁR system in 2014, with individual parameters. The planning engine uses real-time public transport timetable data to create travel plans. A lot of customer feedback has been received that the BKK travel planner offers some inappropriate itineraries. There are many reasons for this, that could be map data error, traffic disruption, schedule error or parameterization error.

Under this measure, inspection will be carried out and all abnormalities that appear in the itinerary creation will be revealed. An individual action plan is drawn up for these disorders, however, due to the combined effect of the interventions, the measures are implemented in one action package. As a result of the development, a significant improvement in the quality of the itineraries is expected as follows:

- offering more efficient transfer connections as a result of managing waiting times
- due to the weighting of the number of transfers, the display of additional relevant itineraries (with suitable travel times).

- favouring public transport itineraries instead of an unrealistically large amount of walking as a result of handling the weighting for transfer and waiting time values.

5.6.1.2. Preparation of the measure

With the participation of several departments of BKK, all items queuing for the development for the FUTÁR-system were reviewed and prioritized. Then, the possible travel planning anomalies were collected. After this, the technical description of the development is being worked out. As, the travel planning software is a boxed software, we do not fully understand the operation of the planning engine and its parameterization options. Therefore, after formulating the business needs and expectations, the technical content, the development of which we order, is being created in cooperation with the contractor. After finalising the technical description, feedbacks are about to be received from various departments and the potential effects of the development were estimated to support other developments.

BKK currently uses the OTP2 (OpenTripPlanner) travel planning engine, which is based on standard engine solutions supplemented with BKK's unique needs. When the system was introduced, many settings were tested, which resulted in the current operation. An operational logic provides a unified solution for travel planning for all travel modes and all residences on the extremely extensive public network. During everyday use, we find that the current operation of the travel planning engine does not provide a solution for all cases, more precisely, in many cases it is not suitable, and the most optimal itineraries are not displayed for the users. BKK assessed these problems and detected specific cases to be dealt with, for which measures packages were defined. Among the measures are the introduction of new parameters, the modification of existing weightings (e.g. transfer, waiting, walking), the prioritization of certain itinerary alternatives and the development of several new operating logics (e.g. in which case do we offer an itinerary with more walking, in which case do we offer savings in travel time itinerary with several transfers, what logic is used to manage the itinerary generation within each time window, how we take into account the real traffic situations that change every second, etc.).

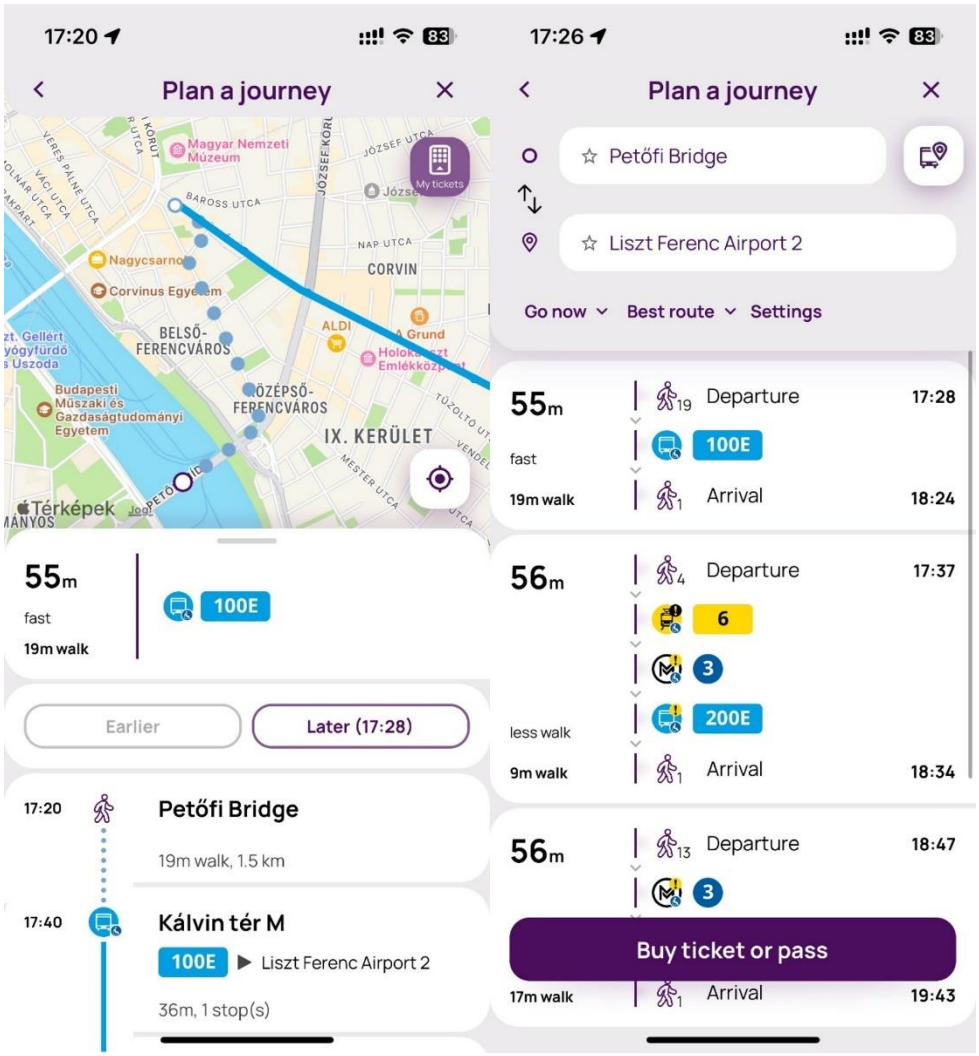

Figure 17. Current display of itinerary proposal for a planned journey at BudapestGO.

5.6.1.3. Challenges & Mitigations

The content of the measure has been changed from the originally planned, while the title remained the same. The scopes of the three BUD measures (BUD_02, 04 and 05) (see details in the first version of related measure descriptions) were originally based and linked to a planned software development, namely the integration of shared mobility services into the BudapestGO application. This software development (including other functional developments) was subject to a public procurement procedure. According to the original schedule (that was set up in the beginning of 2023) the public procurement was planned to conclude, and developments to start in 2023 July. The procedure however was delaying, and additionally prolonged by an unforeseen legal issue (one of the applicants filed an appeal in October 2023 against the decision of the procurement board – and the procedure only reached final conclusion in 2024 January). The delays generated a risk of not being able to implement these three BUD measures before the anticipated deadline set forth by the UPPER consortium. This made the BKK team to start considering mitigation actions for not delaying any further these measures – or modify their content to be independent from the shared mobility integration.

It was the time when a budget reallocation was initiated, affecting also BUD_04 and 05 measures, leaving only PM for these two and allocating the Services and other goods budget to a more reasonable procurement within BUD_01 UPPER measure (this procurement procedure has succeeded in early May 2024).

However, a consequential update of the timeline of BudapestGO related software development functions was needed, as only part of the planned upgrades could be completed in 2024, and the others had to be moved to 2025. Therefore, additional aspects were investigated to narrow down the priority list for 2024. In February 2024, a survey was carried out by BKK among BudapestGO app users, and from the results it was clear that the priority of shared mobility integration seems less valuable that it was expected from the aspect of customer satisfaction. As it can be seen in Figure 18 below, out of the 3417 respondents, only 10% of them indicated that the e-scooter integration would be useful to enhance BudapestGO. The BKK management responsible for the strategic development plan of BudapestGO decided to give this function development a lower priority. The shared mobility integration will still happen but later and not within UPPER. In order to provide more valuable and relatable contents for the BUD measures, that would have a more significant impact on the customer experience, BKK UPPER team had to take the results of this survey also into consideration. All these led to changing the scope of BUD_02, BUD_04 and BUD_05.

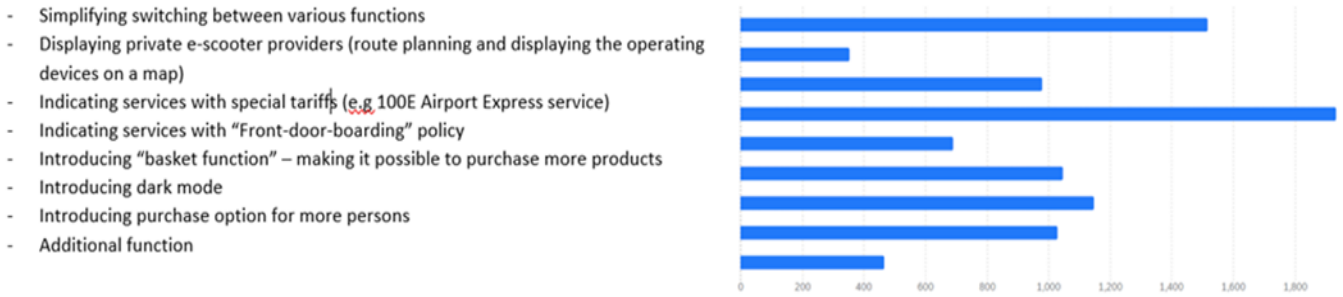

Figure 18. BudapestGO users' opinion on new features according to the survey carried out in February 2024.

The biggest challenge when creating the rule system is that the individual rules can only be implemented globally, so in the case of millions of travel planning occurrences, the global effects of the amendments must be examined in a complex manner, possible wrong travel planning must be minimized, and care must be taken to ensure that the measures formulated in the measure packages result in a real quality improvement implementation. Therefore, these will be also subject to the comprehensive testing of the implemented changes.

5.6.1.4. Next steps towards implementation

The technical description is being finalised and feedbacks are about to be received from various departments of BKK and the potential effects of the development were estimated to support other developments. The estimated value of the finalised technical content is going to be defined with indicative request for proposals. The developer of the boxed travel planning software has exclusivity for carrying out the development task. After the receipt of the request, the internal approval process of BKK is going to be started.

The development time is estimated to last from 60 to 90 days starting in October 2024. After the completion of the development, the development is going to be tested and evaluated by BKK. Testing and related processes are estimated to be completed in December 2024.

5.6.2. BUD_05: New services to increase accessibility and convenience of PT

5.6.2.1. Description of the measure and main outcomes expected

It is the request of the BKK business area to be able to display different service features (special traffic characteristics, which are typical for a given situation or vehicle) in BudapestGO in the future. The BKK travel planning engine is integrated into the application as a separate system element. The purpose of frontend development based on backend development is to display special traffic characteristics, i.e. service characteristics, on the map layer. Certain conditions are subject to special rules/characteristics, the introduction of which may influence users in their choice of mode of transport.

5.6.2.2. Preparation of the measure

With the participation of several departments of BKK, all items queuing for the development for the FUTÁR-system[6] were reviewed and prioritized. The preparation of the technical description has started, and the technical content was explained. The potential effects of the development were measured to other development items as well, synergies ad IT aspects were asserted and discussed. The internal confirmation process of BKK started and licenses from various departments were about to be received.

The aim of the measure is to expand the already mentioned service features with the following categories:

- Conditions with individual fee regulation: Display of conditions with individual fee regulation (for example: 100E or nostalgia), for which the traditional line ticket and pass type products are not valid.
- Bicycle transportation: Bicycle transportation is permitted on certain types of vehicles (for example: Tatra), but not on other types of vehicles (for example: CAF).
- Certain types of vehicles alternate on certain routes, so it is easier for the Customer if the application includes this information for the services of each route.
- Connections affecting agglomeration: Connections between Budapest and agglomeration operate with a different system of rules (in terms of tariff system), hence the display of validity information related to BKK products that help customers.
- Local bus conditions: the Budapest pass is not valid for sections beyond Budapest city limits.
- Suburban railway line (HÉV) conditions: the Budapest pass and line ticket are not valid for sections beyond the Budapest city limits.
- Suburban State railway lines: The section within Budapest can only be used with a Budapest pass (other BKK fare products are not valid).
- Volánbusz intercity coach connections: connections between lines 300-900, which run within Budapest, can only be used with the Budapest fare product (other BKK fare products are not valid).

[6] The FUTÁR-system is the main mobility management and traffic control system of BKK.

- Air conditioning services: Display of comfort services for vehicles with air conditioning and/or Wi-Fi. In terms of priority, it is less important than the previously mentioned service characteristics, but at the same time it is relevant from the point of view of Customer Experience.
- Electric buses: Separate labelling of electric buses in the name of sustainability.

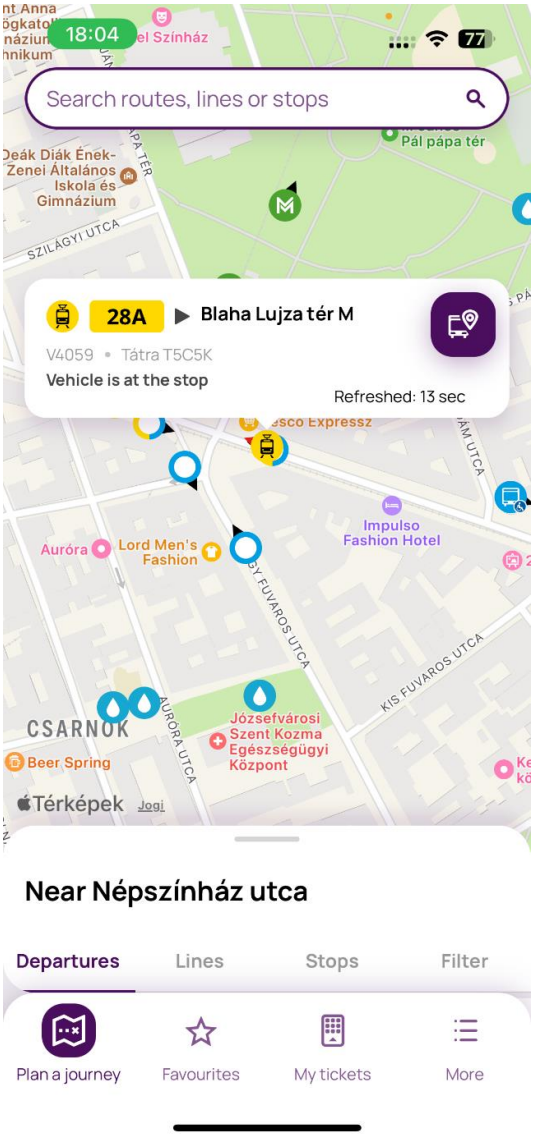

Figure 19. Current display of the service features (identifying vehicle, type of vehicle and its position) at BudapestGO.

5.6.2.3. Challenges & Mitigations

The content of the measure has been changed from the originally planned, while the title remained the same. The justification for this change is the same as for BUD_04 and is provided in the section 5.6.1.3.

The development does not only serve the purpose of displaying the so-called service features on the BudapestGO frontend, the logic of the display is created on the backend side. The biggest constraint is that BudapestGO is supplied with data directly by the internal FUTÁR and indirectly partially from the ForTe systems. Primarily, it is

necessary to create the possibility of transferring the service characteristics on the ForTe page. This also requires the development of several ForTe modules, because while the assignment of specific service characteristics of the service and route needs to be done in the module used by the BKK's traffic management department, the assignment of vehicle-specific service characteristics must be done in the vehicle's master data. Moreover, BKK is not able to perform this task directly, the cooperation of the service providers is also essential, we get to the production of the data during coordinated work processes. After that, we can develop the backend operating logic of the travel planner, the complexity of which process depends on several factors. Certain service features must be used only at certain times of the day or only for certain vehicles. This can be handled by itself within the framework of the established rule system, however, operative traffic control interventions, outdated vehicle data packages and technical driver logins all have an impact on the correctness of the displayed service characteristic data, especially in cases where the aforementioned change of time of day occurs, or a heterogeneous vehicle fleet in terms of services drives in a given relationship. It is also necessary to develop a system of rules on the basis of which logic the system displays the individual services in the event of individual dispatcher or driver interventions (e.g. application of a new route, diversion, replacement, etc.). Special rules are required for each occurrence.

5.6.2.4. Next steps towards implementation

The request for an indicative quotation has already been closed and currently is being discussed. The internal approval process of BKK will start among with procurement process until the conclusion of the contract.

After the internal process, the development is going to be put into operation and testing period is going to be started. Testing and related processes are estimated to be completed in December 2024.

5.7. Leuven

5.7.1. LEU_03+04: To increase visibility and ease of use of public transport by offering improved information on public transport, parking and shared mobility options

5.7.1.1. Description of the measure and main outcomes expected

The measure will focus on two main challenges: what information is actually needed and/or is relevant for end users, and what are efficient ways to provide this information to the end user. Citizen engagement will be crucial to formulate an answer to these questions. Consequently, the main deliverable for this measure is the development of a framework for accessibility and mobility information. In the next phase, based on this framework, relevant information will be streamlined into datasets that can be onboarded in the city data-infrastructure and shared across platforms, which can also benefit internal users (city advisors and planners). Existing channels and platforms will be evaluated and redesigned when necessary.

5.7.1.2. Preparation of the measure

Internal input was collected from various departments of the city (Digital Communication, Data & GIS, etc.). An analysis of the use of the zonaarleuven.be website, which contains mobility information about Leuven, is being carried out. Additionally, possibilities, best practices, and successful projects for information channels and the integration of information from key mobility services are being explored. A good example was found in the city of Ghent, where a similar project is being undertaken. The city maintains a website dedicated to parking, featuring real-time occupancy

data and directing visitors to specific car parks during events. This website is actively promoted and should be mandatorily included by event organizers in their communications. Additionally, the city is exploring ways to further optimize and expand their dashboard, which provides citizens with information on the occupancy of car parks and bicycle parking facilities.

The preparation of the measure also involved exploring methods for gathering input from external stakeholders, primarily mainly visitors to the city, to identify what information is missing, most relevant, and to determine the most effective means of communication with end-users. The city is currently conducting four distinct street surveys, each incorporating a component related to user information. Details on the survey conducted are presented in Table 7 below. Over a two-week period, job students are surveying bus service users, users of peripheral car parks, users of city centre car parks, and visitors to the city centre at various key locations. The target is to collect approximately 600 responses. Details of the survey content can be found in the table below. An analysis and major conclusions drawn are expected by the end of August. Additionally, contact information is being collected from individuals interested in further discussing this topic during a focus group scheduled for September to provide more detailed information to determine the actions to develop and the information channels to prioritize.

Table 7. Details on the survey conducted in the framework of LEU_03+04.

Survey	Questions
Bus service	- What is the main purpose of your ride? - How satisfied are you with the information about your bus journeys? - Where do you look for information about getting around in and around Leuven by bus? - Is there any information you are missing? If so, which?
Peripheral parkings	- What is the main purpose of your displacement? - Do you know how to take the free bus to Leuven city centre? - How did you locate the car park? - How satisfied are you with the signage to the car park? - Where do you look for information to get around in and around Leuven? - Is there any information you are missing? If so, which?
City centre parkings	- What is the main purpose of your displacement? - How did you locate the car park? - How satisfied are you with the signage to the car park? - Where do you look for information to get around in and around Leuven? - Is there any information you are missing? If so, which?
City centre visitors	- What is the main purpose of your trip? - Where do you look for information to get around in and around Leuven? - Is there any information you are missing? If so, which?

Parallel to the user's need analysis, stakeholder involvement and revision of best practices, the technical preparation of the implementation was started. This included the identification of key datasets yet to be integrated in the city data platform, preparing data for onboarding and developing first, rudimentary geodashboards.

Given that easily and comfortably combining modes of transport is of crucial importance within the mobility policy framework of the city, which is also reflected in measure LEU_02, the initial focus of the technical preparation and development is on datasets that can contribute to this end, including real-time data on Park&Rides occupancies, Park&Bikes and shared mobility availability. An API was set up to onboard real-time parking availability (Table 8).

Table 8. API for real-time parking availability.

GET /open-data/parkings/real-time
This endpoint retrieves real-time parking information.
Request
There are no request parameters for this endpoint.
Response
The response includes real-time parking occupancy and parking status information and is a JSON object with the following schema.

Table 9. Schema of the response regarding real-time parking occupancy and parking status information.


```
JSON
{
  "modelBaseVersionG": "",
  "parkingParkingTablePublication": {
    "lang": "",
    "publicationTime": "",
    "publicationCreator": {
      "country": "",
      "nationalIdentifier": ""
    },
    "parkingTable": [
      {
        "versionG": "",
        "versionTime": "",
        "idG": "",
        "type": "",
        "hierarchyElementGeneral": [
          {
            "parkingPlace": {
              "type": {
                "value": "",
                "extendedValueG": ""
              },
              "versionG": "",
              "idG": "",
              "layer": 0
            }
          }
        ]
      }
    ]
  },
  "parkingParkingStatusPublication": {
    "lang": "",
    "publicationTime": "",
```

```
    "publicationCreator": {
      "country": "",
      "nationalIdentifier": ""
    },
    "parkingStatusInformation": [
      {
        "parkingPlaceStatus": {
          "reference": {
            "idG": "",
            "targetClass": ""
          },
          "occupancy": {
            "numberOfSpacesOverride": 0,
            "numberOfVacantSpaces": 0,
            "numberOfOccupiedSpaces": 0,
            "kind": ""
          }
        }
      }
    ]
  }
}
```


5.7.1.3. Challenges & Mitigations

It was intended to use U-GOV to gather input from external stakeholders, primarily city visitors, to determine what kind of information is missing and which means of communication with end-users should be explored. However, the U-tool could not be deployed as initially intended, and the city's own citizen participation platform also turned out to be inadequate for this purpose, resulting in a delay. An alternative method for collecting input from visitors had to be found. It was decided to conduct street surveys with job students, but this was only possible during the summer holidays. The analysis and conclusions of these surveys will not be available until the end of August. Consequently, the original timeframe foreseen for the next steps towards implementations has been adapted as indicated below.

5.7.1.4. Next steps towards implementation

Following the analysis of the street surveys, a focus group is being organized to gather more detailed information. The purpose is to determine which actions to develop and which information channels to prioritize. The process will identify quick wins, priorities to be tackled within the UPPER timeframe and a more general, long-term strategy and roadmap. This may include: improvements to the city website, interactive maps, open data, availability data, a route planner, integration of Mobility as a Service (MaaS), wayfinding, traffic guidance, bicycle parking guidance, or social traffic management.

Taking into consideration the delay caused by the change in approach to the citizens participation, the deadline for determining the actions to develop and the information channels to focus on and drafting the framework has been moved to the end of October. The resulting implementation plan will be drafted by the end of the year.

Considering the technical preparation for the implementation, the onboarding of extra data sources of all relevant mobility services into the city data platform has already started and a first version of this will be ready by the deadline mentioned in the monitoring templates. The technical development will continue as much as possible in parallel with the development of the implementation plan. Depending on the final outcomes of the user need analysis, stakeholder involvement and revision of best practices, an iterative development process will be started, focusing on quick wins

and high-priority needs. For the possible development of a dashboard and the possible (re)design of frontend applications, we do not foresee any delay for the time being.

5.8. Thessaloniki

5.8.1. TES_01: Optimum transfers on P&R areas based on real-time data

5.8.1.1. Description of the measure and main outcomes expected

Thessaloniki's measure 01 aims to increase intermodal trips that include PT and reduce trips made by car to the city centre. Towards this, a multimodal hub around a metro station is created and also, a digital service is developed that provides real-time information to travellers. The real-time information is about i) parking space availability in the designated area, ii) PT scheduling and iii) shared modes availability. The digital service has been integrated in an already operating MaaS app.

5.8.1.2. Preparation of the measure

1. Selection of P&R area

TES_01 focuses on the area around the Nea Elvetia metro station. This area has been envisioned by the local authorities to be the first complete multimodal hub in the city, where the metro system will be connected with multiple bus lines, shared modes and private cars (through appropriately designed parking areas). It is an ambitious project, which was highly prioritized by Thessaloniki's Sustainable Urban Mobility Plan (SUMP) and accompanies the construction project of the main metro line.

Nea Elvetia is the final station of the main metro line, in the eastern part of the city. Actually, the area constitutes the entrance to the municipality from the eastern side of the Thessaloniki's Urban Area and it is in close distance to the "Macedonia" airport and also in proximity to the city's ring road and the Thessaloniki – Nea Moudania road, which connects Thessaloniki with a main touristic area (i.e. Chalkidiki). Combined with the presence of green spaces and its connection with the municipalities of Kalamaria and Pylaia–Chortiatis, this area gains a stronger hyper-local character, with the passenger flows expected to be particularly high. Serving these flows is the main challenge for the management and operation of the multimodal hub.

As it becomes understood, Nea Elvetia will have a major role in Thessaloniki's transportation system, in the near future, when the metro system will be operational. At the same time, important challenges are expected to be faced, since a "greenfield" area will be transformed in an area that concentrates large passenger flows. For these reasons, Nea Elvetia was selected for this measure. It is believed that the management of the large flows and the operation of the multimodal hub in general, can be significantly benefitted by the digital service that will provide real-time information to the travellers.

2. Use cases and technical requirements

Prior to the development of the new digital service, the first step was to define its use case scenarios. The core use cases defined were: a) enable users to check available parking spaces and b) enable users to check next PT arrival. It is noted that no use case scenario for shared modes availability was established, since this use case is already served by the MaaS app, and the MaaS integrator already gathers and provides the users with the related information. The two use cases are described in Table 10 and Table 11.

Table 10. Use case "Check available parking spaces".

Check available parking spaces	
ID	**TES01_UC01**
Description	User needs to drive to Nea Elvetia station to take the bus or metro. Through the app she/he will be informed on the available parking spaces of the P&R area in order to arrange properly her/his trip. To do so, the user simply clicks on the P symbol on the map. If the user is heading to the parking and wants to be alerted about the parking space availability, then the option "Κρατήστε με ενήμερο/η για την διαθεσιμότητα" is available. The user may click on this option, and he/she will receive a notification when the parking spaces are equal to or less than the defined threshold.
Actors	Users, Application, Server
Input	Internet connection, account created, user logged in.
Basic Events' Flow	1. User opens the application. 2. User clicks on the relevant symbol (P) on the map. 3. A pop-up window appears showing the number of available parking spaces. **END.**
Output	User is informed about the parking space availability.

Table 11. Use case "Check next PT arrival through the map interface".

Check next PT arrival through the map interface	
ID	**TES01_UC02**
Description	User may want to see the next PT arrival in a specific METRO station/bus stop. An alternative to "Άφιξη MMM" is clicking on the corresponding symbol on the map and the info of next PT arrivals appear on the bottom of the screen (just like the info on shared vehicles).
Actors	Users, Application, Server
Input	Internet connection, account created, user logged in.
Basic Events' Flow	1. User opens the application. 2. User clicks-on the METRO station or bus stop symbol. 3. Info on the Next 2 PT arrival appears on the bottom of the screen. **END.**
Output	User gets informed about the arrival of the next 2 PT routes.

After several consultations between the developers of CERTH/HIT (which develops the digital service) and the MaaS provider (which is responsible for the integration in the MaaS app), a list of technical requirements was defined for serving properly the abovementioned use cases. The technical requirements are presented in Table 12.

Table 12. List of technical requirements for the digital service.

ID	**Technical Requirements**	**Category**
TES01_TR01	The application must be able to run on mobile phones operating in Android OS and iOS.	Compatibility
TES01_TR02	The application must be available in local language (Greek).	Localization
TES01_TR03	The application must protect users' data (GDPR).	Security
TES01_TR04	The application must be compatible with GTFS.	Compatibility
TES01_TR05	Information on next PT must be provided within 8 seconds or less response time.	Performance
TES01_TR06	Information on available parking spaces must be provided within 8 seconds or less response time.	Performance
TES01_TR07	The application must be able to send notifications to the user.	Usability

TES01_TR08	The application must support a map interface.	Usability
TES01_TR09	The application must be able to locate users' position.	Usability
TES01_TR10	The application must utilize secure authentication methods to enhance user account security.	Security
TES01_TR11	The application must comply with WCAG (Web Content Accessibility Guidelines) standards to ensure a universally accessible user interface.	Usability
TES01_TR12	The application must have a robust error-handling mechanism to gracefully manage unexpected errors and provide informative error messages to users.	Usability
TES01_TR13	The application must undergo regular security audits and updates to address emerging threats and vulnerabilities promptly.	Security

3. Development of the service and integration into the existing MaaS

At this stage of the project, the information regarding the parking space availability in real-time is not yet available. However, the information about public buses' estimated times of arrivals (ETAs) at the bus stops has been gathered through the provider of Thessaloniki's bus system telematics system. For visualizing this information in the MaaS app, an API was developed between CERTH/HIT and the MaaS provider. This API is being documented in Table 13.

Also, Figure 20 presents how the information about public buses has been integrated in the MaaS app. All bus stops are presented as "pins" in the initial screen of the app, which includes a city map. It is noted that on the same map information about the locations of the available shared modes (e-bikes, e-scooters, e-cars) is being shown. The user can click on a bus stop and a pop-up screen appears. This pop-up screen provides the bus stop name, as well as two different options:

- The schedule of arrivals of the various bus lines in the specific bus stop. This information is static, and it can be useful during the phase of planning a journey (e.g. one day before executing the journey)
- The estimated times of arrival of the various bus lines in the specific bus stop. This information is dynamic, and it can be useful during the phase of carrying out the journey (e.g. while driving to the bus stop).

Table 13. Documentation of API for public buses information.

Purpose	Retrieval of information on next bus arrival (map interface)		
Consumer / Provider components	Inbound API Aggregator / Public Transport Operator (OASTH)		
Communication protocol	HTTPS	Type:	POST
Communication authentication	Basic Auth		
Communication endpoint	https://api.upper.imetb.gr/bus/stops		
Information format	JSON		

Information request payload	{
	"maxLat": 40.858858,
	"minLon": 22.364549,
	"minLat": 40.290437,
	"maxLon": 23.517537
	}		

Information response code	HTTP 200 OK		
Information response payload	[{ "eta": "https://api.upper.imetb.gr/bus/eta/2315", "id": "2315", "lat": 40.3563944,		

	"lon": 23.0024901, "name": "NTOYPAKI B΄", "routes": "https://api.upper.imetb.gr/bus/stoptimes/3:2315/20240220" }, …]
Comment	The requested body can be skipped (empty request). Then the code will fetch the stops of the default area (whole Thessaloniki). Even if at least one required parameter is not given, the code will fetch the default. All the nested endpoints require the same authentication (Basic Auth) and they operate with GET method. You may change the ending of the “routes” endpoint to reflect the date that you wish to get the bus route schedule for.

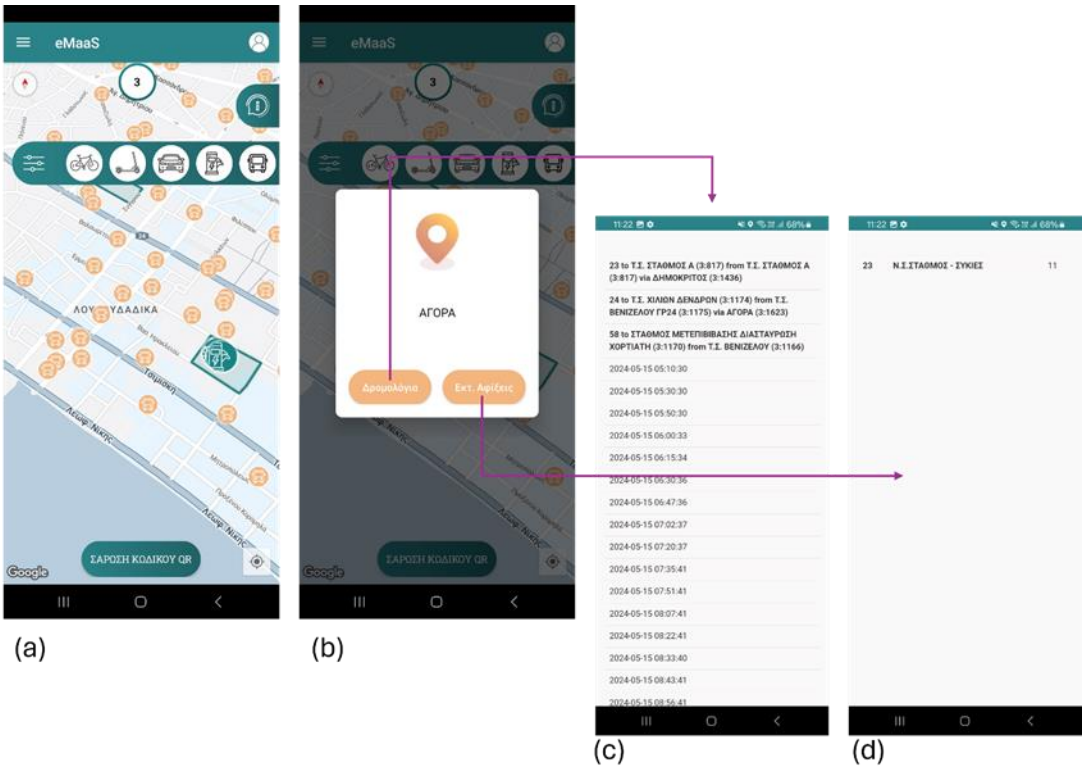

Figure 20. (a) Map interface of the application, (b) Bus station’s information menu appears when the user selects a bus station. (c) The schedule of the buses serving this stop. (d) Estimated next bus arrival.

5.8.1.3. Challenges & Mitigations

The operation of metro system was originally planned (after multiple delays) for the beginning of 2024, however there was an additional delay, and now it is expected that the operation of the metro system will start in November 2024. This delay also dragged along concurrent projects such as the creation of the multimodal hub in Nea Elvetia station. This UPPER measure is highly dependent on these facilities. Without having ready the multimodal hub facilities (and the parking station in it), it is not possible to gather and provide information to the MaaS app users about the parking space availability. Responsible authorities assure that in the beginning of 2025 metro will be operational, and at least an initial parking area will be available in the Nea Elvetia area.

Thessaloniki cluster has also adopted a backup plan which includes using a P&R area in the railway station of the city, where a metro station also exists. However, it is considered of great significance to demonstrate this measure using the Nea Elvetia multimodal hub due to its significance for the city, as described above.

5.8.1.4. Next steps towards implementation

Once the metro system becomes operational and (at least) an initial parking area will be available in the Nea Elvetia station, appropriate equipment will be installed in the parking area for estimating at real-time the availability of parking spaces. Based on this information, the digital service will be updated for providing the parking space availability to the users. Also, the metro system GTFS will be sought for also including information about the services provided by the metro (similarly with the information that is already provided for public buses). After this, a user engagement strategy will be developed to recruit potential users for the demonstration phase of the measure.

5.8.2. TES_05: To enhance the information provided through adapted services for different groups of passengers

5.8.2.1. Description of the measure and main outcomes expected

Thessaloniki's measure 05 builds on a previously existing multimodal trip planner, which was integrating information for car-sharing, bike-sharing, scooter-sharing and walking. A generic utility function was used for route planning. Under this measure, public transport information is being integrated as well and the route planning is being based on user preferences (instead of a generic utility function). The updated multimodal trip planner has also been integrated into the existing MaaS application (eMaaS), with the aim to increase intermodal trips that include public transport and minimize user's travel disutility when combining different modes.

5.8.2.2. Preparation of the measure

1. Case description

In Thessaloniki, a pilot MaaS system was launched in 2023, aiming to promote multimodality[7]. The system constitutes of 5 shared mobility hubs, where e-cars, e-bikes and e-scooters are available. For further extending the spatial coverage of the system and covering additional origins-destinations, virtual stations were developed, where only e-bikes are available. As such, e-bikes can act as a first/last-mile solution and connect additional (popular) areas with the shared mobility hubs (Figure 21). As a functionality of the MaaS app, a multimodal trip planner was developed for assisting users in taking optimal decisions about their trips. A main inefficiency of this multimodal trip planner was that public transport was not incorporated in the proposed multimodal solutions, due to lack of data (GTFS). This inefficiency is being bridged through the updated/enhanced multimodal trip planner that has been developed as part of the UPPER project.

[7] https://emaasproject.gr/

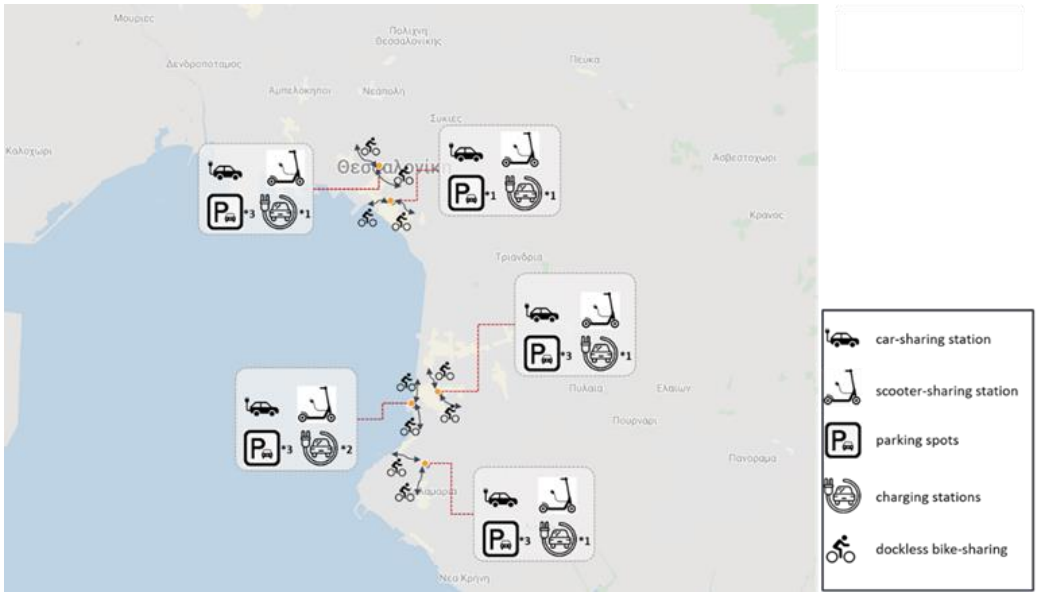

Figure 21. Thessaloniki's MaaS operational model.

2. Technical specifications and architecture

The architecture of the updated/enhanced multimodal trip planner is presented in Figure 22. As it is shown, CERTH/HIT as the developer of the multimodal trip planner communicates through APIs with the MaaS provider for three purposes: a) receiving real-time information about the availability of shared modes (along with their location), b) receiving the trip requests that are being made by the users through the MaaS app, c) sending the multimodal solutions for providing them to the users through the MaaS app. These connections were already developed for the purposes of the previously existing multimodal trip planner. However, some modifications were made for: a) ensuring that the users id is being sent to CERTH/HIT (this is required for the individualization process), b) ensuring that CERTH/HIT will receive the information about specific modes that the user wants to exclude from the proposed multimodal solutions, c) incorporating public transport in the proposed solutions that are sent to the MaaS provider and in turn are provided to the user. Except for these modifications, in the framework of the UPPER project a connection between CERTH/HIT and the public transport authority was established, which was totally missing in the previously existing multimodal trip planner. This connection ensures that CERTH/HIT receives updated GTFS information for the public buses.

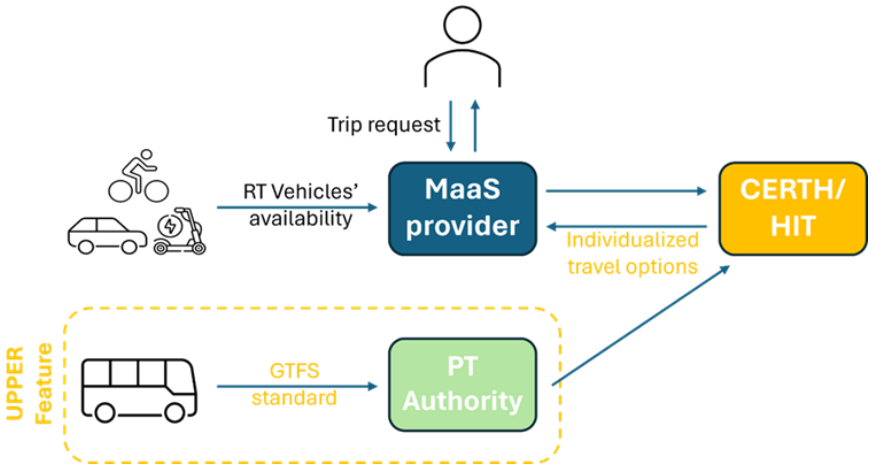

Figure 22. Architecture of the updated/enhance multimodal trip planner.

3. Algorithm for individualized trip planner

The already existing MaaS app was integrating a multimodal trip planner, which was developed by CERTH, and combined car-sharing, bike-sharing, scooter-sharing and walking, in an optimal way. For solving the multimodal trip planning problem, the first step was to identify the various alternative unimodal and multimodal solutions that can be reasonable from users' perspective. Considering the spatial allocation of the shared mobility hubs and the bike-sharing stations, 12 alternative solutions were identified, as presented in Figure 23.

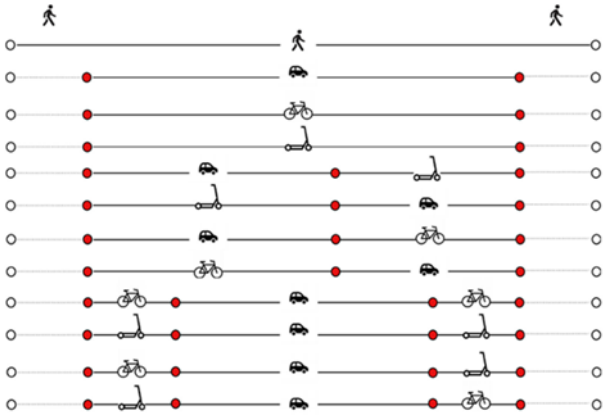

Figure 23. Representation of the 12 alternative solutions (previously existing multimodal trip planner).

The second step was to define the criteria, based on which the various alternatives will be assessed for providing to the user the optimal one or a ranking of the alternatives. For this prioritization task, 3 criteria were defined, namely travel time, travel cost and number of transfers between different transport modes. The calculation of travel time was made with the aid of the OpenTripPlanner (OTP)[8], which is an open-source software capable for providing passenger information and transportation network analysis. Travel cost was calculated considering the travel times and the cost of using the various modes in Thessaloniki's MaaS system.

Since the different criteria are measured in different units, a way to combine the different criteria in a single utility function is needed. For doing so, a stated preference (SP) approach was followed. A very short survey was designed, consisting only of 4 different SP scenarios. In each scenario, the respondents had to select between two different trips. The trips were different with regards to the travel cost, the travel time with the different modes and consequently the number of transfers between the modes. The four SP scenarios are presented in Table 14.

Table 14. Stated preference scenarios for defining a generic utility function.

Trip 1	**Trip 2**
Trip duration with shared car: 35 minutes	Trip duration with shared bike: 8 minutes + Trip duration with shared scooter: 15 minutes
Trip total cost: 3.5 €	Trip total cost: 5 €
☐	☐
Trip 1	**Trip 2**
Trip duration with shared bike: 15 minutes	Trip duration with shared scooter: 8 minutes
Trip total cost: 2.5 €	Trip total cost: 3.5 €
☐	☐
Trip 1	**Trip 2**
Trip duration with shared car: 35 minutes	Trip duration with shared scooter: 15 minutes
Trip total cost: 2.5 €	Trip total cost: 3.5 €
	☐

[8] https://www.opentripplanner.org/

Trip 1	Trip 2
Trip duration with shared car: 35 minutes + Trip duration with shared bike: 8 minutes	Trip duration with shared car: 15 minutes + Trip duration with shared bike: 8 minutes + Trip duration with shared scooter: 8 minutes
Trip total cost: 3.5 €	Trip total cost: 3.5 €

Based on the responses a simple binary logistic regression model was developed for estimating the impact that the various criteria have on the choice of respondents. The results of the binary logistic regression model led to the following utility function.

$$GC = -0.18 \times ttc - 0.236 \times ttb - 0.37 \times tts - 0.275 \times ttw - 1.073 \times c - 3.925 \times nt \quad (1)$$

where:

- tt_c, tt_b, tt_s, tt_w is the travel time with shared car, bike, scooter and walk respectively,
- c is the total cost of trip,
- nt is the number of transfers between different modes.

Within UPPER, the already existing multimodal trip planner was updated/enhanced in two main directions: a) integration of public transport in the proposed solutions, b) individualization of the proposed solutions based on users' historic trips. The addition of public bus services results in an increase of the alternative solutions that need to be examined. More specifically, 23 possible solutions are now identified, as presented in Figure 24. Moreover, the utility function (equation 1) should also include a parameter and a variable related to the travel time with public transport. Based on the findings of a recent study that conducted in the city of Thessaloniki and models the willingness to use a shared scooter instead of public transport, the parameter of the "travel time with public transport" variable can be derived (Nikiforiadis et al., 2023). More specifically, the parameters identified by the referenced study, along with the already identified parameter for the "travel time with scooter" variable, are being used to estimate the parameter for the "travel time with public transport" variable. As such, the utility function now takes the following form.

$$GC = -0.18 \times tt_c - 0.236 \times tt_b - 0.37 \times tt_s - 0.275 \times tt_w - 0.314 \times tt_{pt} - 1.073 \times c - 3.925 \times nt \quad (2)$$

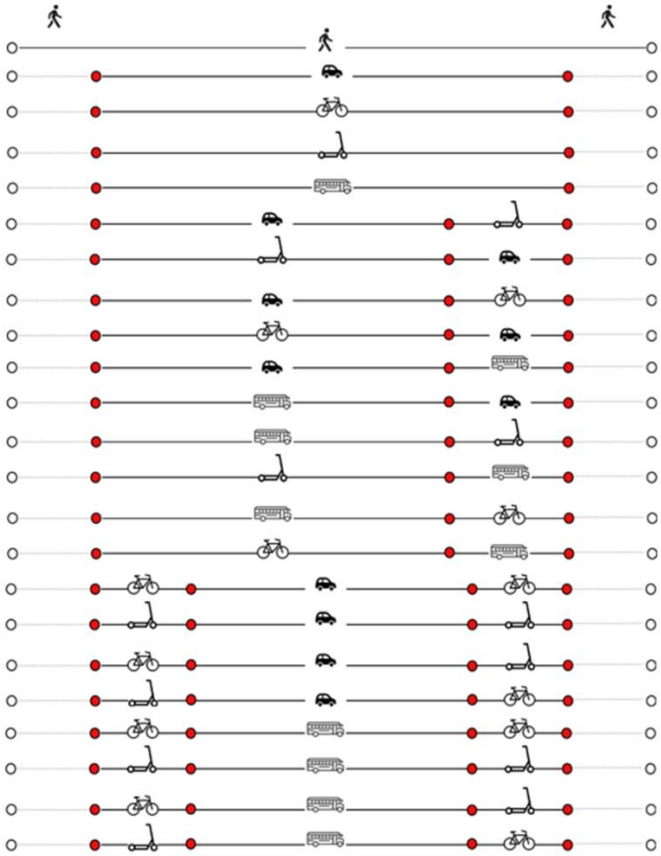

Figure 24. Representation of the 23 alternative solutions (updated multimodal trip planner).

The new form of the utility function, as well as the initial one, is generic (i.e. the same for all users). For incorporating individual preferences in the utility function, a mechanism is being proposed that will consider for each user his/her historic trips, as they are gathered by the eMaaS app. Considering that the eMaaS app records only the trips that the user made through shared car, bike and scooter, the adaptation of the utility function can only be made with regards to the specific modes. As a result, an adaptation factor is being added in the function of each one of the three modes and the final form of the utility function is the following.

$$GCi = -0.18 \times f_{ci} \times tt_c - 0.236 \times f_{bi} \times tt_b - 0.37 \times f_{si} \times tt_s - 0.275 \times tt_w - 0.314 \times tt_{pt} - 1.073 \times c - 3.925 \times nt \quad (3)$$

The adaptation factors (fc, fb, fs) are being computed separately for each user i and they are dynamically changing as the user makes new trips. The three adaptation factors are computed using the following steps.

Step 1: calculate adaptation factors for each separate historic trip

i) if it is a car trip:

$f_{c1} = \frac{t_b}{t_c}$, if $\frac{t_b}{t_c} > 1$ then cap fc1 to 1 (4)

$f_{c2} = \frac{t_s}{t_c}$, if $\frac{t_s}{t_c} > 1$ then cap fc2 to 1 (5)

ii) if it is a bike trip:

$f_{b1} = \frac{t_c}{t_b}$, if $\frac{t_c}{t_b} > 1$ then cap fb1 to 1 (6)

$f_{b2} = \frac{t_s}{t_b}$, if $\frac{t_s}{t_b} > 1$ then cap fb2 to 1 (7)

iii) if it is a scooter trip:

$f_{s1} = \frac{t_c}{t_s}$, if $\frac{t_c}{t_s} > 1$ then cap fs1 to 1 (8)

$f_{s2} = \frac{t_b}{t_s}$, if $\frac{t_b}{t_s} > 1$ then cap fs2 to 1 (9)

where *tc, tb, ts* correspond to the travel time that is needed with car, bike and scooter for a trip from the origin to the destination of the specific historic trip.

Step 2: calculate adaptation factors for each user

$f_{ci} = \frac{\sum_{j=1}^{n}(fc1j+fc2j)}{n}$ (10)

$f_{bi} = \frac{\sum_{j=1}^{n}(fb1j+fb2j)}{n}$ (11)

$f_{si} = \frac{\sum_{j=1}^{n}(fs1j+fs2j)}{n}$ (12)

where n is the number of trips that the user i carried out with the specific mode.

4. Integration into existing MaaS app

In the case of Thessaloniki's MaaS system, the multimodal trip planner service made available to the users both as a stand-alone web app and as an integrated feature in an already existing MaaS app (Figure 25). The multimodal trip planner results are presented with the aid of a map and the service provides not only the optimal trip, but also alternative solutions that are not exceeding specific thresholds. In this way, the user can easily compare and select among the solutions. Moreover, checkboxes have been added allowing users to exclude specific mode(s) from the proposed multimodal solutions.

Figure 25. Multimodal trip planner user interface in MaaS app.

5.8.2.3. Challenges & Mitigations

The main challenge that was identified during the development of this measure is the need for optimizing the programming code, since the individualization approach requires a lot of computations for each trip request (the number of computations is increasing as the number of user's historic trips is increasing), which could result in a delayed response of the service and in turn in an undesired user experience.

5.8.2.4. Next steps towards implementation

The updated multimodal trip planner has already been integrated in the MaaS app and it is already operational. Within the next months, continuous testing will be performed for optimizing the programming code and providing the best possible user experience. Also, as an additional next step, the GTFS for the metro system will be sought (when the metro becomes operational) for integrating metro in the proposed multimodal solutions too. After the testing period, users will be recruited to run the demonstration.

5.9. Hannover region

5.9.1. HAN_01: Digital infrastructure

5.9.1.1. Description of the measure and main outcomes expected

A new, digital sales channel for the transport association will be introduced as part of this measure. The aim is to simplify access to local public transport for everyone in the Hannover region. This will be achieved through the new check-in/be-out system (funded by another project) and the digital tariff as billing (funded by UPPER, developed under this measure). Figure 26 presents the functionality of check-in/be-out system. Before starting their journey, passengers will no longer have to decide in advance on a fixed ticket ('do I only need a single ticket, or would it be worthwhile for me to buy a day ticket today?') or have knowledge of the different tariff zones in the Hannover region. With the new system, passengers can get on PT vehicles and confirm the start of their journey in the check-in/be-out app. When the passenger finishes their journey and gets off, the system recognises this automatically. A fare is then calculated based only on the distance travelled as the crow flies from the start to the end point. The price (digital tariff) is made up of a basic price (paid per journey) and a working price (per aerial kilometre travelled). This system is primarily intended to appeal to occasional PT customers who do not yet use public transport at all or only use it irregularly.

Figure 26. Functionality of the check-in/be-out system.

Further information on the check-in/be-out system and the digital fare may be found here:

1. https://www.uestra.de/epaper/verbundbericht/2023/index.html#10 (Page 11)
2. https://www.uestra.de/gvh-journal/2024/1/index.html#4 (Page 4)

The main outcomes of the measure will be:

- A new sales channel for all occasional customers of the transport association. This simplifies access to PT. Secondly, more people will travel by public transport and less by car. The modal split is therefore also influenced and there is a modal shift towards eco-mobility. A Concept Study for a successful tariff implementation (market saturation between 5-10% in the current bar tariff.
- A new, more complete, database of Passenger data, also a dashboard is planned on which it will be possible to see where journeys take place in the CiBo system, how many journeys take place and when these journeys take place.

5.9.1.2. Preparation of the measure

1. **Concept study:**

An expert office was commissioned to draw up a concept study for the development of the digital tariff. The results of the study were, firstly, the fixed pricing of the tariff, i.e. the definition of a basic price per journey and a working price per linear kilometre travelled, as well as a linear price curve. For this purpose, trip, daily and monthly caps were developed, which are dependent on the prices in the bar tariff. A journey cap is therefore always related to the price of a one-way journey in tariff zones A, B, C, the daily cap is based on the day ticket for zone A and the monthly cap is always based on the price of the Deutschlandticket. To find these prices, two workshops were held with the relevant stakeholders. Further components of the concept study were the preparation and follow-up of documents for the committee run, as well as the calculation of a potential group discount. The components for bicycle transport and the children's discount are based on the existing discount in the bar tariff.

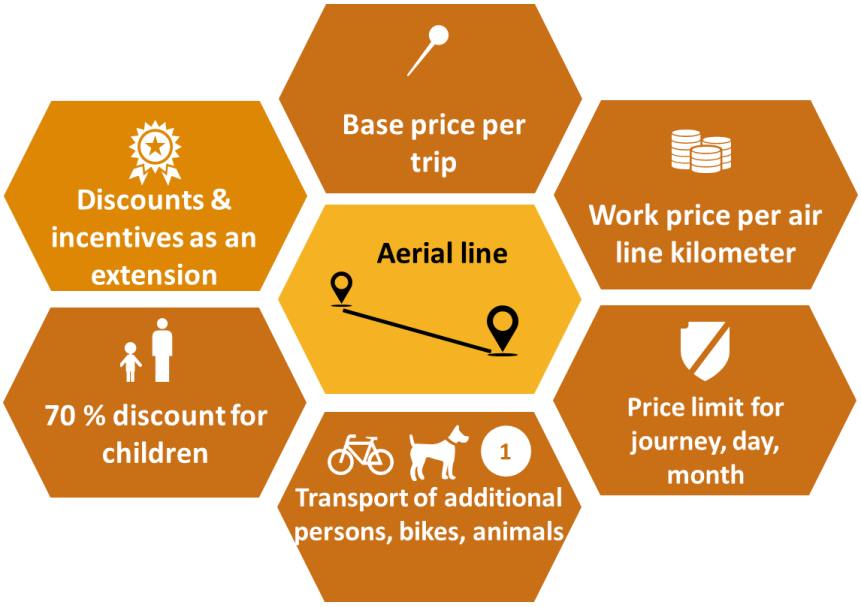

Figure 27. Tariff logic and components of the digital tariff.

The conceptualisation and development of the components presented in Figure 27 were part of the concept study. Further discounts and give-aways are also possible, but these will become relevant when the tariff is further developed in the coming years. This is not considered a delay of the measure.

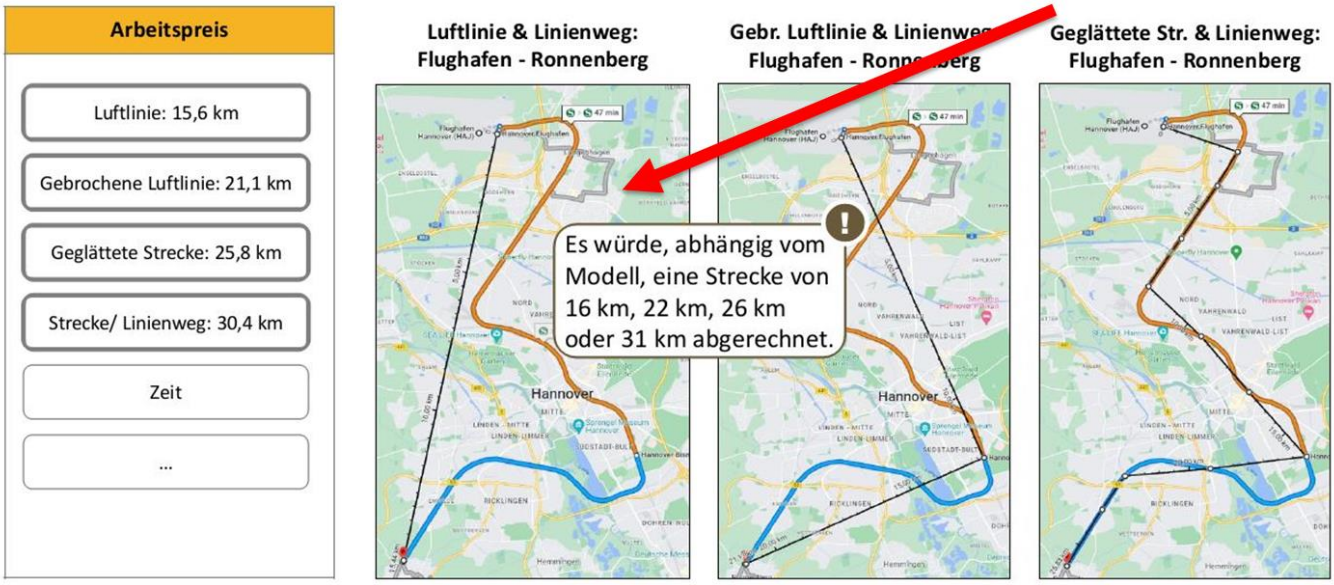

Figure 28. As the crow flies, only the distance between the start and end points is paid, regardless of any other 'detours' the PT makes towards the destination.

2. **Definition of data to be collected:**

Data requirements for the monitoring of KPI's were collected in close coordination with the Check-in/ Be-out (CiBo) project. These were communicated to the service provider of the CiBo system as requirements. This includes the percentage of correctly recognized stations among all journeys and correct journey recording, user satisfaction and the market saturation of the new tariff. In addition, the download figures for the CiBo app and later also for the GVH

app will be tracked as soon as the system has been integrated into the GVH app. This is also not a delayed measure; we are dependent on the tender for the GVH app. It is planned to display this data on a dashboard.

3. **Commissioning in the Hannover Region and the transport authority (GVH):**

The committee process was started at the beginning of 2024 and is almost complete at the current time. A few committees and the approval of the tariff by the approval authority are still missing. This is expected to be granted in autumn 2024.

4. **Creation of a marketing and evaluation concept:**

An evaluation and marketing concept has started. A before and after evaluation will take place in the area of market research. In the field phase of the evaluation, focus groups will be invited to discuss the parameters of the digital tariff. The aim is to adapt the marketing of the new system to the requirements of the target group and thus simplify access to PT for as many people as possible.

5.9.1.3. Challenges & Mitigations

A great challenge was to create a fare that is attractive for both passengers and transport companies. This has to be seen in the light of the loss of revenue that can result from the digital fare. This happens because some journeys are cheaper in the digital fare than they would have been in the normal bar fare. We were able to overcome this challenge by liaising closely with the consultants on pricing and the general design of the fare. There was also close coordination on the requirements for the digital fare with all those involved from the transport companies and the approval authority.

Good coordination with CiBo Project is essential for the success of the measure. Close coordination with the project participants of both projects and all stakeholders takes place on an ongoing basis. The requirements of the digital tariff must also be able to be mapped by the CiBo system, which is why close coordination and communication with the service provider of the CiBo system is also necessary after the contract has been awarded, who will begin to set up the system step by step in the near future.

When pricing the digital fare, it was a major challenge to consider and assess the interactions between the €49 ‘Deutschlandticket’ and the new digital tariff. Both products should not compete with each other and should remain equally attractive for passengers. The aim is for the ‘Deutschlandticket’ to be the best product for frequent travellers and for the digital tariff to be the alternative for all occasional customers. We have solved this challenge by introducing a monthly cap in the digital fare, which is based closely on the price of the ‘Deutschlandticket’ but is always higher. This prevents customers from switching to one tariff or another.

The evaluation will start in August with a field phase in which interviews will be held in focus groups. A corresponding briefing paper for the market research was prepared in advance. These group discussions will focus on possible discounts for potential users of the system and how these are assessed. In addition, the participants should be given an explanation of the system and provide information on how it can be better explained and advertised. The second phase of the evaluation will take place after the system has been introduced. However, as the system will not be introduced until 1 January 2025, the post-evaluation will of course only take place afterwards. The concept for the market research has already been developed, so there is no delay in this measure either.

The basic outline of the marketing concept has already been finalised but is currently being put out to tender. We expect to be awarded the tender at the beginning of September. However, we already have a concept and a name for the new tariff in August, with the presentation of the first results by the marketing agency. In this respect, there is a slight delay in the preparation of the measure, but this cannot be described as serious. The introductory application is due to start in December, as the measure will not be implemented until 1 January 2025.

5.9.1.4. Next steps towards implementation

The next step in the introduction of the new fare system is the approval by the licensing authority and the adjustment of the fare regulations. This is expected in September and will take place together with the approval of the price level in the bar tariff for 2025. The focus group discussions for the field phase of the market research will take place in August. These dates are fixed and will not delay the implementation of the measure in any way. The consultants will then recalculate the prices and adjust the digital tariff prices to the prices of the bar tariff. Once the marketing agency has been awarded the tender, the launch campaign will start being implemented.

5.9.2. HAN_04: Mobility dashboard solution

5.9.2.1. Description of the measure and main outcomes expected

Under this measure, the existing mobility dashboard is to be expanded in cooperation with the Lower Saxony / Hannover Region Traffic Management Centre. As the state reporting centre for the traffic warning service in Lower Saxony and as the input point for the Hanover Police Headquarters, the Lower Saxony / Hanover Region Traffic Management Centre (VMZ) is responsible for ensuring that all incoming traffic reports about particularly dangerous situations are forwarded to radio stations without delay.

Information on traffic congestion, roadworks or traffic obstructions can already be viewed on the current mobility dashboard. The occupancy of P+R car parks and the location of B+R stations can also be viewed. However, the focus is more on individual transport and almost not at all on local public transport. Within the UPPER project, this dashboard is now to be supplemented by the PT component.

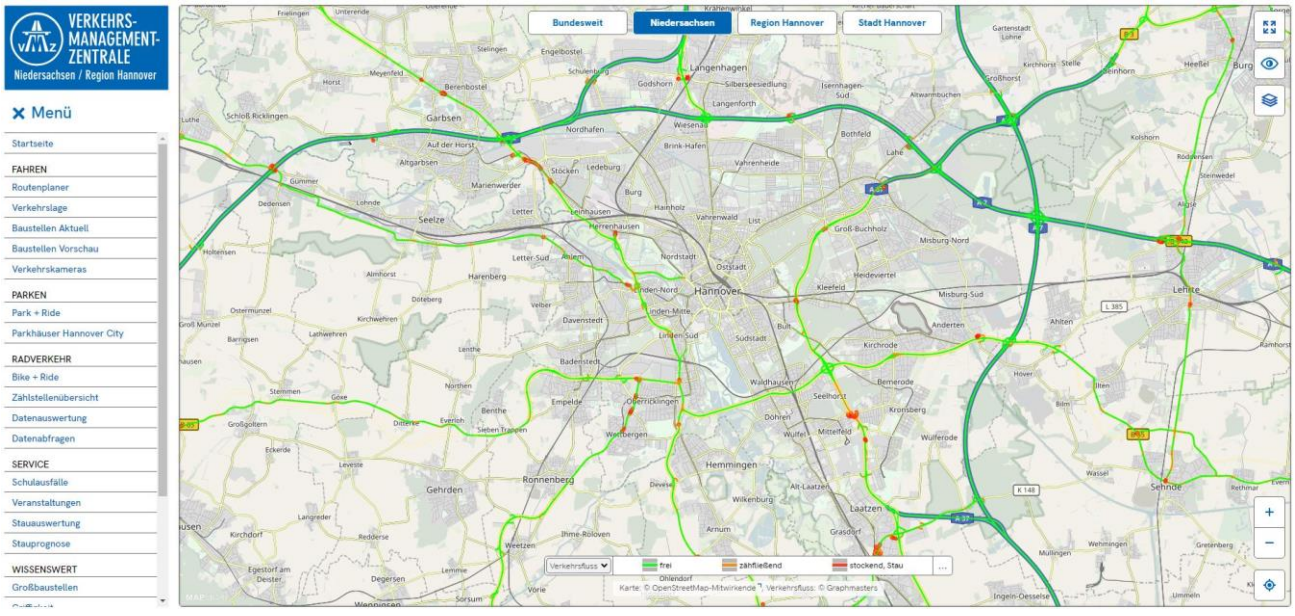

Figure 29. Current dashboard of the VMZ.

The U-TWIN tool developed within the project is planned to be used as an interface for the expansion of the existing mobility dashboard. The idea is to feed the real-time data into the U-TWIN tool and then build an interface to the existing VMZ mobility dashboard. The aim is then to have a dashboard that can be used as a graphical timetable for the PT, especially at special events such as large fairs or concerts. The plan is to integrate real-time data from the PT, i.e. vehicle locations and current capacity utilisation of the respective bus or city tram.

5.9.2.2. Preparation of the measure

In order to be able to implement the measure properly, preparatory activities must also take place here. This primarily involves finding links to existing projects and defining use cases for the extended mobility dashboard. This definition took place in close consultation with the VMZ, as they are best placed to assess the cases in which U-TWIN and real-time data from the PT can provide support. Different scenarios were designed and discussed in the coordination rounds. During these discussions, we also jointly defined the use cases. The result was that the future extension of the VMZ dashboard is to be used for special events after an internal test phase. Links to existing projects were also found. These exist primarily with the projects within the PT funding model region and the 'Harri Intermodal' project. The links will play an important role in the further development of the measure next year/ 2026.

In addition, the collection of potential data is certainly an important preparatory step for the implementation of the measure. To this end, the data requirements were first evaluated and discussed.

Required data includes:

- Real-time data of the PT
- Utilisation data of the individual vehicles
- Road conditions
- It is being investigated whether weather data may be included

Contact persons for requesting data were defined. The next step is to get in touch with them and request the data so that it can then be seamlessly integrated into the U-TWIN tool.

5.9.2.3. Challenges & Mitigations

Before the internal discussions on setting up the mobility dashboard could begin, the functionality and possibilities of the U-TWIN tool first had to be correctly understood. This included information on the necessary interfaces and questions about data protection. However, these questions were clarified in several coordination meetings with ETRA and Rupprecht Consult.

Another challenge was to clearly define which data should be displayed on the dashboard and for what purpose. To this end, we had internal meetings and developed and discussed scenarios.

The final decision on the technical requirements is still outstanding. We expect this for August or September. This is due to the current holiday period. A delay is therefore possible for this preparatory step. However, a significant delay in the implementation of the measure is not expected.

One of the next steps in preparing the implementation of the measures is to contact the persons responsible for providing the data. It is expected that this data will be made available without any problems, but there may also be delays here. However, these are not yet foreseeable at this stage and will be brought to the attention of the Task Leader as soon as they occur.

5.9.2.4. Next steps towards implementation

The next step is therefore to define the final technical requirements and approach the contact persons for data provision. Once the data is available, it will then be defined who exactly within the Hannover Region or the VMZ will be responsible for integrating the U-TWIN tool into the VMZ dashboard.

6.Conclusion

This document presented the work performed under Task 4.4 of UPPER project to develop mobility measures to transit into MDTS and promote user-friendly multimodal nodes. This work included both supporting activities performed by horizontal partners and cities together (i.e., the MaaS workshops) and actions specifically from cities (i.e., use case definition, development effort etc.). It is hoped that this deliverable will offer a pathway for other cities and/or projects to inspire, replicate, and facilitate the implementation of similar mobility measures.

In general, measures under T4.4 are quite mature considering that this Task included measures related to MDMS and MaaS, therefore development efforts were needed for most of them. However, some delays may be envisioned in terms of the implementation of measures. Detailed information on this aspect may be found in Chapter 5 in the corresponding section of each measure as well as in the Annex where monitoring templates are included. Overall, no significant delays are expected for the T6.4 Large scale demonstration in the living labs which starts in January 2025 (M25) except maybe for the IDF_04, where the organisation of the Olympic and Paralympic Games in Paris during August/September 2024 prevented the engagement of the required external stakeholders.

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. Then, all task leaders met during the MSLG meetings and reported about the progress and specific challenges addressed. These consecutive steps of interaction between responsible task leader and cities and afterwards among task leaders aimed to decrease the complexity of the monitoring process.

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8.Annexes

ANNEX A: Monitoring templates for all measures under Task 4.4.

ANNEX B: Points of attention for measures under Task 4.4 in the context of the 2nd MaaS Workshop.

ANNEX A: Monitoring templates for all measures under Task 4.4.

Monitoring template for Measure VAL_05 “New Multimodal Digital Mobility Services (MDMS) with a focus on accessibility and inclusion”

Objectives of the measure

- Simplify the use of sustainable transport modes in the city.
- Increase the use of sustainable modes of transport, especially PT ridership.
- Optimize public space (indirectly through promoting sustainable modes).
- Enhance social inclusion.

Description of the measure

In Valencia, a new MaaS app is under development. The main functionalities have already been defined, however under VAL_05 new features considering Mobility as a Right concept will be added. End users (PT users or potential PT users) will be involved in the definition of relevant new functionalities for the MaaS in order to cover the needs of certain users’ groups with special needs (people with mobility issues, people with intellectual issues, Gender perspectives).

Measure outputs:

This measure will deliver:

- New features for the MaaS app (“Ciudades Conectadas”) to ensure that the APP is accessible for everyone.

Access to the services offered by operators affiliated with the PMCC (Connected Cities Traveler Platform), allowing users to efficiently plan and optimize their trips within the city by providing up-to-date information on public transportation, as well as offering route and travel recommendations based on user preferences.

Related UPPER tools:

U-GOV: Can be used to identify user needs, especially those related to VRUs and special target groups. Will be used in case be required when the tool be in a status more advanced.

Steps to ready-to-demo measure

Steps	Description	Involved partners/ externals	Category of action	Deadline	Monitoring indicator	Comments
1	Sign agreement with the company responsible for the development: INDRA	EMT/INDRA	Legal	09/01/23	Date when officially starts the project.	Out of the scope of UPPER. Official launch of "Ciudades Conectadas" (MaaS) project.
2	First certification with an external company and definition of use cases	EMT	Technical	20/02/24	Validated first phase of the project by a third part (Inetum).	The certification is out of the scope of UPPER project, while the definition of Use Cases related to people with disabilities is part of UPPER.
3	Delivery Concept of Product	INDRA	Technical	03/09/24	Second certification and delivery product concept and next milestones.	
4	Development of functionalities for disabilities people	INDRA	Technical	01/03/25	Delivery product for testing	Integration into the existing MaaS app and testing functionalities for disability people

Monitoring template for Measure ROM_06 “Innovative features into the MDMS system according to the mobility patterns and needs of users’ groups”

Objectives of the measure

- Increase the use of MDMS services by designing according to user needs.
- Increase the “sustainable trips”.
- Support the increased attractiveness of sustainable transport modes.
- Support the National take-up of the MaaS

Description of the measure

The ROM_06 measure follows the steps for the implementation of the core system of the MaaS in Rome. The ROM_06 measure is linked and dependent on the National framework called “Mobility as a Service for Italy (Maas4Italy)”, managed by the Ministry for Infrastructures and Transport (MIT) and the Department for Digital Transformation (DTD). Building on the MaaS4Italy Project, this measure foresees the integration of the main services into the Rome MaaS platform, integration of all the sharing and information services on LPT in the Data Lake of the new RSM MMC, making them available through standard APIs and interfaces with simple Urban Mobility App.

Measure outputs:

This measure will deliver:

- Identification of the local governance model
- Identification of the MaaS operators for the first trial of the system in Rome.
- Involvement of at least 1.000 users for the first phase trial.
- Definition and creation of the MaaS integration platform.
- Execution of the trial with the incentives definition, follow-up and data analysis.
- Integration of the Rome MaaS within the National Maas4Italy platform.

Related UPPER tools:

U-GOV to support the engagement and communication with users

Steps to ready-to-demo measure

Steps	Description	Involved partners/externals	Category of action	Deadline	Monitoring indicator	Comments
1	Identification of MaaS operators	Rome Mobility Department	Social/Technical	May 2023	Final selection of MaaS operators	
2	Engagement strategy	Rome Mobility Department, RSM	Social	Jun 2023	Users recruited	An incentives plan was implemented
3	Test of the service	RSM	Social/Technical	Nov 2023	Collection of data	The 1st trial ended on 30th nov 2023
4	Draft Operational plan submission	RSM/Rme Mobility department	Technical/Policy	June 2024	Approval by regional government	Pending
5	Development of the services	Rome Mobility Department, RSM and technical partners	Software	2025 - depending on the outcomes of the Regional feedback	Application to be fully operational	The analysis of the test phase outcomes will support the steps to the full implementation of the Maas
6	Integration of all the PT operators on the platform	Rome Mobility Department, RSM and technical partners	Software	2025 - depending on the above	Application to be fully operational	

Monitoring template for Measure IDF_04 “Added-value services in multimodal nodes to integrate active modes with PT”

Objectives of the measure

At measure level:

- The aim of this measure is to test and introduce new features withing the existing MaaS mobile application, accessible for beta tester users. New services can include micro-mobility provider(s) such as bike or e-scooter to promote their usage as a mean to reduce carbon footprint.
- Increasing the awareness of the micro-mobility services that exist on the territory by testing new features within the existing regional MaaS application

Contributing to city level objectives of:

- Strengthening the settlement of new mobility sharing service such as bike stations and e-scooters sharing services
- Encouraging the usage of active mobilities, especially in the region of Versailles Grand Parc by integrating micro-mobility service(s) in the regional MaaS application.
- Reducing carbon footprints by providing alternative solutions for the first/last miles.

Description of the measure

The measure consists in strengthening the visibility of new micro-mobility services and encourage the use of active modes such as walking and biking. Stations for bike and e-scooters rental in some strategic points of the territory such as train stations, around main bus lines and residential districts can be integrated in the MaaS application and promoted as alternative for the first and last mile. To this end, this alternative mobility service will be integrated in the MaaS application developed by Instant System, which will bring more consistency in the comprehension of the sustainable mobility offer for the users, more visibility to the service, and will facilitate its use and bring more users.

Measure outputs:

This measure will deliver:

- The integration of a micro-mobility service in a MaaS application.
- Key Performance Indicator on multi-modal trips compared to personal vehicles, for instance the reduction of carbon footprint etc.

Related UPPER tools:

The implementation of this measure will not be supported by IT tools from the UPPER toolkit.

Steps to ready-to-demo measure

Steps	Description	Involved partners/externals	Category of action	Deadline	Monitoring indicator	Comments
1	Agreement with IDFM	Instant System – Versailles Grand Parc – ile de France Mobilité	Legal	After end of OG 2024 developments, September 2024	MoU signed with Ile de France Mobilité (IDFM)	
2	Agreement with micro-mobility providers	Instant System – Versailles Grand Parc	Legal	January 2025	Agreement signed	
3	Data collection	Instant System - TIER	Data	March 2025	TIER API provided to Instant System	
4	Definition of technical requirements	Instant System – IDFM	Technical	November 2024	List of requirements and figure (flowchart) depicting the architecture	
5	Development of new features of IDFM	Instant System – IDFM	Software	March 2025	Features ready for integration	
6	Integration of new features of IDFM	Instant System – IDFM	Software	September 2025	App ready for testing	
7	Testing of the upgraded IDFM	Instant System – IDFM - Versailles Grand Parc	Software	October 2025	App to be fully operational (Lab version)	

Monitoring template for Measure IDF_05 “Promote the use of the PT service by visitors in large events”

Objectives of the measure

At measure level:

- The aim of this measure is to promote the use of public transport and alternative mobility services through to the Olympic Games which will gather a large number of users.
- The measure will evaluate the impact of a dedicated MaaS app:
    - On helping participants of the Olympic Games in finding the appropriate routes to go from/to the Olympic Games events
    - On enabling the accessibility of public transport – and of such big events – to persons with disabilities thanks to the MaaS application.

Contributing to city level objectives of:

- Limiting traffic congestion in cities and/or areas hosting events related to the Olympic Games by limiting the number of private vehicles.
- Enabling and fostering the use of active mobility modes to citizens with disabilities

Description of the measure

Measure outputs:

This measure aims at promoting active mobility trips during the Olympic Games. The main objective of this measure is to help cities involved in the Olympic games to regulate the traffic and ease the transfer of participants from/to events locations. To that aim, the major outcome will contribute to measure the impact of a dedicated MaaS application offering a multimodal journey planner (with PT and other active modes), as well as accessibility services, especially in the area of Versailles Grand Parc where are located three Olympic and Paralympic Games sites.

This dedicated MaaS application will deliver:

- The possibility to search for multi-modal trips suggesting active transport modes (depending on the requirements that will be defined) in a dedicated MaaS application focused on Olympic and Paralympic Games.

Supporting activities:

Promotion of the use of MaaS applications by the city stakeholders (cities hosting the Olympic Games) in the communications promoting the event.

Related UPPER tools:

The implementation of this measure will not be supported by IT tools from the UPPER toolkit.

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	Instant System, IDFM Versailles Grand Parc	Social	January 2024	Description of area and use cases	
2	Definition of the indicators to monitor	Instant System, IDFM Versailles Grand Parc	Data	February 2024	KPIs list	
3	Development of the digital services (app)	Instant System IDFM	Software	April 2024	Digital service to be fully operational	
4	Testing of the demo (app and the rest of the necessary features)	Instant System IDFM	Technical	September 2024	MaaS app including accessibility feature operational for testing environment	
5	Data collection and analysis	Instant System IDFM Versailles Grand Parc	Data, reporting	March 2025	Data extract to fuel the measure report	

Monitoring template for Measure MAN_05 “Modernize and increase the attractiveness of digital sales channels and private sector partnerships”

Objectives of the measure

- Modernize digital sales environment/ EFM module implemented.
- Increase attractiveness of digital sales channels and reduce conventional tickets.
- Reducing technical access barriers, hence promoting the use of sustainable mobility modes.

Description of the measure

On the occasion of recently introduced D-ticket (Germany-wide flat-rate PT ticket), rnv will implement major upgrade and extension to existing sales, billing, and settlement systems towards ensuring nation-wide interoperability. This upgrade of rnv’s backend sales systems will enable us to ensure full interoperability of all D-Tickets sold by rnv as well as ensure a digital and secure ticket inspection process for all D-tickets, regardless of its origin. This measure will enable rnv to allow further customer groups to move from conventional/ analogue ticketing to a future-proof, interoperable and fully digital system.

Measure outputs:

This measure will deliver:

- Implementation of an electronic fare management (EFM) module to the existing sales background system, ensuring full compatible to VDV-KA standard.
- Increase the share of digital products sold in comparison to conventional products sold among the monthly/ yearly passes.

Related UPPER tools:

The implementation of this measure will not be supported by IT tools from the UPPER toolkit.

Steps to ready-to-demo measure

Steps	Description	Involved partners/externals	Category of action	Deadline	Monitoring indicator	Comments
1	Scanning of relevant business processes, market research on available solutions	RNV	Social	01/06/2023	Report on market research	Creating a report will help define the final requirements in the next step
2	Definition of requirements	RNV	Technical	01/08/2023	Final list of requirements	
3	Data collection	RNV	Data	01/12/2023	Creation of Data collection finalized	
4	Prepare procurement process, tendering	RNV	Legal	01/02/2024	Awarding process completed	
5	Implement upgrade and extension to existing sales, billing, and settlement systems	RNV	Software	01/12/2024	Fare system upgraded	Testing is also included in this step

Monitoring template for Measure LIS_07 “To create a new Multimodal Digital Mobility Services (MDMS)”

Objectives of the measure

- Provide user-friendly MDMS/MaaS platform to address trip planning, ticket purchase and vehicle and platform access validation.
- Increase number of users of MDMS/MaaS.
- Ensure access to MDMS/MaaS platforms for Lisbon citizens.

Description of the measure

Currently, in Lisbon metropolitan area there are a few MaaS platforms being used, owned by different companies and with different functionalities. This measure includes the analysis of the existing MDMS/MaaS platforms operating in the Lisbon metropolitan area; this analysis will form the base for designing and implementing new features of MDMS/MaaS platforms.

Measure outputs:

This measure will deliver:

- Report on: the status of MDMS/MaaS platform global state of the art; the characterization of the MDMS/MaaS platforms existing in Lisbon metropolitan area; and a discussion of several scenarios to follow, with advantages and disadvantages, to help decision making.
- Eventual design and development of new features of MDMS/MaaS APPs, if the decision goes in this direction.

Related UPPER tools:

U-TWIN: This tool may be used to represent the Lisbon metropolitan mobility and transport network, and help decision-makers analyse the strategy to follow and the MDMS/MaaS platforms features to develop;

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	Analysis of the existing MDMS/MaaS platforms	TML, MaaS local operators	Social/Technical	March 2024	Report on the existing MDMS/MaaS platforms	
2	Identify and consult stakeholders (MaaS platform operators, PT operators, PT users…)	TML, MaaS platform operators, PT operators	Social	May 2024	List of stakeholders consulted	
3	Identify need for a new metropolitan MaaS platform vs improvement of existing ones	TML, MaaM local operators	Technical	June 2024	Pros and cons listed and decision taken	
4	Define general requirements for the new features	TML, MaaM local operators	Technical	July 2024	List of requirements produced	
5	Design Terms of Reference for possible MaaS features developments	TML	Software	August 2024	Terms of Reference produced	

Monitoring template for Measure BUD_04 “To improve the route planner to increase the user satisfaction”

Objectives of the measure

The OTP travel planning engine was integrated into the FUTÁR system in 2014, with individual parameters. The planning engine takes real-time timetable data into account when creating travel plans.
We receive a lot of customer feedback that the BKK travel planner offers them inappropriate itineraries. There are many reasons for this: map data error, traffic disruption, schedule error, parameterization error. Analyzing the operation of the planning engine and examining non-optimal road plans, as well as uncovering the underlying causes, is a complex task. Within the framework of the project, we will determine the inadequacies in travel planning and explore the parameter modification and development options, by modifying which we can offer optimal travel plans to commuters. The effect that can be realized during the project is the time gain for those using the travel planner as a result of the optimal travel plans.

Description of the measure

Measure outputs:

During the inspection, all abnormalities that appear in the itinerary planning will be revealed. An individual action plan is drawn up for these disorders, however, due to the combined effect of the interventions, the measures are implemented in one action package.

As a result of the measures, a significant improvement in the quality of the itineraries is expected as follows:

- offering more efficient transfer connections as a result of managing waiting times
- due to the weighting of the number of transfers, the display of additional relevant itineraries (with suitable travel times).
- favouring public transport itineraries instead of an unrealistically large amount of walking as a result of handling the weighting for transfer and waiting time values

Related UPPER tools:

The implementation of this measure will not be supported by IT tools from the UPPER toolkit.

Steps to ready-to-demo measure

Steps	Description	Involved partners/externals	Category of action	Deadline	Monitoring indicator	Comments
1	Preparation of technical description	BKK Department of Business Development of Digital Channels	Technical	30 September 2024	Finalised technical description	
2	Contract conclusion	BKK Department of Business Development of Digital Channels, Partner TBD	Legal	31 October 2024	Agreements signed	
3	Putting the development into operation	BKK Department of Business Development of Digital Channels	Software	31 December 2024	Completed functions	

Monitoring template for Measure BUD_05 “New services to increase accessibility and convenience of PT”

Objectives of the measure

It is the request of the BKK business area to be able to display different service features (special traffic characteristics, which are typical for a given situation or vehicle) in BudapestGO in the future. The BKK travel planning engine is integrated into the application as a separate system element. The purpose of frontend development based on backend development is to display special traffic characteristics, i.e. service characteristics, on the map layer. Certain conditions are subject to special rules/characteristics, the introduction of which may influence users in their choice of mode of transport.

Description of the measure

Measure outputs:

The aim of the project is to expand the already mentioned service features with the following categories:

- Conditions with individual fee regulation: Display of conditions with individual fee regulation (for example: 100E or nostalgia), for which the traditional line ticket and pass type products are not valid.
- Bicycle transportation: Bicycle transportation is permitted on certain types of vehicles (for example: Tatra), but not on other types of vehicles (for example: CAF).
- Certain types of vehicles alternate on certain routes, so it is easier for the Customer if the application includes this information for the flights of each route.
- Connections affecting agglomeration: Connections between Budapest and agglomeration operate with a different system of rules (in terms of tariff system), hence the display of validity information related to BKK products that help customers.
- Ø Local bus conditions: the Budapest pass is not valid for sections beyond Budapest city limits.
- Ø Suburban railway line (HÉV) conditions: the Budapest pass and line ticket are not valid for sections beyond the Budapest city limits.
- Ø Suburban State railway lines: The section within Budapest can only be used with a Budapest pass (other BKK fare products are not valid).
- Ø Volánbusz intercity coach connections: connections between lines 300-900, which run within Budapest, can only be used with the Budapest fare product (other BKK fare products are not valid).
- Air conditioning services: Display of comfort services for vehicles with air conditioning and/or Wi-Fi. In terms of priority, it is less important than the previously mentioned service characteristics, but at the same time it is relevant from the point of view of Customer Experience.
- Electric buses: Separate labelling of electric buses in the name of sustainability.

Related UPPER tools:

The implementation of this measure will not be supported by IT tools from the UPPER toolkit.

Steps to ready-to-demo measure

Steps	Description	Involved partners/externals	Category of action	Deadline	Monitoring indicator	Comments
1	Preparation of the technical report	Various Departments of BKK, including IT	Social / Technical	30 September 2024	Finalised technical description	
2	Contracting	Various Departments of BKK	Legal	31 October 2024	Agreements signed	
3	Putting the development into operation	Various Departments of BKK	Software	31 December 2024	Completion	

Monitoring template for Measure LEU_03+04: "To increase visibility and ease of use of public transport by offering improved information on public transport, parking and shared mobility options."

Objectives of the measure

- Improve data sharing and build better information services.
- Improve the integration and interoperability of key mobility services including public transport.
- Improve service level of public transport.
- Improve user satisfaction.

Description of the measure

The measure will focus on two main challenges: what information is actually needed or relevant for end users, and what are efficient ways to get this information to the end user. Citizen engagement will be crucial to formulate an answer to these questions. Consequently, a framework for accessibility and mobility information will be drafted. Based on this framework, relevant information will be streamlined into datasets that can be onboarded in the city data-infrastructure and shared across platforms, which can also benefit internal users (city advisors and planners). Existing channels and platforms will be evaluated and redesigned when necessary.

Measure outputs:

This measure will deliver:

- Include data sources of all relevant mobility services in city data platform and relevant real-time data sources in traffic management system.
- Develop internal/external BI dashboard.
- Develop new framework for accessibility and mobility information.
- Redesign website/app.

Related UPPER tools:

U-GOV to support the citizen engagement.

U-TWIN for the integration of real-time information.

Steps to ready-to-demo measure

Steps	Description	Involved partners/externals	Category of action	Deadline	Monitoring indicator	Comments
1	Determine approach for citizens' engagement	Stad Leuven	Technical	30/06/2024	Strategy plan for citizens' engagement	We had planned to use U-GOV for this purpose, but as this tool is only usable from 2025, we have to find another solution.
2	Collect input for the framework from the council and advisors from different department	Stad Leuven	Social/ technical	30/06/2024	List of requirements/ input for the framework	
3	Citizens' engagement: stakeholder input for determining what information is missing, most relevant and which means of communication with end-user should be explored	Stad Leuven	Social	31/08/2024	List of requirements/ input for the framework	
4	Explore possibilities, best practices and successful projects for information channels/ integration of information of key mobility services	Stad Leuven	Technical	31/08/2024	List of ideas/ input for the framework	Depending on initiatives for knowledge exchange with the UPPER-cities and partners in WP4
5	Determine which actions to develop/ which information channels to focus on	Stad Leuven	Technical	31/10/2024	(Approved) framework/ principles for accessibility and mobility information	

6	Identify possible extra data sources needed	Stad Leuven	Data	31/10/2024	Data	
7	Develop an implementation plan for the different actions and information channels	Stad Leuven	Technical	31/12/2024		
8	Onboard extra data sources of all relevant mobility services in city data platform if necessary	Stad Leuven	Data	31/12/2024	Database	
9	Development (external) dashboard if necessary	Stad Leuven	Data	30/06/2025	Launch dashboard	
10	(Re)design frontend application(s)	Stad Leuven	Software	31/10/2025	Frontend applications are set for the demo	

Monitoring template for Measure TES_01: “Optimum transfers on P&R areas based on real-time data”

Objectives of the measure

- Increase intermodal trips that include PT.
- Understand the potential of P&R areas.
- Reduce trips made by private cars in the city centre.
- Reduce pollutant emissions.

Description of the measure

Under this measure, an analysis will be undertaken to locate suitable P+R areas; following the analysis, a P+R area will be selected. This measure also foresees the development of a digital service that will provide real-time information to the traveller (parking availability in P+R areas, PT arrival, availability of shared mobility modes). The service will be integrated into an existing MaaS app (eMaaS).

Measure outputs:

This measure will deliver:

- An analysis for the suitable areas for P&R in Thessaloniki.
- A digital service that will facilitate intermodality.
- A P&R area where PT, private car parking and shared modes will be combined.

Related UPPER tools:

U-NEED: It can be used along with already existing methodologies of CERTH for facility location planning, specifically for the identification of the appropriate P&R areas.

U-SIM.live and U-TWIN: These two tools can be used in conjunction with Thessaloniki’s strategic traffic model, developed by CERTH, for estimating PT in-vehicle volume.

Steps to ready-to-demo measure

Steps	Description	Involved partners/externals	Category of action	Deadline	Monitoring indicator	Comments
1	Definitions of use cases for the digital service	CERTH, TheTA	Technical	30/11/2023	Description of use cases	
2	Analysis for suitable P+R areas	TheTA, CERTH,	Social/Technical	29/02/2024	Selection of P+R area	Consultations with relevant stakeholders are foreseen, while the selection will be also affected by the progress of the parking construction in Nea Elvetia metro station. U-Need will also assist.
3	Definition of technical requirements and architecture	CERTH	Technical	29/02/2024	List of requirements and figure (flowchart) depicting the architecture	
4	Data collection	TheTA, CERTH	Data	30/04/2024	Gathering of GTFS (possibility also for GTFS-RT for a single line), and definition of mechanism for receiving parking availability at real-time	
5	Grant permission for implementing a shared micromobility station	TheTA, CERTH,	Legal	31/05/2024	Agreement achieved	The station will probably be virtual (geofenced area)
6	Development of the digital service	CERTH	Software	30/06/2024	Preparation of APIs for information exchange	

7	Integration of the service into the existing MaaS app	CERTH MaaS technology provider	Software	31/07/2024	Real-time information provided to the users through the MaaS app	Collaboration with the developer of the existing MaaS application
8	Implementation of the shared mobility station(s) in the P&R area(s)	CERTH, TheTA	Infrastructure/Technical	31/07/2024	shared mobility station implemented in the P&R area	The station will probably be virtual (geofenced area)
9	Testing of the demo (app and the rest of the necessary features)	CERTH, TheTA	Technical	31/08/2024	All set for the demo	

Monitoring template for Measure TES_05: “To enhance the information provided through adapted services for different groups of passengers”

Objectives of the measure

- Increase intermodal trips that include PT.
- Minimize users’ travel disutility.
- Reduce trips made by private cars.

Description of the measure

This measure builds on an existing multimodal trip planner. Currently, it integrates car-sharing, bike-sharing, scooter-sharing and walking. A generic utility function is used for route planning. Under this measure, PT mode will be integrated (GTFS data for public buses and metro) and the route planning will be done according to user preferences (instead of generic utility function). The updated multimodal trip planner will also be integrated into an existing MaaS application (eMaaS).

Measure outputs:

This measure will deliver:

- A mechanism for individualizing multimodal planner’s outcomes.
- A new generation multimodal planner.

Related UPPER tools:

The implementation of this measure will not be actively supported by IT tools of the UPPER toolkit.

Steps to ready-to-demo measure

Steps	Description	Involved partners/externals	Category of action	Deadline	Monitoring indicator	Comments
1	Definition of use case(s) for the new generation multimodal planner	CERTH	Technical	30/11/2023	Description of use case(s)	
2	Data collection	CERTH, TheTA	Data	29/02/2024	Gathering of GTFS	
3	Conceptualize trip planner individualization	CERTH	Technical	30/04/2024	Definition of the mechanism through which the proposed trips will be individualized	Individualization will be based on the historic trips of each user (specifically those made through the MaaS app)
4	Definition of technical requirements and architecture for the new generation multimodal planner	CERTH	Technical	31/05/2024	List of requirements and figure (flowchart) depicting the architecture	The existing architecture will be adapted for including the new mode (PT)
5	Develop algorithm for individualized trip planner	CERTH	Software	30/06/2024	Algorithm to be fully operational – Preparation of API for sending algorithm's result	
6	Integration of new generation multimodal planner into the existing MaaS app (eMaaS)	CERTH, MaaS technology provider	Software	31/07/2024	New generation multimodal planner to be fully operational	Collaboration with the developer of the existing MaaS application (BRAINBOX)
7	Testing of the demo (app and the rest of the necessary features)	CERTH, TheTA	Technical	31/08/2024	All set for the demo	

Monitoring template for Measure HAN_01: “Digital tariff piloting”

Objectives of the measure

- Improve data sharing and build better information services.
- Improve the integration and interoperability of key mobility services including public transport.
- Improve service level of public transport.
- Improve user satisfaction.
- Easier access to public transport

Description of the measure

This measure will develop a new check-in/be-out system that calculates the distance travelled and charges the user accordingly. The Hannover region is now divided into tariff zones which correspond to different ticketing, and this might confuse PT users. By introducing this digital tariff, PT access will be much simplified.

Measure outputs:

This measure will deliver:

- Easier access to public transport
- Easier billing of the PT -> No need to buy a ticket beforehand
- Integration of Check-in/ be out System and Digital tariff into the new GVH App

Related UPPER tools:

Possibly: U-GOV to collect user feedback about the App and the usability of the new tariff system from different target users.

Steps to ready-to-demo measure

Steps	Description	Involved partners/externals	Category of action	Deadline	Monitoring indicator	Comments
1	Concept Study	Consultant office and all transport associations involved	Technical	12/2023	Concept study ready	
2	Commissioning in the Hannover Region and the transport authority (GVH)	Region Hannover/ GVH	Legal	07/2024	Authorisation in all governing bodies and committees	
3	Define which data can be collected	All transport associations involved, Hannover Region, CiBo Service Provider	Data	09/2024	Creation of database	Must be clarified with CiBo service provider and depends on the progress of the tendering process
4	Creation of a marketing and evaluation concept	Region Hannover/ GVH	Social	Summer/ Autumn 2024	Finalised evaluation and marketing concept created	Depends on tendering processes
5	Go live with Ci-Bo and digital tariff	Region Hannover/ GVH/ÜSTRA	Technical	01/2025	introduction	

Monitoring template for Measure HAN_04: “Mobility dashboard solution”

Objectives of the measure

- Improve user information on mobility options.
- Promote the use of Park & Ride facilities.
- Reduce individual car-traffic in urban areas.
- Promote multimodal transport chains.
- Promote public transport
- Maybe: Monitoring of projects related to the SUMP -> Which projects are currently running (profiles), what is currently being implemented in the direction of the SUMP

Description of the measure

This measure foresees the expansion of the existing mobility dashboard through the addition of new features (e.g., availability of P+R parking spaces, real-time public transport data) or implementing a new dashboard solution (not sure yet).

Measure outputs:

This measure will deliver:

- Prototype of a mobility dashboard or a prototype of an enhanced Mobility Dashboard with new data and maybe integrated real-time public transport data.
- (Implementation of mobility dashboard with our traffic management unit (as part of our Team)).

Related UPPER tools:

U-SIM live or U-Twin to combine and display the available data on public transport use (departure times, road works, delays or other) together with, for example, the data from our cycle counting stations in the best possible way.

U-SUMP tool to constantly monitor the targets set out in the 2035+ Transport Development Plan. Close collaboration with our traffic management unit.

Steps to ready-to-demo measure

Steps	Description	Involved partners/externals	Category of action	Deadline	Monitoring indicator	Comments
1	Definition of use cases	Region Hannover	Social/Technical	05/2024	Description of use cases	currently not yet possible, as the tool is not yet ready - Relates to the features and use cases of U-TWIN tool (Connection not sure yet)
2	Identify connecting elements to existing projects	Region Hannover	Data	05/2024	Successful creation of Roadmap to implementation of Mobility Dashboard	
3	Data collection	Traffic Association, Traffic Management Centre	Data	09/2024	Creation of database	
4	Definition of technical requirements	Region Hannover	Technical	09/2024	Final list of technical requirements	

UPPER
Unleashing the Potential of Public Transport in Europe

ANNEX B: Points of attention for measures under Task 4.4 in the context of the 2nd MaaS Workshop

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City	Measure ID	Appraised by	"Point of attention" category	Evaluation result: Point of attention/Comment	Solution you can present	Task	Group
LEU	LEU_03+04	ICLEI	Tailored communication for increased acceptance and buy-in	Consider whether it is better to have separate brands/identities for some functions of the city (like management of disruption/roadworks/inconveniences) and a separate one for positive engagement to include modal share. There is a danger that if all transport-related activities fall under one banner, then the brand could be tarnished by activities which (necessarily) frustrate commuters. However, integration and use of all available channels for different purposes is definitely a positive.		T4.4	A
LEU	LEU_03+04	ICLEI	Active stakeholder engagement during measure development	It would be useful to hear an update on the citizen engagement plan, and hear how people from all walks of life are being included.		T4.4	A
LEU	LEU_03+04	EPF	Tailored communication for increased acceptance and buy-in	How do you intend to engage users? What do you mean by accessibility (in which context is the term being used)?	focus groups, interviews, surveys etc. Important to have a clear definition of what accessibility	T4.4	A
LEU	LEU_03+04	ECF	Data management and privacy	Consider including (safe) bicycle parking in the data framework if it is not already in there (similar to OSL_08)		T4.4	A
LEU	LEU_03+04	EPF	Active stakeholder engagement during measure development	Citizen engagement activities are planned (serious games, crowdsourcing campaigns); on the other hand, target groups are said to be 'all potential PT users and users of other mobility services' but mainly 'visitors as opposed to citizens'. Why make this choice, and which channels are considered to reach them? Are the foreseen engagement activities in this case catered to finding out about this group's specific needs (will be more difficult to reach than citizens?). From the measure description, it was not clear whether the idea is to create a sort of 'data lake' / data portal to use for B2B purposes, and/or whether also B2C information flows are envisaged. In case the purpose of the measure is to create a data portal, there is also a B2B target audience to consider (mobility service providers, app developers, ...). In either case, it will be very important to collaborate with and involve other mobility service providers that have their own apps and websites that people already use (De Lijn, NMBS, Google maps, and others), and to see which requirements (e.g., in terms of data standards) they have. In general some other concepts in the description are not very clear, like 'a framework for accessiblity and mobility information' or 'BI dashboard', so it would help to clarify them when reaching out to stakeholders.	Clearly identify target stakeholders (B2B and B2C) and choose engagement activities accordingly. Clarify concepts such as 'framework for accessibility and mobility information' and 'BI dashboard'.	T4.4	A
LEU	LEU_03+04	EPF	Tailored communication for increased acceptance and buy-in	On the one hand, the description mentions that 'existing channels and platforms will be evaluated and redesigned' and 'redesign website/app' is one of the measure outputs; however it's not really clear which website or app is meant. A data portal website (B2B)? Or is Leuven planning to develop its own multimodal route planner app/website (B2C)? To note that for end-users, this might not really work due to 'app fatigue' and habitual use of other apps/info sources, plus the need for a broader geographic coverage esp. if visitors to the city are targeted. Likewise, in case the target audience are B2B users, it's important to reach out and consider their needs so it is useful for them.	Clarify which 'website / app' is envisioned within the measure and who is the target audience (B2B - B2C).	T4.4	A
MAN	MAN_05	EPF	Mobility as a right: Universal accessibility leaving no one behind.	It is important to consider people who have difficulties using digital services; e.g., people with a visual impairment, the elderly, and people who cannot afford the purchase of smart phones. These groups risk being left behind.	Awareness raising and training for the handling of new technologies (inclusion is important)	T4.4	A
OSL	OSL_08	ECF	Active stakeholder engagement during measure development	Consider using local cyclists organisation volunteers as enthusiastic test users for the integration of bicycle parking in the Ruter app		T4.4	A
OSL	OSL_08	EPF	Seamless multimodality/intermodality	See comments LIS_07: For end-users, it is important to 1. have a comprehensive overview of available options, 2. have a neutral ranking of those options in terms of criteria such as travel time, price, number of transfers, accessibility for PRM, 3. be able to buy a ticket for the whole journey in a one-stop-shop. During the trip: real-time information (-> for this, data exchange needed (cf. MMTIS Delegated Regulation, revised Rail Passenger Rights' Regulation) and assistance (e.g., advice on re-routing) in case of disruptions / missed connections.		T4.4	A
VAL	VAL_05	ICLEI	Active stakeholder engagement during measure development	This measure already well recognises that mobility needs differ between different segments of the population and mobility tools for consumers need to reflect this better. Since there has not been a further update, it would be helpful to know the progress in arranging a workshop with the relevant communities and if it has happened what its outcomes have been.		T4.4	A
VAL	VAL_05	EPF	Mobility as a right: Universal accessibility leaving no one behind.	Accessibility can also be seen from a financial perspective. For example, if the MaaS solution is expensive, or if you need a credit card to pay, some people will not be able to use it. Not everyone has access to smart phones (or knows how to use one) or internet. Some MaaS apps require a local phone number and this can leave behind some users. Not to forget that also the app / website itself has to be accessible, notably considering people with visual impairments (e.g., text to speech functionality, use of colour contrasts). The objectives in the document are not aligned with the measures put in place (social inclusion).	Important to consider all user groups when developing new services (age, income, gender, social status etc.)	T4.4	A
VAL	VAL_05	EPF	Tailored communication for increased acceptance and buy-in	Under 'supporting activities', it is said that there is a 'great module on communication'. Just to note that having a stand at the UITP summit is a great way to reach other cities, but also sufficient attention must be paid to communicating about the MaaS app to citizens - including those vulnerable groups that are being targeted.	Develop targeted communication activities, aiming to reach citizens in general and also groups vulnerable to exclusion	T4.4	A
VAL	VAL_05	IFP	Mobility as a right: Universal accessibility leaving no one behind.	MaaS does include the information on the quality and universal acessibility of the catchment area?	Include information about the walking and whelling stage of the PT trip in the MaaS	T4.4	A
VAL	VAL_05	IFP	Active stakeholder engagement during measure development	Are you going to engage with local organizations dealing with walking, persons with disabilities and cycling	Engage with local organizations dealing with walking, persons with disabilities and cycling	T4.4	A
BUD	BUD_02	UITP	Seamless multimodality/intermodality	Attention to make multimodal digital mobility services complementary with PT and not compete with it. Data collection currently not focusing on understanding where shared services make sense, hence, understanding where PT is underperforming and could benefit from shared services. Solely giving free rides could potentially just replace PT trips. Shared services could be seen as a short-term enhancement of PT. Within the SWOT analysis, BUD further wants to increase its data-based decision making, which can be enhanced by this measure.		T4.4	B
BUD	BUD_04	UITP	Seamless multimodality/intermodality	Attention to finding the right organisational strucuture to integrate private operators into the public MaaS. Decision between full integartion and trnasfer via deep link needs to be made - also if BKK has a contract with a third party (acting between BKK and the MSPs) or if contracts need to be defined between BKK and all MSPs individually.		T4.4	B
BUD	BUD_02	ICLEI	Tailored communication for increased acceptance and buy-in	Consider whether aligning more intense discount periods could be done during periods such as European Mobility Week.		T4.4	B
BUD	BUD_02	ICLEI	Tailored communication for increased acceptance and buy-in	Consider how the incentives can also reward occasional users/those who do not have fixed 5 day 9-5 working patterns, such as people who work/commute part time or have caring responsibilities. How to reach out to new audiences and not just reward those already travelling sustainably.		T4.4	B
BUD	BUD_02	ICLEI	Tailored communication for increased acceptance and buy-in	The advertisement/communication plan is an important step, and should include a thorough understanding of the target audiences prior to a messaging style being determined.		T4.4	B
BUD	BUD_02	EPF	Environmental impacts on CO2 emissions, energy use, and air quality.	Monitor the impact on modal split - the aim is not to move people away from public transport, walking or cycling, but rather to offer additional shared mobility services as a complement to them.		T4.4	B
BUD	BUD_02	EPF	Active stakeholder engagement during measure development	No clear mention of end user engagement. The concept is to attract people who use PT already - think also about how to reach other people that do not currently, and also create an attractive try-out offer for them (both for PT itself and/or other -shared- services). Not everyone has access to a smart phone. Not everyone has access to a credit card.	Engaging users (via focus groups, questionnaires, information points) to raise awareness at a neighbourhood/local level to understand their needs and also inform them	T4.4	B
BUD	BUD_04	ICLEI	Tailored communication for increased acceptance and buy-in	Would providers be accepting of any common umbrella branding to help communicate the breadth of services on offer - irrespective of whether they can be integrated in one app or not?		T4.4	B
BUD	BUD_04	EPF	Seamless multimodality/intermodality	MaaS alone cannot increase public transport usage. Please refer to the other BUD measures. Monitor the impact on modal split - the aim is not to move people away from public transport, walking or cycling, but rather to offer additional shared mobility services as a complement to them.	The fares should be included in the proposed itineraries so that the users can be better informed when planning their trips. Important to have an application were users can filter the	T4.4	B
BUD	BUD_05	EPF	Tailored communication for increased acceptance and buy-in	The measure description and title of the measure seem to be two different things. The title is about acessibility whereas the description is about information accuracy. Take care to offer the same information on all different channels (e.g., at the stop, in the app, on the BKK website, ...) - to increase trust and reliability.	Re-write the measure or re-define the objectives. Pay attention to how the information will be put forward to passengers (different channels).	T4.4	B
IDF	IDF_05	EPF	Mobility as a right: Universal accessibility leaving no one behind.	Don't forget that the MaaS app itself also needs to be accessible, notably for people with visual or cognitive impairments (e.g., text to speech functionality, use of color contrasts, intuitive and simple UI, good help function, ...). Not everyone has access to or can use digital apps, especially for first and last mile.		T4.4	B
IDF	IDF_05	FACTUAL	Tailored communication for increased acceptance and buy-in	Will there be any incentives in place for the users choosing more sustainable ways to move? How will the active modes be promoted?		T4.4	B

IDF	IDF_05	EPF	Seamless multimodality/intermodality	Getting people into PT is not only a question of MaaS only (but affordability, time budget, frequency, safety, time planning, capacity, accessibility to the MaaS app, information and easy ticketing). Will integrated fares be offered including first-last mile services?		T4.4	B
ROM	ROM_06	EPF	Seamless multimodality/intermodality	How do you take into account people's needs. How do you ensure you have a representative sample participating in the pilot? See also comments LIS_07.	Analysis of data should be ongoing. Users should be involved throughout the whole	T4.4	B
ROM	ROM_06	IFP	Mobility as a right: Universal accessibility leaving no one behind.	MaaS does include the information on the quality and universal acessibility of the catchment area?	Include information about the walking and whelling stage of the PT trip in the MaaS	T4.4	B
ROM	ROM_06	IFP	Active stakeholder engagement during measure development	Are you going to engage with local organizations dealing with walking, persons with disabilities and cycling	Engage with local organizations dealing with walking, persons with disabilities and cycling	T4.4	B
HAN	HAN_01	EPF	Seamless multimodality/intermodality	Good idea to simplify fares and also to align with the Deutschlandtariff. Two points: 1. Will users be informed beforehand of how much their trip will cost? 2. Will you foresee another way to tap in and tap out, e.g. by using a payment card? Only through the app is a barrier as not everyone will have it or want to install it. Continue to foresee ticketing machines so people without the app / without payment card can also purchase tickets. Learn from other cities that have already implemented a similar solution.		T4.4	C
HAN	HAN_04	FACTUAL	Seamless multimodality/intermodality	How will the mobility dashboard promote the use of P&R facilities?		T4.4	C
LIS	LIS_07	ICLEI	Active stakeholder engagement during measure development	It would be helpful if the results of the analysis of other journey planning platforms could be shared, and what the plans are for understanding the preferences of users in undertaking journey planning.		T4.4	C
LIS	LIS_07	ICLEI	Mobility as a right: Universal accessibility leaving no one behind.	This discussion should also consider those who do not use digital platforms, but still rely on paper-based systems such as using paper timetables and buying tickets in person. How can their needs also be met, and what are their barriers to more digital use? How could a new digital solution run in tandem with still supporting on-street and printed information.		T4.4	C
LIS	LIS_07	EPF	Seamless multimodality/intermodality	Different MaaS platforms can create confusion for the users. How do you ensure equal access to these platforms for all (inclusivity and leaving no one behind). Is the city of Lisbon thinking of developing its own MaaS app, or considering to impose certain obligations on the existing ones? For end-users, it is important to 1. have a comprehensive overview of available options, 2. have a neutral ranking of those options in terms of criteria such as travel time, price, number of transfers, accessibility for PRM, 3. be able to buy a ticket for the whole journey in a one-stop-shop. During the trip: real-time information (-> for this, data exchange needed (cf. MMTIS Delegated Regulation, revised Rail Passenger Rights' Regulation) and assistance (e.g., advice on re-routing) in case of disruptions / missed connections. EPF is also involved in the Multimodal Passenger Mobility Forum, final report of the discussions so far is available here: https://transport.ec.europa.eu/news-events/news/multimodal-passenger-mobility-forum-final-report-2023-02-02_en	Organise workshops to find out cittizens' needs for MaaS apps and their experience with using exitsting ones.	T4.4	C
TES	TES_01	FACTUAL	Environmental impacts on CO2 emissions, energy use, and air quality.	What is the digital service to be developed? Will there be any incentives in place for the users that decide to park at the facility?		T4.4	C
TES	TES_05	EPF	Seamless multimodality/intermodality	The MaaS app alone will not reduce car usage. Indeed, it will help improve the routing and PT information for the users but it will not improve the quality of the PT in terms of responding to people's needs. But, having said that, the inclusion of PT information is indeed crucial as PT is the backbone of multimodality, which can then be complemented by the other shared services that were already considered. Who is going to develop / market / own the MaaS app?	There are more factors to consider and not just the MaaS app alone if you want to get people out of their cars including the quality of service. Not everyone has access/wishes to have a smart phone, credit card etc.	T4.4	C
TES	TES_05	IFPEN	Mobility as a right: Universal accessibility leaving no one behind.	What are the conditions for access to the new DRT service? Will a new pricing scheme be applied, or will having a current TC subscription be sufficient to access the service?		T4.4	C
HAN	HAN_04	UITP	Passenger flow and occupany technologies	Definition of passenger flow and occupany technologies and create a roadmap of technologies needed	Consultation of UITP resources as this topic is one of the topics of IT committees. We published a reference report on passenger flow and crowd management technologies in 2022 https://cms.uitp.org/wp/wp-content/uploads/2022/10/Report-PassengerFlow-Oct2022-v4b.pdf and a new knowledge brief on why investing on these technologies are comin up that we can share knowledge	T4.4	C