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## Summary sheet

<b>Deliverable No.</b>	2.3
<b>Deliverable name</b>	Set of process parameters and indicators for ReVeAL measures
<b>Project Acronym</b>	ReVeAL
<b>Full Title</b>	Regulating Vehicle Access for improved Livability
<b>Grant Agreement No.</b>	815069
<b>Responsible Author(s)</b>	Daniel Guzman, Koos Fransen, Dirk Lauwers, Sidharta Gautama
<b>Peer Review</b>	-
<b>Quality Assurance Committee Review</b>	Bonnie Fenton, Rupprecht Consult
<b>Date</b>	Nov 30 2019
<b>Status</b>	Final
<b>Dissemination level</b>	Public
<b>Abstract</b>	-
<b>Version</b>	1.0
<b>Work Package No.</b>	2
<b>Work Package Title</b>	Reviewing UVAR options and building scenarios
<b>Programme</b>	Horizon 2020
<b>Coordinator</b>	Stadt Bielefeld
<b>Website</b>	<a href="http://www.CIVITAS-REVEAL.eu">www.CIVITAS-REVEAL.eu</a>
<b>Starting date</b>	June 1, 2019
<b>Number of months</b>	36

## ReVeAL partners

	<b>Partner name</b>	<b>Abbreviation</b>	<b>Country</b>
1	Stadt Bielefeld	Bielefeld	Germany
2	Comune di Padova	Padova	Italy
3	Università degli studi di Padova	UNIPD	Italy
4	Gemeente Helmond	Helmond	Netherlands
5	V-Tron BV	V-TRON	Netherlands
6	Municipality of Jerusalem	Jerusalem	Israel
7	City of London Corporation	CoL	UK
8	Transport for London	TfL	UK
9	Centro de Estudios Ambientales	CEA	Spain
10	Sadler Consultants Europe GmbH	Sadler	Germany
11	TRT Trasporti e Territorio SRL	TRT	Italy
12	WSP Sverige AB	WSP	Sweden
13	Polis	Polis	Belgium
14	Universiteit Gent	UGent	Belgium
15	Rupprecht Consult – Forschung und Beratung GmbH	Rupprecht	Germany

## Document history

Version	Date	Organisation	Main area of changes	Comments
1.0	30/11/19	UGent	Construction of the document	

## List of acronyms

<b>KPI</b>	Key Performance Indicator
<b>LEZ</b>	Low-Emission Zone
<b>MFL</b>	Measure Field Leader
<b>PC</b>	Pilot Coordinator
<b>TA</b>	Transition Area
<b>UVAR</b>	Urban Vehicle Access Regulation
<b>WP</b>	Work Package
<b>ZEZ</b>	Zero-Emission Zone

## ReVEAL overview

### Smarter urban vehicle access regulations

Despite urgent calls for “smarter urban vehicle access regulations” in the Urban Mobility Package and other high-level political commitments, very few decision makers are keen on going public with the idea of restricting car access (in time or space) in urban areas. ReVeAL will help to add Urban Vehicle Access Regulations (UVAR) to the standard range of urban mobility transition approaches of cities across Europe. Toward this end, the ReVeAL consortium will combine conceptual work and case study research with hands-on UVAR implementation in six pilot cities and systematic stakeholder interaction and professional communication activities.

The ReVeAL approach works along three different dimensions when considering the implementation of new UVARs:

- It looks at a range of UVAR measures, grouping them into *Measures Fields*.
- It looks at all measures through the lens of four *Transition Areas*, which need to be taken into account in any local setting (Governance and Financing, Mobility Services and Concepts, System Design and Technology, User Needs and Acceptance)
- It approaches all of these in the light of the stages of the change process, understanding that cities at different stages are capable of different levels of ambition.

These aspects are crucial to consider for the implementation of any kind of UVAR measure. ReVeAL will open and expand the UVAR toolbox through a dedicated work package (WP2 – UVAR Options and Scenarios), covering both established and cutting-edge approaches. The most important and new ones are Pathways to Zero-Emission Zones (ZEZ) as well as planning and design-related approaches for Spatial Interventions at district level such as superblocks. Also included is the broad array of Pricing Measures (e.g. dynamic road and curb space user charges, congestion charging, paid or regulated parking space) and radically novel approaches such as C-ITS-based strategies to control vehicle access through automated C2I communication or geo-fencing. ReVeAL includes world-leading experts in these four areas who can support the pilot cities during the design and implementation of their UVAR measures. Some of these approaches will be considered in more detail in scenario building activities which will take place in each of the Pilot Cities.

## Overview of Deliverable 2.3: Set of process parameters and indicators for ReVeAL measures

*This deliverable defines the process evaluation parameters and impact assessment indicators to characterise UVAR measures. The parameters and indicators determine the different dimensions of the context and the impact of the ReVeAL process in a city. They are developed within the scope of the Transition Framework (WP1) and the Evaluation Framework (WP4). The set of parameters and indicators is documented in WP2 as the underlying data structure to encode the information gathered during the pilots and research in a knowledge database to support cities making decisions about possible UVAR implementation. The main concepts needed to understand the set are summarised here. The full methodologies can be found in the deliverables in WP1 and WP4.*

### Describing urban vehicle access regulations

ReVeAL gathers and structures existing evidence, current trends and developments in the implementation of various UVAR measures in Europe and around the world. Evidence will be gathered in four ReVeAL Measure Fields, namely:

- Spatial Interventions
- Pricing Measures
- Pathways to ZEZ
- Future Options

The purpose is to construct a ReVeAL knowledge base that will serve as a basis for building UVAR-related scenarios for the six ReVeAL pilot cities as well as feed into the Process Advisor of the decision support tool for cities post-project.

The knowledge base is filled with best practices and experience of existing UVAR implementations and the observed processes in the pilot cities. Data will be collected and related to the three Measure Fields: Spatial Interventions, Pricing Measures and Pathways to ZEZ. Future Options are handled differently as due to its nature little known implementations exist yet.

Two types of UVAR activity will be collected:

- **City case studies**

A city case study is an extensive review of a city where implementation of measures in one or more Measure Field is taking place (e.g., a ZEZ by design in Amsterdam, a pollution charge in London or the circulation plan in Ghent). The case study looks into the change processes and give a connected view on UVAR implementation.



- **UVAR building blocks**

A measure in this context is a building block (e.g. a parklet) that moves in the direction of a larger implementation (e.g. superbloc). Such measures may take the form of small or large-scale initiatives, or specific aspects of initiatives ranging across the different ReVeAL Transition Areas. These could include, for example, parklets, urban freight regulation, or successful methods to implement an aspect of a controversial LEZ (e.g. a logistics hub).

**The set of process evaluation parameters and impact assessment indicators developed in this deliverable relate to the city case studies.** It is meant to describe the process of implementation of larger UVAR implementations and the impact that has on urban indicators. The set of parameters and indicators has been developed by the Transition Framework (WP1) and the Evaluation Framework (WP4) and the reasoning was established in those work packages.

## Process Evaluation Parameters

*A large variety of factors can play a role in the success of an UVAR implementation. Many of these factors depend on the specific context of a city and need to be understood in order to identify if a specific practice is relevant for a city in question. Within the ReVeAL project, a transition framework is being developed in order to structure UVAR-related urban change processes. The framework aims to understand the context of a city and to identify the different urban variables affecting UVAR implementation. The purpose is to be able to support cities on possible pathways for successful implementations of UVAR and this based on 'learning by example' from existing cases. The framework is developed in WP1 and a full description can be found in the guidelines document (D1.1). In this section, the main concepts are summarized in order to understand the related process parameters.*

## The ReVeAL Transition Framework

ReVeAL will analyse and learn from existing UVAR implementation in cities worldwide and from its pilot cities' UVAR activities (**learning by example**). Focus is on describing the actual UVAR implementation and the processes that lead to a successful or unsuccessful implementation.

- For the UVAR measures, **a city implementation is analysed** with respect to the actual building blocks implemented, the scale of implementation, city spatial layout, main traffic flows, modal split, regional fleet distribution, etc.
- In addition, the dynamics of a city during UVAR implementation are also **analysed through the lens of four transition areas**. They identify the supporting conditions that can drive an implementation to success.

## LEARNING BY EXAMPLE



Figure 1. The UVAR implementation and the supporting processes in the four transition areas.

The ReVeAL transition framework groups the UVAR processes into four **transition areas**:

1. Governance and financing
2. User needs and acceptance
3. Mobility services and concepts
4. Technology and system design

Each of these areas captures independent dynamics in a city. These can couple with the activity of UVAR implementation, to strengthen, slow down or stop the implementation process or to drive it towards certain choices. Process evaluation focuses on the dynamics in these transition areas.

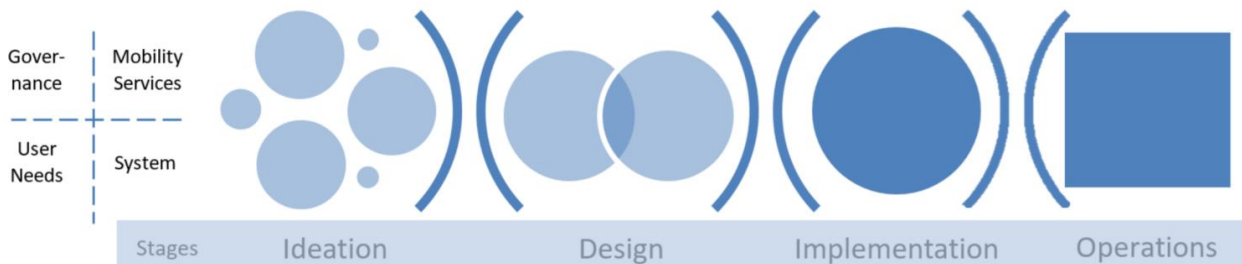


Figure 2. UVAR lifecycle.

To also assess the maturity of the city with respect to its UVAR implementation process, the ReVeAL transition framework divides the UVAR lifecycle (Figure 2) into a series of four phases. The UVAR phases correspond to different time periods involved in a set of activities and processes:

- **UVAR ideation phase:** Time span in which problems come to the attention of governments and possible solutions are discussed. It is characterised by the identification and definition of the problem. This stage ends when a problem is defined in such a way that solutions become concrete and feasible. The thought processes in this stage are on a conceptual level and the details of the scheme are not necessarily discussed in this phase.
- **UVAR design phase:** Time span in which UVAR solution designs are developed in more detail. In this stage, initial concepts are worked out. Multiple designs may be considered here including

alternative implementations, technologies etc. The dynamics in the four transition areas can influence strategic and technical choices for the UVAR implementation.

- **UVAR implementation phase:** Involves executing the UVAR options selected at the decision-making phase. This involves all the action necessary to put the UVAR measures into practice, including (if applicable): pilots, demos, referendum, communication, legal permits, etc.
- **UVAR operation phase:** Here all the activities following the launch of the UVAR implementation take place. This may include the monitoring and evaluation of the measure, the coupling with new UVAR measures, polling and fine-tuning.

The activity in the four transition areas is described in the context of this UVAR lifecycle because different types of activity can be expected in different phases of a city's UVAR process.

## The Transition Area datasheets

In the transition framework, each transition area is described by a set of questions that are meant to capture the process dynamics relevant for UVAR implementation. The focus is on gathering concise and structured information on the process of UVAR implementation in a city. Each area is covered by a datasheet of targeted questions, often with discrete answers. This structured approach was favoured to facilitate decision support using this knowledge base as it allows better clustering and matching of observed cases and the identification of good practices for new cities (i.e. learning by example). This approach risks the loss of information as some valuable elements may not yet be captured by the set of questions. This will be evaluated during pilot execution by the Measure Field Leaders and the Pilot Coordinators and the datasheets can be extended or revised based on their experience.

Regardless of possible needed adaptation, the principle remains the same: the datasheets capture the process information of UVAR implementation in its different stages. Each transition area is presented as a list of questions divided in two sections:

- (1) **General assessment:** this polls the current state of the city relevant for that specific transition area (e.g. the presence of enforcement technology or shared mobility);
- (2) **Phase-related questions:** questions that poll for specific coupling of transition area aspects on the procedures and development of UVAR implementation. Different questions are relevant in different phases in the UVAR lifecycle.

The datasheets will be processed further in WP4 for evaluating the process, but they encode the data describing the processes and can be considered as proxy for the evaluation parameters (see Annex 1 for the datasheets).

**Illustration of Datasheet Transition Area ‘Technology and System Design’**

<b>UVAR Technology (Enforcement)</b>		N/A	Under consideration	Exploratory	Operational
Manual inspection and windscreen stickers Manual toll collection Automated Number Plate Recognition (ANPR) Radio-frequency identification (RFID) Dedicated short range communication (DSRC) - RFID Global Navigation Satellite System / Cellular Networks (GNSS/CN) Automatic bollards					

<b>Curbside management (Parking)</b>		N/A	Under consideration	Exploratory	Operational
Payment	In situ (parking meter) Mobile payment In-vehicle (parking meter) Prepaid payment				
Pricing	Time of the day/week Demand (dynamic) Zone/area				

*Example of general assessment questions that poll for the presence of certain technology options relevant for UVAR.*

<b>Selection drivers</b>	Operational costs	Investment cost	End-user cost	Reliability	Interoperability	End-user friendliness	Privacy	Previous experience
Manual inspection and windscreen stickers Manual toll collection Automated Number Plate Recognition (ANPR) Radio-frequency identification (RFID) Dedicated short range communication (DSRC) - RFID Global Navigation Satellite System / Cellular Networks (GNSS/CN) Automatic bollards								

*Example of phase-related questions that poll for the selection of enforcement technology during the UVAR design phase.*

## Impact Assessment Indicators

Impact assessment analyses the impacts that can be attributed to a measure, a package of measures, or a policy which has been designed to reach a certain objective. Broadly speaking, an impact assessment measures to what extent the well-being of the society has changed due to the implementation of a measure. It deals with understanding the practical/technical effects of measures within the city in contrast to process evaluation, which is concerned with understanding why measures implementation succeeds or fails.

For the assessment of an impact it is essential to collect and analyse the data from the site where an UVAR measure will be or has been introduced, developing a scenario without a measure being implemented (i.e. business-as-usual scenario) and with its implementation (i.e. measure scenario). The assessment of an impact can be carried either before or after the implementation of a measure. If the assessment is developed before (i.e., ex-ante), it can help to decide which measure will be best to solve the problem. If the assessment is developed after (i.e. ex-post), it can help to understand if a measure has been helpful, and to what extent, in tackling the identified problem.

Impact assessment is divided into five different impact areas. These are as follows:

1. **Economic impacts:** The economic impact focuses on the estimation of the benefits (or effectiveness) generated by a measure in relation to the resources used for ideation, design, implementation and operation. In economic terms, the balance between the costs a measure implies and benefits generated has to be evaluated in order to assess the extent to which it can contribute to the economic welfare of the residents of an urban area. It is important to remember that the economic impact is measured on behalf of the whole society, not from the perspective of a single individual.
2. **Energy impacts:** Energy impact concerns the effect of a transport measure on energy consumption, for example assuming the introduction of alternative fuels or changes in the mix of propulsion systems of the fleet of vehicles in the area where a measure is implemented. Other measures can also contribute to the reduction of the energy impacts by, for example, encouraging users to shift to less energy-consuming transport modes (i.e., collective transport, car sharing, bicycle, walking, etc.).
3. **Environmental impacts:** Environmental impacts consider transport measures that aim at improving the quality of the environment or, according to public economics, at reducing the external costs of transport. This objective can be achieved by using cleaner or less noisy vehicles, which in general create lower at-source emission levels. Environmental impacts can be quantified as variations of the volume of emissions of local pollutants (i.e. CO, NO<sub>x</sub> and particulate matter), greenhouse gases emissions (i.e. CO<sub>2</sub>) and noise level for affected residents. The emissions of pollutants also depend on the mix of vehicles and the assumed evolution of the fleet over time.
4. **Societal impacts:** Societal impact evaluation is focused on assessing the general acceptability of a measure and its effects on how easily people are able to travel around in a city (i.e. physical and economic accessibility), including their feeling about security. These may in turn have further effects on, for example, health and employment opportunities.
5. **Transport system performance impacts:** The transport system performance considers different aspects related to the implementation of a measure. The analysis of this type of impact aims to understand how much a measure could contribute to better urban transport.

For each area, a number of KPIs is defined. These are listed in Annex 2, together with a brief description and the data needed to carry out quantitative calculations or qualitative estimations. A full description of the evaluation methodology can be found in D4.1 (Process Evaluation and Impact Assessment Framework).



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## **Annex 1: Transition area datasheets**

1a: Governance and financing

1b: User needs and acceptance

1c: Mobility services and concepts

1d: System design and technology

## **Annex 2: Impact assessment datasheet**

Annex 1a: Governance and Financing - general assessment, financing

<b>Decision making context</b>	
Who makes decisions? (political stream) Please provide the city's organigram /structure / 'chain of command' Leading politicians in the UVAR project	<i>City Organigram</i> <i>5 names</i>
Who formulates technical solutions? (Policy stream) Leading technicians in the UVAR project within the city services Leading external/contracted technicians in the UVAR project	<i>text</i> <i>5 names</i> <i>5 names + affiliation</i>
Leading opinionators/civil society and media voices on the UVAR project	<i>5 names + affiliation</i>
UVAR champion: who leads the process? (person or unit/organisation)	<i>text</i>
Electorial period	<i>Timeline (Elections, beginning of campaign)</i>









Annex 1a: Governance and Financing - general assessment, financing

<b>Financing of accompanying measures</b>	
Accompanying measures funded by UVAR implementing authority? Accompanying measures funded by Third parties? if Y: by whom?	<i>text</i>

Annex 1a: Governance and Financing - UVAR financing questions

<b>Funding of UVAR establishment</b>	
Plan/study: estimated cost / payed by whom?	€/ text
Installment of equipment: estimated cost / payed by whom?	€/ text
Communication and public involvement: estimated cost / payed by whom?	€/ text
Enforcement: estimated cost / payed by whom?	€/ text
<b>Management and purpose of revenue streams</b>	
earmarking? regional/national government? transparent allocation of revenue?	text
<b>Audit and oversight</b>	
audit and oversight procedures in place?	
<b>Procurement(*)</b>	
Which items are you planning to procure?	text

Ideation	Design	Implementation	Operation
Ideation	Design	Implementation	Operation
Ideation	Design	Implementation	Operation
Ideation	Design	Implementation	Operation

Annex 1a: Governance and Financing - UVAR financing questions

<b>(*) The procurement procedure (For each procured item) **</b>			
Step 1: Preparation and planning	Procurement procedure prepared and planned	Defining the need in terms of functions Open and restricted procedure (procurement method) Competitive dialogue and negotiation Using joint procurement	text text
Step 2: Definition of specifications and standards	Specifications and standards specified	Approaching the market: are relevant market actors involved? Using performance based specifications Additional specifications of products, services and works	text
Step 3: Submission of tenders and selection of tenders	Tenders submitted and selected	Selection criteria (implementation of environmental management systems...)	text
Step 4: Valuation of tenders and award		Award criteria (e.g. specific or overall CO2 emissions, life cycle costing, ...)	text
Step 5: Contract implementation and management	Contract implemented and managed	Monitoring and reporting obligations: contracting authority/ supplier / third party Quality standards and bonus/malus schemes applied	

\*\*The procurement procedure (EC, 2018) consulted in 'Topic Guide. Public procurement of sustainable urban mobility measures', F. Rudolph and S. Werland (Wuppertal Institute), 2019.

User needs and acceptance

User needs

User needs captures the habits and preferences of users of a service or an environment. In understanding future user needs special attention should be paid to the differences among users regarding age, socio-economic and cultural background, preferences and abilities etc.

Within the ReVeAL context user needs are the degree to which users can understand how an UVAR functions. For example, do travelers understand what vehicles are allowed into a low-emission zone or how much they need to pay going into a congestion charging zone? How easy is it to pay? What is the process for getting an exemption?

Early in the ReVeAL process future user groups and their possible different user needs should be identified. During the whole process the importance of the different user needs should be assessed and monitored. In the latter phases of the process communication and engagement with the targeted user groups is essential to understand and explain the new situation.

User needs: Template guidance.

The User needs-template should be answered and updated continuously during the process. Some questions are relevant in all four phases while other relate only to the early or the later phases. The template questions and their relevant phases provides a guidance to backtrack the availability of historical information. I.e. when are different user needs and their importance mentioned? When was an explicit user needs identification process in place? Have they performed a user-centered information campaign and if so when did it take place?

User acceptance

User acceptance is the demonstrable willingness within a group to use a system or measure for the tasks for which it was designed. User acceptance is partly affected by the design characteristics of policy measures and partly by individual mechanisms. It relates also to political acceptance, and UVAR measures in general are controversial.

Understanding how user acceptance will develop over time is essential for creating political acceptance. Hence monitoring and measuring public acceptance should be performed periodically during the ReVeAL process. In doing this it is important to understand and address questions regarding equity, fairness and self-interest and how it affects level of acceptance in both policy design and communication. Equity refers to how the costs and benefits resulting from a measure are distributed over the population, whereas perceptions of fairness are individual. In the context of congestion charging self-interest has been shown to have substantial impact on attitudes towards the charges. The same pattern could be expected regarding other UVAR measures.

User acceptance: Template guidance.

The User acceptance-template consists of four checklist questions, two desk study questions and two opinion poll questions. The first four questions are to be answered once early in the process. The two desk study questions could be answered through a continuous analysis of local media articles and news stories. The opinion poll questions should be answered by the local public. Since the nature of public acceptance is nonlinear, we recommend that they should be answered at least two and ideally four times during an UVAR life-cycle. How often and when is specific to each city, their UVAR and time frame. If answered twice

- 1 year to half-year before implementation (1)
- Half-year to 1 year after implementation (4).

If answered four times

- 1 year to half-year before implementation (1)

- 1-3 months before implementation (2)
- 1-3 months after implementation (3)
- Half-year to 1 year after implementation (4).

Both the desk study questions and the opinion poll questions require more resources (personnel and survey advertising),

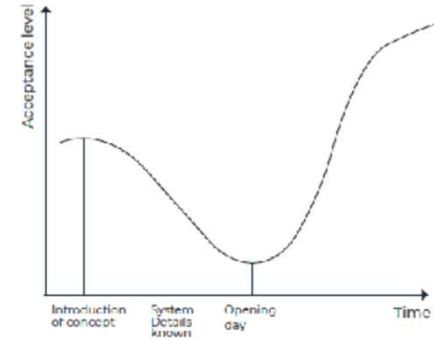


Figure 1. Typical Dynamic Pattern of Acceptance. Adapted from (Goodwin 2006) and (Schade, Seidel and Schlag 2004) and with recommended times for opinion polls.

If historical data about how user acceptance have been monitored and measured is lacking for the specific UVAR, some guidance to how the city handles user acceptance can be found in earlier similar processes.

D2.3: Annex 1b - User Needs and Acceptance - User Needs

What is the importance of different user needs?	Not	Somewhat						
	important	important	Important	Dominant	Ideation	Design	Implementation	Operation
Congestion reduction								
Improved travel time reliability								
Air quality improvements								
Quality of urban space								
Reduction of CO2 emission								
Improved traffic safety								
Noise reduction								
Vibration reductions								
Better public transit								
Improved walkability								
Improved bicycle opportunities								
Affordability of travel								
Improved health								
Ease of finding parking space								
Economic vitality of the city								
Ease of use								
Ease of understanding the policy								
Privacy and anonymous travel								
Role for public to participate in design process								
Transparant decision making								
Public information on costs, benefits and alternatives								
					Ideation	Design	Implementation	Operation
<b>Is there an explicit process to identify user needs?</b>								
					Ideation	Design	Implementation	Operation
<b>Is there an information campaign to explain how the new situation will work for travellers</b>								





**Checklist questions**

<b>Is your city monitoring media attention continuously?</b>	
<b>If yes: What is the general tone in media with regards to the policy measure?</b>	
Left Neutral Right	

<b>Is your city measuring public acceptability periodically?</b>	
<b>If yes:</b>	
<b>What is the current level of acceptability for measure x?</b>	<i>Percentage</i>
<b>If no: What are the main barriers to measuring public acceptability issues</b>	
Costs Personell Political will	

<b>Have different relevant interest groups been identified?</b>	
Car lobby groups Climate groups Bicycle and active modes Other...	<i>text</i>

<b>Have you identified different vulnerable groups?</b>	
Socio-economic Ethnicity Geographical Age Disability Gender	

**Desk study questions**

<b>What are the main arguments of the opposition?</b>	
Fairness Affordability Measure costs Doubt effectiveness of measure Anti-car Competitiveness	

<b>What are the main arguments of support?</b>	
Liveability Congestion Revenue use Sustainable development Competitiveness Fairness	

**Opinion poll questions**

To what extent does the public think the measure will solve societal problems and meet objectives?	
To what extent does the public understand how to use/travel in the new situation?	

#### Mobility services and concepts

"Mobility concepts" refer to innovative mobility schemes and services focused on the use of new technologies, vehicles and transport infrastructures also in combination with existing elements (e.g. active mobility, public transport or other UVAR measures) in order to accelerate, maximize or introduce significant changes in mobility patterns and landscapes or significantly mitigate negative impacts.

Within the ReVeAL's UVAR mobility services and concepts transition area, the mobility concept can be described as a set of coherent and organized actions and measures (both physical and intangible) able to support the ideation, design, implementation and operation of a specific (or a set of) UVAR measure(s) in a city/ metropolitan area.

Examples of mobility services inside a mobility concept are MaaS (Mobility as a Service), automated and/or electric shuttles, new public transport options, ride hailing platforms, application of C-ITS (Cooperative Intelligent Transport Systems), shared bikes, cars, vans and mopeds, (cycle) logistics schemes, etc.

<b>What are the existing sustainable mobility services in the city/metropolitan area?</b>	
Frequent urban public transport Extensive and continuous cycle network Park and ride schemes Park and walk/bike schemes Extensive charging network for e-vehicles Bike sharing Car sharing Van sharing Other sharing system (mopeds, scooters, etc.) Automated/electric shuttles C-ITS (Cooperative Intelligent Transport Systems) MaaS (Mobility as a Service) Ride hailing platforms/services Urban logistics platform/infrastructure Urban logistics schemes Cycle logistics Others	<i>text</i>

Annex 1c: Mobility Services and Concepts - UVAR phase questions

<p>Ideation Design Implementation Operation</p>		
	<p><b>What are the mobility services that have been implemented in this UVAR phase?</b></p>	<p>- <b>(If "Implemented") Has their implementation already been planned, independently from the process of the specific UVAR measure?</b></p>
<p>Public transport improvement/development Public transport services (fleet, ticketing, infomobility, etc.) development Extension of bus/tram lanes Extention of cycle network Park and ride schemes development Park and walk/bike schemes development Other new parking options Extension of charging network for e-vehicles Bike sharing system development Car sharing system development Van sharing system development Other sharing system (mopeds, scooters, etc.) development New automated/electric shuttles Application of C-ITS (Cooperative Intelligent Transport Systems) Introduction of MaaS (Mobility as a Service) Introduction of ride hailing platforms/services New urban logistics platform/infrastructure Urban logistics schemes development Cycle logistics development Other urban logistics scheme/development Cycle logistics development</p>		

Annex 1c: Mobility Services and Concepts - UVAR phase questions

<p><b>Have ex-ante evaluation activities (transport models/ projections/ forecasts, both from a supply and a demand point of view) for the implementation of the mobility services been conducted? - (If "Yes") What has been their outcome?</b></p>	<p><b>Have the mobility services been already in operation in the past but currently failed or have they originally been planned but eventually not implemented?</b></p>	

Annex 1c: Mobility Services and Concepts - UVAR phase questions

- (If different from "No") Why the mobility service has failed or has not been implemented?	Have the mobility services been included in plans or other strategies? Which one (the most important and pertinent prevails)?	Has the in-depth design (definition of technical features such as size, dimensions, model, format, energy and telematic necessities, etc.) been prepared for the mobility services?



Annex 1c: Mobility Services and Concepts - UVAR phase questions

<b>Have the necessary management needs (in terms of provision of the necessary maintenance interventions to preserve a good operational level and provision of the necessary coordination within and between involved departments of the administrative bodies) been provided for the mobility services</b>	<b>Have mitigation elements in order to reduce unexpected and undesired effects of the mobility services been needed? Which ones?</b>

#### System design/technology

The system design/technology transition area focus on the availability, functionality, and status of UVAR-related systems – and the technologies that make up these systems – in a city throughout the UVAR life cycle. This transition area identifies five different clusters. These are:

*Curbside management (Parking):* Parking is one of the most commonly used means to regulate access to urban areas. When implementing UVAR, parking places, policy, control, and payment mechanisms should be aligned and supportive of UVAR. In the context of the System design/technology transition area, this cluster focus on the enforcement mechanisms, and the technological capabilities of the control entities with regard to (dynamic) pricing strategies.

*UVAR Technology (Enforcement):* This cluster provides an overview of the different technological options used for UVAR enforcement. Here we focus in the set of alternatives that are considered, not only during the design phase, but in any of the later UVAR phases. Especial attention is given to the main drivers for the selection of the alternatives (e.g. interoperability, reliability, privacy, etc.).

*UVAR Technology (Communication):* Communication and the use of information are crucial when implementing UVAR schemes. "Experience has demonstrated that effective information and communication can mitigate criticism and lead to successful and smooth implementation of an UVAR scheme, ensuring its long-term effectiveness" (Ricci et al., 2017). Communication in the system design/technology transition area relates to the different communication channels used and their purpose (one-way vs. two-way communication engagements).

*Traffic management systems:* This cluster covers the variety of data applications used for traffic management, grouping them from a functional point of view. These systems give support to the UVAR measure during its development. The capabilities of the installed systems reflect the awareness and control a city may have over its own mobility, which aligns the set of UVAR measures considered and the monitoring and evaluation of the implemented UVAR measure.

*Infrastructure:* The objective of infrastructure in the context of the system design/technology transition area is twofold. It refers to (1) dedicated infrastructure for targeted modes (EV charging stations), necessary to impulse a modal shift, in this case to cleaner technologies, and (2) dedicated infrastructure for communication (VMS) necessary for traffic information management and control, that in later stages of the UVAR lifecycle can also support the communication of the UVAR measure.

Annex 1d: System Design and Technology - General Assessment

<b>UVAR Technology (Enforcement)</b>	Status
Manual inspection and windscreen stickers Manual toll collection Automated Number Plate Recognition (ANPR) Radio-frequency identification (RFID) Dedicated short range communication (DSRC) - RFID (GNSS/CN) Automatic bollards Other	

<b>Curbside management (Parking)</b>		Status
Payment	In situ (parking meter) Mobile payment In-vehicle (parking meter) Prepaid payment	
Pricing	Time of the day/week Demand (dynamic) Zone/area	

<b>Traffic management systems</b>	Status
(1) Traffic analysis	
(2) Traffic monitoring	

(1) Traffic analysis	These applications aim at understanding the urban traffic and mobility, for instance, by recognizing patterns, explaining typical situations, and by understanding atypical effects.
(2) Traffic monitoring	This kind of applications focus on a derived analysis in which the focus is on the evolution of traffic in time, e.g., behavioral changes during peak hours, weekends, etc.
(3) Traffic information	These applications focus on the collection and sharing of traffic information with mobility partners and/or with road users and citizens.

Annex 1d: System Design and Technology - General Assessment

(3) Traffic information	
(4) Traffic management	

(4) Traffic management	Applications capable of applying different measures to adjust the demand and capacity of the traffic network in time and space to better 'match' the traffic demand and supply (capacity).
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Infrastructure	Magnitude per UVAR area	Magnitude per city area		
Electric vehicle network	<i>Number</i>	<i>Number</i>	Charging stations/ km <sup>2</sup>	Used for
Variable message sign	<i>Number</i>	<i>Number</i>	Units/km	

UVAR Technology (Communication)	Status
Strong website presence	
Variable-message sign (VMS)	
Road surface marking	
Road signaling	
Mass media	
Social networks	
Other	

Annex 1d: System Design and Technology - UVAR phase questions

Importance in decision-making		Not important	Somewhat important	Important	Dominant	Ideation	Design	Implementation	Operation		
Traffic applications	(1) Traffic analysis										
	(2) Traffic monitoring										
	(3) Traffic information										
	(4) Traffic management										
Infrastructure	Electric vehicle network										
	Variable message sign										
Curbside management (Parking)	Payment	In situ (parking meter)									
		Mobile payment									
		In-vehicle (parking meter)									
	Pricing	Prepaid payment									
Time of the day/week											
	Demand (dynamic)										
	Zone/area										
Decision support tool(s) in the decision-making		Decision support tool				Ideation	Design	Implementation	Operation		
Traffic modelling											
Traffic simulation											
Environmental modeling											
Environmental simulation											
Other		<i>text</i>									
UVAR Technology Selection (Enforcement)		Not considered	Considered	Selected		Ideation	Design	Implementation	Operation		
Manual inspection and windscreen stickers											
Manual toll collection											
Automated Number Plate Recognition (ANPR)											
Radio-frequency identification (RFID)											
Dedicated short range communication (DSRC) - RFID											
Global Navigation Satellite System / Cellular Networks (GNSS)											
Automatic bollards											
Other											
UVAR Technology (Communication)		Not used	One-way	Two-way		Ideation	Design	Implementation	Operation		



Annex 1d: System Design and Technology - UVAR phase questions

<b>Third-party data sharing (2)</b>	
Is the information on UVAR currently being shared with third-party data providers?	

<b>Open access data update</b>	
Does it exist any open access data mechanisms, agreements, or regulations to provide/update (real-time) information on the city's access	

Ideation	Design	Implementation	Operation
Ideation	Design	Implementation	Operation

Annex 1d: System Design and Technology - UVAR phase questions



Annex 1d: System Design and Technology - UVAR phase questions

Annex 1d: System Design and Technology - UVAR phase questions

(1) Traffic analysis	These applications aim at understanding the urban traffic and mobility, for instance, by recognizing patterns, explaining typical situations, and by understanding atypical effects.
(2) Traffic monitoring	This kind of applications focus on a derived analysis in which the focus is on the evolution of traffic in time, e.g., behavioral changes during peak hours, weekends, etc.
(3) Traffic information	These applications focus on the collection and sharing of traffic information with mobility partners and/or with road users and citizens.
(4) Traffic management	Applications capable of applying different measures to adjust the demand and capacity of the traffic network in time and space to better 'match' the traffic demand and supply (capacity).

Selection drivers	Operational costs	Investment cost	End-user cost	Reliability	Interoperability	End-user friendliness	Privacy	Previous experience
Manual inspection and windscreen stickers Manual toll collection Automated Number Plate Recognition (ANPR) Radio-frequency identification (RFID) Dedicated short range communication (DSRC) - RFID Global Navigation Satellite System / Cellular Networks (GNSS/CN) Automatic bollards Other								



Annex 1d: System Design and Technology - UVAR phase questions

Other	<i>text</i>		
<b>Partners involved</b>		Are their platforms currently operational? (Is the information in	How is the approach/engage with this company?
Google Waze TomTom Verizon connect HERE Technologies Other	<i>text</i>		
<b>Mechanisms</b>			
Social media Dedicated websites SMS Open digital maps Other	<i>text</i>		

## Annex 2: Impact Assessment

## IMPACT ASSESSMENT

No.	Impacts	Category	Indicator	Description	Data and/or unit	Scope	
						City-wide	Area
<b>PILOT-RELATED INDICATORS</b>							
<b>ECONOMY</b>							
IA1	Benefits	Operating revenues	Operating revenues	Revenues per pkm or vkm	Euros/pkm or Euros/vkm, quantitative		X
IA2		Rent	Land rent	Mean real estate values	Euros, quantitative		X
IA3		Savings	Travel time savings	Monetised savings in travel time	Euros/pkm or Euros/vkm, quantitative		X
IA4	Costs	Costs	Capital costs	Capital cost per system or unit	Euros, quantitative		X
IA5			Operating costs	Costs per time period	Euros/time period, quantitative		X
IA6			Managing and maintenance costs	Costs per time period	Euros/time period, quantitative		X
IA7			Congestion costs	Costs per vkm	Euros/vkm, quantitative		X
IA8			Social costs	Costs per fatalities and injured persons	Euros/fatality and Euros/injured, quantitative		X
<b>ENERGY</b>							
IA9	Energy Consumption	Fuel consumption	Vehicle fuel efficiency	Fuel used per vkm, per vehicle type	MJ/vkm, quantitative		X
IA10			Fuel mix	Percentage of fuel used by type	%, quantitative		X
<b>ENVIRONMENT</b>							
IA11	Pollution and nuisance	Emissions	CO2 emissions	CO2 per vkm by type	G/vkm, quantitative		X
IA12			CO emissions	CO per vkm by type	G/vkm, quantitative		X
IA13			NO2 emissions	NO2 per vkm by type	G/vkm, quantitative		X
IA14			Particulate emissions	PM10 and/or PM2.5 per vkm by type	G/vkm, quantitative		X
IA15		Noise	Noise	Level of noise (relevant locations)	Index (%), qualitative		X
<b>SOCIETY</b>							
IA16	Acceptance	Awareness	Awareness level	Awareness of the policies/measures	Index (%), qualitative		X
IA17		Acceptance	Acceptance level	Attitude of current acceptance of the measure	Index (%), qualitative		X
IA18	Accessibility	Spatial accessibility	Accessibility level by social groups	Physical accessibility of pilot area (by gender, age, physical condition, nationality/ethnicity)	Index (%), qualitative		X
IA19	Safety	Transport safety	Injuries and deaths caused by transport accidents	Numbers of accidents, fatalities and casualties caused by transport accidents, per mode	No, quantitative		X
IA20	Equity	Equity	Equity level by social groups	Equity of the UVAR measure (by gender, age, physical condition, nationality/ethnicity)	Index (%), qualitative		X
<b>TRANSPORT</b>							
IA21	Quality of PT service	Service reliability	Accuracy of timekeeping - peak	Percentage of services arriving / departing on time	%, quantitative		X
IA22		Travel times	Average service speed - peak	Average speed of PT (selected bus and tram lines)	Km/h, quantitative		X
IA23	Transport system	Traffic levels	Traffic flow by vehicle type - peak	Average vehicles per hour by vehicle type - peak (relevant locations)	Veh per hour, quantitative		X
IA24			Traffic flow by vehicle type - off peak	Average vehicles per hour by vehicle type - off peak (relevant locations)	Veh per hour, quantitative		X
IA25		Congestion levels	Car travel time - peak	Average travel time - peak (selected corridors)	Minutes, quantitative		X
IA26			Car travel time- off peak	Average travel time - off peak (selected corridors)	Minutes, quantitative		X
IA27		Freight movements	Goods vehicles	Daily number of goods vehicles	No, quantitative		X
IA28		Soft mobility levels	Pedestrian flows	No. of pedestrians (relevant locations)	No. per hour, quantitative		X

Annex 2: Impact Assessment

IA29			Cycle flows	No. of cyclists (relevant locations)	No. per hour, quantitative		
IA30		Sharing mobility	Access to shared modes	No. of bike sharing, car sharing and micro-mobility stations	No, quantitative		X
IA31		E-mobility	Charging points	No. of charging points for electric vehicles	No, quantitative		X
IA32	Public space	Public space usage	Area dedicated to transport and other needs	Extent of walkable areas, cycle paths, PT lanes, surface reserved to vehicles (general speed limit and reduced speed limit - 30km/h), parking spaces, green areas	m2, quantitative		X
<b>CONTEXT INDICATORS</b>							
<b>ENVIRONMENT</b>							
IA33	Pollution	Air quality	CO levels	CO concentration	Ppm or g/m3, quantitative	X	
IA34			NO2 levels	NO2 concentration	Ppm or g/m3, quantitative	X	
IA35			Particulate levels	Particulate PM10 and/or PM2.5 concentration	Ppm or g/m3, quantitative	X	
IA36			Black carbon levels	Black carbon concentration	Ppm or g/m3, quantitative	X	
<b>TRANSPORT</b>							
IA37	Transport system	Modal split	Average modal split-passengers	Percentage of passenger-km for each mode	%, quantitative	X	
IA38			Average modal split-vehicles	Percentage of vehicle-km for each mode	%, quantitative	X	
IA39			Average modal split- trips	Percentage of trips for each mode	%, quantitative	X	
IA40		PT usage levels	PT ridership	PT trips per inhabitant	No, quantitative	X	
IA41		Regulated zones	Area included in regulated zones	Extent of Limited Traffic Zones, Low Emission Zones, Zero Emission Zones	km2 or m2, quantitative	X	