



UVAR Box

Digitising &
exchanging
UVAR data
across Europe

UVAR
Box

Disclaimer

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The contents of this publication are the sole responsibility of UVAR Box and can in no way be taken to reflect the views of the European Union.

List of Acronyms

BAST - Bundesamt für Straßenwesen, German national highway’s agency

C-ITS - Cooperative Intelligent Transport System

EMERG - Emergency Pollution Scheme

GIP - Graph Integration Platform

HGV - Heavy Goods Vehicles

LEZ - Low Emission Zone

LTZ - Limited Traffic Zone

MIMS - Ministero delle Infrastrutture e della Mobilità Sostenibili, Italian Ministry of infrastructure and sustainable mobility

NAP - National Access Point

NAPCORE - National Access Point Coordination Organisation for Europe

NDW - National Data Warehouse for Traffic Information, Dutch RTTI NAP

PARK - Parking Regulation

PED - Pedestrian Zones

RTTI - Real Time Traffic Information

SDG - Single Digital Gateway

UBA - Umweltbundesamt, German Ministry of Environment

UML - Universal Modelling Language

UVAR - Urban vehicle Access Regulation

VM-IVRA - Traffic Management – Information & Route Guidance, Dutch project on LEZ data collection, digitalisation, and communication

VMS - Variable Message Signs

ZEZ - Zero Emission Zone

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Digitise your UVAR

Readers who are interested in digitising the UVAR in their city can find all the information needed on uvarbox.eu/uvarbox-tool/. This page provides all necessary information to start the digitisation process for your city, including:

- ✓ A written manual with detailed instructions on how to use the UVAR Box Tool
- ✓ A video in English summarising the main instructions
- ✓ A link to the right contacts to obtain a login to the UVAR Box Tool
- ✓ The link to the tool itself (which you can only access with an account)
- ✓ Additional contact details in case further support is needed



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Get to know UVAR Box

Structure and objectives

The UVAR Box project is funded by DG MOVE to digitise standardised Urban Vehicle Access Regulations (UVARs) in Europe, with a focus on the countries of Austria, Belgium, Germany, The Netherlands, and Italy. The project was coordinated by ARMIS¹ and operated for two years since its initial start in August 2020. It focuses on the creation of the necessary data structure and tools, as well as the cooperation between local partners in the respective countries, to efficiently digitise already available UVAR data, and to provide a usable solution for future processes.

The result is a digitised and standardised catalogue of more than 700 UVARs, mainly low emission zones located mostly in the five countries mentioned above. Besides low emission zones, several parking regulations, pedestrian areas, and limited traffic zones are included. The data on these traffic regulations is provided in the European-wide harmonised DATEX II² standard, a machine-readable language used in Europe for the exchange of traffic information. This data was produced with the support of a tool created to facilitate the digitisation of UVARs, and make this process as friendly as possible.

The aim of the digitisation efforts is also to comply with data production requirements for the Single Digital Gateway³ (SDG), which facilitates online access to information, administrative procedures, and assistance services that EU citizens and businesses may need in another EU country.

The following chapters take a closer look at the project's definition of UVARs, and their potential effect on inner cities, as well as the functioning of the DATEX II standard, the UVAR Box digitisation tool, the national digitisation approaches, and a future outlook on the potential production, update and use of the digitised data. Besides providing a summary of the achievements of UVAR Box on the European and national level, the aim of this document is to give an overview on the usability of the developed tools and their potential impact on the wider community of European cities, as well as an access to them and to the related documentation.

The project is executed by ten partners with ARMIS as the coordinator. Five of these partners are supporting the local digitisation process as so-called 'country coaches': PRISMA for Germany (DE), AustriaTech for Austria (AT), TRT and MemEx for Italy (IT), and MAPtm for both Belgium and the Netherlands (BE and NL). ARMIS, Sadler Consultants, and POLIS Network have supported the outreach to local stakeholders and the digitisation process in additional countries (Spain, Portugal, France, Sweden). Further information about the digitisation process, local challenges, and an overview on the achievements in each of the five UVAR Box countries are available in the section "2) Approaches and digitisation results per country". Additionally, Albrecht Consult, Harrod Booth Consulting and U-Trex are the DATEX II experts of the consortium, and Sadler Consultants advised on the overall impact and processes of the project.

1 <https://www.armis.pt/>

2 <https://www.datex2.eu/>

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

Description of the challenge

▣ Air pollution

The World Health Organisation (WHO) estimates that fine particle pollution causes more than 350.000 premature deaths in the EU27 and the United Kingdom combined. Even though not all casualties can be directly associated with the passenger car or road transport in general, one must highlight this significant burden on the health sector and European society as a whole. Although the number of deaths related to fine particle pollution was halved in the last 30 years, reducing passenger cars' negative externalities in European inner cities still requires stricter measures to meet the EU health-based air quality limit value. Besides these significant impacts, other pollution in the form of excess noise and most importantly climate emissions should not be neglected.

The UVAR Box project recognises the efforts that cities and car manufacturers have made to reduce overall pollution levels by investments in (public transport) infrastructure and by producing low-emission vehicles. UVARs can help reduce the burden by regulating the access of all or specific types of vehicles to defined zones, since without these the fleet renewal of sufficiently low emission private and public transport vehicles will take several decades.

▣ Road users' information

The creation of an UVAR requires the authority to spread the information on its existence, to ensure vehicle drivers and operators comply with it. This can be a challenge, especially in the case of non-local visitors who (potentially) wish to access a restricted zone. Language is sometimes an obstacle, as information on traffic signs is often only available in the local language. The disregard for these existing rules due to a lack of knowledge is a lose-lose-situation for vehicle users and the city. Drivers face an avoidable fine and contribute to congestion and pollution in the regulated zone. Therefore, there is a great incentive for municipalities to spread information on the UVAR as much as possible.

▣ Harmonisation, Accessibility, Market integration

There are three obstacles in the process of informing road users about UVARs:

- ✓ The diversity of locally adapted and adopted measures makes it difficult to anticipate the type of restriction drivers will face in an area they are not used to entering with their vehicle. Thus, harmonisation of the different regulation types is necessary.
- ✓ The multiple formats and localisations of the information on the regulations hinders their accessibility. Standardisation is required to facilitate access to the information.
- ✓ The lack of digital information makes UVARs difficult to integrate in road user information and navigation systems. Digitalisation in a harmonised and standardised format enables municipalities to provide usable data to service providers, who can include them in their services targeting road users.

Definition of the scope

UVARs are measures to regulate the access of motorised vehicles to urban infrastructure and areas. A diverse set of access regulations is used by cities, of which the most frequent examples are Low Emissions Zones (LEZ), Limited traffic Zones (LTZ), and Parking Regulations. The UVAR Box project also covers Congestion Charges and Pedestrian Zones.

At a conceptual level, an UVAR regulates under what conditions motorised vehicles are allowed to access a defined location. Those conditions are, inter alia, the weight or the size of the vehicle, its emission level, its occupancy rate, or specific time periods, current air pollution level in the area, or again the driver status as resident of the area, as taxpayer or paying the local traffic congestion fee.



Based on these conditions, five types of UVARs were defined and assessed on this project:

✓ Low Emission Zone (LEZ)

LEZs restrict access to a specific area within a city according to the vehicle's emission standards. They are often implemented as a measure to address harmful air pollution from road vehicles where the EU air quality standards are breached. Extensions of LEZs are Zero Emission Zones (ZEZ), that only allow access to vehicles with no (tailpipe) emissions. Moreover, besides not being deeply explored by the project, some cities and regions implement emergency pollution schemes (EMERG), where UVARs are triggered depending on the pollution levels (either actual, over the previous days, or predicted).

✓ Limited traffic Zone (LTZ)

LTZs are areas where permits are required to access the zone. Permits' conditions can include type of trip, type of vehicle, and can in addition include payment or emissions requirements. In most cases, the access restriction is limited to a certain period (e.g., between 21:00 and 06:00). Vehicles of residents, emergency vehicles, delivery vehicles, etc. may be exempted.

✓ Congestion or Urban Road Toll Charges

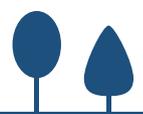
Congestion charges or urban tolls limit vehicles' access to areas, points or road sections to vehicles paying a fee, which gives a price incentive for drivers to switch to other modes of transport or travel times. They levy a toll or charge on certain roads, which (without the charge) are often congested – most often in city centres. They can be considered as a specific type of LTZs.

✓ Parking Regulations (PARK)

Restricted parking zones are areas where only residents or other permit holders are allowed to park at certain times of the day. The aim is to reduce parking congestion in residential areas or cities.

✓ Pedestrian Zone (PED)

Pedestrian zones can be seen as the most 'extreme' UVARs, where in principle no vehicular access is allowed. Sometimes cycles are granted access, and there are usually time windows for delivery and other essential access.



Further information

UVAR Box has three communication streams: social media, the project homepage, as well as brochures and deliverables. Relevant documents of the latter category are also linked in the respective chapters on the digitisation tool and the chapter on data access & information services. All public deliverables are available in our online **digital library**⁴.

We invite readers to follow the project on **Twitter**⁵ and to join our **LinkedIn Group**⁶. Even though the project ends in August 2022, further updates and information about the wider topic of urban vehicle access regulations

will be published through these channels. This also applies to the content of 'UVAR Exchange' as the follow-up project, which is highlighted in the section 7 "Future perspectives".

'UVAR Exchange' is also represented on the dedicated project website of **UVAR Box**⁷, which is our main dissemination platform. It includes information about the digitisation tool, a news and events archive, the previously mentioned digital library, as well as contact details of the country coaches. The homepage will remain live in the upcoming years.

⁴ <https://uvarbox.eu/library/>

⁵ <https://twitter.com/UvarBox>

⁶ <https://www.linkedin.com/groups/12479675/>

⁷ <https://uvarbox.eu/>

Discover DATEX II

DATEX II is a machine-readable, EU-wide digital data standard for traffic regulations, which is also suitable for data modelling. Besides DATEX II, the format TN-ITS also exists which describes an interface from road operators to map makers - a good channel for those UVARs that are mainly static, whereas DATEX II standards also address dynamically (de-)activated and temporary regulations.

DATEX II can include UVARs that are time-related, such as entry restrictions of vehicles into historic city centres between 9AM and 9PM during workdays. On the other hand, static UVARs could for example refer to bans on Heavy Goods Vehicles (HGVs) in dedicated zones.

The UVAR Box project created a data profile based on the DATEX II model. It shall be noted that the DATEX II and the TN-ITS community have meanwhile teamed up and launched a cooperation on harmonised traffic regulation modelling in the scope of the [NAPCORE platform](#)⁸. The DATEX II model created inside the UVAR Box project is an input into this cooperation.

DATEX II uses a modelling approach where the actual data is described in universal modelling language (UML), based on the CEN/TS 16157-11 standard, which covers the data domain of traffic regulations. This UML description allows for an easily readable graphical representation of the UVAR, using classes with attributes, and their relation to each other.

The actual artefacts used by data providers/consumers to create interface software are then automatically generated by a software tool on the [datex2.eu](#) website. The standard consists of the assigned actual types of regulation, and sub-models for conditions.

The diagram above shows how this model – which also had to be evolved with many attributes specific to traffic regulation orders related to UVARs – has been extended for modelling UVARs with a dedicated layer for controlled zones. More information on DATEX II can be found on the [dedicated website](#)⁹.

⁸ <https://napcore.eu/>

⁹ <https://datex2.eu/>



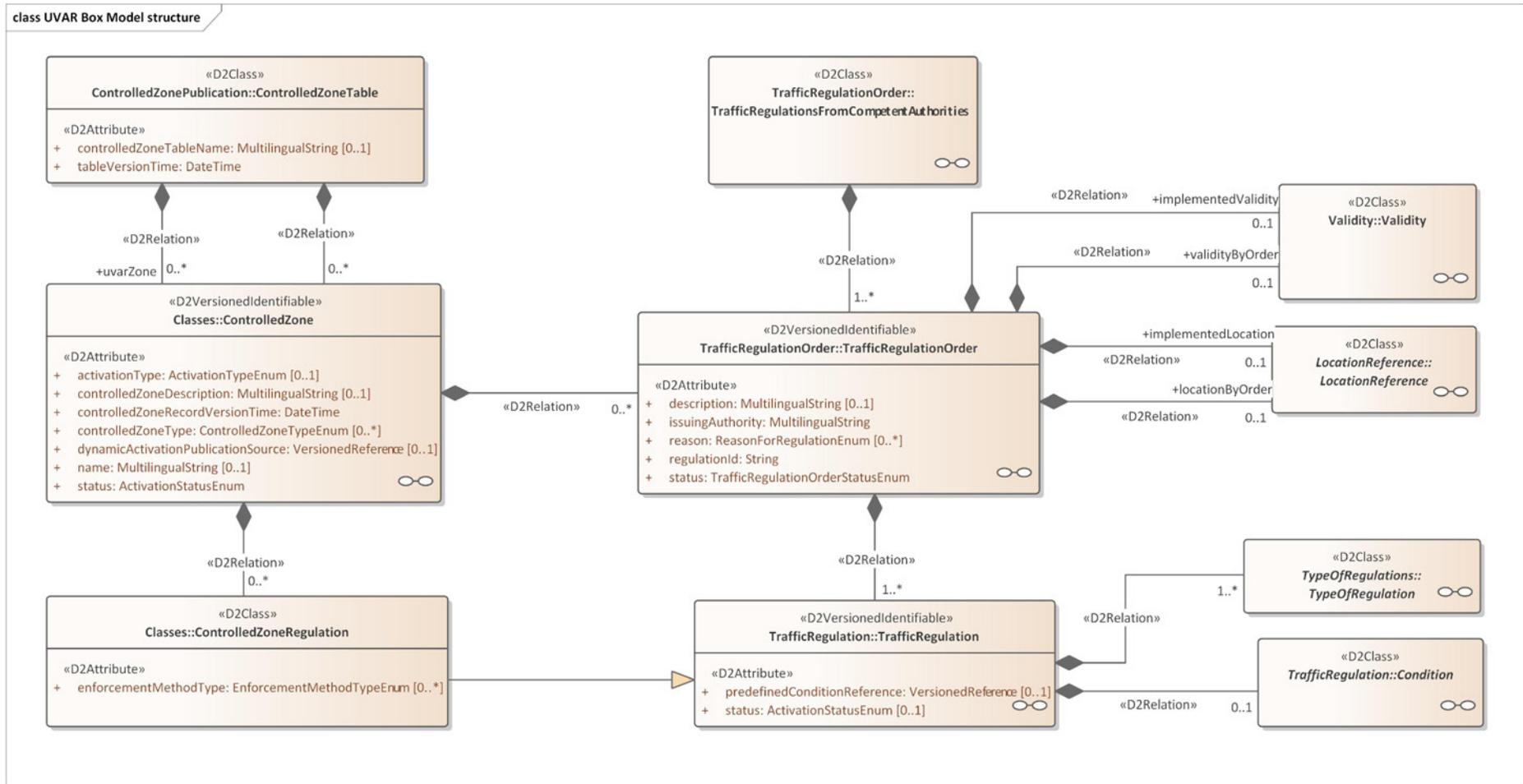
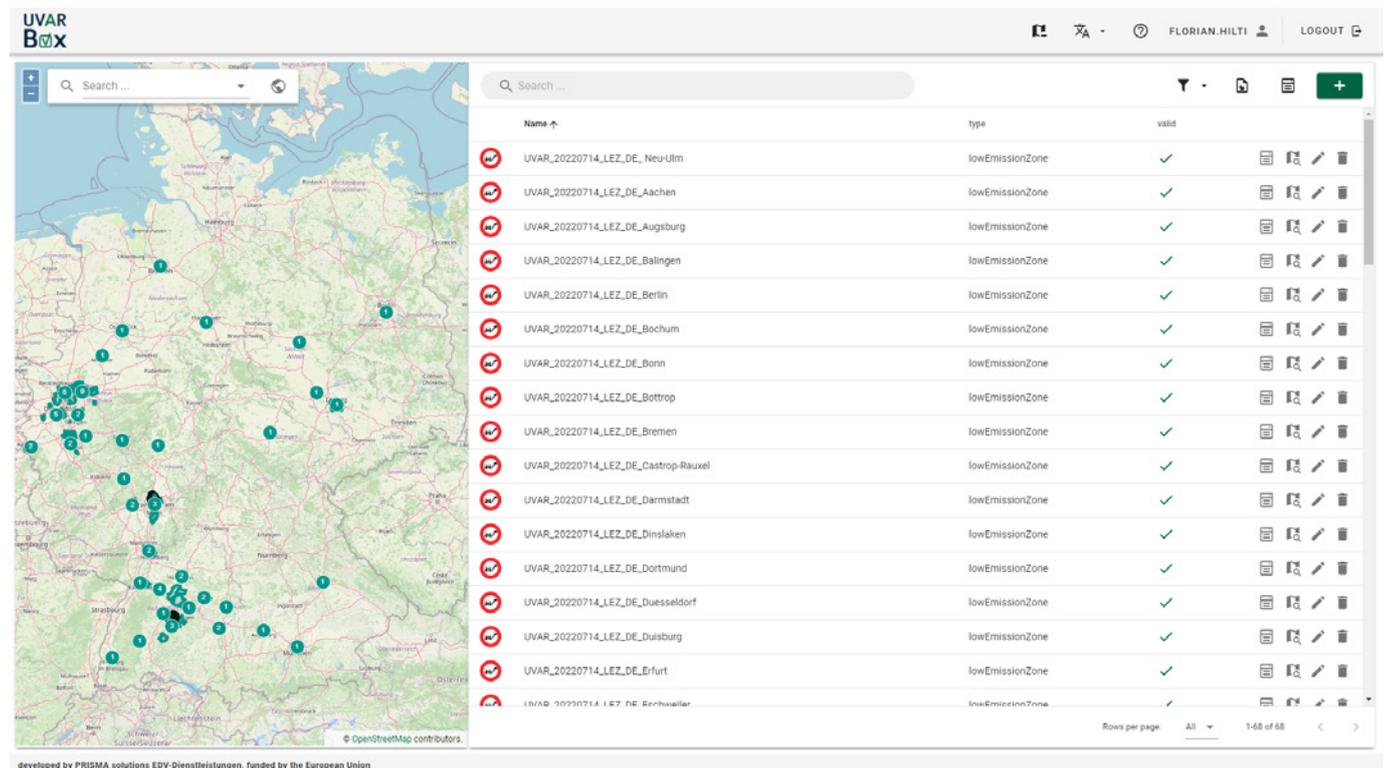


Figure 1 - DATEX II model structure

Use the UVAR Box Tool

The UVAR Box project has created a tool to facilitate the conversion of UVAR information into DATEX II standardised data. The picture below gives a screenshot of the German LEZs entered in the UVAR Box tool.



Picture 1 - Screenshot of the German LEZs within the UVAR Box tool

Usage

The UVAR Box Tool is a digitisation tool created for cities to be able to import, manage and export UVAR data. It builds upon the definition of the DATEX II model created in the UVAR Box project and follows a generic approach on how to use and manage UVAR information. It is available as a web-application and hence can be used with standard web-browsers without the need of installation by the user. It is designed for municipal and regional authority colleagues in charge of UVARs, and their IT and digitisation colleagues, and in a way that everyone can use it without having a significant technical expertise.

Function

The UVAR Box Tool allows cities to generate UVAR machine-readable data in DATEX II format. The following data input and output methods/use cases are available.



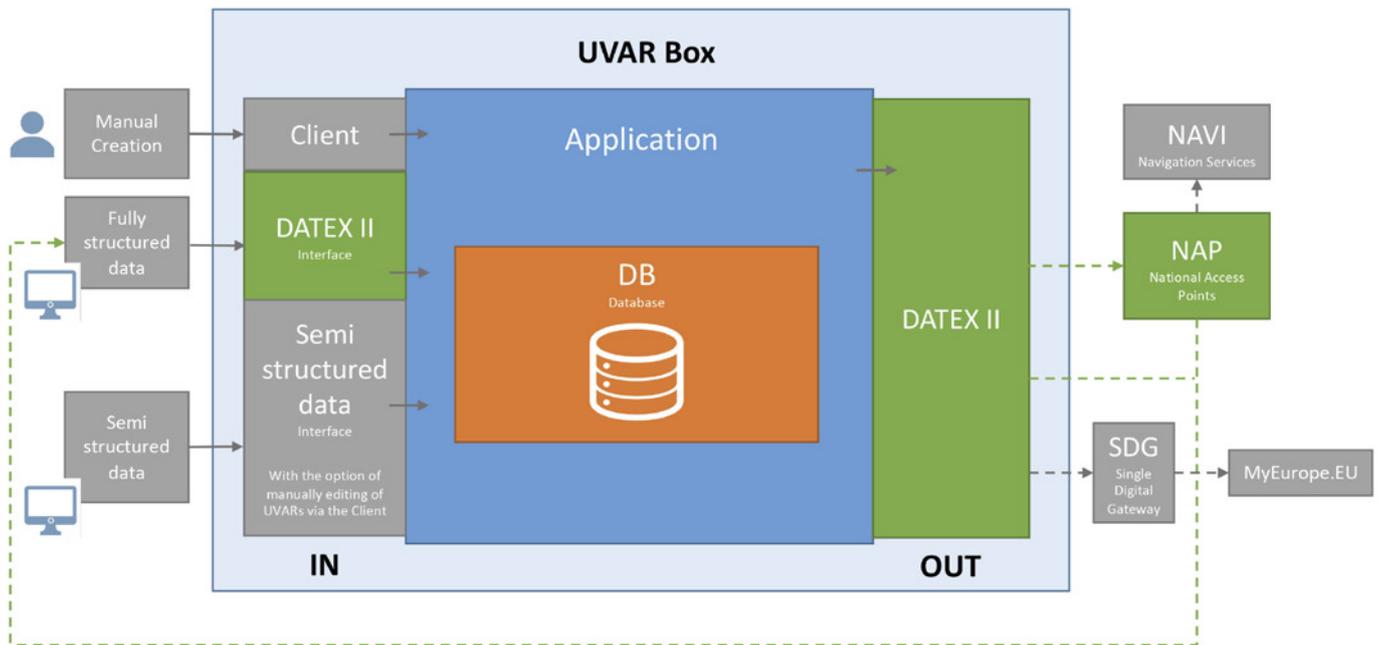


Figure 2 - Use cases of the UVAR Box tool

▣ 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 current DATEX II model. The UVAR data is validated on import and rejected if validation fails. The import can be triggered via the UVAR Box tool. 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.

▣ Manual creation of UVAR

It is possible to create a new UVAR on the tool. For this purpose, templates 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 are 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 prefilled). Hence having well-defined templates as a basis eases the process of creating an UVAR. Templates are currently available for the main types of UVAR. Different templates are also available where relevant for each of the five project focus countries, and in some cases also regions, where there is an UVAR framework that pre-specifies certain aspects of the scheme.

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. Boundaries can also be drawn manually.

▣ 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.

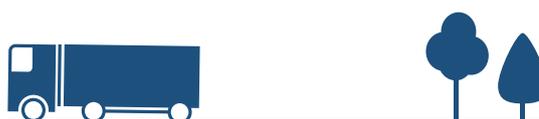
After importing, the UVAR can be edited in the UVAR Box Tool and attributes can be edited as needed.

This use case follows a generic approach which allows the import from 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.

Exploitation of the Data output

The UVAR data stored in the UVAR Box tool can be exported in a standardised data format – DATEX II. The export can be triggered via the UVAR Box Tool. 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, as well as on the cities open data portal. More information on this exploitation potential is provided in the section 6 “UVAR data access and information services”.

Furthermore, the exported data allows the creation of SDG web-based data. This data can be further published and made accessible to a wider non-expert audience.

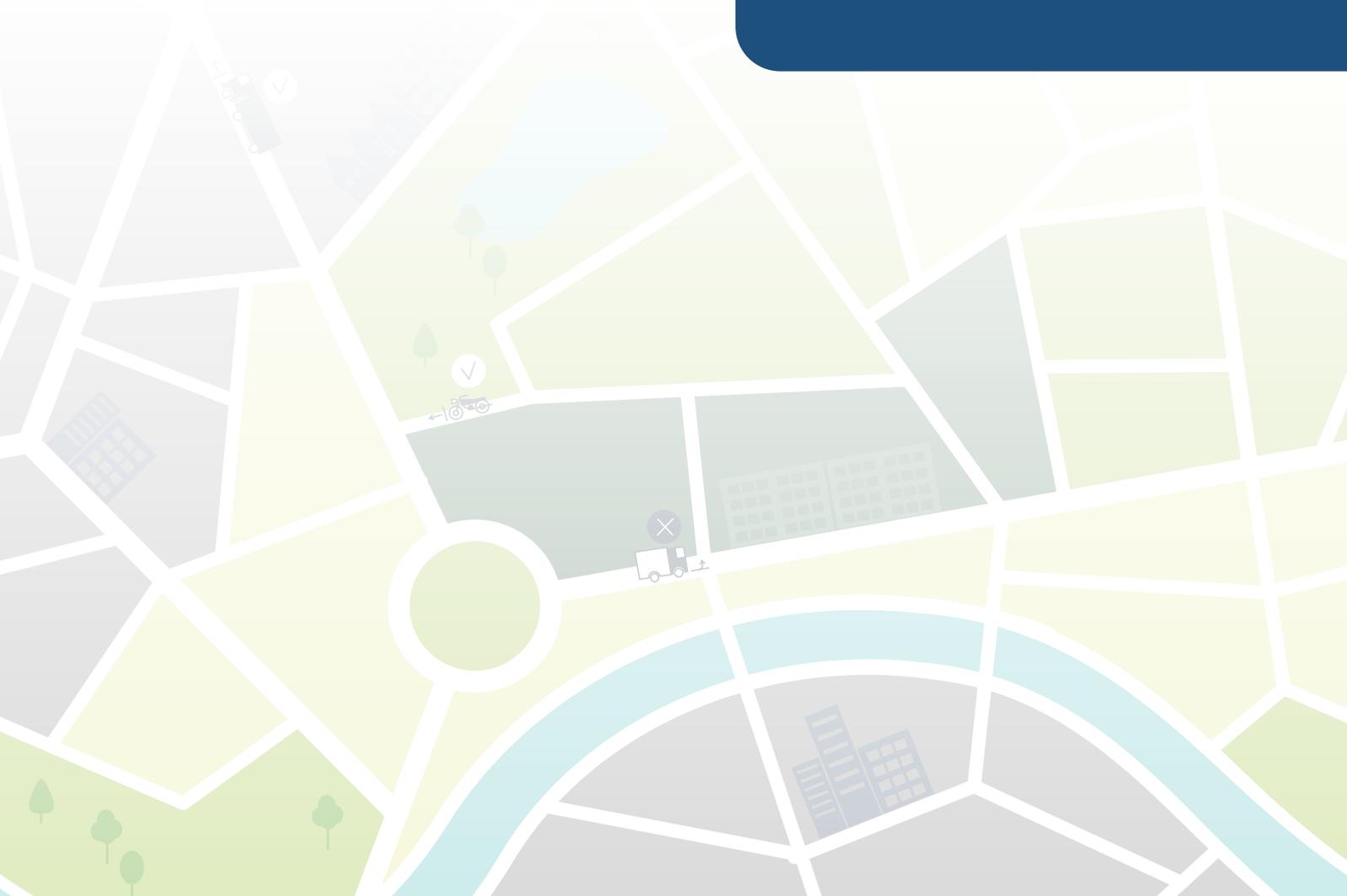


Further information



Detailed information on the UVAR Box tool and how the digitisation process can be started are available on the dedicated page of our **website**¹⁰. This page provides you with all necessary information to start the digitisation process for your city, which includes a written manual for the tool, video, information concerning the registration and additional contact details.

¹⁰ <https://uvarbox.eu/uvarbox-tool/>



Find out our approaches and results per country

Austria

▣ Overview

Currently, Austria has 274 UVARs digitally available on the UVAR Box tool: 8 LEZs, 6 emergency scheme LEZs, 1 PED with 260 different streets, and 259 PARK. These have been created with standard Templates. The LEZs are based on regulations of federal states, while the PARKs are based on regulations of municipalities and cities. The data was collected through requests to the responsible municipalities/cities, as well as through requests to the federal states. The responsible authorities either had the required data in the form of a regulation (PDF) or in a geodata set (Shape file). The geodata set is a Graph Integration Platform (GIP) - data management tool for municipalities/cities - Export. As an alternative, the PARK data could be collected by a questionnaire. This information was supplemented by the data of the municipality/city website. AustriaTech then entered the data into the tool.



▣ Cooperation

The digitisation strategy planned for the data to be collected in cooperation with the federal states, cities and municipalities. The LEZs were sent by the respective federal states and entered by AustriaTech. For the PARK data, the cities were contacted and asked to fill out a questionnaire for each UVAR, or to send the data in the form of an ordinance or a Shape file. The AustriaTech staff then transferred the data into the tool, downloaded it as an Excel list with data and screenshot of the zones, and sent it back to the municipalities for validation. In parallel, the data was validated by the tool regarding the DATEX II UVAR data model. This ensured that the data had been entered correctly.

▣ Future Plans

For the future, it is planned that the federal states, municipalities and cities enter their data themselves. For this purpose, it is planned to register them as user of the UVAR Box Tool. Here, the authorities are supported by the existing documentation and the expertise of the Country Coaches. Alternatively, there should be a possibility to export the data from the GIP into DATEX II. The created UVARs should then be made available on the NAP for interested service providers.

Belgium

▣ Overview

In Belgium, there are currently 3 existing LEZs in cities, which are a combination of LEZs and LTZs. All three of them are available on the tool and validated by city representatives. There are also many cities with pedestrian zones. The digitisation of UVAR information in Belgium is mainly driven through the initiatives of cities. Most of the cities provide UVAR information via their public websites but only larger cities have machine-readable data available via city open data portals. The Belgium National Access Point enables the publication of RTTI (Real Time Traffic Information) data when the data is made available and hosted by the cities.



▣ Cooperation

The digitisation strategy entailed identification of Belgian front runner cities in UVAR digitization, and jointly identifying the most suitable UVAR digitisation method, according to their current practices and the available UVAR Box tooling.

The resulting methods and best practices served as examples for follower cities, showcased in the developed training material and in UVAR Box workshops. They were also used by the country coaches in their several bilateral meetings to provide constant support to city officials across Belgium. It was however difficult to find a good process for the validation of the UVAR data digitised on the UVAR Box tool: city representatives needed to validate the accuracy of the data on the tool,

as some interpretation was required to enter the data in a standardised form, but this validation step was a challenge due to the lack of time, resources, and DATEX II knowledge of the city staff.

▣ Future Plans

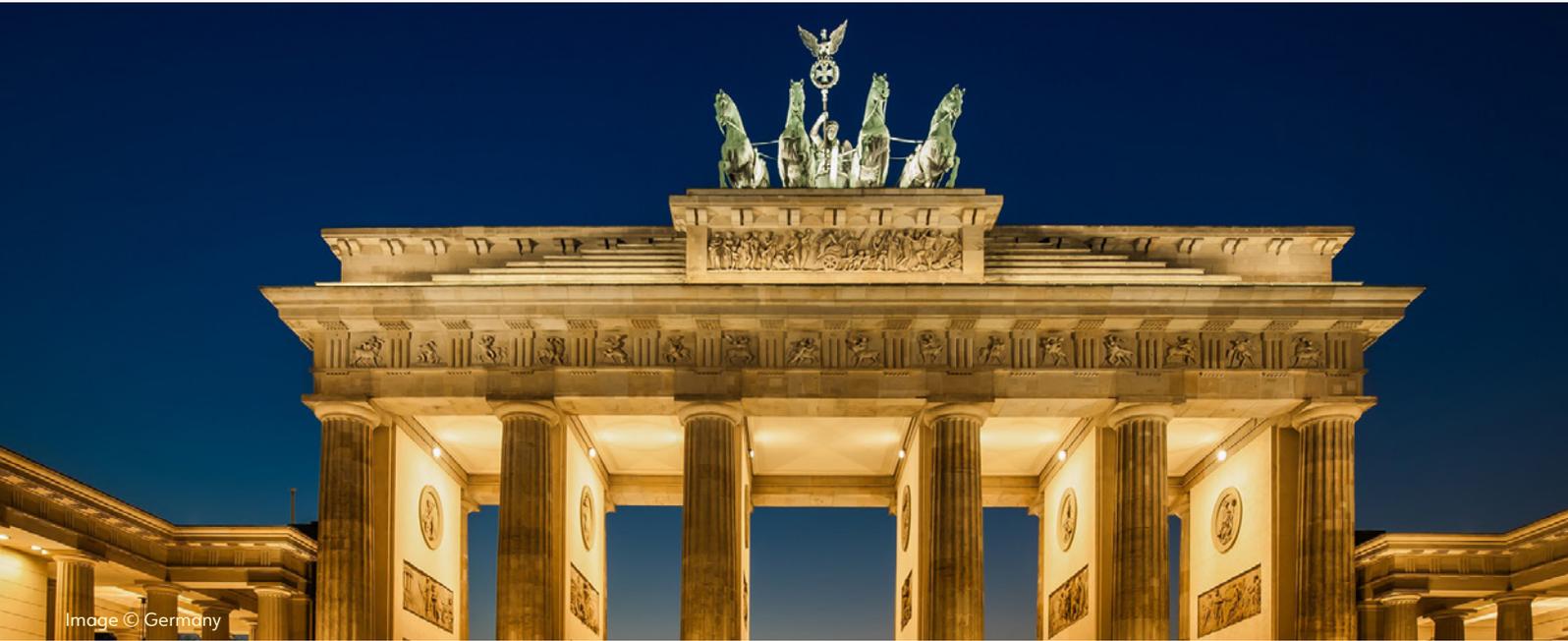
The UVAR Box Tool, its documentation and training tools will be available to help cities to digitise and provide UVAR data. Nevertheless, it is necessary to further support Belgian cities on the uptake and use of the tool. Furthermore, cities need to identify the right resources and responsible departments to make use of the UVAR Box Tool. This support is especially needed towards the smaller cities with UVARs, that have less available resources and expertise.



Germany

▣ Overview

Germany currently has 68 LEZs, which all operate in the same UVAR framework of low emission zones (“Umweltzone” in German). They are all available on the UVAR Box Tool. The legislative framework to create a LEZ was introduced nationwide in 2007. The categorisation depends on the EU-wide vehicle emission standards for vehicles, ranging from Euro 1 (high emission/red sticker) to Euro 4 (low emission/green sticker). Before the digitisation process, UVARs were available in a partially structured digital form and published by the Umweltbundesamt (UBA) on its [homepage](#)¹¹.



▣ Cooperation

The digitisation strategy for LEZs has been to digitise the regulations within the consortium, based on the official data and digital maps published by the UBA. For other regulations, the cities got access to the UVAR Box tool, so they can either manually digitise the data directly in the tool or import it by using a structured Shape file and then edit it in the tool.

The most important cooperation was with the UBA. Furthermore, a national working group consisting of the national highways’ agency (Bundesamt für Straßenwesen (BAST)), Bundesländer (states), regions, cities and private companies, was involved in the discussion. This working group also works in close cooperation with the German NAP. Furthermore, all cities with LEZs were contacted directly via phone and email.

▣ Future Plans

In order to make the results of UVAR Box sustainable and long-lasting, it is necessary to further accompany and support German cities on their way to long-term maintenance of UVAR DATEX II data. A formal cooperation has not yet been created for Germany. Additionally, data integration depends on the service providers and on their capacity to integrate the newly developed DATEX II standard for UVARs, which still needs to be established amongst the German NAP and German cities. However, through the stakeholder group previously mentioned, whose members also include HERE and TomTom, such a cooperation may arise. Although resource availability is a major challenge for German cities, they see the benefits and advantages of the UVAR Box project and the UVAR Box Tool. It is now crucial not to leave them alone, but to continue to accompany and support them in this important task.

11 <https://gis.uba.de/website/umweltzonen/index.php?tab=uwz#karte>

Italy

▣ Overview

A significant proportion of the European UVARs are located in Italy, including around 200 LEZs and over 400 LTZs. All Italian LEZs, 3 Italian LTZs, and 8 Italian EMERG are now digitally available on the UVAR Box Tool.

These UVARs are adopted in cities of various sizes, from the capital of Rome to small and mid-sized cities and communes in the countryside. Despite these high numbers, the digitisation level of Italian UVARs was very low at the beginning of the project, and only the largest cities, such as Milan and Rome, already had some (partially and non-DATEX II) digitised UVAR data. Unfortunately, most municipalities need to invest in digital skills and suitable tools to carry out the UVAR digitisation process. Thus, UVAR Box provides the ideal solution for a significant number of Italian cities. Thanks to the UVAR Box digitisation tool, Italian country coaches digitised a significant number of LEZs.



Image © Italien2020

▣ Cooperation

As a first step, regional and national authorities, as well as the “Italian Ministry of Infrastructure and Sustainable Mobility” (MIMS), were directly contacted in order to get support to establish contacts with local authorities. While contact with the national ministry was efficient, for several reasons, this approach, unfortunately, had limited success with the cities themselves. Therefore, the Italian country coaches started the UVAR data digitisation process themselves and succeeded in digitising around 200 LEZs. This data has been validated by the tool against the UVAR DATEX II data model, and hopefully over time content should be validated by the cities to guarantee a smooth integration into the framework of the Italian NAP. Yet, a well-defined validation process still needs to be in place. A congestion charge and an LTZ were also digitised. A significant step towards the full digitisation of data has been made and many Italian municipalities are dedicated to finishing the digitisation process, as the significant level of attendance to the Italian information meeting showed in April 2021.

Since then, municipalities were contacted directly by Italian country coaches through various channels, such as “peer to peer” meetings, calls, or emails.

▣ Future Plans

Thanks to the UVAR Box Tool, the digitisation and standardisation of UVAR data can continue and be translated directly into DATEX II. This latter action requires the involvement of the municipal IT departments, which has been supported by the country coaches, as some administrations lack the technical expertise. Nevertheless, Italian municipalities will continue to digitise their UVAR data in the future thanks to the UVAR Box Tool and documentation. The data integration processes into the system of the Italian national access point in the future would allow real time updates, which are essential for pollution emergency schemes that can trigger the activation of temporary UVARs. Overall, with 28 more LEZs digitised than the ones that were identified in the **CLARS database**¹² at the time of the project proposal, and with the launch of the cooperation process with the authorities, the objectives of the UVAR Box project have been achieved.

¹² <https://urbanaccessregulations.eu/>



The Netherlands

▣ Overview

Currently, 15 Dutch cities have a LEZ, and more than 30 cities are planning to implement ZEZs for city logistics by 2025. Additionally, nearly every city in the Netherlands has specific on-street parking regulations and pedestrian zones. All current 15 LEZs have been digitised by the Rijkswaterstaat VM-IVRA project using the UVAR Box DATEX II data model. Additionally, one Dutch LTZ is digitally available on the UVAR Box tool. The Dutch national and local authorities are working on the UVAR digitisation since several programmes were introduced in 2018 by the Ministry of Infrastructure and Water Management in the framework of a Smart Mobility policy plan with the aim to scale up nationally the digitalisation of mobility. The UVAR Box use cases are spread throughout different existing digitisation initiatives, which required the identification of the most appropriate stakeholders to approach.

In that sense, the UVAR Box Dutch country coaches looked to identify and collaborate with these Dutch national initiatives, presenting and taking in mind the project principles: harmonised machine-readable data in DATEX II format and access of UVAR data via the NAP. Based on these understandings, collaboration was set-up towards adding value to the current work and also to take the lessons learned in order to apply it to the UVAR Box project.



▣ Cooperation

A collaboration was set up with Rijkswaterstaat (the Dutch Ministry of Infrastructure and Water Management) and the Dutch RTTI NAP (National Data Warehouse for Traffic Information, NDW). These two stakeholders work jointly within the “VM-IVRA” project (Traffic Management – Information & Route Guidance) on the collection, digitisation, and provision of LEZ data, to inform vehicle operators and navigation service providers. In this project, road authorities and service providers work together on getting traffic management information into in-vehicle navigation services, informing road users, and enhancing the traffic management performance, towards the goal of a robust road network.

The collaboration entailed persuading the collaborators to use the DATEX II model developed within UVAR Box as opposed to their previous (national) format.

Furthermore, the UVAR Box Tool and principles have been introduced by the several national and regional digitisation initiatives, to both public and private organisations dealing with digitisation and publication

of UVAR data, to promote their use in the current and upcoming initiatives bringing forward the digitisation of UVARs.

▣ Future Plans

The UVAR digitisation process in the Netherlands is in place and following the UVAR Box and EC approach. There are currently nationally coordinated initiatives supporting the continuation of digitisation and publication of UVARs while using the tooling provided by UVAR Box. Both the national level and cities are aware of the benefits of UVAR digitisation and are working on the different national and European initiatives. The NAP is also prepared and able to publish and provide access to the UVAR data. Nevertheless, there is still the plan to digitise other forms of UVARs, such as pedestrian zones. Next to this, efforts should be taken on developing and implementing activities supporting the sustainability of the UVAR data, in particular supporting cities managing the UVAR data quality (accurate and up to date) and therefore assuring its value for service providers to continue using it in the services.

Understand UVAR Data Access and Communication

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 depends on how accessible the data is (format, searchable and available for use), and how valuable the information is perceived by service providers, and how much it is incorporated into their information and navigation services delivering UVAR information to road users.

Data Accessibility

The recently updated Delegated Regulation on RTTI prescribes that any digitised UVAR data should be made accessible via the RTTI NAP. These NAPs are set up by each European Member State to provide a single point of access to traffic data for service providers to use.

Currently there are different implementations of RTTI NAPs in the 5 UVAR Box focus countries, with different

distribution of roles and responsibilities in the provision and accessibility of RTTI and UVAR data. In the UVAR data value chain (Diagram 3), UVAR authorities are responsible for collection and generation of UVAR data, and NAPs for its publication as a national single point of contact for service providers. The RTTI encourages Member States to facilitate generation of data, which is then able to be published on the NAPs.

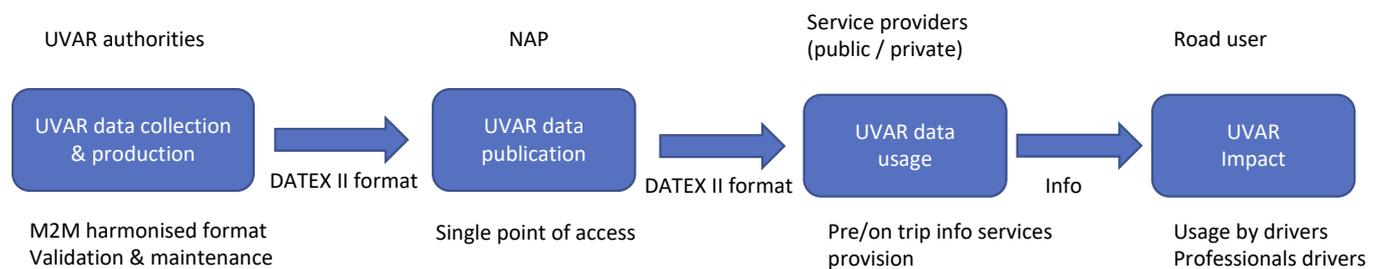


Figure 3 - UVAR Box' foreseen UVAR data process

There are several different types of NAPs, which means that the data is accessed slightly differently. Sometimes data is directly available at NAPs (e.g., in the Netherlands), sometimes NAPs work as a registry guiding the user to data holders (e.g., in Austria).

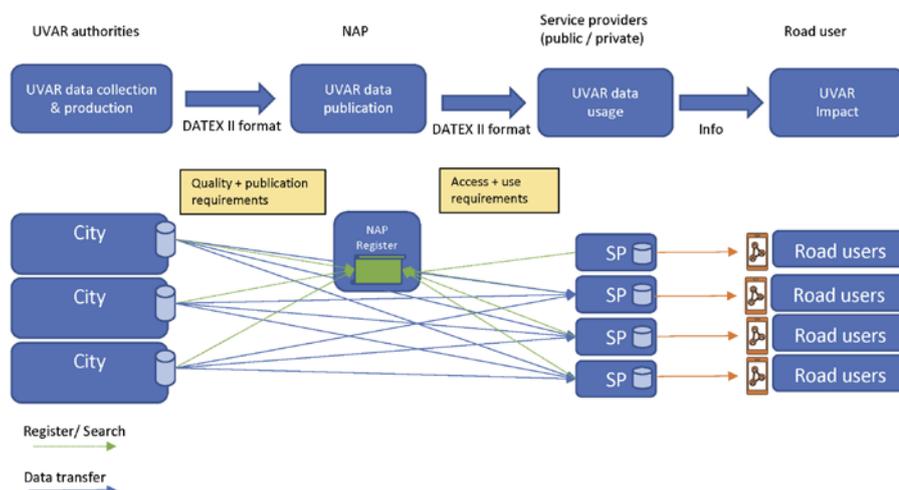


Figure 4 - "RTTI data directory" NAP model

When data is directly available on the NAP, extra accessibility services are provided for RTTI data, such as a uniform data configuration module, and data quality (availability) monitoring services, as well as the monitoring of data access and usage by data consumers.



When the NAP is a registry with a search function describing datasets and sources where data is available to be retrieved, the UVAR data quality and accessibility conditions are defined and managed by the UVAR authorities.

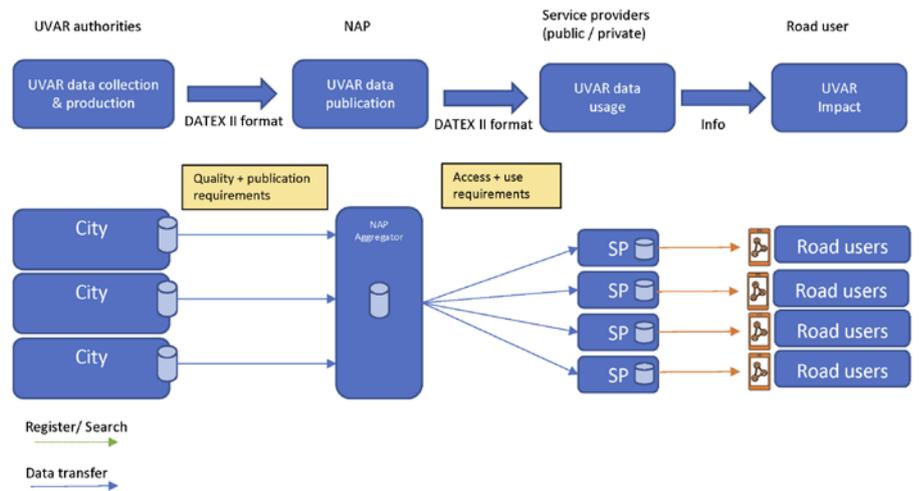


Figure 5 - "RTTI data services" NAP model

More detail on the different processes planned for UVAR data publication at national level can be found in our deliverable D3.1 Demonstration of UVAR data access in trip planning and navigation services, publicly available on our website when validated by the European Commission.

The NAPCORE program, a joint initiative of the 27 Member States, is working towards a more harmonised European Network of NAPs. It addresses the interoperability challenges of different European NAP implementations, as well as the required specific UVAR data specifications concerning harmonised quality definitions and access conditions. NAPCORE is one of the key agencies taking the work of the UVAR Box forward, as well as producing a harmonised metadata catalogue for UVAR data. This metadata catalogue will ensure an easy identification of available and accessible UVAR data. Ideally, this metadata would be set-up in a machine-readable

format, so that UVAR data sets can easily be accessed by service providers integrating that data into their end-user services.

Due to the various approaches from the NAPs, the Single Digital Gateway (SDG) provides information for human readers on the web, to ease the movement of citizens and businesses within the European Union. The UVAR Box project has established the liaison with the SDG responsible entity, "Your Europe", to ensure that the UVAR DATEX II data generated could be integrated on their portal. The liaison 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 improve the overall quality and the effective implementation of the solution.

Data integration in information services

UVAR Box conducted consultations with a broad number of service providers, with the aim to introduce and discuss the following points:

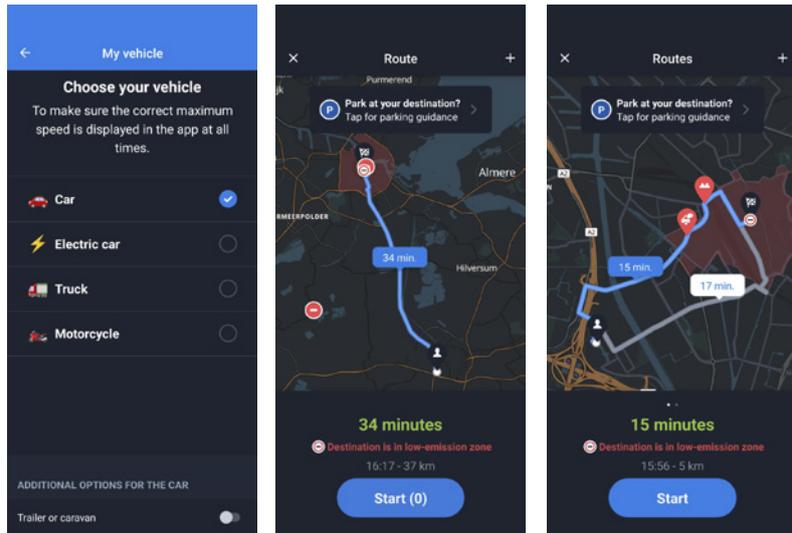
- ✓ Explain the UVAR Box project and the proposed approach of the European Commission on the access of UVAR data;
- ✓ Collect stakeholders' requirements and suggestions for UVAR data access, usage and integration in information services;
- ✓ Explore opportunities to demonstrate the integration of UVAR DATEX II data in their information and navigation services to road users, either through the participation in the UVAR Box Hackathon, or through the adoption and integration of the new UVAR data as part of their own service development activities.

The UVAR Box stakeholder consultations showed that the high number of organisations involved in the definition and publication of UVAR information is a challenge for service providers to be able to identify relevant data. This could be solved by providing a single point of access to data at the NAP, where the responsible UVAR authority publishes their available UVAR data in DATEX II. Service providers must be able to clarify the interpretations and status of the regulations. An additional obstacle for higher data quality and integration is the diversity of methods, quality, and techniques, like georeferencing definitions and data formats, that are currently used to integrate the services. Thus, the objectives of the UVAR Box project were widely welcomed by the expert stakeholders.

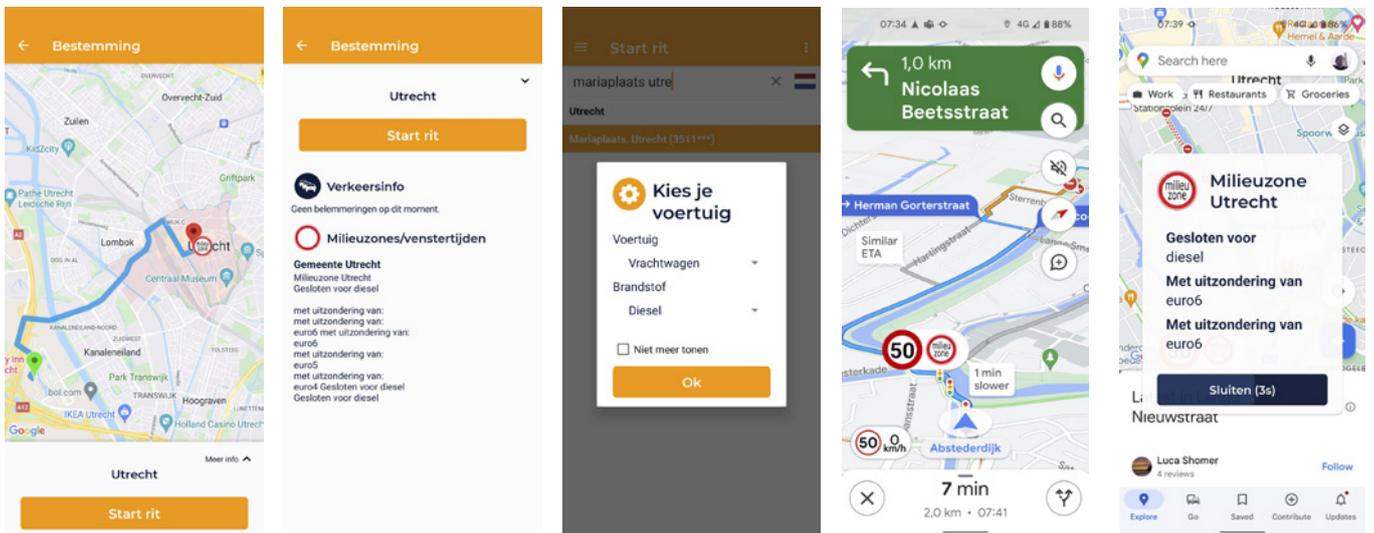
During the UVAR Box project timescale, it was possible to demonstrate the use of UVAR LEZ data in the context of Dutch program "VM- IVRA" Traffic Management – Information & Route Guidance: LEZ UVAR information was digitised with the UVAR Box DATEX II model and published by Dutch NAP, available for navigation service providers to use and integrate in their services. The LEZ UVAR DATEX II data is used by 3 navigation and information service providers in a proof-of-concept period: Be-Mobile with "Flistmeister" app; Locatienet with Onderweg app; and TripService through the Waze app.

To further explore the potential of UVAR data in user information services, the UVAR Box project also organized a hackathon. The aim was to challenge developers to use the UVAR data and demonstrate new and alternative uses that could be a benefit to both users and city authorities.

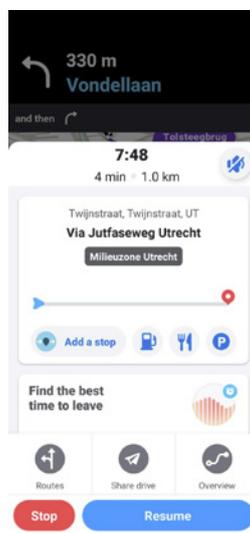
The event included an online presentation of the challenge, and a showcase of the results/award ceremony at the EU ITS Congress in Toulouse, in May 2022. As there was no stakeholder able to participate in the challenge, the project took the chance to promote service providers' work in contact with UVAR Box instead of the award ceremony. Service providers were invited to make demonstrations of the possible use/integration of the DATEX II UVAR data. NDW (the Dutch NAP for RTTI), Be-mobile, and HERE presented their exploitation of the UVAR data, while UVAR Box and UVAR Exchange showcased the efforts conducted to provide the data and improve UVAR implementation in Europe.



Picture 2 - Screenshots of LEZ UVAR data integrated in pre-trip information in Be-Mobile/Flitsmeister App



Picture 3 - Screenshots of LEZ UVAR data integrated in pre-trip information in Locatienet / Onderweg App



Picture 4 - Screenshot of UVAR data integrated in the Waze application

Learn about UVAR future perspectives

Post project process harmonisation

The UVAR Box results will be handed over to the NAPCORE initiative. Within NAPCORE, DATEX II is continuously updated, ensuring further development of the standard itself as well as adapting the DATEX II UVAR profile, if needed.

Furthermore, NAPCORE should ensure that all European Member States and NAPs have knowledge and access to the developed UVAR Box Tool. It will be up to every single NAP to decide how to deal with the tool in the future. Some NAPs could provide access to the UVAR Box Tool directly via their NAP as a service for data holders. Already today, NAPs are not solely providing access to data, but are also providing support services for their stakeholders, including data holders and data users, as seen above. The UVAR Box Tool can become an additional service from NAPs to data holders for generating UVAR data in the correct format. This is of specific interest to authorities as the UVAR Box Tool ensures that all required information, as laid down in the RTTI Delegated Regulation, is provided and the authority fulfils the legal requirements.

In addition, the UVAR Box Tool will be used by city authorities. For the authorities of bigger cities, who usually have their own digital tools integrated into an overall IT infrastructure, the UVAR Box Tool will be provided as a complete set to be integrated in the existing processes. However, even in those cases where the UVAR Box Tool is used as a specific version integrated into an already existing system, a central service needs to be provided, e.g., by the NAP authority. This central service needs to ensure that updates on the tool itself and on the underlying DATEX II profile are included into all up and running versions of the UVAR Box tool. The NAPs should provide support services to the single UVAR Box tool users in that case.

Additional support on UVARs in UVAR Exchange

Several challenges concerning UVARs still exist, even after the successful digitisation of UVAR information by the UVAR Box project. Even if information is displayed digitally, foreign drivers often have trouble understanding road signs, due to the different national approaches. Whereas a 'stop sign' is internationally codified, signs that indicate UVARs are not harmonised and are often complex, including a significant amount of text (in the national language). Thus, the UVAR Exchange project works to enable an EU-wide harmonised approach to physical road signs working with international and EU organisations responsible for road sign coordination and standardisation, including the [UNECE](#)¹³. The project also looks at harmonising and testing variable message signs (VMS), as well as demonstrating the provision of information directly to a connected vehicle via Cooperative Intelligent Transport System (C-ITS) messages.

Another challenge is the lack of exchange and integration of vehicle data in cross-border enforcement, particularly relevant for border or touristic areas. On the one hand, revenues from fees and fines are lost as the tracing of vehicle information of foreign cars that enter an UVAR is difficult or not possible, and in some border towns around a third of the fines are not able to be collected, and there is resentment of the resident population. On the other hand, users are required to register their vehicles, as payment or registration options are limited to national databases, which represents an administrative burden for them. The UVAR Exchange project pilots the cross-border sharing of vehicle and driver information for vehicle enforcement by cooperating with cities, national authorities, and (digital) solution providers.

¹³ <https://unece.org/road-traffic-and-road-signs-and-signals-agreements-and-conventions>





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