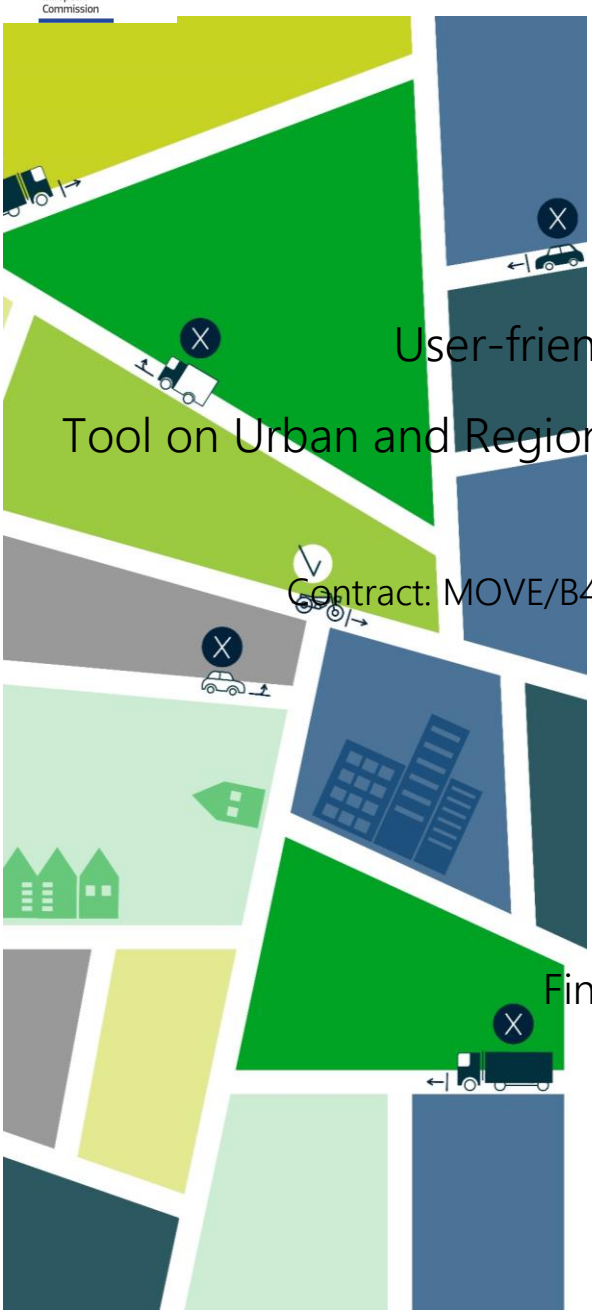

User-friendly Information

Tool on Urban and Regional Access Regulations Schemes

Contract: MOVE/B4/SER/2019-498/SI2.832125

Final Report

Consortium:

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Document bios

Document file name	Work Package	Tasks
UVARBox_FinalReport_10-2022_2.0	WP0	1

Version history

Version	Date	Description of changes	Author	Partner
0.1	07/2022	First draft	WP0	ARMIS
0.2	08/2022	Structure and content contributions	All	All
0.3	08/2022	Revision	All	All
1.0	09/2022	Comments integrated	WP0	ARMIS
2.0	10/2022	DG MOVE comments integrated	All	All

Disclaimer

Executive Summary

More and more European cities are introducing urban vehicle access regulations (UVARs) of different kinds. These local access regulations serve policy objectives such as air quality, liveability, climate change and congestion reduction. The most common types of UVARs include Low Emission Zones, Parking Regulations, Congestion Charging Schemes, Limited Traffic Zones and Pedestrian Zones.

Providing relevant and effective information regarding UVAR schemes to all road users is of utmost importance to ensure schemes are respected and publicly accepted. They also facilitate the organisation of access of goods and people into urban areas. Where UVARs are deployed, it is important that they allow for seamless and user-friendly travel across the single market, without leading to discrimination of non-resident drivers.

While EU-wide information on UVARs is available on the website www.urbanaccessregulations.eu, currently, no digitised static and dynamic machine-readable data is available in a standardised or interoperable format. There is an obvious advantage for road users and road transport operators to be able to have integrated information on UVAR schemes in apps, fleet management tools and navigation devices while planning their trip and during their journey.

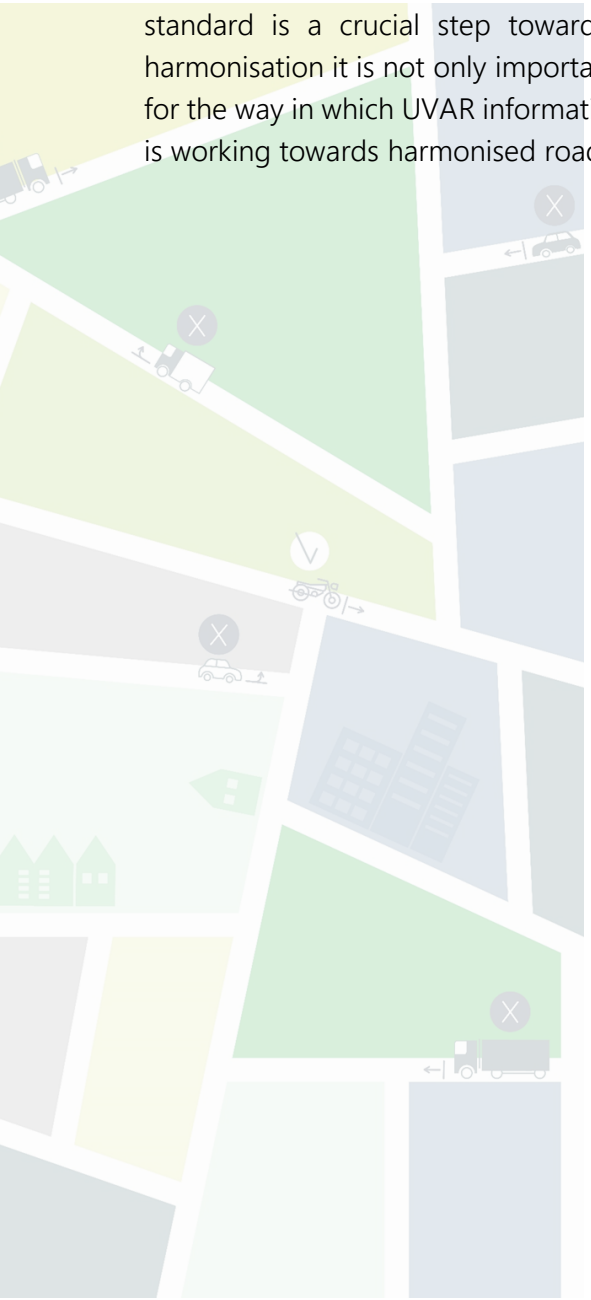
UVAR Box is an EU-funded project (MOVE/B4/SER/2019-498/SI2.832125) providing tools to enable road users' information on access regulations to cities and regions in Europe, digitally, both ahead of and during their trip. The project started in September 2020 and ran for two years. The project focused on the following 5 Countries to be used as pilot Member States: Austria, Belgium, Germany, Italy, and the Netherlands. Furthermore, other countries such as Portugal, Spain, Latvia, and France were active in the project initiatives. The main outcomes were the following:

- A data structure for data on UVARs following the DATEX II standard.
- Collection and digitisation of UVAR DATEX II data to enable its incorporation into navigation systems or mobile applications.
- A user-friendly software tool, documentation and training to help authorities digitising UVAR information according to the prescribed standard.

These outcomes support the harmonisation of UVAR information from local authorities, and support road users in their trip planning across the EU. By establishing a Country Coaches' Board (CCB) on the 5 pilot Member States above mentioned, the UVAR Box was able to assist local authorities and Member States to set up their issuing procedures, digitally. As a result, more than 500 UVAR schemes were made available in DATEX II.

Future key challenges to sustain the project's achievements include scaling the use of the developed UVAR Box Tool and UVAR DATEX II standard beyond the project and building on the communication and knowledge sharing established within the project. The link to the NAPCORE initiative is crucial, as a strong liaison with NAPs and the work taken on by the NAPCORE working groups are highly important for making UVAR data accessible. Raising awareness and improving the knowledge of the DATEX II

standard is a crucial step towards harmonisation of UVAR information. In the broader context, harmonisation it is not only important to take into consideration for machine-to-machine data, but also for the way in which UVAR information is provided to drivers. In that regard, the project UVAR Exchange is working towards harmonised road signs for UVARs across the European Union.



1 Introduction

1.1 Purpose of the Final Report

The present document refers to the Final Report of the Preparatory Action UVAR Box — User-friendly Information Tool on Urban and Regional Vehicle Access Regulation Schemes, Reference number: MOVE/B4/2019-498.

The UVAR Box, starting in August 2020 and running for 2 years, was led by ARMIS, in cooperation with a team of active and engaged actors, hands-on and actively contributing for the topics, over the past years. This is a team of well-known and respected professionals in the field: AlbrechtConsult, ARMIS, AustriaTech, MAPtm, MemEx, POLIS, PRISMA solutions and TRT, and including Harrod Booth Consulting, Sadler Consultants and U-Trex as subcontractors.

The purpose of this Final Report is to present the activities carried out during this two-year period, the results and outcomes of the project, and the strategy defined to assure its sustainability afterwards.

The report is divided into four main chapters. The first main chapter (chapter 2) provides an overview of the procedures done under the definition of UVAR data and data exchange. Then, chapter 3 is dedicated to the UVAR Box Tool, while chapter 4 explores the methods and collaborations addressed for UVAR data provision and access. Finally, chapter 5 sets recommendations for the sustainability of the UVAR data digitisation after the project ends and the maintenance of the artifacts produced. The Annex includes a summary Table per work package, the cities/organisations contacted by the CCs, and a GANTT with all formal meetings, deliverables, and milestones (planned dates vs real dates). The report does not go to deep on the results of each task, but instead, exposes the main outcomes and the processes behind it and links to the deliverables where detailed information can be found. The UVAR Box website[1] comprises a library with all the approved public deliverables.

1.2 General Overview of the Project

More and more European cities are introducing Urban Vehicle Access Regulations (UVARs) of different kinds. These local access regulations serve policy objectives such as air quality, liveability, climate change, and congestion reduction. The most common types of UVARs include Low Emission Zones (LEZ), Parking Regulations (PARK), Congestion Charging Schemes (CS), Limited Traffic Zones (LTZ) and Pedestrian Zones (PED). Providing relevant and effective information regarding UVAR schemes to all road users is of utmost importance to ensure schemes are respected and publicly accepted.

The general objective of the project is to foster real-time information to road users, in particular motorists (i.e., both professional and non-professional drivers), about urban and regional access schemes. The specific objective is to carry out a preparatory action project focusing on the needed enablers, i.e., preparation for standardisation, data provision requirements and tools to support streamlining of public

1 https://uvarbox.eu/

authorities' issuing procedures for UVAR-related information, in order to facilitate the integration of the UVAR information into mobile apps or navigation devices.

The project began by developing the necessary structured data model, containing the necessary detailed information on UVAR schemes, the UVAR DATEX II data model. This became the foundation for developing a software user-friendly tool, hereinafter referred to as the UVAR Box Tool.

Developing the UVAR structured data model, means to identify the minimum universal data categories and information structure (including geographical scope, type of UVAR, access conditions, tariffs - prices and validity, payment options, exemptions, etc.). This model was the basis for the development of a friendly web-based tool, designed to be used by cities, or any other UVAR competent authorities, when generating digital UVAR schemes and making that information available.

When it comes to UVAR digitisation, the project was ambitious. CLARS[2] database was considered the baseline for providing evidence of the existing UVARs, with special focus on 5 pilot Member States, but giving a "catch-all" data for the whole of Europe. The 5 pilot countries were Austria, Belgium, the Netherlands, Germany, and Italy. From each these countries, the goal was to cover 100% of the LEZ identified on CLARS, resulting in at least 242 LEZs in total. For other UVAR types and other countries, a "best-effort" approach was followed.

The establishment of a Country Coaches' Board (CCB) for the 5 pilot Member States was crucial to reinforce the outreach activities, towards as many cities as possible. The Country Coaches (CCs) were appointed by the Consortium, for facilitating the interaction with local authorities, providing guidance and support, while operating in the local language. Understanding cultural subtleties and embedded national policies on UVAR was key for the overall success of the project. The Country Coaches' ITS expertise helped raising awareness about the need to adjust current UVAR issuing procedures to be future proof, when evolving into machine-readable formats.

The data model and the UVAR Box Tool, along with the CCB activities, allowed data on UVAR schemes to be made available in adequate machine-readable formats following the DATEX II data exchange European standard, that traveller information service providers (TISPs) may use for navigation systems or mobile applications. Thus, it is ensured the creation of an important data source contributing to accurate, up to date, continuous and interoperable EU-wide real-time traffic information services (RTTI) to road users, pre-trip and on-trip.

Once available, the UVAR DATEX II data has the potential to become a valuable asset for policy makers, road authorities and service providers, but only if it is fully exploited. This depended on how easily accessible the data is, and how valuable the information is perceived by service providers, as well as on how this data can be incorporated into their information and navigation services. The key aspect of WP3 was to demonstrate and showcase how UVAR DATEX II data could be accessed via the network of

2 https://urbanaccessregulations.eu/

European NAPs, to be used by service providers for provision of UVAR information on navigation services.

In parallel, the project aimed at facilitating the process for making the same information available, but in human-readable format, in accordance with the Single Digital Gateway (SDG) Regulation, ensuring the provision of pre-trip information.

Finally, several topics were addressed when looking into future sustainability of UVAR machine-readable data creation and accessibility to users, via the NAPs. Encouraging authorities to integrate the provision of UVAR data in their existing and/or future eGovernment-processes and procedures, seemed to be the most accurate, cost-efficient and sustainable way forward. Different governance regimes between Member States, or even regions were taken into consideration for the strategy developments undertaken in WP4.

1.3 Communication support and strategy

To ensure the sustainability of data collection and accessibility, stakeholders had to be involved in the processes from the beginning of the project. They brought helpful inputs for the design of the UVAR Box Tool and enabled their developments by using them. Considering the importance of stakeholder engagement for the success of the project, a whole work package was dedicated to the strategy and support for communication, dissemination, and involvement. The Work Package 5 "Stakeholder engagement and communication support" had five main objectives:

- Planning the messages to communicate and the target audiences as well as their outreach channels;
- Set up the (mostly digital) tools for efficient communication, dissemination, and engagement;
- Position UVAR Box on the European scene;
- Provide training and take-up opportunities;
- Create a community for the project legacy.

Based on the D5.1 – Communication Strategy, including national campaign outline and stakeholder support facility procedures, stakeholder categories and their required engagement levels were defined, as well as the channels to reach out to them. Other EU-funded projects supporting UVAR Box dissemination and networking were identified in this deliverable as well.

A recognizable visual identity was developed for the project to support visibility online and at events. It was used for all communication material (leaflet, roll-up, brochure, slide deck, letter, and deliverable templates) and tools (social media accounts and visuals, website, email template).

The UVAR Box website[3] was developed by POLIS and has showcased all activities conducted by the consortium as well as the developments in the UVAR Exchange project. It has supported all events with invitation and registration as well as agenda information and meeting reports' publication. Besides events

3 https://uvarbox.eu/

and news promotion, the website displays all public deliverables produced by the consortium and entails a specific page with instructions on how to use the UVAR Box Tool[4], including a link to register as a user and start digitising UVARs. The Tool dissemination is based on this webpage.

To support the uptake of the UVAR Box Tool by UVAR responsible authorities, all information on how to use it is publicly available. The three use cases are explained in the introduction of the webpage, before the process to access the tool is detailed: get a user access through outreach to the project coordinator, then register and start digitising. A manual to explain each feature of the tool has been prepared as a deliverable of the project (see WP2) and is accessible on this webpage. A video demonstrates step by step how to proceed to digitise UVARs in each of the use cases. Support on the use of the tool was provided by the country coaches during the project lifetime and will hopefully be continued within the NAPCORE initiative. Several workshops and bilateral meetings have been organised to inform stakeholders, adapt the Tool to their needs, and support them in using it. After supporting cities in digitising the first UVARs, service providers' access was provided to enable the exploitation of the available data.

The stakeholder engagement strategy planned the events' line-up: from promotional events and stakeholder engagement workshops to take-up meetings and the hackathon to exploit results, a logical sequence ensured the UVAR Box positioning and effective interaction with key stakeholders. The detailed report on these events is available in the deliverable D5.2 – Events Report. The table below lists the UVAR Box events.

Table 1 - List of UVAR Box events

Event	Date	Location
Urban Mobility Days 2020	01-10-2020	Online
Dynaxibility4CE workshop on UVAR Topic Guide	15-10-2020	Online
First Stakeholder workshop	24-11-2020	Online
POLIS Annual Conference session on UVARs	03-12-2020	Online
Second Stakeholder workshop – Austria	23-03-2021	Online
Second Stakeholder workshop – Germany	25-03-2021	Online
Second Stakeholder workshop – Netherlands	30-03-2021	Online
Second Stakeholder workshop – Belgium	30-03-2021	Online
Second Stakeholder workshop – Italy	15-04-2021	Online
C-Roads Webinar	18-05-2021	Online
Second Stakeholder workshop – Other countries	15-06-2021	Online
Urbanism Next Pecha Kucha session Round 2	18-06-2021	Online
Third Stakeholder workshop	20-09-2021	Online
ITS World Congress	11/15-10-2021	Hamburg
CIVITAS Forum	21/22-10-2021	Aachen
POLIS Annual Conference session on UVARs	01-12-2021	Gothenburg
UVAR Exchange first stakeholder workshop	13-12-2021	Online
First Take-up workshop	01-03-2022	Online

4 https://uvarbox.eu/uvarbox-tool/

Capacity building webinars*	January-July 2022	Online
Hackathon Kick-Off	09-05-2022	Online
POLIS Traffic Management WG meeting	24-05-2022	Brussels
UVAR experience session	30-05-2022 to 01-06-2022	Toulouse
Second Take-up workshop	04-08-2022	Online
Final Conference	07-09-2022	Hybrid in Brussels
Urban Mobility Days 2022	21-09-2022	Brno
POLIS Annual Conference session on UVARs	01-12-2022	Brussels

*Initial planned but replaced by one-to-one or small focused discussions.

Finally, the communication, dissemination, and stakeholder engagement strategy launched and organised the national awareness raising campaigns. These campaigns were the core of the UVAR Box dissemination strategy due to the significant role of the national level in the uptake of the project's outcomes. Key stakeholders were identified at national level to support the development of accurate functions and processes for the UVAR Box Tool, including national authorities, agencies, operators, regional authorities and agencies, states in federal countries, and most developed cities with regards to UVARs. Frontrunner cities tested the tool, digitising UVAR samples. National and regional organisations supported the consortium in providing UVAR data when already collected from the local level and available, and network access otherwise. Once the tool was usable, feedback collection and training were conducted at national level in national languages, with key members of the UVAR community in the given countries. The details of the stakeholders contacted is available in Annex.

To coordinate these national campaigns, the consortium named partners responsible for most important countries in terms of UVAR numbers. These partners, called "Country Coaches", were part of the "Country Coaches Board" (CCB) set up at the beginning of the project. More information on the CCB is available below.

1.4 Country Coaches Board (CCB)

The Country Coaches Board (CCB) was created to better assure the coverage of UVARs digitisation. Each country has certain particularities, influenced by the administrative and political division of the country, the languages spoken, the level of development of UVARs, as well as the level of established cooperation, just to name a few examples. With the aim of facilitating the processes on a national level, CCs were named for the following 5 pilot countries: Austria, Belgium, The Netherlands, Italy and Germany. The selection of these Member States is based on the fact that the respective countries have a significant number of UVARs, as well as an elaborate level of cooperation between the different administrative levels. Furthermore, in these countries, the concept of UVARs is well-established.

The CCB is formed by selected national experts, who act as the link between the European project level and the local and national authorities, as well as the cities and other urban municipalities in the respective countries. The list of the selected entities to represent each country is provided below:

- Austria: Austriatech, as the "daughter" of the Transport Ministry, was responsible for coordinating the digitisation endeavours of the UVAR Box in Austria. The Alpine Republic has a well-organised dataset of pedestrian zones, as well as a long-standing cooperation between the central government and the 'Länder', due to its federal system. One of the many benefits of UVAR Box for Austria was to foster the coordination between European and national frameworks.

- Belgium: MAPtm is the country coach of Belgium and The Netherlands. While there are certainly big differences between The Netherlands and Belgium on organisational levels, the countries are closely related, and therefore MAPtm was able to understand the local context well. The challenge was the communication with officials from cities and regions in the three languages.

- Germany: The digitisation of UVARs and the communication between stakeholders in Germany was supported by PRISMA solutions, a traffic expert and solution provider based in Germany and Austria. Germany has a long tradition of urban vehicle access regulations. In the beginning of 2010, environmental zones, which limit access for vehicles with high emissions to certain urban areas, came into effect in many cities. Specific bans of certain diesel vehicles followed in 2018. Furthermore, there are many other UVARs in German cities, such as parking regulations, congestion charge schemes, limited traffic zones, or pedestrian zones. The digitisation of UVARs and the communication between stakeholders in Germany was supported by PRISMA solutions, a traffic expert and solution provider based in Germany and Austria.

- Italy: Italy has the highest number of UVARs, which have been identified by project partners. Therefore, the country coach is facing a large challenge. Italian CCs are represented by TRT and MemEx.

  TRT – Trasporti e Territorio is the ideal organisation to coordinate this task, due to their expertise on the national and European level thanks to their engagement with European projects.
  MemEx is an Engineering Consultancy Company working since 1994 in the field of Urban Mobility, ITS and Smart Cities. The company's main clients are Italian and European Public Administrations and Public Transport Operators. MemEx provides consultancy services for design of access regulation actions and traffic management solutions. Thus, the main challenge for MemEx is to obtain the required contributions by as many as possible cities with the opportunity also to enlarge its contacts' network.

- The Netherlands: MAPtm is the country coach of the Netherlands, the country in which the traffic management agency is located. Thanks to several years of cooperation between MAPtm and various urban administrations across the Netherlands, MAPtm has the necessary connections to foster the digitisation process. With their experience both on the policy side, as well as the implementation side of innovative traffic management solutions they are a good fit for piloting with digitisation processes.

2 UVAR data model definition

UVARs fall into Article 5 of Delegated Regulation 2022/670. In general, this regulation mentions both, DATEX II as well as TN-ITS as standards that can be used. Since the requirements stated by users include dynamic regulation aspects (e.g., dynamic activation of regulations based on environmental conditions), and also in line with the requirements stated in the call-for-tender, the Consortium decided to provide the UVAR Box data profiles using DATEX II as a basis. The corresponding DATEX II Standard is CEN/TS 16157-11, which provides a general-purpose model for traffic regulations and had been delivered by the CEF Programme Support Action "DATEX II", which terminated in June 2021. Most UVARs make use of such traffic regulations. Some could actually be modelled to a large extent with the existing DATEX II model. Nevertheless, the analysis carried out in the UVAR Box project showed that quite a number of extensions would be required, but further to that also an additional layer on top of the pure traffic regulations was needed in order to capture the complexity of UVARs across Europe. Hence, the decision was taken to perform this revision of the existing DATEX II standard inside the UVAR Box project, but also to launch a Preliminary Work Item in CEN TC278 WG8 that makes this work visible also on CEN level. The whole package created inside the UVAR Box project has been handed over to NAPCORE Sub-Working Group 4.1 and will lead to the next revision of the CEN Standard.

2.1 Data definition, structuration and exchange (DATEXII profile)

WP1 started with investigations on existing and planned UVARs, and the processes to create, define and communicate them. It provided an overview of UVARs and their processes in the EU (Deliverable 1.1 - UVAR *State of the Art Report*). This overview was the basis for structuring UVAR data and the development of related machine-readable formats. The final objective is to enable UVAR-responsible authorities to use the developed format to digitise their measures and make them understandable for applications and navigation software that will enhance the information of road users to ensure better respect of the UVARs.

Based on this, WP1 created a concept for structuring datasets suitable for the different types of UVARs identified. This concept was based on the DATEX II base standards available and mapped the requirements captured so far to the concept available therein, but also indicated where extensions would be needed. Besides the base standard CEN/TS 16157-11, this work included also data elements used from the DATEX II standard libraries CEN/EN 16157-2 (elements for location referencing) and CEN/EN 16157-7 (common data elements). Both standards provided a large set of valuable elements to be used, but some also required extensions, which were captured and provided as extension proposals. The result of this work was presented in Deliverable D1.2 - *Structure for different data sets relevant for the definition of UVARs*.

Based on the work presented so far, the UVAR Box team set up an environment to develop the UVAR data model. The model was developed iteratively during the project where each iteration led to an updated model draft, which then was frozen and delivered inside the consortium for other work packages. WP2 used the artefacts provided this way to develop the DATEX II data profiles for the different

UVAR types and based on that finally develop the UVAR Box Tool software. WP3 used the that drafts to circulate them to service provider and collect their review comments in order to ensure that the UVAR Box deliverables would be useful for them to enrich their services. The final version was Draft 3, which is also the basis of the UVAR Box Tool delivered and that UVAR dataset being created by this tool.

The DATEX II model for UVARs is composed of two main parts. The *TrafficRegulation* model (prCEN/TS 16157-11:2022) and the developed *ControlledZone* model that adds elements that are necessary for the definition of UVARs. The latter has essentially been created based on input of the SOCRATES 2.0 project. Besides that, the model contains two extensions of existing DATEX II content models. Firstly, the *Common* model[5], which is a collection of data concepts that appear in many different DATEX II data publications, including data characteristics for classes of vehicles and a model for time validity. Besides that, the *LocationReferencing* model[6] provides data structures that support a number of methods for providing the location of an object. Both models contain essential concepts that are relevant for the definition of UVAR information. Besides that, existing DATEX II standards can be extended via the DATEX II "LevelBExtension" mechanism, which offers backwards compatibility. Such extensions can be proposed to be taken into account in a future revision of the standard, becoming "approved extensions". The *TrafficRegulation* model already defines some LevelBExtensions for both the *Common* and the *LocationReferencing* model, adding relevant elements for the definition of traffic regulations and having been approved by the DATEX II PSA. During the development of the DATEX II model for UVARs, additional required model elements have been identified and added to the extension packages.

The diagram below shows how this model has been extended for modelling UVARs. Moreover, Draft 3 is described in detail in deliverable D1.3 - *DATEX II Profiles for UVAR data Exchange and Template for SDG*.

5 EN 16157-7:2018, Intelligent transport systems — DATEX II data exchange specifications for traffic management and information — Part 7: Common data elements

6 EN 16157-2:2019, Intelligent transport systems — DATEX II data exchange specifications for traffic management and information — Part 2: Location referencing

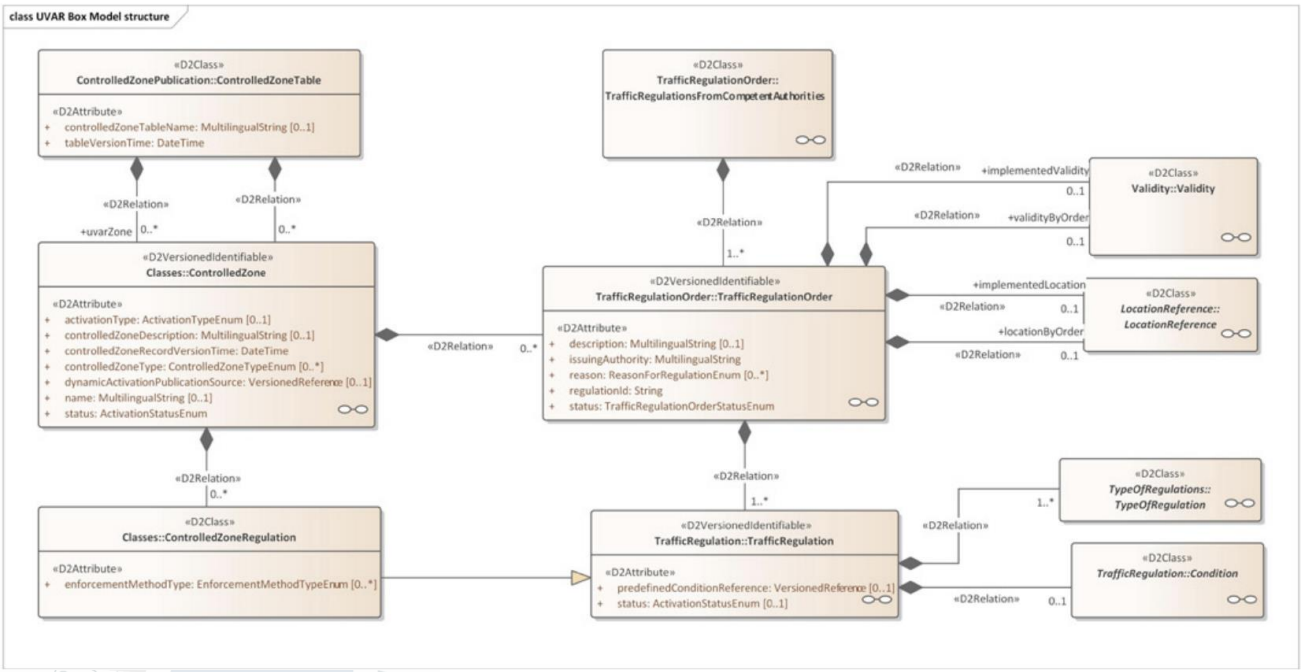


Figure 1 - DATEX II model structure.

Regarding the template for SDG, one important insight gained during the process when getting into contact with SDG experts from Your Europe was that the UVAR data model developed by the UVAR Box project was actually very well suited as input for the Single Digital Gateway. Based on the mechanisms of machine processable and language independent data modelling inherent to DATEX II, the experts were able to set up a mock-up to show how UVAR data could be presented in their portal. D1.4 - *Report on NAPs and SDG liaison for data exchange* – summarises the European framework to be considered for both NAP and SDG UVAR data exchange and sets recommendations for future activities within these tasks. Moreover, the results of the liaison with Your Europe are described in section 4.2.2 of this report.

3 UVAR Data Generation

3.1 UVAR Box Tool

The UVAR Box Tool was designed and developed to provide a user-friendly software tool for the digitisation, maintenance and export of UVAR machine readable data in standardised form (DATEX II). It was created within the framework of "WP 2: UVAR data generation, collection and maintenance". WP2 consisted of the following tasks:

- Task 2.1: Data collection framework (lead: PRISMA solutions)
- Task 2.2: UVAR tool (lead: PRISMA solutions)
- Task 2.3 UVAR tool acceptance (lead: ARMIS)
- Task 2.4: Data collection and maintenance (lead: MAPtm)

The results of WP2 were the following:

- D2.1 Overview report on legal processes for UVAR definition
- D2.2 Functional specification of UVAR tool
- D2.3 UVAR tool
- D2.4 Specification of UVAR related data-flows for data collection and data maintenance
- D2.5 Technical documentation and user documentation of UVAR tool
- D2.6 UVAR data

3.1.1 Methodology and functional specification of UVAR Box Tool

The UVAR Box Tool builds upon the work done in other work packages (e.g., UVAR data model definition in WP1) and follows a generic approach on how to use and manage this information. The functional specification of the UVAR Box Tool (D2.2) is based on the analysis of the legal processes and the knowledge about the national institutional arrangements (D2.1). It provides concepts for the system architecture and its components, insights to software and database design, configuration functionality, user interface and use cases of the UVAR Box Tool. The functional specification served as basis for the subsequent software development.

3.1.1.1 Agile software development

An agile approach was adopted during the development of the UVAR Box Tool. Based on the works of task 2.1, use cases and functionalities were defined and documented. This was accompanied by a continuous discussion process with the respective task members. After the design of the software, the features of the tool were continuously implemented, demonstrated to the project partners and made available for testing. In this way feedback cycles were kept short and allowed efficient adaptations of the implemented functionalities.

The software development process followed some of the basic principles of Scrum and was supplemented with adaptations where appropriate. The requirements were documented in the respective UVAR product and sprint backlogs. For this purpose, an agile project management tool was used to allow issue and project tracking. The process was accompanied by the respective development team meetings (daily, sprint planning, sprint review and retrospective) to continuously improve the software development process.

3.1.1.2 Application design

The UVAR Box Tool is designed as a client/server web-application which communicates via REST interfaces. The client is developed as single-page-web application in the Javascript-Framework "VUE.js", using OpenLayers for the map component. Hence, the UVAR Box Tool can be used with standard web-browsers. Server-side components are developed in Java, an object-oriented programming language.

The following frameworks and libraries – available as FOSS (free and open-source) software – are the most important frameworks being used:

Client frameworks/libraries:

- Vue.js - JavaScript Framework
- Vuetify - Component/Design Framework
- OpenLayers – JavaScript map library
- OpenStreetMap – WMS (Web Map Service) - basemap

The server is a J2EE Application, using Hibernate as database layer. The server provides an administrative user interface as html-pages and forms.

Server frameworks/libraries:

- Modular java-application
- compiled and packaged with Maven
- Java-EE server (Wildfly) – application server
- JAX-RS (Rest services)
- Jackson JSON processing
- Java API for XML Processing
- JTS Java Topology Suite
- GeoTools – Java GIS toolkit
- Hibernate Spatial

As storage PostgreSQL with PostGIS extension is used.

The documentation of the REST interfaces is autogenerated from Java code and can be viewed via the administrative user interface.

Content wise the UVAR Box Tool is designed as schema/configuration driven application. Therefore, the editor-form is not hardwired to the XML-structure but derived from the DATEX II XSD schema with the addition of layout-hints from configuration files and translations from language files.

For distributing and hosting the UVAR Box Tool instances it is recommended to use DockerHub and distributed infrastructure which can run Docker containers. Apart from the application server, a spatial database is required.

The UVAR Box Tool uses the "Basic HTTP authentication" mechanism. It was chosen for simplicity and for making access from third party systems (import/export) easy. Specific Server-API access from the client or third party systems requires the user to have the appropriate roles. Each user is assigned to a group. When a UVAR is created/imported/cloned, the creator and the group of the creator are stored with the UVAR. The UVAR can be edited by users of the same group. Assigning the "Edit all" role to a user allows the user to edit UVARs of all groups.

Further information about the used frameworks/libraries for implementing the tool can be found in the technical documentation (D2.5).

3.1.1.3 Tool release, deployment and documentation

The releases of the tool package were made available on the internal project and will be published open source on a suitable repository (strategies for the sustainability of the UVAR Tool are presented on D4 - *Organisational frameworks for publication of UVARs in place and European and Member State Strategies to ensure sustainability of data collection and accessibility*) to allow further development after the project lifetime. The tool package contains all the sources needed for building and deploying the UVAR Box Tool. It includes scripts to compile the software and sample configuration files. The tool package is accompanied by the respective technical documentation and user documentation. Hence it provides a user manual which guides the user of the UVAR Box Tool through the different use cases and functionalities of the tool and on the other hand a technical documentation for administrators which guides through setting up and configuration of the software.

During software development, the tool was deployed on a test server hosted by project partner PRISMA solutions to allow easy publishing of tool increments in short cycles by the software development team. The UVAR Box Tool on the test server was used by project partners and Country Coaches to test the functionalities of the tool, generate UVAR test data and for demonstration purposes. The UVAR Box Tool for collecting UVAR data has been deployed on the official UVAR Box server[7] hosted by project lead ARMIS and allowed Country Coaches, cities and municipalities to digitise and maintain UVAR data.

3.1.2 User Walkthrough

The UVAR Box Tool allows to generate UVAR machine readable data in DATEX II format and supports various use cases. Beside the interfaces to import and export UVAR data, a user-friendly user interface for manual creation and maintenance of UVARs was developed.

7 http://uvarbox.armis.pt:2403/uvar

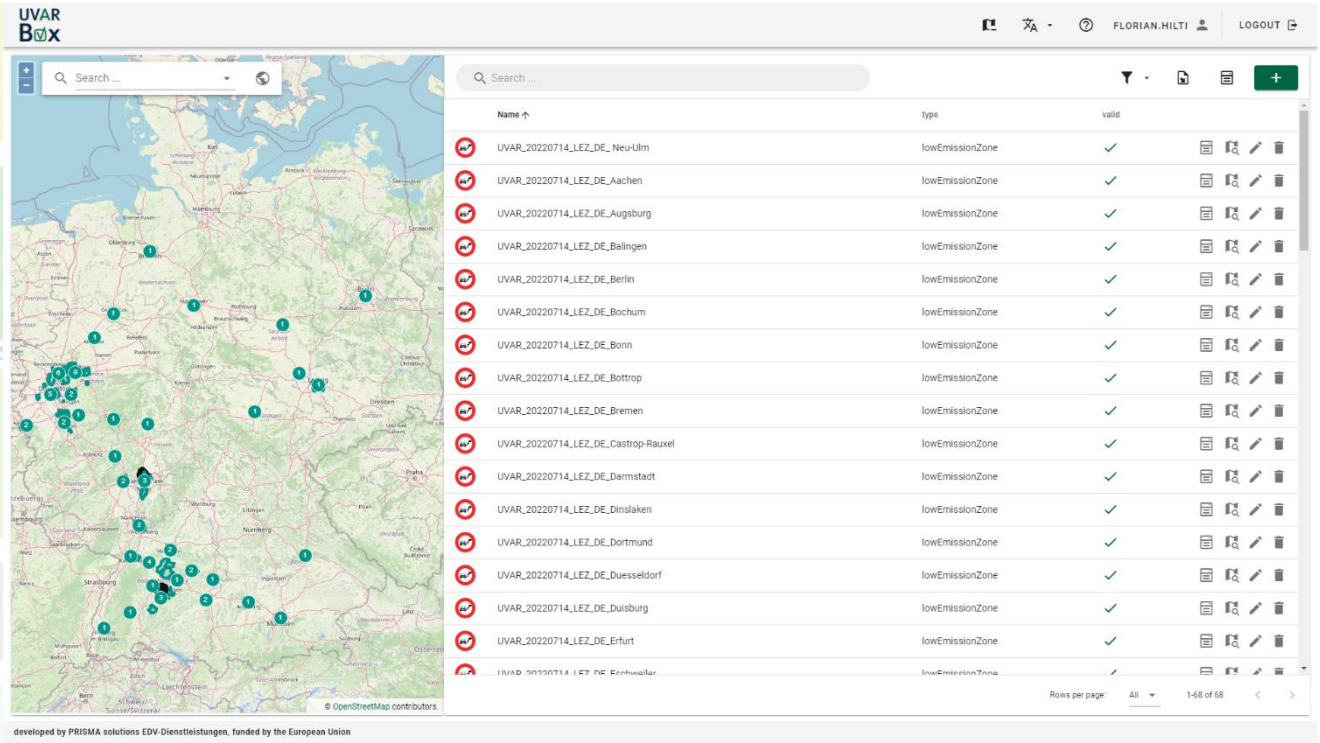


Figure 2 - UVAR Box Tool – user interface - map and list.

The user interface consists of the following components (see Figure 2):

- Top bar: The following information and configuration tools are available through the top bar: hide map, language selection, user manual, current user, logout
- List: On the right side of the user interface the list is displayed. The list provides an overview of all UVARs and can be searched and filtered. Depending on the user's permissions and the UVAR properties different icons/buttons are available per UVAR.
- Map: On the left side of the user interface the map is displayed. It gives an overview of all UVARs and their locations. It allows to navigate the map using the respective buttons and mouse. In the search box the user can search the map for specific locations.
- Form: The form shows details about the UVAR.

The following use cases are supported by the user interface of the UVAR Box Tool:

- Login to the System
- Create a new UVAR
- Search existing UVARs
- Edit existing UVAR
- Add Geometry from File
- Store UVAR with attributes
- Save Template
- Navigate map

- Navigate map (zoom&pan) to default spatial extent (as defined in configuration file)
- Search in the Map for Cities and Regions
- Filtering the Map
- Import/Export data
- Logout of the System
- Change password

Some of the main use cases are described below. For further details regarding use case definition and implementation please see the functional specification (D2.2) and the user documentation (D2.5).

3.1.2.1 *Login to the System*

A prerequisite for using the system is a valid login (Figure 3). This serves both to identify authorized users and to determine the role that the logged-in user has in the system. In addition to the functionalities and permissions of a user, administrators have the ability to manage all users of the system.

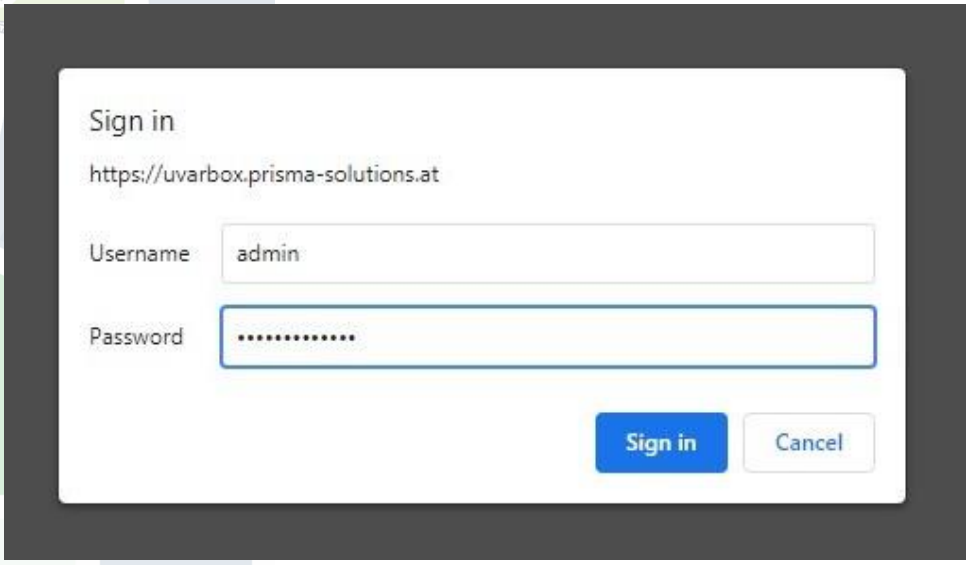


Figure 3 – Login.

3.1.2.2 Manual creation of UVAR

For the purpose of manual creation of UVAR, templates (Figure 4) are used to make it easier for those entering the data. A template refers to a specific UVAR type with conditions, attributes and values prefilled, and the variables limited to those that would be found in that UVAR type. Templates simplify the process of defining a UVAR because only characteristics relevant for that city or region need to be filled in (e.g., a national LEZ framework would have many of the characteristics pre-filled). Hence having well-defined templates as a basis eases the process of creating an UVAR. On manual creation of a UVAR, the use case "add existing geometry from Shapefile" can facilitate defining the location by using geometries already stored in a Shapefile.

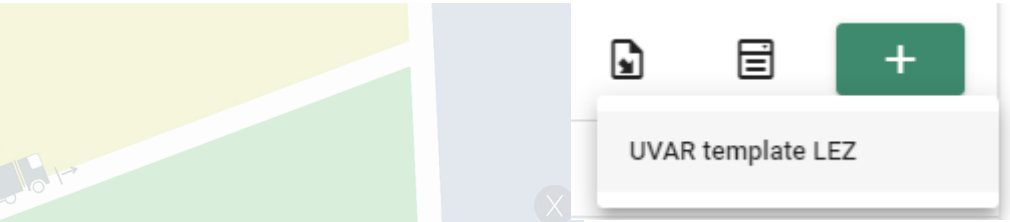


Figure 4 - Create a new UVAR.

3.1.2.3 Edit existing UVAR

Editing of an existing UVAR (either imported or created on the tool) is possible. The form of the UVAR can be entered by pressing the Edit UVAR icon. The form (Figure 5) opens and the UVAR can be edited.

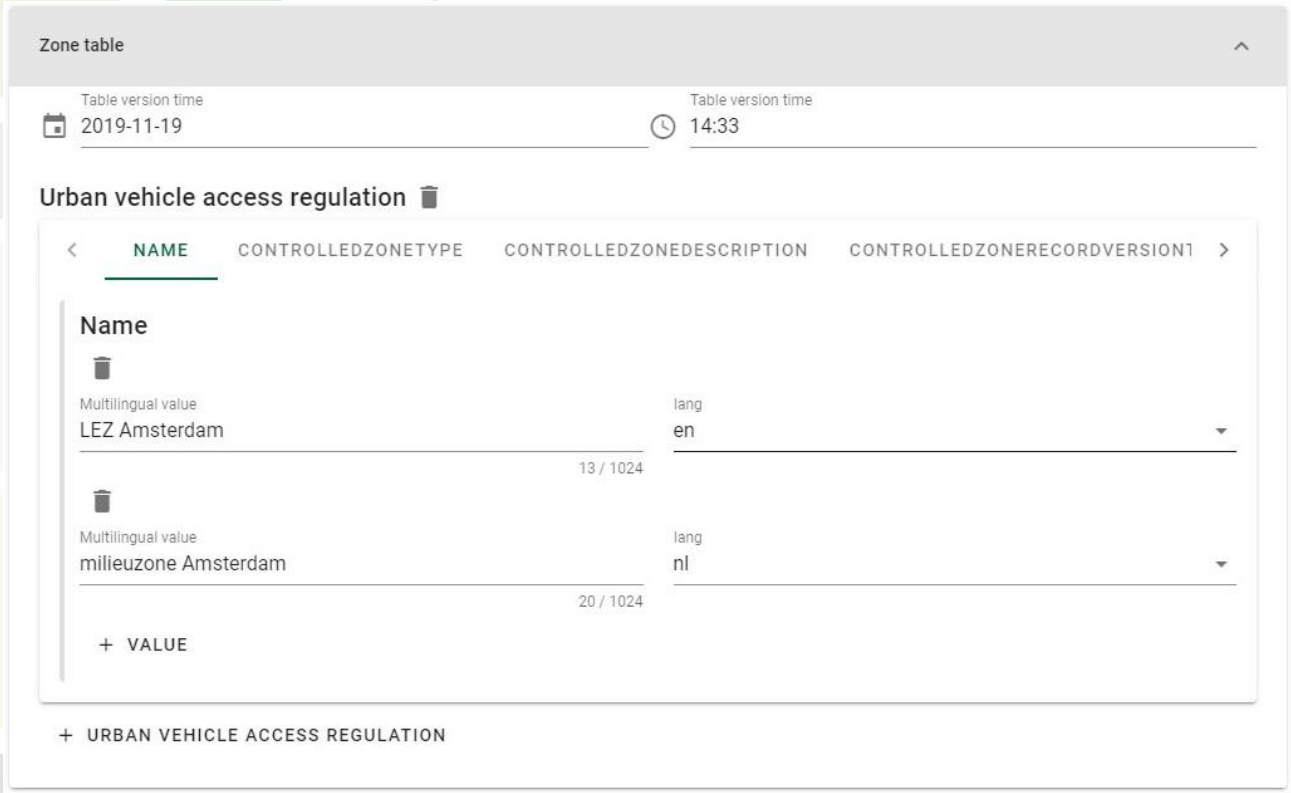


Figure 5 - UVAR form - zone table – name of UVAR.

3.1.2.4 Import of a fully digitised UVAR (DATEX II format)

A prerequisite for this use case is a fully digitised UVAR in the correct data structure according to the DATEX II model. The UVAR data is validated on import and rejected if validation fails. The advantage of this use case is that it allows for the easy update and maintenance of the UVAR in DATEX II format over time and can be used for UVAR data, initially created outside of the UVAR Box Tool.

3.1.2.5 Import of semi-structured data

A prerequisite for this use case is data in a predefined structure and format. Hence, UVAR data containing geometry and attributes (stored in a Shapefile) and an import template (stored as XML) are needed. The import template defines the mapping of the attributes of the Shapefile to the DATEX II UVAR structure.

This import template is basically an UVAR template (DATEX II) but contains placeholders to fill in the attributes of the Shapefile. The import can be triggered via the UVAR Box Tool.

After importing, the UVAR can be edited in the UVAR Box Tool and attributes can be modified as needed.

This use case follows a generic approach which allows to import different data sources, as long as they are pre-processed to the specified input format, and to define the import template (mapping to DATEX II) based on the structure and availability of existing data.

3.1.2.6 Export data

UVAR data stored in the UVAR Box Tool can be exported in a standardised data exchange format – DATEX II. Once exported, UVAR data can be made available/published e.g., via the National Access Points (NAPs), to be used or integrated by service providers or other systems. Furthermore, the exported data allows the creation of Single Digital Gateway (SDG) web-based data in different formats, that can be further published.

3.1.3 UVAR tool acceptance

The development of the UVAR Box Tool followed an iterative process. The main concern was to have a functional tool working for the correct digitisation of UVARs as soon as possible. Nevertheless, after releasing a first version in February 2022, several other versions were developed not only to include new use cases but also to improve the quality of the software. When releasing a new version, black box and operational acceptance testing was performed by ARMIS. Within the same lines, the actual users of the tool, which were, at the time, the country coaches, were asked to provide feedback concerning their user experience. To help organising the content and harmonise the feedback given, under T2.3 - UVAR tool acceptance, led by ARMIS, a table was created listing all the use cases and asking for its validity. Also, a space was open for comments concerning each function. Based on the feedback provided on these tables, and discussions during the meetings, several alterations were made in order to have a software as complete and user friendly as possible. Unfortunately, due to the lack of time and resources, not all suggestions could be addressed and were kept as future improvements that could be taken into consideration in future UVAR-related activities.

Furthermore, in order to try to access to what extent the UVAR Box Tool, associated documentation, and support given meet the requirements and expectations, a questionnaire[8] was created for final users outside the UVAR Box Consortium. The questionnaire was sent to any user that wanted to use our tool, regardless of its purpose. Unfortunately, due to the delay of the overall activities, this only reached the users in August, and we could not receive any feedback before the official close of the project.

Both the table listing the use cases (with the CCs feedback) and the questionnaire for external users can be found in the Annex of D2.4 - *Specification of UVAR related data-flows for data generation, collection and data maintenance*.

8 https://docs.google.com/forms/d/e/1FAIpQLSdcinvmxpCTMIs5zHSQOB7sicxHHx-Xp_2SZCa7BndfsZzm7w/viewform?usp=sf_link

3.2 Overview report on legal processes for UVAR definition

3.2.1 Methodology

As part of WP2 and as a basis for functional specification of the UVAR Box Tool the business processes of the legal creation of UVARs were investigated. The analysis of the processes covered both static and dynamic regulations and included all types of UVARs that were part of the project. Hence, the objective was to understand the process, both country-specific and general, and to find out where and how the UVAR Box Tool should be integrated best in the legal process of UVAR ordinances in order to secure data maintenance as close as possible within the existing processes and to ensure that it is an integral part of the process, so reducing the chances of it being a forgotten stage of the process.

The process analysis was based on desk research on the regulatory process of defining UVARs (and other traffic regulations) from previous projects as well as consortium expertise.

Based on this information, and after collecting relevant questions about the individual process steps that are relevant for the assessment, a questionnaire was created to involve the different key public UVAR authority stakeholders and private entities on the UVAR Box to gather information and feedback on this understanding of the workflow. This was done in cooperation between WP2, 4, and 5, and on the basis of the output of WP1.

The questionnaire was designed in English, Italian, German, and French. The dissemination was undertaken by the country coaches using their contact list, which was evolved during the activities of WP5. The feedback was screened and deepened in country specific calls, meetings, and workshops. The detailed results of the questionnaire were already published in the Interim Report.

The information gathered including the output of the questionnaire was then presented in country-specific stakeholder workshops for the focus countries of the UVAR Box Project. In these workshops, the country coaches presented both the commonalities and country-specific differences, and recommendations as to where the UVAR Box Tool could be integrated in the process.

These lessons learned were documented in D2.1 and together with inputs from the countries on specific requirements for the UVAR Box, served as basis for the several outputs of the project, namely D2.2.

3.2.2 Main outcomes

In summary, it can be said that the process for creating UVARs, which was defined at the beginning of the project based on the previous experience of the partners from the various countries, has proven to be fundamentally correct, and that the differences between the countries and within countries generally lie in the details.

Notwithstanding, the degree of digitisation still varies widely between and within the different countries, so that while in some cities UVARs are already available in machine-readable format (usually non-DATEX II), or the geography only is available in GIS format, in others the data is still exclusively human-readable.

In all countries, the larger cities tend to be more developed and digitised, and able to digitise; smaller ones have fewer UVARs implemented as well as less machine-readable data and resources with which to provide that digital data.

DATEX II as a data exchange standard is already known to some cities or regions, but for others, it is still completely unknown, or its use is only in the planning stage. Within that framework, the data exchange of UVAR data with the NAPs rarely takes place anywhere yet – the exception being the Netherlands and Germany, for which UVAR DATEX II data has already become available during this project.

Those cities that already used GIS or other digital tools (rather than MS Office tools) for the management of their UVARs, did not want to introduce another tool and would require/prefer for interfaces to or the incorporation of the UVAR Box software into their existing tools. Cities and regions that have not used any digital tools referred to the issue of the lack of resources and the extra work as being a barrier to using a new or additional tool.

However, many cities and regions from the 5 focus countries wanted to do pioneer work and were willing to be one of the first users of the UVAR Box Tool. The usefulness of a uniform and cross-country data exchange format was understood by many and welcomed despite the concerns mentioned above.

For the UVAR Box project, this meant that in developing a strategy for the sustainable future management of the digitisation of UVAR data, there is no single solution, nor is there a clear path per country, but across countries, different solutions needed to be evaluated on how to use the UVAR Box Tool in different settings efficiently, in terms of resource use and effectively in terms of having the most complete and up-to-date data possible; complete data for each UVAR, as well as including all the relevant UVARs in that country.

The steps to get closer to this goal of the sustainable, complete, up-to-date creation and collation of machine-readable UVAR data were addressed and further concretised in the cross-work package activities of the UVAR Box project.

The insight into the business processes of the legal creation of UVARs helped understanding how to help digitise the data, and to outline strategies for the sustainable creation and collation of these data as described in D2.4 (see subsequent chapter) and the deliverables of WP4.

3.3 *Specification of UVAR related data-flows for data collection and data maintenance*

For the specification of the UVAR-related data-flows, it is important to introduce the concept of UVAR data value chain model. The UVAR data value chain model is broad and covers not only data collection but also the entire process until the data gets through their final users, which are the drivers/road users. To illustrate the approach, Figure 6 exposes the process that starts with the source of the information, which, in most cases, are city authorities.

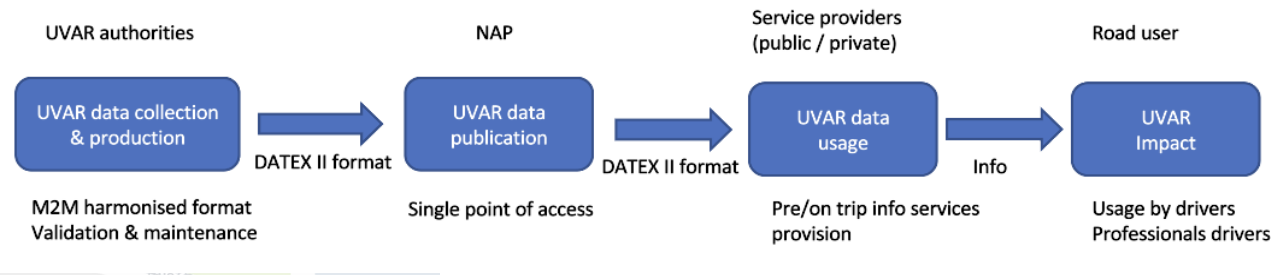


Figure 6 - UVAR data value chain model.

At this stage, the UVAR data is collected and must fulfill several requirements to ensure data quality. In that framework, information should be digitised and translated to machine-to-machine (in the case of UVAR Box DATEX II standard) harmonised format to feed the NAPs and other relevant publishing places. The responsible transport authority, operator, infrastructure manager, or transport on demand service provider must ensure the validation and maintenance of the information provided.

The goal of the UVAR value chain above is to provide accurate and actual UVAR information to users in order to increase the awareness of and compliance with the UVAR.

Besides its accessibility also the quality of the data and its management, is of extreme importance for its value and credibility for usage and acceptance both by the service providers translating into information and ultimately the (road) users. UVAR data quality management can then be defined as a continuous process on the monitoring and update of UVAR data characteristics based on an agreed evaluation criteria to be applied for validation and classification. This process needs to be defined and implemented in coordination with local or national quality frameworks, as well as organisational, functional and technical architectures.

By having harmonised information published, and ensuring adequate data quality management, service providers (public or private) can make use of the data and integrate it into their services which will create a direct impact on final users.

The UVAR Box project, namely the UVAR Box Tool and the CCs' assistance, aims at facilitating the transition from the first to the second stage of this chain, allowing an easy and correct harmonisation of the information that will feed the following stages of the process. Other parts of the UVAR Box project link out to the service providers in later stages of the chain.

The following section describes CCs' experience and strategy adopted for data collection.

3.3.1 *Country-specific strategies*

Austria

The Austrian Country Coach had established the contact to the Austrian Association of Cities and Towns and the Cities Counsel, which is the municipal interest group of a total of 259 cities and larger municipalities.

The two organisations are the major stakeholders in Austria, which together includes nearly every city in Austria which grants a major advantage when it comes to harmonisation process about UVARs. The association helped disseminate information on UVAR Box to its members and supports the digitalisation process of the UVAR Box, by sharing their data with the Consortium. In return, the Cities will get the converted UVAR Data in DATEX II V.3.3 for their data share point.

Until the project end, Austrian country coaches managed to digitise the Austrian LEZs (8 + 6 emergency LEZs), PARK (259) and PED (1 UVAR scheme containing 260 streets from Vienna). The 274 UVARs were digitised by the CCs and some of the parking schemes were subsequently validated by the city authorities. The authorities were contacted by the CCs with a request to validate the data. The validation of the data will be done successively and most of the data should be validated in the future.

Belgium

In Belgium the country coaches have been working together with representatives of different cities. The priority was with the so called "front-runner" cities, Antwerp, Brussels, and Ghent. These are the cities that have LEZs implemented. In discussions with these cities, experiences were gathered on the use of DATEX II, specific needs, and different processes. Dissemination activities about the project, and the different project results such as the UVAR Box DATEX II model and the Tool have been performed to other cities, such as Mechelen and Hasselt. The digitisation activities have been performed by the country coaches with UVAR Box Tool.

Germany

In Germany, the country coaches have established contact with all major cities, most of the states, the Deutsche Städtetag, the Umweltbundesamt (UBA), the Bundesanstalt für Straßenwesen (BASt), the Bund Länder Konferenz and the MDM User Group. The last one is a strategic working group working on the development of the German NAP, while the BASt is the operator of the NAP on behalf of the Federal ministry for Digital and Transport.

Amongst the cities contacted, all cities have LEZs. During the project, all German LEZs were collected and all cities with LEZs got access to the UVAR Box Tool. The collected data was published in DATEX II, Version 3, using the data model from UVAR Box project, on the newly established German NAP, the Mobilithek[9].

9 https://mobilithek.info

The suggested strategy for Germany is to have the UBA, which is currently publishing the data in an open GIS platform and therefore has the data ownership, as a national data coordinator for UVAR. They could use the UVAR Box Tool to collect the data directly from the cities, and thus improve the process of data collection, and publish the data on behalf of the cities. This strategy needs and will be further discussed with UBA and BASt.

Italy

The Italian Country Coaches (ICCs) carried out different types of work aiming to engage Italian authorities at different levels and to digitise UVAR data as much as possible.

The ICCs contacted the national (Italian Ministry of Infrastructure and Sustainable Mobility – MIMS) and regional authorities and established a cooperation in order to support the project activities and to cooperate for defining a currently lack national framework. In parallel, the ICCs disseminated to local authorities (municipalities) the UVAR Box project information during the time related objectives and results (e.g., the DATEX II model) in order to engage the potential interested cities presenting at least one kind of UVAR.

Nevertheless, the above-mentioned approach faced many difficulties specially related to the late UVAR Box Tool release and to the regional authorities unavailability. For this reason, due to the need to digitise in a fast way the UVAR data, ICCs collected and digitised in DATEX II the regional/local UVAR regulations, in particular related to Low Emission Zone (LEZ) and imported the defined XML file into the UVAR Box Tool. In this way, the initial targets related the 100% LEZs digitisation has been largely achieved (195 LEZs have been defined into the tool).

Despite the information has been gathered from approved regulations, the digitised data should be validated by the local UVAR responsible in the future.

The Netherlands

In The Netherlands the country coaches have been able to collaborate successfully with the Rijkswaterstaat VM-IVRA project, part of the "Digitise Government" initiative. In this initiative governmental processes and information are digitised, using a national approach. In the VM-IVRA project, LEZ data is being digitised by a private contractor, with the help of the ministry by providing cities and/or regions with incentives to provide data to the private contractor. Due to the collaboration between the VM-IVRA project and the UVAR Box project, the CCs have been able to establish that the digitisation activities for the LEZs made use of the UVAR Box DATEX II UVAR model, and that the results are publicly available as open data at the national access point.

Other Countries

For other countries, the digitisation process was made on a "best-effort" basis. ARMIS, POLIS, and Sadler Consultants were responsible for trying to reach other cities/regions besides the ones already comprised within our 5 pilot Member States. Nevertheless, the entire consortium was free to make other contacts and delegate further country-coach related activities to the above-mentioned partners.

The strategy adopted relied on disseminating the project and the tool and offer support. In the end, 2 LEZ and 1 LTZ from Lisbon were digitised. By the end of the project, also Barcelona and Riga had credentials for accessing the UVAR Box Tool and were interested in using it for digitsing their UVARs.

3.3.2 UVAR DATEX II data results

Overall, it could be concluded that it is hard to get cities or regions to be involved with digitising UVAR data. While some do see the need to do so, they often lack the resources, or are unable to prioritise this against their many other tasks. Motivation could increase if digitisation is supported by national authorities, for example in national UVAR guidance, procedures, or frameworks. Most cities do, however, have information on their website, but not in machine-to-machine format.

Notwithstanding, with the CCs support and engaging activities, with the help of the UVAR Box Tool, and making use of the UVAR DATEX II data model created by WP1, it was possible to digitise more than 500 UVAR schemes. The number of UVARs produced by Country and per UVAR type are presented in the Table below.

Table 2 – Digitised UVAR DATEX II data.

	Italy	Belgium	Netherlands	Austria	Germany	Portugal	Total
LEZ	195	3	15	7	66	2	288
LTZ	3	2	1	0	0	1	7
PED	0	0	0	1*	0	0	1
PARK	0	0	0	260	0	0	260
EMERG	8	0	0	6	0	0	14
	206	5	16	274	66	3	**570**

*1 UVAR scheme comprising 260 streets.

Moreover, LEZ from the Netherlands and Germany were digitised and made accessible via NDW[10]https://opendata.ndw.nu/milieuzones.xml, and Mobilithek[11], respectively.

The list of digitised UVAR DATEX II data can be found in the annex of D2.4.

10 https://opendata.ndw.nu/milieuzones.xml
11 https://mobilithek.info/

4 UVAR Data Provision

4.1 UVAR data access in pre-trip and on-trip (navigation) services

Throughout the entire project the aim has been to include potential users of the projects' end results in the process. This part has its main focus on the provision of digitised UVAR information complying with the results of the standardised UVAR DATEX II data model developed in WP1.

A series of interactions and consultations were held with different groups of service providers, starting with an initial group of multinational organizations mainly to collect initial feedback on the UVAR DATEX II data model. This initial group was constituted by: HERE Technologies; TomTom; INRIX; Be-Mobile; Google Maps; and BMW.

Further contacts have been held, together with a broader number of national service providers, in order to:

1. Introduce and discuss the UVAR Box project and the EC proposed approach on the access of UVAR data.
2. Collect information on functional and business requirements for access and usage of UVAR data into their (existing) processes.
3. Explore opportunities for demonstration of the integration of UVAR DATEX II data into their information and navigation services to road users, either through the participation in UVAR Box Hackathon or, adoption and integration of the new UVAR data as part of their own service development activities.

The broader list of contacted of service providers is:

- HERE Technologies
- IRU
- Matrixian
- Municipia SpA
- Umweltzone App
- Locatienet
- ÖAMTC
- Campy App
- TomTom
- INRIX
- ASFINAG
- SIMACAN
- Be-Mobile
- Clearly
- IN GROUPE
- Google Maps

During the initial development phase of the DATEX II model, the first group of service providers was invited to provide feedback on different iterations of the model. This feedback was valuable to make sure the data model that was being developed could be used by service providers, and thus they could use the digital UVAR information in their pre-trip and on-trip (navigation) services.

In addition, interviews were held with several service providers, complemented by a survey disseminated through international service providers in order to get more insight into functional and business requirements that they see for access and usage of UVAR data. Through this questionnaire, more insight in the following questions was collected:

- What challenges do service providers see with the proposed process?
- What needs to happen to make sure data can be digitised according to the data model?
- What needs to be in place in order to have this information available through the EU network of NAPs?
- What are the factors contributing to the willingness to use this data when it is available?

Further contacts were made with the service providers and with other parallel UVAR related initiatives already (or planning to) using UVAR data and able to share with us their experiences and concepts, as demonstration of current and upcoming services using UVAR data.

That was the case of the VM-IVRA program from the Dutch road director Rijkswaterstaat, where the Low Emission Zones information services were developed and delivered in a collaboration between the road authorities, the Dutch NAP and three pre-trip and navigation information service providers. The analysis of these services served as basis for showcasing the use of the UVAR DATEX II data in two pre-trip and navigation information services. More detailed information about the outcomes of the program can be found in D3.1 - *Demonstration of UVAR data access in trip planning and navigation services*.

4.2 Integration with NAPs and SDG

4.2.1 NAP framework

To understand how UVAR data can be integrated with the European network of NAPs, first it had to be understood how the NAPs in the pilot member states function. Only after this was well understood an individual approach could be set up for the integration of the UVAR data for the member states. Based on these findings, recommendations would be made for European wide implementation.

The Country Coaches performed research in order to learn more about the situation for each member state. Bilateral meetings with pilot Member State NAPs have been held in order to involve them in the project, and to discuss the proposed process by the European Commission for the publication of UVAR data.

Through collaboration with the NAPCORE project, a survey was disseminated towards all European NAPs to retrieve more information on the functional and business requirements that the NAPs see for the publication of UVAR information.

Assessment of the NAPs discovered that NAPs are set up differently in different Member States. Some NAPs, such as those of Germany and the Netherlands, provide direct access to data, while others, such as those of Austria and Belgium, are set up as registries and link to the source of the data. Metadata descriptions are needed to make data accessible in the NAPs. Establishing harmonised metadata descriptions is work being taken up in the NAPCORE project. In the future, this work will enable data accessibility across different NAPs.

There are also differences between NAPs in regard to dataset quality. During the project it was also discovered that there are differences between NAPs in regard to readiness to accept UVAR data. In particular, the Italian NAP is currently not capable of accepting UVAR data. Although these differences between NAPs exist, the data management and registration processes are similar across different NAPs.

4.2.2 SDG framework

Your Europe portal, the Single Digital Gateway[12], provides online access to accurate and up-to-date information which facilitates interactions between citizens, businesses, and competent authorities by providing access to online solutions, facilitating day-to-day activities, and minimising the obstacles encountered in the internal market. Following a distinct approach from the NAPs, the information provided for the web-based gateway is aimed at human readers on the web, to inform themselves in advance of travelling.

The consortium has been in discussion with Your Europe to explore the integration of the UVAR DATEX II data in the SDG.

A first approach relied on the technical requirements. The UVAR Box consortium has presented to Your Europe all the work done in terms of UVAR DATEX II modelling. Within the same lines, the UVAR Box Tool was showcased, and access given for them to explore the content and use cases.

Having the technical requirements granted, Your Europe started working in a mock-up to show how UVAR data could be presented in their portal. The Amsterdam LEZ digitised in the UVAR Box Tool was used as a basis for creating the mock-up content.

This cooperation, aligned with some individual work from the Your Europe technical team, was successful and the SDG IT architecture, the business, functional and technical requirements were met for the provision of UVAR information based on the data created by the UVAR Box Tool. An outcome for this interaction was a mock-up with possible options for data provision. Still, further developments should be made to put this into force and improve the overall quality of the solution.

12 https://europa.eu/youreurope/index_en.htm

In the near future, it is expected that, by using the harmonised UVAR DATEX II data, Your Europe will be capable of defining an automatized procedure for providing this kind of information on their website. Via all existing channels (NAPCORE, SDG national coordinators, etc.) the SDG plans to use this format to be promoted in municipalities across the EU.

More information regarding this collaboration and respective outcomes can be found in D3.1 - *Demonstration of UVAR data access in trip planning and navigation services*.

4.3 Evaluation of end-user information services

The primary aim of the work package 3 was to provide UVAR information to end users like travellers, fleet planners and citizens, by offering different ways to access the information, and to ensure that access restrictions are accurately and seamlessly reflected in planning and navigation services.

There were different dimensions to this task:

1. The first step was to enable access to UVAR data, through either the NAPs or other public managed service, that ultimately support any app-based and web-based service of many stakeholders (approached in task 3.1 and described in D3.1).
2. The second step was to identify the necessary steps of data validation, interpretation, processing and presentation were the main challenges to address in this integration step. The work package had delivered a complete process flow describing these integration steps for the provision of UVAR information services, from where data becomes available to when the end user is able to see UVAR information and act upon it.

There were three objectives among this task:

- Compliance assessment with the obligations for the DRs (e.g., 886/2013 or 2015/962).
- Propose a process for inspection about UVARs based on a closed loop with the responsible persons
- UVAR data validation process along the UVAR data value chain:
    1. Validation using the UVAR Box Tool
    2. Validation by NAPs
    3. Validation feedback loop by service providers
- The evaluation of end-user information services was done through a comparison of different end-user services (web-based, app-based or via navigational devices) with the published UVARs.

All of these objectives and outcomes were detailed in D3.2.

4.4 Hackathon

The UVAR Box Hackathon was developed under task 3.3 and led by ARMIS. This event was settled to further explore the potential of UVAR data in user information services, to challenge developers to use the available data and to demonstrate new and alternative uses that are of benefit to both users and city authorities. In that framework, the hackathon aimed to encourage to develop new apps, additions to existing apps, specific UVAR-relevant features and effective ways to access and query the UVAR data set.

The UVAR Box Hackathon was planned to be a hybrid event, which includes an award ceremony to take place at a mobility/transportation-related event to promote the outreach of the hackathon results and the UVAR Box project. Due to COVID-related unforeseen circumstances, the UVAR Box hackathon took place in the EU ITS Congress in Toulouse (May-June 2022) instead of the Transport Research Arena Conference (TRA) in Lisbon, as initially planned.

The main risk, known in advance, was the possibility of lacking participants. To mitigate this risk, the entire organising team was early committed to this event, and all partners were involved in its dissemination. The organisation was divided into distinct tasks that were assigned to the most suitable partners, counting on everyone's collaboration. Despite the efforts in trying to mitigate the risk, the results were not as expected, and the hackathon did not have any official participants or solutions developed. In that framework, and besides giving flexibility to interested parties in terms of program and dates, the event was closed earlier.

Due to the lack of success in terms of what was expected for a "typical" hackathon, the organising committee decided to change the approach and focus on the demonstration of the UVAR data value. Thus, the "Presentation of the UVAR experience project" took place in Toulouse. The award ceremony showcased the work of service providers in contact with UVAR Box, who were invited to make demonstrations on the possible use/integration of UVAR data and the data model developed by WP1. In the end, besides the dissemination of the UVAR Box and UVAR Exchange, these sessions counted with the participation of NDW (the Dutch NAP for RTTI), Be-mobile, and HERE. This fulfilled the goal of the task, which was to explore the potential of UVAR data.

All project partners were involved in the planning of the event, which began in March 2022. Practical support to organise the event and communication material was provided and resourced by WP5.

More information about the Hackathon[13] and the "Presentation of the UVAR experience project"[14] can be found at the UVAR Box website[15].

[13] https://uvarbox.eu/events/hackathon/
[14] https://uvarbox.eu/uvars-were-a-hot-topic-at-the-its-congress-in-toulouse/
[15] https://uvarbox.eu/

5 Sustainability strategy for data collection and accessibility, and development and provision of UVAR information services

Work package 4 analysed organisational and legal frameworks for UVAR provision and made recommendations regarding sustainability strategies for UVAR data collection and accessibility in the future.

The analysis undertaken as part of the work highlighted that organisational and legal frameworks differ between Member States, and Member States are in different stages of digital provision of UVAR data. In the Netherlands, appropriate procedures and tools are in place and all UVAR data is digitised, but the use of DATEX II in this context is limited. In Austria, processes and tools are in place on a federal level, but there are large differences in the extent of UVAR digitisation between regions and cities, and DATEX II is not used for UVAR data. In Belgium, mainly initiatives of some large cities drive the digitisation of UVAR data, but DATEX II is not used, and there are, as well, large differences between cities and municipalities concerning UVAR digitisation. In Italy and Germany, the level of UVAR digitisation is lower, but increasing. Again, big cities are far ahead of smaller municipalities in digitisation.

Consequently, Member States, as well as cities and municipalities, face individual challenges in regard to digital UVAR provision. Where processes and tools for digital provision of UVAR data are in place, the main challenge is adapting existing processes and tools to introduce new tools or the DATEX II model. Where processes and tools are not in place, it is a challenge to implement them. Especially smaller municipalities struggle with a lack of necessary resources and personnel who have the required knowledge. This is a general challenge faced in many Member States. Other general challenges include low awareness and knowledge of the obligations of the Delegated Regulation (EU) 2022/670 and the DATEX II model, fragmented availability of UVAR data, as it is currently available in different formats and on different platforms, and complexity, as UVAR data provision often requires cooperation between many different stakeholders with distributed responsibilities.

During the project, the UVAR Box Tool has been made available as a web application hosted by ARMIS. Different ways in which the tool could be made available in the future were assessed, and Member State strategies for future UVAR data provision and use of the UVAR Box Tool were elaborated. Based on this, recommendations for a sustainable strategy for the tool were derived. It is recommended that the tool is made available on a Member State level and an organisation or project is put in place for maintaining the tool and supporting Member States in implementing the tool on a national level. It is also recommended that the tool is further developed in order to scale its use and to be effectively used by cities.

A sustainability strategy for the developed UVAR DATEX II model was elaborated. It is recommended, that further work should be undertaken to harmonise the DATEX II standard. On a European level, the DATEX II model should be further developed in the NAPCORE initiative, which is taking over the model. On a national level, a national UVAR DATEX II profile and artefacts should be established. Cities should begin using DATEX II to digitise UVAR data. Overall, it is recommended to raise awareness of the standard and to train personnel on it.

Recommendations were formulated on a European, national and local level to ensure sustainable UVAR data access. At the European level, it is recommended that transparent standards for UVAR data collection regarding data categories and attributes, quality and format are established. Furthermore, it is recommended that the UVAR DATEX II model is further developed and a harmonised UVAR metadata description is established within the NAPCORE initiative, as these are needed to make data accessible in the NAPs, and will allow data accessibility across different NAPs. It is also recommended that possible consequences of incomplete or incorrect information are clarified, as currently, public authorities are concerned of being responsible for incorrect UVAR information.

On a national and city level, recommendations include:

- Ensuring that NAPs enable publishing UVAR data via the NAP.
- Raising awareness about and improving knowledge of DATEX II.
- Encouraging cities and regions to digitise UVAR data in DATEX II and make it available via the NAP.
- Clarifying questions and obligations regarding data ownership and data usage rights.
- Collaboration with service providers is recommended, as service providers eventually using the digitised UVAR data is necessary for providing value to road users.
- It is also recommended, that the UVAR SUMP guidelines[16] are updated. UVARs could be further detailed in these guidelines, and that the need to publish UVAR data in DATEX II should be specified therein. Through this, the SUMP guidelines can raise awareness of UVAR provision and the DATEX II standard.

6 Final considerations and next steps

The UVAR Box project started in August 2022 and ran for two years. Several challenges were faced, but, with mitigation strategies and a strong cooperation between the entire team, they were overpassed and did not bring significant risks to the project achievements. Overall, with a Consortium provided with a range of expertise and key strengths in distinct areas, it was possible to successfully achieve the project goals of:

1. Establish and define an adequate UVAR data structure (the UVAR DATEX II data model) to ensure full compatibility and coherence with the UVAR Box Tool and enable the compliance of digital UVAR information with the Single Digital Gateway (SDG) regulation. Data structures were defined based on the existing data model from the CEF PSA for different data sets relevant for the definition of the different types of UVARs.
2. Develop a digitisation support tool, the UVAR Box Tool, which is based on the UVAR data structure. This user-friendly tool aims at being used mainly by cities and other UVAR competent authorities as

16 https://www.eltis.org/mobility-plans/sump-concept

entry point to provide and update their UVAR information. As output, the tool allows to export machine-to-machine standardised UVAR DATEX II data.

3. Encourage the emergence of innovative services exploiting the UVAR Box Tool and the UVAR DATEX II data. The project should enable and encourage mobility service providers to make use of the produced harmonised UVAR data.
4. Define a strategy to ensure UVARs can be digitised after the end of the project. It includes working with authorities to integrate the UVAR Box Tool in their digital processes, reach out to the NAPs to enable UVAR data accessibility, and facilitate contact with mobility information service providers to use the available UVAR data.

Besides the successful results, the project faced several challenges. WP0 was responsible for monitoring the project progress by ensuring the project was effectively and efficiently managed and that all administrative and financial duties were carried out in full compliance with contractual requirements. For that purpose, it was crucial to keep regular contact with all partners to ensure that the project direction was maintained, and interfacing with the Commission for all matters associated with the project. WP0 main objectives were making sure that outputs and results are of the highest quality and relevance and to proactively identify potential risks and develop mitigation strategies.

The UVAR DATEX II model was developed by WP1 and consequently, PRISMA Solutions developed a digitising Tool based upon this model. Efforts were made in order to make the UVAR Box Tool as complete and user-friendly as possible. Furthermore, the software reached its final goal which was to allow the digitisation of harmonised UVAR DATEX II data, and especially for people who are not specialised in DATEX II. Nevertheless, and besides establishing a feedback loop from users aiming at improving the software quality, not all suggestions could be addressed and there is still space for improvements.

Having the UVAR Box Tool available for digitisation, the CCs activities were crucial for achieving the high numbers of UVAR schemes digitised according to the UVAR DATEX II model. A key aspect of WP 2 was to build capacity and help cities to establish a sustainable and manageable path to allow generation and collection of data in digital format by using the tools provided. This was only possible due to the country coaches, who were in direct contact with cities and authorities, trained them, and support them to convert the data. In the end of the project, more than 500 UVAR schemes were available in machine-to-machine format, according to the proposed harmonised data structure. The CLARS[17] expertise and contacts for UVARs also played an important role in the pilot project setup. CLARS was used to help identify requirements for DATEX II standard and to facilitate liaison with cities to be contacted and share contacts from UVAR authorities around Europe.

Having the harmonised UVAR DATEX II data available, its value can only be recognised if it is fully exploited and integrated in profit solutions. WP3 was responsible for setting the contact with the National Access Points and support the integration of this data into pre-trip and on-trip information services. The process of making the data available through the NAPs was explored within the 5 core pilot Member

17 http://www.urbanaccessregulations.eu/

States. In this framework, a complete process flow describing these integration steps for the provision of UVAR information services, from where data becomes available to when the end user is able to see UVAR information and act upon it, was provided. Furthermore, the UVAR Box project has established a collaboration with Your Europe platform. The aim is making the UVAR data available through the Single Digital Gateway for EU citizens. After involving both technical and organisational Your Europe teams, it was concluded that the UVAR DATEX II data generated was suitable as input for the SDG.

Several issues needed to be addressed when looking into future sustainability of UVAR machine-readable data creation and accessibility to re-users, via the National Access Points. Encouraging authorities to integrate the provision of UVAR data in their existing and/or future eGovernment-processes and procedures, seems to be the most accurate, cost-efficient and sustainable way forward. WP4 has developed a strong strategy, elaborating recommendations to ensure the sustainability of data collection and accessibility covering the European as well as national level on the roles of various stakeholders in the provision of UVARs to road users and how to address them.

Communication and dissemination were of extremely importance to guarantee the success of the project. The communication/dissemination activities carried out during the two-year project revealed to be a success for gaining relevant contacts and promote constructive discussions. Within the same lines, a proper strategy is the key to achieve the UVAR Box goals by making the tool reach as much entities as possible and train them for an efficient use. This applies not only for the project lifetime but also for after its closure. The activities carried out by the CCs during the Summer 2022 are expected to be pursued by cities and UVAR authorities for a sustainable digitisation and maintenance of UVAR data. For that purpose, training and communication material was developed by WP5.

The pandemic situation made it difficult to have presential meetings and events. Several activities were performed online, such as workshops and surveys' dissemination, counting with the participation of different cities and stakeholders. Nevertheless, in May 2022 it was possible to attend a presential event, the EU ITS Congress in Toulouse. Moreover, a final workshop was organised in Brussels (in hybrid format) in September 2022. Both events allowed fruitful interactions, not only within the Consortium members and between the EC/EP members, but also with external parties such as relevant service providers or cities' representatives.

Having described the core activities and achievements of the UVAR Box project, and having in mind that a long-term sustainability strategy was prescribed, the following points can be reinforced and taken as recommendations for future UVAR-related plans or initiatives:

- The NAPCORE initiative, which is developing a harmonised and interoperable network of NAPs is the most suitable initiative to take into consideration the specific characteristics of UVAR information. The initiative could work on a harmonised process for data provision through Europe, including a data quality framework. The harmonisation of the process together with a solid data quality framework will increase the trust that users of navigation services can have. Service providers need to be able to rely 100% on the service that they get their information from, as the user will likely use that as one of their sources.

- DATEX II knowledge should be promoted for wider use. In a survey response, it became clear that there are still service providers that are not familiar with DATEX II. If all UVAR data will be published according to this standard at the NAPs, it is essential that the organisations disseminating this information to the road users are familiar with DATEX II and know how to incorporate this information into their services. This will increase the potential uptake of the UVAR data.
- Harmonised data quality criteria on, for example, an appropriate location referencing method, and information timeliness need to be (further) developed. When these criteria are set, there should be a process in place where the data quality will be checked on it. This will increase the level in which the service providers can assume that the data is technically a correct representation of the real-life situation. If the location referencing is off, or when information is not provided/updated timely, the data could be considered useless for integration in navigation services.
- UVAR information is perceived as complex information. Thus, since it comprises a lot of complex categories, such as a lot of exemptions, for different time periods, for different vehicle owners, with local nuances, UVAR information is generally seen as vulnerable to interpretation errors.
- In the current situation, access to the right source of UVAR information is difficult due to the different governance structures by public authorities in Member States. A lot of one-on-one relationships are necessary. Moreover, a lot of resources are necessary to implement UVAR information in end-user services. Therefore, the proposed structure where NAPs publish UVAR information is seen as really valuable. Conditions for this are that the UVAR information is available in a standardised format and data quality needs to be guaranteed.

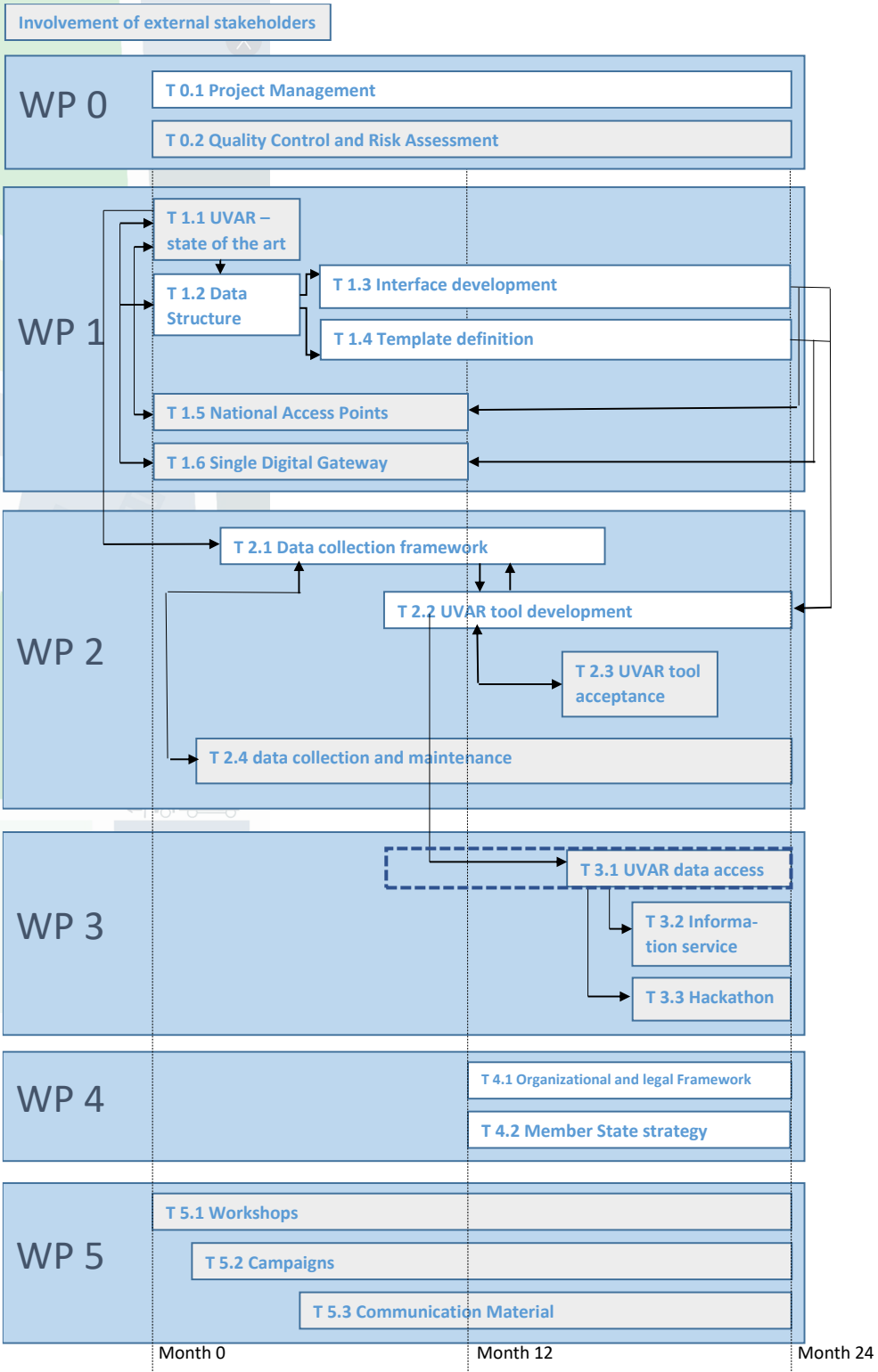
Glossary

Term	Definition
APIs	Application Programming Interfaces
CCB/CCs	Country Coaches Board/Country Coaches
CEN/TS 16157	European standard for Intelligent Transport Systems – DATEX II data exchange specifications for traffic management and information.
CEN/TS 17268	European standard for Intelligent transport systems. ITS spatial data. Data exchange on changes in road attributes.
CLARS	Charging, Low emission zones, Access Regulation Schemes – most complete platform currently identifying UVARs in Europe
CS	Congestion charging Scheme
CZ	Controlled Zones
D#.#	Deliverable with the number of the WP
DATEX II	Electronic language used in Europe for the exchange of traffic information and traffic data
DCAT-AP	DCAT Application Profile for data portals in Europe is a specification based on W3C's Data Catalogue vocabulary (DCAT) for describing public sector datasets in Europe.
DR	Delegated Regulation
EMERG	Emergency scheme
EN 16157	European standard for Intelligent transport systems. DATEX II data exchange specifications for traffic management and information.
EU	European Union
FOSS	Free and open-source software
GIP	Graph Integration Platform
GIS	Geographic Information System
GitHub	Is a web-based Git or version control repository and internet hosting service which is mostly used for code.
ITS	Intelligent Transport Systems
ITS Directive	Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport
LEZ	Low Emission Zone
LTZ	Limited Traffic Zone (ZTLA in Italy)
M2M	Machine-to-machine
MDM	Mobility Data Marketplace

MIMS	MIMS Ministero delle Infrastrutture e della Mobilità Sostenibili – Italian Ministry of infrastructure and sustainable mobility
MS	Member States
NAP	National Access Point
NAPCORE	National Access Point Coordination Organisation for Europe – project reference MOVE/B4-2020-123
NDW	National Road Data Portal
PARK	Parking Regulation
PED	Pedestrian Zone
PSA	Programme Support Action
PSI	Public Sector Information
RTTI	Real-time traffic information services
SDG	European Unique portal to access information, procedures and assistance on EU and national rules and rights related the Single Market
SHP	Shapefile format – is a popular geospatial vector data format for geographic information system (GIS) software. Esri shapefile is a zip archive that contains at least the shp, shx and dbf files.
SUMP	Sustainable Urban Mobility Plan
TISPs	Traveller information service providers
TN-ITS	Transport Network – Intelligent Transport Systems
TRA	Transport Research Arena Conference
TRO	Traffic Regulation Order
UBA	Umweltbundesamt - German Environment Agency
UVAR	Urban Vehicle Access Regulation
UVAR Box Tool	Tool enabling the digitisation of UVARs
UVAR DATEX II data	UVAR data following the DATEX II model created under the UVAR Box project
WP	Work package
XML	Extensible Markup Language – is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable. The design goals of XML emphasize simplicity, generality and usability across the Internet.
ZEZ	Zero Emission Zone

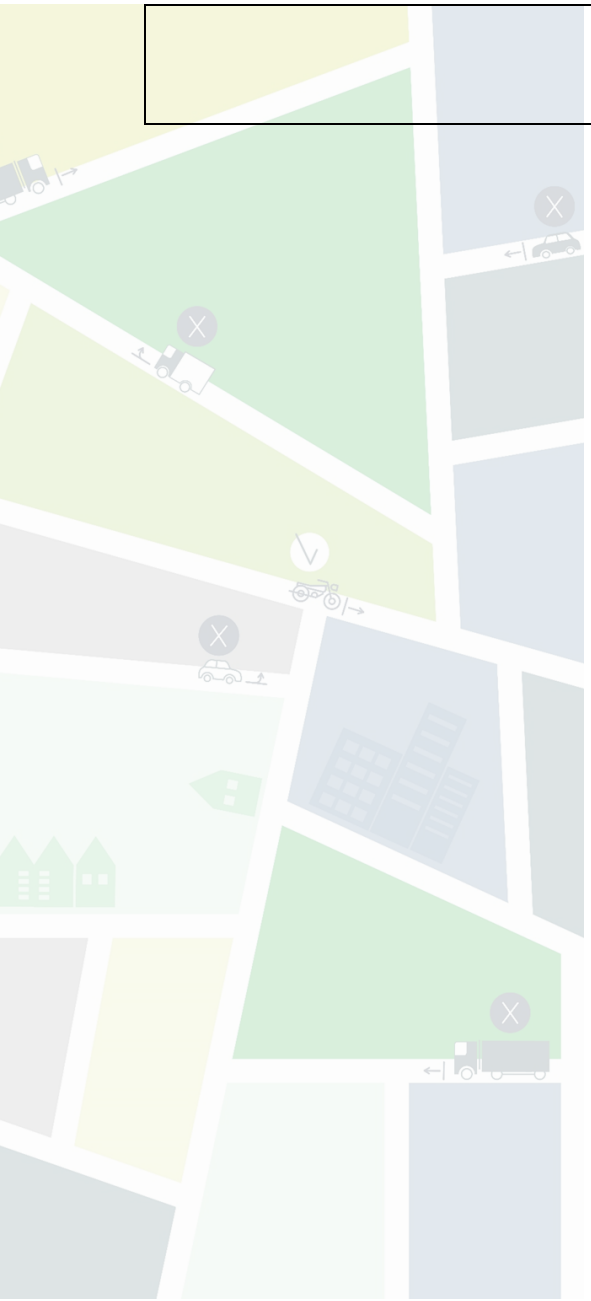
Annex

Links between the project's activities



WP0	
Objectives:	
• Ensuring the project is effectively and efficiently managed and that all administrative and financial duties are carried out in full compliance with contractual requirements, keeping accurate records of costs, resources and time scales for the project (progress monitoring). • Keeping regular contacts with the all the partners to ensure that the project direction is maintained. • Interfacing with the Commission for all matters associated with the project. • Coordinating the preparation and distribution of all major deliverables. • Preparation and submission of progress reports, Inception report, Interim report and Final report • Organisation of Steering Committee meetings, meeting with the Commission, Kick-off and Final meetings. • The main objectives are making sure outputs and results are of the highest quality and relevance and to proactively identify potential risks and develop mitigation strategies. More specifically, the activities in this task include: o to apply the quality assurance plan. o to establish adequate processes within this action to get the optimum high-quality results. o identify potential risks and develop mitigation strategies. o develop and activate when needed proper contingency plans. o reduce risks to an acceptable level by optimising the resources available and o applying sensible precautions in relation to specific threads o estimated risk impacts on costs, schedule, scope, and quality	
Deliverables	
• Signature of the Tender contract • Monthly progress reports • Signed Consortium Agreement • Inception Report • Draft Interim Report • Internal documents: o Project Management Guidelines o Deliverables' Revision Process o Deliverables' Template o Responsibility Matrix o Workplan o Deliverables & Milestones details	
Main challenges	*Mitigation strategies*
Difficulties and consequent delay on managing some deliverables and milestones.	Regularly assess on tasks' progress. Have regular general and bilateral meetings with the necessary partners.

	When necessary, exchange e-mails and set up meetings with the commission to discuss major issues.



WP1	
Objectives	
The objective of this Work-Package is to propose a definition and structuring of UVAR data, define and develop, together with DATEX experts, the necessary interfaces to enable the exchange of such data. This work will also lead to the finalisation of the European DATEXII profile for UVAR, in cooperation with the DATEXII CEF Programme Support Action. Information also needs to be provided for web-based information for My Europe and the Single Digital Gateway (SDG), aimed at human readers on the web, to inform themselves in advance of travelling. Encoding details (e.g. as MS Word or html) will be aligned with SDG requirements.	
Deliverables	
• D1.1 UVAR state of the art report (February, 28th, 2021) • D1.2 Structure for different data sets relevant for the definition of UVARs (February, 28th, 2021) • D1.3 DATEXII Profiles for UVAR data Exchange and Template for SDG (August, 31st, 2021) • D1.4 Report on NAPs and SDG liaison for data exchange (August, 31st, 2021)	
Main challenges	*Mitigation strategies*
1. Organise stakeholder feedback with so many stakeholders, using different languages, etc. 2. The model will have limits; UVARs in different countries have such a huge amount of different attributes and aspects that we run the risk co create a model of unusable complexity	1. Use online questionnaires; move to smaller sessions; clarify and intensify the role of Country Coaches 2. Clearly identify the aspects needed for machine interpretable data exchange; refer to further information (e.g. permit procedures) via references or links; allow for textual attributes for additional information

WP2	
Objectives	
The objective of this Work-Package is to establish the organisational and technical foundations for the UVAR data generation and for the long-term data maintenance after project end.	
Deliverables	
• D2.1 Overview report on legal processes for UVAR definition • D2.2 Functional specification of UVAR tool • D2.3 UVAR tool package + development report • D2.4 Specification of UVAR related data-flows for data generation, collection and data maintenance • D2.5 Technical documentation and user documentation of UVAR tool • D2.6 UVAR data	
Main challenges	*Mitigation strategies*
1. CC wanted to have a (more) user centered mockup to use in interaction with the stakeholders till the tool is finished/to promote the tool 2. During testing of the UVAR Box Tool additional requirements regarding tool functionality and usability came up. 3. In addition to technical and user documentation additional material was needed to spread the word about the UVAR Box Tool and to support CCs in their activities 4. Due to incorporating more feedback and delivering various improved versions of the UVAR Box Tool, the development phase had to be extended. As a result, the already limited time for data collection/for the stakeholders to be introduced and use the tool became even shorter.	1. Mockups of user interface were designed to be used by CC to speak with the stakeholders till the tool was finished. 2. Additional requirements were analysed, estimated, prioritised and – if feasible – implemented. Based on the feedback on usability of the tool given by CCs an iterative process was set up to incorporate the feedback as much as possible into the development of the software. Hence, the usability and quality of the software improved constantly, but also resulted in the necessity to develop and deploy various software releases. 3. Dissemination materials (presentations, training video, website, FAQ) were provided in close collaboration with WP5 and shared in various meetings. In order to try to access to what extent the UVAR Box Tool, associated documentation, and support given meet the requirements and expectations, a questionnaire was created and shared. 4. Tool dissemination and existing data collection strategies were discussed and adapted by CCs. Different data collection strategies were implemented in each of the countries to reach the project objectives regarding data coverage.

WP3	
Objectives	
The objective of this Work Package is to support the integration of UVAR data accessible in National Access Points into pre-trip and on-trip information services provided to end users.	
Deliverables	
There were no WP3 deliverables in the first 12 months of the project.	
Main challenges	*Mitigation strategies*
1. Defining and agreeing on the method, process and conditions for making UVAR data available via the NAP from the 5 core pilot Member States during the rest of the project duration. 2. Engage a representative number of service providers (operating on multinational and or national level) available for collaboration in testing and validation of UVAR data in own services. 3. Identify the best date and location for the Hackathon organization	1. Build up on the NAPs engagement work done within WP1 and explore opportunities created by recent parallel initiatives (revision ITS Directive, NAPcore) for collaboration. 2. Leverage the progress on recent parallel initiatives (revision ITS Directive, NAPcore) for collaboration in order to enhance the focus on UVAR from EC. Country Coaches to identify potential service providers operating national or regional level.

WP4	
Objectives	
The objective of the Work Package is to elaborate UVAR strategies to ensure the sustainability of data collection and accessibility and to cover the European as well as national level on roles of various stakeholders in the provision of UVARs to road users and how to address them. In addition, the quality assurance and procedure of UVAR data needs to be ensured.	
Deliverables	
• D4: D4.1 & D4.2 Organizational frameworks for publication of UVARs in place and European and Member State Strategies to ensure sustainability of data collection and accessibility (M24)	
Events	
• M2 (October 2020): Attending to WP+TL Leader Meetings; Collecting needs from WP to CC and agreeing on coordination. • M3 (November 2020): Conception and setting up the stakeholder questionnaire via Lamapoll.de. • M5 (January 2021): Attending to WP+TL Leader Meetings; Attending to CCB Meetings. • M7 (February 2021): Attending to WP+TL Leader Meetings; Attending to CCB Meetings; Preparation for the UVAR SCO meeting; UVAR Stakeholder Workshop Austria. • M8 (March 2021): Attending to WP+TL Leader Meetings; Attending to CCB Meetings. • M9 (April 2021): Deliverable and Milestone Meeting. • M10 (May 2021): Attending to WP+TL Leader Meetings; Attending to CCB Meetings; Austrian Stakeholder meeting on UVAR DATEX II profiles; • M11 (July 2021): Austrian Stakeholder meeting with ITS Vienna Region; Austrian Stakeholder meeting with ASFINAG for beta testing the UVAR Box. • M14 (October 2021): Kick off Work Package 4 • M15 (November 2021): Kick off Meeting WP4; WP4 Stakeholder workshop to find a strategy for European and Member States. • M17 (January 2022): Information was collected from cities and data holders for 4.1 and to develop a strategy for 4.2. • M18 (February 2022): Obtaining feedback from national authorities/representatives. • M23 (July 2022): Preparation of the WP4-WP5 workshop about sustainability aspects of UVAR provision and the UVAR Box tool: Preparation and dissemination of communication for inviting participants and of content for workshop. • M24 (August 2022): WP4 – WP5 Stakeholder Workshop together with WP5 about sustainability aspects of UVAR provision and the UVAR Box tool.	
Main challenges	*Mitigation strategies*
1. WP4 is scheduled to start M17, late within the project duration and short time for establishing stakeholder engagement and involvement.	1. Work on the tasks and stakeholder involvement started earlier than scheduled and close cooperation with the WP+TL leader was established. 2. Close cooperation with CCs and MS.

2. The complexity of analysing the very different framework conditions in the individual member states. 3. A major challenge is to coordinate the sustainability strategy with all stakeholders within the project lifetime at the different time levels (short, medium and long term).	3. A strategy already exists for the long-term operation but further discussions are needed for the short term and medium term provision of the tools.

<table>
<tr><td colspan="2">WP5</td></tr>
<tr><td colspan="2">Objectives</td></tr>
<tr><td colspan="2">The WP 5 has the following objectives:
• Establish and manage the project's stakeholder community and their involvement in the WPs 1, 2 and 4, thus supporting the validation and development of tools and documentation.
• Manage workshops that inform and support the project's activities, including the WP3 hackathon.
• Conduct targeted awareness campaigns towards those authorities competent to manage UVARs, in order to increase take-up of the project's tools.
• Preparing communication material and events, linking up with dissemination activities.</td></tr>
<tr><td colspan="2">Deliverables</td></tr>
<tr><td colspan="2">• D5.1 Communication strategy, including national campaign outline and stakeholder support facility procedures (M1)
• D5.2 Stakeholder Workshop reports and summary conclusions (M24)
• D5.3 Project leaflet (M3)
• D5.4 Project Brochure (M24)</td></tr>
<tr><td colspan="2">Events/Milestones</td></tr>
<tr><td colspan="2">• M1 (September 2020): Communication Strategy & Presentation at UMD 2020
• M2 (October 2020): Contact base & Communication ground & channels (visual identity, website, social media accounts)
• M3 (November 2020): Workshop 1 & Project leaflet
• M4 (December 2020): Presentations at POLIS Conference & Meeting with ACEA
• M5 (January 2021): Dissemination of questionnaire
• M6 (February 2021): Project leaflet
• M7 (March 2021): Workshop 2 for Austria, Germany, The Netherlands, Belgium
• M8 (April 2021): Workshop 2 for Italy
• M9 (May2021): Presentation at C-Roads webinar
• M10 (June 2021): Presentation at Urbanism Next conference & Workshop 2 for other countries
• M11 (July 2021): Strategy to train cities to use the UVAR Box tools
• M14 (September 2021): Workshop 3
• M15 (October 2021): Presentation at ITS World Congress & Stand at CIVITAS Forum
• M17 (December 2021): Presentation at POLIS Conference & UVAR Exchange workshop
• M20 (March 2022): Workshop 4
• M22 (May 2022): Presentation at POLIS WG meeting on traffic management & Hackathon+UVAR experience session at ITS Europe Congress
• M23 (August 2022): Workshop 5 & Events Report & Final brochure
• M24 (September 2022): Final conference</td></tr>
<tr><td>Main challenges</td><td>Mitigation strategies</td></tr>
<tr><td>1. Diversity of stakeholders to involve, from European networks and organisations' representatives to technical people involved in machine-readable formats and implementation of regulations</td><td>1. Different types of meetings: from presentations at EU events and organisation of general presentation workshops, to dedicated smaller meetings in national languages with deeper exchanges</td></tr>
</table>

2. Diversity of languages and national administrative and legal cultures are at the root of UVARs' diversity, and difficult to overcome 3. Maintain a contacts database and follow-up on contacts while respecting GDPR 4. Number of contacts and quality/intensity of the support to provide them require high resources	2. Contacts through Country Coaches and involvement in smaller meeting in national languages with exclusively national stakeholders 3. Check out on the database at every WP leaders/CCB meeting to make sure it is used and up to date 4. Reallocation of budget and resources towards Country Coaches, creation of a common support tool for the training on UVAR Box tools

CCB - Cities/organizations contacted

AUSTRIA
The Austrian Association of Cities and Towns, Cities Counsel, ASFINAG Road Operator, Ministry for Transport (BMK), Wiener Linien Public Transport Operator, Graz City, Vienna City, Mödling City, Salzburg Research, I T S Vienna Region, Digitrans.expert GmbH, Salzburg City, ÖAMTC,
BELGIUM
Antwerp, Brussels Mobilité, Brussels Environment, Ghent, Hasselt, Mechlin, Liege, Flemish Ministry of Mobility (Mobility department, Environment department), Wallonia Ministry (Mobility department), Federal Ministry of Mobility (NAP), Brussels Regional Informatics Centre (CIRB), Be-Mobile
THE NETHERLANDS
Amsterdam, Arnhem, Enschede, Groningen, Haarlem, Helmond, Maastricht, Rotterdam, Utrecht, Ministry Infrastructure and Watermanagement (Digitalisation program managers, Zero Emissions Zones program managers, Milieuzones, Digitalisation Logistics program), Rijkswaterstaat (National Road Authority), RDW (Netherlands Vehicle Authority), National Road Data Portal (NAP) BeneluxSecretariaat , Matrixian (digitalisation service provider), Technolution, TomTom, Locatienet, Simacan, Campy, Connekt (Dutch mobility and logitics public private network organization)
GERMANY
Aachen, Augsburg, Berlin, Bochum, Bonn, Bottrop, Bielefeld, Bremen, Castrop-Rauxel, Darmstadt, Dinslaken, Dortmund, Duisburg, Düren, Düsseldorf, Erfurt, Eschweiler, Essen, Frankfurt, Freiburg, Gelsenkirchen, Gladbeck, Hagen, Halle (Saale), Hamburg, Hannover, Landkreis Harburg, Heidelberg, Heidenheim, Heilbronn, Herne, Herrenberg, Herten, Ilsfeld, Karlsruhe, Kassel, Kempten, Köln, Krefeld, Langenfeld, Leipzig, Limburg an der Lahn, Magdeburg, Mainz, Mannheim, Marburg, Mönchengladbach, Mühlacker, Mülheim, München, Münster, Neuss, Neu-Ulm, Oberhausen, Offenbach, Osnabrück, Overath, Pfinztal, Pforzheim, Recklinghausen, Regensburg, Remscheid, Reutlingen, Schramberg, Schwäbisch Gmünd, Siegen, Stuttgart, Tübingen, Ulm, Urbach, Wendlingen, Wiesbaden, Wuppertal, Baden-Württemberg, Bayern, Hessen, Nordrhein-Westfalen, Thüringen, Umweltbundsamt, Bundesanstalt für Straßenwesen, Ministrys Policy Coordination Group, Deutscher Städtetag, Bund Länder Konferenz, MDM User Group
ITALY
Public transport Operators: Agenzia della mobilità piemontese; AMAT, Milan; ANM, Napoli; ATB, Bergamo; CTM, Cagliari; MOM, Treviso; Tempi Agenzia, Piacenza; Tiemme, Tuscany South; ITS Stakeholder: TTS Italia, Project Automation, MIMS – Ministero delle Infrastrutture e Mobilità sostenibili ANCI: Abruzzo; Alto Adige; Basilicata; Calabria; Campania; Emilia Romagna; Friuli V. Giulia; Lazio; Liguria; Marche; Molise; Puglia; Sardegna; Sicilia; Toscana; Umbria; Veneto Regions: Emilia-Romagna; Veneto; Lombardia Municipalities: Abbiategrasso, Acquaviva, Acqui Terme, Adria , Ala, Alba Adriatica, Albino , Alessandria, Alpignano, Altamura, Ancona, Andalo, Andria, Aosta, Arco, Arezzo, Argelato, Arona, Arquata Scrivia, Asolo, Asti, Atessa, Atri, Avezzano, Avigliana, Badia Polesine, Bari, Barletta, Bassano del Grappa,

Bellagio, Belluno, Bergamo, Biella, Bisceglie, Bitonto, Bollate, Bologna, Bolzano, Borgo Valsugana, Brescia, Brindisi, Brivio, Busto Arsizio, Cagliari, Calderara di Reno, Camaiore, Cambiano, Campi Bisenzio, Campobasso, Campomarino, Cantù, Caorle, Capannori, Carisolo, Carpi, Carrara, Casale Monferrato, Casalecchio di Reno, Caselle Torinese, Casnate con Bernate, Castel Maggiore, Castelfranco Emilia, Castelfranco Veneto, Castenaso, Catania, Catanzaro, Cattolica, Cecina, Celano, Cento, Cepagatti, Cerignola, Cernusco Sul Naviglio, Cesena, Chieri, Chieti, Chioggia, Chivasso, Cinisello Balsamo, Cinto Euganeo, Città Sant'Angelo, Cittadella, Cles, Colico, Collegno, Cologno Monzese, Comano Terme, Como, Concorezzo, Conegliano Veneto, Cormano, Corsico, Cortina D'Ampezzo, Crema, Cremona, Curtatone, Dimaro Folgarida, Empoli, Este, Faenza, Ferrara, Fiorano Modenese, Firenze, Foggia, Forlì, Formigine, Fossano, Francavilla al Mare, Gallarate, Genova, Gioia dei Marsi, Giulianova, Granarolo dell Emilia, Grosseto, Grugliasco, Guglionesi, Imola, Isernia, Ivrea, Jesolo, La Loggia, La Spezia, Lanciano, L'Aquila, Lavis, Lecce, Lecco, Ledro , Legnano, Leini , Lignano Sabbiadoro, Lissone, Livigno, Lodi, Lovere, Lucca, Lucca, Malgrate, Manfredonia, Maranello, Martina Franca, Martinsicuro, Mede, Melegnano, Mezzocorona, Mezzolombardo, Milano, Mirano, Misano Adriatico, Modena, Molfetta, Molveno, Moncalieri, Monselice, Monsuè, Montenero di Bisaccia, Montesilvano, Monza, Nago Torbole, Napoli, Novara, Novi Ligure, Oggiono, Orbassano, Ortona, Ovada, Ozzano dell Emilia, Paderno Dugnano, Padova, Palermo, Parma, Paullo, Pavia, Penne, Perugia, Pescara, Peschiera Borromeo, Piacenza, Pinerolo, Pineto, Pinzolo , Pioltello, Piombino, Piove di Sacco, Pisa, Pistoia, Poggibonsi, Pontedera, Portoferraio, Potenza, Prato, Primiero San Martino di Castrozza, Quartu Sant'Elena, Ravenna, Reggio-Emilia, Rho, Riccia, Riccione, Riccione , Rimini, Riva del Garda, Rivoli, Roma, Romano di Lombardia, Roseto degli Abruzzi, Rosignano M.mo, Rovereto, Rovigo, Rozzano, Rubano, Rubiera, San Bonifacio, San Donà di Piave, San Donato Milanese, San Giovanni Teatino, San Giuliano Terme, San Giuseppe Vesuviano, San Lazzaro di Savena, San Mauro Torinese, San Michele al Tagliamento, San Salvo, Santena, Saronno, Sassuolo, Savigliano, Scandicci, Schio, Segrate, Senago, Serravalle Scrivia, Sesto Calende, Sesto Fiorentino, Sesto San Giovanni, Settimo Torinese, Siena, Silvi, Silvi, Sirmione, Sondrio, Spino d'Adda, Spoltore, Sulmona, Taranto, Teramo, Termoli, Tione di Trento, Torino, Tortona, Tortoreto, Trani, Trecate , Tremezzina , Trento, Treviglio, Treviso, Udine, Valenza, Valsamoggia, Varese, Vasto, Venafro, Venaria Reale, Venezia, Vercelli , Verona, Vicenza, Vinovo, Vizzolo Predabissi, Zola Predosa
OTHER EU MEMBER STATES
ES: Barcelona, Bilbao, Madrid, Vitoria-Gasteiz, Catalonian regional Government, HU: Budapest IE: Dublin SE: Gothenburg, Stockholm PO: Krakow FR: Liège, Lille, Paris, Strasbourg, Grenoble, Bordeaux, Reims, National Environment Ministry, ADEME, Grand Metropole Paris, region of Normandy, Transportdata.gouv PT: Lisbon, Porto CZ: Prague LT: Ministry of Transport of Lithuania LV: Riga Dissemination to all over 520 CLARS UVAR authority members

GANTT

WP	Leader	task	PM Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
			Leader	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	1-Sep	Oct-21	1-Nov	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22
0	Armis	0.1	Armis																								
		0.2	Armis / Sadler																								
1	Albrecht	1.1	POLIS																								
		1.2	Albrecht																								
		1.3	Albrecht																								
		1.4	Albrecht																								
		1.5	AustriaTech																								
		1.6	Armis																								
2	PRISMA	2.1	PRISMA																								
		2.2	PRISMA																								
		2.3	Armis																								
		2.4	MAPtm																								
3	MAPtm	3.1	MAPtm																								
		3.2	AustriaTech																								
		3.3	Armis																								
4	AustriaTech	4.1	AustriaTech																								
		4.2	AustriaTech																								
5	POLIS	5.1	POLIS																								
		5.2	POLIS																								
		5.3	POLIS																								

First year

Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21
D5.1	Meeting with EC	Stakeholder workshop 1	WPleaders + TC meeting	Inception Report	D1.1	*SC meeting*	WPleaders + TC meeting	WP0 progress report	WPleaders + TC meeting	WP0 progress report	Meeting with EC
WP0 progress report	WPleaders + TC meeting	D5.3	CCB meeting	WP0 progress report	D1.2	WPleaders + TC meeting	CCB meeting	WP1 progress report	CCB meeting	WP1 progress report	WL leaders meeting
WP1 progress report	CCB meeting	WP0 progress report	WP0 progress report	WP1 progress report	D5.3	CCB meeting	WP0 progress report	WP2 progress report	WP0 progress report	WP2 progress report	Draft interim report
WP5 progress report	Project leaflet	WP1 progress report	WP1 progress report	WP2 progress report	WP0 progress report	Stakeholder workshop 2	WP1 progress report	WP5 progress report	WP1 progress report	WP5 progress report	D1.1
	WP0 progress report	WP2 progress report	WP2 progress report	WP5 progress report	WP1 progress report	WP0 progress report	WP2 progress report		WP2 progress report		D1.2
	WP1 progress report	WP5 progress report	WP5 progress report		WP2 progress report	WP1 progress report	WP5 progress report		WP5 progress report		D1.3
	WP2 progress report				WP5 progress report	WP2 progress report					D1.4
	WP5 progress report					WP5 progress report					WP0 progress report
											WP1 progress report
											WP2 progress report
											WP5 progress report

Second year												
Sep-21	**Oct-21**	**Nov-21**	**Dec-21**	**Jan-22**	**Feb-22**	**Mar-22**	**Apr-22**	**May-22**	**Jun-22**	**Jul-22**	**Aug-22**	**Sep-22**
SC meeting	WPleaders + TC meeting	WL leaders meeting	WPleaders + TC meeting	WPleaders + TC meeting	*SC meeting*	Take-up workshop 1	WPleaders + TC meeting	WL leaders meeting	D1.1	SC meeting	SC meeting	*SC meeting*
WPleaders + TC meeting	CCB meeting	WP0 progress report	CCB meeting	CCB meeting	WPleaders + TC meeting	WP0 progress report	CCB meeting	UVAR sessions at the EU ITS Congress	D1.2	WPleaders + TC meeting	Take-up workshop 2	Final meeting
CCB meeting	WP0 progress report	WP1 progress report	D2.1	WP0 progress report	CCB meeting	WP1 progress report	D2.4	WP0 progress report	D3.3	CCB meeting	D2.1	Final conference
Stakeholder workshop 3	WP1 progress report	WP2 progress report	D2.2	WP1 progress report	D2.3	WP2 progress report	D2.5	WP1 progress report	D4.1	Draft final report	D2.2	Final report
Interim Report	WP2 progress report	WP5 progress report	WP0 progress report	WP2 progress report	WP0 progress report	WP3 progress report	WP0 progress report	WP2 progress report	D4.2	WP0 progress report	D2.3	
WP0 progress report	WP5 progress report		WP1 progress report	WP3 progress report	WP1 progress report	WP4 progress report	WP1 progress report	WP3 progress report	WP0 progress report	WP1 progress report	D2.4	
WP1 progress report			WP2 progress report	WP5 progress report	WP2 progress report	WP5 progress report	WP2 progress report	WP4 progress report	WP1 progress report	WP2 progress report	D2.5	
WP2 progress report			WP3 progress report		WP3 progress report		WP3 progress report	WP5 progress report	WP2 progress report	WP3 progress report	D3.1	
WP5 progress report			WP5 progress report		WP4 progress report		WP4 progress report		WP3 progress report	WP4 progress report	D3.2	
					WP5 progress report		WP5 progress report		WP4 progress report	WP5 progress report	D4.1 & D4.2	
									WP5 progress report		D5.2	
											D5.4	
											WP0 progress report	
											WP1 progress report	
											WP2 progress report	
											WP3 progress report	
											WP4 progress report	
											WP5 progress report	

WP0	
WP1	
WP2	
WP3	
WP4	
WP5	

Deliverable planned date
Virtual Meeting
Event
Deliverable actual date
Monthly Report