

D2.4 UPPER Measures, requirements and policy recommendations

WP2 User needs, baselines definition and project requirements





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Acronyms

| Acronym / Abbreviation | Meaning |
|------------------------|---|
| CINEA | European Climate, Infrastructure and Environment Executive Agency |
| BRT | Bus Rapid Transit |
| LEZ | Low Emissions Zone |
| ZEZ | Zero Emissions Zone |
| PT | Public Transport |
| MaaS | Mobility as a Service |
| PTO | Public Transport Operator |
| PTA | Public Transport Authority |
| SUMP | Sustainable Urban Mobility Plan |
| VRU | Vulnerable Road User |
| WP | Work Package |
| ID | Identification |
| GA | General Assembly |
| ICB | Impact Creation Board |
| MaaS | Mobility as a Service |
| MDMS | Multimodal Digital Mobility Service |
| UVAR | Urban Vehicle Access Regulations |
| GDPR | EU general data protection regulation |

| | |
|------|---|
| API | Application Programming Interface |
| REST | Representational State Transfer |
| UTC | Coordinated Universal Time |
| GTFS | General Transit Feed Specification |
| GIS | Geographic information system |
| VKT | Vehicle kilometre Travelled |
| PKT | Passenger Kilometre travelled |
| KPI | Key Performance Indicators |
| OS | Operational System |
| OD | Origin-Destiny |
| AI | Artificial Intelligence |
| NZC | NetZero Cities |
| EU | European Union |
| FAQ | Frequent Asked Questions |
| ATM | Automated Teller Machine |
| PRM | Persons with Reduced Mobility |
| POI | Point Of Interest |
| NGO | Non-Governmental Organization |
| DRT | Demand Responsive Transport |
| OSM | Open Street Map |
| TOD | Transport Oriented Development |
| EV | Electric Vehicle |
| NAP | National Access Point |
| CCAM | Cooperative, connected and automated mobility |
| EMDS | Ecosystem Management Decision Support |

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Abstract

The UPPER project envisions a transformative future for public transportation in European cities. Its primary objective is to position public transportation as the cornerstone of urban mobility systems. To achieve this ambitious vision, UPPER is set to implement and evaluate around 80 measures that aim to discourage private vehicle usage ("pushing") and enhance public transport ("pulling"), emphasizing inclusivity and Mobility as a Right (MaaR). To support the implementation of these measures, the UPPER project is developing a "Support toolkit" comprising of seven innovative technology-driven solutions. The project's success depends on understanding the technical, operational, and governance requirements and regulatory constraints to be met by both the nearly 80 measures and the UPPER support toolkit. This deliverable plays a pivotal role in delineating these requirements.

In particular, this deliverable outlines the high-level and specific requirements identified in a collaborative manner for each of the UPPER tools, setting the stage for their development. The requirements identified determine the functionalities and features that the tools supporting the 'push and pull' measures during the project will have, providing essential guidance for the respective developers.

Crucial to the project's success is the determination of the specific needs and considerations for the successful development and deployment of the measures in the UPPER demo sites. The cross-cutting and the detailed requirements to be met by each one of the nearly 80 measures of the project are one of the key pillars of this deliverable.

Additionally, this deliverable offers policy recommendations to be considered depending on the different local policy framework in place. These policy recommendations are aimed at supporting the implementation and at fostering the replication of the measures in other cities as well, with a focus on governance aspects and achieving mobility as a fundamental right for all.

Keywords

Technical requirements, Operational requirements, Legal requirements, Policy recommendations

1. Introduction

1.1. Purpose of the document

The overarching goal of the UPPER project is to unleash the potential of public transportation, transforming it into the central pillar of mobility systems across European cities. To realize this ambitious vision, UPPER will conceive, implement, and showcase around 80 measures designed to both discourage private vehicle usage ("pushing") through access and parking restrictions, charging schemes, regulations, etc., and stimulate the use of public transport ("pulling") by enhancing its offer, multimodal integration, efficiency, safety, comfort, introducing economic incentives, improving the perception among citizens, etc. UPPER will adopt a user-centric and inclusive approach, leaving nobody behind and guaranteeing the alignment with the Mobility as a Right (MaaS) concept, which stresses that inclusive mobility should be conceived as a right for everyone. These measures will be showcased in 5 primary pilot sites and 5 follower sites, where the measures' impact and contributions to UPPER's objectives will be evaluated.

The UPPER project will support the ten cities and regions throughout the implementation of their measures. To fulfil this objective, an "UPPER support toolkit" will be developed, encompassing 8 pioneering technology-driven solutions. This toolkit will aid cities in designing, simulating, monitoring, evaluating, expanding, and maximizing the impact of their "push and pull" measures.

In order to develop the tools of the UPPER toolkit, as well as to prepare the 80 "push and pull" measures for deployment, it is necessary to first determine the requirements that all of them must meet to effectively achieve the overall objectives of the UPPER project. Deliverable 2.4 aims to document the efforts undertaken in task T2.4, which seeks to aggregate the technical, operational, and governance requirements, along with regulatory constraints, that the UPPER measures and the UPPER support toolkit must satisfy. This deliverable is a key outcome for the UPPER consortium, outlining the necessary technical and legal requirements for the UPPER toolkit and establishing essential guidelines for deploying and demonstrating the comprehensive set of nearly 80 "push and pull" measures.

Likewise, this deliverable will present a set of identified policy recommendations and a useful tool for discussing and evaluating the impact of each one of them. These policies can be of significant assistance in supporting the implementation of the identified measures, helping better understanding of their impact and promoting their replication in other cities. These policies will encompass governance aspects and provide a comprehensive strategy for achieving mobility as a right.

The lead authors would like to thank mainly to all UPPER sites' representatives and their local collaborators for their active contribution, interest and information provided throughout the process of collecting the requirements to be met to develop and deploy their measures. Lastly, the lead authors would like to thank everybody who provided input, insights and comments to this document.

1.2. Structure of the document

This document is structured as follows:

- Chapter 1 serves as an introduction and also gives an overview of the tools of the "UPPER support toolkit" (further detailed in the Annex section) as well as the main categories in which the "push and pull" measures are grouped.
- Chapter 2 describes the methodological approach followed to identify and define: the specific requirements that the UPPER toolkit must accomplish, the requirements and recommendations for the deployment of the UPPER measures, and the policy recommendations.

- Chapter 3 presents the results of the work performed under T2.4. It includes an overview of the technical, operational and legal requirements for each solution of the UPPER support toolkit and the validation and iteration phases (further detailed in the Annex section). It also presents the specific requirements for each of the measures (further extended in the Annex section), as well as the recommendations for each measure category. Finally, a set of policy recommendations for the pilot sites is presented in this section.
- Chapter 4 serves as a conclusion, summarizing the key findings of the document.

1.3. UPPER toolkit

The role of the UPPER consortium is to provide support to cities in implementing their desired measures. To do so, UPPER will develop and provide a set of IT supporting tools ('UPPER Measures Implementation Support Toolkit') that will support the UPPER measures in different phases of their design, development and implementation.

This section briefly presents the 8 tools that constitute the 'UPPER Measures Implementation Support Toolkit'. Further and detailed description of the tools can be found in ANNEX A: UPPER toolkit product cards.

1.3.1. U-TWIN

U-TWIN is based on the concept of Urban Digital Twins (UDT). It supports the city by offering an integrated and modular real-time representation of urban mobility assets and their actual operation status. U-TWIN provides the city and the mobility authorities with a comprehensive solution that makes it easy to understand the complex interrelation between the PT operation, traffic, users demand, events and other urban factors.

U-TWIN not only facilitates the real-time visualisation and monitoring of PT, but also detects abnormal situations (in terms of excessive occupancy level, delay w.r.t schedule, low air quality...) and provides forecasted information (travel times, estimated time of arrival, occupancy, air quality...) supporting the PTOs and PTAs to implement corrective actions, if needed, in an efficient way.

1.3.2. U-SIM.plan

U-SIM.plan is a comprehensive, flexible software system for transportation planning, travel demand modelling and network data management. Designed for multimodal analysis, U-SIM.plan integrates all relevant modes of transportation (trains, trams, buses, pedestrians, bicyclists, cars and trucks) into one consistent network model. It makes it the standard for macroscopic simulations and macroscopic modelling of transport networks and transport demand, public transport planning, and for the development of transport strategies and solutions, providing insights for long-term strategic planning but also short-term operational use. U-SIM.plan is based on PTV Visum.

1.3.3. U-SIM-live

U-SIM.live is a real-time simulation-based decision support platform for PT Operators and Agencies. It uses live data and curated data about PT provided by U-TWIN: schedule modifications, service disruptions, live PT vehicle positions, and passenger counts on board, at stations/stops and boarding/alighting. With these, it provides continuous data analytics, generates alerts and supports the operational decisions, by allowing to simulate on-the-fly alternative mitigation strategies, and quantify the resulting effects of each of these.



1.3.4. U-SUMP

U-SUMP provides a data-driven platform that helps to guide and track the development, implementation, and update of SUMP's with a climate-neutrality focus. It aims to support the continuous monitoring of goals, as defined in individual SUMP's, with the help of a pre-defined set of indicators that can be visualised in the form of a dashboard. U-SUMP is also designed to act as a data-based decision-support tool, providing input to decision makers on trends and the achievement of targets .

The platform will integrate the results of the UPPER measures and guide the development, implementation, and update of the SUMP's of the partnering cities, while keeping the climate-neutrality target in focus. The tool targets both local and regional authorities, PTOs and PTAs.

1.3.5. U-NEED

U-NEED is a data analytics and big data visualisation tool that helps city authorities, PTOs and PTAs to understand the multimodal transport demand and how people move around the city, so as to adapt PT offer accordingly. The tool integrates origin-destination (OD) information from different transport modes, provides a geographic 3D representation of the flows of people and identifies the main inefficiencies of PT offer (geographic areas not well covered, excessive travel times, insufficient capacity...).

The goal is to help defining the optimal PT capacity, schedule, frequency and routes based on the user needs and passenger flows. U-NEED also allows optimising the offer in the short/medium term, by predicting PT demand and operation under certain circumstances and anticipating abnormal situations.

1.3.6. U-GOV

U-GOV is an inclusive, continuous and data driven community engagement platform to power decision making at city level. U-GOV is designed to foster the citizen participation at four levels: Information/Sensitization – Consultation/Dialogue – Collaboration/Co-creation – Alliance/Decision making.

It provides a meeting point among the different actors of social innovation, allowing them to make proposals and foster public consultation, discussion, enrichment, co-creation and validation of new solutions and services to advise decision-makers. The platform will be in digital format and will include a collection of tools employed in social innovation, to be used by mobility agents (PTOs and PTAs).

1.3.7. U-KNOW

U-KNOW is an online portal for public transport knowledge exchange, collaboration, and innovation. U-KNOW's objectives are to facilitate knowledge transfer, promote best practices, and stimulate innovation in the field of public transport. It aims to support cities, public transport operators, and authorities in creating more sustainable and efficient urban transport systems. U-KNOW promotes knowledge exchange to accelerate the adoption of innovative solutions.

It identifies and promotes best practices in the field, helping optimize transport systems and improve citizens' quality of life. Finally, U-KNOW stimulates innovation by providing a platform for exchanging ideas and sharing cutting-edge research and development. U-KNOW will support cities and project partners as a capacity-building tool, a learning centre structured around the European Commission's Smart and Sustainable Cities Mission and the UPPER measures.



1.3.8. U-TRANSFER

U-TRANSFER will offer a dynamic and interactive platform to guide cities and PTOs through the implementation of knowledge and solutions demonstrated in UPPER and deposited in U-KNOW repository. It will also provide space for knowledge exchange through webinars and implementation guidelines based on a mapping of the needs of the visitors of the platform.

Relationships with ambassador cities and city visits could be established through the platform based on a matchmaking process that can facilitate relationships based on similar challenges, and cultural and governance backgrounds. U-TRANSFER will provide transferability guidelines that will facilitate the transfer of UPPER solutions to a broader range of cities. U-TRANSFER is aimed at cities and stakeholders not directly involved in the project, but who would be interested in replicating the project findings and applying the measures developed and demonstrated in the UPPER sites.

1.4. UPPER measures: High-level categories

The UPPER project seeks to showcase around 80 push and pull measures aimed at increasing the use and satisfaction with public transportation. Each site has devised its own set of measures. Nonetheless, there are numerous similarities and potential synergies among the measures proposed by each demo site. To facilitate the sharing of knowledge, enhance collaboration across sites, and promote mutual learning, the UPPER measures have been categorized into 12 main groups or categories:

- **Redistribution of Urban Space:** These measures involve the strategic reconfiguration of urban areas to shift the emphasis from private vehicles towards pedestrians, public transport, and sustainable modes like cycling. By repurposing roadways, parking spaces, and public spaces, this category seeks to create a safer, more attractive environment for alternative modes of transportation, making the urban landscape more conducive to walking, cycling, and using public transport.
- **PT Stops and Facilities:** Focused on the enhancement of public transport stops and facilities, this category aims to ensure that these spaces are universally accessible, safe, and inclusive for all passengers. This involves redesigning stops to accommodate different needs, such as those of people with disabilities or those who require additional assistance, creating a comfortable waiting environment, and integrating user-friendly information displays.
- **Multimodality (Physical Integration of mobility services and Hub Creation):** This category encompasses the establishment of multimodal transportation hubs and the introduction of diverse transportation options within those hubs. By connecting various modes of transportation such as walking, cycling, buses, trains, and potentially micro-mobility services, these measures aim to simplify and streamline the process of switching between different transport modes for a more seamless travel experience.
- **Multimodality (Operational and Digital Integration of mobility services):** Here, the focus lies on the creation of comprehensive Multimodal Digital Mobility Services (MaaS/MDMS). This includes the integration of diverse transportation options into a single digital platform, enabling users to plan, book, and pay for various modes seamlessly. Additionally, it addresses the integration of ticketing systems and information sharing among different transport modes to contribute to a more connected and user-centric transportation network.
- **Low Emission Zone (LEZ) / Congestion and Pollution Charging Scheme / Smart Parking Management:** This category centres around the implementation of Urban Vehicle Access Regulations (UVARs). It involves both pricing aspects, such as congestion and pollution charges, and regulatory measures like Low Emission Zones (LEZs). Smart Parking Management systems are also part of this, aiming to regulate parking availability and encourage the use of alternative modes, thereby reducing congestion and pollution.

- **Traffic Management and PT Prioritization:** This category of measures seeks to optimize urban traffic flow and enhance the efficiency of public transport systems by creating an environment where public transport is prioritized. Measures include creating dedicated lanes for buses, trams, and other public transport vehicles and implementing traffic light management to grant priority to public transport vehicles, ensuring smoother and faster journeys.
- **Mobility Planning:** This category focuses on optimizing the efficiency, reliability, resilience, and accessibility of the public transport network at both local and regional levels. It involves leveraging data from public transport systems to improve decision-making, enhance service reliability, and provide up-to-date information to passengers. Additionally, it promotes collaboration between stakeholders to ensure effective mobility solutions.
- **On-Demand Mobility Services:** This category also seeks to improve the efficiency, reliability, and accessibility of public transport. Specifically, it explores the integration of on-demand mobility services to complement traditional fixed-route public transport options, catering to specific user needs (such as people living in peri-urban or isolated areas or with special needs).
- **User Perception of Quality of Service (QoS):** With a focus on enhancing the public's perception of public transport, this category aims to elevate the overall user experience. Measures involve better understanding and addressing issues that affect passengers' satisfaction, such as cleanliness, safety, reliability, and information availability. By providing a comfortable and reliable journey, public transport becomes a more attractive choice.
- **Incentivization:** These measures target the encouragement of public transport usage, often tailored to specific user groups. Incentives may include fare discounts, loyalty programs, or exclusive offers that emphasize the benefits of using public transport, making it a more appealing option compared to private vehicles.
- **Democratic Governance:** This category focuses on involving public transport users, different governance levels and relevant stakeholders in the decision-making process. By soliciting input from passengers, community members, and relevant stakeholders, measures seek to ensure that transportation solutions align with the needs and preferences of those who rely on public transport services.
- **Campaigns:** With the intention of promoting public transport use, campaigns target specific user groups or VRUs. By employing various communication strategies, such as advertisements, outreach events, and educational initiatives, this category aims to raise awareness about the benefits of public transport and encourage behavioural shifts towards more sustainable modes of travel.

The categorization of the 'push and pull' measures within the designated groups can be found in Annex B: Measures grouping per category.

2. Methodology

2.1. UPPER toolkit requirements: VOLERE methodology

The definition of U-Tools requirements **will determine the functionalities and features** that the tools supporting the 'push and pull' measures during the project will have. This is why it is a crucial task that must be carried out with the full agreement of all partners.

Within the UPPER project, the following tools will be developed: U-TWIN, U-NEED, U-GOV, U-SIM (U-SIM.LIVE & U-SIM.PLAN), U-KNOW, U-TRANSFER AND U-SUMP. Each of these tools will be offered to the project cities and regions to support their measures implementation (development, deployment, upscaling...). It is worth noting that **not all measures will require the support of a tool**. However, it is advisable to use them whenever possible, as they can be beneficial for the implementation of the measures.

The process followed to define the UPPER toolkit requirements is based on the VOLERE methodology, which has already been successfully employed in various other projects (USER-CHI, PODIUM, MEISTER) to define both high-level and specific requirements. The VOLERE methodology involves iterative validation and revision of the different requirements by all partners. Therefore, all partners are encouraged to actively participate in defining the requirements for the tools they intend to use. Moreover, the development leaders of each U-tool are responsible for ensuring the effective completion of their U-Tool's requirements.

2.1.1. Approach

The methodology is characterised by an integrated approach (Figure 1): specific requirements for the UPPER support tools (U-tools) obtained from the technical experts and pilot sites of the consortium through the Volere tool may be implemented.

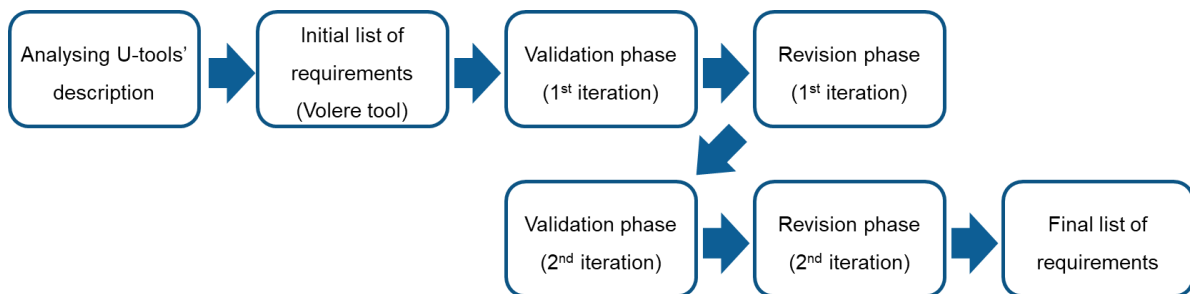


Figure 1. VOLERE Methodological approach

The identification of the specific requirements comprises a broader set of requirements to be considered within the development process of the U-tools. The following subsections provide a detailed overview of the applied approach.

2.1.2. VOLERE methodology

To define the requirements necessary for the development of each of the UPPER support tools, the Volere methodology has been followed.

This methodology has been proven successful in previous H2020 projects such as USER-CHI, DORA, MEISTER, X-FLEX, NOBEL GRID, WISEGRID, or CROSSBOW, where it was used mainly because of its simplicity. It helped

project partners to describe, discuss, formalise, and track the project requirements explicitly and collaboratively. Besides being successfully realised in the above-mentioned previous projects, the Volere methodology was selected for the following reasons:

- It requires simple steps to identify and formalise the requirements unambiguously.
- It provides an easy process to track and evaluate the progress of the project.

The application of the Volere methodology is not only useful in the initial phases of the project for specifying requirements, but it is also helpful in specifying a reference point for the later stages.

Besides being efficient and easy to use, the Volere methodology provides a mechanism for all partners to specify the requirements in a standard format. Thereby, specifying the additional context of a requirement such as the rationale and the acceptance criteria for every requirement helps to build a common understanding of the overall system. Furthermore, defining priorities helps to clarify the focus of the project.

In order to prioritize requirements, the project consortium has introduced five different classes of priorities. These classes range from one (lowest priority) to five (highest priority) and the consortium has defined them as follows:

- **5 - High:** Requirements in this class are either realizing a key innovation of the project or they are needed to realize it. These requirements are necessary to achieve the goals of the project.
- **4 - 3 Medium:** Requirements in this class are not necessary to realize a key innovation but they are necessary or very helpful to realize the application prototypes. These requirements are important to the application developer.
- **2 - 1 Low:** Requirements in this class are not necessary neither for realizing a key innovation nor for the application of the prototypes. However, in a broader context possibly beyond the scope of the project, they may be important.

Therefore, for the success of the project, it is essential to fulfil the requirements with high priority. Concerning providing thorough support for product developers, it is important to realize the requirements with medium priority as well. The requirements with low priority, do not have immediate relevance to the project. However, if they are taken into account may provide additional features or benefits for applications or users.

2.1.3. VOLERE tool

Aiming at defining an optimum and complete list of requirements, a web-based application based on the Volere methodology has been used for gathering the requirements in UPPER. This web tool incorporates the concepts in the data model, the templates within its user interface, and the procedural patterns in the application business rules. The Volere tool facilitates collaborative and interactive work between partners iteratively and progressively.

For the UPPER requirements gathering, WP2 partners agreed to classify the requirements, based on a software separation. In total, nine groups of requirements were created. Each requirement is therefore associated to the product (or the specific part of the product) that has to accomplish it, as it is shown in Figure 2.



Figure 2. Groups of requirements defined for UPPER support tools (U-tools).

For each group of requirements, all partners from the different pilot sites were involved as collaborators. Therefore, multidisciplinary groups were created formed by technical experts and pilot site leaders responsible to define, discuss and agree on the requirements for each group. For each U-tool, special collaboration was requested from those cities/regions willing to use/test the tool for supporting the implementation of their ‘push and pull’ measures.

The original author of each requirement, supported by the web tool, specifies, reviews and resolves the overall Volere process. Iteratively, this process is repeated for each set of new requirements that are included in the tool. Once all issues are closed and no further requirements are expected, the result constitutes the final list of requirements (Figure 3).

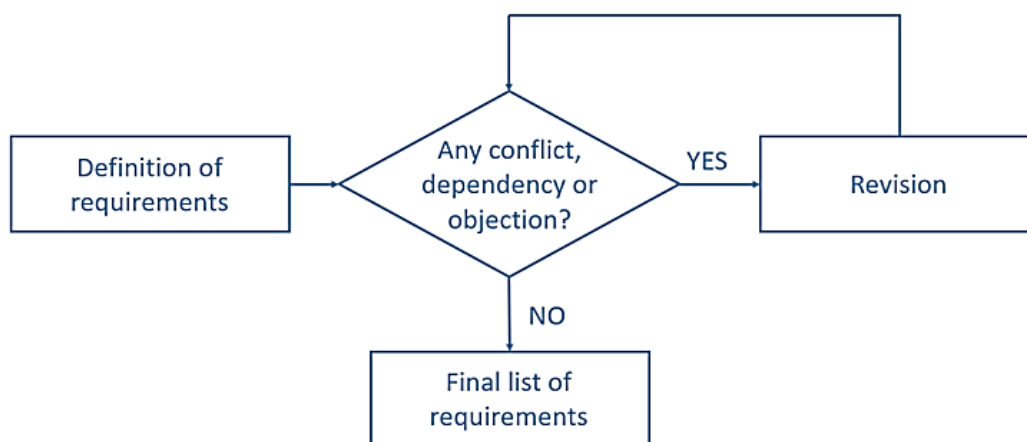


Figure 3. Requirements specification process diagram

2.1.3.1. Requirements definition.

In this first stage, a complete list of the requirements of the U-tools that are needed to meet the project objectives and the pilot needs should be defined. To create this list, all partners who are interested in using a specific U-Tool were encouraged to participate in the definition of its requirements.

This initial list of requirements has been refined and expanded in future iterations. In this stage, 236 requirements were initially included in the Volere web tool throughout 2 and a half weeks, from mid-May to beginning of June 2023.

The most useful information and the main functionalities of this stage are available on the main page, which could be seen in Figure 4:

- **List of requirements:** The list of requirements with some additional options.
 - Filtering options: The list of requirements filtered per id., type, and/or filtered per author.
 - Expand table: Show/hide some columns, displaying more or less information about the requirement.
- **Requirements management:** Modification options for requirements.
 - View a requirement.
 - Edit a requirement (only available for the author).
 - Delete a requirement (only available for the author).
- **Requirements tracing:** After the first validation, a new service is made available for keeping track of all requirements history.

UPPER project requirements specification

The **Volere Requirements Specification Template** is intended for use as a basis for the UPPER project requirements specification.

The current status of the requirements specification process is: **FINISHED and CLOSED**

- UPPER project requirements list

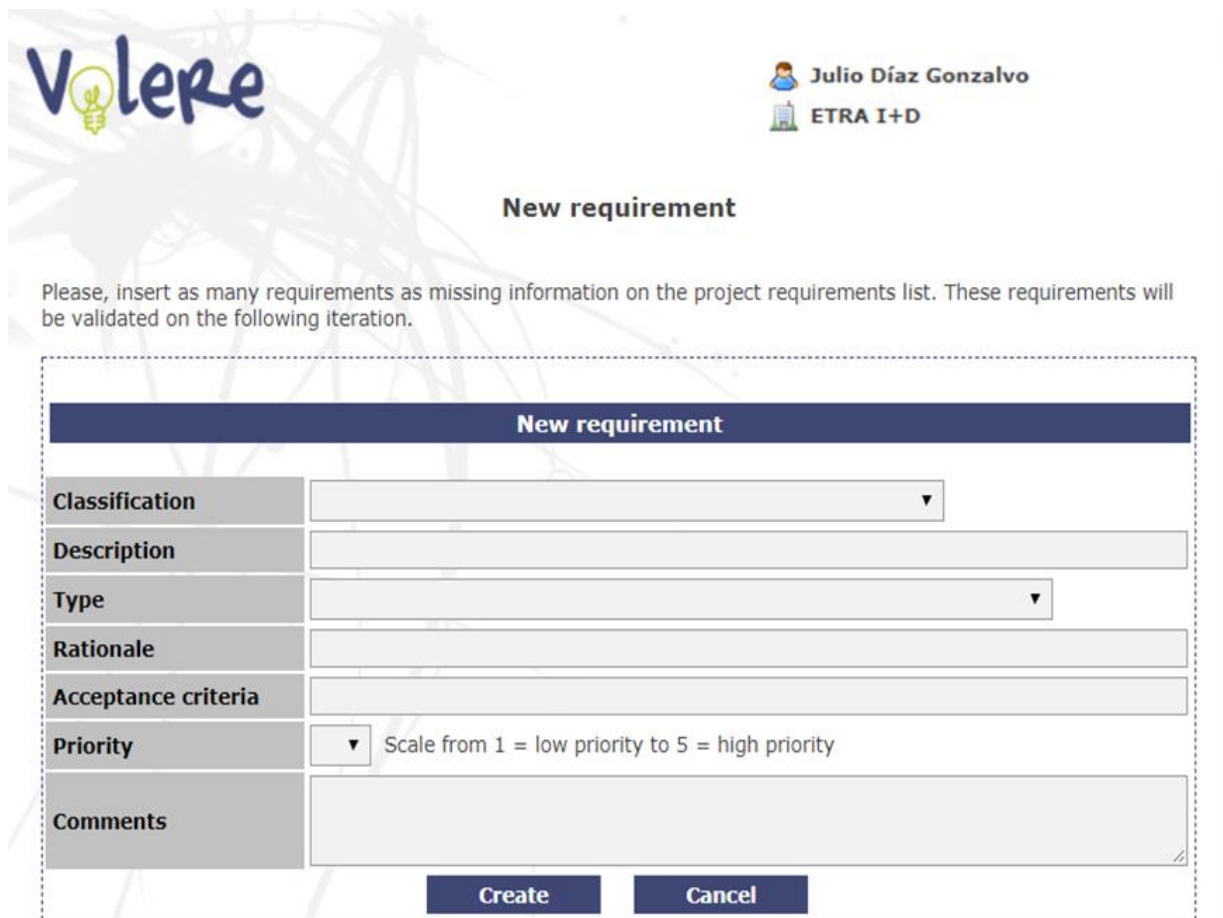
Show requirements history Export to CSV Export to XML for Testlink

Expand table Go downwards

| Filtered by classification group = | | organization = | | | |
|------------------------------------|---|--|-------------------------------------|-----------------|----------------------------------|
| ▲ Id. ▼ | Description | ▲ Classification ▼ | Type | ▲ Priority ▼ | ▲ Author ▼ |
| <i>Unique Id.</i> | <i>A one sentence statement of the intention of the requirement</i> | <i>The classification group which the requirement belongs to</i> | <i>The type from the template</i> | <i>Priority</i> | <i>Author of the requirement</i> |
| GEN_001 | All systems and tools must conform to GDPR | General requirements (for ALL U-tools) | Functional and data requirements | 5 | ETRA (Daniel Villalobos) |
| GEN_003 | The tools developed should be compatible with different operating systems (Windows, Linux, MacOS, etc.) unless the tool has specific requirements | General requirements (for ALL U-tools) | Functional and data requirements | 5 | ETRA (Daniel Villalobos) |
| GEN_004 | Users as operators of PT control centre have a browser | General requirements (for ALL U-tools) | Usability and humanity requirements | 3 | SISTEMA (Daniele Tiddi) |
| GEN_006 | Maximum number of users contemporaneously active on each tool must be agreed in advance | General requirements (for ALL U-tools) | Performance requirements | 3 | SISTEMA (Daniele Tiddi) |
| GEN_007 | Components communicating via API must rely on the REST principles, or more modern data queues | General requirements (for ALL U-tools) | Functional and data requirements | 3 | SISTEMA (Daniele Tiddi) |
| GEN_008 | Software can have a downtime for updates | General requirements (for ALL U-tools) | Operational requirements | 3 | SISTEMA (Daniele Tiddi) |
| GEN_009 | HW running the software can be accessed from remote | General requirements (for ALL U-tools) | Operational requirements | 5 | SISTEMA (Daniele Tiddi) |
| GEN_010 | Date time data should be processed in UTC by developed tools | General requirements (for ALL U-tools) | Functional and data requirements | 5 | ETRA (Miguel Company) |

Figure 4. Volere main page

- **Insert a new requirement:** Opens a new window (Figure 5) to allow adding a new requirement. All the fields are required except for the “Comments” field which is optional. The required fields are:
 - ID: The code of this requirement. Appended by an automatically generated sequential number, this ID uniquely identifies each requirement. This ID will be generated after the requirement has been added. (See Figure 6).
 - Classification: The group of requirements to which the requirement belongs.
 - Description: A one-sentence statement which describes the intention of the requirement.
 - Type: The type of requirement as defined by Volere.
 - Rationale: A justification of the requirement.
 - Acceptance criteria: A measurement of the requirement for further verification that the solution matches the original requirement.
 - Priority: The importance for the customer of successfully implementing the requirement



Volere

Julio Díaz Gonzalvo
ETRA I+D

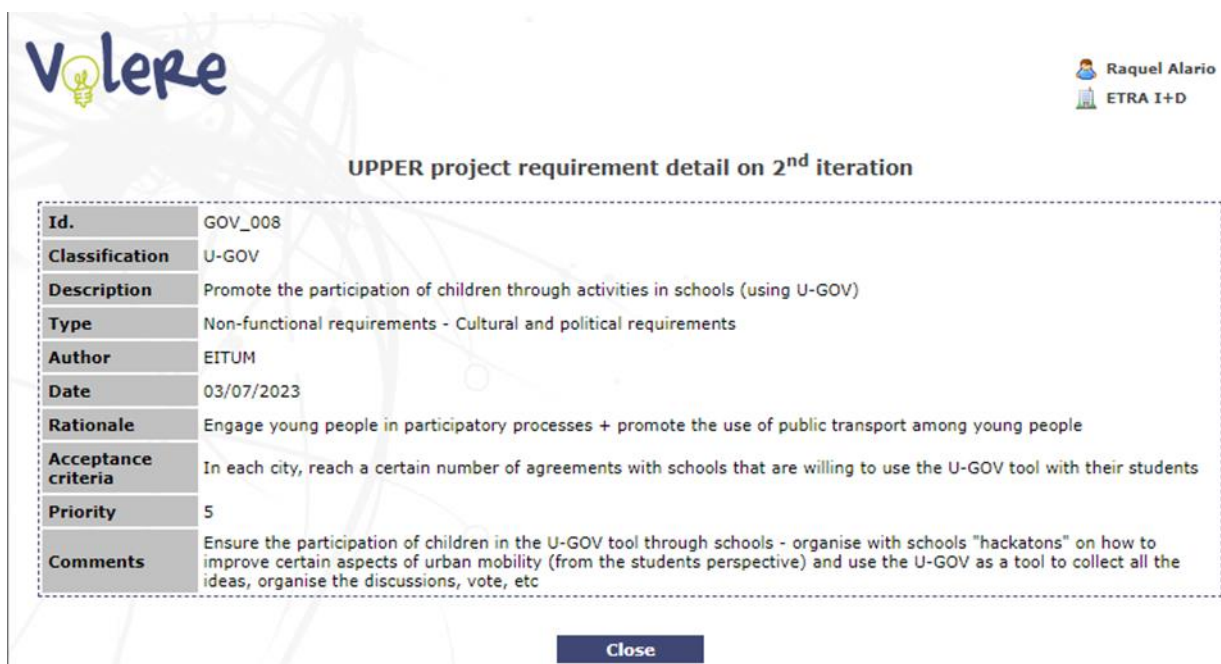
New requirement

Please, insert as many requirements as missing information on the project requirements list. These requirements will be validated on the following iteration.

| New requirement | |
|---------------------|---|
| Classification | <input type="text"/> |
| Description | <input type="text"/> |
| Type | <input type="text"/> |
| Rationale | <input type="text"/> |
| Acceptance criteria | <input type="text"/> |
| Priority | <input type="text"/> Scale from 1 = low priority to 5 = high priority |
| Comments | <input type="text"/> |

Create Cancel

Figure 5. Window to insert a new requirement



Volere

Raquel Alario
ETRA I+D

UPPER project requirement detail on 2nd iteration

| | |
|----------------------------|--|
| Id. | GOV_008 |
| Classification | U-GOV |
| Description | Promote the participation of children through activities in schools (using U-GOV) |
| Type | Non-functional requirements - Cultural and political requirements |
| Author | EITUM |
| Date | 03/07/2023 |
| Rationale | Engage young people in participatory processes + promote the use of public transport among young people |
| Acceptance criteria | In each city, reach a certain number of agreements with schools that are willing to use the U-GOV tool with their students |
| Priority | 5 |
| Comments | Ensure the participation of children in the U-GOV tool through schools - organise with schools "hackatons" on how to improve certain aspects of urban mobility (from the students perspective) and use the U-GOV as a tool to collect all the ideas, organise the discussions, vote, etc |

Close

Figure 6. UPPER project requirement details

2.1.3.2. Requirement Validation.

After the initial definition of requirements, the validation process begins. All the requirements should be approved by all the users. At this stage, all the users should review the requirements to identify conflicts and dependencies between requirements. Furthermore, any objection must be pointed out:

- **Objection:** A reason or argument due to disagreement, opposition, refusal, or disapproval of the requirement.
- **Conflict:** Requirements that cannot be implemented if another requirement is implemented or there is a conflict due to an insufficient definition of the requirement.
- **Dependency:** Requirements that have some dependency on other requirements.

2.1.3.2.1. How to insert an objection

An **Objection** is a reason or argument offered in disagreement, opposition, refusal, or disapproval of the requirement. To introduce an objection in VOLERE, the procedure is as follows:

- Identify the Requirement ID to which we want to object.

| Id. | Description | Classification | Type | Author |
|-------------------|--|--|-----------------------------------|----------------------------------|
| <i>Unique Id.</i> | <i>A one sentence statement of the intention of the requirement</i> | <i>The classification group which the requirement belongs to</i> | <i>The type from the template</i> | <i>Author of the requirement</i> |
| GOV_001 | When users submit feedback regarding the public transportation system, the tool shall provide an option to select the specific aspect or service they are providing feedback on. | U-GOV | Functional and data requirements | ETRA (Julio Díaz Gonzalvo) |

Figure 7. VOLERE: How to insert an objection (I)

- Press icon  to add a new Objection.




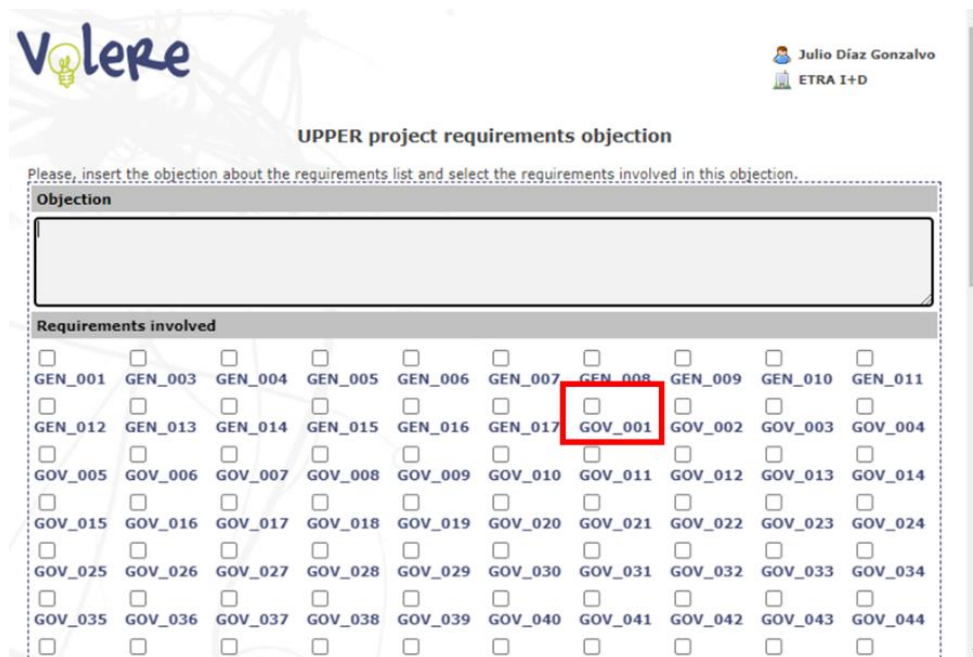
| - Dependencies, conflicts and objections | | | | |
|--|------------|----------------------|-----------|---|
| Please, insert the dependencies and conflicts detected on the list above or any other objection. | | | | |
| Id. | Dependency | Requirements revised | Validator |  |
| There are no dependencies on the requirements list! | | | | |
| Id. | Conflict | Requirements revised | Validator |  |
| There are no conflicts on the requirements list! | | | | |
| Id. | Objection | Requirements revised | Validator |  |
| There are no objections to the requirements list! | | | | |

Figure 8. VOLERE: How to insert an objection (II)

- Select the requirement ID on which we want to make the objection and write the description of the Objection.



UPPER project requirements objection

Please, insert the objection about the requirements list and select the requirements involved in this objection.

Objection

Requirements involved


| | | | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GEN_001 | GEN_003 | GEN_004 | GEN_005 | GEN_006 | GEN_007 | GEN_008 | GEN_009 | GEN_010 | GEN_011 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GEN_012 | GEN_013 | GEN_014 | GEN_015 | GEN_016 | GEN_017 | GOV_001 | GOV_002 | GOV_003 | GOV_004 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GOV_005 | GOV_006 | GOV_007 | GOV_008 | GOV_009 | GOV_010 | GOV_011 | GOV_012 | GOV_013 | GOV_014 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GOV_015 | GOV_016 | GOV_017 | GOV_018 | GOV_019 | GOV_020 | GOV_021 | GOV_022 | GOV_023 | GOV_024 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GOV_025 | GOV_026 | GOV_027 | GOV_028 | GOV_029 | GOV_030 | GOV_031 | GOV_032 | GOV_033 | GOV_034 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GOV_035 | GOV_036 | GOV_037 | GOV_038 | GOV_039 | GOV_040 | GOV_041 | GOV_042 | GOV_043 | GOV_044 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Figure 9. VOLERE: How to insert an objection (III)

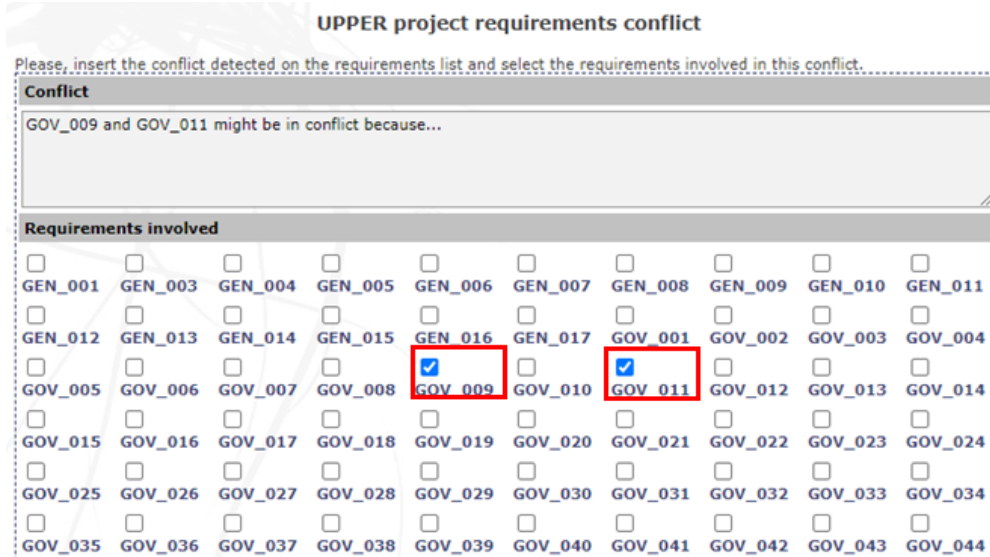
- The new objection has been created and the Validator and Revisor for that requirement have been assigned. The Validator is the person who has introduced the objection and the Revisor is the person who generated the requirement.

2.1.3.2.2. How to insert a conflict

Two or more requirements are in **Conflict** if those requirements cannot be implemented if another requirement is implemented. To introduce a conflict in Volere, the procedure is as follows:

- Identify the Requirements ID on which we want to make the conflict.
- Press  icon to add a new Conflict.

- Select the requirements IDs on which we want to make the conflict (, a conflict occurs necessarily between two or more requirements) and write the description of the Conflict. For example:



UPPER project requirements conflict

Please, insert the conflict detected on the requirements list and select the requirements involved in this conflict.

Conflict

GOV_009 and GOV_011 might be in conflict because...

Requirements involved


| | | | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GEN_001 | GEN_003 | GEN_004 | GEN_005 | GEN_006 | GEN_007 | GEN_008 | GEN_009 | GEN_010 | GEN_011 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GEN_012 | GEN_013 | GEN_014 | GEN_015 | GEN_016 | GEN_017 | GOV_001 | GOV_002 | GOV_003 | GOV_004 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GOV_005 | GOV_006 | GOV_007 | GOV_008 | GOV_009 | GOV_010 | GOV_011 | GOV_012 | GOV_013 | GOV_014 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GOV_015 | GOV_016 | GOV_017 | GOV_018 | GOV_019 | GOV_020 | GOV_021 | GOV_022 | GOV_023 | GOV_024 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GOV_025 | GOV_026 | GOV_027 | GOV_028 | GOV_029 | GOV_030 | GOV_031 | GOV_032 | GOV_033 | GOV_034 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| GOV_035 | GOV_036 | GOV_037 | GOV_038 | GOV_039 | GOV_040 | GOV_041 | GOV_042 | GOV_043 | GOV_044 |

Figure 10. VOLERE: How to insert a conflict

- A new conflict has been created and the Validator and Revisor for that requirement has been assigned. The Validator is the person who has introduced the conflict and the Revisors are the people who generated the requirements.

2.1.3.2.3. How to insert a dependency

Two or more requirements are **Dependent** if their fulfilment depends on the partial or total implementation of other requirements. To introduce a dependency on VOLERE, the procedure is as follows:

- Identify the Requirements IDs on which we want to establish the dependency.
- Press  icon to add a new Dependency.
- Select the requirement IDs on which we want to establish a dependency (remember, a dependency occurs necessarily between two or more requirements) and write the description of the Dependency.
- The new dependency has been created and the Validator and Revisor for that requirement has been assigned. The Validator is the person who has introduced the Dependency and the Revisors are the people who generated the requirement.

2.1.3.3. Requirement Revision.

After the validation, the revision process begins. The dependencies, conflicts, and objections highlighted by the experts during the Validation stage must be revised and solved by the requirement’s author. However, if the authors do not agree with the validator’s comments, they can include their viewpoint in the “Revisor’s comments” section for explanations and requirement clarifications. In this stage, the authors of the requirements pointed to be revised are able to add comments to the dependency, conflict, or objection.

2.1.3.3.1. Step 1: Check the requirements with issues

Each partner should **identify** each one of the requirements that have been **impacted by an objection, conflict, or dependency**, by checking the Requirement revised column in the Dependencies, Conflicts, and Objections section.

| Dependencies, conflicts and objections | | | | |
|--|--|---|---|--|
| Please, revise the dependencies and conflicts detected by the validators on the list above or any other objections. Go downwards | | | | |
| Id. | Dependency | Requirements revised | Validator's approval | Revisor's comments |
| DEP_432 | The two requirements can be merged into a single one | <ul style="list-style-type: none"> ETRA (Daniel Villalobos) <ul style="list-style-type: none"> <input type="checkbox"/> GEN_003 <input type="checkbox"/> IFPEN (Chasse) <input type="checkbox"/> STP_010 | <ul style="list-style-type: none"> <input checked="" type="checkbox"/> PTV (Charlotte Fiechon) | <ul style="list-style-type: none"> » Comment 1 by ETRA (Daniel Villalobos): <i>I think we should establish it based on what we decide in objection OBJ_1523.</i> » Comment 2 by IFPEN (Chasse): <i>Agree, these requirements can be merged into one.</i> |
| DEP_433 | These two requirements can be merged into a single one | <ul style="list-style-type: none"> RNV (Julian Schrögel) <ul style="list-style-type: none"> <input type="checkbox"/> GEN_016 <input type="checkbox"/> TML (Pedro Machado) <input type="checkbox"/> GEN_022 | <ul style="list-style-type: none"> <input checked="" type="checkbox"/> PTV (Charlotte Fiechon) | <ul style="list-style-type: none"> » Comment 1 by RNV (Julian Schrögel): <i>As GEN_016 seems to be the more general requirement, I suggest to delete GEN_022. If needed, specifics can be added to GEN_016</i> |

Figure 11. Dependencies, Conflicts, and Objections section

2.1.3.3.2. Step 2: Add comments on the issues

The requirements impacted with an objection, conflict, or dependency have the “Add comment” button enabled. The revisor(s) (the partner who introduced the requirement) are the people in charge to start writing comments.

The comments could be oriented to explain the requirement:

- Is **reaffirmed as described** (could be a misunderstanding or maybe the requirement description was confusing).
- The revisor noticed that the requirement should be **edited**.

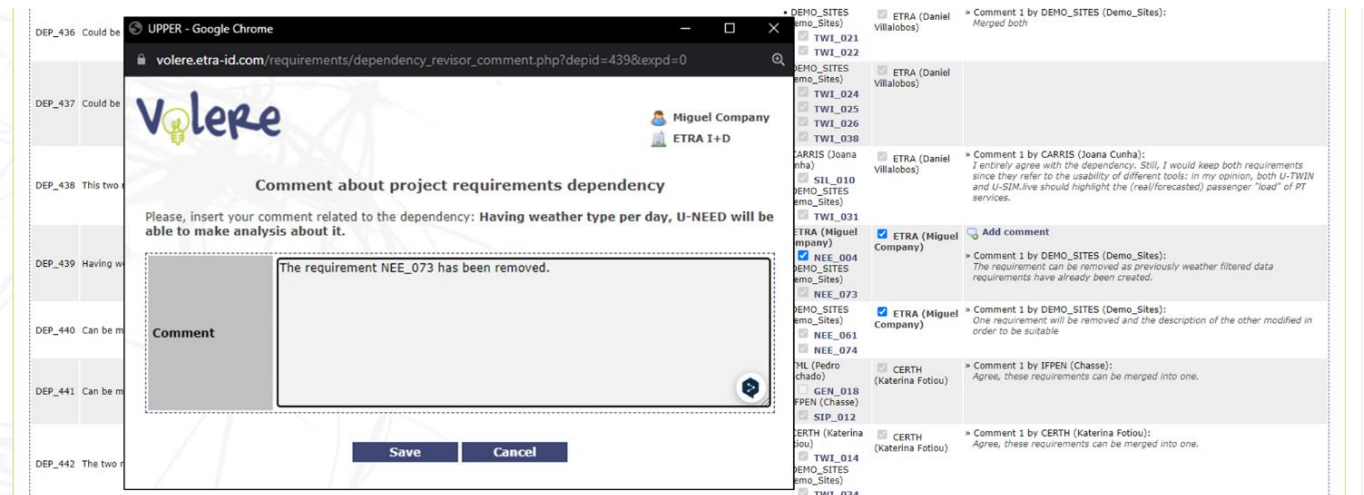


Figure 12. Example of a comment on a project requirement dependency (I).

After saving the comment introduced, the comment will appear in the mentioned objection/dependency/conflict (see Figure 13).

| | | | | |
|---------|---|--|---|--|
| DEP_439 | Having weather type per day, U-NEED will be able to make analysis about it. | <ul style="list-style-type: none"> • ETRA (Miguel Company) <ul style="list-style-type: none"> <input checked="" type="checkbox"/> NEE_004 • DEMO_SITES (Demo_Sites) <ul style="list-style-type: none"> <input checked="" type="checkbox"/> NEE_073 | <input checked="" type="checkbox"/> ETRA (Miguel Company) | Add comment » Comment 1 by DEMO_SITES (Demo_Sites): <i>The requirement can be removed as previously weather filtered data requirements have already been created.</i> » Comment 2 by ETRA (Miguel Company) [edit delete]: <i>The requirement NEE_073 has been removed.</i> |
|---------|---|--|---|--|

Figure 13. Example of a comment on a project requirement dependency (II).

In case the revisor detects that the Requirement needs extra information or needs to be modified then, after writing the comment, the requirement should be edited. The requirements can be edited during the revision phase.

2.1.3.3.3. Step 3: Mark the objection, conflict or dependency as revised

The person who wrote the requirement should **mark the issue as revised** they have written the comments and edited the requirement (if necessary) (Figure 14).

| | | | | |
|---------|---|--|---|---|
| DEP_439 | Having weather type per day, U-NEED will be able to make analysis about it. | <ul style="list-style-type: none"> • ETRA (Miguel Company) <ul style="list-style-type: none"> <input checked="" type="checkbox"/> NEE_004 • DEMO_SITES (Demo_Sites) <ul style="list-style-type: none"> <input checked="" type="checkbox"/> NEE_073 | <input checked="" type="checkbox"/> ETRA (Miguel Company) | » Comment 1 by DEMO_SITES (Demo_Sites): <i>The requirement can be removed as previously weather filtered data requirements have already been created.</i> » Comment 2 by ETRA (Miguel Company): <i>The requirement NEE_073 has been removed.</i> |
|---------|---|--|---|---|

Figure 14. Mark the requirement dependency/objection/conflict as revised.

2.1.3.3.4. Step 4: Mark the objection, conflict or dependency as validated

The person who detected the conflict/dependency/objection should check the changes and comments made. If agrees, should mark the requirement as **validated**. If not, he or she should **argue the reason why** (Figure 15).

| | | | | |
|---------|---|--|---|---|
| DEP_439 | Having weather type per day, U-NEED will be able to make analysis about it. | <ul style="list-style-type: none"> • ETRA (Miguel Company) <ul style="list-style-type: none"> <input checked="" type="checkbox"/> NEE_004 • DEMO_SITES (Demo_Sites) <ul style="list-style-type: none"> <input checked="" type="checkbox"/> NEE_073 | <input checked="" type="checkbox"/> ETRA (Miguel Company) | » Comment 1 by DEMO_SITES (Demo_Sites): <i>The requirement can be removed as previously weather filtered data requirements have already been created.</i> » Comment 2 by ETRA (Miguel Company): <i>The requirement NEE_073 has been removed.</i> |
|---------|---|--|---|---|

Figure 15. Mark the requirement objection as validated.

2.1.3.4. Iterations and final results.

The previously explained process is repeated several times in order to include newly defined requirements, as shown in Figure 16.

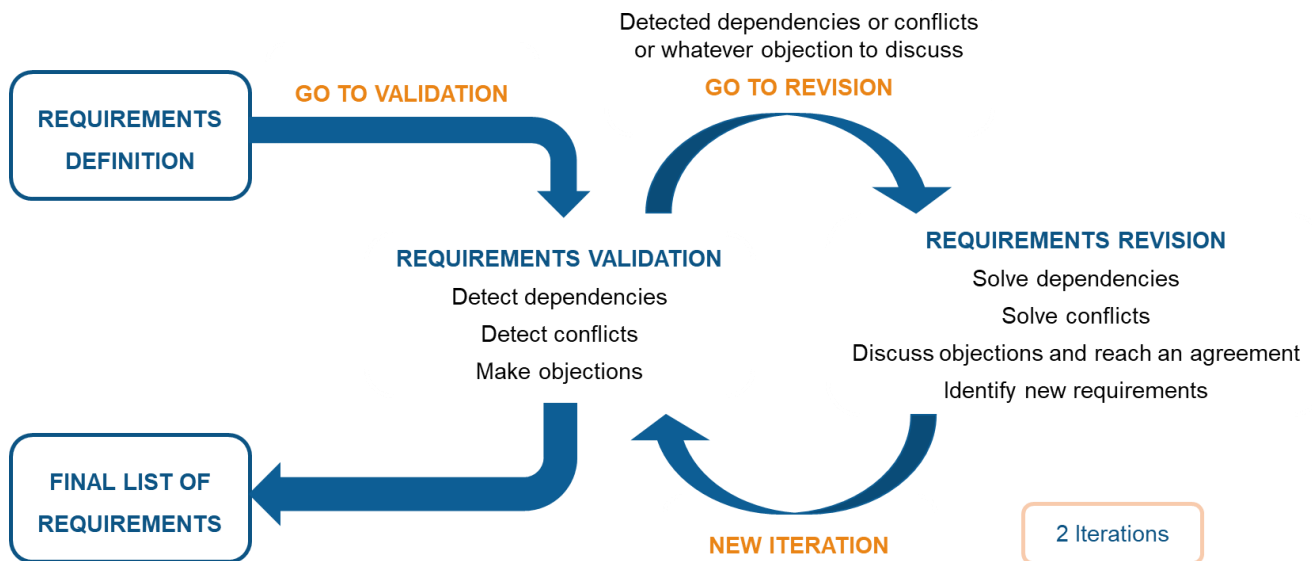


Figure 16. Volere iterative process

Once the final iteration is finished, all issues have been closed, and no more requirements are expected, the final list of requirements is available. The Volere web tool not only provides this final list but also allows to access the history of each requirement and its associated issues, so any consultant can keep track of the path that leads to the definition of each requirement.

In the case of UPPER, two iterations have been performed. Each iteration lasted one month (two weeks for the validation stage and two for the revision in each iteration), according to the following calendar:

Table 1 VOLERE methodology: Iterations calendar

| PHASE | DESCRIPTION | WHO | START | END |
|-------|--|--------------|------------------|-----------|
| 1 | Definition of the preliminary list of requirements | All partners | May 17th | May 30th |
| 2 | First validation | All partners | May 31st | Before GA |
| 3 | First revision | All partners | During GA | June 27th |
| 4 | Second validation | All partners | June 28th | July 11th |
| 5 | Second revision | All partners | July 12th | July 25th |
| 6 | Final list of requirements | All partners | End of July (M7) | |

During the General Assembly in Versailles (June 2023), a physical workshop was organized in order to support the pilot sites in the definition of additional requirements for the U-tools. Each U-tool developer moderated a round-table and helped the pilot sites and their local clusters to better understand the U-tools and the support they can give to the 'push and pull' measures and to define requirements according to their needs and expectations for the U-tool.

During the iterative process, several dependencies, conflicts, and objections among the requirements were detected and solved by the consortium, for each one of the U-tools. Those issues are presented and described in Section 3.1.

2.2. UPPER measures requirements

The UPPER project aims to implement and demonstrate over 80 push and pull measures in 10 European cities and regions, with the goal of unleashing the potential of public transport. This section outlines the methodology that has been followed to define the requirements to be met by the measures that will be piloted in the living labs and twinning sites.

Two different methodologies have been followed:

- To identify the **high-level** requirements and recommendations per **measure category**, a collaborative workshop has been organized.
- To identify the **measure-specific requirements**, a comprehensive “Measure requirements” template has been used.

The aim of both methodologies is to ensure a **comprehensive and collaborative approach** to define the requirements for the project's measures across all pilot cities. By using a common template and by fostering collaboration through a workshop and multiple joint meetings both online and in person, it is possible to gather valuable insights and achieve a unified understanding of the requirements.

On a last stage, the requirements identified by the cities and their respective local clusters are further enriched with the inputs provided by the members of the ICB, thus leveraging the expertise and perspectives of all stakeholders involved in order to achieve the project's objectives successfully.

2.2.1. Measure-specific requirements

Firstly, a **template** was distributed to the pilot sites, allowing them to autonomously define the specific requirements for the measures to be implemented in their respective cities.

The UPPER ‘Measures Requirements Template’ (*Annex C: Measure requirements template*), developed by ETRA and validated by the technical and horizontal partners, aims to guide the demo sites in the definition of specific requirements for the measures to be implemented in their cities and regions. The template outlines key areas and offers a structured format to capture the specific needs and considerations for the implementation of each measure in terms of:

- **Infrastructure:** In case the implementation of the measure requires using, deploying, updating or intervening on any physical and organizational structures and facilities (e.g. buildings, roads, PT lanes, hubs, stations, PT stops,...)
- **Equipment / hardware:** In case the implementation of the measure using, buying, developing or intervening on any equipment or hardware system.
- **Software:** In case the implementation of the measure requires using, buying, developing or intervening on any software or in case certain software requirements need to be satisfied.
- **Data:** In case the implementation of the measure requires the access/monitoring/collection of any type of data.
- **Permits / tenders:** In case the implementation of the measure requires launching a tendering process or requesting any permits.

- **External support:** In case the implementation of the measure requires specific skills & capacities and in case external collaboration or outsourcing is needed to cover them.
- **Legal constraints:** In case the implementation of the measure needs to take into account any legal considerations or comply any specific regulation to be implemented. The legal requirements can derive from both, the European as well as the national or regional legal framework.
- **Security / safety considerations:** In case the implementation of the measure needs to accomplish any security or safety requirements.
- **Social / Cultural / Political considerations:** In case the implementation of the measure is conditioned by any social, cultural and/or political restriction and if it needs to accomplish specific requirements in this regards.
- **Functionalities:** In case the measure needs to accomplish and/or develop a specific list of functionalities in order to reach its objective (e.g. new functionalities to be included in a Maas).

The template has been carefully prepared, ensuring it is comprehensive and user-friendly. Clear instructions accompany the template to facilitate their effective utilization by the pilot cities (see Annex C: Measure requirements template). The aim is to support the demo sites in the definition of the specific requirements that are most relevant to their unique circumstances. Throughout this phase, continuous support and assistance to the pilot cities was offered.

The measures' requirements definition process included the following steps. At each stage, the results were made available for all demo sites to stimulate learning from each other:

- V0.1 – After presenting the “Measure requirements template”, pilot sites were asked to fill in one template per measure.
- V0.2 – Pilot sites sent their initial measure requirements templates to the horizontal partner giving direct support to the site, who performed a detailed review of all measures' requirements and provided feedback. The resulting measure requirements V0.2 were shared with all the cities, to stimulate learning from each-other. Here below the support provided by the horizontal partners to the demo sites:
 - Valencia: ETRA
 - Rome: FIT + EURO CITIES
 - Hannover: RC
 - Mannheim: EMTA
 - Budapest: EITUM
 - IDF: POLIS
 - Lisbon: FACTUAL
 - Leuven: KUL
 - Oslo: UITP
 - Thessaloniki: CERTH
- V0.3 – Based on the revisions suggested from the horizontal partners, pilot sites provided a revised version of the measure requirements templates. The resulting templates V0.3 were shared with all the cities, to stimulate learning from each-other.
- V0.4 – Version 0.3 was reviewed by ETRA to refine the requirements. Comments were provided to pilot sites.

- V1.0 – The pilot sites addressed the comments provided in V0.4 and developed the final version of the measure requirements (V1.0).

2.2.2. High-level requirements and recommendations per measure category

This section outlines the methodology followed by the UPPER project in order to define in a collaborative way the high-level requirements and recommendations to be considered by the cities and regions willing to implement a measure related to a specific area (or measure category).

The methodology followed was based on a set of **world cafés**, where open discussions about cross-cutting requirements and recommendations for the design and implementation of each group of measures was promoted. The cities and regions (with their local clusters) and the ‘experts on the field’ coming from the ICB were strongly encouraged to take a leading and active role in the cafés.

The 80 measures, classified into 12 categories, were afterwards grouped into 5 major groups of measures to facilitate the organization of the session.

- **World café 1:** Reorganization of urban space, PT stops and multimodal hubs
 - Measures dealing with the reallocation of urban space from private vehicle to pedestrians, PT or other sustainable transport modes (such as bikes).
 - Measures dealing with the creation of multimodal hubs and the supply of new transport modes (active and/or PT) in those hubs.
 - Measures dealing with the adaptation/redesign of the PT stops to make them safe, inclusive and accessible.
- **World café 2:** MaaS / MDMS / Multimodal journey planner
 - Measures dealing with the creation of MaaS and/or MDMS schemes (multimodal digital mobility services)
 - Measures dealing with the digital integration of mobility services (active and/or PT)
 - Measures dealing with the integration of ticketing systems of different transport modes.
- **World café 3:** LEZs & BRT / Traffic light priority
 - Measures dealing with the creation of UVARs, including (*ref: ReVeAL project*):
 - Spatial interventions: PT priority lanes (+ PT prioritization through traffic light management), reduced parking supply,...
 - Pricing aspects: Pollution/congestion charge, parking charge, traffic flow management,...
 - Regulatory measures: ZEZ/LEZ, regulation by vehicle/emissions/time,...
- **World café 4:** Network planning / Real-time monitoring / Data collection
 - Measures dealing with PT network management and improving the efficiency, reliability, resilience and accessibility of PT at local and regional level.
 - Measures exploiting the potential of PT data and improving data collection, data sharing and data access mechanisms.

- **World café 5:** Incentives and campaigns / Perception of PT / Participative governance / Service & user satisfaction
 - Measures dealing with the incentivization and the promotion of PT (with potential focus on specific target users or VRUs).
 - Measures aiming to improve public perception of PT and aiming to involve PT users into the design of solutions and measures.

This collaborative workshop brought together representatives from each pilot site developing measures under a certain category and experts in the different fields (coming from the Impact Creation Board (ICB)), fostering in that way the collaboration, productive discussion and cross-pollination of ideas to define high level requirements across the different cities.

During the workshop, participants had the opportunity to share their insights, discuss challenges, and explore potential common requirements. A collaborative atmosphere that values the input and opinions of all participants was facilitated, ensuring that every voice was heard and considered.

2.2.3. Comprehensive review

The last step in the definition of the 'UPPER measures requirements' involved a comprehensive review of the requirements obtained in the previous phases. This final phase ensures the accuracy, completeness, and alignment of the defined requirements with the overall goals of the UPPER project.

During this phase, some members of the ICB carefully examined the compiled requirements, paying especial attention to their feasibility, relevance, and potential impact. By conducting a thorough review, the aim was to enhance the clarity and quality of the requirements, ensuring they effectively support the project's measures.

Productive discussions among the reviewers, the participating cities and the project team were encouraged to address any discrepancies or areas for improvement. The focus was on achieving a final set of refined requirements that accurately reflect the needs and objectives of the UPPER measures.

2.3. Policy recommendations

2.3.1. Approach

The UPPER project aims to support the ten UPPER sites in reaching, through the implementation of the proposed measures, the ambitious project targets that were part of the HORIZON-MISS-2021-CIT-02-02 call in line with the priorities of the European Green Deal:

- Increase the share of public transport (modal split) in the modal distribution of motorized transportation by approximately 30%.
- Increase user satisfaction with public transport by 25% compared to the 2023 baseline.

These ambitious policy targets are needed to accelerate the transition towards Climate Neutrality especially considering that most UPPER sites are part of the 100 Climate-Neutral and Smart Cities.

To reach these objectives without leaving anybody behind in the process, the demo sites have proposed approximately 80 push and pull measures, aimed at improving the PT usage. The measures are aligned with the strategic plans, policies and systemic views, as well as the background of each of the UPPER sites involved. The

section on the “policy recommendations” aims to provide UPPER sites with some potential policies that might support the implementation of the selected measures.

The approach followed has been based on the investigation of policy recommendations proposed by relevant trade associations, such as UITP and Polis, federations of user groups, such as EPF, ECF and IFP, multi-stakeholder initiatives, such as EUR, EIT-UM, ICLEI and EMTA, and consultancy agencies such as RC, FAC and FIT, all of them partners in the UPPER project. For the sake of simplicity, in the following chapter these organisations will be referred to as “horizontal partners”.

2.3.2. Methodology

The identification of policy recommendations is aligned with the classification adopted by the UPPER project to group the ‘push and pull’ measures. This is mainly based on the five mobility innovation axes described below:



Innovation axis 1: Mindset and culture: Perception of accessibility, User satisfaction, Concept of Freedom, Maslow applied to PT, the status of PT, PT as a carrier of culture, image, ‘coolness’.



Innovation axis 2: Urban mobility planning: Ability to structure space at regional, local and hyperlocal level, PT as the focal point for urban development and economic activity, the combination of infrastructures and services.



Innovation axis 3: Mobility services ecosystem: Intermodality, MDMS, digital ecosystem, eMobility system, the first mover in automation.



Innovation axis 4: Road network management: Priority management (traffic lights), access regulation, low emission zones regulation and monitoring, parking space management.



Innovation axis 5: Democratic governance: Multi-stakeholder and multi-level governance, PT as a driver for inclusion, societal return on investment of long-term capital and revenue spending.

Each of the project measures contributes mainly to one of the 5 innovation axes, depending on its activities, inputs and outputs. This classification is reflected in Fig. 17. The use of the same classification for measures and policy recommendations, allows for a clearer understanding of which policies can support which measures.

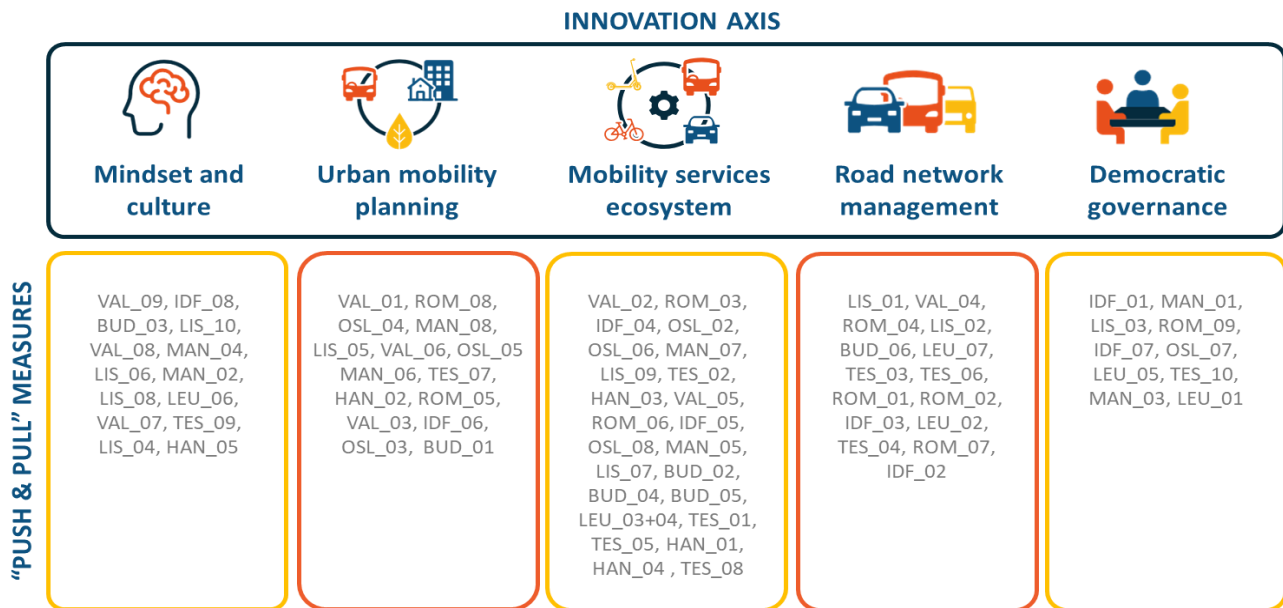


Figure 17. UPPER measures distributed on each Innovation Axis

The horizontal partners were tasked with identifying policies with potential relevance and impact. Their responsibility also included categorizing these policies using the innovation axes defined within the UPPER project framework. The categorization of the selected policies included providing category information for each policy as follows:

- **Policy Name:** A concise name for quick identification
- **Timeline:** Duration specification for implementation, categorized as short-term (1-2 years), medium-term (2-10 years), or long-term (more than 10 years).
- **Description:** A brief policy description.
- **Best Practices:** Examples of best practices related to the identified policy, including references.
- **Related measure:** Upper measures associated with this policy.
- **Drivers and Barriers:** Descriptions of drivers and barriers that can help explain why policies succeed or fail.
- **Proposed by:** The organization affiliation of the policy author.
- **Reference:** Any related references, such as websites, articles, or papers.

The policy collection was coordinated by the following partners, to ensure a consistent collection and description of new policies in each one of the 5 innovation axes:

- Mindset and culture (FIT)
- Urban mobility planning (RUPPRECHT CONSULT)
- Mobility services ecosystem (EMTA)
- Road network management (POLIS)
- Democratic governance (EUROCITIES)

The initial aim of this exercise was to pinpoint a collection of policies detailed in existing literature that were already in practice and had the potential to address the primary user barriers as identified in the UPPER project.

Following the creation of this policy matrix, which encompasses over 50 policies, the goal was to evaluate the impact of the specific policy programs. This evaluation entailed an analysis of their equitable application, the engagement of essential target users, and the identification of the primary beneficiaries, guided by the variables identified by Todd Litman that influence transport equity analysis.

Acknowledging that the effective adoption and execution of these policies can be impacted by a range of factors that can either drive or hinder progress, it was decided to employ the same set of drivers and barriers previously identified in D2.2 to support or impede the implementation of the SUMP (Sustainable Urban Mobility Plan). These **drivers** include public, political and professional acceptability, funding mechanisms, a clear motivation for change, data driven decision, engagement of citizens and stakeholders, capacity of the actors involved, administrative delivery, forecasting methods, strategic timing/momentum. **Barriers** include lack of funding mechanisms, lack of public, political and professional acceptability, unclear legal framework, unclear responsibilities, difficult to understand on data-based evidence, unclear relation to strategic framework (e.g., SUMP), undefined motivation, weak evidence based, knowledge and skills gaps, difficulties in defining the right moment for implementation

Finally, to understand how to better address social and environmental equity issues, we defined a list of **8 policy impacts categories: 1.Universal Access, 2.Inclusivity, 3.Reliability, 4.Efficiency, 5.Safety, 6.Resilience, 7.Sustainability, 8.Financial Viability** that were used to map the differences across sites and horizontal partners.

The involvement of the UPPER demo sites in this process is supported by the idea that:

- Cities, their authorities and transport operators are the ones who know the needs of the city/region best and must define the set of measures and the supporting policies that will allow PT to become the backbone of mobility in cities.
- Success in one context does not guarantee success in another, as it depends on social-economic characteristics, travel behaviour and urban design, linked to the background transport policies, geographical characteristics, together with the demographic distribution pattern.

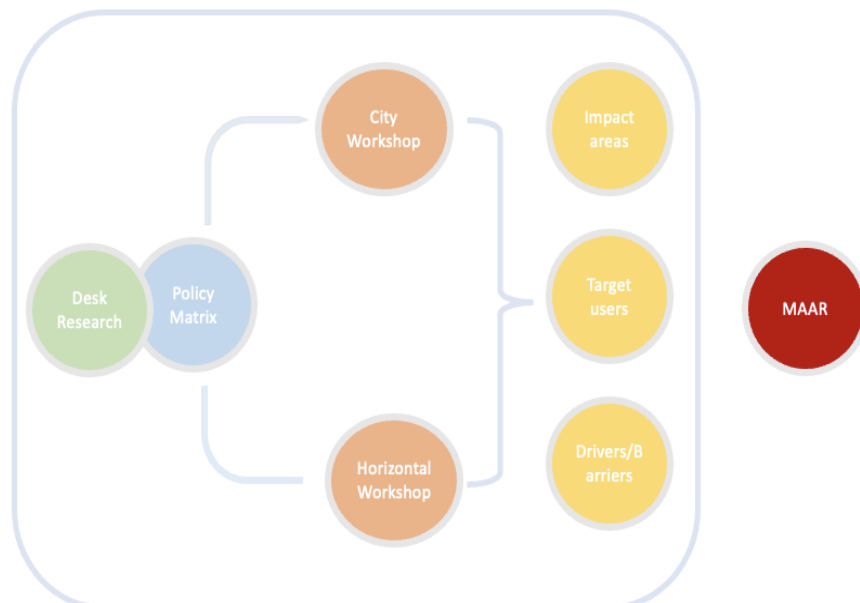


Figure 18. Methodological approach for policy recommendation discussion in UPPER sites

The policy recommendations matrix has been completed (and is presented in Section 3.3.1), and the results have been examined and reviewed, including: the underlying convictions, the theories and dominant models that apply in each site considering their characteristics and mobility patterns, and the criteria against which a policy is evaluated.

3. Results

3.1. UPPER toolkit technical, operational and legal requirements

The requirements have been classified into nine groups. There is one group for the cross-cutting requirements common to all the U-tools (called 'GENERAL'), and then one group for each U-tool of the UPPER support toolkit (U-TWIN, U-SIM.plan, U-SIM.live, U-SUMP, U-NEED, U-GOV, U-KNOW and U-TRANSFER). The group that each requirement belongs to is part of the ID of the requirement itself (namely as GEN, TWI, SIP, SIL, SUM, NEE, GOV, KNO and TRA respectively).

According to the approach presented in Section 2.1 and the Volere methodology, the specific requirements for the UPPER support tools (U-tools) have been defined. This activity has been performed in a cooperative way among the members of the consortium. The lists of requirements presented in this Section are the results of the two iterations performed following the Volere methodology. As a result of the revision and validation process, some of the requirements initially introduced were finally removed. This justifies the gaps in the requirements identifications (IDs).

3.1.1. Cross-cutting requirements

3.1.1.1. List of cross-cutting requirements

The eight U-tools, while far from being independent, are all interrelated and therefore share common characteristics. For this reason, the project's consortium identified and formulated a series of high-level requirements that are transversal to all the U-tools. These cross-cutting or General Requirements (GEN) are presented in the following table:

Table 2 Cross-cutting U-tool requirements

| ID | Description | Priority | Type |
|---------|---|----------|-------------------------------------|
| GEN_001 | All systems and tools must conform to GDPR | 5 | Functional and data requirements |
| GEN_003 | The tools developed should be compatible with different operating systems (Windows, Linux, MacOS, etc.) unless the tool has specific requirements | 5 | Functional and data requirements |
| GEN_004 | Users as operators of PT control centre have a browser | 3 | Usability and humanity requirements |
| GEN_006 | Maximum number of users simultaneously active on each tool must be agreed in advance | 3 | Performance requirements |
| GEN_007 | Components communicating via API must rely on the REST principles, or more modern data queues | 3 | Functional and data requirements |
| GEN_008 | Software can have a downtime for updates | 3 | Operational requirements |

| ID | Description | Priority | Type |
|---------|--|----------|---|
| GEN_009 | HW running the software can be accessed from remote | 5 | Operational requirements |
| GEN_010 | Date time data should be processed in UTC by developed tools | 5 | Functional and data requirements |
| GEN_011 | The tool should be designed to be user-friendly, clean and easy to use | 4 | Usability and humanity requirements |
| GEN_013 | Information exchange between all components should be made only over secure communication channels. | 4 | Security requirements |
| GEN_014 | Data at rest should be protected from unauthorized access. | 4 | Security requirements |
| GEN_015 | Front-ends shall ask the users to grant all permissions required by the system. | 3 | Legal requirements |
| GEN_016 | End-user front-ends designed to be used by a broader public, shall comply with accessibility guidelines, e.g. follow the W3C guidelines on accessibility | 4 | Usability and humanity requirements |
| GEN_017 | KPI and metric output from tools should align with or inform definitions and methods described in UPPER evaluation handbooks/database | 4 | Functional and data requirements |
| GEN_018 | All tools should have tutorials on how to use the tool | 4 | Usability and humanity requirements |
| GEN_019 | Tools aimed at different user categories (stakeholders, customers, ...) must allow for the creation of different type of users. | 4 | The client, the customer and other stakeholders |
| GEN_020 | All tools must allow for the definition of different actions with no mix of the data | 2 | Functional and data requirements |
| GEN_021 | When a user wants to export data, the tool shall provide the possibility of doing so at least for the most common standards (pdf, word, excel...) | 3 | Functional and data requirements |
| GEN_023 | The datasets should be provided in a standardised format and go through a quality assessment | 5 | Functional and data requirements |

3.1.1.2. Main Figures of the Validation and Revision Process

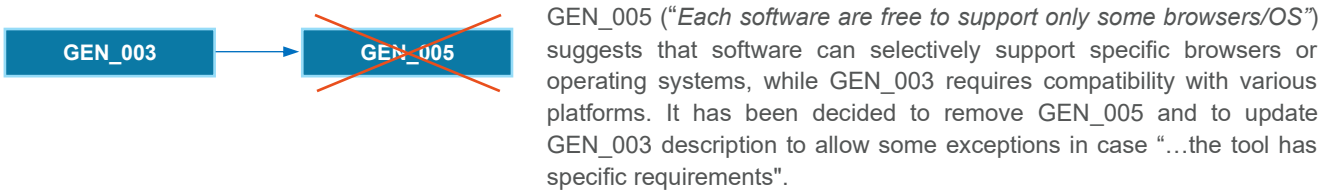
3.1.1.2.1. Dependencies

No relevant dependencies have been identified.

3.1.1.2.2. Objections

- GEN_016** “Front-ends shall comply with accessibility guidelines, e.g. follow the W3C guidelines on accessibility” Unfortunately, it not possible to make U-SIM.plan accessible to blind people. There are some graphical interfaces that cannot be made accessible. As the requirements was addressed to end-user frontends for interaction with a broader public, the requirements has been reformulated to “End-user front-ends designed to be used by a broader public, shall comply with accessibility guidelines, e.g. follow the W3C guidelines on accessibility”
- GEN_017** “KPI and metric output from tools should align with definitions and methods described in UPPER evaluation handbooks/database” has been replaced by “KPI and metric output from tools should align with or inform definitions and methods described in UPPER evaluation handbooks/database” as the link between the output of tools and the evaluation metrics should be aligned in a bidirectional way (ie. Finding the best solution possible: adapt the output of the tool or adapt the evaluation metrics to the possible outputs)
- GEN_019** “All tools must allow for the creation of different type of users”. This is not supported in U-SIM.plan. The software is aimed at transport planner experts. The creation of different type of users would make the licensing more complex. Therefore the requirements has been replaced with “Tools aimed at different user categories (stakeholders, customers, ...) must allow for the creation of different type of users.”

3.1.1.2.1. Conflicts



3.1.2. U-TWIN requirements

This chapter describes the specific requirements for U-TWIN, introduced by the partners through the Volere tool.

3.1.2.1. List of specific requirements

Table 3 U-TWIN specific requirements

| ID | Description | Priority | Type |
|---------|--|----------|----------------------------------|
| TWI_001 | U-TWIN must provide a formal representation of public transport live data | 5 | Functional and data requirements |
| TWI_002 | All the actions performed should be registered in an independent data repository with traceability of actions enabled for identifying possible issues. | 3 | Functional and data requirements |
| TWI_003 | Realtime data should be available to be consumed | 5 | Operational requirements |
| TWI_004 | U-TWIN should display alerts from U-SIM.live when available | 2 | Functional and data requirements |

| ID | Description | Priority | Type |
|---------|--|----------|-------------------------------------|
| TWI_005 | New schedule must be made available (published) | 4 | Functional and data requirements |
| TWI_006 | Latest schedule update must be made available somewhere | 4 | Functional and data requirements |
| TWI_007 | The timestamp of the content of the schedule update must be available in the data | 3 | Functional and data requirements |
| TWI_008 | U-TWIN shall be compatible with the GTFS (General Transit Feed Specification) standard, and shall import and process GTFS data provided by transport agencies | 5 | Functional and data requirements |
| TWI_009 | Correct and up-to-date calendar data in GTFS for accurate route information | 5 | Operational requirements |
| TWI_010 | U-TWIN should allow users to zoom in, zoom out, and move around a background map whether or not there is information loaded | 5 | Functional and data requirements |
| TWI_011 | Selectable Map Styles based on predefined options | 5 | Functional and data requirements |
| TWI_012 | Display delay and advance information in U-TWIN tool | 5 | Functional and data requirements |
| TWI_013 | Information legend for U-TWIN tool | 5 | Functional and data requirements |
| TWI_014 | The tool should display and analyse information related with shared mobility services. | 3 | Users of the product |
| TWI_015 | The prediction horizon options should be carefully considered (it is connected to the time that PTO/PTA need to act). | 4 | Users of the product |
| TWI_016 | The tool should be able to communicate with other platforms that are already being operated by PTO/PTA. | 4 | Users of the product |
| TWI_017 | U-TWIN needs to be compatible with data types and standards use by UPPER partners (U-Twin entry data) | 4 | Functional and data requirements |
| TWI_018 | U-TWIN needs to be compatible with information systems used by UPPER partners (U-Twin export data), and allow for differentiation of public and decision maker users | 3 | Functional and data requirements |
| TWI_019 | The tool should show pop-ups with relevant information when an alert happens. | 5 | Usability and humanity requirements |
| TWI_020 | The tool should be able to show air quality alerts (based on real-time air quality data) in order to adjust in advanced the PT offer. | 3 | The scope of the product |
| TWI_022 | When Public Transport inefficiencies happen (delay, high occupancy rates...), the tool shall detect them and provide alerts and relevant information. | 5 | The scope of the product |
| TWI_027 | When data sharing is needed, the tool shall use standardised data. | 5 | Functional and data requirements |
| TWI_028 | The tool shall display in real time weather information | 3 | The scope of the product |
| TWI_029 | The geospatial map displayed as a base-map has to display relevant information of cities. | 4 | Functional and data requirements |
| TWI_031 | The tool shall display information about Public Transport vehicles occupancy levels, if available. | 5 | Functional and data requirements |

| ID | Description | Priority | Type |
|---------|--|----------|----------------------------------|
| TWI_035 | When a road work is happening in a road section, the tool shall inform about it in form of an alert. | 5 | Functional and data requirements |
| TWI_037 | The tool shall display real-time information about parking occupancy data. | 4 | Functional and data requirements |
| TWI_038 | The tool shall provide information about public events regarding to the location and time range and the impact of PT routes, deviations and so on. | 4 | The scope of the product |
| TWI_039 | Data formats integrated in U-TWIN should be compatible with data formats used in U-SIM. | 5 | Functional and data requirements |
| TWI_040 | U-TWIN will show forecasted information about occupancy levels provided by U-SIM.live and will identify abnormal situations. | 5 | The scope of the product |

3.1.2.2. Main Figures of the Validation and Revision Process

3.1.2.2.1. Dependencies



TWI_001 directly depends on TWI_003 for the real time data representation



TWI_031 is directly dependent on SIL_010, as U-TWIN will show passenger occupancy based on the U-SIM.live simulations and data. Both requirements are kept since they refer to the usability of different tools. Both tools should highlight the real/forecasted passenger “load” of PT services.

3.1.2.2.2. Objections



TWI_020 was edited from: “The tool should be able to predict the activation of air quality protocols (based on real-time air quality data) and provide alerts in order to adjust in advanced the PT offer”, to the following: “The tool **should be able to show** air quality **alerts** (based on real-time air quality data) in order to adjust in advanced the PT offer.” This was made due to the fact that U-TWIN should not predict anything but only show info.



This requirement (*TWI_023: When vehicles are platooning, the tool shall show a relevant alert.*) was removed because the tool won’t display alerts for platooning as there’s no easy way to handle it apart from the delays that are already a core part of the tool.



TWI_028 was edited from: “The tool shall display in real time weather information and its link with potential PT alerts (e.g. rainy day and overcrowded PT)” to the following: The tool shall display in real time weather information”. This change is based on the fact that U-TWIN as a digital twin will only display info but not trying to link with potential alerts or predict anything.

TWI_029

A comment was added to TWI_029 in order to clarify that this requirement needs data to be available. Otherwise, it cannot be met.

~~TWI_030~~

(TWI_030: The tool should (if possible) integrate information related to schools (start and finish hours) and the impact on traffic or PT operation (e.g. reduction of the number of PT lanes in a certain street) This requirement was removed based on the fact that school data is out of the scope of the tool and the project.

~~TWI_032~~

(TWI_032: The tool shall display information about traffic allowed speed limits.) This requirement was removed because speed limits are out of the scope of the product.

~~TWI_033~~

(TWI_033: The tool shall display information about the cycling network regarding to different features such as type of infrastructure, surface quality, width, closures, deviations and so on.) This requirement was removed because the cycling network quality is out of the scope for a digital twin. Somehow it will be handled in U-NEED with isochrones.

~~TWI_036~~

(TWI_036: The tool shall display real-time information about walkability data (quality of walking).) This requirement was removed because the walkability data is out of the scope of the product

3.1.2.2.3. Conflicts

No relevant conflicts have been identified.

3.1.3. U-SIM.plan requirements

This chapter describes the specific requirements for U-SIM.plan, introduced by the partners through the Volere tool.

3.1.3.1. List of specific requirements

Table 4 U-SIM.plan specific requirements

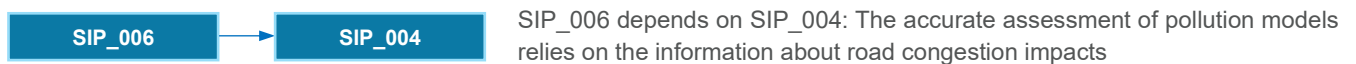
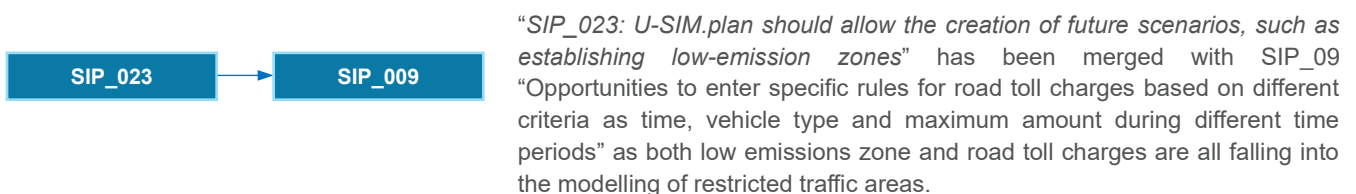
| ID | Description | Priority | Type |
|---------|---|----------|----------------------------------|
| SIP_001 | A Visum Model is a prerequisite to use U-SIM.plan | 5 | Functional and data requirements |
| SIP_002 | Users should be able to define the technical specifications of e-buses and charging stations. | 4 | Users of the product |
| SIP_003 | U-SIM.plan should allow scenario comparison within the tool interface | 4 | Functional and data requirements |
| SIP_004 | U-SIM.plan map should display positive and negative impacts of measures on road congestion | 4 | Look and feel requirements |
| SIP_005 | U-SIM.plan should enable linking to multiple PTV Visum models | 5 | Functional and data requirements |
| SIP_006 | Ensure that air & noise pollution models make a fair assessment of policies that slow down car travel, rather than use irrelevant racetrack emission models | 4 | Functional and data requirements |

| ID | Description | Priority | Type |
|---------|--|----------|----------------------------------|
| SIP_007 | The tool should compute mode choice for each scenario, so that traffic evaporation benefits are truly captured. | 5 | Functional and data requirements |
| SIP_008 | Compute the number of jobs accessible in 30' or 45' for each populated zone, and for an average person, as part of scenario testing. | 3 | Functional and data requirements |
| SIP_009 | U-SIM.plan should make it possible to simulate prospective scenarios to reduce the use of private cars, such as low-emission zones and road toll charges. | 4 | Functional and data requirements |
| SIP_010 | The software must be compatible with Windows | 2 | The scope of the product |
| SIP_011 | The software must be open to allow users to modify and/or add other functionalities (extensibility). | 4 | Functional and data requirements |
| SIP_013 | The software must include a graphical interface that allows the transportation network to be created "automatically" from GIS data such as Open Street Map (OSM) and public transport data (GTFS). | 4 | Functional and data requirements |
| SIP_014 | The software will feature a graphical interface to "automatically" create transport demand disaggregated by home and business zone. | 2 | The scope of the product |
| SIP_015 | U-SIM.plan must be based on a microscopic approach, in particular, agent-based, to model individuals' mobility behaviours (e.g., choice of modal, choice of routes, driving) and infrastructure as finely as possible (roads, and mobility services) | 5 | Functional and data requirements |
| SIP_016 | U-SIM.plan should allow studies at different scales going from a simulation at an intersection to a region's scale. | 5 | Functional and data requirements |
| SIP_017 | U-SIM.plan must allow intermodality taking into account the multimodal offer available. | 5 | Functional and data requirements |
| SIP_019 | U-SIM.plan should allow agents, depending on the traffic situation (e.g., congestion, accidents), to perform dynamic changes in behaviour (e.g., modification of the initial route). | 3 | Functional and data requirements |
| SIP_020 | U-SIM.plan should offer enough parameters to facilitate the calibration of the model and perform various scenarios. | 4 | Functional and data requirements |
| SIP_021 | U-SIM.plan must output indicators on the use of transportation modes (e.g., modal shares, VKT, PKT, emissions). | 5 | Functional and data requirements |
| SIP_022 | U-SIM.plan should make it possible to evaluate current public transport services and future extensions (e.g., number of vehicles used, number of passengers transported by line/station and mode (bus, metro), waiting time) and other mobility services | 5 | Functional and data requirements |
| SIP_024 | U-SIM.plan should allow study the attractiveness of transport modes | 5 | Functional and data requirements |

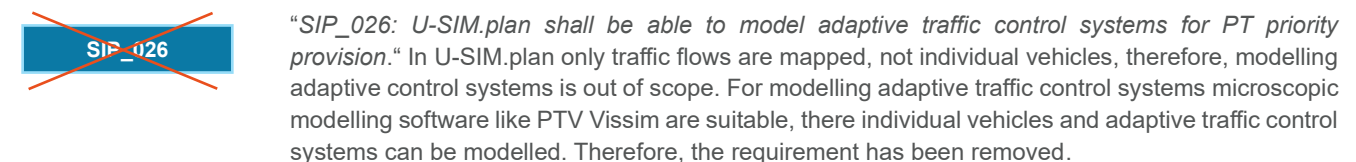
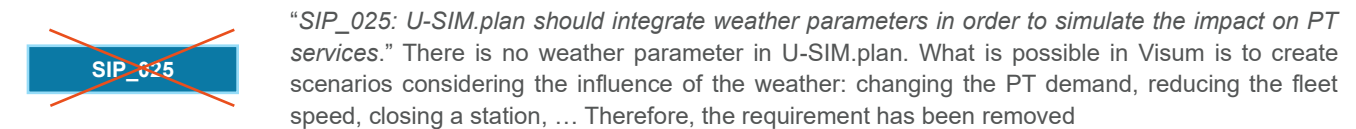
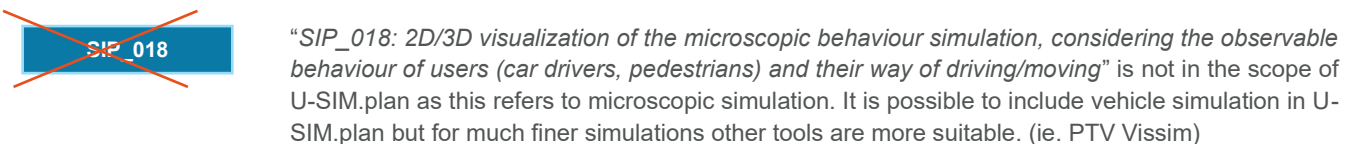
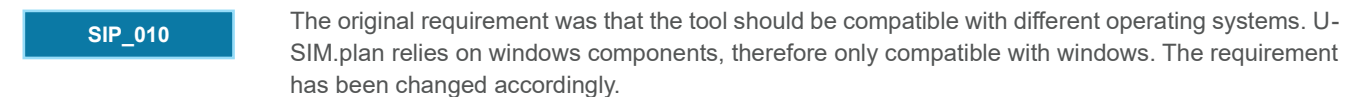
| ID | Description | Priority | Type |
|---------|--|----------|----------------------------|
| SIP_027 | U-SIM.plan should accept data for existing and planned PT stops and visualize for both cases the travel demand (tabulated outputs to compare). | 3 | The purpose of the product |

3.1.3.2. Main Figures of the Validation and Revision Process

3.1.3.2.1. Dependencies



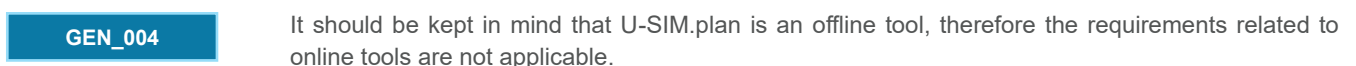
3.1.3.2.2. Objections



3.1.3.2.3. Conflicts

No relevant conflicts have been identified.

3.1.3.2.4. Other comments



SIP_005

U-SIM.plan enable linking to multiple PTV Visum models but as there can be many difference between the models (names, etc.) it can still require a lot of manual work.

SIP_006

PTV Visum offers an assessment of emissions based on a given assignment and vehicle composition. The calculation follows the Handbook Emission Factor for Road Transport (HBEFA, <https://www.hbefa.net/>), if this is considered a fair assessment is let to the user.

SIP_011

It is possible to extend the functionalities of the software using scripts (COM interface). It has however some limitations.

3.1.4. U-SIM.live requirements

This chapter describes the specific requirements for U-SIM-live, introduced by the partners through the Volere tool.

3.1.4.1. List of specific requirements

Table 5 U-SIM.live specific requirements

| ID | Description | Priority | Type |
|---------|--|----------|----------------------------------|
| SIL_002 | U-SIM.live must enable a user to choose a reaction (including “do nothing” within 5 minutes | 3 | Performance requirements |
| SIL_003 | U-NEED should enable the simulation of various mitigation actions. | 4 | Users of the product |
| SIL_004 | KPIs should be reported for the most effective mitigating actions (not for a single action). | 4 | Users of the product |
| SIL_005 | Ability to import / export GTFS / GIS data. | 4 | Functional and data requirements |
| SIL_008 | Map should pinpoint locations where disturbances are detected | 4 | Look and feel requirements |
| SIL_009 | U-SIM.live should be integrated with the ticketing data | 4 | Functional and data requirements |
| SIL_010 | Clicking on a line/stop should showcase current estimated passenger volumes | 3 | Look and feel requirements |
| SIL_011 | Simulate congestion, CO2 emissions, air pollution, and noise pollution scenarios for impact indicators | 4 | Functional and data requirements |

3.1.4.2. Main Figures of the Validation and Revision Process

It was highlighted the strong interconnection between U-SIM.live and the data collected and internally dispatched by U-TWIN. Also, it has been highlighted how some of the data generated by U-SIM.live needs to be collected and republished by U-TWIN, again. For this reason, the two tool have set a series of coordination meetings to design the data workflows and exchanges between the two tools.

In general, different users have expressed a vague understanding of the scope and capabilities of the tool, and the differences with respect to the neighbour tools U-TWIN and U-SIM.plan. For this reason, before the next phase a set of meetings will be performed with each user, showing mock-ups and agreeing on the working environments, available and desired data and workflows.

3.1.4.2.1. Dependencies

No relevant dependencies have been identified.

3.1.4.2.2. Objections

~~SIL_007~~

(SIL_07:U-SIM.live should highlight deviations between planned and executed PT services). This is a live data monitoring topic, to be rather fulfilled by U-TWIN, in case. This requirements has been removed.

SIL_009

To be clarified what data is made available by the different sites, and at what frequency. Remind that U-SIM.live is a real-time decision support tool

SIL_010

To be clarified the workflow. Ideally yes, but it should be kept in mind that the main data visualization tool is expected to be U-TWIN: U-SIM.live data will also be made available there

SIL_011

To be clarified the requirements, and methodologies, also based on the available data (e.g., road surface)

~~SIL_012~~

(SIL_012:U-SIM.live should integrate weather parameters in order to simulate the impact on PT services). Already agreed via email to be removed. We are keen to define a satisfying methodology for the use case: in case we can discuss this when the use case is clearer.

3.1.4.2.3. Conflicts

No relevant conflicts have been identified.

3.1.5. U-SUMP requirements

This chapter describes the specific requirements for U-SUMP, introduced by the partners through the Volere tool.

3.1.5.1. List of specific requirements

Table 6 U-SUMP specific requirements

| ID | Description | Priority | Type |
|---------|--|----------|----------------------------------|
| SUM_001 | The users should be able to select specific indicators and provide connected data sets necessary | 5 | Functional and data requirements |
| SUM_002 | U-SUMP should generate a visual display (dashboard) of the analysed data for the selected indicators | 5 | Look and feel requirements |
| SUM_003 | U-SUMP should be applicable to PT planning, monitoring, and decision-making activities | 3 | The scope of the product |
| SUM_004 | The tool should be able to feed the existing mobility observatories (TML, CML, Lisboa E-Nova, VoxPop...) | 4 | Functional and data requirements |

| ID | Description | Priority | Type |
|---------|---|----------|---|
| SUM_005 | The tool should allow editing and/or adding new sets of measures/indicators/goals | 5 | The scope of the work |
| SUM_006 | The tool should be produced in the Out-systems development platform | 4 | The scope of the product |
| SUM_007 | U-SUMP provides a data-driven platform that helps to guide and track the development, implementation, and update of SUMP with a climate-neutrality focus. | 5 | The purpose of the product |
| SUM_008 | Clients: Local and Regional authorities, PTAs/PTOs | 5 | The client, the customer and other stakeholders |
| SUM_009 | Stakeholders: Citizens and other interested parties | 4 | The client, the customer and other stakeholders |
| SUM_010 | Users - Public transport planners | 5 | Users of the product |
| SUM_011 | Users - City/Region officials | 5 | Users of the product |
| SUM_012 | The tool should allow users to filter data based on data/ time ranges. | 5 | Users of the product |
| SUM_013 | The tool should allow the users to set city's goals and monitor the progress towards achieving them. | 3 | Users of the product |
| SUM_014 | The tools should allow the users to update city's goals. | 3 | Users of the product |
| SUM_015 | The tool should allow users to view historical data and KPIs for assessing the trend. | 4 | Users of the product |
| SUM_016 | The tool should allow modifications regarding the SUMP's measures (adding new measures or upgrading existing ones based on progress monitoring). | 5 | The scope of the work |
| SUM_017 | The tool should have the option to provide a public frontend dashboard with indicators selected by the user from the available set. | 4 | Functional and data requirements |
| SUM_018 | The tool should have an optional comparability function available for users that want to compare their results to the ones of other users reporting on the same indicators. Data would only be comparable for indicators where parties at both ends have provided consent for this. The comparison is only visible in the platform, not as part of a dashboard that can be published. | 4 | Functional and data requirements |
| SUM_019 | There should be the possibility to have multiple user profiles for the same account | 5 | Functional and data requirements |
| SUM_020 | A secure backend dashboard function should be available | 5 | Functional and data requirements |
| SUM_021 | The tool should suggest possible indicators the users could choose to visualise based on the data availability | 3 | Functional and data requirements |
| SUM_022 | The tool should suggest required data sets and recommended format for collection based on indicators user wants to report on | 3 | Functional and data requirements |
| SUM_023 | The tool should have access to databases providing real-time data | 5 | Functional and data requirements |
| SUM_024 | The tool should have a secure gateway to data sources | 5 | Functional and data requirements |

| ID | Description | Priority | Type |
|---------|--|----------|-------------------------------------|
| SUM_025 | The datasets should be compatible with the accepted platform formats | 5 | Functional and data requirements |
| SUM_026 | Data from U-SUMP will be used for evaluation in WP7, based on defined reporting requirements | 4 | Functional and data requirements |
| SUM_027 | U-SUMP will be used as the main source document for the evaluation of the overall impact multipliers matrix per city measures at Functional Urban Area (FUA) | 4 | Functional and data requirements |
| SUM_028 | Tool should send automatic alert messages to the users, when required (e.g., abnormal situation recognised, dataset errors, threshold value of indicators achieved etc.) | 4 | Functional and data requirements |
| SUM_029 | All the actions performed should be registered in an independent data repository with traceability of actions enabled for identifying possible issues. | 5 | Functional and data requirements |
| SUM_030 | The system should generate relevant graphs, allowing the user to analyse the filtered data and draw clear and accurate conclusions | 5 | Functional and data requirements |
| SUM_031 | The tool should provide different type of graphs (histogram, heatmaps, etc) that the user may select to visualize data. | 3 | Functional and data requirements |
| SUM_032 | The tool should be able to communicate with other platforms that are already being operated by PTOs/PTAs. | 5 | Functional and data requirements |
| SUM_033 | Public dashboard (frontend) should be easily embedded into websites | 4 | Functional and data requirements |
| SUM_034 | The landing page of U-SUMP should present a comparison of different public data from the user cities in a visual format | 2 | Functional and data requirements |
| SUM_035 | The tool should compute an average value of every indicator based on the data available from reporting cities | 5 | Functional and data requirements |
| SUM_036 | Target values should be requested from the users for every indicator they select | 5 | Functional and data requirements |
| SUM_037 | U-SUMP will have an intuitive interface | 5 | Look and feel requirements |
| SUM_038 | The U-SUMP interface will be available in different languages | 4 | Look and feel requirements |
| SUM_039 | The platform must be compatible across all devices (desktop, mobile, tablet etc.) to ensure proper user experience. | 5 | Look and feel requirements |
| SUM_040 | U-SUMP will provide guidance for data curation | 4 | Usability and humanity requirements |
| SUM_041 | User guidelines (Help) should be available as an in-app icon/link | 5 | Usability and humanity requirements |
| SUM_042 | The product (backend) shall be used (and easily understood) by people working in the field of Urban Mobility | 4 | Usability and humanity requirements |
| SUM_043 | The frontend (public dashboard) should be easily understood by all categories of people | 4 | Usability and humanity requirements |

| ID | Description | Priority | Type |
|---------|---|----------|--|
| SUM_044 | The platform should be designed to comply with universal design principles. | 5 | Usability and humanity requirements |
| SUM_045 | U-SUMP will use well established metrics/KPIs and provide their sources with references in an info tab | 5 | Usability and humanity requirements |
| SUM_046 | Users have the option to provide feedback/request for other indicators to be added | 5 | Usability and humanity requirements |
| SUM_047 | Users need to agree to give Tech Support access to their account when needed | 4 | Maintainability and support requirements |
| SUM_048 | Technicians should have Admin-level access rights to the accounts | 5 | Maintainability and support requirements |
| SUM_049 | Tech support will be reachable through an in-app icon/link | 5 | Maintainability and support requirements |
| SUM_050 | Provide a secure backend | 5 | Security requirements |
| SUM_051 | Secure connection to data source | 5 | Security requirements |
| SUM_052 | Two factor authentication login for users | 5 | Security requirements |
| SUM_053 | The tool shall comply with local regulations and accessibility standards, to ensure equal access and usability for individuals with disabilities. | 5 | Legal requirements |
| SUM_054 | Users must agree to the Product's Terms and Conditions before being allowed to use the app | 5 | Legal requirements |
| SUM_062 | The platform must be compatible across all devices (desktop, mobile, tablet etc.) to ensure proper user experience | 4 | Functional and data requirements |
| SUM_063 | U-SUMP should provide an alert when underperformance in achieving a goal is detected. | 3 | The purpose of the product |
| SUM_064 | Sensitive data should be automatically masked/hidden towards users without high-level security credentials | 5 | Functional and data requirements |
| SUM_065 | The frequency of the data collection should be specified/recommended for each indicator | 2 | Functional and data requirements |
| SUM_066 | Ask user to specify the functional urban level for which the data is collected (neighbourhood/district/municipality/region/etc.) | 3 | Functional and data requirements |
| SUM_067 | Provide options to filter indicators based on categories (walking/cycling/performance/met targets/etc.) | 5 | Functional and data requirements |
| SUM_068 | Multiple typologies of users with different rights should be available | 5 | Operational requirements |
| SUM_069 | The tool should suggest possible correlations between indicators and provide new analysis perspectives | 2 | Functional and data requirements |
| SUM_070 | The tool should be harmonised with other SUMP applications and platforms | 3 | The scope of the product |
| SUM_071 | For indicators without a standard calculation method (e.g. Modal Split) request for method to be described by user | 5 | Functional and data requirements |

3.1.5.2. Main Figures of the Validation and Revision Process

3.1.5.2.1. Dependencies



SUM_002 depends on SUM_001 as it requires the selection of specific indicators and connected data sets. This dependency will be investigated during the product development phase.



SUM_004 depends on SUM_001 as it requires connected data sets which would further be fed into existing data observatories. This dependency will be investigated during the product development phase.



It was raised that SUM_002 and SUM_017 seem to be quite similar, however, the 017 requirement relates to a public frontend, while the 002 relates to a secure backend. It is found that they are not that similar, especially because one is a "Look and Feel" and the other is a "Functional" requirement.

3.1.5.2.2. Objections

No relevant objections have been identified.

3.1.5.2.3. Conflicts

No relevant conflicts have been identified.

3.1.6. U-NEED requirements

This chapter describes the specific requirements for U-TWIN, introduced by the partners through the Volere tool.

3.1.6.1. List of specific requirements

Table 7 U-NEED specific requirements

| ID | Description | Priority | Type |
|---------|--|----------|----------------------------------|
| NEE_001 | All the actions performed should be registered in an independent data repository with traceability of actions enabled for identifying possible issues. | 3 | Functional and data requirements |
| NEE_003 | U-NEED shall allow users to filter data based on date and time ranges | 5 | Functional and data requirements |
| NEE_004 | U-NEED shall allow users to filter data based on weather types | 5 | Functional and data requirements |
| NEE_005 | U-NEED shall allow users to filter data based on day types | 5 | Functional and data requirements |
| NEE_006 | U-NEED shall allow users to filter data based on one or several days of the week | 5 | Functional and data requirements |
| NEE_007 | U-NEED shall allow users to filter data grouping different types of filters | 5 | Functional and data requirements |

| ID | Description | Priority | Type |
|---------|--|----------|-------------------------------------|
| NEE_008 | Historical weather data of each pilot site is needed | 5 | Functional and data requirements |
| NEE_010 | When a user filters data by a specific transport modality, the application displays the relevant origin-destination information on a background map. | 5 | The scope of the product |
| NEE_011 | U-NEED should allow users to zoom in, zoom out, and move around a background map whether or not there is information loaded | 5 | Usability and humanity requirements |
| NEE_012 | When one or more layers are loaded onto the map, the user should be able to activate or deactivate them independently | 5 | Usability and humanity requirements |
| NEE_013 | The system must be designed to ensure optimal performance and speed even when handling large volumes of data | 4 | Performance requirements |
| NEE_014 | The Graphical User Interface should include a visible and easy-to-use toolbox that allows users to access the different features of the tool | 5 | Usability and humanity requirements |
| NEE_016 | U-NEED shall be compatible with the GTFS (General Transit Feed Specification) standard, and shall import and process GTFS data provided by transport agencies | 5 | Functional and data requirements |
| NEE_018 | Pilot sites must provide an up-to-date calendar that includes working and holiday days | 5 | Functional and data requirements |
| NEE_020 | U-NEED shall allow users to view historical traffic data | 2 | Functional and data requirements |
| NEE_021 | Correct and up-to-date calendar data in GTFS for accurate route information | 5 | Operational requirements |
| NEE_022 | Make sure information flows between U-NEED, U-SIM and U-TWIN are smooth + avoid developing similar features in each tool (e.g. 3D representation of traffic flows in U-NEED vs U-TWIN) | 5 | Open issues |
| NEE_023 | The tool should send a notification when an abnormal situation is being predicted. | 4 | Users of the product |
| NEE_024 | The prediction horizon options should be carefully considered (it is connected to the time that PTO/PTA need to act). | 4 | Users of the product |
| NEE_025 | The tool should not provide a single mitigation measure, but a set of alternatives. | 4 | Users of the product |
| NEE_026 | U-NEED should allow users to filter data based on the type of PT service (e.g. bus, metro). | 5 | Users of the product |
| NEE_027 | U-NEED should provide different type of graphs (histogram, heatmaps, etc) that the user may select to visualize data. | 5 | Usability and humanity requirements |
| NEE_028 | Provide tools to understand non-numeric data, such as spatial data (e.g., thematic maps). | 4 | Usability and humanity requirements |
| NEE_029 | Provide the option to reveal relationship, dependencies to various data filters to understand trade-offs of decisions. | 4 | Usability and humanity requirements |
| NEE_030 | Ensure that big data can scale up on 3D faces, even with less accuracy or less options being available. | 3 | Performance requirements |

| ID | Description | Priority | Type |
|---------|---|----------|-------------------------------------|
| NEE_031 | Ensure that it can run to windows and mac (or other OS defined by the majority of partners). | 3 | Performance requirements |
| NEE_032 | Provide different visualization styles, enough to support data filters if needed. | 3 | Performance requirements |
| NEE_033 | Dynamic relationship of visualizations with several input aspects. | 3 | Functional and data requirements |
| NEE_034 | As a visualization tool, U-NEED will be able to use editing tools only to filter data if it is relevant | 4 | Usability and humanity requirements |
| NEE_035 | Maintaining a history of user actions that can be shown in a list. | 4 | Functional and data requirements |
| NEE_036 | U-NEED will be able to show inefficiencies in different public transportation modalities by providing summarized reports with filtered data information and KPIs, if it is possible to calculate them. | 5 | Usability and humanity requirements |
| NEE_038 | Selectable Map Styles based on predefined options | 5 | Functional and data requirements |
| NEE_039 | Information legend for U-NEED tool | 5 | Functional and data requirements |
| NEE_040 | U-NEED should be adapted to the PTV Visum O/D Matrix standard | 4 | Functional and data requirements |
| NEE_041 | U-NEED should be adapted to the GTFS standard | 4 | Functional and data requirements |
| NEE_042 | U-NEED should take ticket validations as input for demand estimation | 3 | Functional and data requirements |
| NEE_043 | U-NEED menu should allow to easily update case study data elements | 3 | Functional and data requirements |
| NEE_044 | If and where the tool predicts demand, it should alert the user on the simplified nature of the tool that could be misleading (for instance if the tool doesn't compute the effect of ambitious new policies on mode shift) | 3 | Functional and data requirements |
| NEE_046 | The tool should provide output to measure impact indicators: modal split, accessibility to mobility services,... | 4 | Functional and data requirements |
| NEE_049 | The tool should make data transfer easy when users want to import/export data. | 4 | Look and feel requirements |
| NEE_051 | Heatmap of problem areas / well working areas | 3 | Functional and data requirements |
| NEE_052 | The tool allows effective and accurate identification of unserved or poor-quality service areas on a geospatial map. | 4 | Functional and data requirements |
| NEE_053 | The tool allows efficient and accurate analysis of private vehicle transport flows in a given geospatial area. | 1 | Functional and data requirements |
| NEE_054 | The tool should be able to effectively and accurately identify vulnerability variables that may be related to air quality in locations that users want to analyse, such as hospitals and school zones. | 1 | Functional and data requirements |
| NEE_055 | The tool should provide reports that cross-reference Origin-Destination matrix information with surveys provided by U-GOV. | 1 | Functional and data requirements |
| NEE_057 | The tool should evaluate the filtered Origin-Destination data that is being analysed. | 4 | Functional and data requirements |

| ID | Description | Priority | Type |
|---------|--|----------|----------------------------------|
| NEE_062 | If a transfer between modes happens, the tool shall detect the time when it happened and the different modality data involved. | 1 | Functional and data requirements |
| NEE_063 | The tool will allow some locations to be displayed according to their use or typology: Housing, jobs, leisure, commercial and so on. | 3 | Functional and data requirements |
| NEE_064 | The tool shall allow estimating the influence of the weather on the use of active modes or the mode substitution (public transport, private car, etc.) by processing large transport data sets. | 3 | The scope of the product |
| NEE_065 | The tool should display information of PT demand (passengers) in peak and off-peak hours in order to facilitate the PT offer adjustment. | 3 | Functional and data requirements |
| NEE_066 | The tool shall display static information about the Public Transport modalities such as stops and routes. | 5 | Functional and data requirements |
| NEE_067 | If it is possible to detect the time between transfers and the stops involved, the tool shall calculate the waiting time range of passengers. | 3 | The scope of the product |
| NEE_068 | The system shall allow the import and display of information related to origin-destination matrices of Public Transport, using standardised information. | 5 | The scope of the product |
| NEE_070 | The tool shall display Origin-Destination information about bicycles using data sources such as automatic counters and GPS tracking. | 1 | Functional and data requirements |
| NEE_071 | The tool should integrate information about mobility needs based on surveys (conducted through U-GOV or others) and take it into account when generating reports on inefficiencies in the PT offer/system. | 1 | The scope of the product |
| NEE_072 | The tool should digest and display information about micromobility and shared system. | 1 | Functional and data requirements |
| NEE_074 | The tool shall provide quantitative information about the impact of special events over the Public Transport uses and passengers flows. | 4 | The scope of the product |
| NEE_078 | U-NEED shall allow import Points Of Interest locations such as hospitals, schools, universities and so on to make possible geospatial analysis | 1 | Functional and data requirements |

3.1.6.2. Main Figures of the Validation and Revision Process

3.1.6.2.1. Dependencies

NEE_074

NEE_061

The requirement NEE_061 (*“The tool should locate important or big events on a geospatial map taking into account the place and when is happening”*) was removed and the rationale and acceptance criteria of NEE_074 was modified due to the DEP_440. Rationale: “User can filter data showed, specifically for particular areas of influence”.

Acceptance Criteria: “When user wants to display the affection of a particular event, he/she is able to draw the influence area by a particular radius or shape, and the data showed of Public Transport and passengers flows are filtered for this area only.”

3.1.6.2.2. Objections

NEE_034

The description of NEE_034 was changed after specifying that U-NEED will not be able to edit information directly on the map, but just use editing tools for filtering data (OBJ_1528). Old description: “U-NEED capabilities may be separate in two clusters. One for viewing and one for editing (thus different user experience will be required).” New description: “As a visualization tool, U-NEED will be able to use editing tools only to filter data if it is relevant”.

~~NEE_047~~

(NEE_047: Provide metadata of the available data in a standardised way (e.g. DCAT)). Users will filter data according to different topics as date ranges, time ranges, type of weather and so on, but they will not have direct access to the Origin Destination data. However, they will be able to export data in a Visum format following data specification itself. The requirement was removed due to the OBJ_1536 objection.

~~NEE_048~~

(NEE_048: should facilitate access to data available in existing data portals like INSPIRE and data.europa.eu). U-NEED is not intended to share data beyond the possible relationship with U-SIM.plan, when users will be able to export data in a Visum format. Thus, we do not see applicable to create metadata. The requirement was removed due to the OBJ_1537 objection.

NEE_036

Fix/change requirement description as accorded by e-mail: “U-NEED will be able to show inefficiencies in different public transportation modalities by providing summarized reports with filtered data information and KPIs, if it is possible to calculate them”. The requirement description was reedited due to the OBJ_1529 objection.

~~NEE_037~~

(NEE_037: Accept data for existing and planned PT stops and visualize for both cases the travel demand (tabulated outputs to compare)). This requirement was deleted from U-NEED due to the OBJ_1530 objection and was created again as a requirement for the U-SIM.plan because U-NEED is not intended to show planned Public Transportation stops, only existing assets.

NEE_044

Due to the OBJ_1488 objection, the rationale field description was filled with the following text: “If AI predicts transport demand in special circumstances, the user should be reminded of the conservative nature of AI: it learns from observed patterns and does not see untapped potential for 2x PT ridership”, since some cities could be interested on this.

~~NEE_050~~

(NEE_050: The tool should be a solution to efficiently handle and process geospatial data using different interoperable formats as GML, Geojson and SHP). The requirement was removed due to the OBJ_1538 objection because, at first sight, the tool will be able to import data from origin-destination matrices in standard formats, such as Visum format. As a visualisation tool, U-NEED is not intended to be a GIS software, so the tool itself will be able to import specific data related to the requirements of each pilot city, but not in a generic way. If a particular format is needed, the tool shall provide a feature to be able to import that specific format.

NEE_053

The priority of this requirement has been downgraded due to the OBJ_1539 objection because not all the pilot sites will provide with private car OD matrixes. As far as U-NEED will be feed with private vehicle OD data, the tool will display this information.

NEE_054

The priority of this requirement has been downgraded due to the OBJ_1540 objection because not all the pilot sites will provide air quality information in order to be displayed over the map. Otherwise, the tool will not be able to display anything about it. In addition, vulnerable areas or buildings layers should be provided.

~~NEE_056~~

(NEE_056: The tool should provide microscopic simulations, offering a common model for U-TWIN and U-NEED). The requirement was removed due to the OBJ_1541 objection because neither U-NEED nor U-TWIN will provide with simulations.

NEE_057

Rationale field was filled for specifying the scope of the requirement due to the OBJ_1542 objection. U-NEED shall allow detecting inefficiencies on relevant Public Transport as a result of the analysis.

~~NEE_058~~

(NEE_058: The tool shall allow to get information of Public Transport validations according to the type of user). This requirement was removed due to the OBJ_1543 objection. No information will be provided about type of user, unless the cities provide with this kind of information. So, that filter will be treated in particular if the cities provide with this information and have the interest to analyse it. This requirement has to be removed in general, but treated in particular with the interested cities.

~~NEE_059~~

(NEE_059: The tool should provide results regarding to inefficiencies from a social perspective). This requirement was removed due to the OBJ_1544 objection. A new filter should be designed to take this into account, but at the beginning no social type information would be provided, so this filter has no sense unless the cities will provide with this information. This requirement has been removed in general, but will be treated in particular if any city is interested in.

~~NEE_060~~

(NEE_060: The tool should identify street and Public Transport routes that are most likely to be affected by weather conditions). This requirement was removed due to the OBJ_1545 objection. Weather data will be provided in general for the whole city, so no particular weather by street will be shown.

NEE_062

This requirement was removed due to the OBJ_1547 objection. This functionality depends on the ticketing of a city in particular, if different public transport modalities are unified in the same transport card or not. So, it is really difficult to trace the transfers users do. If provided, it will be considered in particular.

NEE_063

If a specific pilot site wants to filter or display data regarding to specific locations such as jobs, leisure, commercial and so on, should provide with this information. The information could be retrieved from Open Street Map, TomTom and so on. In any case, the city should also provide this information if needed. The description was modified due to the OBJ_1550 objection.

NEE_064

PTOs will be able to filter public transport data and other modalities provided regarding to weather conditions. From this point of view the tool will provide with different reports that can be compared later by the PTOs. The acceptance criteria of this requirement was completed due to the OBJ_1557 objection.

NEE_054

The priority of this requirement has been downgraded due to the OBJ_1559 objection because not all the pilot sites will provide with different possible characteristics for a ticketing validation to be considered as a transfer or not. Under these circumstances, the tool will be able to detect

transfers, display them into the map and calculate time ranges between stops from the ticketing information itself.

(*NEE_069: The tool should be able to calculate the average max traffic speed per road section (probe data, TomTom,...) in order to take corrective actions for safety reasons*). This requirement was removed due to the OBJ_1560 objection. U-NEED is intended for Public Transport, detect inefficiencies and so on. Regarding to private traffic, the tool will be able to display origin destination matrixes if data is provided, but the calculations of max speeds is not in the scope of the tool, at a first sight. It would be studied in particular if needed, and if data needed is provided.

~~NEE_069~~

The priority of this requirement has been downgraded due to the OBJ_1561 objection because U-NEED is intended for importing and displaying origin destination data. Therefore, it has no sense having this information unless a city is interested. But, data has to be prepared in some way before being imported.

NEE_070

The priority of both requirements has been downgraded to the lowest priority due to the OBJ_1562 objection. Surveys data need to be filtered in the same way that data is filtered in U-NEED (date and time ranges, areas that are being analysed and so on). If U-GOV is able to filter the affected surveys, it would be possible to show survey results in analytical reports in U-NEED. Otherwise, not.

NEE_055

NEE_071

The priority of this requirement has been downgraded due to the OBJ_1563 objection because micro-mobility companies do not usually publish this data because of commercial issues. Unless origin-destination data of shared mobility and micro-mobility is shared by cities, the information won't be displayed.

NEE_072

(*NEE_075: The tool shall display information about stages of multimodal trips - i.e. Walk + PT + Walk; NEE_076: The tool shall display information about stages of multimodal trips - i.e. Walk + PT + Walk.; The tool shall integrate and display walking data as a transport mode (either for first / last mile or walk all the way as a transport mode)*). These requirements have been removed due to the OBJ_1565 objection. If cities can provide walkability information, then it can be studied the creation of a functionality to analyse the accessibility and display walking times to each city location.

~~NEE_075~~

~~NEE_076~~

~~NEE_077~~

3.1.6.2.3. Conflicts

No relevant conflicts have been identified.

3.1.7. U-GOV requirements

This chapter describes the specific requirements for U-GOV, introduced by the partners through the Volere tool.

3.1.7.1. List of specific requirements

Table 8 U-GOV specific requirements

| ID | Description | Priority | Type |
|---------|---|----------|---|
| GOV_001 | When users submit feedback regarding the public transportation system, the tool shall provide an option to select the specific aspect or service they are providing feedback on. | 3 | Functional and data requirements |
| GOV_002 | U-GOV will send notifications via email to users when i)a transport/mobility participatory process is being organised, including an on-going survey so they can submit their responses and ii)when there are news regarding transport in their city | 5 | The scope of the product |
| GOV_003 | The platform must manage GDPR restrictions | 5 | Legal requirements |
| GOV_004 | Different user profiles will be considered in the platform | 5 | Users of the product |
| GOV_005 | Links with the citizen participatory platforms that already exist in some cities (e.g. decidimVLC in Valencia) | 4 | The scope of the product |
| GOV_006 | Set up specific groups of discussion based on different mobility topics | 5 | The scope of the product |
| GOV_007 | Use U-GOV surveys to analyse third party mobility incentives fares politics | 5 | The purpose of the product |
| GOV_009 | The VISUAL diagnosis in the Information/Sensitization section should include KPIs provided by UPPPER tools (U-SUMP, U-NEED) that provide a good overview of urban mobility in the city. | 5 | The scope of the product |
| GOV_010 | The platform must be compatible across all devices (desktop, mobile, tablet etc.) to ensure proper user experience. | 5 | Functional and data requirements |
| GOV_011 | The platform should be designed to comply with universal design principles. | 5 | Usability and humanity requirements |
| GOV_012 | New section to track the implementation of the co-designed measures | 5 | The scope of the product |
| GOV_014 | The Interface should be user friendly for any basic technology end user, with few stepping stones in the process | 4 | Look and feel requirements |
| GOV_015 | The tool interface should have back-office access, for the city certified users to manage and edit participation process information | 5 | The client, the customer and other stakeholders |
| GOV_016 | The tool should send automatic reply when the citizen or stakeholder submits their participation query | 5 | Usability and humanity requirements |
| GOV_017 | Tool should send automatic alert messages to the users, when required | 4 | Functional and data requirements |
| GOV_018 | The platform must include a protocol to manage the user's profile | 5 | Users of the product |
| GOV_019 | Some of the KPIs presented in the information module can be fed with datasets from U-TOOLS | 4 | Functional and data requirements |
| GOV_020 | The platform will host questionnaires. Simple questionnaires will be hosted in the platform, and other questionnaires will be hosted in | 5 | Functional and data requirements |

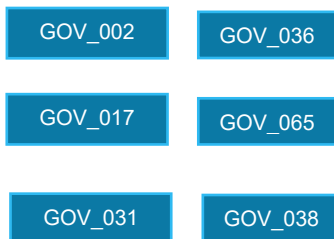
| ID | Description | Priority | Type |
|---------|--|----------|-------------------------------------|
| | commercial platform (Miro, Mentimeter, SurveyMonkey, Google Forms, ...) | | |
| GOV_021 | The promoter (project manager profile) of each initiative will have access to its project, in order to update status | 5 | Functional and data requirements |
| GOV_024 | The platform user should be able to report videos/photos that reveal personal data for deleting them from databases. | 3 | Legal requirements |
| GOV_026 | Users should be able to edit/delete the feedback they provided. | 4 | Users of the product |
| GOV_027 | Project manager should be able to notify/alert specific categories of users. | 2 | Users of the product |
| GOV_028 | Clear distinction of which tools are used by whom (teams, stakeholders etc) in U-GOV. | 5 | Usability and humanity requirements |
| GOV_030 | Ensure that U-GOV is updated with the most recent city data and on-time. | 5 | Usability and humanity requirements |
| GOV_032 | Outcomes should be always available to interested users, in specific visual formats. | 3 | Usability and humanity requirements |
| GOV_033 | Best practices of a topic can be briefly presented to persuade more users to participate. | 2 | Usability and humanity requirements |
| GOV_034 | Action (history) tracker for each participant-part of personal data. | 4 | Usability and humanity requirements |
| GOV_035 | U-GOV should provide statistical information regarding citizens' responses to polls/surveys. | 4 | Functional and data requirements |
| GOV_037 | When different scenarios of a measure have been defined from UPPER consortium, U-GOV should enable citizens to understand/view economic/environmental benefit according to each scenario (e.g., combining PT with active modes). | 3 | Functional and data requirements |
| GOV_039 | U-GOV can enable citizens to enter their travel behaviour in their personalized cards and ask how their mobility could improve. | 3 | Functional and data requirements |
| GOV_043 | Netnography data visualization. PT assessment in social media by end users. Rating, Positive Comments vs. Negative, Hate level, Words per gender, Tourists vs Inhabitants, Emotions | 4 | Functional and data requirements |
| GOV_044 | Open Data portal at cities: Users' satisfaction barometer with PT, to be shown in the information module | 4 | Functional and data requirements |
| GOV_045 | To show a map with the ongoing projects, in the collaboration module. The maps include links to the project page in the platform. | 4 | Functional and data requirements |
| GOV_046 | The alliance module includes results of previous projects, developed with citizens participation | 4 | Functional and data requirements |
| GOV_047 | The collaboration module includes the possibility of uploading an anonymized contribution for an ongoing project | 3 | Functional and data requirements |
| GOV_048 | A registered user can upload contributions for an ongoing project, in the module participation | 5 | Functional and data requirements |

| ID | Description | Priority | Type |
|---------|---|----------|----------------------------------|
| GOV_050 | The user profile will include demographic data: Gender, Age, District, Awareness level (behavioural change), family typology, mobility habits, ... | 5 | Functional and data requirements |
| GOV_051 | End users contribute to ongoing projects with photos and videos; these files can require high storage capacity | 5 | Functional and data requirements |
| GOV_052 | The end user can select the type of contribution they are making: passive (questions, multimedia files, ideas, ...), or more active (participation in workshops, activities, ...) | 4 | The scope of the product |
| GOV_053 | Audios and videos will be reviewed offline | 3 | Functional and data requirements |
| GOV_055 | The tool should provide users with a clear understanding of the governance background of a measure and inform which organisations are involved in what capacity (responsibilities, funding, operation, maintenance) | 4 | The scope of the work |
| GOV_058 | The platform should cover PT in a given city/metropolitan region provided by the cities or operators at large and make the distribution across "mobilisers of initiatives" in the backoffice/afterwards | 5 | Risks |
| GOV_060 | Opportunities to export data from surveys to perform analysis in dedicated software | 5 | Functional and data requirements |
| GOV_061 | The tool should provide output that can be used for user satisfaction indicator calculation | 4 | Functional and data requirements |
| GOV_063 | Multiple possibilities (channels) to invite people to the tool (mail, SMS, QR-code, web address ++) | 5 | Functional and data requirements |
| GOV_066 | Functionality that end users can use to provide feedback about ongoing processes in their city. | 4 | Functional and data requirements |
| GOV_068 | Cities should provide local language translations | 5 | The scope of the product |
| GOV_070 | The platform should include a "Mobility habits module" to inform about news and improvements related to mobility in the city | 4 | Functional and data requirements |
| GOV_078 | The platform should differentiate ongoing projects at neighbourhood level and those at the whole city level | 4 | Functional and data requirements |
| GOV_079 | The platform will include a forum facility to facilitate dialogue with participants | 3 | Functional and data requirements |
| GOV_081 | The platform includes in the Collaboration module tools to search ongoing projects employing different topics: geographical area, transport mode, key words... | 5 | Functional and data requirements |
| GOV_082 | The platform includes a tool to organize offline events (in person workshops, focus groups, conferences, activities, ...) | 4 | The scope of the product |
| GOV_084 | The Collaboration module should include a tool to positively assess ('likes') and comment existing contributions by other participants | 3 | Functional and data requirements |
| GOV_085 | The platform should include a moderation in contributions publish and identify hateful comments or inappropriate contents before being published. | 5 | Functional and data requirements |

| ID | Description | Priority | Type |
|---------|--|----------|--------------------------|
| GOV_087 | The City Stories includes the possibility of presenting projects performed in other cities | 2 | The scope of the product |

3.1.7.2. Main Figures of the Validation and Revision Process

3.1.7.2.1. Dependencies



Dependency 399: GOV_002, GOV_017, GOV_31, GOV_036, GOV_38 and GOV_065 can be merged into one requirement: Send automatic alerts to users when: i) upcoming event is planned, ii) their input/feedback is required or a consultation process is open, iii) there are updates in a field that interests the user, iv) news about the transport system



Dependency 400 : Both requirements are related to GDPR and can be merged into one. GOV_003 is quite general while GOV_023 describes a concrete requirement and is proposed to be kept. Indeed GOV_023 is included in GOV_003; yet, we propose keeping GOV_023 since it reminds a specific requirement regarding visual content. Dependency 418: All these requirements relate to GDPR. Make an umbrella GDPR requirement for all tools (GENERIC).



Dependency 420: GOV_036 alerts would be far more relevant and citizen-centric if GOV_040 was implemented (for citizen to map their places of interest and frequently used routes). If citizens are able to enter their common routes on a map interface then alerts could be sent to remind them to continue entering routes etc.



Dependency 414: The rating of Transport modes collected in social networks GOV_043 could be employed as an indicator of user satisfaction GOV_061; other data sets could be employed, as barometers included in councils' open data portals GOV_044.



Dependency 419: GOV_061 customer satisfaction score requires GOV_050 on user characteristics in order to control and correct inevitable biases associated with an online engagement platform like U-GOV. Such platforms are not designed like a survey and hence lack a robust sampling protocol.

3.1.7.2.2. Objections



The description is updated to specify the exact notification method, that will be email.

GOV_007

Incentivise participation in U-GOV through individual discounts on mobility fares. Difficult to measure and to define - a collaborative approach would be needed among all the stakeholders to agree on how to define these discounts.

~~GOV_008~~

(GOV_08: *Promote the participation of children through activities in schools (using U-GOV)*). This requirement is removed because the participation will not be done by school children

GOV_009

The description is updated to clarify the fact that U-GOV will not calculate KPIs but will be provided by other U-TOOLS

GOV_012

New section to track the implementation of the co-designed measures. One of the main complaints around participatory process is that very often citizens do not see how their contributions are being used or how their ideas are materialised into tangible things and therefore they have the feeling that they are "losing" their time when taking part on participatory process, increasing the perception that these processes are being organised just because they are a legal requirement. Having a section/feature to track the implementation of the measures that they contribute to develop (e.g.: status (planned, in implementation, executed), % of execution, expected finalised date, etc) could help changing this perception and at the same time would increase the transparency of the process.

GOV_019

The description is updated to clarify the fact that U-GOV will not calculate KPIs but will be provided by other U-TOOL

~~GOV_022~~

(GOV_022: *Online meeting functionality integrated in the platform, or link to a commercial platform (Teams, Google Meet, Zoom, ...)*). The requirement is deleted because the platforms won't be integrated as are out of the scope of the app. Alternatively, a link could be provided in the app.

~~GOV_023~~

(GOV_023: *Uploaded videos and photos should be blurred for avoiding capturing personal data*). The requirement is deleted due the needed of a revision after upload and before public posting, this measure is not necessary.

~~GOV_040~~

(GOV_040: *U-GOV could enable citizens to enter common trip routes on a map interface*). The requirement is deleted because the common trip routes won't be provided as a map route but a form-like step-by-step trip.

GOV_053

The requirement is updated to clarify that audio and videos will be reviewed offline but not using any natural language

GOV_056

The tags won't be added automatically but provide a list of common tags to more accurate selection by the publisher

~~GOV_057~~

(GOV_057: *Enable live-feedback with GPS location (or in connection with location identifiers like QR codes in vehicles, etc.) to create a sense of ownership and make users to "agents" of the overall PT system performance, informing live about PT issues*). The requirement is deleted because the live position tracking is out of the scope of the app and could have some legal and technical problems related to GDPR

GOV_058

The description is updated to reflect that the regions should be provided by PTO or cities

~~GOV_059~~

(GOV_059: *The tool should have an interactive map component where the end-user can provide location-specific input.*) The requirement is deleted because the need of make a fully accessible app for every user and some technical difficulties in this particular.

GOV_060

The description is updated to reflect that the format should not be preselected but decide during the development.

~~GOV_067~~

(GOV_067: *Possibility to deactivate some features such as forums.*) The requirement is deleted because as this is not a final product, the full functionalities should be show in the app.

GOV_068

The requirement is updated to reflect that the translations should be provided by the cities or PTO.

~~GOV_069~~

(GOV_069: *Best neighbourhood practices in the Mobility habits module.*) The requirement is deleted because the functionality is out of the scope of the app as the live tracking will not be provided but with surveys.

~~GOV_071~~

(GOV_071: *To show mobility data per user profile in Mobility habits module.*) The requirement is deleted because the functionality is out of the scope of the app as the live tracking will not be provided.

~~GOV_072~~

(GOV_072: *Integration with city available platforms.*) The requirement is deleted because the existing platforms will be linked but not embedded in the service.

~~GOV_073~~

(GOV_073: *Feedback button.*) The requirement is deleted because the mobility habits will not need for a feedback button.

~~GOV_074~~

(GOV_074: *Include unexpected events in the mobility network.*) The requirement is deleted as there's already a digital twin in U-TOOLS.

~~GOV_080~~

(GOV_080: *MoviMeter.*) The requirement is deleted because the MoviMeter will not be present as the living daily tracking will not be provided.

GOV_085

The requirement is updated to reflect that won't be an automatic system but an offline revision

~~GOV_086~~

(GOV_086: *U-GOV App.*) The requirement is deleted because the first iteration of the service will be completed with a responsive WebApp

~~GOV_088~~

(GOV_088: *Registration with Social Network profiles (e.g. Gmail).*) The requirement is deleted because the needed of some personal data that could not be retrieved by social profiles

~~GOV_089~~

(GOV_089: *Share your participation in social networks.*) The requirement is deleted because some technical issues regarding the social sharing APIs and methods.

3.1.7.2.1. Conflicts

GOV_009

GOV_019

KIPs will not be calculated by U-GOV but provided by another U-TOOLS.

3.1.8. U-KNOW requirements

This chapter describes the specific requirements for U-KNOW, introduced by the partners through the Volere tool.

3.1.8.1. List of specific requirements

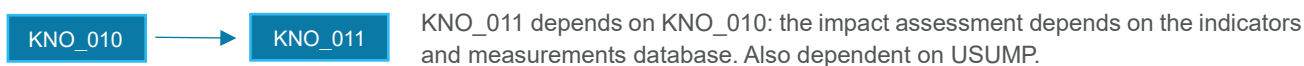
Table 9 U-KNOW specific requirements

| ID | Description | Priority | Type |
|---------|---|----------|-------------------------------------|
| KNO_001 | U-KNOW shall identify and showcase best practices in the field of public transport that have demonstrated positive impact and sustainability. | 5 | Functional and data requirements |
| KNO_002 | U-KNOW shall incorporate automatic translation capabilities to facilitate the dissemination of knowledge | 3 | Usability and humanity requirements |
| KNO_003 | U-KNOW shall provide an online platform for public transport professionals to exchange knowledge, ideas, and best practices. | 4 | Functional and data requirements |
| KNO_004 | Clarify with the NZC/Mission the technical requirements to make the links between U-KNOW and the Mission platform | 5 | Functional and data requirements |
| KNO_005 | Alignment with the Mission regarding the content to be created and included in the U-KNOW tool to avoid an overlapping with the services offered in the Mission Platform | 5 | Open issues |
| KNO_006 | In the resource library include additional sections for regulations, policies and strategies at the EU level | 5 | The scope of the product |
| KNO_007 | include a section/option to allow users (external to the consortium) to suggest content that can be included in U-KNOW. Users won't be able to provide their own content unprompted. A quality review process will be done. | 5 | The scope of the product |
| KNO_008 | Include a section of other innovative projects (both EU-funded and not) to promote the use of PT | 3 | The scope of the product |
| KNO_009 | include a section within the UPPER newsletter informing about U-KNOW news. | 5 | Users of the product |
| KNO_010 | U-know will contain a measure impact indicator database where indicators and their measurement methods are defined | 5 | The scope of the product |
| KNO_011 | Inclusion of open tools provided by UPPER partners for impact assessment | 4 | Open issues |
| KNO_013 | User experience and design of online platform attractive to increase engagement | 5 | Look and feel requirements |
| KNO_014 | Include search by key themes, topics, indicators | 4 | Functional and data requirements |
| KNO_016 | Content should follow quality guidelines | 5 | Functional and data requirements |
| KNO_017 | U-KNOW should not overlap with existing well-known tools such as ELTIS, new value needs to be created and connection with existing tools sought after | 4 | Open issues |

| ID | Description | Priority | Type |
|---------|--|----------|-------------------------------------|
| KNO_018 | AI features to improve the tool's usability, facilitating search, filtering and translation of content | 2 | Usability and humanity requirements |
| KNO_019 | Case studies and good practices should be direct, structured in a clear way: presenting the problem, the context and lessons learned in an HONEST manner- the wins and the loses. | 4 | The scope of the work |
| KNO_020 | Factsheets should include key information on different areas: administrative, financial, cultural and political, operational... | 3 | The scope of the work |
| KNO_021 | Link with U-TRANSFER for users looking to compare. Self-assessment Questionnaire to be included in one of the tools to allow for the user to understand their PT system in a wider context. Link U-KNOW measures depending on questionnaire results. | 3 | The scope of the work |
| KNO_022 | Include follow-up contacts to case-studies and best-practices (with the appropriate consent) | 2 | Usability and humanity requirements |
| KNO_023 | The platform must be compatible across all devices (desktop, mobile, tablet etc.) to ensure proper user experience | 4 | Functional and data requirements |
| KNO_024 | U-KNOW should provide buttons to redirect to the UPPER site and social media accounts. | 5 | Functional and data requirements |
| KNO_025 | Categories of governance structure for cities/regions to self-assess | 4 | Functional and data requirements |

3.1.8.2. Main Figures of the Validation and Revision Process

3.1.8.2.1. Dependencies



3.1.8.2.2. Objections

KNO_007 Include a section/option to allow users (external to the consortium) to suggest and share content that can be included in U-KNOW. This has been addressed with a quality review process which will ensure that U-KOW's content is of sufficient quality and relevancy.

KNO_006 The platform will include sections for regulations, policies and strategies at the EU level and will also link to international organisations that promote PT (ITF, World Bank, WRI, etc) on specific resources. However, since we aim to avoid having a “promotional platform” we'll avoid having general links. Moreover, it should also be discussed how to integrate into U-KNOW interesting and relevant information (e.g. library of resources, their own use cases, etc) these organisations have.

3.1.8.2.3. Conflicts

No relevant conflicts have been identified.

3.1.9. U-TRANSFER requirements

This chapter describes the specific requirements for U-TRANSFER, introduced by the partners through the Volere tool.

3.1.9.1. List of specific requirements

Table 10 U-TRANSFER specific requirements

| ID | Description | Priority | Type |
|---------|---|----------|-------------------------------------|
| TRA_001 | U-TRANSFER courses should be subtitled to local languages | 5 | Users of the product |
| TRA_002 | Include a filter to allow cities to easily identify the transferability guidelines and other content that may interest them | 5 | Usability and humanity requirements |
| TRA_003 | include a FAQ section for each measure | 5 | The scope of the product |
| TRA_004 | The User Interface (UI) of tool should support local languages. | 3 | Users of the product |
| TRA_005 | U-TRANSFER should work in close collaboration with U-KNOW on how knowledge is stored and disseminated | 5 | The scope of the work |
| TRA_006 | More attractive and simpler measures representation | 3 | The purpose of the product |
| TRA_007 | Unsuccessful result learning | 4 | The purpose of the product |
| TRA_008 | Survey to have a clearer view of the status quo | 4 | The purpose of the product |
| TRA_009 | Be aware of existing transfer tool | 4 | The scope of the work |
| TRA_010 | The platform must be compatible across all devices (desktop, mobile, tablet etc.) to ensure proper user experience | 4 | Functional and data requirements |
| TRA_011 | Categories of governance structure for cities/regions to self-assess | 4 | Functional and data requirements |

3.1.9.1. Main Figures of the Validation and Revision Process

3.1.9.1.1. Dependencies

No relevant dependencies have been identified.

3.1.9.1.2. Objections

No relevant objections have been identified.

3.1.9.1.3. Conflicts

No relevant conflicts have been identified.

3.2. Measures requirements

3.2.1. Measure-specific requirements

The UPPER living labs and the twinning sites have already identified the main requirements to be met in order to successfully deploy their ‘push and pull’ measures. These requirements have undergone an iterative review process to ensure that sufficient detail was provided for each of the relevant requirement categories. The requirements for each one of the UPPER measures can be found in *measures requirements*.

It is important to note that some of the requirements cannot be identified at this stage of the project, as they depend on preliminary analyses that are already part of the development of the measure. This means that only after this preliminary study (survey, simulation...) these requirements will be established. A particular case that should also be mentioned is the situation in Valencia, whose measures are currently (at the date of delivery of this deliverable) in a review process by the new city government.

3.2.2. High-level requirements and recommendations per measure category

3.2.2.1. Reorganization of urban space, PT stops and multimodal hubs

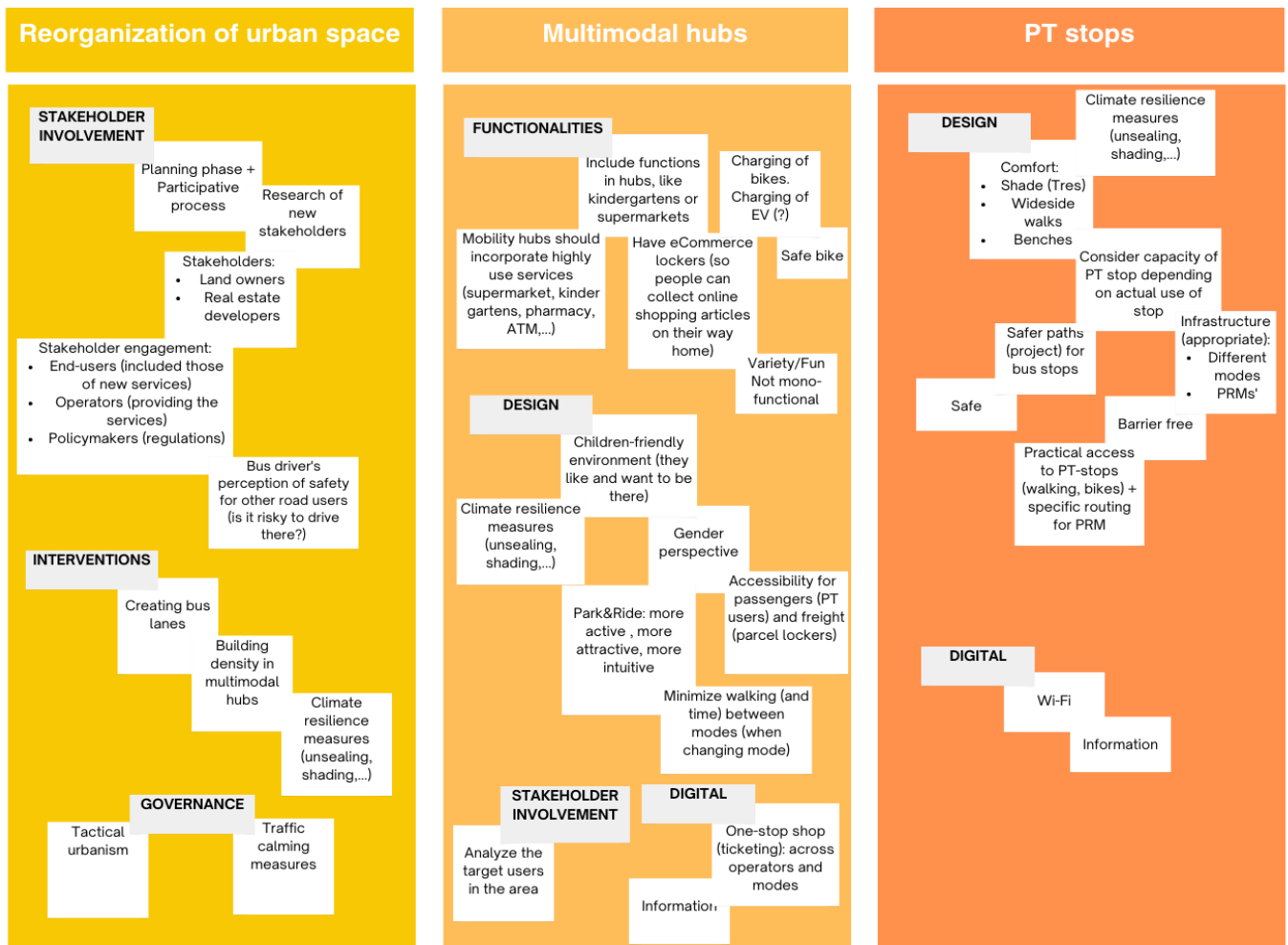


Figure 19. High-level requirements: Reorganization of urban space, PT stops and multimodal hubs

3.2.2.1.1. Reorganization of urban space

In terms of **stakeholder involvement**:

- Participative processes need to be considered during the planning phase of urban space reorganization.
- Multiple stakeholders need to be involved when reorganizing urban space in favour of PT and active transport modes, including:
 - Landowners and Real estate developers
 - Business owners in the affected area
 - End-users (included those of new services)
 - Operators (providing the services)
 - Policymakers (regulations)
 - Bus driver's perception of safety for other road users (is it risky to drive there?)

Different **strategies** are recommended when reorganising urban space in favour of PT and active modes, including:

- Creation of dedicated bus lanes or corridors to prioritise PT
- Building density in multimodal hubs
- Ensure climate resilience of the interventions (unsealing, shading,...)

With respect to the **governance** level and the role of the authorities in the reorganisation of the urban space, it is recommended that:

- Tactical urbanism is used, if possible, in order to test in advance (before starting major infrastructure works) the impact and acceptance of the measure.
- Traffic calming measures are implemented to mitigate potential externalities (in terms of traffic congestion) of the space reorganization in favour of PT and active modes.

3.2.2.1.2. Multimodal hubs

Multimodal hubs should avoid being mono-functional and should (at least) consider the integration of multiple **functionalities**, including:

- Highly **used services** not necessarily linked to a transport mode, such as kindergartens, pharmacy, ATM or supermarkets.
- Regarding logistics, **eCommerce lockers** (so people can collect online shopping articles on their way home)
- Regarding **active modes**, safe bike parking and chargers for e-bikes.
- Variety/**fun** functionalities to make more pleasant and attractive the use of these spaces (for any target group).

When **designing** or redesigning/improving a multimodal hub, basic principles should be considered:

- Offer a children-friendly environment (they like and want to be there)

- Design climate resilient hubs (unsealing, shading,...)
- Guarantee that gender perspective is correctly integrated
- Make them more attractive and more intuitive (wayfinding), especially for the Park&Rides
- Guarantee accessibility for passengers (PT users) and freight (parcel lockers)
- Minimize walking (and time) between modes (when changing mode) and apply universal design principles for wayfinding, thus facilitating transfers

Regarding the **stakeholder involvement** in the design, redesign or upgrade of a hub:

- It is strongly recommended to analyse the target users in the area in order to ensure that their needs (in terms of functionalities, services,...) are covered.

In terms of hubs **digitalisation**, it is key to:

- Ensure that accurate and, if possible, **real-time information** on the different transport modes is offered to the citizens both at the station and in the most popular travel planner apps (e.g., Google Maps)
- Facilitate, as far as possible, unified fares and a **one-stop shop for ticketing** (what requires collaboration across operators and modes).

3.2.2.1.3. PT stops

When **designing** attractive, accessible and advanced PT stops, there are basic principles that must be guaranteed:

- Minimum **comfort** levels (for every target group) must be ensured, including:
 - Shade (Trees, roof of the stop, take advantage of the shade provided by buildings,...)
 - Wide sidewalks
 - Benches
- The PT stops should be **climate resilient** (unsealing, shading, pluvial water drainage,...)
- **Safety** should be guaranteed, not only in the access to the PT stop (safe paths for bus stops), but also during waiting time. This also refers to lighting design.
- Regarding the **access** to the PT stops:
 - The access to PT-stops (walking, bikes) should be practical and intuitive, including for persons with reduced mobility (PRM). The PT stop should be all accessible.
 - The stops should be barrier free to ensure the accessibility to PT to any potential user.
- The **infrastructure** (the stop itself) should be appropriate to the service offered and the target groups addressed. This includes:
 - Ensure the adequacy of the infrastructure to the different transport modes offered, as well as the expected and desired passenger flow (especially for BRT or rail systems where the vehicles are larger and stops are further apart, larger waiting areas may be planned and required)

- Considering the special needs of PRMs' and other groups (including also the provision of information about the PT services offered to specific groups, such as blind people).
- Consider the actual use of stop (number of users, queues,...) in order to ensure that the capacity of the PT stop can handle such volume of passengers.
- Cohesiveness with the environment and other infrastructure, e.g. to avoid conflicts with other users.
- Ensure correct planning of circulation flows (avoid flows of people crossing each other's paths, ensure minimal width for hallways and waiting areas, etc.)
- Ensure that signage is coherent and inclusive (clear arrows and icons, braille, tactile pavement, etc.)

In terms of the **digital** component of the PT stops, it is advisable:

- To (at least) consider the option of integrating added value functionalities such as **Wi-Fi** or charging points for the smartphones.
- Provide real-time **information** on the PT offer (arrival time of next bus,...)

3.2.2.2. MaaS / MDMS / Multimodal journey planner

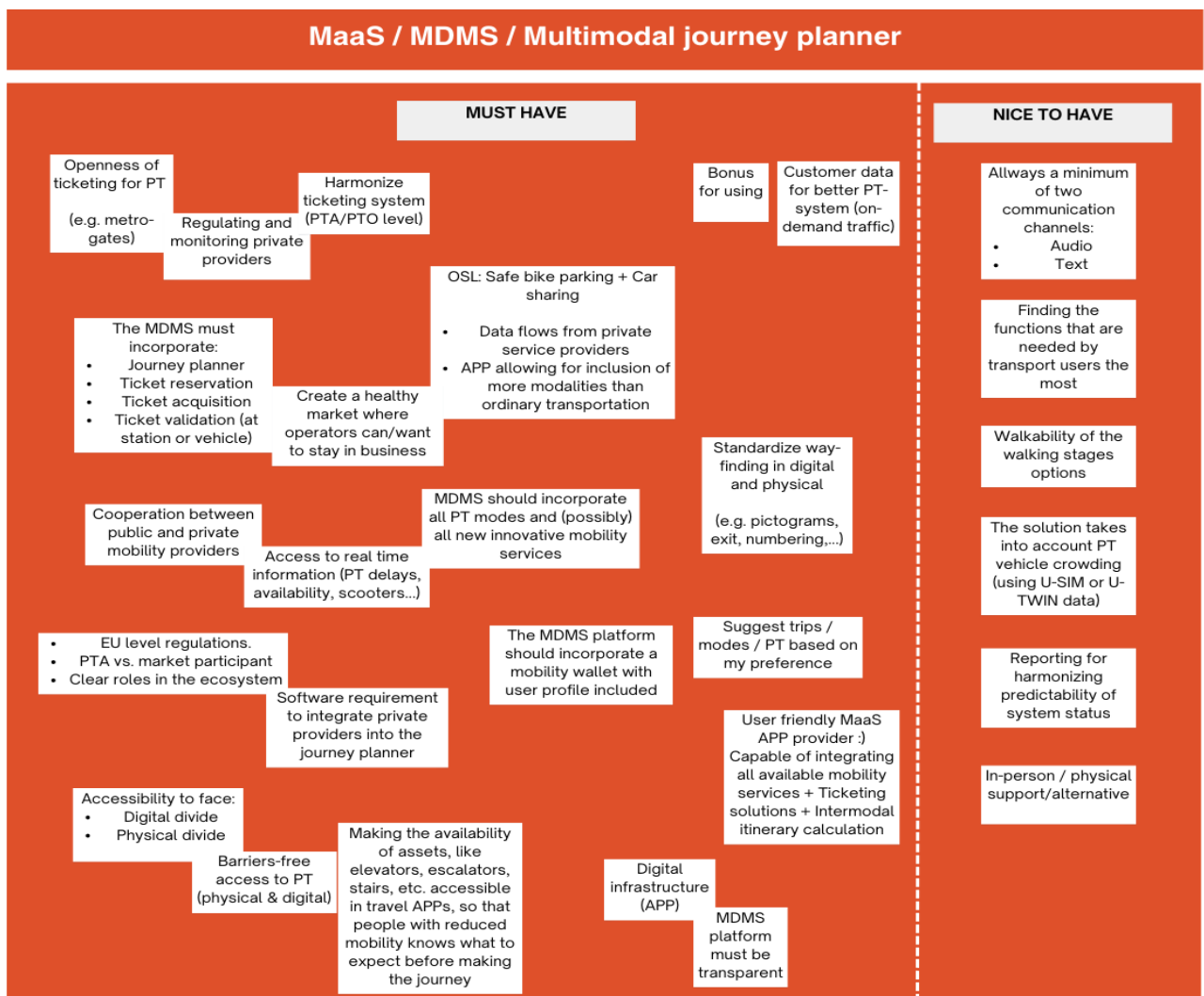


Figure 20. High-level requirements: MaaS / MDMS / Multimodal journey planner

3.2.2.2.1. Functional requirements (prerequisites)

- The MDMS should incorporate Journey planner; Ticket reservation; Ticket acquisition; Ticket validation (at station or vehicle): In order for the MDMS service to be considered complete, it should integrate in one single application planning of the trip; booking of intermediate trips; paying for tickets and validating them at the various check points.
- MDMS should incorporate all PT modes and (possible) all new mobility services: The provided service should incorporate as many modes as possible in one single application, including both PT modes and other mobility services, such as active modes, taxis, car sharing, etc.
- Access to real time information (PT delays, availability, scooters): Information in real-time needs to be provided to the user through the application. This includes availability of modes at the specific time frame (e.g. available bikes at parking stations), delays or disruptions in the PT routes, as well as advice on the crowdedness of PT modes during the requested time frame. Moreover, information and guidelines in regard to potential claims from the different operators in case of disruptions in trips should also be provided.
- Standardized way of finding in digital and physical (e.g. pictograms, exit, numbering, etc.): information regarding stops, exit points, bus number, etc. should be provided in standardized and easy to comprehend form. The clearness with which information is provided should take into consideration the average user (if not less) and not users that are a priori familiar with such applications.
- The suggested trips/modes/PT routes by the application, need to be based on the traveller's preferences, including a stated desire/preference walking transfer distance/time.
- Accessibility to phase digital and physical divide: Similarly, to the above requirement, the operation of the app should be clear and straightforward so that it is easily accessible and usable by all types of users (including mobility impaired, blind, etc). Universal design principles should be followed in order to achieve accessibility.
- Open Shading Language (OSL) for safe bike parking and car sharing: Data flows to be ensured from private service providers, along with an app that allows inclusion of more modalities than public transportation
- The MDMS platform must be transparent and avoid self-preferencing and commercial based results.
- Barrier-free access to PT (digital and physical): The application should be accessible (digitally) to all users, including mobility impaired and visually challenged, while it should ensure that information and advice on physical access is provided. To ensure the latter, it is necessary that the availability of assets such as elevators, escalators, stairs, etc. is included and provided through the app. This way, the relevant user groups will be in the position to know beforehand what to expect while taking their trip.

3.2.2.2.2. Ticketing requirements (prerequisites)

- Openness of ticketing for PT (e.g. metro gates): tickets and bookings made through the various systems (MaaS) should give the opportunity to enter all PT modes (e.g. closed systems such as metro gates).
- Harmonize ticketing system (PTO, PTA level)
- Cooperation between public and private mobility operators: The Public Transport Authorities, Public Transport Operators, as well as the rest of the other companies participating in the scheme providing the integrated service should cooperate to harmonize the ticketing system and enable the travellers to use one single ticket for all trips. Cooperation should be also established to offer tickets to users.

- The MDMS should incorporate a mobility wallet with a user profile included: The travellers using the MDMS services should be introduced with the availability of a mobility wallet, providing them the opportunity to pay for all tickets (if not one single is available) through the application. This should include PT modes, active modes rental, taxi services, etc.
- Bonus for using: Incentives should be provided to users in order to use the service/app. These incentives could be reduced prices for next trips using the same modes, free tickets, other bonuses provided by cooperating companies.
- The MaaS provider should ensure the provision of a user-friendly app capable of integrating all available mobility services, ticketing solutions and intermodal itinerary calculation.
- The ticketing pricing scheme needs to be designed to facilitate access to the service to all user groups (affordability of PT to the poorest groups should be the base unit of measure).

3.2.2.2.3. Data requirements (prerequisites)

- Customer data for better PT system: the operators need to collect data from travellers regarding their preferences and habits while using PT services, to improve and customize the provided services. All data collection procedures need to fully respect GDPR rules and obtain the consent of the relevant stakeholders.
- Software requirements to integrate private providers in the journey planner: the software needs to open to integrate apps from all potential players, especially private companies.

3.2.2.2.4. Governance requirements (prerequisites)

- Regulating and monitoring private providers: Private companies participating in the scheme of the provided MDMS service need to follow all the rules and laws that also regulate PTAs. The abidance to these rules needs to be closely monitored. Clear roles in the ecosystem should also be ensured.
- Create a healthy market where operators will want to stay in business: On the other hand, the rules that private companies need to follow should not discourage them from participating in the schemes.
- EU level regulations: to ensure fair participation to all potentially involved organizations and companies, the schemes need to be governed by EU regulations. This way, companies from all over EU may participate in any such scheme.

3.2.2.2.5. Other requirements considered “nice to have”

- A minimum of communication channels should be ensured, including both audio and text, to serve all types of users, including visually challenged.
- Identification of the functions that transport users value the most.
- Provision of information regarding “walkability” of the walking stages options. This includes the provision of information regarding the walking part of the journey, such as length, uphill or downhill, picturesque route, interesting POIs along the route, etc.
- The solution considers the PT crowding (using U-SIM or U-TWIN data)
- Reporting for harmonizing predictability of system status
- In person/physical support /alternative

3.2.2.3. Low Emission Zones & Bus Rapid Transit / Traffic light priority

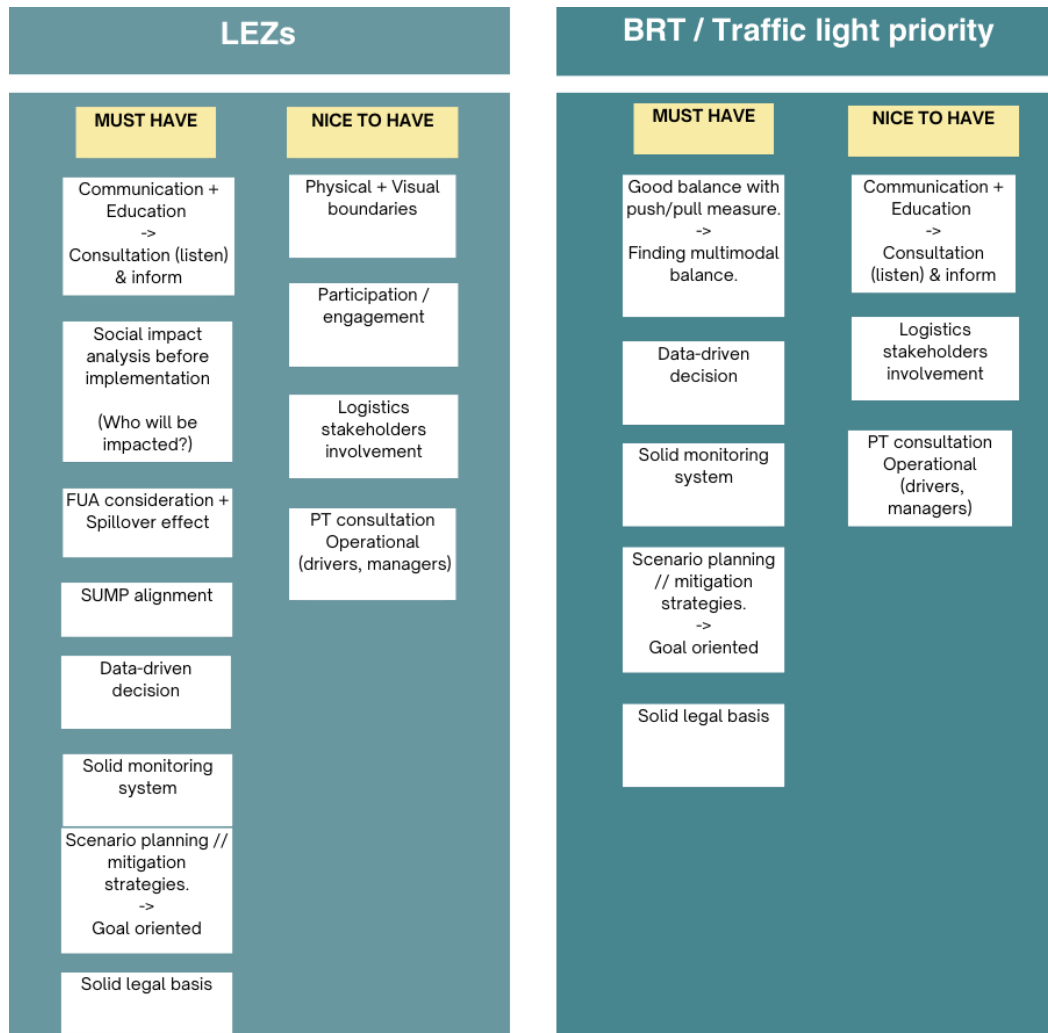


Figure 21. High-level requirements: LEZs & BRT / Traffic light priority

All measures including a traffic regulation (limit vehicles access or prioritize public transport) should respect the following high-level requirements:

- **Preparation** is needed.
 - **Social impact analysis:** affected residents and the potential consequences of a LEZ implementation must be identified before implementation. As part of the impact analysis, consider strategies to mitigate the effects on traffic and air pollution right outside the LEZs, as it will likely increase and create environmental and social backlash.
 - **Communication & Education:** key stakeholders must be informed of the plans, their concerns must be heard and considered through consultation processes, and addressed through interactive education processes. A good communication strategy is critical. This is important to disseminate impact and make the voices of allies and people satisfied with recent changes heard. This is especially important to counteract car drivers/lobbyist detractors who tend to be more vocal and powerful.

- Good balance: push and pull measures must be mutually supportive to reach a common goal, and ensure a fair multimodal urban transport system. Implementation in 2-3 phases and going from interim to permanent intervention could be helpful for quick wins/test out solutions and increase awareness raising and gain support throughout the process.
- The regulation must be **integrated** into local urban context and policies.
 - Geographical & socio-economic index: define and consider Functional Urban Areas and anticipate Spillover effects
 - Regulatory framework and policy alignment: include access regulations in local SUMP
- The implementation requires **monitoring** and a **solid basis** to ensure goal fulfilment.
 - Monitoring system: key indicators and data must be defined, collection methods and tools planned, and used while implementing the measure. Balance between quantitative and qualitative indicators is necessary: Barcelona, for example, has included indicators like the number of social exchanges and activities, and the number of people of different genders and ages at different times of the day to measure and highlight the success of intervention in reclaiming road space back for people instead of cars
 - Data driven: all decisions in the design, implementation, and update of an access regulation should rely on data from the monitoring system.
 - Mitigation: implementation scenarios should be studied, risks should be defined, along with mitigation strategies supporting the main goal of the regulation implementation.
 - Legal basis: a solid reference framework is necessary to enshrine the purpose and processes to follow for a usable efficient access regulation.

In addition, the following requirements are helpful when implementing a vehicle access regulation:

- Physical implementation: visual boundaries can help enforcement and respect of the regulation.
- Participation: stakeholder engagement can help improve and adapt the regulation to specific contexts and increase its acceptability.
 - Logistics stakeholders are key to involve as they represent a large part of unavoidable traffic
 - Public transport operational staff has key perspective on traffic challenges (drivers, managers)

For BRT/traffic light priority, we would also like to mention a “Nice to have” feature:

- Combine traffic lighting priority for bus lanes with more physical interventions to partially or fully segregate the lane to increase service performance. Combination with physical interventions is also an opportunity for rethinking street sections as a whole and reclaiming space not only for public transport but for active mobility, public space, and green areas.

3.2.2.4. Network planning / Real-time monitoring / Data collection

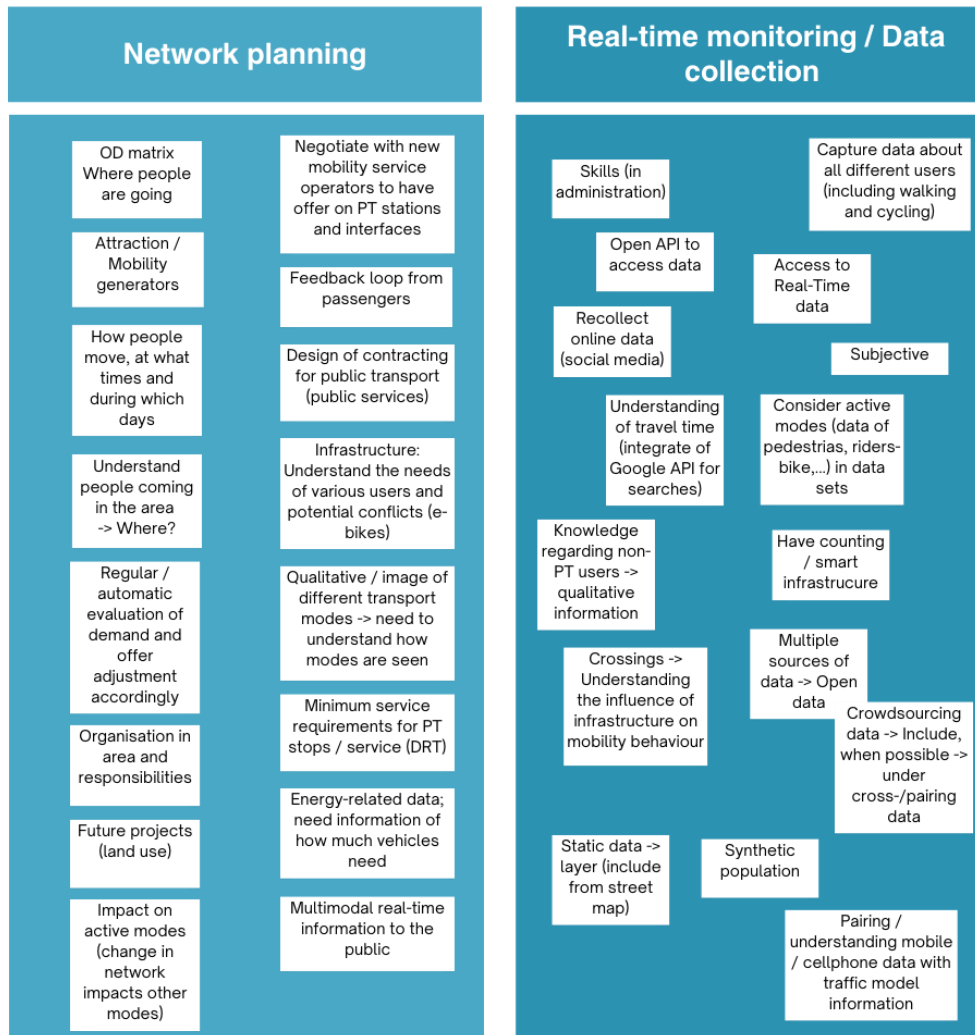


Figure 22. High-level requirements: Network planning / Real-time monitoring / Data collection

The various high-level requirements identified by the UPPER workshop participants were divided into 3 categories. Fulfilling each of these requirements implies the existence within the specific UPPER site of a mechanism facilitating it. For example, fulfilling the requirement for “existence of a feedback loop from passengers” can be done via a number of ways, either mandated by law or by the initiative of the local authority or company. For example, a law may require the PTO in the area to have an open contact/complaint form on their website and have a regular meeting with the local NGO representing pedestrians.

Especially for this first category of high-level requirements – engaging with stakeholders – each entity may have a number of KPIs measuring the volume and level of interactions, but this is beyond the scope of the exercise undertaken in the workshop. Several of the requirements identified have been assigned to more than one category.

3.2.2.4.1. Engagement with the public and other stakeholders

- Existence of a feedback loop from passengers.
- Knowledge of the mobility generator points – i.e. Points of Interest – in the area.
- Regular/automatic evaluation of demand and offer adjustment accordingly.

- Understanding of the people coming into the area (e.g. daytime population) and where they are going.
- Qualitative image and understanding of how different transport modes are seen, such as status/prestige of each mode.
- Future projects in the area, specifically land use.
- Multi-modal real-time information being made available to the public.

3.2.2.4.2. Governance aspects

- Negotiate with new mobility services operators to have offer on PT stations and interchanges.
- Design of contracting for public transport services – i.e. the contract allowing flexibility to adjust the network.
- Understanding/knowledge of the organizational aspects of the area and the entities responsibilities.
- Future projects in the area, specifically land use.
- Impact of active modes, i.e how a change in network impacts other modes.
- Skills in administration: Need to have people in the Administration with skills in data analysis and processing.

3.2.2.4.3. Operation of mobility services

- O-D matrix to understand where people are going.
- Knowledge of the mobility generator points – i.e. Points of Interest – in the area.
- How people move, at which times and during which days – variability of mobility patterns.
- Infrastructure level: understand the needs of various users and potential conflicts, especially with e-bikes.
- Regular/automatic evaluation of demand and offer adjustment accordingly.
- Understanding of the people coming into the area (e.g. daytime population) and where they are going.
- Knowledge of and existence of minimum service requirements for PT stops and services – i.e. DRT-type serving some areas.
- Energy consumption data understanding how much vehicles are being used.
- Impact of active modes, i.e. how a change in network impacts other modes.
- Multi-modal real-time information being made available to the public.

3.2.2.4.4. Data

- Open API to access data: Open API will make it possible to develop web services to exploit the data.
- Synthetic population: Some data is currently not accessible. They could be generated from computer simulations based on a synthetic population reflecting this reality.
- Static data à layer (include from street map): Make available static data including PT lines and road network from open street map such as OSM
- Crossing à understanding the influence of infrastructure on mobility behaviour: Data collected must make it possible to assess the impact of the infrastructure on mobility behaviour.

- Recollect online data (social media): Social networks can help to report real-time information such as incidents on the public transport network. They also make it possible to assess the level of user satisfaction.
- Understanding of travel time (integrate of Google API for searches)
- Access to real-time data: Real-time data allow adopting dynamic behaviours depending on the evolution of traffic and the public transport network.
- Capture data about all different users (including walkers and cyclists): To have inclusive public transport, all the data from other modes, including walking and cycling, must be taken.
- Consider active modes (data of pedestrians, riders-bike,..) in data sets: Similar to the requirement 8.
- Multi sources of data à Open data: The open data web site must aggregate several sources of data both relating to public works and information on other modes of transport, the environment, etc.
- Crowdsourcing data à Include, when possible à under cross/pairing data: The aim is to allow users to be able to share/integrate information during their trips.
- Pairing/understanding mobile/cell phone data with traffic model information: A better understanding of mobility behaviour requires the exploitation of several data sources (from mobile phones and traffic) often requiring them to be merged.
- Knowledge regarding non-PT users qualitative information.
- Subjective aid perception Data (before/after and others)

3.2.2.5. Incentives, campaigns / PT perception / Participative governance / User satisfaction

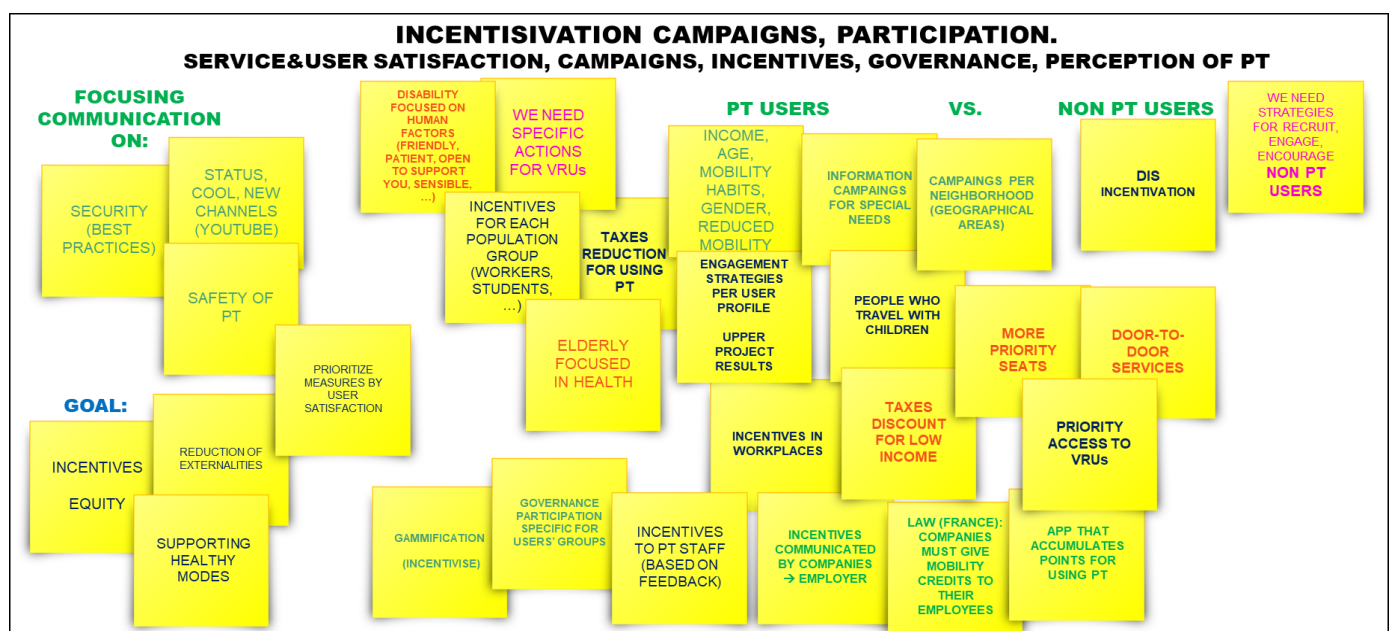


Figure 23. High-level requirements: Incentives and campaigns / PT perception / Participative governance / Service & user satisfaction

The mobility measures included in WP5 are related to promote a behavioural change in citizens mobility habits. This behavioural change will be achieved if the PT is a real transport alternative for citizens (quality of the PT), and the active transport modes are promoted and incentivised.

Regarding workshop results, it was agreed by participants that all the measures should have a common goal, based on:

- Incentives, as a resource to be employed by measures' promoters to engage citizens.
- Equity, to address specific needs of different users' groups.
- Reduction of externalities; citizens control their mobility (as much as possible).
- Supporting healthy modes; active mobility as an alternative to daily mobility.

For communication interventions, they must be focused on the PT strengths, so results generated by the UPPER project user research could be a robust reference. In addition, communications should be adapted to geographical areas, considering cultural differences among citizens of different countries.

To design measures related to behavioural change we must distinguish between PT users and non-PT users

Regarding the PT users we should adapt the communication to different users' profiles, with different needs, considering user's satisfaction. Results generated in UPPER user research could be a robust reference for users' profiles and needs. On the other hand, incentives must be adapted to user profiles' needs, considering incentives in:

- Workplace; this includes incentives for PT's staff
- Economic incentives: tax reduction, prizes for being active
- Special focus on VRUs

Strategies to engage Non-PT users must be different, and have to be adapted to their mobility habits. In principle, these strategies should focus on disincentivising the use of private car

3.3. Policy recommendations

This section presents the main policies and related measures that have been selected, labelled and evaluated under each one of the five innovation axis as a result of the two workshops organised with the horizontal partners and demo sites. It details one policy for each one of the innovation axes and present the main differences between demo site leaders and horizontal partners.

3.3.1. Recommendations per innovation axis

Through these interactive workshops, there was a focus on better understanding the driving forces, obstacles faced, and the perceived effects of these policies from the perspective of the stakeholders closely involved in their implementation. These meetings offered a more nuanced view of the policies, making it possible to gain insights into the context in which they were developed and their intended societal impact.

The combination of quantitative data analysis and qualitative stakeholder input provides a comprehensive understanding of urban mobility policies, ensuring that the assessment reflects both the numerical outcomes and the real-world experiences of the cities and partners involved

3.3.1.1. Mindset and culture

Gender inclusion is the main policy recommendation identified targeting user accessibility perception. Several policy measures experiences were provided both from literature review and from implemented projects. Ad hoc measures focusing on making PT stops safer or addressing a PT and taxi gender equality promotion campaign were described.

The policy has transversal impact on all citizens and not just on PT users or on the specific gender category addressed.

‘Women’s travel patterns are commonly acknowledged to differ from men’s, and these variances are marked by persistent inequality. In any given metropolitan environment, women bear a bigger share of their household’s travel burden and make more trips related to domestic and caretaking tasks. Mobility is critical to women’s empowerment since it allows them to access opportunities as well as challenge patriarchal restraints. Furthermore, women’s mobility improves access to occupations in low-income homes, enhancing their family’s prospects of overcoming poverty...’

According to statistics, women rely on public transport more than men, throughout the world, especially when they are from lower socioeconomic groups.’ (Gender, Inclusive Transport and Sustainable Development Goals: A Legal Perspective to Transport Policies by Aakriti Singhai and Krati Singhai)

Similar drivers have been highlighted both by horizontal partner and demo site leaders. However, site leaders admit that this type of policy is easy to integrate when there is the right momentum, while horizontal partners stress more the need for wider acceptance of the measure.

Demo site leaders highlight among the main barriers the unclear responsibility as one of the main risk for implementing this kind of policy and measures, while horizontal partners highlight the lack of public, political and professional acceptability as the main risk factor.

Table 11 Policy measures addressing Mindset & Culture

| Measure category | Policy name | Objective | Approach |
|---|-------------------------------------|---|--|
| Campaigns | Campaign for gender inclusivity [2] | Enhance safety and inclusion for women and marginalized genders in public transport. | Implement gender-sensitive policies and initiatives to eliminate harassment, provide safe waiting areas, and promote awareness, also through the use of public transport ambassadors). |
| Campaigns | Campaign for role model endorsement | Increase PT ridership and promote sustainable transport options. | Utilize high-profile politicians/celebrities as role models to influence social norms and acceptance of public transportation. |
| User perception of the Quality of Service (QoS) | Improve wayfinding [3] | Encourage walking and public transport as sustainable modes of transportation through improved navigation both inside and outside transit stations. | Create a schematic pedestrian map that displays walking distances and times between important city points, making it easy for citizens to choose walking as a transportation mode. Develop a comprehensive wayfinding system based on research of movement flows, aiming to improve the walking experience. Create a metro station map showing walking time and distances within stations. |

| Measure category | Policy name | Objective | Approach |
|---|--|---|--|
| User perception of the Quality of Service (QoS) | Frequent monitoring of QoS perception [4] | Assess the quality of walking and public transport experiences, particularly for older people. | Conduct surveys to collect data on the mode of transport used and the difficulty of accessing public transport. |
| Incentivization | Dissuade from car ownership in place of public transport | Promote car ownership reduction and adoption of public transport. | Offer public transport card that provides free public transport in exchange for scrapping a highly polluting vehicle. |
| Incentivization | Bicycle use incentivization | Encourage cycling through tax incentives and purchase premium schemes. | Offer tax incentives and purchase premiums for cycling at the national, regional, and local levels. |
| Incentivization | Targeted and integrated fares | Provide subsidized or free integrated public transport passes to specific groups, always or just in specific occasions. | Offer free or reduced fare public transport passes to students, elderly, low-income people and/or during special events, such as sporting events of high pollution episodes. |
| Incentivization | Gamification [5] | Encourage sustainable commuting choices through gamification. | Create a point-based system, leader boards, and challenges to reward and motivate commuters for sustainable trips. |

3.3.1.2. Urban mobility planning

Smart free district was the main policy related to address the restructuring of a specific urban area with the specific target to take PT at the focal point and increase its usage.

This policy is part of UPPER measures in Rome and in few other sites that point to enlarge low-emission zones (LEZs) or increase its enforcements. As the main aspects that this policy might favour are safety in neighbourhoods and the increase in the accessibility, reliability and efficiency of PT.

The target users of this policy are mostly residents, shop owners, tourist and VRU (pedestrian and cyclist,..) passing through it.

Public, political and professional acceptability is considered one of the main barriers by both demo site leaders and horizontal partners. Regarding the main drivers, the engagement of citizens and exploitation of the right momentum are considered two of the main enabling factors.

Table 12 Policy measures addressing Urban Mobility Planning

| Measure category | Policy name | Objective | Approach |
|--|--|--|--|
| Redistribution of urban space | Smart Car-Free Districts | Plan new developments to be more car-independent | New way of living |
| Multimodal hubs | Multimodal Hubs | Identify and develop seamless mobility hubs | Better transport integration, sustainable mobility |
| Integration of modes and ticketing / MaaS / Multimodal journey planner App | Integrated Fare System Implementation | Streamline and simplify fare collection | Ensure interoperability, coordinate fare structures, transfer rules, and fare capping mechanisms |
| Mobility planning | Inclusive Urban Mobility Strategies | Promote inclusive transport strategy | Extend suburban rail services, harmonize fares, improve information availability, tackle safety issues |
| Traffic Management and PT Prioritization | Dedicated Space/Lanes for PT | Implement TOD and BRT system | Implement Bus Rapid Transit (BRT) system, dedicated lanes for bicycles |
| On-Demand Mobility Services | Promotion of Shift from Fossil to Zero-Emission Vehicles | Shift to EVs, expand EV charging infrastructure | Mandatory EV charging infrastructure in buildings, subsidies, zero-emissions public transport buses |
| User perception of quality of service | Impact Assessment of New Mobility Services | Assess impacts of new mobility services | Real-time impact assessment, define data requirements, research on indicators |
| LEZs / Congestion and Pollution Charging Scheme / Smart Parking Management | Introduction of Low Emission Zones | Implement Low Emission Zones | Establish Low Emission Zones to reduce emissions |
| LEZs / Congestion and Pollution Charging Scheme / Smart Parking Management | EV Infrastructure Deployment | Expand EV charging infrastructure | Deploy accessible and efficient EV charging solutions |
| Incentivization | Promotion of Shift from Fossil to Zero-Emission Vehicles | Shift to zero-emission vehicles | Subsidies, charging infrastructure, zero-emissions public transport buses |

| Measure category | Policy name | Objective | Approach |
|------------------------|---|--|---|
| Democratic governance | Introduction of SUMP as a Compulsory Practice | Mandate Mobility Master Plans | Legislation requiring cities to develop Mobility Master Plans promoting integrated and sustainable transportation |
| PT stop and facilities | Green and Smart Bus Stops | Improve waiting time in bus stops | Design innovative bus stops with various amenities |
| Campaigns | Promotion of Active Mobility | Encourage active transport modes | Enact pro-cycling and pedestrian-friendly measures, develop comprehensive transport plans |
| 15-minute city | 15-Minute City | Create accessible neighbourhoods within 15 minutes | Develop neighbourhoods with essential services within a 15-minute walk or bike ride |

3.3.1.3. Mobility services ecosystem

The policy of **incentivising data sharing models** is described as part of several initiatives led by EC commission, from the adoption of NAP (National Access Points) and open data space to the MAAS alliance initiative. This policy is here described with reference to the digital and operational integration of mobility services.

Among the main users, the Public Transport operator as well as the multimodal and PT commuters, especially young people, and occasional travellers were highlighted.

The main drivers that are considered by the demo site leaders are the capacity (skills and knowledge) of the actors involved together with a key role of data-driven decisions. The horizontal partners also consider the capacity and skills as a key factor, while also point the acceptability of these measures by the citizens and political leadership as a main driver.

Among the barriers, both groups agree that the unclear legal framework might represent a threat as well as the lack of capacity, acceptability and data-driven decision making.

Table 13 Policy measures addressing Mobility Service Ecosystem

| Measure category | Policy name | Objective | Approach |
|--|--|--|---|
| Multimodality (Operational and Digital Integration of mobility services) | Policy Making for Data Sharing [6] [7] [8] | Long term: Advance data sharing for sustainable mobility | Data sharing models and incentive schemes |
| Multimodal hubs | Micromobility and Cooperative, connected automated mobility (CCAM) policies to | Short/medium term: Develop policies for micromobility and CCAM | Regulation, management, providing information on guidelines, permits, and law |

| Measure category | Policy name | Objective | Approach |
|--|---|---|---|
| | support PT and multi-modality [10] | | |
| Mobility planning | Centralized system for information on transport assets | Medium term: Integrate station accessibility data into travel apps | Collaboration agreements to prevent data fragmentation |
| Traffic Management / New Lanes / PT Prioritization | A smart bus stop | Medium term: Develop advanced bus stop infrastructure | Overhead air cooling and filtration system, real-time pollution data collection |
| Redistribution of urban space | Redesigning the railway area in a multifunctional node with added services | Long term: Transform railway area into a multifunctional hub | Redesigning station areas for urbanization, public transport interchange |
| Incentivization | Getting people on-board | Medium term: Promote demand-responsive transport (DRT) | Various nudging and promotional campaigns |
| Traffic Management / New Lanes / PT Prioritization | Bicycle parking facilities at transit stations [15] | Long term: Enhance bicycle parking at train stations | Increasing quantity and quality of bike parking |
| Traffic Management / New Lanes / PT Prioritization | Keep public transport services/stations open extra hours during large events [16] | Short-term: Extend public transport hours during events | Prevent reliance on private cars, enhance event accessibility |
| Incentivization | Incentive-based software system [17] | Short-term: Implement incentive-based software system for school commutes | Tagging system for active school commuting |
| On-Demand Mobility Services | On-demand shuttle service [18] | Medium term: Launch on-demand shuttle service | Free service introduction, competitive pricing |
| Mobility planning | AI technology to improve bus network | Medium term: Implement AI to optimize bus routes | AI-driven route optimization, real-time data analysis |
| Ticketing | Making premium features in travel apps free for everyone [19] | Short term: Unlock premium app features for public transport users | Offer premium features for free, enhance app usability |
| Mobility planning | Assessing roadmaps by four qualities: concrete, | Medium term: Evaluate e-mobility roadmaps based on four qualities | Concrete, actionable, localized, flexible roadmaps |

| Measure category | Policy name | Objective | Approach |
|--|--|---|---|
| | actionable, localized and flexible. [20] | | |
| PT stop and facilities | Making PT stops and stations central hubs | Medium term: Centralize daily functions around PT stops | Allocation of daily functions to stations |
| PT stop and facilities | Integrate all P&R stations into a single "P&R" system offer [21] | Short term: Create an integrated P&R system for user convenience | Integration of P&R spaces into a single system |
| Multimodality (Physical Integration of mobility services and Hub Creation) | Graphical integration platform for all infrastructure information [22] | Medium term: Create a comprehensive digital infrastructure information platform | Utilize data for informed planning and routing |
| Multimodality (Operational and Digital Integration of mobility services) | Using the development of the European mobility data space for the creation of an open MaaS/MDMS ecosystem [23] | Medium term: Leverage EMDS for open MaaS/MDMS ecosystem | Smart middleware and local connectors, regional MaaS ecosystems |

3.3.1.4. Road network management

Dedicated PT lanes and regulation enforcement are also part of the redistribution of urban space and improvement of network management of some UPPER sites.

The main impact of these policies are not only to increase the speed of PT, but also to avoid the negative effect of private mobility, such as traffic congestion and increase accidents risks, which affect PT operations as well. The main beneficiaries are therefore the PT users and the PTOs.

One of the main driver refers to the public acceptability of such type of measure. However, it is also mentioned that it should be integrated into a wider set of policies to assure it triggers meaningful results.

Table 14 Policy measures addressing Road Network Management

| Measure category | Policy name | Objective | Approach |
|-------------------------------|--|--|--|
| Redistribution of urban space | Dedicated Lanes for Public Transport and Traffic Regulation Enforcement [24] | Create dedicated lanes for public transport and enforce strict traffic regulations to prioritize buses and other desired vehicles. | Use physical barriers, clear signage, and camera enforcement to deter unauthorized vehicles from entering bus lanes. |

| Measure category | Policy name | Objective | Approach |
|--|---|---|--|
| Redistribution of urban space | Allocation of Parking Fee Revenue to Fund Public Transportation Improvements [25] | Direct parking fee revenue towards enhancing and expanding public transportation services. | Communicate revenue allocation, establish a dedicated fund, ensure improvements benefit diverse communities. |
| Multimodality (Physical Integration of mobility services and Hub Creation) | Park-and-Ride Facility Expansion and Digitalization | Expand and digitize park-and-ride facilities to promote seamless intermodal transportation. | Identify convenient locations, provide real-time information, design user-friendly facilities. |
| Redistribution of urban space | Shared Streets Implementation/Reallocation of Space | Transform urban streets into shared spaces for pedestrians, cyclists, and slow-moving vehicles. | Use distinctive signage, traffic calming measures, and urban design. |
| Mobility planning | Design Multimodal Network Management Strategies | Develop comprehensive strategies for managing a city's multimodal transportation network. | Coordinate different modes of transportation, prioritize accessibility. |
| Traffic Management / PT Prioritization | Signal Prioritization and Smart Traffic Signal System [26] | Integrate technology to give priority to public transport vehicles at traffic signals. | Real-time data, traffic modelling, pedestrian/cyclist detection. |
| Multimodality (Physical Integration of mobility services and Hub Creation) | Enhance Urban Nodes and Interchanges | Transform urban interchanges into well-connected, multi-modal transportation hubs. | Design hubs for accessibility, encourage mixed-use development. |
| Traffic Management PT Prioritization | Safe Speed Limits [27] | Implement safe speed limits in urban areas for road safety. | Clear signage, community engagement, technology enforcement. |
| Traffic Management / New Lanes / PT Prioritization | Traffic Filters and Time-Dependent Vehicle Access Restrictions | Implement physical barriers and time-dependent access restrictions. | Consultation, clear signage, alternative last-mile delivery. |
| Integration of modes and ticketing / MaaS / Multimodal journey planner | Digital Tools for Access Regulation [28] | Develop digital platforms for traffic data collection and exchange. | Collate data, regulate local and foreign traffic, ensure driver awareness. |

3.3.1.5. Democratic governance

As part of democratic governance the experience of lab gov was used as a reference and the policy of **city as Common Good** has been provided. *“To say that the city is a common good is to suggest that the city is a shared resource, open to, shared with, and belonging to many types of people”.* [29]

There has been common understanding that this kind of policy are benefiting the whole city and all citizens.

Regarding the drivers, there is a common agreement that the essential ingredients are: engagement of citizens and stakeholders as well as the public, political and professional acceptability of the adopted policy measures and capacity of the actors involved.

Among the main barriers, there has been a more variegated type of results. Demo site leaders agreed unanimously that the lack of public, political and professional acceptability was the main risk, while one person pointed out that the lack of clear motivation triggers understanding barriers. Horizontal partners also defined other obstacles such as the identification of the right momentum as well as unclear responsibilities.

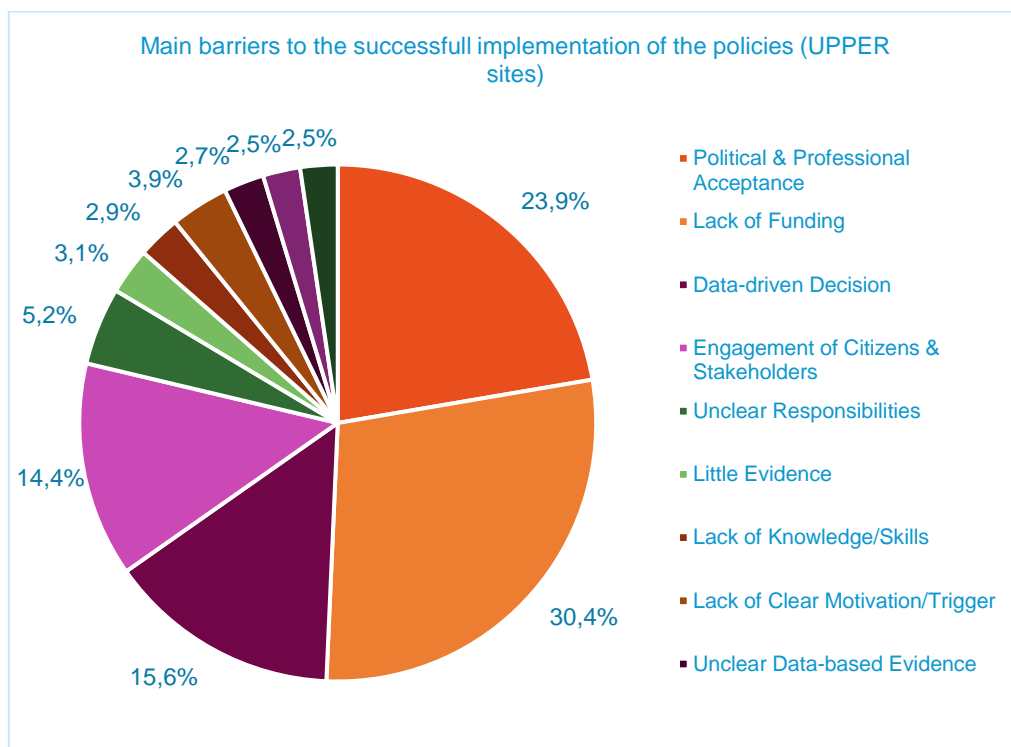
Table 15 Policy measures addressing Democratic Governance

| Measure category | Policy name | Objective | Approach |
|--|--|--|--|
| Democratic governance | City as Common Good [29] | Establish a democratic governance model for the city, treating it as a common good. | Promote collaborative decision-making for urban planning. |
| Mobility planning | Societal Return on Investment of Long-Term Capital Spending [30] | Showcase the societal returns of long-term rail infrastructure investments. | Investment in rail infrastructure |
| Integration of modes and ticketing / MaaS / Multimodal journey planner App | Citizen Participation for Sustainable Cities [31] | Involve citizens, stakeholders, and experts in urban mobility planning decisions. | Various participatory methods and digital platforms for engagement. |
| Democratic governance | Establish Participatory Processes | Involve citizens in mobility planning through schools, trusted intermediaries, and innovative methods. | Engagement through schools and platforms, targeting underrepresented groups. |
| Redistribution of urban space | Bicycle Heroes EU Youth Voices for Active Mobility [32] | Co-create solutions to barriers faced by students in active mobility to school. | Young people identify obstacles and develop solutions in a design competition. |
| Redistribution of urban space | Involving Young People in Mobility Planning and Co-Creation [33] | Involve pupils in improving mobility and urban design through education and engagement. | Replicating an urban mobility planning process in schools, workshops, and digital platforms. |

3.3.1.6. Summary

The pie chart (Figure 24) presents the main drivers and barriers identified for the implementation of all identified policies. A clear pattern can be identified. The most significant driver identified is "Political & professional acceptance" (23.9% share), closely followed by "Data-driven decision" and "Engagement of citizens & stakeholders." These results suggest that a strong commitment from political and professional stakeholders, along with data-driven decision-making and community involvement, are crucial drivers for the success of the identified policies.

On the other side, "Lack of funding" and "Lack of public or political acceptance" stand out as the predominant barriers, (with 30.4% and 25.2% share, respectively). The data indicates that financial constraints and the challenge of gaining public and political buy-in are substantial hurdles in the path of successful implementation.



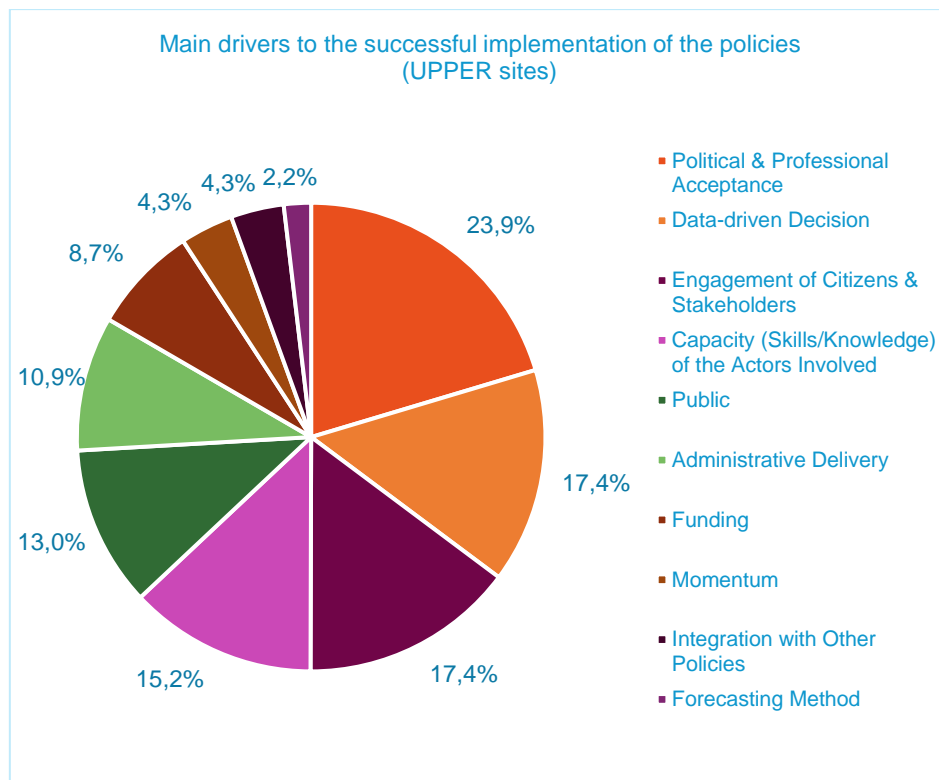


Figure 24. Main barriers and drivers in policy implementation for UPPER sites

The pie charts in Figure 24 shows the key drivers and barriers that the UPPER demo sites deem important when implementing policies such as the one listed above. It emphasises the importance of securing funding, addressing public and political acceptance, and actively engaging stakeholders and decision-makers to ensure effective policy implementation.

It's evident that the majority of policies prioritise commuters, private transport users, and public transport users, demonstrating a strong emphasis on catering to the needs of all user types involved. However, it's also notable that residents of areas with low accessibility to transport are underrepresented, which may raise concerns about the inclusivity of these policies.

Furthermore, the inclusion of students, at-risk genders, elders, reduced mobility individuals, and tourists, though to a lesser extent, showcases a positive effort to address the diverse mobility requirements of these specific segments of the population. These findings indicate progress toward more inclusive and diverse urban mobility planning.

3.3.2. Impact evaluation of the policy recommendations

Both from the mentimeter results available in the *Annex E: Policy recommendations – Mentimeter results* and from the evaluation provided on the policy matrix it was possible to identify many similarities in the classification and evaluation of the policies proposed, between horizontal partner and demo site leaders. As a general remark, demo site leaders have provided much lower scale (expressing values from 3-6) compared to horizontal partners, who express them from 4-10. This might reflect the fact that, demo site leaders are very well aware of the difficulties that can be associated with the implementation of the policies

One of the few differences is related to the reliability. For the demo site leaders, the reliability is essential as well as the universality of the service, while for the users association and network partners, safety and inclusivity are recognized as the main PT characteristics that might drive the city to be more liveable. Finally, PT is well recognized



by both groups to have a role in reducing private motorization, combating mobility poverty and promoting sustainable and green mobility for all.

This subsection presents the potential impact that both horizontal partners and demo site leaders assigned to the above identified policies. Here below, the main results for each impact category are presented:

- **Universal Access Impact** (Horizontal partners): Multimodal Hubs are notable for their impressive score of 7.69, signalling their effective promotion of universal access through well-connected mobility hubs.
- **Inclusivity Impact** (UPPER sites): Inclusive Urban Mobility Strategies shine with a strong score of 7.28, underscoring their commitment to fostering inclusivity in urban mobility planning.
- **Safety Impact** (UPPER sites): Safe Speed Limits is a standout policy, earning a high score of 6.58, emphasising the prioritisation of road safety. Dedicated Lanes for Public Transport and Traffic Regulation Enforcement also demonstrate strength, with a safety score of 6.28.
- **Resilience Impact** (UPPER sites): The 15-Minute City policy stands out with a resilience score of 6.50, reflecting its dedication to resilient neighbourhood design. Design Multimodal Network Management Strategies also excels with a score of 6.25, emphasising resilience in urban mobility strategies.
- **Financial Viability Impact** (UPPER sites and Horizontal partners): Policies such as Redistribution of urban space (6.38), Promotion of Shift from Fossil to Zero-Emission Vehicles (6.36), and Citizen Participation for Sustainable Cities (6.13) all excel in terms of financial viability, demonstrating the commitment to economically sustainable urban mobility strategies.
- **Sustainability Impact** (UPPER sites and Horizontal partners): Introduction of Low Emission Zones takes the lead in sustainability with a score of 6.25, promoting reduced emissions. Keeping public transport services/stations open extra hours during large events also contributes to sustainability with a high score of 6.22.
- **Reliability Impact** (UPPER sites): The Centralised system for information on transport assets is a top performer, with a high score of 6.25, showcasing efficient information management for enhanced reliability. Additionally, keeping public transport services/stations open extra hours during large events excels with a score of 6.10, further emphasising the importance of reliability in urban mobility.
- **Efficiency Impact** (UPPER sites and Horizontal partners): Some notable policies, such as the Centralised system for information on transport assets (6.58) and 15-Minute City (6.08), highlight the shared focus on improving efficiency through data-driven and neighbourhood design approaches.

These results reveal varying strengths and weaknesses across different impact categories, providing valuable insights for policymakers and urban planners. They can make informed decisions and prioritise policies aligned with specific urban mobility goals, whether it's enhancing inclusivity, universal access, reliability, efficiency, safety, resilience, sustainability, or financial viability. The distinction between Upper sites and Horizontal partners' scores highlights the diversity of strategies and strengths in different aspects of urban mobility planning.

3.3.2.1. Mindset and Culture

Average score (Upper sites): 6.2

Average score (Horizontal partners): 6.5

Both UPPER sites and horizontal partners prioritise improving Mindset and Culture, particularly with policies like "Campaign for gender inclusivity" and "Campaign for role model endorsement." For this innovation axis, both UPPER sites and horizontal partners show a strong commitment to improving inclusivity and cultural acceptance in urban mobility.

3.3.2.2. Urban Mobility Planning

Average score (Upper sites): 6.1

Average score (Horizontal partners): 6.4

There's an alignment in promoting digital tools for access regulation and incentivizing a shift to zero-emission vehicles, showcasing commitment to a sustainable mobility ecosystem. A strong emphasis is also put on car-reduced planning, with policies such as "Introduction of SUMP as a Compulsory Practice", "15-minute cities" and "Low emission zones" receiving high scores. The Urban Mobility Planning axis shows commonalities in digital infrastructure and the promotion of sustainable transportation modes, as evidenced by the policies mentioned.

3.3.2.3. Mobility Services Ecosystem

Average score (Upper sites): 6.1

Average score (Horizontal partners): 6.3

Both groups emphasize advanced solutions, including the introduction of AI technology for optimizing bus networks, improved information accessibility, and comprehensive transportation plans. Both are focused on leveraging technology and data for efficient planning, with an eye towards better accessibility and data-driven decision-making.

3.3.2.4. Road Network Management

Average score (Upper sites): 6.2

Average score (Horizontal partners): 6.6

Both groups recognize the importance of regulating road networks, with policies such as "Dedicated Lanes for Public Transport and Traffic Regulation Enforcement" and "Signal Prioritization and Smart Traffic Signal System". These policies reflect a shared commitment to enhancing transportation efficiency and safety. Implementing such policies can lead to smoother traffic and reduced congestion in urban areas.

3.3.2.5. Democratic Governance

Average score (Upper sites): 6.0

Average score (Horizontal partners): 6.6

Both UPPER sites and horizontal partners promote democratic governance, with an emphasis on participation through schools and digital platforms. The preference for policies such as "Establish Participatory Processes" and

"Involving Young People in Mobility Planning and Co-Creation" highlight their dedication to democratic involvement. The Democratic Governance category reveals the commitment of both groups to fostering participation in decision-making processes.

3.3.3. Policy discussion and recommendations

Both UPPER sites and horizontal partners share a commitment to enhancing various aspects of urban mobility, with some minor score variations indicating potential differences in emphasis and approach. Notably, there is a focus on digital tools, data-driven decision-making, and sustainability across different categories.

These differences in scores may reflect variations in policy approaches and strategies between horizontal partners - that are mostly representing a specific user category- and UPPER sites -that instead from one side should take in consideration the local and regional authorities plans and objectives-. From one side the networking partner represents their multiple target users associations, promote capacity building and ad hoc measures, and should assure the sustainability and empowerment of the association itself. From the other side local authorities main activities, as described by CIVITAS, includes:

- Key role in the implementation of transport measures at city level.
- Involve stakeholders and promoting a culture of sustainable urban mobility.
- Planning processes and integration of urban policies.
- Monitor progress of implementation and providing feedback on the planning process.

Therefore, it's essential to consider these distinctions when making decisions and recommendations for urban mobility planning to create a comprehensive and effective strategy. It is also crucial to "bring real results in changing mobility patterns." This requires developing policy actions in cooperation with local entities and users' representatives to ensure long-lasting, far-reaching positive impacts. One of the main needs highlighted in the PT diagnosis document [D2.2] is stakeholder and citizen engagement, which requires effort, skills, and specific partnerships for the engagement process to have positive results for both the city authority and the users.

The UPPER Deliverable D2.2 pointed out that there is a strong connection between the measures included in the respective SUMP or equivalent planning document and their UPPER measures. In a few cases, the planned upcoming update of the planning documents SUMPs, can be taken as an opportunity to consider a larger area than the traditional administrative area of the city for an effective sustainable mobility planning. This requires a dialogue between the City Authority and the neighbouring area of a city taking into account the peculiarities of each regions and its specific transport problems related to geographical, industrial, demographic and historical behaviours patterns.

Moreover, a crucial factor for all the sites is the existence of an efficient, sufficient, continuous funding mechanism linked with a good administration. The alignment between the political, professional, and public acceptance is necessary to implement the urban mobility policies, and most of all the presence of a relevant and sufficient staff with skills and level of knowledge required to support the policies development and implementation.

One of the recurring drivers that has been highlighted by city partners is that often the success depends on the specific moment or "momentum" in the city's development and its readiness to adopt and implement certain policies. This should also then be considered in connection to the process of UPPER toolkits development and its adoption and connection to the related measures.

In the UPPER Deliverable D2.3, using a co-creative and inclusive approach it was possible to underline some of the main challenges and related solutions, taking into consideration also the real feasibility of those. To foster inclusivity and accessibility, a list of issues that the policies should address were identified during the serious games: an

information system that can address route deviations, fostering accessibility and creating a consistent information network, for those people with disabilities, especially during emergency situations; the physical design of stops and urban space, that should also take into account safety issues as emergency buttons; an informed, trained and helpful staff are few of the main issues pointed out.

The concept of integrated policies is critical. While the UPPER focus has been on measures related to local public transportation, it is essential to recognize that integrated policies, covering different policy areas (social housing, health and social services, education,..), can have similar positive effects on mobility. Truly integrated policies may require addressing regulations at a higher level than just the municipal/regional level. Therefore, achieving comprehensive and integrated mobility policies may also involve advocacy and collaboration at higher governance levels.

The success of sustainable and inclusive mobility extends to an integrated approach, recognizing the interplay between transport policies, social policies, and the broader regulatory framework. It is through this comprehensive perspective that cities can best shape their transportation systems to meet the evolving needs of their residents.

The exercise described has provided a policy matrix framework that provides useful examples of policy best practices. It is also a useful tool for discussing and evaluating the impact of each policy and related measures focusing not only towards its environmental, acceptability and sustainability impact but also on the equity and broader social contribution of a specific policy. As conclusions, the UPPER final policy recommendations are merged with Todd Litman's [35] vertical and horizontal equity evaluation, with SUSMO [36] policy recommendations and STARS [37] project main outcomes to provide the following recommendations:

1. The results of the Urban Mobility Planning axis suggest that integrating transport policies with land use policies, following TOD (Transport Oriented Development) guideline, can have a key role in the improvement of non-motorized accessibility.
2. The result of the Democratic Governance axis, more specifically policies related cities as common good, put a strong focus on prioritizing people over vehicles and the creation of a more diverse, less automobile-dependent transport system that effectively serves non-drivers.
3. The serious games reported in D2.3 stress the importance of engaging with stakeholders to assure a universal design in transportation services that accommodate people with disabilities and other special needs, such as using strollers and handcarts.
4. Among various policies discussed to improve inclusivity, both policies that involve campaigns and policies that aim at providing special mobility services are to be considered of equal importance for the achievement of inclusivity for all. Such services include the ones outlined in the mobility ecosystem axis targeted to people with special mobility needs and those living in the peri-urban areas,
5. To reach mobility as a right, it is stressed the importance to promote equity and to treat everyone equally, as suggested in the available literature, such as Todd Litman. Awareness campaigns should inform citizens about the cost they impose using their preferred mobility patterns.
6. The insights provided in the Mobility Service Ecosystem axis put a strong emphasis on promoting the transition towards a zero-emission future and renewable energy, adopting new green fleets and efficient services.
7. It is finally highlighted, in line with the policies recommended within the road network management axis, the need to improve public transport services and to promote their benefits via open data and seamless connectivity by prioritizing them in the road network management framework.

4. Conclusions

The deliverable D2.4 is a pivotal outcome for the UPPER consortium, as it consolidates the technical, operational, and legal requirements that the UPPER support toolkit must meet. It also encompasses regulatory requirements, limitations, and vital guidelines for deploying and demonstrating the extensive set of nearly 80 "push and pull" measures, ensuring the effective achievement of the project's overarching goals.

In particular, this deliverable specifies the requirements for the "UPPER support toolkit," which consists of U-TWIN, U-NEED, U-SIM.plan, U-SIM.live, U-SUMP, U-GOV, U-KNOW, and U-TRANSFER. The active involvement of demo sites and their local clusters has played a vital role in the process of defining these requirements for the UPPER toolkit. These demo sites and clusters serve as the end-users of these tools, giving them a leading role in determining the functionalities that the tools need to incorporate to align with their specific needs and expectations. It's worth highlighting that UPPER's tools have been specifically designed to provide support for the development, deployment, and scaling of measures in cities and regions. Therefore, the identification of potential gaps in the proposed measures has been of utmost importance to enable the identification of new functionalities for the tools, with the ultimate goal of bridging these gaps.

The identification of requirements for the tools, has not only requested the contribution of the UPPER demo sites. It is important to note that UPPER's tools are not entirely standalone; in several cases, there will be connections between them. For instance, U-TWIN and U-SIM.live are directly connected, with the former acting as a data and providing essential data to U-SIM.live for running simulations. A connection also exists between U-NEED and U-SIM.plan, with U-NEED being used to detect inefficiencies in public transportation, and U-SIM.plan serving as the tool for conducting simulations to identify the best strategy to address these inefficiencies. Therefore, there's a need to define the requirements associated with the flow of information between these tools. Another noteworthy case is U-SUMP, which draw upon some of the tools (U-GOV, U-NEED, U-SIM, etc.) to calculate KPIs. Consequently, developers of each tool have actively participated in defining requirements, not only for their specific tool but also for those tools with which there will be a certain level of interaction.

by Over the coming months, ^{rate} the developers of the UPPER tools will work to integrate the identified requirements, especially those with the highest priority, in their tools, aiming to deliver an initial functional version of the tools M16 (April 2024) and the final version M28 (April 2025).

Regarding the measures requirements, they have been defined both at a high level and at a specific level. At a high level, work has been done by measure category, and a series of recommendations have been proposed for cities/regions to consider when designing and developing measures within these categories. The proposed recommendations are ambitious and represent an ideal scenario. Nevertheless, the local context of each pilot will determine the extent to which these recommendations can be integrated into the proposed measures. Among others, they outline the aspects that should be taken into account when designing or constructing a multimodal hub, covering infrastructure, services, and digitalization of the same. Also, the functionalities that a MDMS should incorporate to be considered comprehensive have been defined. Similarly, recommendations have been provided regarding aspects to consider when designing UVARs (Urban Vehicle Access Regulations) with the goal of achieving proper integration into the local urban context and policies.

At the specific measure level, each pilot has worked closely with members of its local cluster to define the specific requirements necessary for developing and, ultimately, demonstrating their measures. These specific requirements encompass infrastructure, hardware, software, data, new functionalities, legal, security, external support, permit requests, tendering as well as political, social, and cultural requirements. Defining these specific requirements in detail helps map out what needs to be in place before launching the measures demonstration. The support of horizontal partners has been crucial in this process to assist the pilots in achieving greater levels of detail in requirement definitions and identifying key elements for measure development that may have been overlooked.

Finally, this deliverable provides the demo sites with a set of policy recommendations designed to assist them in better understanding the potential impact of implementing the selected "push and pull" measures.



The collaboration between the project's horizontal partners and the demo site leaders has been crucial to, in a first instance identify potential urban mobility policies and, in a subsequent phase, evaluate their relevance and potential impact on cities. The comprehensive analysis carried out delved into the factors driving these policies, the challenges encountered during their implementation, and the perceived effects. This analysis was conducted from the perspective of stakeholders deeply involved in their execution, resulting in a better understanding of the policies, the context in which they were formulated, and their intended societal impact.

UPPER aims to encourage both the participating cities and those following their lead to rediscover their role in promoting mobility as a fundamental right and to recognize the pivotal role of public transport in the transition toward a more decarbonized and equitable society.

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ANNEX A: UPPER toolkit product cards

Note: The product cards included in this Annex will evolve as the U-tools are developed. The final version will be delivered in M28 (April 2025), together with the final version of the tools.



U-TWIN

Comprehensive solution for real-time monitoring of PT assets and decision support tool

Objectives of the product

U-TWIN, based on the concept of Urban Digital Twins (UDT), supports the city by offering an integrated and modular real-time representation of urban mobility assets and its actual operation status. U-TWIN provides the city and the mobility authorities with a comprehensive solution that makes it easy to understand the complex interrelation between the PT operation, traffic, users demand, events and other urban factors. U-TWIN not only facilitates the real-time visualisation and monitoring of PT, but also detects abnormal situations (in terms of excessive occupation level, delay w.r.t schedule, low air quality...) and provides forecasted information (travel times, estimated time of arrival, occupation, air quality...) supporting the end user to implement corrective actions, if needed, in an efficient way.

Main functionalities

- Provides an integrated and modular real-time representation of urban mobility assets and PT operation.
- Integrates and displays static information such as background maps, PT stops location, PT routes, ...
- Integrates and displays standardized real-time information about traffic, PT vehicles position, occupancy level of PT vehicles, demand at PT stops, events, road works,
- Based on data analytics, detects abnormal situations and displays a set of alerts notifying vehicle delays, excessive occupancy level, accidents, vehicle failures, poor air quality inside vehicles, ...
- Based on historical data deep learning models, provides predicted information on the arrival time of a PT vehicle to the next stop as well as the predicted demand.
- U-TWIN allows the city, PTOs and PTAs to detect in real-time abnormal situations and initiate corrective actions, via simulation of potential mitigation measures through U-SIM.live.
- U-TWIN allows the simulation models (U-SIM) to be updated and changed as their physical equivalents change.

Prediction:

- ❖ Predicted arrival time (corrected w.r.t schedule)
- ❖ Predicted demand

Real-time alerts:

- ❖ Delays (w.r.t schedule)
- ❖ Excessive occupancy level
- ❖ Accidents
- ❖ Vehicle failure...

Real-time information on:

- ❖ Geolocation of PT vehicles
- ❖ Traffic information
- ❖ PT demand
- ❖ Events, road works...

Background maps

End users

The city authorities, PTOs and PTAs are the main end users of U-TWIN. This tool supports them in the real-time monitoring of PT and in the identification of abnormal situations to initiate corrective actions. However, since U-TWIN behaves as an integrator and standardiser of different data sources, it can also be used as a data lake to feed additional systems, such as simulators (U-SIM) or other applications requesting real-time information (MaaS, ...).



U-SIM.plan

Offline transport modelling software for planning

Objectives of the product

Macroscopic modelling of transport networks and transport demand, public transport planning, and for the development of transport strategies and solutions. USIM.plan provide insights for long-term strategic planning and short-term operational use. **U-NEED** can be used beforehand to detect potential inefficiencies within the PT offering. U-SIM.plan can be then used to simulate and implement effective strategies to address them.

Note: for this tool, a PTV VISUM model is needed as prerequisite.

Main functionalities

- **Multimodal transport modelling:** Plan transportation in a city or a region, get information on the mode split, analyse all travel processes in detail, and find the best solutions for present and future mobility challenges.
- **Public transport planning software - Optimize operations and user experience:** Provides key figures on user experience (travel times, frequency, walking times, fares), as well as operational aspects and costs (operating times, performance kilometres, empty runs, vehicle requirements, depot use). Evaluates network and timetable variants and operating concepts.
- **Public transport planning software - Plan fleets, infrastructure, and electrification:** provides tools for travel demand forecasting, fleet planning, and operational concepts for the best long-term fleet procurement and maintenance. Fleets with different types of vehicles can be allocated according to flexible criteria, including demand. Depot capacities, turning times, empty runs, and other factors are also considered. Electric vehicles are also considered: their unique energy consumption, charging processes, and charging infrastructure. Different operating concepts, like overnight and opportunity charging, can be compared.
- **Planning and integration of new modes of mobility:** Supports to design, analyse, and integrate new modes of mobility. Cars, bikes, walking, and ride-sharing schemes, as well as their integration with all the variants of public transport can be modelled. It is also possible to study the effects of autonomous and connected vehicles.
- **Assessment of air and noise pollution from transport:** Includes procedures for calculations of emissions and noise from transport. When used early in the planning process, it can help to detect unwanted effects of transport measures, such as increases in total emissions due to detours.
- **Analysis of toll systems, low emissions zones, and access restrictions:** Model toll systems and access restrictions, such as low emissions zones (LEZs) or bans on trips for through-traffic. For area-wide restrictions like LEZs resulting detours in routing and KPIs are considered. Toll systems are studied as distance-based, area-wide, or tariffs between network access points. A special assignment procedure provides realistic representation of user preferences between toll costs and travel times. As a result, evaluate how tolls affect users' route lengths, travel times and costs, and the expected revenues for operators.
- **Visualization and flexible graphics:** meaningful maps, diagrams, and 3D presentations
- **Extensibility and transparency:** Calculation methods are displayed in a graphical user interface – so programming and scripting knowledge are only needed in advanced applications.
- **Scenario manager:** Enables effective preparation and evaluation of scenarios - create and manage modifications to the model, define and extract key KPIs and compare them.

End users

Mainly the transport planners & engineers and the transport operators.

U-SIM.live

City platform tool aimed at live public transport decision support

Objectives of the product

U-SIM.live is a real-time simulation-based decision support platform for PT Operators and Agencies. It uses live data and curated data provided by the U-TWIN tool about PT (schedule modifications, disruptions, PT vehicle positions, passenger counts) to provide continuous data analytics, generating alerts and supporting operational decisions, by allowing to simulate alternative mitigation strategies, and quantify the effects of each of these.

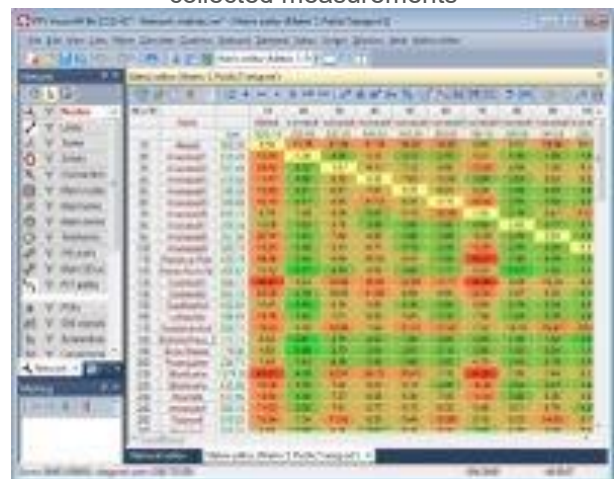
Note: for this tool, no PTV VISUM model is needed.

Main functionalities

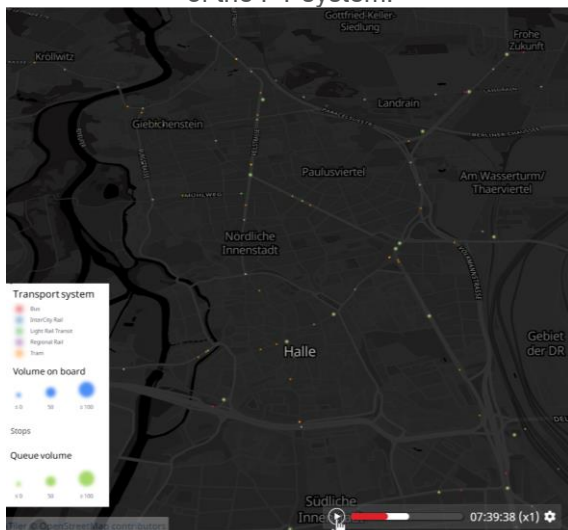
1. Live passenger volume estimation



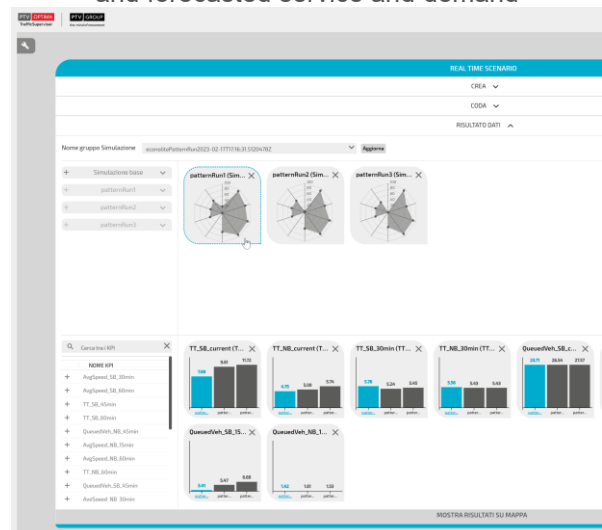
2. Estimated PT passenger demand, based on collected measurements



3. Map view of simulated PT system, both vehicles, infrastructure and passengers, focused on the live and short-term situation, including a near future projection of the PT system.

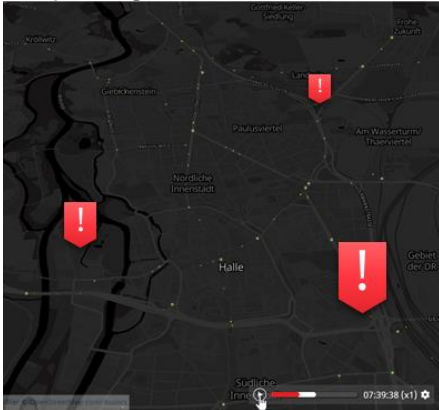


4. Live data-driven decision support: quantification of the effects of short-term mitigating actions on the PT service, via simulation, combining the current and forecasted service and demand





5. Generate alerts on values of customizable indicators trespassing customizable thresholds



6. Continuous short-term passenger volume forecast (few hours)

7. KPIs of the PT system, measured on both observed (simulated) demand and supply

End users

Mainly transport operators and transport planners. Transport operators can take correcting decisions, to reduce existing or forecasted critical conditions.

U-SUMP

U-SUMP provides a data-driven platform that helps to guide and track the development, implementation, and update of SUMP's with a climate-neutrality focus.

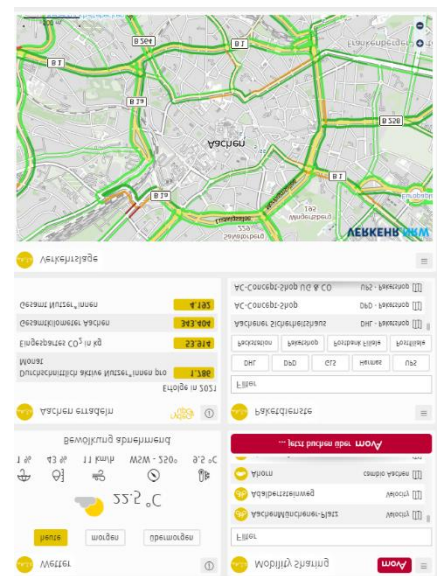
Objectives of the product

U-SUMP aims to overcome the challenge of the continuous and real-time monitoring of goals as defined in SUMP's by providing a streamlined and compact visual overview of datasets and progress towards set targets in the area of SUMP's monitoring. Based on the Sustainable Urban Mobility Indicators (SUMI) and other related KPIs defined in the frame of UPPER, U-SUMP will allow for the continuous monitoring of SUMP goals, thus contributing to the goal of achieving climate-neutrality until 2030.

Aside from supporting the partnering sites to guide the monitoring, implementation, and update of their SUMP's, the platform will support the sites to monitor the results of the "push & pull" measures based on their pre-established KPIs. The tool targets both local and regional authorities, and PTOs and PTAs.

Main functionalities

- Private and secure back-end interface, with intuitive commands.
- Possibility to select the indicators for monitoring, based on the available data for the user.
- Monitoring of SUMP-related UPPER measures through selected indicators.
- Internal, secure visual dashboard solution for internal decision-making processes.
- Possibility to have a public visual dashboard (with selected indicators) to ensure transparent communication about public transport and mobility measures with stakeholders and citizens.
- For users that opt to have the comparability function enabled, the possibility to compare with each-other their progress on the same indicator they report on.
- Comparing and assessing to what extent UPPER cities are on track to achieve public transport and climate-neutrality targets.



End users

- Local and regional authorities

Benefits: visual solution to analyse the progress towards climate neutrality targets of a variety of SUMP-related KPIs in one glance.

This will help identify low and high-performance areas as well as interrelations between the performance of different KPIs.

- Public transport authorities and public transport providers

Benefits: similar to above.



U-NEED

Supporting tool to define the optimal PT offer based on user needs and passenger transport flows.

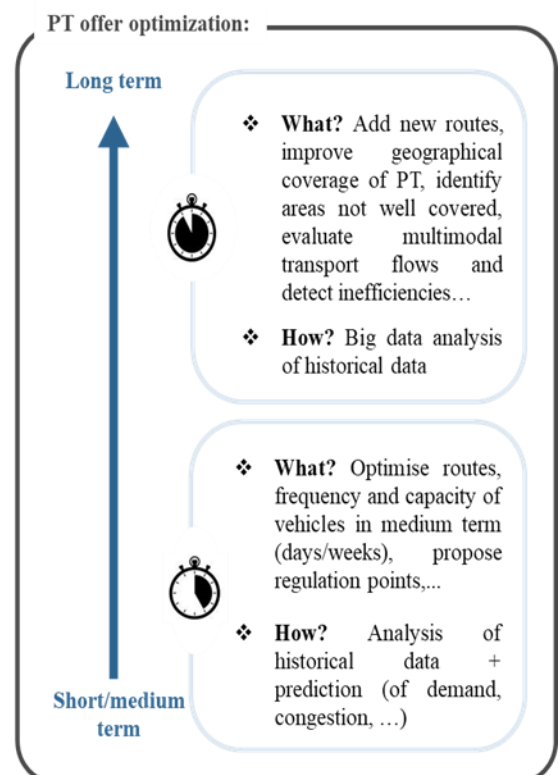
Objectives of the product

U-NEED is a data analytics and big data visualisation tool that helps city authorities, PTOs and PTAs to understand the multimodal transport demand and how people move around the city, so as to adapt PT offer accordingly. The tool integrates origin-destination (OD) information from different transport modes, provides a geographic 3D representation of the flows of people and identifies the main inefficiencies of PT offer (geographic areas not well covered, excessive travel times, insufficient capacity...).

The goal is to help defining the optimal PT capacity, schedule, frequency and routes based on the user needs and passenger flows. U-NEED also allows optimising the offer in the short/medium term, by predicting PT demand and operation under certain circumstances and anticipating abnormal situations.

Main functionalities

- Integrates (and calculates, if needed) origin-destination (OD) matrices from different transport modes.
- Provides a geographic 3D representation of passenger transport flows in overlapped layers for the different transport modes.
- Different filters can be created (per day, month, time, weather,...) to identify and visualize valuable information.
- Compares PT offer to the overall passenger flows to identify inefficiencies (areas not well covered, inefficient PT travel times,...).
- Summarized reports will be provided showing detected inefficiencies and the filters applied over the OD matrixes.
- Based on deep learning, it also predicts PT demand and traffic congestion under certain circumstances (weather, events,...), allowing to anticipate abnormal situations and to initiate corrective actions to adjust the offer in a preventive manner (modify the route, increase the frequency, add extra bus on a specific day, propose regulation points...).
- U-NEED is connected to U-SIM.plan, where potential mitigation measures can be simulated to select the most suitable one.



End users

The main end users of U-NEED are the PTOs, but also the city authorities and PTAs. This tool helps them to: (i) better understand how people moves around the city; (ii) detect inefficiencies in the PT offer; (iii) and define strategies to adapt and optimise it accordingly (in the short/medium/long term).



U-GOV is a platform that facilitates citizen participation to advice decision makers.

Objectives of the product

U-GOV is an **inclusive, continuous and data driven community engagement platform** to power the decision making. U-GOV foster the citizen participation, in four levels: Information/Sensitization - Consultation/Dialogue - Collaboration/Co-creation - Alliance/Decision making. **It provides a meeting point** among the different actors of social innovation, where **to make proposals and foster the public consultation, discussion, enrichment, co-creation and validation of new solutions and services to advice the decision makers.**

The platform will be **in digital format** and **will include a collection of tools employed in social innovation**, to be used by mobility agents.

Main functionalities

U-GOV will have a dedicated dashboard per city implementing it. The planned functionalities are:

- **Information/Sensitization** - The platform will show information on mobility diagnosis from netnography data per living lab city, behavioural change campaigns, incentive measures, or ongoing actions information.
- **Consultation/Dialogue** - The platform will have three participation channels for consultation and reflection: *open forum* for anonymous users to discuss topics; *moderated forum* for debate on specific topics by invitation or selection of participants; a channel that will host appointments for online discussion groups or online surveys.
- **Collaboration/Co-creation** – The platform will provide two main functionalities: the *ideas collection* will allow to upload videos, photos, comments and descriptions about new solutions; and the *proposals development* activities to organise co-creation workshops, ideas forums to enrich the ideas and online concept assessments.
- **Alliance/Decision making** - The platform will provide three main functionalities: the *vote, selection and evaluation* of new products and services in anonymous mode; the *validation process* through questionnaires and forums about the usability, acceptance, satisfaction and useful of new develops; and a tool to participate during pilots and demonstration studies.
- The platform will also include a module to monitor the action progress by the mobility agents (cities, PTO's, PTA's...).
- Personal data management screen for users/citizens.

| U-GOV A basic structure for the participation levels | | | |
|---|---|---|--|
| Information / Sensitization | Consultation / Dialogue | Collaboration / Co-Creation | Alliance / Decision making |
| VISUAL Diagnosis Key Indicators, ... | OPEN Channel Anonymous citizenship, needs, demands, ... | IDEAS Collection Open channel, videos, photos, ... | POLL Popular vote, alternatives selection, ... |
| COMMUNICATION Behavioural change, ... | SEGMENTED Channel User profile, debates, fora, ... | PROPOSALS development Workshops, online assessment, ... | VALIDATION Pilot tests, ... |
| ONGOING Actions Projects, ... | 4-HELIX approach Academia, enterprises, citizenship, administration | | |



End users

All mobility agents are candidates to use U-GOV with benefits. Two main roles are identified: the project manager, who mobilises initiatives (intermediate users) and the citizenship (end users).

The role of the mobiliser of initiatives (cities, PTO's, PTA's and other mobility providers) covers its information needs on the platform. The platform provides them the framework for collaboration with citizens and recruitment of participants; real-time information on mobility diagnoses based on the perception and experience of citizens; providing information and receiving feedback from campaigns and actions; a toolbox of participative methodologies that allow activities to identify needs and preferences, ideation and co-creation of solutions, and validation of new initiatives. The city can become a test bed. U_GOV provides the comprehensive management of online participatory processes, and supports face-to-face activities.

The citizenship role as an informer, adviser, co-creator, validator and communicator, allows citizens to take an active part in the development processes of their city and influence decision-making, empowering them. U-GOV provides the citizen with relevant information as real-time information on mobility diagnoses or campaigns, and the possibility of direct intervention on the mobility decisions and city's mobility strategies.



U-KNOW

U-KNOW is an online portal for public transport knowledge exchange, collaboration, and innovation

Objectives of the product

U-KNOW's objectives are to facilitate knowledge transfer, promote best practices, and stimulate innovation in the field of public transport. It aims to support cities, public transport operators, and authorities in creating more sustainable and efficient urban transport systems by providing information on measures with proven impact. U-KNOW promotes collaboration and knowledge exchange to accelerate the adoption of innovative solutions and provides a platform for exchanging ideas and sharing cutting-edge research and development. The tool identifies and promotes best practices in the field, explaining not only what to do and how to do it, but also why to take these actions, because they have a certain impact.

At the first instance, U-KNOW will support cities and project partners as a capacity-building tool, a learning centre structured around the Cities Mission and the UPPER measures, which have been shown to have a positive impact. Secondly, U-KNOW will serve as a dissemination tool including information about the UPPER measures and tools, and their impact on urban transport systems.

Main functionalities

U-KNOW's main functionalities provide a wide range of resources, tools, and opportunities for users to deepen their knowledge, skills, and networks in the field of public transport and sustainable mobility.

- Resource Library: a vast library of resources related to public transport including publications, case studies, best practices, and toolkits.
- Factsheets of the UPPER cities, measures and tools
- Webinars: the portal will host regular webinars on various public transport mobility topics, featuring experts from academia, industry, and government.
- Community: U-KNOW will be linked to the Mission platform to encourage collaboration among stakeholders. The Mission platform will serve as the networking hub for both U-KNOW and UPPER, and will include a dedicated group for communication and information sharing.
- Mission-oriented: Specific resources focused on public transport and climate neutrality will be developed and linked with the Mission platform.
- U-KNOW will be based on the CIVITAS SATELLITE learning platform and evaluation framework, going beyond it in sustainability and PT efficiency, levels of innovative solutions adoption and mobility ecosystem innovation readiness, among others.

End users

The main target users of U-KNOW are cities, public transport operators, and authorities who are interested in creating more sustainable and efficient urban transport systems. These may include policymakers, urban planners, public transport managers, researchers, and other stakeholders who are involved or interested in the planning, design, and operation of public transport systems.

U-TRANSFER

Implementation support platform and knowledge exchange hub for UPPER cities and PTOs

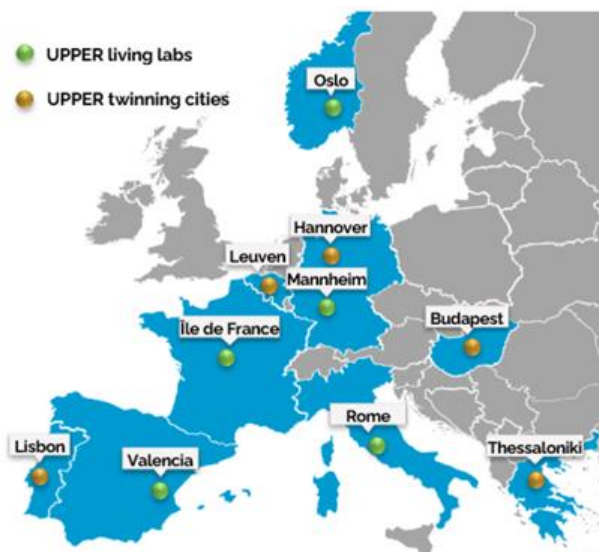
Objectives of the product

U-TRANSFER will offer a dynamic and interactive platform to guide the cities and PTOs through the implementation of knowledge and solutions demonstrated in UPPER and deposited in U-KNOW repository. It will also provide space for knowledge exchange and discussion on the enablers and barriers that govern the implementation and replication of successful solutions.

U-TRANSFER will provide tailored workshops, courses and implementation roadmaps based on detailed mapping of needs of the visitors of the platform. Relationship with ambassador cities and city visits could be established through the platform based on a matchmaking process that can facilitate relationships based on similar challenges, cultural and governance background. U-TRANSFER will provide transferability guidelines that will facilitate the transferability of UPPER solutions to a broader range of cities.

Main functionalities

- Space for peer-to-peer learning
- Dynamic communication with the visitor and identification of measures relevant for visitor's challenges
- Tailored workshops implementation roadmaps and courses
- Provide transferability guidelines
- Interactive online discussion board
- Dynamic knowledge sharing tailored to the needs of the visitor of the platform
- Matchmaking process facilitating relationship between ambassador and replicator cities of similar size, background and facing similar challenges
- Setting up and implementing innovative pilots, potential challenges and ways to replicate and scale them up
- 8 online workshops with UPPER living labs.



End users

U-TRANSFER is aimed at cities and stakeholders not directly involved in the project, but who would be interested in replicating the project findings and applying the push-pull measures described in the cities.

U-TRANSFER guidelines and platform functionalities will also be distributed via the platform for the EU Cities Mission. The relationship with the cities involved in the Mission will be facilitated through the cooperation with NetZeroCities Mission Platform.

Annex B: Measures grouping per category

| Measure category | Measure ID | Measure name |
|--|------------|--|
| Redistribution of Urban Space | VAL_01 | Redistribution of urban space with a focus on Mobility as a Right |
| | ROM_08 | (Re)Designing the urban space to promote active travel modes, PT and environmental “30 zones” |
| | OSL_04 | Reduce parking supply for private cars and reallocate it for shared modes of transport |
| | MAN_08 | Redesign urban space and test alternatives of using it for social purposes |
| | LIS_05 | To enhance multimodal interconnection with the peri-urban municipalities |
| Multimodality (Physical Integration of mobility services and Hub Creation) | VAL_02 | Creation of a network of multimodal hubs |
| | ROM_03 | To adapt the PT offer and include new mobility services in multimodal interchange nodes |
| | IDF_04 | Added-value services in multimodal nodes to integrate active modes with PT |
| | OSL_02 | Design multifunctional hubs to increase the accessibility to public transport and active modes in strategic areas outside the centre and city accesses |
| | OSL_06 | Develop and implement solutions for improved user experience in the first/last mile |
| | MAN_07 | Create a network of mobility hubs in cooperation with the regional transport association, open for multi mobility providers |
| | LIS_09 | To improve the integration of PT and active travel modes |
| | TES_02 | To simulate and analyse the needs of PT for LEZ demand fulfilment |
| | HAN_03 | Added-value services in multimodal nodes to integrate PT with active modes |
| | TES_08 | To create new incentive based services in the MDMS to increase the use of PT |
| Multimodality (Operational and Digital Integration of mobility services) | VAL_05 | New Multimodal Digital Mobility Services (MDMS) with a focus on accessibility and inclusion |
| | ROM_06 | Innovative features into the MDMS system according to the mobility patterns and needs of users’ groups |
| | IDF_05 | Promote the use of the PT service by visitors in large events |
| | OSL_08 | Increase visibility of sustainable modes of transport and measuring effects by integrating in MaaS-solutions |
| | MAN_05 | Modernize and increase the attractiveness of digital sales channels and private sector partnerships |
| | LIS_07 | To create a new Multimodal Digital Mobility Services (MDMS) |
| | BUD_02 | To create new mobility packages of Multimodal Digital Mobility Services (MDMS) |
| | BUD_04 | To improve the route planner to increase the user satisfaction |
| | BUD_05 | New services to increase accessibility and convenience of PT |
| | 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 |
| | TES_01 | Optimum transfers on P&R areas based on real-time data |
| | TES_05 | To enhance the information provided through adapted services for different groups of passengers |
| | HAN_01 | Digital infrastructure |
| | HAN_04 | Mobility dashboard solution |
| Mobility planning | VAL_03 | To optimise public transport offer based on advanced technology |
| | IDF_06 | Advanced technology to optimise the PT offer in line with users’ needs and patterns |

| | | |
|--|--------|---|
| | OSL_03 | Develop a roadmap for new mobility alternatives and operating models to reduce the private car ownership |
| | MAN_03 | Data-driven platform for supporting PT planning and operations based on the concept of Mobility as a Right |
| | BUD_01 | To improve the efficiency and convenience of PT service |
| | TES_09 | To raise environmental awareness and trigger behavioural change towards PT |
| | ROM_05 | To design the PT surface infrastructure adapted to the gradual introduction of new electric buses |
| | LIS_04 | To improve PT offer, adapted to school students |
| | LEU_01 | To exploit the existing mobility data to enhance the evolution of public transport policies |
| | VAL_07 | To provide the citizens with clear and accessible information before and during the trip |
| | IDF_02 | Setting-up of a dynamic Digital Twin of the territory to enrich the data collected and evaluate future measures, policies and solutions |
| | HAN_05 | U-SUMP |
| | ROM_07 | Use of advanced technology to increase the efficiency and reliability of PT |
| Traffic Management and PT Prioritization | VAL_04 | To reduce travel times through the implementation of dedicated bus lanes |
| | ROM_04 | To design the new high frequency and high-capacity PT infrastructure |
| | LIS_02 | Promote, extend services and prioritise PT |
| | BUD_06 | To improve the existing PT prioritizing tools in Budapest |
| | LEU_07 | Increase the quality of the PT services through traffic management and dedicated lanes for PT |
| | TES_03 | To improve transit services through dynamic multimodal management of PT corridor |
| | TES_06 | Social optimum-based traffic management to reduce PT travel times and increase user satisfaction |
| On-Demand Mobility Services | VAL_06 | To improve the Public Transport offer in peri-urban areas |
| | OSL_05 | Develop and implement segmented Demand Responsive Transport (DRT) solutions |
| | MAN_06 | Defining concepts and test instruments to improve mobility in peri-urban areas for different user groups |
| | TES_07 | To increase the accessibility to PT in low demands areas of the city |
| | HAN_02 | Sustainable transport chains |
| User Perception of Quality of Service (QoS) | VAL_09 | Improving the air quality and the feeling of safety (after Covid) in buses |
| | IDF_08 | Improve public perception of PT |
| | LIS_10 | To improve the quality and efficiency of the bus service |
| | BUD_03 | To understand dependencies between the level of service and passenger satisfaction |
| Low Emission Zone (LEZ) / Congestion and Pollution Charging Scheme / Smart Parking Management | ROM_01 | To reduce private vehicles by implementing a “pollution charge” scheme in the core part of Rome Zone 2 |
| | ROM_02 | Promoting modal shift towards PT with the implementation of a LEZ in Rome Zone 3 |
| | IDF_03 | Impact evaluation and future design of low emission zones and restricted traffic zones |
| | LEU_02 | To study the needs of parking and public transport in different areas of the city |
| | TES_04 | To influence modal shift through congestion sensitive Parking pricing |
| | LIS_01 | Restrict car access in the city |
| Incentivization | ROM_09 | To create incentive packages to support multimodality |
| | IDF_07 | To incentivise the use of Public Transport for commuters |
| | OSL_07 | To incentivise the use of PT and shared/active modes of transport |

| | | |
|-------------------------------|--------|--|
| | LEU_05 | Mobility for all by optimising the use of financial incentives to increase the share of PT |
| | TES_10 | To incentivise the use of PT in combination with active modes |
| Democratic governance | IDF_01 | Participative governance framework for the update of the regional SUMP |
| | MAN_01 | Establish participative governance and dialog formats to address the citizens with a focus on the (special) needs of user groups |
| | LIS_03 | To improve the mobility planning |
| PT stop and facilities | VAL_08 | To design and develop an innovative, inclusive and convenient stop for buses |
| | MAN_04 | An attractive, accessible, secure, comfortable, multifunctional and clean PT stop |
| | LIS_06 | To improve comfort, convenience and safety of PT interfaces |
| Campaigns | MAN_02 | Campaigning for sustainable forms of transport, such as PT, walking and cycling. Establishing a PT culture with PT as a green, safe, inclusive, and social space |
| | LIS_08 | To implement campaigns and partnership initiatives |
| | LEU_06 | To launch communication campaigns and digital tools to increase the uptake of PT |



Annex C: Measure requirements template

| | |
|---|---|
| Infrastructure | <p>Please, specify if the design, development and/or implementation of this measure has any specific infrastructure requirement. Do you need to use, deploy, update or intervene on an infrastructure to implement this measure? If so, indicate the requirements.</p> <p><i>* Infrastructure refers to any physical and organizational structures and facilities (e.g. buildings, roads, PT lanes, hubs, stations, PT stops,...)</i></p> |
| Equipment/ Hardware | <p>Please, specify if the design, development and/or implementation of this measure has any hardware or equipment requirement. Does the measure require using, buying, developing or intervening on any equipment or hardware system? If so, indicate the requirements.</p> |
| Software | <p>Please, specify if the design, development and/or implementation of this measure needs to satisfy specific software requirements. Does the measure require using, buying, developing or intervening on any software? If so, indicate the requirements.</p> <p><i>* This section refers to cities' internal softwares, and not to the U-tools.</i></p> |
| Data | <p>Please, specify if the design, development and/or implementation of this measure requires the access/monitoring/collection of any type of data. If this is the case, indicate the related requirements.</p> |
| Permits/ Tenders | <p>Please, specify if the design, development and/or implementation of this measure requires launching a tendering process or requesting any permits. If this is the case, when is this permit or tender going to be launched or requested? Which are the estimated deadlines?</p> |
| External support | <p>Please, indicate what skills & capacities are needed to implement the measure. What external collaboration or outsourcing is needed?</p> |
| Legal | <p>Please, specify if there are legal requirements to be considered for the design, development and/or implementation of this measure. The legal requirements can derive from both, the European as well as the national or regional legal framework. Does this measure need to take into account any legal considerations or comply any specific regulation to be implemented? If so, indicate the requirements.</p> |
| Security/ Safety | <p>Please, specify if the design, development and/or implementation of this measure need to accomplish any security or safety requirements. If this is the case, indicate the related requirements.</p> |
| Social /Cultural / Political | <p>Please, specify if the design, development and/or implementation of this measure is conditioned by any social, cultural and/or political restriction and if it needs to accomplish specific requirements in this regards.</p> |
| Functionalities | <p>Please, specify the list of functionalities that the measure needs to accomplish and/or develop in order to reach its objective (e.g. new functionalities to be included in a Maas).</p> |

** If any of the fields listed in the table does not apply to the measure, just write “NA”.*



Annex D: UPPER measures requirements

1. VALENCIA (LIVING LAB)


VAL_01: Redistribution of urban space with a focus on Mobility as a Right

| | |
|-------------------------------------|---|
| Infrastructure | <p>This measure aims to redistribute the urban space in the surroundings of Av. Blasco Ibañez. Therefore, it requires the intervention on the infrastructure, including:</p> <ul style="list-style-type: none"> • Make public transport routes wider and create a dedicated bus lane. • Redesign the route of the bus lane to smooth the route. • Increasing the distance for the dedicated bus lane. • Improvement of pedestrian and cyclist accessibility and access to public transport. • Adapt the sidewalks, pedestrian crossings and bus stops in accordance with the new road design. • Share the bus lane for other public bus operator integrating suburban network. <p>This measure focuses only on the construction project, while the civil engineering works of the project will be supported by the Next Generation funds.</p> |
| Equipment / Hardware | <p>N/A</p> |
| Software | <p>N/A</p> |
| Data | <p>This measure requires collecting basic data to support decision-making on modal distribution according to type of trip in the city of València, major journeys: total journeys, bus routes; topographic data and information from the affected services.</p> |
| Permits / Tenders | <p>This measure requires launching a tendering process for the construction project (output of the measure). The construction project (technical paper) will establish the technical requirements for the redistribution of the urban space in the surroundings of Avenida Blasco Ibañez with a focus on MaaR. The construction project will include: report, plans, specifications, budget, health and security study. The information about the launch of the tender, closing of the tender, award of contract, among others, it's being modulated by the administrative and public procurement process.</p> |
| External support | <p>Project Manager, expertise area: civil engineering / technical engineering in public works / industrial engineering.</p> |
| Legal | <p>The legal requirements mainly consider administrative, public procurement and accessibility laws. In addition, the local legal framework related to public space should be considered.</p> |
| Security / Safety | <p>ISO standards about quality management and environmental issues. Basic studies on safety and health.</p> |
| Social /Cultural / Political | <p>The design, development, and implementation of that measure can be conditioned by various social, cultural, and political factors. These factors can impact the feasibility and success of VAL_01 measure, and often require specific considerations and requirements as those listed below. Considering València SWOT Analysis results (page 6, Annex A):</p> <ul style="list-style-type: none"> • Social factors: equity and accessibility, behavioural patterns, public acceptance and community engagement. • Cultural factors: historical context and cultural norms. • Political factors: policy framework (new mandate), budget allocation according to mandate plan and stakeholders alignment, especially through an open dialogue with the Sustainable Mobility Table (Mesa de la Mobilitat Sostenible) and other tools. |
| Functionalities | |

VAL_02: Creation of a network of multimodal hubs

| | |
|--------------------------------------|---|
| Infrastructure | Depending on the results of the preliminary study, the mobility offer will be improved in the hub. That will lead to the need of deploying new mobility services and the improvement and efficient connection of the different transport modes. That may affect the PT stops, the bike sharing stations and the bike lanes in the actuation area. |
| Equipment / Hardware | This measure might require the deployment of multimodal panels, integrating real-time information on the mobility offer in the hub. |
| Software | This measure requires the deployment of new local maps clearly and easily showing the situation of every mobility service. |
| Data | <p>The implementation of this measure requires:</p> <ul style="list-style-type: none"> For the preliminary study, the collection of data (potentially through a survey) regarding the transportation needs and preferences, as well as the barriers to modal shift for users (and potential users) of PT and sustainable mobility in the targeted area. For the preliminary study, the collection of detailed information about the existing public transportation and sustainable mobility services in the targeted area, along with their characteristics: available modes of transportation, frequency, intermodal connections, and levels of integration (including physical, operational, fare, and information integration). For the potential deployment of information panels, this measure requires access to real-time information about different modes of transportation (public and/or sustainable) in the targeted area. The specific information to be accessed varies based on the mode of transportation, so it will depend on the modes available in the targeted area. <ul style="list-style-type: none"> In the case of buses (idem for trams/metros/trains): bus locations, arrival times of the next bus, waiting time for the coming buses, delays, alerts/disruptions, etc. In the case of shared bikes: bike station locations, walking distance to the station, number of available bikes, etc. |
| Permits / Tenders | <ul style="list-style-type: none"> For the deployment of new mobility services in the area of actuation (new PT stops, new bike-sharing stations,...), relevant permits should be requested. For the deployment of multimodal panels, authorization for installation on public roads should be requested. |
| External support | Collaboration from other mobility service providers (those operating in the actuation area) is required for the proper implementation of the measure. |
| Legal | The legal requirements mainly consider administrative, public procurement and accessibility laws. In addition, the local legal framework related to public space should be considered. |
| Security / Safety | ISO standards about quality management and environmental issues. Basic studies on safety and health. |
| Social / Cultural / Political | <p>The design, development, and implementation of that measure can be conditioned by various social, cultural, and political factors. These factors can impact the feasibility and success of VAL_02 measure, and often require specific considerations and requirements as those listed below.</p> <p>Considering València SWOT Analysis results:</p> <ul style="list-style-type: none"> Social factors: equity and accessibility, behavioural patterns, public acceptance and community engagement. Cultural factors: historical context and cultural norms. |



| | |
|---|---|
| | <ul style="list-style-type: none"> Political factors: policy framework (new mandate), budget allocation according to mandate plan and stakeholders alignment, especially through an open dialogue with the Sustainable Mobility Table (Mesa de la Mobilitat Sostenible) and other tools. |
|  | N/A |

VAL_03: To optimise public transport offer based on advanced technology

| | |
|------------------------------|--|
| Infrastructure | Infrastructure interventions might be required at some point. However, it will depend on the results of the PT offer analysis and the corrective strategies finally implemented. |
| Equipment / Hardware | N/A |
| Software | This measure will require using U-SIM.plan (based on VISUM software) to simulate the different corrective strategies and make a decision. That will require adapting the VISUM model in order to perform the relevant simulations. |
| Data | This measure requires: <ul style="list-style-type: none"> - Collecting Origin-Destination historical data from different transport modes (bus, shared-bike, private vehicle, etc.) to perform the geospatial analysis of passenger flows, analyse potential underlying trends, identify inefficiencies in the current offer and elaborate future recommendations. Since U-NEED will be used, the data requirements are established by the tool itself (GTFS standard). - Historical traffic data. - Collecting feedback from specific user groups (potentially through a survey) to ensure that the adapted PT offer covers the needs of every target group. |
| Permits / Tenders | N/A |
| External support | External collaboration is required from: <ul style="list-style-type: none"> - Get information from the public administration: Municipality traffic centre. - Private vehicle data providers (TOMTOM, car-sharing fleet operators, mobile phone sources...), to provide OD matrix of private vehicles. - Other transport operators: FGV, Valenbisi, MetroValencia,...All these transport operators can also provide data for mapping the citizens mobility patterns. |
| Legal | To ensure data protection requirements by design, GDPR must be complied when collecting OD data (from private or public entities), and for carrying out the survey. Cooperation and coherence between the City Hall, EMT (PTO) and traffic operator protocols: data transmissions and communications. |
| Security / Safety | To ensure the accomplishment of GDPR requirements by design: <ul style="list-style-type: none"> - Lawfulness, fairness, and transparency. - Purpose Limitation. - Data minimization. - Accuracy. - Storage limitation. - Integrity and confidentiality. - Accountability. |
| Social /Cultural / Political | The design, development, and implementation of that measure can be conditioned by various social, cultural, and political factors. These factors can impact the feasibility and success of VAL_03 measure, and often require specific considerations and requirements as those listed below. Considering València SWOT Analysis results: the corrective strategies finally implemented might be conditioned by political reasons, or by the PTO budget restrictions. |
| Functionalities | N/A |

VAL_04: To reduce travel times through the implementation of dedicated bus lanes

| | |
|-------------------------------|---|
| Infrastructure | This measure requires the intervention on Blasco Ibañez Avenue. Some space from private cars need be reallocated to PT to create a dedicated corridor for the bus. For the segregation of the bus corridor, physical barriers could be used. That will prevent private cars from occupying the dedicated bus lane. |
| Equipment / Hardware | <ul style="list-style-type: none"> - To implement the traffic light priority, the equipment of the traffic regulators needs to be adapted. The traffic regulators should perform the Traffic Management Plans indicated by MISTRAL. They will receive the priority requests and execute them. - In case of a dedicated priority line, it could be necessary to install different sensors (TBD). |
| Software | MISTRAL is the Smart Mobility Platform developed by ETRA I+D that will be used for the realisation of the measure. It will be adapted to execute the corridor management (depending on the strategy selected) and the priority requests to the Traffic Regulators. |
| Data | <p>This measure requires:</p> <ul style="list-style-type: none"> - For the preliminary study: <ul style="list-style-type: none"> o Data collection of the people mobility needs in the arterial and its adjacent areas. Potential data sources: ticketing (facilitated by EMT) + survey. o Current space dedicated for the private car parking. o Current service of the public transport: number of seats, number of vehicles in off-peak hours and in peak hours. - The data needed to implement the traffic light priority will vary based on the final solution adopted, choosing between real-time vehicle position or sensor detection. |
| Permits / Tenders | N/A |
| External support | N/A |
| Legal | Formal implementation agreement, if needed. |
| Security / Safety | N/A |
| Social / Cultural / Political | <p>The design, development, and implementation of that measure can be conditioned by various social, cultural, and political factors. These factors can impact the feasibility and success of VAL_04 measure, and often require specific considerations and requirements as those listed below.</p> <p>Considering València SWOT Analysis results:</p> <ul style="list-style-type: none"> - Social factors: equity and accessibility, behavioural patterns, public acceptance and community engagement. - Cultural factors: historical context and cultural norms. - Political factors: policy framework (new mandate), budget allocation according to mandate plan and stakeholders alignment, especially through an open dialogue with the Sustainable Mobility Table (Mesa de la Mobilitat Sostenible) and other tools. |
| Functionalities | N/A |

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

| | |
|-------------------------------------|--|
| Infrastructure | N/A |
| Equipment / Hardware | Include Time Estimated Panels in the bus shelter. |
| Software | This measure requires implementing new features for the MaaS to ensure that the APP is accessible for everyone. Universal accessibility and design for all by design should consider: <ul style="list-style-type: none"> - Suitable for most users without any modification. - Easily adaptable to different users. - Allow interaction with technical aids |
| Data | This measure requires: <ul style="list-style-type: none"> - For the preliminary study, the collection of information about the needs of target users (VRUs). This requires the organization of a workshop and potentially a survey. Data should comply with GDPR. - Depending on the new features, extra data will be needed (e.g. accessibility of the different PT stations and stops, elevator location, etc.). |
| Permits / Tenders | This measure builds on top of the project “Ciudades Conectadas”, funded by Next Generation European funds. |
| External support | INDRA is the technology provider for “Ciudades Conectadas” and will implement any change in the app. EMT Valencia is responsible to define and execute the project. |
| Legal | To ensure data protection requirements by design, GDPR must be complied when collecting OD data (from private or public entities), and for carrying out the survey or workshops, if case. |
| Security / Safety | N/A |
| Social /Cultural / Political | The design, development, and implementation of that measure can be conditioned by various social, cultural, and political factors. These factors can impact the feasibility and success of VAL_01 measure, and often require specific considerations and requirements as those listed below. Considering València SWOT Analysis results: <ul style="list-style-type: none"> • Social factors: equity and accessibility, behavioural patterns, public acceptance and community engagement. • Cultural factors: historical context and cultural norms. • Political factors: policy framework (new mandate), budget allocation according to mandate plan and stakeholders alignment, especially through an open dialogue with the Sustainable Mobility Table (Mesa de la Mobilitat Sostenible) and other tools. |
| Functionalities | The identification of new features of the app is part of the project, rather than a prerequisite. Thus, a specific list of functionalities cannot be provided yet, although it will take consideration for: <ul style="list-style-type: none"> - Physical accessibility for people with mobility issues (integrating information about accessibility of bus stops, metro stations, elevator location, etc). - Universal accessibility for people with intellectual issues. - Gender perspectives to fulfil everyone’s needs. |



VAL_06: To improve the Public Transport offer in peri urban areas

| | |
|-------------------------------------|--|
| Infrastructure | N/A |
| Equipment / Hardware | N/A |
| Software | The creation of an automatized Demand Responsive Transport (DRT) system requires the development of a mobile application/ web service for DRT service booking and tracking. |
| Data | For the functioning of the service, it will require the access to database of users (allowed to use the service). |
| Permits / Tenders | Agreement between the Local Transport Authority and EMT |
| External support | Training and support to EMT staff to ensure the system operates efficiently and effectively. |
| Legal | Must comply with GDPR. |
| Security / Safety | N/A |
| Social /Cultural / Political | Especial needs of targeted VRUs should be considered when designing the APP. |
| Functionalities | <p>Creation of an automatized DRT system to cater to the needs of vulnerable users.</p> <p>The mobile application/ web service for DRT service will include:</p> <ul style="list-style-type: none"> - Booking - Tracking (TBD) |

VAL_07: To provide the citizens with clear and accessible information before and during the trip

| | |
|-------------------------------------|---|
| Infrastructure | N/A |
| Equipment / Hardware | N/A |
| Software | <p>This measure requires:</p> <ul style="list-style-type: none"> - The development of a platform for PTOs including: <ul style="list-style-type: none"> o Real-time interactive maps showing detailed information on the bus operation (location, occupancy, delay,...), along with information on traffic status and service disruptions. o Real-time alerts informing PTOs about relevant delays, disruptions, abnormal occupancy levels,... to manage the service and initiate corrective actions if needed (adapt bus routes, increase frequencies, etc.). - The development of an API / service to provide clear and updated information on the bus operation (service disruption, delays, change route, incidents, etc.) to the citizens through screens, APPs, Twitter...(to be decided). |
| Data | <p>This measure requires:</p> <ul style="list-style-type: none"> - Access to real-time and standardized information on different transport modes operation (real-time vehicle location, incidents, delays, occupancy level,...). - Real-time information on relevant issues directly or indirectly affecting the performance and travel time of public transport. This includes real-time information on traffic, road works, special events, accidents, or abnormal situations. - Static information on the PT stops, events, roadworks, PT schedules, etc. - GTFS and GTFS-RT should be used, if possible. |
| Permits / Tenders | N/A |
| External support | N/A |
| Legal | N/A |
| Security / Safety | N/A |
| Social /Cultural / Political | It should be improved the way and means through which this information is provided (visual, audio...). Different user profiles should be considered (disabilities, young and elder people...) when designing the way and means through which the information is provided. |
| Functionalities | <ul style="list-style-type: none"> - The functionalities of the platform addressed to the PTO should be defined by the PTO itself. - The information to be facilitated to the end users (type and format) should be decided by the PTO. The feedback provided by the end-users in the Serious Game can also be considered for the definition of the functionalities. |

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

| | |
|-------------------------------------|--|
| Infrastructure | <p>This measure requires the intervention on a PT stop. An already existing PT stop (most probably, located in Blasco Ibañez Avenue) will be upgraded in order to make it innovative, smart and inclusive. New features (defined through a co-creation process with citizens and VRUs) will be prototyped and installed in the PT stop.</p> <p>The interventions on the PT stop might require (depending on the output of the co-creation process):</p> <ul style="list-style-type: none"> - Adapting the materials of the road surface. - Increasing the shading. |
| Equipment / Hardware | <p>This measure might require (depending on the output of the co-creation process):</p> <ul style="list-style-type: none"> - The installation of cameras with AI capabilities to recognize vulnerable users or detect large crowds. - The installation of cameras for surveillance. - The installation of remote assistance system. |
| Software | <p>This measure might require (depending on the output of the co-creation process):</p> <ul style="list-style-type: none"> - The adaptation of the information about the PT provided in the stop (including the content itself and the format – visual and acoustic) |
| Data | <p>This measure will require:</p> <ul style="list-style-type: none"> - For the preliminary study, information on the users' needs in terms of accessibility, safety, inclusiveness, attractiveness and innovation features for the new bus stop (potentially collected through a workshop). |
| Permits / Tenders | <ul style="list-style-type: none"> - It might require the procurement of materials and resources necessary for the construction of the prototype of the new bus stop. - Obtaining any necessary permits or approvals for intervening on the new bus stop (adapt, upgrade and add new features). |
| External support | N/A |
| Legal | The PT stop should comply with all relevant safety regulations. |
| Security / Safety | The design of the PT stop should pay special attention to the security perception, especially during the night. |
| Social /Cultural / Political | The PT stop should be accessible for every user, regardless his/her condition and age. |
| Functionalities | The new bus stop will incorporate a set of services and features to guarantee accessibility, both physical and cognitive, for all users, including those with disabilities or special needs. |

Note: Measure VAL_09 is currently being re-evaluated. Potential alternatives to the original measure are being studied, including the better integration of the urban bus service with the peri-urban bus service.



2. ROME (LIVING LAB)

ROM_01: To reduce private vehicles by implementing a “pollution charge” scheme in the core part of Rome Zone 2 VAM

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|-------------------------------------|--|
| Infrastructure | The infrastructure is already in place and is under completion. The implementation of this measure is linked to the deployment of access gates made of: cameras, poles, lanes, dynamic signage, connection to the MMC (Mobility Management Centre) for the detection of specific categories of vehicles. Cameras have the technology to transmit data to the Traffic Management Centre of RSM and, consequently to the Local Police. |
| Equipment / Hardware | The equipment needed has already been identified. 53 access gates are under implementation along the perimeter and will be integrated into a unique system, along with the existing 21 access gates. |
| Software | The software is embedded in the system and complies with the national guidelines and the whole process will allow users to select and identify the Euro categories of the traffic flows, and, according to the emission category apply the related fee. |
| Data | The system needs to access the national database of the vehicles’ characteristics and owners. |
| Permits / Tenders | Need the authorisation to start operating the system by the Ministry of Infrastructures |
| External support | The system will be operated with internal resources supported by providers as integrators. |
| Legal | It complies with the existing and updated National guidelines on GDPR and LTZ. The system in Rome complies with the national features, as already implemented in Milan (Area B) |
| Security / Safety | Complies with the existing and updated National guidelines on LTZ. |
| Social /Cultural / Political | Acceptance by the citizenship concerning the traffic restrictions. |
| Functionalities | Integration with incentive and gradual transition systems (Move-in system and bonus pass) |



ROM_02: Promoting modal shift towards PT with the implementation of a LEZ in Rome Zone 3

| | |
|-------------------------------------|---|
| Infrastructure | The implementation of this measure is linked to the deployment of the following infrastructures: cameras, poles, lanes, dynamic signage, connection to the MMC (Mobility Management Centre) for the detection of specific categories of vehicles. Cameras have the technology to transmit data to the Traffic Management Centre of RSM and, consequently to the Local Police. |
| Equipment / Hardware | Currently 51 access gates have been installed (but not yet operational) out of the 154 planned. |
| Software | The SW is included in the procurement and complies with the national guidelines. The whole process will allow us to select and identify the Euro categories of the traffic flows, and, according to the emission category, apply the related fees. |
| Data | The following data are needed: the vehicles' characteristics (typology and emission standards), the owners, the traffic flows entering the restricted area. |
| Permits / Tenders | The system needs the authorisation by the Ministry of Infrastructures to start operating. |
| External support | Internal resources supported by providers (system integrators) |
| Legal | Complies with the existing and updated National guidelines on GDPR and LTZ. |
| Security / Safety | Complies with the existing and updated National guidelines on LTZ. |
| Social /Cultural / Political | <ul style="list-style-type: none"> • Acceptance by the citizenship concerning the traffic restrictions. • Need to consider the social impact of the restrictions. • The measure needs to comply with the Regional regulation concerning the traffic emissions reductions t |
| Functionalities | Integration with incentive and gradual transition systems (Move-in system and bonus pass) |

ROM_03: To adapt the PT offer and include new mobility services in multimodal interchange nodes

| | |
|--------------------------------------|--|
| Infrastructure | <p>The measure consists of the adaptation of interchanging nodes and car parks, through interventions to increase the supply of parking spaces at existing railway and metro stops. The car parks and interchanges examined are Conca d'Oro, Annibaliano, and Anagnina. For Conca d'Oro and Annibaliano, the intervention consists in completing the car parks in structure, built at the metro stations.</p> <p>This measure follows the implementation of works to enlarge, adapt, or build facilities to favour the modal exchange.</p> |
| Equipment / Hardware | NA |
| Software | The measure in part needs to satisfy requirements to achieve PT schedule coordination, and integration of information. |
| Data | The data needed to achieve the objective refer to the above: PT schedule (all modes), fares and ticketing systems, traffic data. |
| Permits / Tenders | NA |
| External support | For the measure purpose, the external support needed refers to the cooperation with the mobility companies in sharing and collecting information. |
| Legal | The building part (not included in the measure) must comply with the national and European tendering and procurement requirements. |
| Security / Safety | The building part (not included in the measure) must comply with the national and European security requirements. |
| Social / Cultural / Political | NA |
| Functionalities | Improve multi-modality offer near park and ride, increasing accessibility and inclusion in the MaaS ecosystem. |

ROM_04: To design the new high frequency and high-capacity PT infrastructure

| | |
|-------------------------------------|---|
| Infrastructure | <p>This measure expects to perform the design of four new tramway lines and part of 2 metro lines, and the design of the Tramlines depot plan according to the principle of "proximity" of depots to lines.</p> <p>The infrastructures expected to deploy this measure have been funded with the RRF (Recovery and Resilience Facility)</p> |
| Equipment / Hardware | <p>This measure follows the procurement of 14 metro trains and 50 trams.</p> |
| Software | <p>Specific design software is needed and is already in use at RSM (Autocad, Civil 3D, Vissim, Maptitude).</p> <p>The design concerns in particular the micro-simulation of the demand relevant to specific branches of the lines. The Software requires dedicated graphics cards and a minimum of 16 gigs of RAM.</p> |
| Data | N/A |
| Permits / Tenders | <p>The tendering for the procurement of the vehicles and for the external support for the design and implementation phase requires a process which involves several stakeholders and needs to comply with the RRF deadline. (At National level a specific procurement code has been issued to simplify some procedures.</p> |
| External support | <p>Design engineers/designers and architects.</p> |
| Legal | <p>Legal aspects concern the drafting of the tender compliant with the Italian and European legislation</p> |
| Security / Safety | N/A |
| Social /Cultural / Political | <p>Stakeholders and associations play a key role in terms of acceptance of the measure(s). In this case, participative and collaborative processes already in the design phase become increasingly important. Citizens through the local city boroughs, sectoral associations (vulnerable road users, cyclists, disabled, etc), representatives of the unions etc can take part in the participation process, with representatives of the local institutions.</p> |
| Functionalities | N/A |

ROM_05: To design the PT surface infrastructure adapted to the gradual introduction of new LEV and ZEV buses

| | |
|-------------------------------|---|
| Infrastructure | The requirements for the electrification of the depots for the new buses are part of the tendering document. |
| Equipment / Hardware | The UPPER measure will intervene on the PT operations following the introduction of the new buses. (Procurement of 411 new electric buses, 269 hybrid, 344 CNG buses, 33 Euro 6 diesels, with the objective of achieving a PT fleet from Euro 6 to zero emission, based on a gradual procurement and introduction of the new buses until the Jubilee starts (the first 6 EURO 6 totally accessible were delivered in July 2023, in July 2023 18 hybrid were delivered, the procurement for the electric one was launched in June 2023) |
| Software | N/A |
| Data | Cartographic data, traffic data, O/D data of the PT users, carrying capacity, battery autonomy, bus routes, timetables, historical occupancy level, historical traffic data. |
| Permits / Tenders | The tendering process for the procurement of the vehicles is necessary and is centralised. The electrification of the depots will follow a parallel process. |
| External support | ATAC, the in-house PTO in Rome has defined the requirements for the tender. |
| Legal | N/A |
| Security / Safety | The depots dedicated to electric or CNG buses must comply with the specific Security standards concerned. The new buses guarantee more safety for the driver who is protected by a separated cabin. |
| Social / Cultural / Political | From the cultural and social point of view electric vehicles are well accepted. The design of the relevant bus lines must combine both the PT demand and the vehicles operation's needs (eg battery recharging cycles) |
| Functionalities | This activity expects a deep design of PT low-emission lanes, due to the complexity of the integration of ZEV vehicles and careful planning of the routes to allow the real operation of the service over a large area, with a choice of the bus depots and of the lanes. The UPPER activities will also evaluate the user satisfaction and PT reliability during the project with a problem-solving approach together with PT operator ATAC. |

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

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|--------------------------------------|--|
| Infrastructure | N/A |
| Equipment / Hardware | N/A |
| Software | The MaaS ecosystem expects to develop a platform with a set of mobility solutions to integrate collective transport with other related services. Specific apps need to be developed for the services which must be integrable "end to end" to future MaaS platforms. |
| Data | All the transport real-time data must be provided to Roma Capitale. The sharing operators will provide dynamic, real-time data on the status of vehicle use and location. Data on the status of the service level of the road network in real time must be available. Data on fares (PT, sharing, taxi etc) |
| Permits / Tenders | N/A |
| External support | The measure is managed with internal resources. |
| Legal | GDPR issues especially concerning users' geo-localisation. |
| Security / Safety | N/A |
| Social / Cultural / Political | It is necessary to engage users for a test phase running in 2023 to both gain feedback on the functionalities and to understand the users' acceptance and how to trigger the MaaS. The launch will be accompanied by a specific communication campaign. The local authority must: protect the needs of citizens and define guidelines for social inclusion; ➤ Support the principles of fair competition delivered by all mobility operators; ➤ Support the principles of fair competition delivered by all mobility operators; ➤ Support the principles of fair competition delivered by all mobility operators. |
| Functionalities | 7 transport modes, 22 operators, identification of clusters of users for the incentives, platform open to integration with the MaaS4Italy platform. |



ROM_07: Use of advanced technology to increase the efficiency and reliability of PT

| | |
|-------------------------------------|--|
| Infrastructure | No specific infrastructure are expected. |
| Equipment / Hardware | Dedicated hardware for the regulation and control of traffic is needed to enhance the capacity of the MMC (Mobility Management Centre) . |
| Software | Dedicated software for the regulation and control of traffic is needed to enhance the capacity of the MMC (Mobility Management Centre). |
| Data | Data from more than 30 types of ITS systems are integrated in a Big Data platform in the renewed MMC to allow a more efficient elaboration of the traffic in real time. |
| Permits / Tenders | NA |
| External support | An external support for the optimal systems integration and support in the definition of the technological requirements accompanies the implementation. |
| Legal | NA |
| Security / Safety | NA |
| Social /Cultural / Political | NA |
| Functionalities | This measure is focused on integration, to establish a dynamic and predictive picture of the state of the road system. This information is used both to control the implementation subsystems (e.g., UTC, PMV, LTZ) and to feed info mobility services for the delivery toward users of traffic and public transport information services. |

ROM_08: (Re)Designing the urban space to promote active travel modes, PT and environmental “30 zones”

| | |
|-----------------------------|--|
| Infrastructure | <p>The measure is focused on reorganisation and safety of the road network and pedestrianisation and redevelopment of specific areas.</p> <p>The actions to be carried out, already underway, concern:</p> <ul style="list-style-type: none"> • reduction of motorized traffic with the remodeling of spaces dedicated to cyclists and pedestrians • Interventions to reduce the speed of motorized vehicles, also through "traffic calming" interventions, through the creation of "Limited Speed Zones" or "Zone 30", where the maximum speed allowed is 30 km/h • identification of spaces and pedestrian paths to be made continuous and safe • creation of new pedestrian areas • furnishing and equipping of pedestrian areas and paths <p>The infrastructures involved are different, according to the specific intervention (PT lanes, kerbsides, sidewalks, etc)</p> |
| Equipment / Hardware | <p>This measure does not require the use of hardware equipment</p> |
| Software | <p>The technical offices mainly use design software (autocad, civil 3D), Geographical Information System (maptitude), traffic simulation software (Vissim)</p> |
| Data | <p>Geometrical characteristics of the road network, pedestrian spaces and pavements, distribution of points of attraction such as schools, squares, offices, traffic flows etc.</p> |
| Permits / Tenders | <p>The implementation of this measure requires the launch of a tendering procedure or the application for permits. The call for tenders will be launched in mid-2024, end-2024.</p> |
| External support | <p>Transport engineers and planners; architects; CAD (Computer Aided Design) expert</p> |
| Legal | <p>TBC</p> |
| Security / Safety | <p>These issues need to accomplish any security or safety requirements, in terms of geometrical characteristics of intervention in favouring of pedestrians and vulnerable users.</p> |



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|---|---|
| Social /Cultural / Political | The main aspect concerns the inclusion and integration of people, increasing the sharing of common spaces and sociability, despite initial resistance to change |
| Functionalities | Improving road safety standards and accessibility for all road users. |

ROM_09: To create incentive packages to support multimodality

| | |
|-------------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | NA |
| Data | The measure requires updated data on the employees' travel behaviour provided by the companies' mobility managers. |
| Permits / Tenders | NA |
| External support | NA |
| Legal | NA |
| Security / Safety | NA |
| Social /Cultural / Political | The objective of this measure is to guide travel behaviour and to build a mobility offer in which local public transport is the preferred transport solution. This is done by stimulating the network of the local mobility managers active in institutions, companies, schools, in promoting sustainable mobility behaviours in their organisations. |
| Functionalities | This measure may take advantage of the functionalities of the new MaaS, as a tool to support individual travel choices. |

3. ÎLE DE FRANCE (LIVING LAB)



IDF_01: Participative governance framework for the update of the regional SUMP

| | |
|------------------------------|---|
| Infrastructure | Venues for meetings or working seminar |
| Equipment / Hardware | NA |
| Software | Teams will be used as a SharePoint and as a dialogue space |
| Data | Need for data on the SUMP agenda and transport authority plannings to organise exchanges at the right moment in order to have the largest impact on the SUMP revision |
| Permits / Tenders | NA |
| External support | For this measure, we will need external support from relevant institutions and partners in order to target and organize dialogues and meetings according to VGP's needs. It implies to strengthen and broaden our network and to put to work our already existing bonds with institutional partners and private ones. |
| Legal | Legal revision of the SUMP by the transport authority (IDFM) |
| Security / Safety | NA |
| Social /Cultural / Political | This measure is strongly reliant on political agendas. In order to implement UPPER measures in the Regional SUMP, we will have to compose with political schedules (schedule of the SUMP for example), but also with political agendas which are implying many moving pieces, especially in IDF. |
| Functionalities | NA |

IDF_02: Setting-up of a dynamic Digital Twin of the territory

| | |
|--------------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | To generate simulation, we use the open-source agent-based model MATSim. |
| Data | <p>The current version of Digital twin needs to be updated and calibrate by integrating recent data such as:</p> <ul style="list-style-type: none"> • The last Household travel survey EGT 2018, • Road count data • Public transit data • Registration (licence) plate survey data • Infrastructure data (BDTOPO, OSM) • Other static data |
| Permits / Tenders | NA |
| External support | <p>IFP Energies Nouvelles oversees the technical development of the digital twin.</p> <p>The following stakeholders will be required for the implementation of this measure:</p> <ul style="list-style-type: none"> - Versailles Grand Parc: Decision maker. - RedLab: In charge of the integration of the output of the digital twin in the mobility observatory. - IFP Energies Nouvelles: In charge of the technical development of the digital twin. - IPR: Can provide specific static data and maps on the territory. - Ile de France Mobilité (PTO on the region): Provide public transport flow measurement. - Other transport operators: All these transport operators can also provide data for mapping the citizens mobility patterns. |
| Legal | Partnership agreements among VGP, IdFM and IFP Energies Nouvelles for the data sharing |
| Security / Safety | NA |
| Social / Cultural / Political | NA |
| Functionalities | <p>This digital twin will allow to obtain a more complete observation of mobility on the territory with the PT interactions with the other mobilities. It will offer the following functionalities:</p> <ul style="list-style-type: none"> • Simulation of the current mobility (traffic flow, use of PT). • Simulation of prospective scenarios as specified in the IDF_03 (e.g., low emission zones). • Computation of non-measured information (carbon footprint and local emissions, ...) |

IDF_03: Impact evaluation and future design of low emission zones and restricted traffic zones

| | |
|------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | To generate simulation, we use the open-source agent-based model MATSim. |
| Data | <p>Assessing the impact of the LEZ requires the use of the following data:</p> <ul style="list-style-type: none"> • Same data used by the IDF_02 to tune the nominal agent-based model • Low emission zone (LEZ/ZFE) survey data • Technological composition of Ile de France vehicle fleet • Different strategies for applying the LEZ (perimeter, time, categories of person, etc.) • Simulation output data such as vehicles emissions, travel times, traffic congestion |
| Permits / Tenders | NA |
| External support | <p>IFP Energies Nouvelles (IFPEN) oversees the development of the digital twin (IDF_02) needing to evaluate the impact of LEZ different scenarios. IFPEN will also carry out the simulations of the restriction measures (LEZ) and the analysis of the results.</p> <p>The following stakeholders will be required for the implementation of this measure:</p> <ul style="list-style-type: none"> - Versailles Grand Parc: Decision maker which define the different prospective scenarios. - IFP Energies Nouvelles: In charge of realisation of the simulation. - MGP (Métropole du Grand Paris): Can support to develop access restriction scenarios. - Ile de France Mobilité (PTO on the region) : Provide public transport flow measurement. - Other transport operators: All these transport operators can also provide data for mapping the citizens mobility patterns. |
| Legal | NA |
| Security / Safety | NA |
| Social /Cultural / Political | We'll have to consider the social impacts when assessing the implementation of the LEZ, as the budget for renewing a new vehicle is not possible for part of the population (risk of social segregation). |
| Functionalities | <p>In collaboration with VGP, here are the functionalities to be accomplished:</p> <ul style="list-style-type: none"> • Simulation (through the digital twin) of the different strategies for applying the LEZ (perimeter, time, categories of person, etc.) • Evaluation of the impact of the different measures on the behaviour of people who are no longer able to use their vehicles (vehicle replacement, modal shift, change of route, etc.) and the traffic (carbon footprint and local emissions, ...) and the use of public transit (fleet and schedule assessment) • Socio-economic assessment helping to determine the financial assistance to be allocated to inhabitants by identifying the categories of the population most likely to be negatively impacted by vehicle restrictions. |

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


| | |
|------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | <p>The goal is to develop a multimodal network, where the Mobility Service Provider TIER will be integrated (and potentially further MSP in the future), and to develop an SDK (Software Development Kit) of this network which is meant to be integrated to the MaaS app – which will have access to all available MSP integrated in the network.</p> <p>Regarding the gamified incentive system, an SDK provided by the technology provider is to be integrated into the MaaS app developed by Instant System.</p> |
| Data | <p>This measure would require the collection of external data flow from the MSP TIER, through an API/SDK or webservice that they would provide: vehicles availability, localisation, battery level (...); and process data such as payment, unlocking, account management, customer service...</p> |
| Permits / Tenders | NA |
| External support | <p>A connector is to be developed/delivered by the MSP TIER. Some data storage will probably have to be externalised.</p> |
| Legal | <ul style="list-style-type: none"> - Commercial contracts to elaborate and close (e.g. between Instant System and the MSP TIER). - Partnership agreement (such as MoU) to elaborate and close with IDFM. |
| Security / Safety | NA |
| Social /Cultural / Political | NA |
| Functionalities | <p>(if an agreement is reached with IDFM):</p> <ul style="list-style-type: none"> - The possibility to unlock and pay e-scooters TIER in the IDFM app via the connection to the developed network. - Dashboard of the transport modes history of the users, and sending of suggestions to reduce their environmental impact and push them to decarbonated mobility modes. |



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

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|-------------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | Use of the MaaS app dedicated to JOP (Jeux Olympiques et Paralympiques), developed by Instant System. |
| Data | Collection of use data, requiring the authorisation of IDFM. Collection of data flow provided by the technology provider of the accessibility feature (to be defined). Collection of data from the mobility service providers supporting access to Olympic Game sites to enable integration in the MaaS app. |
| Permits / Tenders | NA |
| External support | Development of a connector (API/SDK/webservice) by the accessibility technology provider (to be defined) |
| Legal | Partnership agreement to be closed with IDFM. Commercial agreement with the accessibility technology provider (to be defined). |
| Security / Safety | NA |
| Social /Cultural / Political | Promote the use of the JOP dedicated MaaS app/the IdFM MaaS app. |
| Functionalities | A feature enabling PT accessibility to persons with disabilities (such DRT, PT infrastructure detection system, or accessibility of the application – depending on the requirements that will be defined) is to be integrated in the MaaS app, depending on the pilot test results. The MaaS app must provide convenient access to information on available transport options around JOP sites and the possibility to book and pay for these services. |

IDF_06 : Advanced technology to optimize the PT offer in line with user's needs

| | |
|-----------------------------|---|
| Infrastructure | N/A |
| Equipment / Hardware | <p>Requires an IT infrastructure to host the Observatory platform. It physically represents servers and storage to host data and applications.</p> <p>Minimum requirements :</p> <ul style="list-style-type: none"> • Servers: 2 servers with 4 CPU 32 GO RAM • Storage : 500GB estimated (based on data retention and volume) |
| Software | <p>Minimum requirements :</p> <ul style="list-style-type: none"> • Linux OS with Docker embedded. • All developments are made are under GNU Licence using open source technology and frameworks. |
| Data | <p>Collecting, processing and storing data in real time. Various sources may apply :</p> <ul style="list-style-type: none"> • Air quality sensors • Waze alerts and Jams • Cameras with AI capabilities to classify assets • Bikes circulation and cycling routes definitions • Public transports lines and usage • Garbage collector • Weather and forecast • Lights and energy consumptions • ... |
| Permits / Tenders | N/A |
| External support | <p>The Observatory platform will provide multiple KPIs and dashboards based on various data sources. The platform will be based on layers so as to be implemented in IDF and easily replicated in other cities.</p>  <p>Knowledges to feed the "RAW DATA" layer are necessary based on the local sources of the city. Data engineer and/or software developers can be required based on available data sources.</p> |
| Legal | No personal data processed. Compliant to GDPR |
| Security / Safety | N/A |



| | |
|-------------------------------------|---|
| <p>Social /Cultural / Political</p> | <p>N/A</p> |
| <p>Functionalities</p> | <p>List of functionalities below is described considering Waze data source to analyse traffic jam and alerts. It can be applied for any other data source (Bikes circulation, public transports usage, weather, Energy consumption, ...)</p> <p>Define SAS data model (SAS is a storage for raw before processing and computing to final data model), agnostic from existing source, where data will be saved and synchronized. <i>Ex: Create data model for traffic jam (size, type, location...) and traffic alerts (type, location...)</i></p> <p>Create data workflows to process data from the SAS to the reporting database and perform data transformations based on business rules <i>Ex: Aggregate data by city, or district based on their GPS coordinates.</i></p> <p>Create a widget to display (KPI, maps, charts...) on a dashboard based on reporting data source. <i>Ex: A map displays traffic jam and traffic alerts on your location</i></p> <p>Let users customize their dashboards based on a catalog of multiple pre-built widgets and allow users to view dashboard updated in real time based on real time data and update it constantly based on each widget frequency. <i>Ex: Traffic updated each 10 mins, public transport usage updated every 15 mins, ...</i></p> <p>Let users get back in past on a specific date and time and “replay” the action as if they were looking at the dashboard at this moment, viewing the impact of a data over all other data sources. Possible to increase speed to fast forward the time. <i>Ex: Measure the impact of an event across all mobility sources (bikes, jam, pollution, scooter, ...) to take actions to improve it for future events.</i> <i>Ex: Count and follow bikes on a specific location to take action so as to create bike path where it’s actually really useful based on real information.</i></p> |

IDF_07: To incentivise the use of Public Transport for commuters

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|-------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | Use of the MaaS app for professionals (EMY) developed by Instant System (already existing), and configuration for the participating companies. The app will be used by the companies and their employees. |
| Data | Will be collected: <ul style="list-style-type: none"> - Specific data on the participation to their mobility plan, for the app configuration and the compliance of the users with their companies' policies. - Personal data of the employee users, in accordance with GDPR requirements. - Use data of EMY app. |
| Permits / Tenders | NA |
| External support | Support of VGP to identify and connect Instant System with relevant companies. |
| Legal | Partnership/commercial agreements to be closed between the participating companies and Instant System. |
| Security / Safety | NA |
| Social /Cultural / Political | The participating company must have (or wish to develop) an internal sustainable mobility plan. Favourable legal context: the French law "LOM" obliges companies to have a mobility plan. The carbon footprint must also report on the employees' trips. Companies are obliged to address the "Forfait de Mobilité Durable" (FMD) at the agenda of the labour relations (the state enables companies to grant their employees with an allowance to be used for sustainable mobility expenses). |
| Functionalities | EMY app allows companies to implement their mobility policy, in particular their management of mobility credit and "forfait de mobilité durable" (sustainable mobility credits). It offers a mobility app to the employees, to plan their trips from home to work, but also a payment solution to spend the mobility credits given by the company, by the mean of a virtual credit card, usable to any mobility providers. The employee can also manually declare their mobility expenses, for example the kilometres made by bicycle. The companies can manage the data collected for administration needs, KPI assessment and reporting use, thanks to the administration interface. |

IDF_08: Improve public perception of PT

| | |
|--------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | Access to LimeSurvey which will provide an online survey software with results analysis capacities |
| Data | As the measure 08 is based on a survey, we will collect data during the development phase and process it during the implementation phase. In order to collect the data we will need a GDPR compliant panel and an online survey, completed by on field surveys. To process the data we will only need an access to Excel. The data will be stocked on our servers and protected. |
| Permits / Tenders | NA |
| External support | Support from VGP, support from IDFM, and support from the transport services providers. Support from Collectif mobilité (group of 40 transport private and public actors in Ile-de-France Region led by the company Inov360) for the respondents panel constitution. |
| Legal | The measure 08 is a survey that involves multiple sources and panels. It will need to be GDPR compliant. |
| Security / Safety | NA |
| Social / Cultural / Political | When carrying out the surveys, equity (gender, age, disabilities...) in the target groups addressed should be ensured. |
| Functionalities | NA |



4. OSLO (LIVING LAB)



OSL_02: Consistent visual identity for PT and mobility hubs

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|-------------------------------------|---|
| Infrastructure | The implementation of this measure does not require additional infrastructure compared with what is already existing at hubs. We do hope, however, to do some testing on the hubs developed in the MOVE21 project. The testing could for instance include use of mock up signage and temporary wayfinding – so no actual interventions of the hubs’ infrastructure. |
| Equipment / Hardware | Possibly useful to develop mock ups (or potentially actual signage) when testing the hubs’ new visual profile. In that case, there could be a need for some equipment/signs to convey way finding etc. |
| Software | We will solely be using own software when expanding our visual profile to include that of mobility hubs. When it comes to extending the visual profile to digital elements for use in the app/on screens, we also rely on own software and interfaces. |
| Data | This measure will make use of a test group to evaluate and give input on the development of visual design elements. The test group will consist of citizens and users of public transport services. |
| Permits / Tenders | All operators or services that are included in the measure would have a permit or licence to operate in the area already. |
| External support | Only internal Ruter departments/resources are required to implement this measure. |
| Legal | No legal requirements are relevant in the development of our visual identity. We must, however, follow road sign regulations set by NPRA when setting up signage on public grounds. |
| Security / Safety | N/A. |
| Social /Cultural / Political | The new, extended visual profile should follow common principles of universal design, so that it can be understood and used by all - regardless of any disability. |
| Functionalities | Ensure compliance with Ruter's existing design rules when it comes to operational customer information. |

OSL_03: Improve use and accessibility of public transport in conjunction with alternative mobility to reduce private car ownership

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|--------------------------------------|--|
| Infrastructure | The implementation of this measure may require physical interventions in the infrastructure. (We are primarily considering minor interventions in the infrastructure, such as signage, marking and possible more. It has not been decided yet, an FFM analysis of the stretch must be conducted first as part of the measure. It's also possible that analysis concludes that there is no need for physical interventions.) |
| Equipment / Hardware | N/A |
| Software | The FFM model is not based on any kind of software. It is more of a working model. There is currently no technological model. Furthermore, the intention is not to develop a digital platform for model at this point in time. |
| Data | This initiative will require data such as travel time, stop time, and possible more. (To effectively utilize the model, we will need access to various datasets (to be decided in the 'insight' phase). Data will not be fed into the model but will serve as a foundation for making informed decisions when applying the model. Other potentially relevant data includes the number of businesses along the street, pedestrian counts, bicycle counts and more. This has not yet been confirmed.) |
| Permits / Tenders | If there are to be physical interventions, it must be assessed whether permits are required. This is something that cannot be determined at this time, as the extent of physical interventions is unknown. |
| External support | Mainly internal resources. |
| Legal | There might be a need for legal assessments when implementing the FFM model in reality. |
| Security / Safety | It is essential to maintain a proper focus on security and safety when conducting fieldwork. Uncertain about the extent to which this will be important for this initiative. |
| Social / Cultural / Political | To be discussed in the 'insight' phase. |
| Functionalities | FFM |

OSL_04: Reduce dependency on car ownership

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|--------------------------------------|--|
| Infrastructure | No physical infrastructure required to implement the measure, but some infrastructure might be needed to pilot (space for services). Operators, housing associations etc. will need to make suitable space available. |
| Equipment / Hardware | N/A. |
| Software | Ruter's platform for onboarding companies and employees (RuterBedrift) needs to be modified, which is part of the scope of the measure. This platform should also be updated so that it is compatible with Ruter's newly released multi-modal app. This is not part of the scope of this measure, and not a definite requirement, but on Ruter's road map regardless |
| Data | The measure will collect data about residents in housing organizations and the services they want to use. If possible, also how often the services are used and their change in travel habits through customer surveys. |
| Permits / Tenders | Unclear if a tendering process is needed at the moment. Might be that all services are welcome to participate. It will however require quite a lot of business development and negotiations to agree on new pricing options. Timeline TBD. |
| External support | We need to cooperate with real estate owners like OBOS, USBL, and/or others. We need service suppliers/operators to be interested. |
| Legal | GDPR. Also, the measure wants to challenge local regulations on minimum number of private car parking per apartment in housing associations. |
| Security / Safety | Introducing new services open to the public in semi-private spaces like housing association might raise security concerns amongst residents. Learnings and business models from this pilot will also be considered in Ruter's B2B offering. |
| Social / Cultural / Political | Challenging the private car will always raise concerns and strong feelings amongst the affected population. |
| Functionalities | <ul style="list-style-type: none"> - RuterBedrift backend for housing associations. - RuterBedrift in the new Ruter app. - Cooperation agreement with OBOS/USBL - Agreement between Ruter, OBOS/USBL(?) and other service provider on how to bundle services. |

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

| | |
|-------------------------------------|---|
| Infrastructure | N/A. |
| Equipment / Hardware | Nice to have for piloting: - New vehicles which will be acquired for coming DRT-service (planned launch Q1 2024) - Autonomous vehicles through the ULTIMO project |
| Software | The service is meant to make use of Ruter's already existing software and digital interface. |
| Data | Data concerning user expectations and passenger experience will be collected through observations and dialogue with our particular user group. |
| Permits / Tenders | N/A. |
| External support | We plan to cooperate closely with the department of health, ageing and municipal services, as well as relevant city districts. |
| Legal | N/A. |
| Security / Safety | The target group's sense of safety is among the factors we wish to look into. It has more to do with the elderly's perceived state of feeling safe, rather than actual requirements. |
| Social /Cultural / Political | The measure is not conditioned by any political restrictions, but we're planning to investigate any social barriers that the target group might have. We expect that any attempts to change/merge the existing age friendly service will raise questions/concerns among the target group, given the immense popularity of the service. |
| Functionalities | Results from the serious game suggest that we (1) consider allowing for certain telephone bookings (to limit the risk of excluding users), and (2) allow for senior centres and institutions to book digitally on behalf of customers. |

OSL_06: More inclusive micromobility

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|-------------------------------------|--|
| Infrastructure | N/A. |
| Equipment / Hardware | Nice to have: Vehicles for piloting, but Ruter or other Oslo partners will not be the owner of these. We will need to do a RFI before we make a tender. We are planning to pilot vehicles that the users will subscribe to on a monthly basis/and or lease, and therefore keep the vehicles at home. |
| Software | Not planned. Integration of the service in Ruter's app is not included in the measure but will be considered if the pilot is considered a scalable success. |
| Data | The measure plans to follow a group of users to monitor change in travel habits. |
| Permits / Tenders | Will most likely require tendering process. Requirements for suppliers to be decided asap. A request for information will help to define the requirements in the tender. Tendering process finalized within cycling season 24, preferably within Feb. |
| External support | Need partner willing to share insights. |
| Legal | GDPR. Regulation for rental of small electric vehicles. Vehicle requirements (e-scooters and ebikes) |
| Security / Safety | N/A. Through a request for information we can ask the suppliers to give feedback on what kind of security measures they offer they users (for instance free service, insurance, winter tires and so on). This will help us to define what kind of requirements we can have in a tender. For micromobility services, security measures need also to be initiated by the user and owners of the infrastructure. For instance the users need to buy the helmet themselves, and the public should provide infrastructure like bike lanes. |
| Social /Cultural / Political | Measure itself is addressing the challenge that e-scooters are mainly used by youth / young adults, mostly men. We want to target other user groups, with an extra focus on replacing car trips. |
| Functionalities | Cooperation agreement with bike subscription service. |

OSL_07: Pilot V2X to prioritize public transport

| | |
|------------------------------|---|
| Infrastructure | Physical and digital infrastructure for national public roads will be used in the measure. |
| Equipment / Hardware | Edeva equipment and hardware will be used. Edeva - Smart City Solutions |
| Software | Edeva software will be used. Edeva - Smart City Solutions |
| Data | Traffic data as speed, flow, environment, vibration |
| Permits / Tenders | Permits are in house of NPRA. Tenders are ongoing. |
| External support | Edeva, Viken area municipality, Oslo municipality, Ruter, BaneNor |
| Legal | GDPR. |
| Security / Safety | Introducing new services open to the public can be in need of dialog. |
| Social /Cultural / Political | Challenging the private car will always raise concerns and strong feelings amongst the affected population. |
| Functionalities | N/A |

OSL_08: Digital visualisation of services which induce sustainable modes of transport

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|--------------------------------------|--|
| Infrastructure | As part of the integration of bike-lockers in Ruter's multi-modal app, we will also investigate the possibility of adding secure bike parking to public transportation hubs, where space is in short supply. |
| Equipment / Hardware | N/A. |
| Software | An important activity in this measure is software development. Integration of bike lockers requires two-way communications between operator and Ruter. App switch for car sharing will require that Ruter integrates with Entur and/or car sharing operators. |
| Data | This measure will collect data which indicates how much the newly integrated modes are used, in order to evaluate how successful it is. The measure will most likely not need access to users, as Ruter wants users to be registered in our own app. |
| Permits / Tenders | Unclear if a tendering process is needed at the moment. Not many service providers out there. Timeline TBD. |
| External support | Integration partners. Prioritization from Ruter's own developers and designers. |
| Legal | GDPR. |
| Security / Safety | N/A. |
| Social / Cultural / Political | Universal design principles in app design. |
| Functionalities | <ul style="list-style-type: none"> - Standardized API between bike locker providers and the Ruter app. Integration between bike lockers and Ruter app, incl. lock/unlock. - Step by step to-do-list for car sharing providers for their services to be displayed in the Ruter app (app switch for services). - UX design of new services. |

5. MANNHEIM (LIVING LAB)



MAN_01: Establish participative governance and dialogue formats to address the citizens with a focus on the (special) needs of user groups

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|-------------------------------------|--|
| Infrastructure | For the testing of a modular and location-independent mobility advisory service, mobility stands are needed, e.g., using an ono-bike as mobile information counter. |
| Equipment / Hardware | Within this measure the production of information materials (conceptual design, Flyers, online Ads, Posters, or alike) will be required. |
| Software | Data collected through e.g., survey, interviews or dialogue formats will be analysed with standard MS Office tools. |
| Data | (Qualitative) Data collection of mobility needs of relevant target groups, e.g., through different dialogue formats, surveys and use cases. |
| Permits / Tenders | A tendering process to purchase material will be prepared in 2024, for the production of information material and procurement of external support for e.g., the dialogue formats, surveys and use cases. |
| External support | A tendering process to procure external support for e.g., to conduct different dialogue formats and surveys will be prepared in 2024. |
| Legal | NA |
| Security / Safety | NA |
| Social /Cultural / Political | Data collection, e.g. through different dialogue formats, surveys and use cases, should be inclusive of all users, with a special section focusing on the needs of vulnerable target groups. |
| Functionalities | The aim of the measure is to provide a location-independent mobility advisory service. |



MAN_02: Campaigning for sustainable forms of transport, such as PT, walking and cycling. Establishing a PT culture with PT as a green, safe, inclusive, and social space

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|-------------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | The new landing page will be created using the TYPO3 content management system and Adobe Creative Suite software, both of which are already in use at rnv. |
| Data | The existing tracker tools and dashboards are used to collect the number of views/interactions generated throughout the campaign on social media and the landing page to report the measurement KPIs. |
| Permits / Tenders | NA |
| External support | NA |
| Legal | NA |
| Security / Safety | NA |
| Social /Cultural / Political | The campaign focuses on reaching all user groups, with an emphasis on raising awareness of the issue among the younger generations. |
| Functionalities | NA |



MAN_03: Data-driven platform for supporting PT planning and operations based on the concept of Mobility as a Right

| | |
|-------------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | rnv uses secure on-premises data centres to host its software systems. In addition, rnv uses a Microsoft Azure cloud environment. |
| Software | rnv is building its data strategy partly on the Microsoft Azure cloud environment, taking advantage of the micro-services available and the ease of scalability. |
| Data | As part of this measure, rnv will improve the quality of existing data and use available data to improve operations and planning. Relevant data will include, for example, automatic passenger count data, PT schedule data and live data. |
| Permits / Tenders | NA |
| External support | NA |
| Legal | Within this measure, only internal rnv data will be used. |
| Security / Safety | It is important to ensure that data is not falsified, as mobility is a fundamental right for all citizens. Identifying responsible and accountable data owners will ensure that all relevant criteria are met. |
| Social /Cultural / Political | A social requirement is that the gender gap in mobility is highlighted in the data analysis, in order to identify gender gaps in data collection. |
| Functionalities | <p>Within this measure the minimum four different use-cases will be implemented, each featuring a function for the specific use-case:</p> <ul style="list-style-type: none"> - three basic statistics use-cases (e.g., dashboard for specific use-case) - one complex machine-learning use-case (e.g., predictive demand) |

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

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|----------------------|---|
| Infrastructure | 4.2. Greening of PT infrastructure: Within this sub-measure, greening, shading (to reduce direct sunlight and heat in the summer and the un-sealing of formerly paved areas to cope with heavy rainfall will be implemented on PT infrastructure. Also, insights from the UPPER serious game such as: easy pedestrian accessibility and weather-proof stands etc. will be incorporated into the implementation of this measure. |
| Equipment / Hardware | 4.1. Piloting digitalized PT-stop: This sub-measure will integrate digital interfaces, such as a large touch display, into the pilot PT-stop. This will require the hardware to interact with the software and back-end systems, and to meet legal and other requirements for use in public outdoor environments. 4.2. Greening of PT infrastructure: Within this sub-measure, plants and planting gear will be procured and planted. |
| Software | 4.1. Piloting digitalized PT-stop: Within this sub-measure, a software backend system will be implemented, to provide the services to the frontend at the PT stop. |
| Data | 4.1. To implement additional digital services at PT stops, the digital interface will need to use relevant data such as PT timetable and real-time data, PT journey planner and map-based information on nearby services. In addition, lessons learned from the UPPER serious game, such as feedback on the positioning of (digital) information stands and signage at PT stops, etc., will be incorporated into the implementation of this measure. 4.2. Collecting the number of climate-resilience measures implemented at PT-stops and PT-infrastructure. |
| Permits / Tenders | 4.1. Piloting digitalized PT-stop: For the implementation of the digital interfaces into the pilot PT-stop, regular permits from local authorities will be required. Furthermore, the backend system/ software will be procured through a tender process, launching in 2024. 4.2. Greening of PT infrastructure: For the implementation of this sub-measure external support and equipment will be procured through a tender process, launching in 2024. |
| External support | 4.1. Piloting digitalized PT-stop: For this sub-measure external support (electric wiring in public space, set-up of baseplate for digital terminal [device not included here]) for the implementation of the backend system/ software will be required. 4.2. Greening of PT infrastructure: This sub-measure will require external support for the implementation of the greening of PT infrastructure, such as the installation of plant climbing aids, preparation of plant beds, planting of plants, etc., which will be procured through a tendering process to be launched in 2024. |
| Legal | 4.2. Greening of PT infrastructure: As this sub-measure will be working on PT infrastructure, there are technical and legal requirements regarding the safety and stability of rail operations and infrastructure, e.g., the provisions of the PBefG and the AEG; BOStrab/ESBO and rnv-Ril 1.1.101 LRP NA. All work must be carried out in accordance with DA-2022-003-IS-V1. |
| Security / Safety | 4.2. Greening of PT infrastructure: As this sub-measure will be working on PT infrastructure, there are technical and legal requirements regarding the safety and stability of operations, e.g., the provisions of the PBefG and the AEG; BOStrab/ESBO and rnv-Ril 1.1.101 LRP NA. All work must be carried out in accordance with DA-2022-003-IS-V1. 4.3. Platform building standard: <ul style="list-style-type: none"> - PT platforms must fulfil technical and legal requirements regarding the safety and stability of operations. - Also, PT stops must ensure security and the sense of security for all passengers and users in cooperation with local authorities and police. |



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| <p>Social /Cultural / Political</p> | <p>NA</p> |
| <p>Functionalities</p> | <p>4.1. Piloting digitalized PT-stop: Within this sub-measure, new digital functionalities/ services such as PT timetable and PT real-time information, PT journey planner, map-based information on nearby services, etc. will be implemented at the PT stop.</p> |

MAN_05: Modernize and increase the attractiveness of digital sales channels

| | |
|-------------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | The hardware (e.g. servers, etc.) required for this measure is already in place. rnv has modernised its IT sales systems in recent years using VDV standards. Ticket vending machines as well as mobile and web-based ticket sales channels have been modernised. All applications run in secure, on-site data centres, which will also be used for the introduction of the VDV-KA validity check system. |
| Software | The measure includes the use of existing software (such distribution or accounting system, etc.) as well as the implementation of the new electronic fare management (EFM)-feature/ software within this environment. This kind of software is available as off-the-shelf standard by different software companies in the market and will be procured. EFM software allows for passenger control, as well as the sale of tickets, the management of smart cards and advanced ticketing solutions. |
| Data | The measure includes the connection to the Germany-wide D-ticket database to check the validity of tickets according to the VDV-KA standard and to ensure a seamless customer experience. |
| Permits / Tenders | For the implementation of this measure, a software provider as well as an implementation partner will be identified through procurement process, starting in 2024. The cost of this procurement is not part of the UPPER project or Measure_05. |
| External support | As mentioned above, external support for the technical implementation will be required, but the related costs are not part of the UPPER project or Measure_05. |
| Legal | NA |
| Security / Safety | This measure is based on the VDV-KA standard, featuring chip cards and smartphone applications as user media, with secure keys and certificates to prevent fraud and secure ticket inspection process for all D-tickets, regardless of its origin. |
| Social /Cultural / Political | NA |
| Functionalities | The measure will implement the backend functionality to securely inspect and process D-tickets, ensuring interoperability for tickets regardless of their origin. |

MAN_06: Defining concepts and test instruments to improve mobility in peri-urban areas for different user groups

| | |
|-------------------------------------|--|
| Infrastructure | This measure will potentially generate requirements for MAN_07: Mobility Hubs, and as such may require changes to infrastructure. This could be a consequence of this measure and is therefore not included in the measure itself. |
| Equipment / Hardware | NA |
| Software | The measure requires the use of existing software such as PT-Visum and Remix, both already in use within rnv. |
| Data | The use of software such as PT-Visum and Remix involves complex traffic flow models and additional socio-economic, geographical and other data. rnv has established these models and relevant data (collection), which will be used. However, no additional data will be collected as part of this action. |
| Permits / Tenders | NA |
| External support | NA |
| Legal | As PT is organised along administrative boundaries, the city or district is primarily responsible for local PT. While most aspects of this measure will only concern the city of Mannheim, concepts for services across administrative borders together with neighbouring cities and districts will also be presented and discussed within this measure. |
| Security / Safety | NA |
| Social /Cultural / Political | The implementation of the concept developed in this measure will be supported by raising awareness and improving the perception of PT through rnv's marketing and communication activities, as presented in MAN_02. |
| Functionalities | NA |



MAN_07: Create a network of mobility hubs in cooperation with the regional transport association, open for multi mobility providers

| | |
|-------------------------------------|---|
| Infrastructure | Depending on the details of the design and operational concept of the mobility hubs, which are expected to be in place by the end of 2024, changes to the existing infrastructure, such as the addition of parking facilities for different (shared) mobility options, will be necessary. |
| Equipment / Hardware | Depending on the details of the design and operational concept for mobility hubs, e.g., bike stands, signage or street furniture will be required. |
| Software | NA |
| Data | NA |
| Permits / Tenders | Significant changes to or construction of new PT stops/mobi-hubs regular permits from local authorities will be required. For the addition of bike stands, signage or street furniture, these products and the external support for their installation must be procured through a tendering process. |
| External support | External support will be required to install additional cycle racks, signage or street furniture. |
| Legal | As this measure will possibly affect operational PT infrastructure, there are technical and legal requirements regarding the safety and stability of rail operations and infrastructure, e.g., the provisions of the PBefG and the AEG; BOStrab/ESBO and rnv-Ril 1.1.101 LRP NA. All work must be carried out in accordance with DA-2022-003-IS-V1. |
| Security / Safety | The usual rnv safety precautions are required. |
| Social /Cultural / Political | As PT stops are located in public areas, the use of (additional) public space requires the approval of the relevant city authorities, such as the traffic department, planning department or parks department. |
| Functionalities | NA |

MAN_08: Redesign urban space and test alternatives of using it for social purposes

| | |
|-------------------------------------|---|
| Infrastructure | For this measure, changes to existing roads and urban spaces will be implemented. This can range from new road marking of parking spots over the reorganization of parking spaces to constructional changes. No additional, new infrastructure will be created through this measure. |
| Equipment / Hardware | NA |
| Software | NA |
| Data | For this measure, the collection of data on parking spaces in a district is needed, which is already in place. |
| Permits / Tenders | Substantial changes to street layouts will have to be approved by the city and/ or local council as well as the relevant local authorities based on the current law. |
| External support | Possibly a communications agency, road construction companies for construction work. |
| Legal | Parts of this measure stem from changed legal requirements on a state level for city authorities regarding the parking in public space. |
| Security / Safety | NA |
| Social /Cultural / Political | The realization of this measure implies changes that will have direct effects of Mannheim inhabitants, as the overall number of parking spaces will decrease. The issue of motorized individual mobility or cars do have a special sentiment among parts of the community as well as citizens in general. |
| Functionalities | NA |



6. LISBON (TWINNING SITE)

LIS_01: Restrict car access in the city

| | |
|--------------------------------------|---|
| Infrastructure | The road infrastructure will be modified in order to physically restrict car access, this will be done by increasing walkable areas around schools. Part of the infrastructure will be developed in collaboration with another project that Lisbon Municipality is involved in (BICI - Bloomberg Initiative for Cycling Infrastructure). In this context, traffic restriction pilots will be deployed in 4 different school areas. |
| Equipment / Hardware | There may be a need for hardware such as traffic signs, barriers. |
| Software | The implementation of this measure will require analysis software, namely: <ul style="list-style-type: none"> • GIS • AutoCAD • Microsoft Office |
| Data | This measure requires access to: <ul style="list-style-type: none"> • Municipality database regarding school mobility (Observatório da Mobilidade and Plataforma de Gestão Inteligente de Lisboa). The measure will also rely on existing data sources such as the 'Hands Up' Survey and road accident data collected by relevant programs. |
| Permits / Tenders | Here may be a need to launch a tendering process for the procurement of infrastructure elements such as barriers, signs, and other equipment. The timeline for tendering would depend on the Lisbon's procurement schedule. |
| External support | The implementation of this measure requires the collaboration and support of: <ul style="list-style-type: none"> • The education community. • The parish councils. |
| Legal | Legal framework: <ul style="list-style-type: none"> • National legal framework concerning project conception and construction • The implementation of this measure may need to comply with local traffic regulations and safety standards. |
| Security / Safety | Safety is a key consideration for this measure, as it aims to increase safety at school perimeters. The measure should ensure that traffic restrictions do not compromise emergency access or pose safety risks to pedestrians and cyclists. Adequate signage and enforcement measures are essential for safety. |
| Social / Cultural / Political | The implementation of this measure shall require: <ul style="list-style-type: none"> • Political approval. • Citizens' approval, the implementation of traffic restrictions may face resistance from some stakeholders, such as parents who are accustomed to using private cars to transport their children to school. Effective communication and engagement with the school community and citizens will be crucial to address social and political concerns. |
| Functionalities | NA |

LIS_02: Promote extend services and prioritise PT

| | |
|---|--|
| <p>Infrastructure</p> | <p>The measure does not have specific infrastructure requirements for design or implementation. However, as a result of the measure’s implementation and outcome analysis, it may provide recommendations regarding infrastructure changes, such as modifications to bus stops, road structures, or intersections.</p> |
| <p>Equipment / Hardware</p> | <p>The implementation of the measure requires the purchase of cameras to be installed on the buses. The cameras should be:</p> <ul style="list-style-type: none"> • apt for installation on the front of buses • apt for traffic surveillance • equipped/linked to a licence plate recognition software <p>These systems should be designed to prevent tampering or misuse.</p> |
| <p>Software</p> | <p>In complement to the cameras, this measure shall require a compatible camera feed processing and monitoring software that enables:</p> <ul style="list-style-type: none"> • automatic incident detection system • (near) real-time monitoring |
| <p>Data</p> | <p>The implementation of this measure shall require the collection and processing of private data, namely:</p> <ul style="list-style-type: none"> • Identification of vehicle licence plates • Anonymization of recorded persons <p>In addition, data will be collected regarding the traffic conditions and the performance of bus services. The information to be collected includes:</p> <ul style="list-style-type: none"> • The compilation of detected non-compliance instances in bus lanes • PT operational performance indicators (namely, commercial speeds and service delays) along the major corridors where the bus lanes are inserted |
| <p>Permits / Tenders</p> | <p>The implementation of this measure shall require:</p> <ul style="list-style-type: none"> • The tendering of technology providers. This process should be concluded during the first semester of 2024. <p>It will also be necessary to acquire permits for operating the system:</p> <ul style="list-style-type: none"> • Authorization for Public Space surveillance. • Authorization for application of fines. |
| <p>External support</p> | <p>Collaboration with service/equipment providers for camera installation and collaboration with the authorities for regulatory changes.</p> |
| <p>Legal</p> | <p>To legal framework must be reviewed to enable the implementation of the measure. This revision related to:</p> <ul style="list-style-type: none"> • The authorization for the recording of people and vehicles in Public spaces. • The acknowledgement of CARRIS’ authority to apply fines to transgressors. |
| <p>Security / Safety</p> | <p>Ensuring the security and safety of the camera-based enforcement mechanisms on buses and trams is crucial. These systems should be designed to prevent tampering or misuse.</p> |
| <p>Social / Cultural / Political</p> | <p>The implementation of this measure shall require the proper policy and social agreement conditions, namely:</p> <ul style="list-style-type: none"> • The political will to enable the system’s implementation and operation; • To a lesser degree, the citizens’ acknowledgement and acceptance of CARRIS’ authority to apply fines. |
| <p>Functionalities</p> | <p>NA</p> |

LIS_03: To improve the mobility planning

| | |
|--------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | This measure requires access to PTV Visum, for the analysis of the proposed scenarios and the simulation of alternative service network configurations. This measure also requires VIA REMIX to the adjustments of the bus offer plans of Carris Metropolitana. |
| Data | This measure requires: <ul style="list-style-type: none"> • Access the Municipality database; • Access to ANSR data collection regarding road fatalities • Access to the TML bus data base for the adjustments of the bus offer plans, including analysis of offer and demand real data of, at least, the previous year (as Carris Metropolitana services were only launched in 2022/23, there is no historical demand data) • The SUMP will require access to many data bases in the characterization and diagnosis phase |
| Permits / Tenders | This measure requires: <ul style="list-style-type: none"> • Public tender to be conducted in 2023, for acquiring consulting services for the development of the municipal SUMP; • Public tender to be conducted in 2023, for acquiring consulting services for the development of the metropolitan SUMP; |
| External support | This measure will require external support for the development of the metropolitan and municipal SUMPs, although this external support will not be co-financed in the scope of UPPER; |
| Legal | Legal framework: <ul style="list-style-type: none"> • National legal framework concerning public tenders. • Municipal and metropolitan legal framework. • National legal framework considering SUMP developments; |
| Security / Safety | NA |
| Social / Cultural / Political | The implementation of this measure shall require political approval at both municipal and metropolitan level. There is also the need for social approval in the case of SUMP – there will be public participation processes regarding these plans. |
| Functionalities | NA |

LIS_04: To improve PT offer, adapted to school students

| | |
|--------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | The measure mentions the use of PT on-board monitors for the "Amarelo" pilot project, but specific hardware requirements are not detailed. |
| Software | The implementation of this measure uses: <ul style="list-style-type: none"> • National platform for school registration, • Municipal platform for Navegante Escola card, • Lisbon Municipal website for "Amarelo" |
| Data | This measure requires: <ul style="list-style-type: none"> • Access the Municipality database regarding school mobility (Observatório da Mobilidade and Plataforma de Gestão Inteligente de Lisboa) • Gather information about PT use among students, registration for the "Amarelo" pilot project, and the issuance and validation of "Navegante Escola" PT cards. |
| Permits / Tenders | This measure requires: <ul style="list-style-type: none"> • Annual Service Acquisition to purchase the Navegante Escola Cards. • Public tender for acquiring consulting services to monitor and evaluate "Amarelo". |
| External support | This measure requires the collaboration and support of: <ul style="list-style-type: none"> • TML • Parish councils • School community • CARRIS |
| Legal | Legal framework: <ul style="list-style-type: none"> • Regulation (EU) 2016/679 - General Data Protection Regulation |
| Security / Safety | NA |
| Social / Cultural / Political | The implementation of this measure shall require: <ul style="list-style-type: none"> • Political approval. |
| Functionalities | NA |

LIS_05: To enhance multimodal interconnection with the peri-urban municipalities

| | |
|--------------------------------------|--|
| Infrastructure | <p>This development of this measure implies:</p> <ul style="list-style-type: none"> • Installation of new docks stations of bike sharing service. • Improvement of the existing bike lanes. |
| Equipment / Hardware | NA |
| Software | <p>This measure requires the use of:</p> <ul style="list-style-type: none"> • GIS • AutoCAD • Microsoft Office |
| Data | <p>This measure requires access to:</p> <ul style="list-style-type: none"> • EMEL (municipal company) database |
| Permits / Tenders | <p>This measure requires:</p> <ul style="list-style-type: none"> • Public tender to purchase the technical audit concerning existing bike lines. The tender has been finalised and the audit is currently being carried out. • Public tender to purchase new docks station of bike sharing systems (EMEL - municipal company). First phase of the expansion already contracted; new tender planned for the second phase. |
| External support | <p>This measure requires the collaboration of:</p> <ul style="list-style-type: none"> • EMEL |
| Legal | <p>Legal framework:</p> <ul style="list-style-type: none"> • National legal framework concerning public tenders. • National legal framework concerning project conception and construction. |
| Security / Safety | <p>Ensuring the safety and security of cyclists and bike-sharing users is key when planning and implementing cycling infrastructure improvements.</p> |
| Social / Cultural / Political | <p>The implementation of this measure shall require:</p> <ul style="list-style-type: none"> • Political approval. |
| Functionalities | NA |

LIS_06: To Improve the convenience and safety of PT interfaces

| | |
|-------------------------------------|--|
| Infrastructure | In the scope of this measure, some improvements in interfaces will be identified, and it is possible (and desirable) that some changes in the interface may be implemented. |
| Equipment / Hardware | In the scope of this measure, some improvements in interfaces will be identified, and it is possible (and desirable) that some equipment/hardware might be installed. |
| Software | NA |
| Data | TML Interface databases will be revisited, restructured and filled in with relevant data. Therefore, a study that includes characterization of interfaces at metropolitan level will be needed, including data relevant for disabled people accessibility. This databases data will then be used in this measure for the analysis and diagnosis of accessibility conditions, and proposal of solutions and improvement measures. The measure will probably require access to other data, namely data owned by other interfaces owners and managers, like Infraestruturas de Portugal, Metropolitano de Lisboa, etc. |
| Permits / Tenders | This measure might require tenders to the possible implementation of improvements in the interfaces. |
| External support | This measure will require external support for the study/diagnosis of the interfaces and proposal of measures, although this external support might not be co-financed in the scope of UPPER. |
| Legal | NA |
| Security / Safety | NA |
| Social /Cultural / Political | The implementation of this measure requires political approval at metropolitan level. There might also be needed social approval in the case of some implementations. |
| Functionalities | There might be identified new functionalities to be implemented to improve some interfaces/stations/stops. |

LIS_07: To create a new Multimodal Digital Mobility Service (MDMS)

| | |
|--------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | The development of this measure might result in the implementation of some MaaS features, that might need software for their development. |
| Data | MaaS is all about data, so the MaaS platforms or the features to be developed will use many different data: vehicle position, user registration, maps, etc. |
| Permits / Tenders | No tenders are expected, but there might be the need for some in the scope of the development of MaaS or MaaS features. |
| External support | No external support is expected at this moment, but it might happen that the development of MaaS or MaaS features need external expertise to be hired. |
| Legal | The EC is preparing a new regulation that will define rules for MDMS (and MaaS) platforms, and the development of MaaS or MaaS features will have to comply with it. |
| Security / Safety | NA |
| Social / Cultural / Political | The implementation of this measure shall require political approval at metropolitan level. |
| Functionalities | New functionalities will possibly be developed in the scope of this measure, but they are not defined yet. |



LIS_08: To implement campaigns and partnership initiatives

| | |
|------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | NA |
| Data | Data collection mainly involves gathering information on passengers' and citizens' perceptions of PT services, as well as mobility patterns in the city and metropolitan area. |
| Permits / Tenders | This measure requires: <ul style="list-style-type: none"> The tendering of external consultants for auxiliary studies. These processes will be performed in conjunction with the promoted campaigns, we estimate most of the tendering processes will take place in 2025 and 2026. |
| External support | The implementation of this measures requires the support of external consultants and companies to aid in: <ul style="list-style-type: none"> The conduction of Market Studies The operation of larger scale campaigns And, if found suitable during the measure implementation, the testing of novel communication and dissemination platforms |
| Legal | NA |
| Security / Safety | NA |
| Social /Cultural / Political | NA |
| Functionalities | NA |

LIS_09: To improve the integration of PT and active travel modes

| | |
|-------------------------------------|--|
| Infrastructure | The measure implies the installation or the improvement of bike parking facilities at PT stations, both for private and shared bicycles. |
| Equipment / Hardware | The measure will require the implementation of bicycle parking supporting equipment, such as bike boxes, systems to count the number of empty stalls (occupancy rate), maintenance tools and signalling. |
| Software | The measure implies the integration of Lisbon bike sharing tickets with PT tickets, so it might result in the need for proprietary software integration, but probably not, as a webservice might suffice to guarantee this integration. The bike parking equipment might require access control software and monitoring software. |
| Data | The integration of Lisbon bike sharing tickets with PT tickets requires the use of customer data. The bike parking equipment will generate equipment use data, such as real-time occupancy rates and usage data. |
| Permits / Tenders | This measure requires a public tender for the acquisition of bike parking equipment, something that will happen during 2024. |
| External support | This measure will imply stakeholder engagement (metropolitan municipalities, infrastructure owners, PT operators...) for the definition of PT interfaces hierarchy and for the discussion of bikeboxes installation, including cofinancing the infrastructure. |
| Legal | This measure needs to comply with the National legal framework concerning public tenders. Moreover, compliance with data protection regulations is also necessary due to data sharing. |
| Security / Safety | NA |
| Social /Cultural / Political | Both the installation of bike parking equipment and the integration of Lisbon bike sharing tickets with PT tickets need political approval. |
| Functionalities | The integration of Lisbon bike sharing tickets with PT tickets is a new functionality of the Lisbon ticketing system that needs to be accomplished in order to reach the objective |

LIS_10: To improve the quality and efficiency of the bus service

| | |
|-------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | This measure requires access to: <ul style="list-style-type: none"> PTV Visum, to simulate and test different scenarios of possible changes in operations. |
| Data | Data collection is needed for conducting passenger satisfaction surveys and analysing the results. This measure also involves sharing data on quality assessments in public transport. Data on the number of expected PT users the event will generate is needed to define the number of tickets to produce and its characteristics. Data on validations of each ticket is also needed to evaluate the measure. |
| Permits / Tenders | This measure requires: <ul style="list-style-type: none"> The tendering of external consultants for auxiliary studies. These processes will be performed in conjunction with the preparation of survey rounds, we estimate most of the tendering processes will take place in 2025 and 2026. |
| External support | The implementation of this measures requires the support of external consultants and companies to aid in: <ul style="list-style-type: none"> The conduction of Market Studies The conduction of Passenger Surveys |
| Legal | The surveys to be disseminated among passengers must strictly conform to the applicable GDPR regulations. |
| Security / Safety | NA |
| Social /Cultural / Political | NA |
| Functionalities | This measure shall require the development of new functionalities, namely: <ul style="list-style-type: none"> New ticket features and types (digital tickets for events), which need to be integrated with the multimodal ticketing system |



7. BUDAPEST (TWINNING SITE)



BUD_01: To improve the efficiency and convenience of PT service

| | |
|-------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | The BKK operates the Unified Transport Model (UTM) of Budapest, which is a macroscopic model for the city and its surroundings. The UTM is using a computer with high calculating capacity, but there is no need, to buy a new, because it was purchased in 2023 by the BKK. |
| Software | The UTM can be used by the PTV Visum software. |
| Data | The Model contains public transport services as well, but it is capable only for headway-based assignment. In this pilot the BKK will investigate the possible development solution of the model, which can strengthen the reliability of the model in the aspect of operational public transport planning. The development of the time-table based model needs more accurate data about the PT running times per daytime and data about the volume of the mobility needs hourly. Historical data, which is already available form the PT management system, will be used. A household survey is also necessary to update the parameters of the UTM, because it was updated before the Covid-19 pandemic. |
| Permits / Tenders | NA |
| External support | In the development process the BKK would like to collaborate with transport planner companies. They have knowledge in the macroscopic transport model development. Also it is necessary to work together with a company which has expertise in the household surveys. |
| Legal | The UTM is owned by the BKK. Only aggregated data will be used to comply with GDPR |
| Security / Safety | NA |
| Social /Cultural / Political | NA |
| Functionalities | New time-table based assignment algorithm |

BUD_02: To create new mobility packages of Multimodal Digital Mobility Services

| | |
|-------------------------------------|---|
| Infrastructure | N/A |
| Equipment / Hardware | N/A |
| Software | N/A |
| Data | User registration data (from PT customers that are registering for bonus (e.g. shared) transport service access after purchasing PT products – subject to a specific campaign). This can include: e-mail address (BKK does not necessarily collect personal data for this), transaction ID, date of the purchase (depending on the conditions of the specific campaign). Data sharing mechanisms between BKK and the other service providers need to be implemented. |
| Permits / Tenders | N/A |
| External support | BKK will have cooperation arrangements with other private transport providers for the planning and implementation of this measure and to perform the campaign(s). |
| Legal | GDPR requirements to be addressed when planning the collection of personal data during the campaign. BKK does not necessarily collect personal data for the registration of the bonus access. |
| Security / Safety | N/A |
| Social /Cultural / Political | N/A |
| Functionalities | In general, there will be no new functions to be achieved by this measure. It is only the combination of different added value bonus accesses given to other (e.g shared) transportation products when purchasing certain PT products – that are subject to a specific campaign. For these customers/users, this would provide a kind of “shortcut” to these different bonus accesses, without the need to purchase them separately, however, to validate the access, they customers still need to use the different platforms of the service providers. |



BUD_03: Understanding on a deeper level the connection between the service level and passenger satisfaction

| | |
|-------------------------------------|--|
| Infrastructure | N/A |
| Equipment / Hardware | N/A |
| Software | N/A |
| Data | <p>Within the study and research to be conducted and the public engagement activities (such as focus group interviews and questionnaires), the collected and analysed data can include:</p> <ul style="list-style-type: none"> - Demographical data of customers - Personal data of customers (only if personal contact is needed) - Transportation habits and behaviour of customers, their attitude towards different transport modes - Traffic and network data (that are already available for BKK) - Data and results derived from previously conducted user satisfaction research projects - Data on customer complaints – related to the level of service |
| Permits / Tenders | In case of the research and the study, a procurement process is planned to be conducted by the end of 2024 Q2. There is no need for special permits (from outside of BKK). |
| External support | In case of the research and the study, a procurement is planned to be conducted and accordingly, the related tasks are planned to be outsourced. For preparing the technical specification of the study, BKK has the necessary competence. |
| Legal | Researches should be GDPR compliant. |
| Security / Safety | N/A |
| Social /Cultural / Political | N/A |
| Functionalities | In general, there will be no new functions to be achieved by this measure. |

BUD_04: To improve the route planner to increase user satisfaction

| | |
|-------------------------------------|--|
| Infrastructure | |
| Equipment / Hardware | A dedicated server and/or server capacity expansion is required to implement the project. |
| Software | <p>The introduction of Smart city software and integration into the existing BudapestGO architecture are necessary for the implementation of the project.</p> <p>It is important that the new software corresponds and fits into the current software environment of BudapestGO, it is not necessary to purchase any new software.</p> <p>To design the user interface, BKK is currently using the Figma UI design software, for which it has its own subscription, and it is also necessary to use it to design new screenshots. The deep link solution is currently working in BudapestGO for MOL Bubi bicycles and collection stations, this only requires BudapestGO frontend development for the other service providers.</p> |
| Data | Data collection is an important aspect of development. In order to introduce the new function, it is therefore necessary to amend the BudapestGO data management information sheet and the general terms and conditions of the contract. The integration of the data into the BKK data warehouse and Google Analytics is an important element of development in order to measure eroller user habits and usage data and KPIs. |
| Permits / Tenders | The public procurement for the development of BudapestGO will be closed soon (within 1-2 months), so we will already have a subcontractor to implement the tender. |
| External support | <p>BKK internal competence is required for the implementation of project management tasks, all Resources are available. The software development and operation of BudapestGO is carried out by a subcontractor, based on the relevant framework contract.</p> <p>It is also necessary to conclude a contract between BKK and the individual mobility service providers in order to transfer the technological documentation required for integration and to clarify the service conditions.</p> |
| Legal | <p>The travel planning engine is boxed software, the further development of which is only authorized by the manufacturer, realCity Kft. BKK has the rights to use the travel planning engine.</p> <p>In terms of general functions, the BudapestGO application is the property of BKK and has proprietary rights. GDPR Compliance.</p> |
| Security / Safety | N/A |
| Social /Cultural / Political | An important mission for BKK is to make Budapest livable, to reduce the use of cars, and people combine this with alternative means of transport or walking. For this mission, it is important to provide well-planned, easily accessible alternatives, and the integration of eroller service providers can contribute to this. |
| Functionalities | <p>We plan to implement the integration of e-scooter service providers into the BudapestGO app with the involvement of a platform service partner that ensures the integration of shared services. The advantage of this is that the BudapestGO application only needs to be connected to a single platform, but through this platform several e-scooters or shared mobility service providers are involved.</p> <p>Introduction of the MAAS platform, route planning with e-scooters, and the possibility of linking to the application of the given service provider.</p> |

BUD_05: New services to increase accessibility and convenience of PT

| | |
|-------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | <p>Replay is available for use at BKK.</p> <p>The software for the development of the predictor algorithm needs to be developed.</p> |
| Data | <p>It requires the accessibility for the data of BKK.</p> <p>Data to be collected: Provisional timetable departures featured in Replay, actual timetable departures, Number of received customer complaints</p> |
| Permits / Tenders | The travel planning engine is boxed software. The manufacturer, realCity Kft is only authorized for developing the software further. |
| External support | We have the necessary skills, abilities, and competences in-house to implement the measure (order, control). We will purchase the development from the software manufacturer. |
| Legal | The travel planning engine is boxed software. The manufacturer, realCity Kft is only authorized for developing the software further. |
| Security / Safety | NA |
| Social /Cultural / Political | NA |
| Functionalities | <p>The measure is considered as a development, where more accurate departure times will be presented for the system.</p> <p>The predictive planning option will be added as a new functionality to the existing BudapestGO, journey planner application.</p> |

BUD_06: To improve the existing PT prioritizing tools in Budapest

| | |
|-------------------------------------|---|
| Infrastructure | Based on the new analysis tool, we will suggest new development (bus lanes, traffic light changes, etc.) which will give prioritization to the Public Transport |
| Equipment / Hardware | Based on the new analysis tool, we will suggest new development (bus lanes, traffic light changes, etc.) which will give prioritization to the Public Transport |
| Software | NA |
| Data | Actual running times of the PT vehicles, number of users |
| Permits / Tenders | NA |
| External support | Cooperation with Budapest Road Operator: responsible for operating the main roads in the City of Budapest; PT operators: feedbacks from the bus drivers |
| Legal | NA |
| Security / Safety | New PT prioritization tools have to focus on the safety aspects |
| Social /Cultural / Political | NA |
| Functionalities | Development of the new tool, which can measure the effectiveness of the different PT prioritizing tools. The new method also can help on the selection process before implementing a PT prioritizing development. |



8. LEUVEN (TWINNING SITE)

LEU_01: To exploit existing and new mobility data to enhance the evolution of public transport policies

| | |
|-------------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | Integration with city data and BI platforms should be aimed for. If implementation within the project timeframe is not feasible, it should be prepared for implementation later. Efforts should be directed towards seamless integration with existing city data and BI platforms. Consequently, U-tools employed to facilitate the implementation of this measure, should be prepared for maximum compatibility with city systems. |
| Data | This measure focuses on data collection and analytics. Main existing datasets from PTO De Lijn: <ul style="list-style-type: none"> - PT use – Bus ticket sales/Card registrations - Travel times - - PT satisfaction Three types of additional data need to be collected: <ul style="list-style-type: none"> - Survey data on population level: a large survey with a representative sample of the population - Survey data on user level: smaller scale surveys aimed at PT users - Ideational data/citizen participation input |
| Permits / Tenders | We will tender the large-scale survey (excluding analysis and reporting). Tendering is planned for November 23 – January 24. The approach for smaller surveys is still to be decided. |
| External support | Expertise in data analytics, BI and dashboarding, and simulation. This expertise is available within the city as well as in the consortium. |
| Legal | All data will be handled according to GDPR |
| Security / Safety | |
| Social /Cultural / Political | As elections are approaching, we need to be careful with surveys and especially open-ended participation activities in 2023-2024. Collecting data on users' satisfaction and needs should consider participants with different social, economic, gender etc. Characteristics. |
| Functionalities | NA |

LEU_02: To study the needs of parking and public transport in different areas of the city

| | |
|--------------------------------------|---|
| Infrastructure | Implementation of one small-scale peripheral parking lot (information screens, adjustments to the location to change it into a parking lot/ P&R). The selection of the specific location is part of the project. |
| Equipment / Hardware | Based on the preliminary analysis of the current use of the existing P&R, measures can be taken to improve the service level at the existing peripheral parking (such as a hands-free shopping service). The selection of the specific P&R adaptations will depend on the analysis carried out as part of the project. |
| Software | <ul style="list-style-type: none"> - Traffic management software (existing internal software) - evaluate the potential P&R locations should be used (either U-SIM.plan or an internal simulation software). - Tool (U-NEED) for detecting inefficiencies regarding to Public Transportation in P&R surroundings |
| Data | <p>For a preliminary analysis of the current use of P&R's and hubs in combination with PT to identify social patterns, obstacles, and opportunities in these locations, this measure requires:</p> <ul style="list-style-type: none"> - Data on the use of the current main peripheral parking - Available - Data on parking use (on-street and off-street) - Available - Data on PT use – Available - User experience data – to be collected - Origin-Destination data PT – Will be provided by regional authority - GTFS data – Available as open data - A study of the impact that the increased use of these parking sites would have in modal shift (through) the use of simulation tools). |
| Permits / Tenders | Depending on the location, a permit is needed to change the function of the location. Some parts of the campaigns that will be worked out within this measure might be tendered (under measure 6) depending on the available capacity and expertise within the city. This will be in 2025-2026. |
| External support | NA |
| Legal | NA |
| Security / Safety | NA |
| Social / Cultural / Political | NA |
| Functionalities | NA |



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

| | |
|-------------------------------------|--|
| Infrastructure | Depending of the outcome of the stakeholder input: information displays, infrastructural changes to improve “readability” of the bus stops, especially the larger and more complex ones, such as markings, sidewalks, signage, lightings and so on. |
| Equipment / Hardware | NA |
| Software | <ul style="list-style-type: none"> - Development of an internal/external BI dashboard (PowerBI). - Implementation of new or redesigned frontend applications such as city website with integrated accessibility information, interactive maps, basic route guidance application. - Based on the user-need analysis, traffic guidance system of the city should be connected to alternative communication channels, for example in-car communication applications or social media. - User-friendliness for all types of users |
| Data | <p>This measure requires:</p> <ul style="list-style-type: none"> - Stakeholder input for determining what information is missing, most relevant and which means of communication with end-user should be explored - This includes (but is not limited to) (semi) real-time data on shared mobility availability, accurate PT delay information, accident/roadworks/event information, traffic information, parking availability, GTFS data. All this data exists or is available in some form, but it needs to be unlocked for end-users. |
| Permits / Tenders | NA |
| External support | Collaboration with the public transport operator and mobility service operators is necessary. |
| Legal | All data will be handled according to GDPR. |
| Security / Safety | NA |
| Social /Cultural / Political | NA |
| Functionalities | Have to be determined based on the user needs analysis. |



LEU_05: Mobility for all by optimising the use of financial incentives to increase the share of PT

| | |
|-------------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | Implementation of backoffice for financial incentives compatible with any MaaS application that is or might become active in Leuven. Integration with individual mobility service providers is a nice-to-have. |
| Data | This measure requires: <ul style="list-style-type: none"> - Financial information and user data on the current incentives to analyse the impact and efficacy of the current incentives. - Information about PT use among target groups, that will be provided by a large mobility survey and the project “City of Things – Mobiliteitsbudget”, where we will experiment with financial incentives integrated in a MaaS application - User data/ticketing data in test phase. |
| Permits / Tenders | NA |
| External support | Collaboration with/ input from (willingness to implement financial incentives and adherence to data standards) the public transport operator, mobility service operators and MaaS providers is necessary. |
| Legal | GDPR-compliant. |
| Security / Safety | Personal and financial information data from recipients of financial incentives should be handled NA |
| Social /Cultural / Political | The target groups defined should reflect the social reality of Leuven. |
| Functionalities | Have to be determined after the preliminary analysis of the current incentives and the policy plan. |



LEU_06: To launch communication campaigns and digital tools to increase the uptake of PT

| | |
|-------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | Materials needed to implement the communication campaign, such as flyers, posters, goodies and so on. |
| Software | There could need a need for specific software for the communication campaign: interfaces or digital tools to increase participation; i.e., the use of social media or online polls. |
| Data | Population, socio-economic level and mobility expenditure data to make preliminary analysis and to define the target group. This data will be collected as part of measure 1. |
| Permits / Tenders | Some parts of the campaigns that will be worked out within this measure might be tendered depending on the available capacity and expertise within the city. This will be in 2025-2026. |
| External support | Focus groups/citizen engagement |
| Legal | GDPR in the participatory process need to be ensured. |
| Security / Safety | NA |
| Social /Cultural / Political | The approach for this measure should be coordinated with other pilot sites who have similar measures, but the local context and organizational culture of Leuven needs to be taken into account. |
| Functionalities | We need to develop a menu of strategies, aimed at different target groups, to more effectively improve the perception of public transport. This will be further defined later, as part of the measure development. |

LEU_07: Increase the quality of the PT services through traffic management and dedicated lanes for PT

| | |
|-------------------------------------|---|
| Infrastructure | While this measure involves infrastructure adaptations, the actual works and investments are not a part of this project. Within the scope of this project, the measure aims at contributing to the planning and evaluation phase of ongoing infrastructural PT-related projects. UPPER will help to select the locations where the dedicated bus lanes will be implemented. Three proposed locations: N3 Tiensesteenweg/Meerdaalboslaan, N2 Diestsesteenweg, Koning Albertlaan. |
| Equipment / Hardware | NA |
| Software | A simulation software to evaluate the potential locations of the dedicated PT lanes should be used (either U-SIM.plan or an internal macro traffic model). A tool to detect inefficient nodes to determine where to potentially create dedicated PT lanes / traffic light priority. City macro traffic model could be used as an alternative to the U SIM tools and KULeuven models. |
| Data | Data exchange with the PTO De Lijn is important for this measure. In addition to the data on travel times, PT Use that is collected in M01, additional location-specific data might be necessary. Historical data regarding to traffic information, ticketing in PT and/or historical PT delays. |
| Permits / Tenders | NA |
| External support | Collaboration with AWV, the organisation responsible for regional-level roads (= highways and main secondary connections) as the planned infrastructural changes are typically on these roads. |
| Legal | NA |
| Security / Safety | NA |
| Social /Cultural / Political | The measure should take into account that the analyses, simulations and any advice that arises from the analytics, should be framed and presented, taking into account that the policymakers, planners, and advisors are not always very data-minded. |
| Functionalities | NA |

9. THESSALONIKI (TWINNING SITE)

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

| | |
|--------------------------------------|---|
| Infrastructure | <ul style="list-style-type: none"> - Completion of the Nea Elvetia metro station (the construction of the station is completed and its operation is expected to start in the second half of 2024, along with the rest 12 stations of the basic line) - Completion of the parking lot in Nea Elvetia metro station (construction is not part of the project); since there is not yet a definite deadline for the parking lot construction, other suitable P&R alternatives will be examined if delays will be observed. - Installation of a shared mobility station (there is also a possibility for a virtual station – geofenced area where shared vehicles will be allowed to park). |
| Equipment / Hardware | <ul style="list-style-type: none"> - Equipment for parking space availability in the parking lot (the equipment is not part of the project; if obstacles will be identified, a mechanism for estimating parking availability will be developed). - Shared mobility station (there is also a possibility for a virtual station). |
| Software | <ul style="list-style-type: none"> - Development of a digital service to provide real-time information to travelers regarding a) availability of parking spots in the P&R area, b) arrival of PT and c) availability of shared mobility (bicycles, e-scooters etc.). - Integration of this digital service to an existing MaaS application. |
| Data | <ul style="list-style-type: none"> - GTFS data for public buses and metro system, both static and real-time (GTFS-RT is not required but it would provide an added value and it will be sought for at least one specific bus line that connects with the Nea Elvetia area). - Real-time data regarding parking spots availability. - Real-time data regarding the availability of shared modes. |
| Permits / Tenders | <ul style="list-style-type: none"> - Permit for provision of data regarding parking spots availability. - Permit for setting up a shared mobility station (either physical or virtual). |
| External support | <ul style="list-style-type: none"> - Collaboration with the developer of the existing MaaS application for integration purposes. - Collaboration with PTO to obtain GTFS data. - Collaboration with the parking operator to obtain parking availability data. |
| Legal | <ul style="list-style-type: none"> - A consent form regarding the use of the app. - All data shall be anonymized and be compliant with GDPR. |
| Security / Safety | <ul style="list-style-type: none"> - The shared mobility station shall be placed in a way that does not hinder either pedestrians' or vehicles' movement. |
| Social / Cultural / Political | NA |
| Functionalities | <ul style="list-style-type: none"> - Inform travellers in real-time about the availability of parking spots in a parking lot nearby a metro station. - Inform travellers in real-time about the arrival time of next PT vehicle (either metro or bus). - Inform travellers in real-time about the availability of shared mobility vehicles. - Physically integrate PT, parking and shared mobility options in the same area. |

TES_02: Simulation and analysis of PT needs for LEZ demand fulfilment

| | |
|-------------------------------------|---|
| Infrastructure | NA – This measure refers to simulation, thus no physical implementation is foreseen. |
| Equipment / Hardware | NA |
| Software | <ul style="list-style-type: none"> -Develop a digital service that will facilitate PT planning in LEZs. -Usage of Thessaloniki's strategic traffic model. -GIS software in order to model areas that are served by existing PT services and to compare them with travellers' acceptability to walk to/from LEZs. -Software (U-GOV or EU Survey) to perform survey on travellers' satisfaction and behaviour. |
| Data | <ul style="list-style-type: none"> -Origin-Destination (OD) data for all available modes. -GTFS static data. -Existing PT stop locations -Travellers' satisfaction → collection through dedicated survey. -Travel behaviour → collection through dedicated survey. |
| Permits / Tenders | <ul style="list-style-type: none"> -Permit may be needed to use the data from PT operators/authorities. |
| External support | <ul style="list-style-type: none"> -Collaboration with PT operators to get the required data |
| Legal | <ul style="list-style-type: none"> -GDPR issues regarding the survey which will be carried out. -Comply with regulations regarding the PT data. |
| Security / Safety | NA |
| Social /Cultural / Political | <ul style="list-style-type: none"> -Collecting data on travellers' satisfaction and behaviour depends on the willingness of travellers to participate in such surveys. To ensure participation of a critical mass the survey needs to be as quick and targeted as possible. -Collecting data on travellers' satisfaction and behaviour needs to consider participants with different social, economic, gender etc. characteristics. -Selection of the LEZ area should ensure that implementation does not limit accessibility to local shops and businesses. |
| Functionalities | <ul style="list-style-type: none"> - Estimate users' travel behaviour from/to LEZ (e.g., mode, purpose) |

TES_03: To improve transit services through dynamic multimodal management of PT corridor

| | |
|-------------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | <ul style="list-style-type: none"> - Viswalk - Traffic simulation software (software not defined yet, probably VISUM or SUMO) |
| Data | <ul style="list-style-type: none"> - GTFS static data. - OD matrices for all available modes. - Traffic signals cycle. - Existing plans of the corridor – digital plans are preferred. |
| Permits / Tenders | NA |
| External support | <ul style="list-style-type: none"> - Collaboration with Public Authorities and Metro operator in order to obtain existing plans etc. - Collaboration with PTO to obtain PuT static data. - Architect for preparation of module for depicting the proposed plan for Egnatia street. |
| Legal | NA |
| Security / Safety | <ul style="list-style-type: none"> - Existing safety rules should be respected for the Egnatia street plan. |
| Social /Cultural / Political | NA |
| Functionalities | <ul style="list-style-type: none"> - Detailed plan for optimal management of traffic and pedestrian flows. - Detailed plan for reallocation of public space in Egnatia street. |



TES_04: To influence modal shift through congestion sensitive parking pricing

| | |
|-------------------------------------|---|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | - Traffic simulation software (probably VISUM) |
| Data | - OD matrices for all available modes. - Users' survey (through U-GOV or EU survey). - Feedback from relevant stakeholders through participatory processes. |
| Permits / Tenders | NA |
| External support | - Design of the participatory processes in order to evaluate different parking pricing policies. |
| Legal | - GDPR issues regarding the user survey which will be carried out. |
| Security / Safety | NA |
| Social /Cultural / Political | - Survey should consider participants with different social, economic, gender etc. characteristics. - Parking pricing policies shall consider the needs of people of all social groups. |
| Functionalities | - Estimation of WtP for parking in the city centre. - Estimation of traffic impacts due to various parking pricing policies. - Identification of appropriate parking pricing policies for the city of Thessaloniki. |



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

| | |
|--------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | <ul style="list-style-type: none"> - Upgrade an existing multimodal trip planner. - Integration of the planner in an already existing MaaS application. |
| Data | <ul style="list-style-type: none"> - GTFS data for public buses and metro system, both static and real-time (GTFS-RT are not required but they will provide an added value in case they will be made available). - Real-time data regarding the availability of shared modes. - Individualization will be based on the users' preferences as he/she uses the application. |
| Permits / Tenders | NA |
| External support | <ul style="list-style-type: none"> - Collaboration with PT operators and shared mobility providers to carry out dissemination activities targeted to PT and shared mobility users. - Collaboration with the developer of the existing MaaS application for integration purposes. - Collaboration with PTO to obtain GTFS data. |
| Legal | <ul style="list-style-type: none"> - A consent form regarding the use of the app. - All data shall be anonymized and be compliant with GDPR. |
| Security / Safety | NA |
| Social / Cultural / Political | NA |
| Functionalities | <ul style="list-style-type: none"> - Integration of real-time PT data (bus and metro) in the suggested trip plans. - Individualization of multimodal planner's suggested trip plans. |



TES_06: Social optimum-based traffic management to reduce PT travel times and increase user satisfaction

| | |
|-------------------------------------|--|
| Infrastructure | This measure refers to a simulated measure that will be also implemented, during the lifetime of the project, on a busy intersection in the city of Thessaloniki. |
| Equipment / Hardware | Bus on-board detectors will be required to support AI-based bus priority to detect the bus position. The detector will be installed on the bus and it will interfere with intersection traffic lights. This equipment should be purchased and installed for the pilot. Based on intersection analysis, the phasing program will need to be modified. |
| Software | -Software for simulation (VISUM or SUMO). |
| Data | -GTFS data -Traffic volume data per mode - Intersection geometric characteristics -PT data (PT routes, frequencies etc.) -Traffic signal timings -OD data for all available modes |
| Permits / Tenders | -Permission may be needed from PT authorities/operators to use the required data. |
| External support | -Collaboration with PT authorities/operators to get the required data. -Collaboration with Municipality and PT operators to select the optimal intersection. |
| Legal | NA |
| Security / Safety | -Ensure the safety of passengers and pedestrians regarding the C-ITS enabled and AI based priority service. |
| Social /Cultural / Political | NA |
| Functionalities | -C-ITS enabled and AI based bus priority service in the Traffic Control Centre (in case a real-life demonstration takes place) |

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

| | |
|-------------------------------------|--|
| Infrastructure | -NA. The measure does not foresee any fixed stations for the DRT service. |
| Equipment / Hardware | -Taxi vehicles will be used to implement the measure. |
| Software | -Develop a supporting (DRT) application for trip booking (for users) and an application to confirm and respond to requests (for operator). -Software (EU Survey) to carry out the survey on traveling characteristics. |
| Data | -Data from previous DRT pilots. -Traveling characteristics collected through the dedicated survey. - Location of the affected area - Existing PT routes in the affected area - Utilize the data/information from the serious game |
| Permits / Tenders | - NA |
| External support | -Collaboration with the taxi association. |
| Legal | -GDPR issues regarding the survey which will be carried out. -Contract/Agreement with taxi association. |
| Security / Safety | -Ensure secure transactions when booking a trip through the application. -Taxi drivers will be informed and trained to ensure all safety regulations are followed before launching the pilot. |
| Social /Cultural / Political | -Willingness of citizens to participate in the survey for collecting traveling characteristics. -Willingness of citizens to participate in the demonstration. -Dissemination activities should be carried out to ensure a critical mass of participants. |
| Functionalities | -Book a trip through a single application. -Confirm bookings through the application |



TES_08: To create new incentive-based services in the MDMS system to increase the use of PT

| | |
|-------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | NA |
| Software | <ul style="list-style-type: none"> - Development of a digital service assisting evidence-based decision-making. - GIS software |
| Data | <ul style="list-style-type: none"> - PT static data (PT stations, schedules etc.) - OD matrices for all available modes - survey (through U-GOV or EU Survey or Maptionnaire) for identifying areas with accessibility issues - land use data and POIs |
| Permits / Tenders | NA |
| External support | <ul style="list-style-type: none"> - Collaboration with PTO to get the PT static data - Collaboration with shared mobility operators for data provision |
| Legal | <ul style="list-style-type: none"> - GDPR issues regarding the survey which will be carried out. |
| Security / Safety | NA |
| Social /Cultural / Political | <ul style="list-style-type: none"> - Survey should consider participants with different social, economic, gender etc. characteristics. |
| Functionalities | <ul style="list-style-type: none"> - Evidence-based support for selecting optimal locations for shared mobility hubs - Evidence-based support for creating synergies between PTO and shared mobility operators and forming competitive pricing packages |



TES_09: To raise environmental awareness and trigger behavioural change towards PT

| | |
|-------------------------------------|--|
| Infrastructure | NA |
| Equipment / Hardware | - The purchase of e-buses is expected within 2024 (not part of the project) is not required, but it will provide an added value to the measure by giving the possibility of having real data. Funding from EIB or European Recovery Fund or National Fund. |
| Software | - Existing software for electric vehicle operation simulation. |
| Data | - E-buses' technical specifications. - PT static data (PT stations, schedules etc.). - OD matrix for PT. - Data regarding the actual consumption of the e-buses. - Consultation (through U-GOV) for understanding optimal mechanisms for raising environmental awareness |
| Permits / Tenders | NA |
| External support | - Collaboration with PTO in order to collect required PT data and display the appropriate messages in VMS. - Identification of the optimal mechanisms for raising awareness. |
| Legal | NA |
| Security / Safety | NA |
| Social /Cultural / Political | - The plan for the operation of e-buses should treat equally all areas of the city. |
| Functionalities | - Plan for e-buses operation (i.e. electrified bus lines, location and type of chargers). - Plan for raising awareness of sustainable transport options. - Display of messages in VMS for raising awareness, both within buses and at bus stops. |

TES_10: Incentivize the use of PT in combination with active modes

| | |
|-------------------------------------|--|
| Infrastructure | Not specific infrastructure is required. The demonstration of this measure will focus on central Thessaloniki area. |
| Equipment / Hardware | NA |
| Software | - An algorithm will be developed to estimate time of day/type of incentive/redeem method, etc. -Use of software to perform the stated preference survey (e.g., SurveyMonkey etc.). |
| Data | -User characteristics and mobility data -Data regarding willingness to use PT for a provided financial incentive – collection through stated preference survey |
| Permits / Tenders | NA |
| External support | -Collaboration with incentives' providers |
| Legal | -Contract/Agreement with the incentives' providers in order to ensure that travellers participating in the demo will receive their awards. - GDPR issues regarding the survey (stated preference) which will be carried out. -Consent forms to participate in the demonstration. |
| Security / Safety | -Active modes such as bicycle require certain safety measures (e.g., wearing helmet). UPPER consortium should inform demo participants about applicable safety measures and urge them to respect them. |
| Social /Cultural / Political | -A stated preference survey will be carried out to estimate the willingness to use PT for financial incentives. Willingness of citizens to participate is important (social requirement). |
| Functionalities | -Create Incentive packages and allocation mechanism. |



10. HANNOVER REGION (TWINNING SITE)

HAN_01: Digital tariff

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|-------------------------------------|---|
| Infrastructure | For the implementation of the measure and the introduction of the digital tariff in the Hannover Region/GVH, the infrastructure of a check-in/be-out system is needed. This infrastructure is part of another project (not part/ and not funded by the UPPER project) and will be built at the same time as the development of the digital tariff (beacons and back-end). |
| Equipment / Hardware | Updating the PT infrastructure where necessary (e.g. underground PT stops) with beacons that support the check-in be-out system usage. (Funded through complementary project) |
| Software | The digital tariff is to be integrated into the existing GVH app. For this, the software of the app must be adapted by the check-in/ be out service provider and the responsible persons at the ÜSTRA accordingly. It is important that the app and the billing system work as accurately as possible. We want to create a product that is as transparent as possible for the user. A check-in/be-out software is needed as well as a billing system (part of other project). For the digital tariff, an integration into the GVH app is required. Which check-in/be-out software will be used and what the billing system will look like is still unclear at the moment. - Update to be done by a contracted developer. |
| Data | Data is currently still in the process and/or in clarification with the company. Historical data for a before/ after evaluation is not available due to a major hacker attack. |
| Permits / Tenders | Within the introduction of the digital tariff, the creation of a concept for the implementation of the digital tariff was put out to tender. Following this, a company will work out various proposals for the conception of the digital tariff for us. Afterwards, the digital tariff must be approved by various authorities of the Hannover Region, the GVH and the LNVG. We expect approval by the beginning of 2024 at the latest. We are already in contact with all parties involved. |
| External support | It is important that all Partners needed are involved in the Implementation. So, we as Region Hannover are in close contact with the important stakeholders: Üstra/ Regiobus/ DB regio and already set up a regular project meeting. Important decisions that must be taken have to be made by a special consortium involving all partners. Good promotion of the digital tariff is necessary for good market saturation. Therefore, a marketing campaign will be necessary. We will develop this together with the transport companies and the marketing department. |
| Legal | N/A |
| Security / Safety | Security measures must be taken for the introduction of the digital tariff. What these will be in individual cases cannot be conclusively stated at this point in time. However, it is certain that data protection solutions must be found and that the system must be secured as well as possible against external attacks. |
| Social /Cultural / Political | In Germany we have the 49€ ticket, but as it is still in its very beginning stages we do not yet have representative data on e.g. the impact on regional transport. |
| Functionalities | N/A |

HAN_02: Sustainable Transport Chains – on-Demand service sprinti

| | |
|-------------------------------------|---|
| Infrastructure | For the Sprinti expansion, the number of vehicles will be increased from 30 to 120 (not part of the UPPER project). Part of the accompanying evaluation (part of UPPER) is to see what effects the expansion has on various factors in the Hannover Region. For example, how is the occupancy rate of the vehicles? Does the expansion benefit the increase in the number of vehicles? |
| Equipment / Hardware | More vehicles need to be purchased (not Part of UPPER). |
| Software | For the expansion of the Sprinti service, it is necessary that Sprinti bookings are integrated into the GVH app and that there is no longer a separate Sprinti app. (Not part of the UPPER project, is only accompanied in the sense of an evaluation). |
| Data | Since the introduction of Sprinti, the service operator has been collecting a wide range of data on a dashboard. This is very important to monitor the utilisation and availability of the service. How many booking requests are there? How many of them can be fulfilled? How many journeys can be bundled with a Sprinti vehicle? |
| Permits / Tenders | When introducing/expanding on-demand transport, a number of permits must be obtained in Germany. This has already been done in advance for the introduction of Sprinti and only needs to be done in part for the expansion. In this regard, it is particularly important to observe the Passenger Transport Act and to obtain approval from the competent authority at the federal state level. |
| External support | The transport association, the operator and scientific monitoring by the German Institute of Urban Research provide external support for the Sprinti service within the PT model region project. Within UPPER and the evaluation there might be external support needed – currently not sure if support is needed and if so, who it will be and to what extent. |
| Legal | When introducing on-demand offers, several laws must be considered. These include for example the Passenger Transport Act, the Data Protection Ordinance and the Disability Equality Act in Germany. |
| Security / Safety | There are requirements for safety and security such as accessibility for people with disabilities. |
| Social /Cultural / Political | N/A |
| Functionalities | N/A |

HAN_03: Added-value services in multimodal nodes to integrate PT with active modes

| | |
|-------------------------------------|--|
| Infrastructure | The bike tower was specially designed and built for the safe parking of bikes. It was finished in August 2023 and will be opened in October 2023 (not funded by UPPER). In UPPER we will only do an Evaluation on the bike tower (and the mobility hub in Großburgwedel). But since we are dependent on the other projects for this measure, we have to look how and to what extent an evaluation will be possible. |
| Equipment / Hardware | User need a Smartphone to have access to the bike tower. For people without a smartphone, there is the option of purchasing an RFID chip card and using it to gain access to the tower. These have been purchased by the Hannover Region and will be sent to users as needed via a contracted company (not part of UPPER Project). When the card is used, the time slot for access to the bike tower must be booked in advance via the internet, and only after this can the access to the bike tower be made through the RFID chip card. The main access will be via the app (Equipment and Software is not part of UPPER Project) |
| Software | The digital lock and access system to bike parking facilities in the Hannover Region is a specially developed software. It was adapted for use with the bike tower. The app was also developed and expanded specifically for the bike tower (not part of UPPER project). Within UPPER we will evaluate how the digital lock and access system works and what the difficulties are. |
| Data | It is needed that Users register themselves once and deposit their data, which is not maintained and protected by the region itself, but exclusively by a commissioned company. |
| Permits / Tenders | Several tender procedures were carried out for the measure and several permits were applied for. All of them have been completed. |
| External support | There was close cooperation with the municipality where the tower was built and with various companies providing the software and building the tower, supervising the construction and other subcontractors involved in the construction. |
| Legal | For the operation of the bike tower, it is necessary to draft general terms and conditions and to coordinate them with the existing legal framework. This clarifies in which (damage) cases Region Hannover is liable and which risk the users have to bear themselves. This has already been done and is not part of UPPER project. |
| Security / Safety | This issue has been taken care of by the contractor in charge and he has made sure that this machine does not harm anyone. |
| Social /Cultural / Political | The implementation requires that political decision-makers are interested in the project and support it. The fact that the construction of the bike tower has also have an impact on the modal shift towards active mobility has also contributed to the decision. |
| Functionalities | Secure and free bike parking at Wunstorf train station - with digital access system. |

HAN_04: Mobility dashboard solution

| | |
|--------------------------------------|--|
| Infrastructure | No real infrastructure of a constructional type required, as this is a purely digital measure. |
| Equipment / Hardware | Special sensors are needed to monitor the occupancy of the P+R parking spaces. These sensors can then transmit to the dashboard the number of parking spaces still available in the parking lot in each case. If the parking space is occupied, this can also influence the route navigation - another P+R parking space must be approached. (Not funded by UPPER) |
| Software | We currently already have a mobility dashboard that is linked to our traffic management centre. The further development of this dashboard as a software solution is the content of the measure. |
| Data | For the implementation of the measure, we need above all the digital timetable data of local public transport. Complementary to this, live data can also be displayed, which could e.g. show delays of vehicles/light trams. For this data, we first must evaluate which data is necessary for the dashboard and which data we are allowed to show publicly. First ideas for integration into the Mobility Dashboard are bus and train departure times, delays, a route navigation that does not only focus on cars but allows for intermodal route chains. |
| Permits / Tenders | Not yet defined and will be determined during the implementation of the measures. |
| External support | Cooperation with the transport association as well as the service provider of the Mobility Dashboard and the Traffic Management Centre. Further cooperations are possible and will be identified during the measure. |
| Legal | Not yet defined and will be determined during the implementation of the measures. |
| Security / Safety | Security of the mobility dashboard is an important issue, even more important is the protection of sensitive data on the dashboard, so it will be necessary to clarify which data will be part of the dashboard and to what extent. Data protection is therefore also a major issue. |
| Social / Cultural / Political | N/A |
| Functionalities | It is not yet clear whether there will be a new dashboard solution (connecting to the PT model region project) or if we will extend the existing mobility dashboard. The focus of both dashboards will be on public transport. Currently, the dashboard is still very much focused on individual traffic, and we want to improve that. Route navigation to P+R car parks, capacity occupancy of P+R car parks and PT data are to be integrated. How and to what extent has not yet been decided. We are also dependent on other projects for this measure, as we are primarily only supporting it within UPPER and not mainly implementing it. |

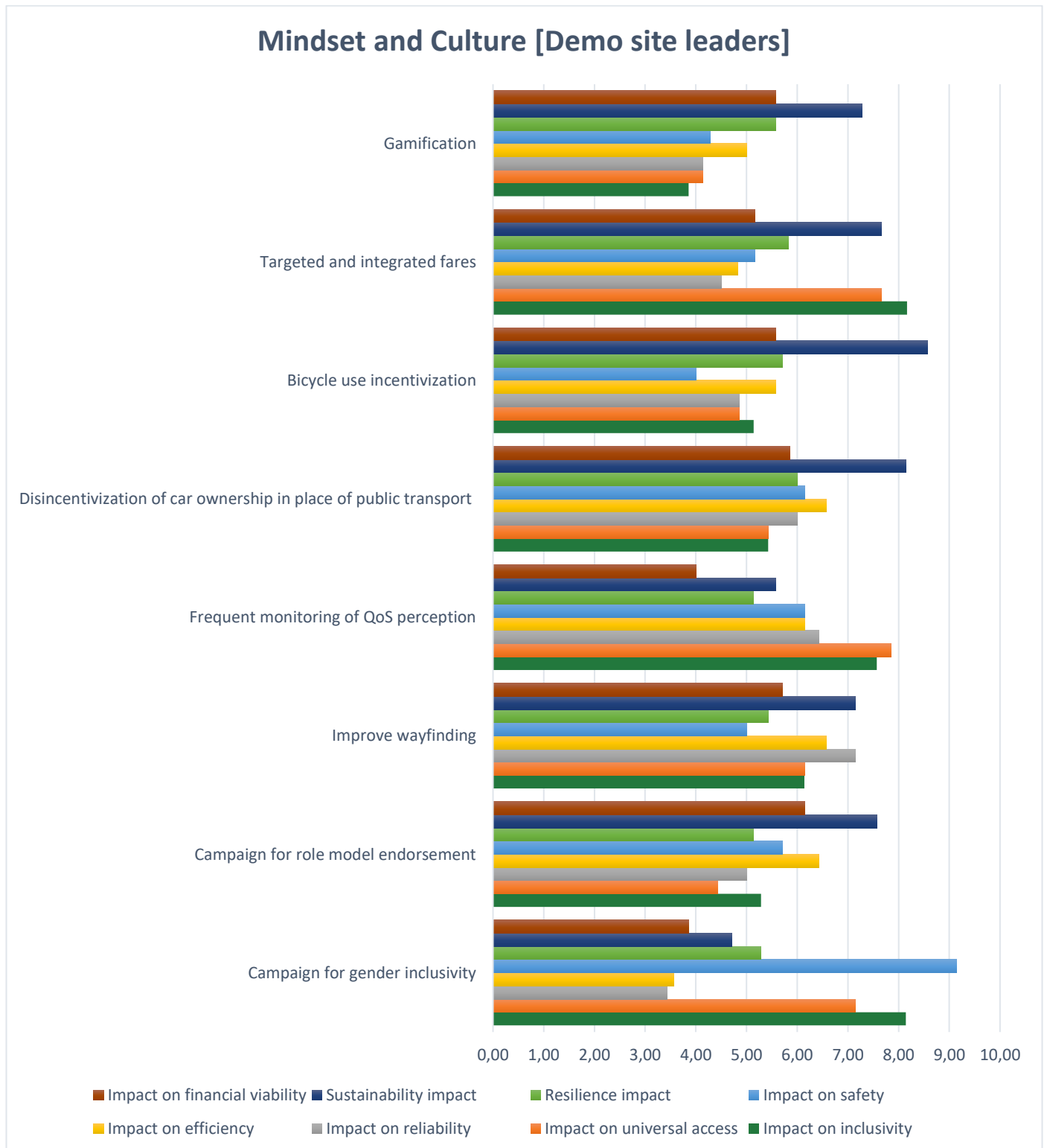


HAN_05: Exploring monitoring options of the cities/regional performance towards achieving the goals of the SUMP

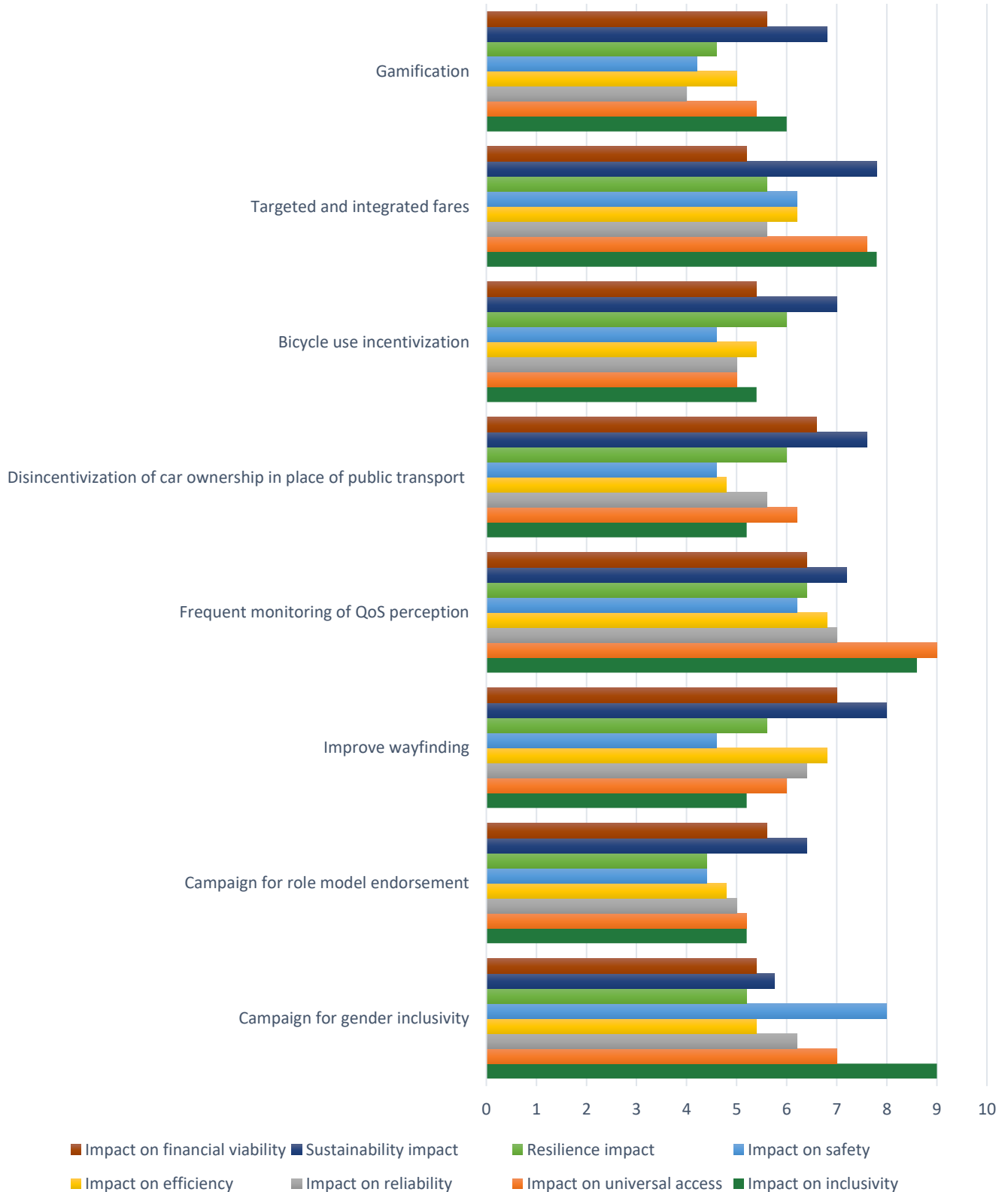
| | |
|-------------------------------------|--|
| Infrastructure | N/A |
| Equipment / Hardware | N/A |
| Software | Using U-SUMP for monitoring selected indicators that are relevant for reaching the SUMP goals. The software currently used by local and regional authorities for data management (can be different from authority to authority). |
| Data | Data sets depend on the selected indicators to monitor. We can only provide some examples of data that will be used: modal share, CO2 emissions, etc. |
| Permits / Tenders | N/A |
| External support | Will be supported by U-SUMP developer, Rupprecht Consult, throughout the measure implementation process. Public Transport Authority/Operator. |
| Legal | N/A |
| Security / Safety | No private data will be shared. The tool developer ensures secure handling and storage of all datasets provided. |
| Social /Cultural / Political | N/A |
| Functionalities | <ul style="list-style-type: none"> - Establish indicators relevant to the SUMP to be monitored - Define and source datasets necessary for the indicators - Use the tool for monitoring progress towards SUMP targets (e.g., climate neutrality) and identify issues in the progress predictions - Use the tool for internal decisions regarding the SUMP implementation and adjustments - Use the tool to communicate the progress of the SUMP to the wider public. |

Annex E: Policy recommendations – Mentimeter results

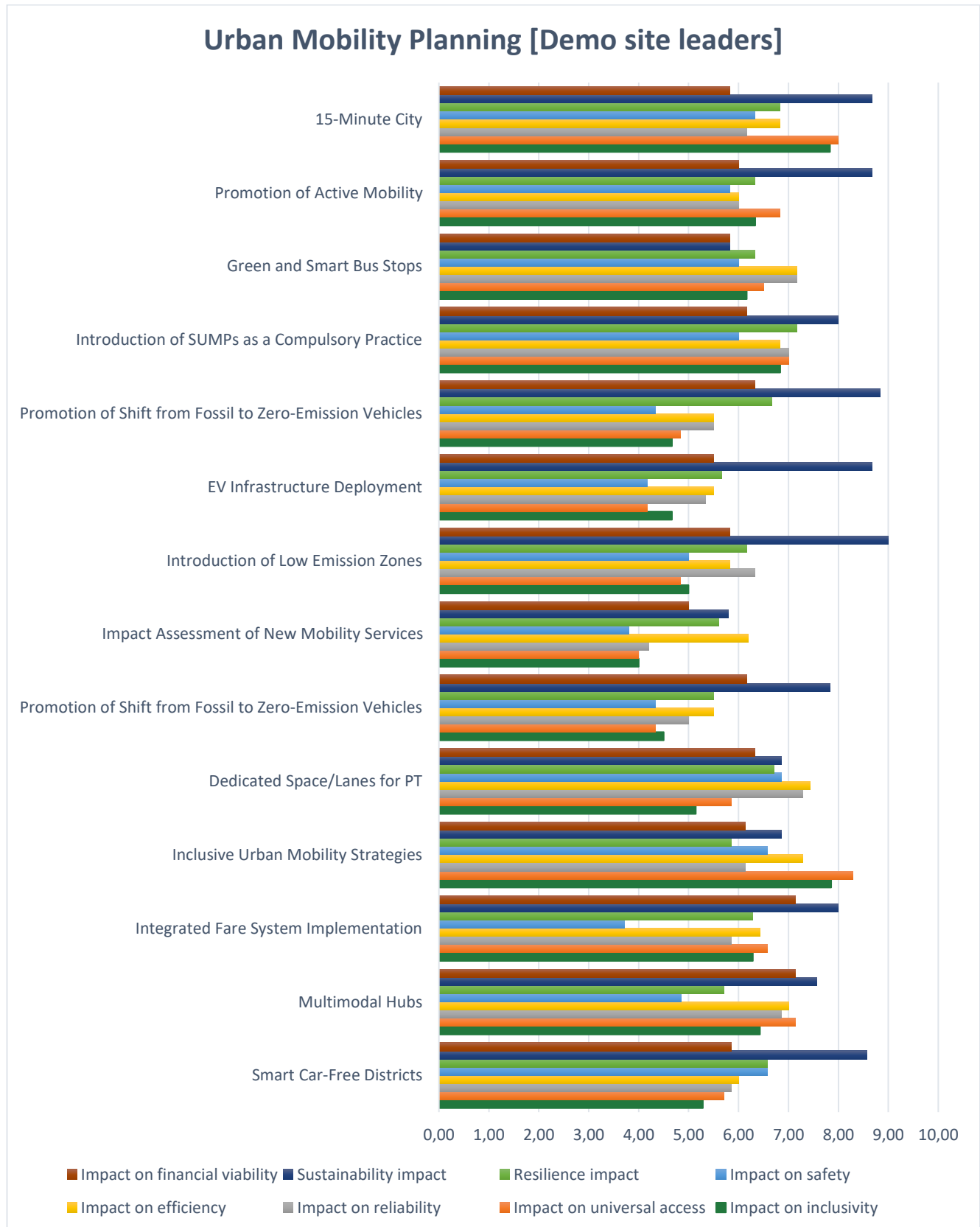
Mindset and Culture



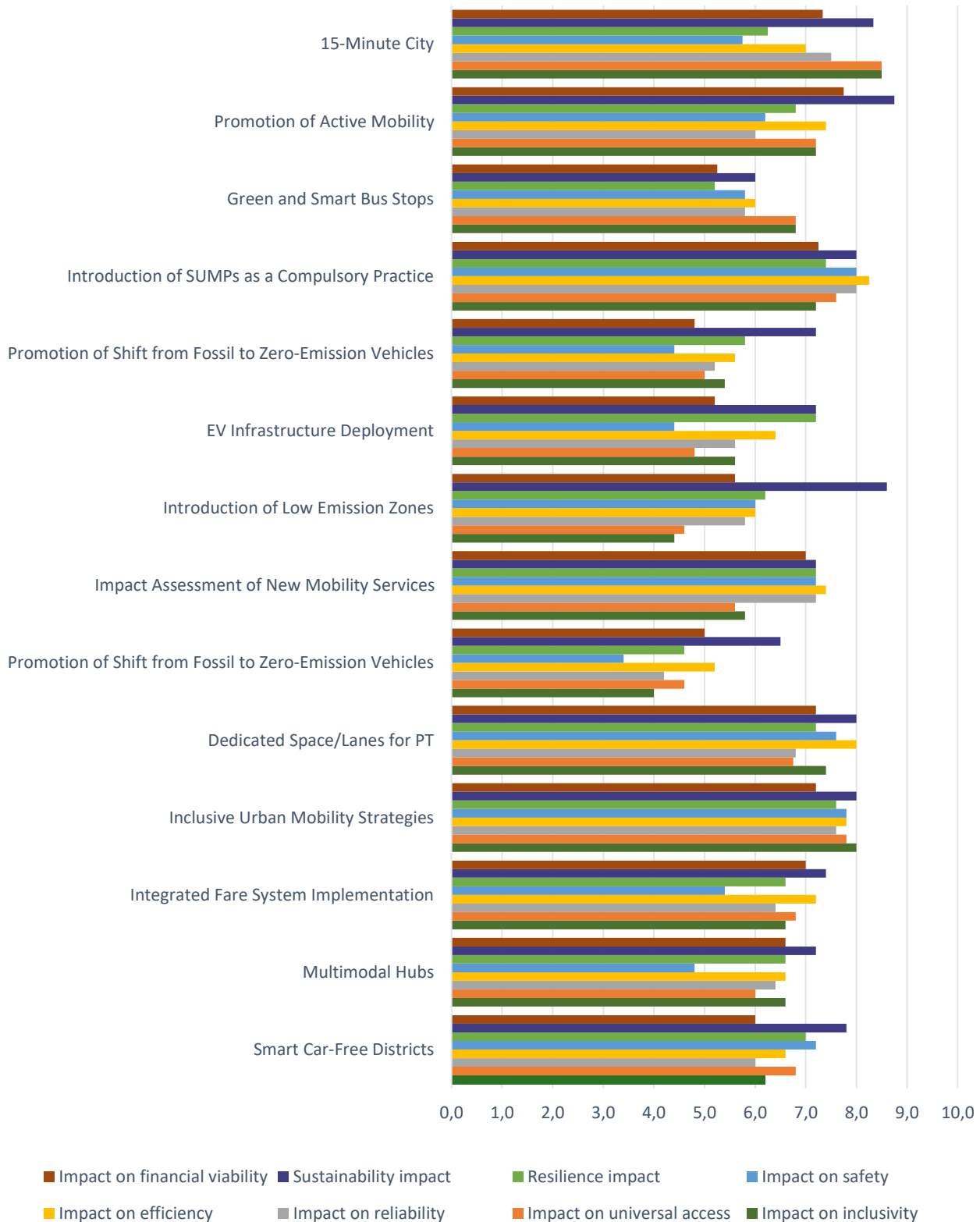
Mindset and Culture [Horizontal partner]



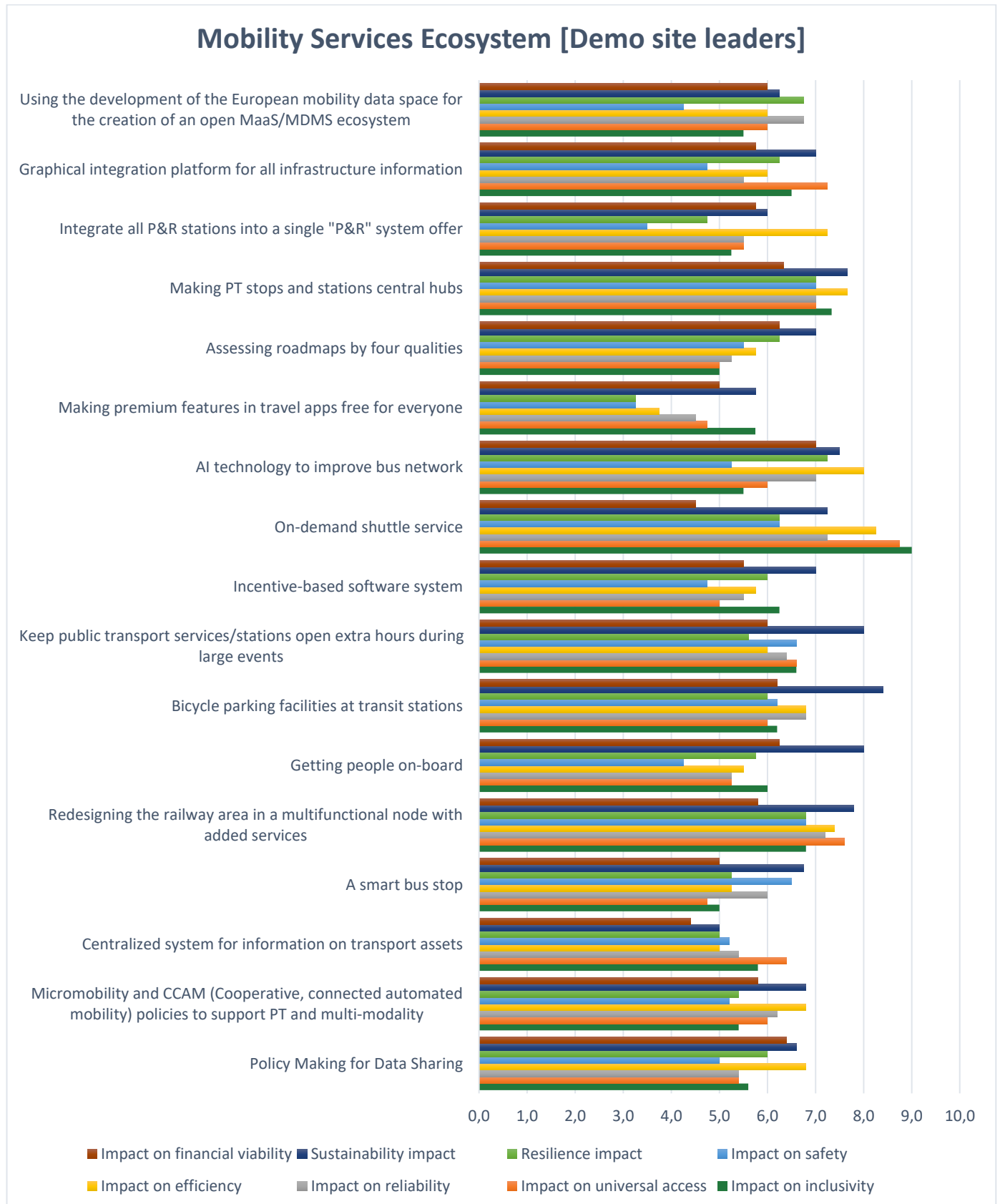
Urban Mobility Planning



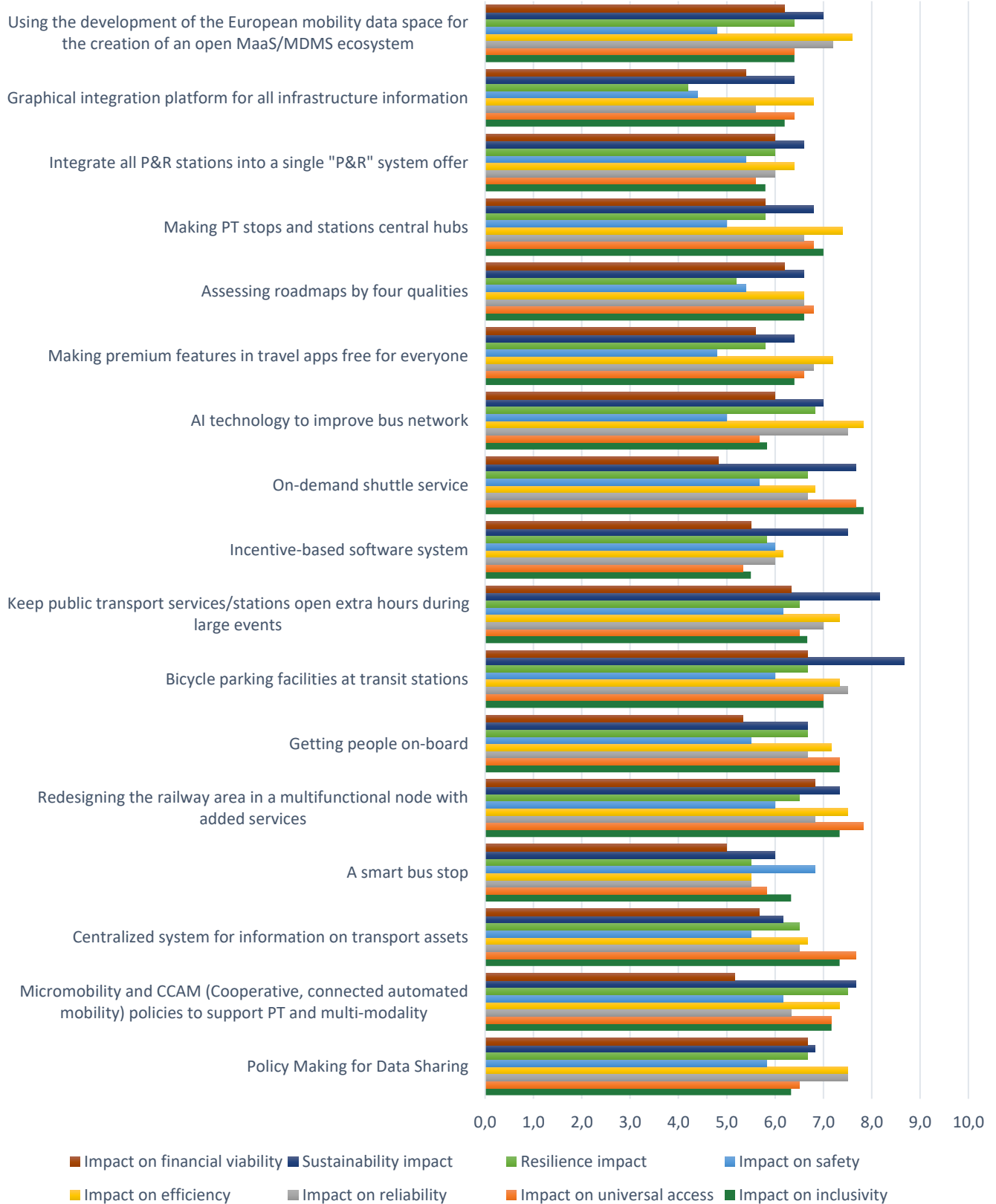
Urban Mobility Planning [Horizontal partners]



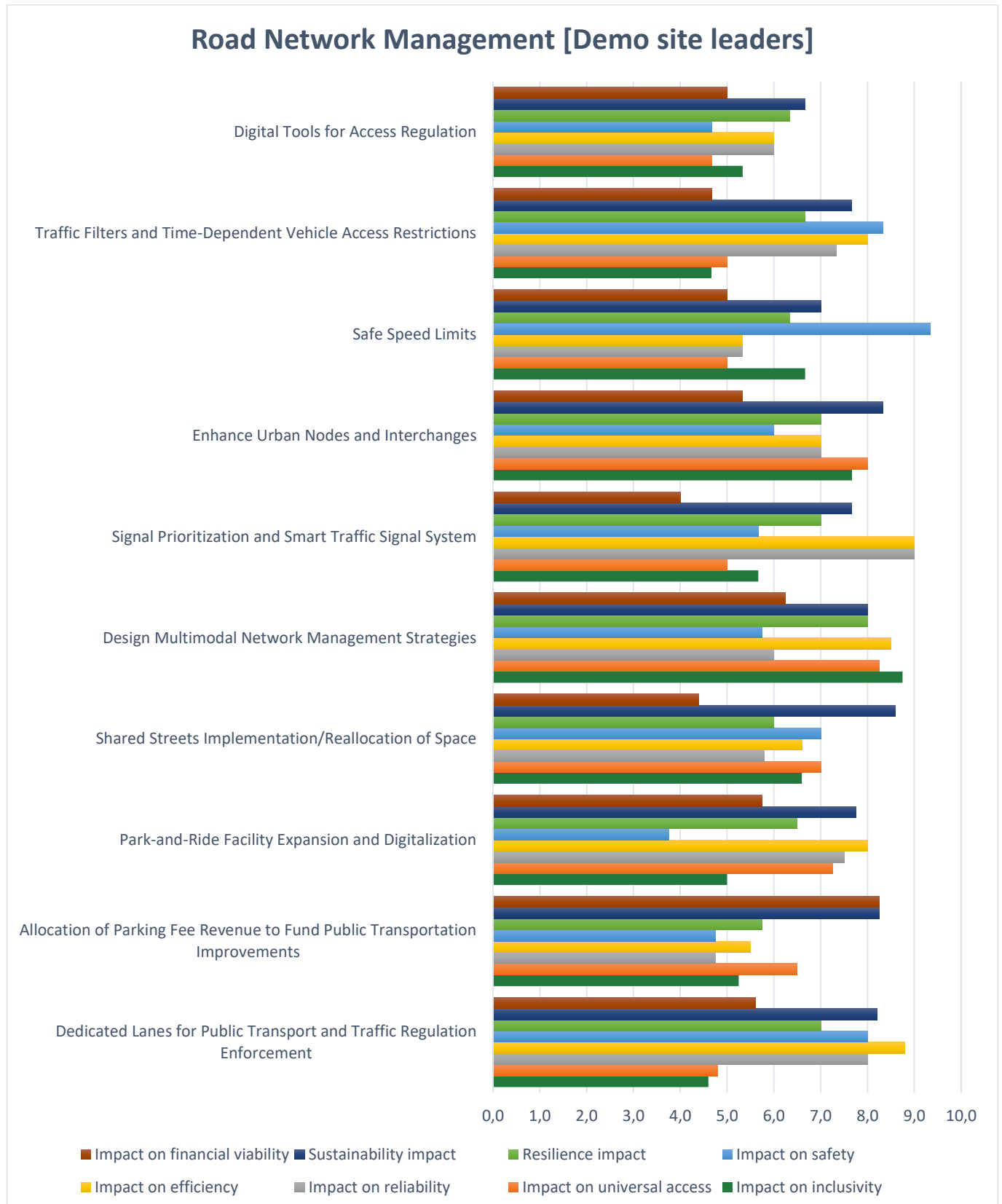
Mobility Services Ecosystem

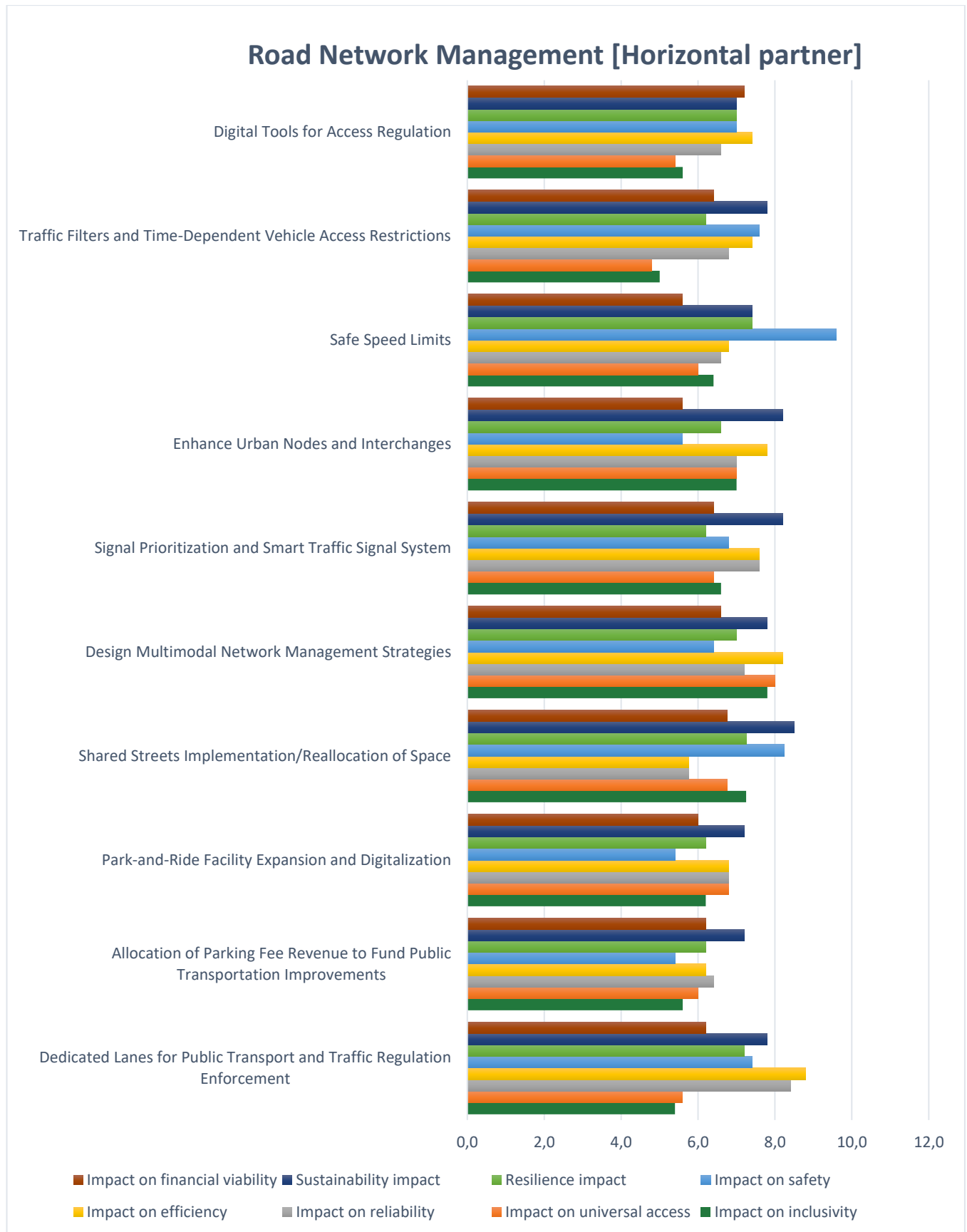


Mobility Services Ecosystem [Horizontal Partner]

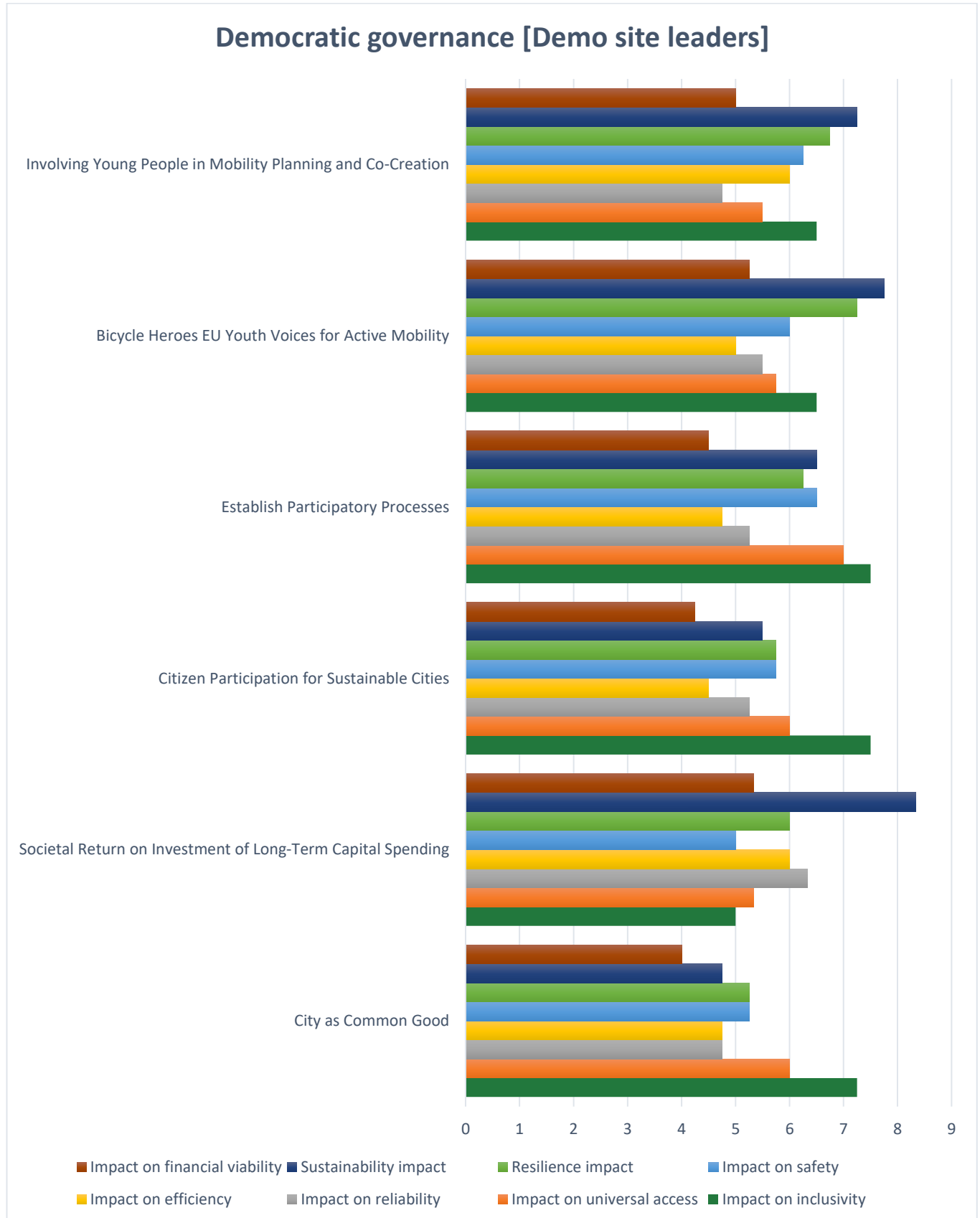


Road Network Management





Democratic Governance



Democratic Governance [Horizontal partner]

