User-friendly Information

Tool on Urban and Regional Access Regulations Schemes

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

D4.1 & D4.2 Organisational frameworks for publication of UVARs in place and European and Member State Strategies to ensure the sustainability of data collection and accessibility

Consortium:

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Document file name	Work package	Tasks
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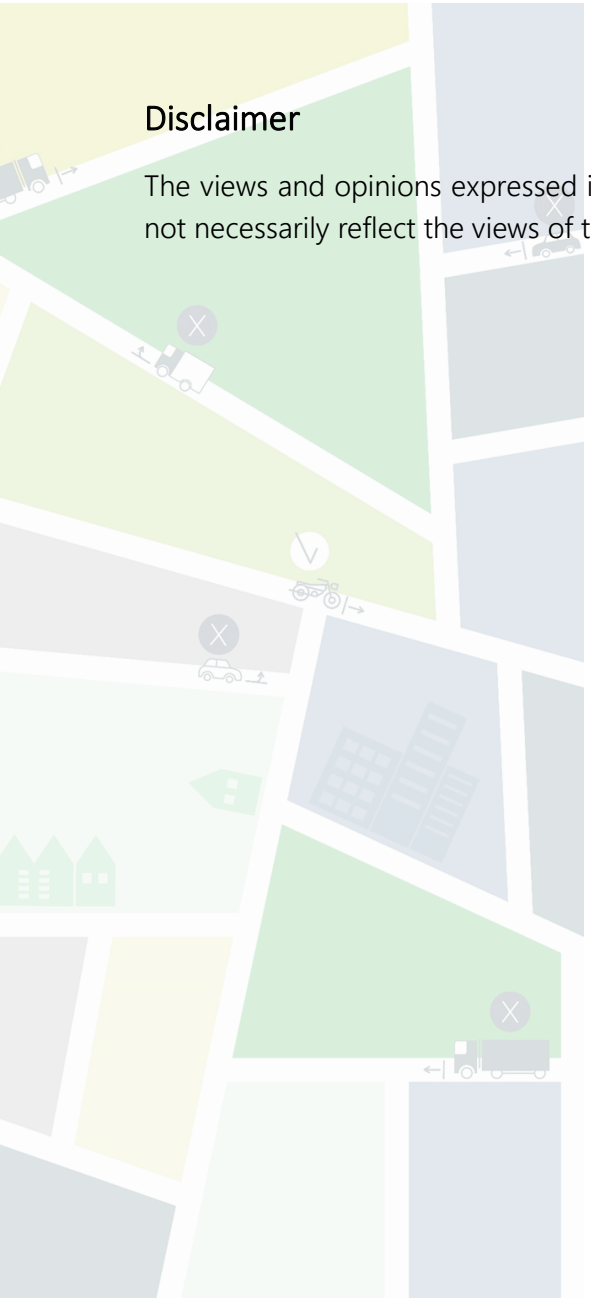

General section

Executive Summary

The UVAR Box project is dedicated to the creation, collection, publication and processing of (digital) Urban Vehicle Access Regulations (UVARs). The project has demonstrated the proof of concept for digitising UVAR data according to the applicable regulations with the developed UVAR Box Tool in the participating Member States. There is also interest from cities and municipalities to digitise UVAR data. However, further work is needed on a European, national and local level to ensure sustainable digital UVAR provision in the future. This includes raising awareness of the advantages and need to digitise UVARs and improving knowledge of the applicable regulations and the DATEX II model, further development of the UVAR DATEX II model and further development and maintenance of the UVAR Box Tool, as well as national structures to aid and encourage local authorities to digitise UVAR data. This deliverable combines the work of tasks 4.1 and 4.2 of the project, presenting the analysis of organisational and legal frameworks for UVAR provision and making recommendations regarding sustainability of UVAR data collection and accessibility in the future.

To ensure a European wide uptake of the digitised UVAR solution developed within the UVAR Box project, including the UVAR Box Tool, it is necessary to analyse existing legal and organisational frameworks. Chapter 2 presents the findings of the analysis of the relevant legal framework on a European level and its implications, which was undertaken as part of task 4.1. Chapter 3 presents the developed UVAR Box Tool and explains future options for making the tool available. Thereafter, chapter 4 focuses on the Member State level, assessing the organisational and legal frameworks as well as challenges at a Member State level, and providing proposals for strategies for future sustainable UVAR provision for each participating Member State. Additional sustainability strategies, which were developed as part of task 4.2, include a sustainability strategy for the UVAR Box Tool as presented in chapter 5, and a sustainability strategy for the developed DATEX II model for UVAR data exchange as presented in chapter 6.

Further, recommendations were formulated on European, national and local levels to ensure sustainable UVAR access, which are presented in chapters 7 and 8. Recommendations for the UVAR SUMP guidelines are elaborated on in chapter 9. Finally, the key findings and recommendations are summarised in the conclusion in chapter 10.

1 General description of the deliverable

1.1 About this document

This report reflects the results of UVAR Box work package 4 and combines the deliverables D4.1 "Report on organisational frameworks in place concerning the publication of UVARs" and 4.2 "European and Member State Strategies to ensure sustainability of data collection and accessibility". The reason for this is that both framework conditions and strategies need to be seen together to enable a sustainable future framework for collecting UVAR related data and make them accessible. Herby one specific element in focus of the document is with the UVAR Box Tool, as this will help generating UVAR data. The maintenance, further development, as well as operation of this UVAR Box Tool is in focus of the document as it serves as one basis for collecting UVAR data.

1.2 Methodology

This report was written based on multiple sources of information, including previous work within the UVAR Box project, as well as external sources of information and consortium expertise. A key source of information was the work with external stakeholders, including a final workshop organised as part of work package 4 in cooperation with work package 5.

The report builds on input collected during the project, including all work packages and in particular deliverables 1.1, 1.4, 1.5, 2.1, 2.4, 3.1 and 3.2, the questionnaire conducted as part of work package 3, as well as expert discussions undertaken during the pilot phase of using the UVAR Box Tool, and work specifically for this report. The information from previous work was used mainly to lay down the foundation regarding the current status of UVAR provision in different Member States.

In addition to information already available, new information for the report was collected by further activities within UVAR Box. Information was collected by country coaches focusing on findings on a Member State level. A stakeholder workshop was organised in cooperation with work package 5, where participants reflected on sustainability aspects of digital UVAR data provision and the UVAR Box Tool. The workshop provided input regarding the importance and sustainability of the UVAR Box Tool including future deployment scenarios. An additional key source of information were interviews, which were held when contacting stakeholders. Finally, information was also collected through desk research and consortium members' expertise.

2 Analysis of the legal framework for the provision of UVARs at a European level

The following chapter outlines the European legal framework conditions and requirements that must be taken into account for the provision of UVAR data under FAIR (findable, accessible, interoperable and re-usable) conditions. For UVARs, this means that UVAR related data, if it is generated, needs to be made accessible including a proper metadata-description. Hereby metadata describes the UVAR data-set by

outlining for example the area covered, type and description of the UVAR, actuality of the respective data set, data owner or conditions to use of the data. This metadata ensures that data is findable and can be easily accessed and re-used in accordance to the license agreement underlying the data. By using a common standard for UVAR data, which is DATEX II according to the European framework conditions, UVAR data is treated as interoperable.

2.1 The European ITS Directive

The proposal on the revision of the European ITS Directive[1] is one guiding frame for the tasks elaborated within the UVAR Box project.

The general objective of the ongoing revision of the European ITS Directive is to increase the deployment and operational use of ITS services across the EU. Enhanced ITS deployment is expected to improve the functioning of the road transport system, including its interfaces with other modes, and to reduce the negative external effects of road transport.[2] The UVAR Box project and the provision of digital UVAR data address the general objectives and, furthermore, contribute to the specific objectives of the revision, such as:

- to increase interoperability and cross-border continuity of ITS applications, systems and services: UVAR Box contributed by providing digital UVAR data on 570 UVAR schemes using the newly established UVAR DATEX II profile and a web-based tool, which is able to produce UVAR data in the required machine-readable DATEX II format to assist those creating digital UVAR data. Generating available and standardised UVAR data for the ITS systems and services, such as navigation systems and mobile applications, supports harmonised local and EU-wide information availability on access regulations, which is in turn more easily presented to and understood by the driver.

- to establish effective coordination and monitoring mechanisms between all ITS stakeholders: The UVAR Box project had an impact on coordination between ITS stakeholders, as it involved and engaged various stakeholders on various levels, including national and local authorities, National Access Point (NAP) representatives and infrastructure and service providers. The successful establishment of the UVAR Box Tool supports cities, communities and regions in following a structured approach to collect and provide UVAR data. The tool itself is based on the DATEX II model developed for UVAR data exchange, which enables an EU-wide harmonised approach for generating and converting UVAR data. Through the use of the tool during the project in the participating Member States, the proof of concept for digitising UVAR data for a

1 Proposal for a Directive of the European Parliament and the Council amending Directive 2010/40/EU on the framework for the deployment of intelligent transport systems in the field of road transport and for interfaces with other modes of transport, published Strasbourg, 14.12.2021 COM(2021) 813 final, 2021/0419(COD), European Commission, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021PC0813&from=EN

2 Review of the Intelligent Transport Systems https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/694240/EPRS_BRI(2021)694240_EN.pdf, November 2021, European Parliament.

number of different types of regulations with the developed UVAR Box Tool has been demonstrated. Furthermore, the gained experience from using the tool can be used by further Member States and cities to establish and develop a coordinated approach for sustainable data collection of machine-readable UVAR data, including making them accessible. The stakeholder engagement strategy, set up by the country coaches, and the UVAR Box Tool, make a strong contribution to collecting and updating the UVAR machine-to-machine data available, and can therefore be used in the future to increase the number of stakeholders involved, as well as the number of digital UVAR data sets available on a Member State level.

- to solve issues relating to the availability and sharing of data that support ITS services: UVAR Box involved and engaged various stakeholders including national and local authorities, NAP representatives, infrastructure and service providers, and raised awareness on the importance of the provision of UVAR data and the current and draft requirements being formulated at the European level. The UVAR Box project identified challenges in the data collection, as well as in the accessibility of UVAR data. The UVAR Box project gained experience of the development of strategies for the sustainable availability of UVAR data, especially through the engagement of the country coaches and the involved NAP representatives. Close cooperation with cities, service providers, and related initiatives, such as NAPCORE, enables the availability of high qualitative and up to date data on access regulations in form of different UVAR schemes, ready to be taken up by service providers, to the benefit of citizens and companies moving across Europe. UVAR Box further contributes to the aims of the proposed revised ITS Directive by increasing the availability of data on the NAPs and other data provision platforms, and simplifying the re-use of data by standardising the data exchange interface.

UVAR Box achievements are in line with the main aims of the priority areas of the amendments to Directive 2010/40/EU as described in the Annex I of the proposal of the ITS Directive[3]; priority area I - Information and mobility ITS services and priority area II - Travel, transport and traffic management ITS services.

The UVAR Box approach, and the elaborated and provided data, rely on traffic regulation orders published by cities, regions or Member States. Traffic regulations are listed content in Annex I. of the proposal for revision of the ITS directive. Therefore, especially the sub point of Annex I, 1.3.1: "The definition of the necessary requirements for the collection by relevant public authorities and/or, where relevant, by the private sector of road and traffic data (i.e. traffic circulation plans, traffic regulations and recommended routes, notably for heavy goods vehicles) and for their provisioning to ITS service providers", and further sub points of Annex I; 1.3.1 are also addressed by the UVAR Box project. The

3 Annexes to the Proposal for a Directive of the European Parliament and the Council amending Directive 2010/40/EU on the framework for the deployment of intelligent transport systems in the field of road transport and for interfaces with other modes of transport, published Strasbourg, 14.12.2021 COM(2021) 813 final, https://eur-lex.europa.eu/resource.html?uri=cellar:26277bcb-5db8-11ec-9c6c-01aa75ed71a1.0001.02/DOC_2&format=PDF

availability of digitised UVAR data is an important building block for defining sustainable mobility management services. Therefore, the UVAR Box project also reflects the aims of priority area II.

The proposal on the revision of the ITS Directive adds Article 6a on availability of data as a new Article into the Directive. This article specifies that Member States need to make data "available for the geographical coverage relative to such data type", which are specified in the Annex III of the Directive. Thus, the Directive sets an obligation for providing specific types of data. This is a relevant point because, as stated in the current proposal of the Directive, in the past the focus has primarily been on making already available data accessible, without obligations to create such digital data. Annex III includes, among others, types of data from the Commission Delegated Regulation (EU) 2015/962, including permanent access restrictions. Thus, this obligation would be relevant to UVARs if the proposed revision of the ITS directive is published in its current form, including this obligation. The proposal of the revision of the Directive foresees provision of this data type as early as possible and no later than the 31 st of December 2025.

The proposal of the revision of the Directive states that crucial data types specified in the new delegated act as a result of the review of the Delegated Regulation (EU) 2015/962, will potentially be included in the types of data to which mandatory data provision applies. One of these is data on "boundaries of restrictions, prohibitions or obligations with zonal validity, current access status and conditions for circulation in regulated traffic zones". UVARs are also relevant here. The proposal for revision of the ITS Directive was written while Delegated Regulation (EU) 2015/962 was under review. Since then, a new Delegated Regulation (EU) 2022/670[4] was published to replace the Delegated Regulation (EU) 2015/962, which includes the specified data category, thus the addition of this data type in the revised ITS Directive is a possibility.

If the proposal of the Directive is published including the obligation to provide these types of data, it would mean that Member States would be required to ensure that digitised UVAR data is available. Thus, Member States would have to ensure UVAR data digitisation, if it is not yet done. At this stage, the UVAR Box Tool support is very helpful, as it is a tool for collecting and providing digital and harmonized UVAR data.

2.2 Delegated Regulations supplementing the ITS Directive

In 2018, the European Commission published the Delegated Regulation (EU) 2015/962[5], supplementing the ITS Directive 2010/40/EU. In February 2022, a new Delegated Regulation (EU) 2022/670[6] was

4 Commission Delegated Regulation (EU) 2022/670 of 2 February 2022 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide real-time traffic information services, European Commission, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R0670&qid=1657370808197

5 Commission Delegated Regulation (EU) 2015/962 of 18 December 2014 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide real-time traffic information services, European Commission, https://eur-lex.europa.eu/legal-content/DE/ALL/?uri=CELEX%3A32015R0962

6 Commission Delegated Regulation (EU) 2022/670 of 2 February 2022 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide real-time traffic information services, European Commission, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R0670&qid=1657370808197

published. Through this, the Delegated Regulation (EU) 2015/962 is repealed from January 1st 2025 and replaced by the revised Delegated Regulation.

The new Delegated Regulation (EU) 2022/670 defines crucial data types and introduces certain new ones related to traffic regulations and restrictions, such as permanent access restrictions, one-way streets, and crucial types of data on regulations and restrictions applicable for "boundaries of restrictions, prohibitions or obligations with zonal validity, current access status and conditions for circulation in regulated traffic zones".

In point 2 of the Annex of the Regulation[7], a new data category on crucial types of data on regulations and restrictions is defined. This includes static and dynamic traffic regulations, and, furthermore, defines in the data category (ix) "boundaries of restrictions, prohibitions or obligations with zonal validity, current access status and conditions for circulation in regulated traffic zones" that covers partly the five types of UVARs, which have been defined as part of the project's scope: low emission zones (LEZ), limited traffic zones (LTZ), congestion charging schemes (CS), parking regulations (PARK) and pedestrian zones (PED). In this regard, it must be mentioned that parking regulation UVARs are not indicated in the list of data types in the Annex of the regulation, whereas in the context of the UVAR Box project work the UVAR types parking regulation were included. The parking UVARs were removed from the Delegated Regulation (EU) 2022/670 to better align with Delegated Regulation (EU) 2017/1926[8] on multimodal travel information service, which is currently under revision and scheduled for finalisation until late 2022.[9]

The Delegated Regulation (EU) 2022/670 defines in Article 2 "data on regulations and restrictions" as data that relates to a traffic regulation or a restriction applicable to vehicles on the road network, and "crucial data types" as data types which are considered crucial for the benefit of increased reliability of real-time traffic information services, supporting safe and efficient door-to-door travel and future mobility services. The UVAR Box project focuses on traffic regulations in regard to UVAR data and raises awareness towards these crucial data types among Member States and cities.

The Delegated Regulation (EU) 2022/670 does not set an obligation for digitising data, however, it sets an obligation for making certain data, which is already in a digital format, accessible via NAPs. Article 3 of the regulation highlights the NAPs, which shall constitute a single point of access to the data listed in the Annex for data users for each Member State. Of particular interest for the UVAR Box project objectives is Article 5, dedicated to accessibility, exchange and re-use of data on regulations and restrictions. Here, point 1 of the Article refers to the DATEX II (EN 16157, CEN/TS 16157) or TN-ITS (CEN/TS 17268) standards, in which data on regulations and restrictions listed in the Annex shall be provided. The UVAR Box project focuses on the development and use of DATEX II, as for a long-term approach the

7 Commission Delegated Regulation (EU) 2022/670, Annex referring to point (2):The crucial types of data on regulations and restrictions, (a) static and dynamic traffic regulations defined data category.
8 Commission Delegated Regulation (EU) 2017/1926 of 31 May 2017 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide multimodal travel information services; https://eur-lex.europa.eu/eli/reg_del/2017/1926/oj
9 Answer given by Ms Vălean on behalf of the European Commission, E-002789/2021, (7.10.2021), https://www.europarl.europa.eu/doceo/document/E-9-2021-002789-ASW_EN.pdf

data format should be applicable for both static and dynamic data. DATEX II is suitable for this, whereas TN-ITS is a technical specification developed for exchanging static road data and attributes only.

Furthermore, in point 2, Article 5 refers to details concerning the provision of the data categories defined in the Annex, including a metadata description and accessibility aspects, such as defining minimum quality requirements that Member States shall agree upon in cooperation with relevant stakeholders, and making data accessible via the national or common access point. The UVAR Box Tool enables Member States and cities to generate UVAR data according to the developed UVAR DATEX II model, and, therefore, contributes to harmonised quality requirements.

In addition, Article 9 describes minimum parameters on updating data on regulations and restrictions, including the data sets in regard to the static and dynamic traffic regulation, including data category (ix) "boundaries of restrictions, prohibitions or obligations with zonal validity, current access status and conditions for circulation in regulated traffic zones". Beside the collection and generation of UVAR data in DATEX II format, the UVAR Box Tool can be used to update this data with low effort, which supports the provision of accurate data in a timely manner.

Article 12 focuses on the Member State obligation to assess whether the data provided complies with the requirements formulated in the Delegated Regulation. The competent authorities of the Member States are in charge of conducting the assessment of compliance. Having the tool in place may support data holders and data users to declare the information requested by the competent authority, as the tool makes it easier to do so.

Within the regulation, requirements for Member States concerning reporting towards the Commission are defined in Article 13. This article will apply already from January 1st 2023, whereas the Delegated Regulation (EU) 2022/670 shall apply from January 1st, 2025. The UVAR Box project activities and stakeholder engagement raise awareness of sustainable data collection and provision, and most of all, the country coaches and their collaboration work with the city, Member State, and NAP representatives will contribute to foster the early implementation of the regulation.

The UVAR Box project was defined before the publication of the Commission Delegated Regulation (EU) 2022/670 in February 2022, nevertheless, the scope and elaborated content is dedicated to support Member States and cities in generating digital UVAR schemes and making that information available.

2.3 Further directives, regulations and legal frameworks

Besides the ITS Directive related regulations, other directives, regulations and initiatives are in place and need to be taken into account for the provision of UVAR data in digital format.

The Single Digital Gateway (SDG) Regulation (EU) 2018/1724

The European Single Digital Gateway Regulation 2018/1724[10], on the establishment of a uniform digital gateway to information, procedures, support and problem-solving services, was published in October 2018, amending Regulation (EU) No 1024/2012. It is intended to facilitate access to the internal market for citizens and companies and to save administrative work. The aim is to make public services and information, such as registering your place of residence, studies, insurance, travel, taxes, and employment contracts, digitally accessible to everyone across all Member States via the "Your Europe" website[11]. Article 1 states, that: "Where this Regulation conflicts with a provision of another Union act governing specific aspects of the subject matter covered by this Regulation, the provision of that other Union act shall prevail."

In Annex 1, area C.: "Vehicles in the Union" refers to information regarding rights, obligations and rules arising from Union and national law and includes in Point 5.: "National traffic rules and requirements for drivers, including rules for the use of the national road infrastructure: time-bases charges (vignette); distance-based charges (toll) and emission stickers". These data categories include low emission zone stickers included in the UVAR Box project.

The regulation recommends (note 55) using the Core Public Services Vocabulary (CPSV) to facilitate interoperability with national service catalogues and semantics. Member States should be encouraged to use the CPSV, but are free to decide to use national solutions. The information included in the repository should be made publicly available in an open, commonly used and machine-readable format, for example by application programming interfaces (APIs), in order to enable its reuse.

Each Member State shall nominate a national coordinator or several national coordinators. This person forms the contact point for the respective administrations, promotes uniform application by the respective competent authorities and represents the state vis-à-vis the Commission (Article 28).

The Member States have until December 2022 to set up the extended information services for cities and municipalities. According to Article 2 of the regulation, these information services also need to include UVARs. The final implementation deadline for the regulation is December 12th, 2023, by which time the countries' digital procedures must be implemented on the website, otherwise citizens can sue the Member States for their right to online administration, or the EU Commission could take action to initiate breach of contract procedures.

The UVAR Box project collaborated with the SDG national coordinators to experiment with ways to present UVAR data exported from the UVAR Box Tool in the SDG platform "Your Europe". The results of the collaboration show that UVAR data taken from the UVAR Box Tool can be shown in the "Your Europe" platform, which is a first step for displaying all essential information on UVARs by the end of 2023, according to the SDG regulation. The UVAR DATEX II data extracted from the UVAR Box Tool meets the SDG requirements, including IT infrastructure, business, functional and technical requirements. This is a

10 Regulation (EU) 2018/1724 of the European Parliament and of the Council of 2 October 2018 establishing a single digital gateway to provide access to information, to procedures and to assistance and problem-solving services and amending Regulation (EU) No 1024/2012, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.295.01.0001.01.ENG

11 https://europa.eu/youreurope/

positive aspect for the sustainability of the tool in the future, and suggests a potential incentive for Member States and cities to produce DATEX II data or use the UVAR Box Tool. However, further work is needed both outside of the UVAR Box Tool to enable the SDG direct access to up-to-date UVAR data, for example through a repository, and in the UVAR Box Tool to further ensure completeness and quality of the UVAR data. This also highlights the high importance of future maintenance and development of the tool, for scaling its use beyond the UVAR Box project.

The SDG does not force creation of DATEX II digital M2M data that would conflict with the ITS directive. The SDG requires information on road rules, vignettes, emissions stickers (and by extension the rules requiring them) as well as road tolls in a certain human-readable format specified by the SDG, and according to Article 2 of the regulation, these information services also need to include UVARs. It is the fact that DATEX II data can be easily converted into SDG format that can provide a *de-facto* requirement to create DATEX II data as the easiest route to providing SDG information in the required format.

The Open Data Directive (EU) 2019/1024

In 2019 the Directive (EC) 2003/98 on the re-use of public sector information (PSI) was superseded by the Directive (EU) 2019/1024[12] of the European Parliament and of the Council on open data and the re-use of public sector information (Open Data Directive). It establishes a set of minimum rules governing the re-use and the practical arrangements for facilitating the re-use of existing documents held by public sector bodies of the Member States or held by public undertakings, in order to promote the use of open data and stimulate innovation in products and services.

It also regulates ensuring non-discriminatory access to existing data. This means that each interested party can access and re-use this data with the same conditions, usually laid down in the license agreements. This is done via the open government data (OGD) platforms (for example, data.gv.at for Austria). However, high value data sets in mobility exclude data covered by the ITS Directive (EU) 2010/40 and its supplementing Delegated Regulations. Therefore, the general rules of the Open Data Directive with regard to making public data available are valid for UVAR data, but there is no requirement to generate data, if it does not exist.

INSPIRE Directive (2007/2/EC)

The purpose of the INSPIRE Directive (EC) 2007/2[13] is to lay down general rules for the enactment of the infrastructure for spatial information in the European Community, for the intention of community environmental policies and policies or activities that could have an influence on the environment. It applies to electronic data sets held by public authorities, or under certain conditions third parties, which fall into the categories of data listed in the Annexes of the Inspire Directive. Here Annex III includes the data type "Area management/restriction/regulation zones and reporting units". The INSPIRE website

12 Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L1024#d1e1727-56-1

13 Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE), https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007L0002&from=EN

description of this category[14] specifies, among other, that it "encompasses any zones that are established in accordance with a legislative requirement related to an environmental policy or a policy or activity that may have an impact on the environment at any level of administration (international, European, national and sub-national)." "This includes, but is not limited to, objectives established to protect and improve environmental quality (includes reducing pollution levels)". As UVARs in part aim to have an impact on the environment, for example to reduce air quality, carbon and noise emissions, the INSPIRE directive applies to them.

The Directive requires, according to Article 5, that metadata with specific information is created and updated for the datasets to which it applies. Implementing rules must, according to Article 7, point 1, take into account relevant user requirements, existing initiatives and international standards for the harmonisation of spatial datasets. In addition, attention must be paid to interoperability, which is taken into account in the development of UVAR. The INSPIRE Directive does not require creating new data it only applies to existing electronic data sets. The Directive requires that the laws, regulations and administrative provisions for complying with the Directive must be in force in Member States by 2009.

European Green Deal (EGD)

The European Green Deal (COM) 2019/640 final[15] is a package with policy initiatives to achieve the goal of EU-wide climate neutrality by 2050. EGD includes initiatives in the areas of climate, environment, energy, transport, industry, agriculture and sustainable finance. It also provides a strategy to accelerate the transition to sustainable and smart mobility. The implementation takes place through the package Fitfor55. This package is a set of proposals to revise climate-, energy- and transport-related legislation, and it includes the initiative for sustainable and smart mobility. Its goal is a net-zero emissions society and economy, which requires the mobility sector to become more sustainable and smarter[16].

UVARs are relevant as instruments to lower carbon emissions in mobility, and the EGD may result in higher numbers of UVARs. Further, digitised UVAR data may contribute to realising automated and connected multimodal mobility. In this way, the EU transport system can be made digitally fit and reduce congestion and pollution by introducing new sustainable mobility services such as UVAR.

New EU Urban Mobility Framework (COM) 2021/811[17]

The New EU Framework for Urban Mobility aims to support Member States, regions, cities, and other stakeholders in the transition of urban mobility to be "safe, accessible, inclusive, smart, resilient and zero-

14 https://inspire.ec.europa.eu/theme/am
15 Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, The European Green Deal, COM/2019/640 final, https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF
16 https://www.consilium.europa.eu/en/policies/green-deal/
17 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, The New EU Urban Mobility Framework. {SWD(2021) 470, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0811&from=EN

emission". It highlights the importance of focusing on public transport, multimodality and active mobility infrastructure.

Regarding UVARs, the framework states that they should allow for seamless and user-friendly travel across different Member States and not discriminate against non-resident drivers. It also highlights that information on UVARs needs to be accessible to road users to enable compliance. The framework foresees digitisation and provision of UVAR information and data in a standardised manner for resolving challenges related to UVARs. The UVAR Box Project is mentioned in the framework, as one effort undertaken by the European Commission to improve provision of information and data sharing regarding UVARs.

The New Urban Mobility Framework stresses the importance on Sustainable Urban Mobility Plans (SUMPs) for urban mobility in the EU. As new mobility and transport services continue to emerge, such as Connected Cooperative Automated Mobility (CCAM) or Urban Air Mobility (UAM), the New Urban Mobility Framework also envisages integrating them into the SUMP framework from the outset and UVAR DATEX II can contribute to this implementation for a facilitated and uniform process.

Sustainable Urban Mobility Plans (SUMPs)

Sustainable Urban Mobility Plans address the complexity of urban transport with the aim of improving the accessibility of urban areas and the quality of life by achieving a shift towards sustainable mobility. The Concept for Sustainable Urban Mobility Plans (COM) 2013/913[18] is a guiding principle that addresses, among other things, the contribution to a better integration of different inter-modality modes and the identification of measures aimed specifically at facilitating seamless and multi-modal mobility and transport.

UVARs are measures that can help achieve sustainable mobility – forming a pincer movement with supportive mobility measures. There are a number of SUMP Guidelines and Annexes, developed by the EC and available on the Eltis website[19]. Also, the Dynaxibility Project[20] is planning a SUMP 2.0 Topic guide incorporating the strategy UVAR and SUMP. In addition, the New Urban Mobility Framework states that the European Commission will publish an updated SUMP concept in a Commission Recommendation to Member States about SUMPs, which is due to be published in 2022.

The EU Horizon 2020 project ReVeAL[21] (Regulation Vehicle Access for Improved Liveability) is providing a toolkit to support cities develop good practice UVARs. This includes a guidance which is intended to work together with the UVAR SUMP Topic Guide to cover cross-cutting issues. The advantages to UVAR authorities of digitising UVARs and the UVAR Box Tool are included in the ReVeAL guidance.

18 Annex, A Concept for Sustainable Urban Mobility Plans to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Together towards competitive and resource-efficient urban mobility, https://eur-lex.europa.eu/resource.html?uri=cellar:82155e82-67ca-11e3-a7e4-01aa75ed71a1.0011.02/DOC_4&format=PDF

19 www.eltis.org

20 https://www.interreg-central.eu/Content.Node/Dynaxibility4CE.html

21 https://civitas-reveal.eu/tools/

2.4 *Analysis of the implications of the legal framework conditions relevant for digital UVAR information*

This chapter presents the findings of the analysis of the legal frameworks presented above, highlighting the implications of the regulations and presents the subsequent recommendations.

Overall, when it comes to digitising and publishing UVAR data, different EU Directives and regulations on a European level are in place, and must be complied with. The responsibility for implementing the European requirements is usually with single Member States, and within Member States, divided between different ministries on a national and/or regional level. Here, national coordination efforts are important to avoid double effort in providing and updating data. This is especially important, when different European Directives are dealt with in different ministries. Local authorities are not always aware of EU directives, as most apply at the national, or in some countries regional, level. In the case of UVARs, the interactions between those responsible for meeting the directives, be it national or regional authorities, and the local UVAR authorities are important.

Delegated Regulation (EU) 2022/670

The new Delegated Regulation (EU) 2022/670 has several implications. The first is with the NAPs. The new data categories defined in the Annex of the Delegated Regulation, are not yet represented at the NAPs and need to be incorporated into the individual national strategies of establishing or extending the NAPs. Existing digital static as well as dynamic UVARs need to be provided via the NAPs in a standard format that is compatible to DATEX II or TN-ITS. The timeline for providing the new data categories foresees provision of data by 2025. Currently, only very limited UVAR data is made available via NAPs, and in most Member States no UVAR data is currently published via the NAP. While the UVAR Box project increased availability of UVAR data in NAPs, as the UVAR data collected during the project in Austria and Germany has been published via the NAPs, further work is needed on a European and Member State level to realise publishing UVAR data via other NAPs. Even more, not all NAPs are currently capable of accepting and publishing UVAR data. With the Member States participating in the UVAR Box project, this is the case for the Italian NAP. Ensuring that NAPs meet the requirements for publishing UVAR data is crucial to enable data holders to publish it.

Each Member State has its own NAP, with its individual functionalities. Some NAPs are only data directories, whereas others are set up as data market places. This has an impact on how data is made available in the NAPs of different Member States. In some NAPs, such as those of Germany and the Netherlands, data can be accessed directly via the NAP. Others, such as those of Austria and Belgium, are set up as registry services, which link the user to the data source. Consequently, the UVAR data made available via the NAPs will be made available differently in different Member States, depending on how the NAP operates. For those which operate as registry services, metadata descriptions, which lead to the data owner, are required to make the data accessible and findable by the users. Currently, no explicit data categories exist for UVAR data. As a result, UVAR data can currently be published via these NAPs using existing relevant data categories. The explicit classification of UVAR data is needed for future data

representation. The harmonised data description (metadata), including UVAR data is undertaken by the NAPCORE sub-working group 4.4. The NAPCORE working group 5 is working on a European wide harmonised approach in regard to the required assessment of compliance referred to in the Delegated Regulations – regarding the Delegated Regulation (EU) 2015/962 a draft already exists, and for the Delegated Regulation (EU) 2022/670 it will be done. A classification according to the Delegated Regulation (EU) 2022/670 will be done after the date of application of the Regulation in 2025. The NAPCORE metadata work is ongoing and expected to be finished in 2024.

Another implication of the Delegated Regulation (EU) 2022/670 is related to the formats in which UVAR data is published. In the Delegated Regulation, the different formats of DATEX II (EN 16157, CEN/TS 16157 and subsequently upgraded versions) or TN-ITS (CEN/TS 17268 and subsequently upgraded versions), which shall be used to provide data on regulations and restrictions, are listed in the Annex. It further enables Member States to cooperate to define possible alternative, or additional standards that shall be compatible with the mentioned ones. These different options may lead Member States to follow different approaches, which is legal, but may also pose a challenge for the cross-border use of the data, especially for providing new data types like UVAR schemes. The UVAR Box Tool, making the creation of DATEX II UVAR data an easier task than it otherwise would be, could help reduce the incentive for national standards. The UVAR Box project found this in the Netherlands, when a national program was converting data in a non-DATEX II format. By working with the national authorities and their contractor, the UVAR Box Project managed to ensure that the Dutch LEZ data was also provided according to the UVAR DATEX II model produced.

Another result of the Delegated Regulation (EU) 2022/670, which is relevant to UVARs, is that the scope of the applicable road network has been widened. The Delegated Regulation (EU) 2015/962 is limited to the Trans-European road network and to motorways and specifically defined urban nodes (so-called TEN-T Network of major roads), whereas the new Delegated Regulation (EU) 2022/670 should be applied to the entire road network, which extends the scope of application to cities and communities and their streets. The reason this has been changed is that urban areas significantly share recurring traffic externalities and other traffic management difficulties, such as congestion, air pollution or noise. For UVARs, this extension to further road networks in urban areas is crucial. This implies a need for a concerted EU-wide activity for UVAR data collection at all levels of government.

The last implication of the Delegated Regulation (EU) 2022/670 identified is related to obligations of digitising UVAR data. The specifications within the Delegated Regulation require the sharing of any existing digital data, but do not oblige any stakeholder to create or start collecting any data that is not already available in a digital machine-readable format. However, it is noted in the Regulation that Member States should be encouraged to find cost-efficient ways to digitise existing data on infrastructure, regulations and restrictions. The UVAR Box project provides a tool in place that can be adapted to the specific user needs for digitising related UVAR schemes in the recommended DATEX II format.

As the Delegated Regulation does not set an obligation for collecting or digitising UVAR data, a crucial question is whether the obligation for this will be set in the revised ITS Directive in line with what is currently stated in the proposal for the revision of the ITS Directive, as explained in section 3.1 of this deliverable. If this is the case, Member States will need to ensure availability of digital UVAR data. However, if no obligation is set for providing digitised UVAR data, there is the risk, that no further priority action is started on a Member State level and a significant speed-up of collecting and publishing UVAR data might not happen. This would also make raising awareness of the advantages of digitising UVAR data and the work undertaken by the Member States to encourage, fund and require cities to digitise data even more important.

The Single Digital Gateway (SDG) Regulation (EU) 2018/1724

The fact that DATEX II UVAR data created with the UVAR Box Tool or otherwise can be easily and automatically converted into the input required for the SDG gives a huge advantage to cities and Member States of producing UVAR data digitised in DATEX II. It means that the same data can be used for their SDG requirements as for other digitisation requirements. As the revised ITS Delegated Regulation only requires the *sharing* of existing data not the *creation* of new digital data, the SDG could in fact, be the EU legislation that, in effect, ensures Member States to ensure that cities *create* digital DATEX II UVAR data as this is the easiest route to provide UVAR data in SDG format – if the revised ITS directive does not follow the current proposal and require creation of UVAR data. The SDG requires UVAR information to be placed on "YourEurope" by the 31st December 2023.

The Open Data Directive (EU) 2019/1024

The Open Data Directive requires non-discriminatory access to data. In practice for local authorities with UVARs this means that if one service provider asks for UVAR data, then a similar service needs to be given to subsequent service providers. The directive does not require public bodies to modify the format of the requested information if the required effort is disproportionate. However, the Directive states that where it is possible and appropriate, information should be made available by public bodies in an open and machine-readable format that ensures interoperability. The UVAR DATEX II model and UVAR Box Tool may be beneficial to public bodies in this context, as the data is provided once in a common format.

European Green Deal

Making the advantages of digitizing UVAR data realising automated and connected multimodal mobility and the aims of the EGD clearer to Member States and UVAR local authorities can help encourage the digitization of UVARs.

INSPIRE Directive (2007/2/EC)

UVAR digitisation activities should consider the INSPIRE directive to ensure coherence between the activities undertaken to fulfil the different directives.

New Urban Mobility Framework (COM) 2021/811

UVAR data digitisation is in line with the New Urban Mobility framework, nevertheless, UVAR digitisation activities should ensure focus on the aspects stated in the New Urban Mobility Framework, including access to information to road users, non-discrimination of non-resident drivers, solutions which benefit both road users and public authorities. Work undertaken in the UVAR Box project is aligned with the framework, as the UVAR Box Tool is a solution for UVAR creating authorities which enables digitising data in a harmonized format, which may further be made accessible to road users via various channels.

SUMP

In terms of digital UVAR data, the UVAR SUMP guidance should include a recommendation to provide digital UVAR data in DATEX II format and place it on the NAP. Including a list of the advantages of doing so to further encourage cities digitization efforts. Given the wider desire to and advantage of digitising all traffic regulations, there would also be benefit of including digitizing traffic regulations in the next update of the overall SUMP guidance documents. In reality it is likely to be a while before the SUMP documents are revised. One of the deliverables of the Dynaxibility project is being discussed as an Annex to the UVAR SUMP Topic Guide, and inclusion of the issue of digital UVAR data and the ReVeaL guidance in this document, if it is added as an Annex, may be a short-term option for SUMP guidance.

3 The UVAR Box Tool

This chapter looks at the UVAR Box Tool, developed as part of the UVAR Box Project by PRISMA solutions and hosted by ARMIS, and related maintenance aspects. Different options for making the UVAR Box Tool available in the future are assessed, and proposed strategies are elaborated for Member States regarding digital UVAR data provision and future use of the UVAR Box Tool.

3.1 UVAR Box Tool in place

The provision of the UVAR Box Tool is of high importance to support Member States and cities in fulfilling the requirements formulated in the Commission Delegated Regulation (EU) 2022/670, which sets requirements for collecting and making available digitised UVAR data accessible in the DATEX II format via the NAP.

Without an EU-wide tool for digitising UVAR data in DATEX II, such as the UVAR Box Tool in place, each Member State, region and local authority would need to have its own tool in place for producing UVAR data in DATEX II. Without such a tool, creating digitised data will be a challenge, especially for smaller authorities with less existing tools, expertise and resources. Therefore, smaller authorities would need support from regional and national authorities for UVAR data digitisation. Furthermore, existing GIS programs used by authorities do not usually include a feature for exporting data in DATEX II, and rarely allow for including the details of the UVAR except for the geography. While making such functionality available in the software currently used by authorities may be possible, it would likely require great effort and buy-in from the software providers. Consequently, authorities would likely need to use external

technical experts to generate UVAR data in the DATEX II format, with its associated costs for the authority. Not having a centrally managed tool and DATEX II format also increases the risk that each Member State develops its own data standard.

In contrast, making a tool, such as the UVAR Box Tool, available for all Member States, regions and local authorities, enables all of these different authorities to digitise their UVARs and publish them in the prescribed harmonised format. Given that the ITS Directive or the Delegated Regulation do currently not require the creation of new digitised data, providing authorities the tools to do so may be a way to encourage them to digitise data, ultimately benefitting road users as well as the authorities themselves, especially if there is a greater awareness of the advantages to the authority of doing so. Advantages include greater awareness of the UVAR, and therefore, greater compliance and impact, as well as fewer complaints and queries. In addition to being an enabler for the digitisation of UVAR data, offering a single tool to authorities EU-wide also provides a potential for opportunities for exchange and mutual learning about UVAR data digitisation and management between Member States and authorities, if a single tool is used. If each Member State has its own tool, then this sharing would be focused on authorities within the Member States, however the basis for the tool would be similar, hence facilitated. Such opportunity would be missed if processes and tools for UVAR digitisation differ between Member States, regions and local authorities.

As explained in chapter 2, the UVAR DATEX II data exported from the tool meets the SDG requirements and can easily be used making information available on the SDG platform. This indicates another potential benefit for authorities from using the tool, as the digitised data in DATEX II is in accordance with both the ITS Directive and the SDG Directive.

It can be concluded that there are benefits to Member States, regions and cities from having the UVAR Box Tool made available for them. Nevertheless, even with the tool in place, ensuring sustainable UVAR data provision in the future requires work and involvement on a European, Member State, and local level.

3.2 Maintenance aspects on data generation and collection with the UVAR Box Tool

Through the experience of using the UVAR Box Tool during the UVAR Box project to create digitised UVARs, knowledge was generated about challenges faced when using the tool, which was discussed also in D2.4. The challenges that have not yet been resolved within the UVAR Box project can become important maintenance aspects of the tool.

Authorities in the various Member States face organisational challenges in the digital provision of UVAR data, which were also apparent during the UVAR Box project. As described in chapter 4, there are large differences in the state of digital UVAR data provision between Member States, and within Member States, particularly between large and smaller authorities. Some Member States and cities have established processes and tools for digitising UVAR data, while in other Member States and cities little UVAR data is digitised and there is a lack of digital processes for provision of UVAR data. Cities and municipalities commonly suffer from a lack of knowledge and resources for digitising and implementing the processes needed for providing and digitising UVAR data. This was also experienced during the UVAR

Box project, as for example in Germany, some cities were not able to use the tool as initially planned to digitise their UVAR data, one reason being the cities' lack of resources. For those cities with established processes and tools in place, it is a challenge to adapt the processes and integrate new tools within it. Due to these challenges, it can be concluded that to ensure further use of the tool, further work is needed to support authorities in the different Member States to use the tool and to integrate the tool into their processes. The UVAR Box project also showed that close coordination between Member States is needed for implementing such a single tool that is commonly used. As the Member States learned to use the tool separately, an outcome was that there are differences in the use of the tool, for example in relation to interpretations of parameters in the tool. For this reason, data validation processes are important, which is discussed in detail in D3.2 - *Report on evaluation of end-user information services*.

In addition to organisational challenges, users faced technical challenges, mainly related to the compatibility of the tool functionalities with existing available UVAR data. Member States experienced, for example, that UVAR data available in a GIS format uses different GIS systems and reference systems, making identification a challenge. Currently, the tool does not have a feature for conversion of the different GIS systems, which is a technical limitation that should be addressed by further development of the tool. Similarly, there were challenges related to the DATEX II model. Particularly, that cities use different versions of the DATEX II model in their other work, and that the DATEX II structure is not backwards compatible. There were also challenges related to importing data. Some Member States already have their UVAR data in a structured format, however there is no possibility to import this to the UVAR Box Tool without restructuring the data before importing it. There is an option for the import of semi-structured data, however the data needs to be converted to fit the import option. Another challenge experienced was that existing information on UVARs is sometimes incomplete, making it difficult to digitise in the tool. Similarly, there are sometimes inconsistencies in how UVARs are implemented from official regulations to practice. As a result, some implemented traffic signs do not fully reflect official regulations and are thus ordered without sufficient legal basis. Lastly, it was identified that new or unusual UVAR types are not always compatible with the templates in the tool. Therefore, a "Template 0" would be needed in the tool to allow adding exotic or hybrid cases of UVARs to the tool without creating a new profile. During the UVAR Box project, the tool was updated on a regular basis and improvements were made in response to technical issues in the tool. To ensure sustainable scaling of the tool in the future, the tool should be further maintained and developed. Suggestions on further development of the tool are outlined in chapter 5.2.

3.3 Scenarios for sustainable processing and publication of UVARs

The UVAR Box Tool is a tool for digitising harmonised UVAR DATEX II data. Figure 1 presents the UVAR data value chain model, which was described in detail in D2.4. The value chain illustrates that UVAR data provision is a process which includes multiple steps and involved actors, which aims to have a positive impact on road users through providing accurate and up-to-date UVAR information. The UVAR Box Tool focuses on facilitating the transition between the first step in the value chain "UVAR data collection & production" and the second step "UVAR data publication", through enabling UVAR data conversion to DATEX II.

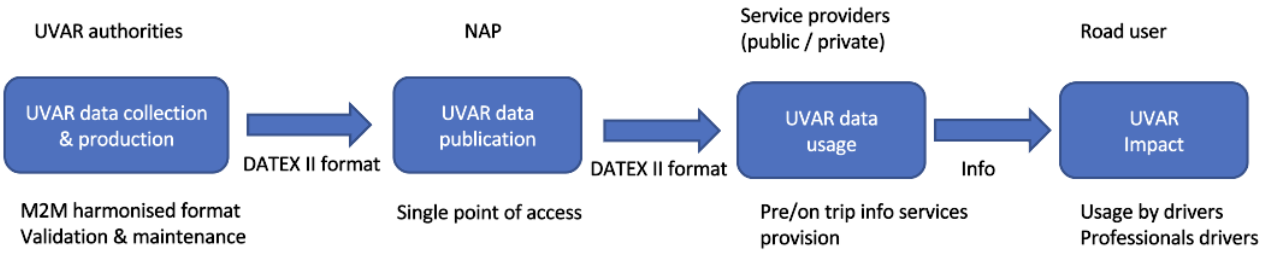

Figure 1: UVAR data value chain model (source D2.4).

Different options for future use of the tool, processing and publication of UVARs have be taken into consideration to define and prepare European and Member State strategies. This section includes outcomes from the WP4/WP5 workshop, incorporates outcomes of D2.4, D3.1 and further sources.

3.3.1 Options on the availability of the UVAR Box Tool

Currently, the UVAR Box Tool, which was developed by PRISMA solutions, is available as a web application (available via http://uvarbox.armis.pt:2403/uvar/), hosted on an online server by the UVAR Box project coordinator, ARMIS. Regarding the future of the tool, after the UVAR Box Project has ended, there are multiple options for how the tool could be made available.

Different possible options for future implementation of the UVAR Box Tool were introduced in D2.4 as deployment scenarios. This report further builds on this, assessing the potential deployment scenarios based on input gathered in the stakeholder workshop organised as part of work package 4 in cooperation with work package 5. A part of the workshop focused on participants reflections on the different deployment scenarios. The following sections will briefly explain the deployment scenarios, after which the content will focus on the reflections on the scenarios. These assessments have further been taken into consideration in defining European and Member States for sustainable digital UVAR provision.

Description of deployment scenarios

One option (scenario a) is making the tool available on local premises. Figure 2 visualises this option and presents the information flows. In this scenario, the tool is hosted locally within the IT environment of the local or regional authority, and users access it directly on their workstation. The data in the tool is stored locally in the IT environment of the authority, in the storage location of choice of the authority. The data can be exported in the DATEX II standard to be shared with the NAP of the respective Member State. Therefore, it could be customised and further developed locally. It could be used together with other systems in the IT environment of the authority, such as existing used Geographic Information System (GIS) tools.

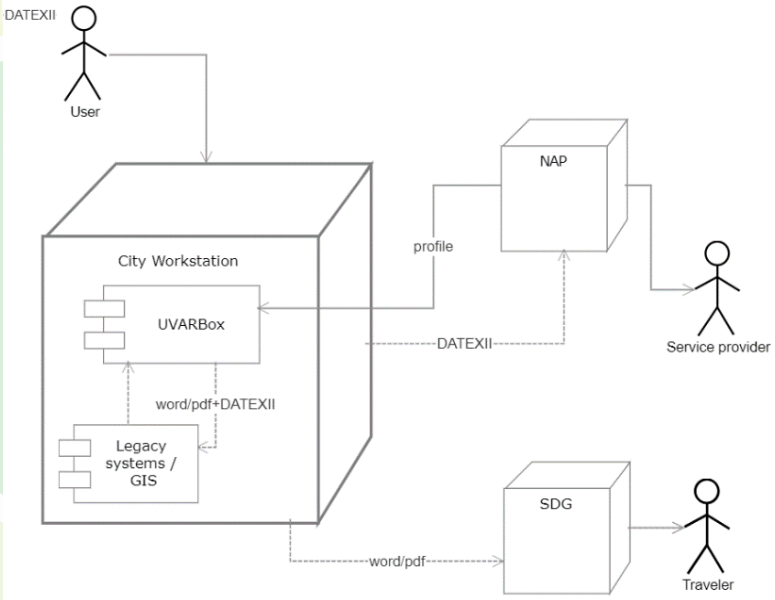

Figure 2: The UVAR Box Tool is available locally on the premises (scenario a) (source: D2.4).

The second option (scenario b) is hosting the tool as a web application on a secure online server, similarly to how the tool is accessible currently. Figure 3 visualises this option. In this scenario, rather than the user accessing the tool directly through their workstation, the user accesses it through a web browser. This web application would not be hosted by the local authority, but rather by an organisation on a national level, such as the NAP or the ministry in charge for implementing the ITS-Directive, or on a European level, for example the European Commission or a nominated organisation by the Commission. Alternatively, it could be hosted through initiatives, such as NAPCORE, or through a follow-up initiative of the UVAR Box project. As in scenario a, the data could be exported in DATEX II to be shared with the NAP of the respective Member State.

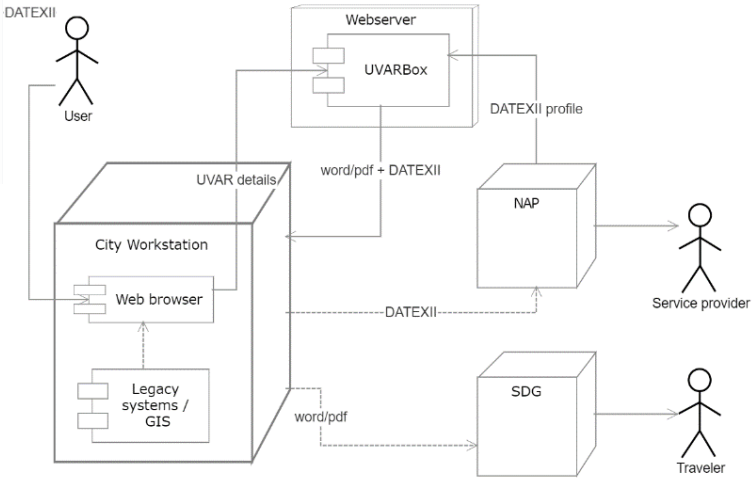

Figure 3: The UVAR Box Tool is hosted in a secure online server (scenario b) (source: D2.4).

In addition to these two scenarios, there are further options. One option is offering both a tool which can be hosted locally, as well as a web-based tool. In other words, both scenario a and scenario b would be realised. Another option is integrating the UVAR Box Tool into existing applications as an Iframe application through an Application Programming Interface (API). An additional option is not using the developed UVAR Box Tool itself, but using the UVAR DATEX II model developed in the UVAR Box project to process and publish UVAR data. With this option, the developed UVAR DATEX II model is integrated into a third-party web application or existing tool. This approach requires prerequisites, such as buy-in from the third-party tool, established IT infrastructure and processes of collecting and publishing UVAR data.

The following sections present reflections on these potential future deployment scenarios of making the UVAR Box Tool available, with regard to organisational and technical aspects of hosting the tool and data, and processes on provision of UVAR data. Contributions from participants from the stakeholder workshop on sustainability aspects have been incorporated into the content.

Reflections on deployment scenarios

Table 1 summarizes the main advantages, disadvantages, opportunities and challenges identified in regard to the described deployment scenarios. The reflections are discussed in detail in sections following the table.

Table 1: Summary of reflections on future scenarios of making the UVAR Box Tool available

Aspect	Scenario a: The UVAR Box Tool is available locally on the premises	Scenario b: The UVAR Box Tool is hosted in a secure online server	Making both scenario a and b available.
Advantages	• Allows high customisation to fit local context and needs • Data owner has full control of the data, storing it and using it	• Less resources needed by local authorities for managing tool	• Allows local authorities to pick tool type which best suits them
Disadvantages	• High level of skills and amount of resources needed by local authorities for managing tool	• Less opportunities for customisation to local context	• May require more effort in maintenance
Opportunities	• Local authorities with resources to customise tool may benefit from integrating it to their process of digitising and managing UVARs • Integrating to other locally used softwares	• Likely requires less resources overall, as maintenance centralised • If feasible, could foster easy data sharing between entities	• Offers opportunities of scenarios a and b

Challenges	• Outputted DATEX II files not unified • Legal challenges implementing tool into local authorities IT infrastructure • Without adding function of publishing UVARs, it does not promote aligning UVAR digitisation across Member State, or make data available for 3rd parties	• Potential issues in tool affect many users • Local authorities may not want to store data on external cloud server • Questions of data ownership and use; defining data access and use restrictions.	• Challenges of scenarios a and b

Reflections on scenario a: making the tool available on local premises

Scenario a poses numerous technical and organisational requirements on local authorities. As in this scenario the tool is hosted locally, it puts responsibility on the local authorities for managing the tool. While this allows adapting the tool to fit the specific needs of the local authority and may enable carrying out more regular and accurate updates, it also requires skills and resources from local authorities for IT, deploying and maintaining the tool, which especially smaller local authorities may not have. Potential issues with the tool need to be addressed locally, which may be more difficult, compared to solving issues centrally, as with a web-based application. In addition to managing the tool itself, in scenario a, local authorities are required to manage the DATEX II data model and profiles locally, requiring expert knowledge in the DATEX II model, which especially smaller local authorities may not have. Regarding the legal aspect, local authorities would likely need to address legal questions related to local legislations, integrating the tool into the local IT infrastructure, permissions for installing it on the computers of authorities, and managing data in relation to the tool. In addition, they may need protocols for regulating access to the tool.

As stated, scenario a would allow to adapt the tool locally to fit the workflows of local authorities. A local authority could customise the tool to fit their specific needs and the types of UVARs in place, which could make producing UVAR data in the tool more efficient. Customisation on a local level may, as well, make it easier to integrate the tool into existing, locally specific, processes of collecting and publishing UVAR data. With the tool being hosted locally, it may be also easier to use it with other locally used software, or to incorporate it into them. This possibility to customise the tool may be beneficial especially for bigger local authorities with more capabilities and resources to utilise the possibilities of customisation.

In scenario a, the data of the tool is also hosted locally in the IT environment of the authority, in the storage location of their choice. This allows authorities, which are the owners of the data, to store the data on their own servers, and therefore fully control the data and its use. This may be an important factor for authorities. However, as the DATEX II data model and profiles would be managed locally, the

outputted DATEX II files would likely not be unified across Member States, or potentially even within Member States. A further option to respond to this, is that the NAP or a European organisation is mandated to take care of disseminating updates and developing the DATEX II data model, and cooperates with local authorities in this regard.

With regard to the aspect of publishing the data from the tool to the NAP, the question of the role of the tool is central; whether it is a tool only for data conversion, or additionally a tool for data publishing. If it is merely for data conversion, as in the current UVAR Box Tool, and publishing data is done separately, local authorities can export their data in DATEX II from the tool, and publish the data through the NAP in a separate process with separate tools. This has the benefit of giving the data owner, the local authority, full control of the data and its use. It also allows for publishing data in an individual process, which is a benefit given the different processes in different Member States for publishing UVAR data largely vary, as explained in detail in D2.1.

If the UVAR Box Tool is also to be used as a tool for publishing UVAR data, in addition to converting UVAR data, there are additional considerations. As the tool is hosted locally in scenario a, to enable third parties to access and retrieve the data, an additional, separate functionality and storage of data in a central location would be required. This could be a web version, to which the data is automatically exported from the locally stored tool. However, it is likely that in scenario a, it would be more challenging to offer such a functionality, than in scenario b, where the tool is hosted on an online server. Nevertheless, such data publishing and viewing functionalities raise questions of data ownership. It remains unclear, whether it is appropriate that third parties could directly access data owned by local authorities. Further, as NAPs in different Member States have different processes for publishing data, it is questionable whether a central data publishing functionality is needed within the tool, or if this should rather be a separate process with separate tools, managed individually in Member States.

Reflections on scenario b: hosting the tool as a web application on a secure online server

Scenario b, where the tool is hosted centrally on a secure online server, offers additional technical possibilities, as well as requirements. Hosting the tool on a web server would require less resources from local authorities in regard to managing the tool, than with a locally hosted tool, as maintenance and updates would be done centrally by the host, rather than the local authorities. This could benefit especially smaller local authorities with less available resources. Nevertheless, a web-based tool may also introduce issues, such as the tool slowing down or crashing at times of high traffic, which would potentially affect many users. To address such issues, sufficient resources would be needed for further development of the technical functionalities and for maintenance. Overall, however, the effort and costs of developing and maintenance of the tool would likely be less with a centralised web-based tool than with local tools implemented by all local authorities, as there would only be the need to maintain one interface.

Having one tool hosted on a web server and used by all Member States would guarantee UVAR data unification, which would be beneficial for enabling EU-wide UVAR exchange. It would, however, decrease the possibilities to customise the tool to fit local contexts. It is unlikely that one tool will fulfil the needs

of all Member States without customisations. In response, an alternative could be having a web server for each Member State. However, this may introduce additional maintenance requirements and coordination to ensure harmonisations across the EU.

Hosting the tool as a web-based application, where data is shared on a secure online server, poses questions about data ownership, storage and sharing. Clear and transparent rules for ownership and usage of the data are necessary and must be ensured. It is up to each Member State or data owner to define these in accordance with the European recommendations. A feasible approach would be to use Creative Commons licences, as used for many data sets provided by the national Open Data Platforms. If the data is owned by local authorities, it is questionable whether local authorities are willing to store the data on an external cloud server, as they may be concerned of potential security risks – however these should be minimised or eliminated by the host. Furthermore, data access restrictions would need to be defined, including questions on who may view the data on the tool, manage it, and export it. This also relates to the question of the role of the tool; whether it is merely an UVAR data conversion tool, or a tool for both UVAR data conversion and publishing. With the latter, the potential envisioned use case is that service providers could directly retrieve UVAR data from multiple Member States from the tool. This type of functionality would likely be easier to implement with a web based tool than with a locally hosted tool. However, this is only feasible if the UVAR data sets across Member States are labelled with transparent and comprehensible licence agreements.

In the workshop, the majority of the participants favoured scenario b over scenario. While this result is not representative, the qualitative reasonings behind the preferences offer valuable perspectives. Explanations for the preference included lower maintenance required for one interface, better cost efficiency, security and improved access to data.

Reflections on other potential scenarios

In addition to scenario a and b, another way of making the tool available in the future could be offering both a tool which can be hosted locally, as well as a web-based tool. As different local authorities have different needs, offering both options would allow authorities decide on the option which best suits them. It may be, for example, that smaller local authorities with less resources, would opt for the web-based tool, while larger local authorities with more resources and need for customization, would opt for the locally hosted tool. While making both options available may result in more effort in maintenance, modern tools, such as Container as a Service (CaaS), could support managing both types of applications together. This additional option would make it possible to offer both types of the tool and their benefits, nevertheless, the challenges of scenarios a and b would remain relevant.

The scenarios of implementing the tool or only the DATEX II model into existing tools used by authorities were not reflected on in the workshop. However, the strategies for UVAR data collection and digitisation which country coaches developed, suggest that these options are also of interest.

Estimating costs of deployment scenarios

It is expected that there are different costs associated with the presented deployment scenarios. The estimation of costs was not the main focus of the study. Nevertheless, the topic of cost estimation was considered, and it was concluded that it is not possible to estimate the costs of the alternative scenarios or how the costs compare to each other. There are two main reasons for this. Firstly, it would be necessary to outline conditions and constraints for each of the scenarios in detail. Secondly, even if these conditions were defined, it would not be possible to estimate costs due to the amount of variables and the wide array of different possible approaches which organisations could take. Due to this, it is not possible to make any accurate or reliable estimates for the costs. For an estimation of the costs, a separate activity focused on a detailed cost estimation would be required.

4 Organisational and legal frameworks and sustainability strategies on Member State level

This chapter focuses on the Member State level. It analyses the existing organisational conditions and frameworks, and challenges, as well as obstacles that the involved stakeholders and organisations currently face. To ensure future sustainability of data collection and accessibility, the existing governance regimes must be taken into account, in particular, the availability of E-governmental processes, existing digital platforms and supportive digital environment in the context of digital UVAR data provision and collection. This analysis is based on the data collected within tasks 1.1, task 1.5 and 2.1 and WP3 by the questionnaire, the data collection within the project under WP2, interviews with national UVAR implementing authorities, as well as complementary information collected through a desk research and consortium members expertise.

Drawing from this analysis, this section presents strategies on a Member State level concerning the different aspects of digital data provision, collection and accessibility of UVAR data. A key part of the sustainability strategy at a Member State level is how to achieve progress in regard to digitising, converting and publishing the national UVARs, as well as the further steps concerning the collection and provision on UVAR data according to the scenarios or plans chosen by the Member State and the existing structures and frameworks in each Member State. Furthermore, strategies on validating and maintaining data, as well as next steps on the national digitisation strategies concerning UVARs, and in general, are addressed.

4.1 Austria

4.1.1 Organisational and legal frameworks in place for publishing UVARs

In Austria, the ministry in charge for implementing the ITS Directive and the related Delegated Regulation is the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation, and Technology

(Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie (BMK)[22]), which is also responsible for nominating the competent authority in regard to the NAP in place. AustriaTech is nominated to be the competent authority/national body, and hosts the Austrian NAP (www.mobilitydata.gv.at), and is also responsible for developing the national NAP approach in alignment with the responsible ministry. The national coordination in regard to the SDG implementation in Austria lies within the responsibility of the Federal Ministry of Finance (Bundesministerium für Finanzen (BMF)[23]). This ministry is also in charge of implementing the open data platforms according to the PSI directive. The national legal framework for UVAR data is defined by the Road Traffic Act (StVO)[24] and the General Administrative Procedure Act (AVG)[25]. On the regional and city level, ordinances and traffic regulations related to UVARs are issued by district authorities of the regions (provinces) and municipal departments. On a city level, they are issued by the responsible mobility department.

Tools and processes are in place for digitising traffic regulations and related UVAR data, but they are currently not capable of providing UVAR data in DATEX II according to the model, but instead in formats such as JSON. Information on regulations from the local and regional authorities is available in various formats (unstructured, semi-structured format) and is partly recorded in the regional Geographic Information Systems (GIS) and incorporated in the national coordinated Graph Integration Platform (GIP)[26].

The digital provision of data is processed on different levels. The established RIS[27] (Legal Information System of the Republic of Austria) is a platform and database which provides information on Austrian law. Its main contents are legislation in its current version (federal and state), law gazettes (federal and state) and case law. The RIS also serves as the framework for the authentic and legally valid electronic publication of the Federal Law Gazette and of the State Law Gazettes. Existing UVAR data is partly available on the open government platform Austria[28] and provided in different machine-readable formats except DATEX II. The Austrian road operator ASFINAG uses and provides data in DATEX II. On a regional and city level, the responsible authorities/data holders provide UVAR related data and combined services mainly via city websites.

4.1.2 Identified organisational and administrational challenges

In Austria, the processes, tools and platforms for digitising and publishing UVAR data on a federal level are in place and will be utilised for publishing the generated UVAR data. It is a challenge for cities with existing processes and tools to adapt their processes. Nevertheless, there is interest from cities to digitise data and use the DATEX II tool. Despite the available and established tools and E-governmental

22 https://www.bmk.gv.at/
23 https://www.bmf.gv.at/
24 Austrian Road Traffic Act, https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10011336
25 Austrian General Administrative Procedure Act.
https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10005768
26 https://www.gip.gv.at/
27 https://www.ris.bka.gv.at/
28 https://www.data.gv.at/

processes to digitise traffic regulations in place, the status on digitising regulations varies on regional and city level. For example, in province Carinthia (Bundesland Kärnten) according to an amendment to the Carinthian General Municipal Code (K-AGO)[29] all regional regulations need to be processed digitally and tools therefore are in place. Other provinces do not have that centralised approach and the status of digitisation and established processes are inhomogeneous.

Consequently, cities may face individual challenges in further developing processes of digitising UVAR data. For example, the City of Vienna has a high interest in integrating the DATEX II model into the own converting software/technical environment, whereas smaller cities rely on support of the UVAR Box Tool to digitise and generate UVAR data. Another identified challenge is the low level of awareness among regional and local authorities regarding the upcoming obligations defined in the delegated regulation to provide UVAR related data in the required DATEX II format. This indicates a challenge in motivating authorities to further develop processes of UVAR digitisation. There are also challenges related to the existing UVAR data. Existing UVAR data is provided on different platforms, data is not harmonised, structured nor easy to find, as harmonised designations and descriptions are missing.

Besides the actual available and collected information on LEZ and parking zones, further information is available which could add value for the end user. For example, in some Austrian cities, like Knittelfeld, electric vehicles (those which are exclusively powered by electricity) are exempt from the parking fee. Upon request, the Citizens Advice Bureau will issue a corresponding exemption certificate. Electric vehicles that already have a green license plate do not need this exemption certificate, since they are clearly electric vehicles. In the short-term parking zone (restricted parking zone), the maximum parking time must be observed, despite the exemption from the parking fee (a parking disc must also be displayed).[30] It has to be further discussed how related information of added value based on city regulations should be taken into consideration, and if they could be covered by the UVAR DATEX II model.

4.1.3 Proposed strategy Austria

In Austria, the plan is to provide the UVAR Box Tool via the Austrian NAP, through integrating the tool into the NAP. The tool will therefore be hosted at a national level, ensuring support to be given to cities and other relevant authorities using the tool. Access to the Austrian city and region level UVAR data created within the UVAR Box project (PARK, LEZ, EMERG, PED) has also been provided via the Austrian NAP. Nevertheless, harmonised EU-wide metadata descriptions, which NAPCORE is working on, are needed to make data well accessible and will be used once they are available. In addition, UVAR data may also be made available by data owners on the Austrian open data platform (www.data.gv.at).

The Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation, and Technology, which in charge for implementing the ITS Directive, is currently working on a comprehensive participation process with approximately 130 participants and an action plan with the focus on driving the digital

29 Carinthian General Municipal Code, https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=LrK&Gesetzesnummer=10000276
30 https://knittelfeld.gv.at/leben-in-knittelfeld/lebensbereiche/verkehr-und-parken/

transformation of the Austrian mobility system. The action plan defines measures on various focal points in the context of digitisation in mobility, including setting up a national mobility data space, and making mobility relevant data available. The Austrian ministry also has the aim for digital UVAR data to be a digital mirror, and a legally valid format of the data. There are many tasks required to achieve this, and the estimated. This process will also help increase digitisation of UVARs in Austria. Encouraging cities in Austria to digitise UVAR data means the Member State has to provide the money for digitisation. Austrian cities are very clear on that: you want that data, you have to pay for creating this data.

4.2 Belgium

4.2.1 Organisational and legal frameworks in place for publishing UVARs

In Belgium the creation of UVARs is regulated and established through the 3 government levels. There is a national legal framework in place at federal level covering several aspects of UVARs. This national framework is complemented with regional regulations for each of the 3 regions, Flanders, Wallonia, and Brussels, led by own policies, and cities can complement this with own regulations based on local policies issued by their mobility and environment departments.

The Belgian federal government and regional bodies in Brussels, Flanders and Wallonia involved in the implementation of intelligent transport systems in Belgium, compose the Belgium ITS Steering Committee and entrusted the development and management of the Belgian NAP (www.Transportdata.be) is set up through collaboration of the Federal government and the Brussels, Flemish and Wallonia. The NAP is managed by the National Geographic Institute (NGI)[31], which is supervised by the Minister of Defence. In Belgium the NAP procedure requires cities, or someone mandated by them, to register and provide a link to the data.

The digitisation of UVAR information in Belgium is mainly driven through the initiatives of the cities, where the larger ones have their own individual digitisation services or tools. Nevertheless, there is no standardised process or machine-to-machine data format in place for digitisation of UVARs, and the level of UVAR digitisation differs widely between cities. DATEX II is known and used for some road traffic data types, but digital UVAR publications mainly use (geo)JSON.

The larger cities that digitally publish UVAR data use the cities' open data portals as publication channels. There is, however, no harmonised manner between cities in regard to how data is published on these open data portals. UVARs that apply to the higher-level road network in the Flemish region are published by the Flemish government through the regional formal regulatory mechanism. UVARs are currently not published at the NAP in the DATEX II format.

Flanders is currently implementing the "MobiliData program"[32] including innovative technology solutions for provision of traffic regulation via digital services and services providers. Mobility policy plans of

31 https://www.ngi.be/website/
32 https://mobilidata.be/en/about-mobilidata

Antwerp and Brussels already include the adoption of new technologies (digitisation) and market trends (service providers) for provision and monitoring of UVAR regulation and information provision.

4.2.2 Identified organisational and administrational challenges

UVAR digitisation is not harmonised in Belgium. In larger cities, the level of digitisation of UVARs is higher, while in other smaller cities it is still in its initial stages. A major challenge is the fact that at all governance levels, there are separate thematic departments involved in the development, implementation and digitization of UVAR policies and regulations. In particular, LEZs commonly require cooperation between the Environmental, Mobility, IT infrastructure, and Fiscal departments. The required knowledge, tools, infrastructure and time capacity for implementing processes for publishing UVARs digitally are available in larger cities. The smaller municipalities suffer from a lack of technical resources and personnel with necessary DATEX II knowledge, which poses challenges for implementing processes for UVAR digitisation. In cities where UVAR digitisation is already a practice, the central challenge is implementing the DATEX II model into existing tools and processes.

4.2.3 Proposed strategy Belgium

Currently, UVAR digitisation activities are mainly driven by individual initiatives of larger Belgian cities, which are the cities that operate LEZs and LTZs. The UVAR Box Tool can be of great help for cities in order to further digitise the UVARs in a harmonised machine-to-machine data format. This could mean that these front runner cities will need either to deploy and maintain the tool with own resources, or be supported by a third party. The experience of the larger cities with using the UVAR Box Tool should provide a leading example for further use in other cities and regions. According to the current practices in Belgium, UVAR digitisation could be organised either through national or regional programs. These should include both the delivery of tools, as well as the necessary technical and digital infrastructure support. This is especially the case for the smaller cities which will otherwise not have the resources, knowledge and infrastructure to do it for themselves, where support is needed. Hosting of the UVAR Box Tool could be done at a regional level in Belgium. For Brussels, the CIRB[33] is in charge of the digital infrastructure, and would therefore be a good candidate. In Flanders, Digitaal Vlaanderen[34] is a governmental agency which provides products and platforms, and therefore could be a good candidate for hosting the UVAR Box Tool. For the region of Wallonia, the organisation best fit to host the tool is yet to be identified. The Belgian NAP is prepared to support the searchability and access to the UVAR data providing a process for cities register their UVAR data using the existing registration process.

4.3 Germany

4.3.1 Organisational and legal frameworks in place for publishing UVARs

33 https://cirb.brussels/
34 https://www.vlaanderen.be/digitaal-vlaanderen

Overall, there is currently no legal framework for the digitisation of UVAR data in Germany. UVAR creation is mostly done by municipalities, with authorities from national, state level and environmental protection authorities involved to differing extents. The Federal Environmental Agency (Umweltbundesamt (UBA)[35]) has been tasked with the job of collating the digital data of the LEZs, which they collect from the regions (Länder), which in turn collect them from their cities, but not currently in DATEX II. The process is largely a manual one with the UBA mostly getting plans and then digitising the data in their own GIS system.

The German NAP, Mobilitäts Daten Markplatz[36], is run by the German Federal Highway Research Institute (Bundesanstalt für Straßenwesen (BASt)[37]), which is under the supervision of the Ministry for Digital and Transport (Bundesministerium für Digitales und Verkehr (BMDV)[38]). Currently, a change is ongoing in regard to the NAP platform. The current NAP platform is about to be replaced with a new platform "Mobilithek[39]".

A nationwide GIS tool from UBA, on which environmental zones are published, is available under https://gis.uba.de/website/umweltzonen/. In agreement with the BASt as the provider of the German NAP, all LEZ data collected within UVAR Box Project were published on the German NAP "Mobilithek" by PRISMA solutions as the German Country Coach.

In Germany, the level of digitisation of UVARs is relatively low; however, it is increasing. Currently, most UVARs are not published in a machine-readable format, although some cities do use machine-readable formats for publishing UVARs, generally in XML or SHP format. The use of the DATEX II standard is minimal. Nevertheless, it is used, for example, in the City of Kassel for parking data.

4.3.2 Identified organisational and administrational challenges

A major challenge in Germany is the lack of a clear legal framework for digitisation of UVARs. There is a partial framework through the UBA for low emission zones. There is also a lack of required policy maker involvement for establishing such a legal framework.

In respect of data collection, it is a challenge to gather data across multiple different districts, because small districts and municipalities do not have the resources to edit and publish the data and often a regional data coordinator is missing. Nevertheless, there are a few positive examples of regional data coordinators, such as the ivm (Integriertes Verkehrs- und Mobilitätsmanagement[40]) in the greater region of Frankfurt am Main or the VRS (Verband Region Stuttgart[41]) in the Region of Stuttgart.

Organisational challenges include the fact that several stakeholders are involved in established UVARs and the responsibilities are therefore distributed. An additional challenge is that the people who are responsible for UVARs are not involved in EU projects, therefore there is gap in knowledge sharing and

35 https://www.umweltbundesamt.de/
36 https://www.mdm-portal.de
37 https://www.bast.de
38 https://www.bmvi.de https://www.bmvi.de
39 https://mobilithek.info/
40 https://www.ivm-rheinmain.de/ https://www.ivm-rheinmain.de/
41 https://www.region-stuttgart.org/

exchange. As with other Member States, cities and municipalities struggle with a lack of resources, which limits their capabilities in implementing processes for UVAR digitisation.

For those cities with established UVAR digitisation processes and tools, implementing the DATEX II standard is likely to be a challenge because of lack of resources and knowledge required for implementation. The results of the questionnaire conducted as part of the UVAR Box project suggest that awareness of the of DATEX II standard is low, although it has improved during the UVAR Box project.

An additional organisational challenge is that the German NAP is currently in a process of new development. The current platform "Mobilitäts Daten Marktplatz (MDM)" is about to be replaced with the new platform "Mobilithek". While the MDM will be in use until the end of 2023, the Mobilithek is already operating and will be the single platform form January 1st 2024. A major challenge will be the data migration from the MDM to the Mobilithek. In order to avoid data migration, the LEZ data collected in the project is already published in the Mobilithek.

4.3.3 Proposed strategy Germany

In Germany, the plan is for cities to further use the UVAR Box Tool to digitise UVAR data, however it is seen as a requirement by the Country Coaches that cities should be further supported in this work. All cities with LEZs have received access to the UVAR Box Tool. Talks are planned between the Federal Environment Agency, UBA, and the Federal Highway Research Institute, BASt, to discuss the possibility of UBA hosting the UVAR Box Tool for Germany for the cities. The advantage for UBA is that this would enable easier collection of UVAR data directly from the cities.

Many cities use third party digitisation tools, integrating the DATEX II model or UVAR Box tool in their tools would be a significant step towards achieving greater and easier digitisation by cities.

The German NAP was launched more than ten years ago as the Mobility Data Marketplace (MDM). For the German NAP, the time has come for a fundamental renewal of the technological basis of the platform. Thus, the MDM will stop operations in 2024 at the latest. In spring of 2022, the new mobility data platform, the Mobilithek, went online. The Mobilithek is the new platform created by the Federal Ministry of Transport and Digital Infrastructure (BMVI) for the exchange of digital information from mobility providers, infrastructure operators and transport authorities as well as information providers. It merges the functions of the National Access Point for mobility data with those of the open data portal mCLOUD[42] in order to offer users the best possible service. Compared to the MDM, it will offer enhanced functions and an improved user experience.

The LEZ data created within UVAR Box was published as temporary data on the Mobilithek for registered users. It is the first dataset in the format DATEX II, Version 3, and the first dataset in the category "Static traffic signs and regulations" published on the new German NAP.

[42] https://www.mcloud.de/

In Germany, the cities which collaborated with the UVAR Box project demonstrated willingness to digitise UVAR data. However, they face challenges due to the availability of the resources required. Within the UVAR Box project, all German LEZ data where digitised, often by the German country coach as opposed to the city itself. For the rest of UVAR data, the level of UVAR digitisation is currently relatively low. Nevertheless, the extent of digitisation of the processes of digital UVAR data provision is constantly increasing. It can be concluded, that there is a strong willingness in Germany to digitise LEZs.

4.4 Italy

4.4.1 Organisational and legal frameworks in place for publishing UVARs

In Italy, the Ministry of Infrastructures and Sustainable Mobility (Ministero delle infrastrutture e della mobilità sostenibili (MIMS))[43] is in charge of implementing the ITS Directive and the related Delegated Regulation. MIMS is also responsible for nominating the competent authority in regard to the NAP. In Italy, MIMS appointed the Road Safety Information Coordination Centre (Centro di Coordinamento per le Informazioni sulla Sicurezza Stradale (CCISS)[44]) to be the competent authority/national body to host the Italian NAP. To implement the NAP and the Single Digital Gateway - "SDG", Agid ("Agenzia per l'Italia Digitale") was appointed. Agid is the national implementing entity coordinated by the Department for European Policies in cooperation with the European Commission and national stakeholders.

Currently, there is no national legal framework regulating the UVAR implementation. The only relevant Italian regulation is Directive D.P.R. n° 250 / 1999[45] which authorises Access Control Systems (cameras) for implementing LTZs - which has required cities to gain permission from the ministry before implementing camera enforcement of LTZs. Furthermore, national guidelines have been released in 2019 in order to provide information related to standard indications to local authorities for implementing the Access Control System. The directive 250 / 1999 is going to be repealed in the near future by a new regulation which will be used to implement the amendments to Article 201 of the "Highway Code".

Furthermore, there is no nationwide GIS tool in place in Italy for defining and digitising UVARs. Only the largest cities, such as Rome, Turin and Milan, have independently digitised UVARs according to the (non-DATEX II) available standards. This was possible as these municipalities have adequate technical departments with high technical-administrative skills. The case of smaller municipalities is different: they do not have highly specialised staff and do not have the resources to engage in these activities. As a result, UVAR data is not digitally encoded and they are only present in traditional paper maps and documents.

There is much variety between cities and municipalities in Italy regarding digitisation of UVARs. In some cities UVARs are digitised and published in machine-readable formats – usually just the geographical boundaries available on the city's own open data portals, and not using DATEX II -, while in many cities,

43 https://www.mit.gov.it/en
44 https://www.cciss.it/web/cciss/homepage
45 http://www.edizionieuropee.it/law/html/51/zn93_02_028.html

UVARs are not digitised at all. The questionnaire ran as part of the UVAR Box project suggests that use of the DATEX II standard for traffic report elaboration is minimal, and awareness of the data model is relatively low. UVARs are currently not published via the NAP, but some cities are digitising the UVAR data in order to be able to publish it via the NAP and SDG in the future.

Agid is also the implementing entity and technical coordinator for implementing the EU regulation 2018/1724 (Single Digital Gateway). The implementation is carried out under the measure 1.3.2[46] included in the PNRR - "Piano Nazionale di Ripresa e Resilienza"[47], that is the dedicated plan/tool for Next Generation EU funding.

At the moment 21 administrative procedures shall be standardised and digitised on the SDG according to the following deadlines:

- 10 procedures (services and information) should be accessible within December 2022. These are the procedures mainly of interest for the Public Administration (National Public Administration, Regions, metropolitan cities, hospitals, Universities and Research Institutes). At the same time the integration test of national components will be carried out.
- 21 procedures (services and information) should be accessible within December 2023 for citizens. These procedures will be implemented on the basis of the "once only" concept in order to make the access to information and services easier for European citizens and enterprises.

4.4.2 Identified organisational and administrational challenges

As stated, the extent of digitising UVARs differs largely between cities and municipalities in Italy. A major challenge is that cities and municipalities have unequal capabilities for digitising data. In particular, small and medium sized cities and municipalities face issues with a lack of expertise and resources for digitising UVARs. Some smaller municipalities do not have the required knowledge or tools available, which are required for digitising UVARs.

The Italian NAP does currently not publish UVAR data. Enabling UVAR publication via the NAP is a challenge, because the NAP is currently not equipped for publishing the data due to technical and organisational limitations, which are planned to be addressed in the near future.

4.4.3 Proposed strategy Italy

During the whole UVAR Box project, the Italian country coaches invested huge efforts to reach out and engage with national, regional and municipal authorities. Subsequently, even if these authorities do not have a specific role in the digitisation of UVARs, they are now aware of the importance of digitisation of the information related to UVARs and they are ready to collaborate in the future, as the UVAR Box Tool is now ready for them to use. The relationship established between the UVAR Box country coaches and the different stakeholders, in particular the Italian Ministry of Infrastructure and Sustainable Mobility, as

46 https://padigitale2026.gov.it/misure/
47 https://www.governo.it/it/approfondimento/pnrr-gli-obiettivi-e-la-struttura/16702

well as responsible Municipalities, is a fundamental starting point to continue work after the UVAR Box project ends. The UVAR data already digitised by the Italian country coaches, mostly LEZs, need to be validated by cities; UVARs that are not yet digitised need to be digitised with the support of the appropriate templates and/or the UVAR Box Tool, and the UVAR data already digitised needs to be standardised following the DATEX II protocol. The latter activity requires a strong involvement of municipalities' IT departments, which was not possible during the project. Therefore, after the project ends, in order to continue the work already done, a significant UVAR data validation campaign is needed for the data already digitised, and work to integrate the UVAR data which is not yet digitised. In summary, the plan is for cities to use the UVAR Box Tool (to be provided as a Software as a Service (SaaS) at the national level or on the cities premises) to digitise UVAR data, however it is seen as a requirement that cities are given significant support in this work. Few Italian cities use third party digitisation tools, integrating the DATEX II model or UVAR Box Tool in their tools would be a significant step towards simplifying digitisation by cities. Future work should take the dialogue forward with these companies.

In Italy, the public authorities which were contacted during the project, demonstrated willingness to digitise UVAR data. However, they face challenges due to the required competences and resources. Overall, the level of UVAR digitisation in Italy is currently extremely low, also because of the very high number of UVARs already implemented by a wide range of authorities, including fairly small towns. It can be concluded, that there is a strong willingness in Italy to digitise UVARs, however, with the current plans, it will likely take a long time for Italy considering the high number of existing UVARs not yet digitised.

There has been a requirement for cities to gain permission from the ministry to use camera enforcement. The Directive "250/1999" is planned to be repealed in the near future and the new regulation could be the opportunity to suggest the mandatory use of the digitized UVAR data. This would give an extremely good way to ensure digitisation of at least the new camera enforced UVARs, namely many Italian LTZs. Requiring cities to reapply could extend this process to existing LTZs.

Most of the Italian LEZs are implemented due to the Po Valley accord, which sets out where and what LEZs are implemented in the northern Italian regions. There is therefore a significant involvement of the regions in LEZ implementation, and coordination of the cities implementing LEZs within many of the regions. The Italian country coaches made extensive attempts to involve the regions with the digitisation process, but without significant success. The regions would however, be in the perfect position to facilitate or undertake the digitisation process – given the fact that many of the LEZs are in relatively small towns with few resources. It may be that the Italian Ministry of Infrastructure and Sustainable Mobility is able to be more successful in persuading the Italian regions to undertake the digitisation work. It may be that the regional environment agencies could also have a role in digitisation.

The MIMS ("Italian Ministry of Infrastructure and Sustainable Mobility") is working to define a national legal framework in order to standardise the regulation for implementing UVARs. In this context a cooperation with Italian country coaches should be continued for providing support and indications. In fact, the Directive "250/1999" could be the right tool for requiring and encouraging the Italian cities to

digitise UVAR data. Currently, local authorities do not appreciate the importance of data digitisation and the results that can be achieved through data creation, sharing and the related integration in NAP and SDG.

The Italian NAP is currently not in a position to host the digitised UVARs, and this needs to be addressed as soon as possible at National Ministry level.

4.5 Netherlands

4.5.1 Organisational and legal frameworks in place for publishing UVARs

In the Netherlands, the Ministry of Infrastructure and Water Management[48] is in charge of implementing the ITS Directive and the related Delegated Regulations, and as such also responsible for nominating the competent authority in regard to the NAP. The National Road Traffic Data Portal (NDW), is nominated to be the competent authority/national body, and hosts the Dutch NAP (https://ntm.ndw.nu/) and is supervised by the Netherlands Vehicle Authority (RDW)[49]. The legal framework concerning UVARs is also by the Ministry of Infrastructure and Water Management, complemented with local UVAR regulations. Both national and local authorities may define and implement UVARs. On the city level, traffic regulations related to UVARs are mostly issued by the mobility and or environmental departments.

In 2018, the Ministry presented a Smart Mobility policy plan as a start of several supporting programs and initiatives aiming to scale up nationally the digitisation of mobility and also cooperation with private transport and mobility sector[50].

All traffic regulation orders, including UVARs, are published in the Netherlands through a central tool (https://verkeersbesluiten.overheid.nl) in PDF format. Additionally, cities publish them through their own websites and map portals in XML and JSON formats. Besides that, "Digitaliseren overheden" (Digitalization of governmental organizations)[51], a joint initiative of the Ministry of Infrastructure and Water Management with provincial and city governments, aims at digitisation of mobility data services. Regional Data Teams work together on the collection, digitisation, and keeping data in the mobility domain up to date. A Regional Data Team acts on behalf of its "own" authorities and is part of regional partnerships with structural staffing and financing.

In the Netherlands, the level of digitisation of UVARs is very high. However, the processes of digitisation differ between the different UVAR types. Regarding data models, the DATEX II standard is used only in Amsterdam for publishing UVAR data.

UVAR digitisation has been partly outsourced to a private organisation digitising some UVARs. The contractor was in the process of digitising the LEZs during the UVAR Box project, but in a national format, not complying with the UVAR Box DATEX II model. Through discussions with all stakeholders, the ministry

48 https://www.government.nl/ministries/ministry-of-infrastructure-and-water-management
49 https://www.rdw.nl/over-rdw
50 https://www.rijksoverheid.nl/onderwerpen/mobiliteit-nu-en-in-de-toekomst/nederland-als-testland-voor-mobiliteit
51 https://dutchmobilityinnovations.com/organisatie-smart-mobility

program manager, Rijkswaterstaat, NDW and contractor, ensured that the new UVAR DATEX II model was and will be used for the digitisation process both now and in the future.

4.5.2 Identified organisational and administrational challenges

As stated, digitisation of UVAR data is already extensive in the Netherlands and there are processes and tools in place for it. However, the DATEX II standard is only used for the UVAR type LEZ. Taking up use of DATEX II for publication for other types of UVARs poses a challenge, as the tools and UVAR data model need to be implemented into the already established and running processes. NDW, the Ministry and the regional governments with their Regional Data Teams are working on implementing the necessary processes, knowledge and resources to digitise and maintain the quality of UVAR data.

4.5.3 Proposed strategy the Netherlands

The Dutch Ministry of Infrastructure and Water Management, in collaboration with other regional and local governments, have initially contracted out the creation of digital LEZ data, now also in DATEX II format, and this process has successfully digitised several urban mobility and logistic data sets. In discussions with NDW, the NAP service operator of the Netherlands, has indicated that NDW is currently the most suitable candidate organisation in the Netherlands to manage the UVAR DATEX II model, assure its further promotion and implementation into existing processes of UVAR digitisation, as well as expand it to other types of UVARs in the Netherlands. This requires further work on the development of the UVAR DATEX II national templates, based on detailed research on the varying characteristics of the different types of regulations in place. NDW is also the most suitable candidate to operate (host and maintain) the UVAR Box Tool. The UVAR Box Tool can be of great value for cities and service providers supporting this scale-up step.

In the Netherlands, there are several ongoing activities regarding the digitisation of public information, serving future digital mobility and logistics services. This also includes specific initiatives related to the UVARs within the scope of the UVAR Box project. The National Access Point for Mobility Data will provide access to and monitor the quality of all relevant mobility data. The "Digitise logistics" and VM-IVRA initiatives, with which the UVAR Box project collaborated in the Netherlands, already initiated digitisation of LEZ data during the UVAR Box project period. While DATEX II is currently only used for the 15 LEZ UVARs in the Netherlands, there is a dedication to implement the DATEX II model further in regard to "zero emission zones" and LTZ provision in the Netherlands. The recently launched National Access Pont for Mobility Data will be the initiative to coordinate the access and quality of all the mobility data, including UVAR data, produced by the different initiatives.

The SDG implementation in the Netherlands is coordinated by the Association of Netherlands Municipalities (Vereniging van Nederlandse Gemeenten, (VNG)[52]). A solution to support the collection of the required information has been centrally developed and hosted, and is now being delivered to Dutch cities for introduction of the required information. The coordination of the UVAR Box with SDG Dutch

52 https://vng.nl/

activities need to be further explored also taking into consideration the project results on the discussions with SDG Europe provided in D3.1.

4.6 Other Member States

4.6.1 Organisational and legal frameworks in place for publishing UVARs

For other countries, the organisational and legal frameworks for UVAR creation were not closely investigated. Nevertheless, it is apparent that the frameworks vary across Member States. For example, in some countries, including Portugal, Ireland and Latvia, only local authorities are involved in the processes. In other counties, including France, Spain, the Czech Republic, Poland and Sweden, both national and local authorities are involved with low emission zones, whereas cities alone make decisions on limited traffic zones. The use of third-party digitisation tools is also varied, as are the preparations towards meeting the SDG requirements.

4.6.2 Identified organisational and administrational challenges

A challenge present in some other Member States is that no UVARs or only a part of UVARs are published in a machine-readable format. This is a challenge for example in Ireland, Spain and in France. On the contrary, in other Member States, such as Sweden, UVAR publication is highly digitised, and the opportunity there is to have discussions with the organisations to make sure that this digitisation is in DATEX II. The overall challenge is, therefore, that while harmonisation of processes across Member States would be beneficial for data exchange, Member States are currently at very different stages of digitation of UVAR data. Added challenges include organisational barriers to identify contacts responsible for UVARs due to varying institutional frameworks, as well as language barriers for implementing new tools.

4.6.3 Proposed strategy other Member States

The options depend on the situation in the country. Where UVAR publication is already highly digitised, such as Sweden, there is an opportunity to have discussions with the organisations to make sure that this digitisation is in DATEX II.

In Member States where there is no significant digitisation process in place, a process such as the UVAR Box project is likely to be needed, as well as raising awareness of the advantages to the authorities of digitisation of UVARs. NAPCORE would be in a position to work with the NAPs in all Member States to ensure that they are in a position to host the UVAR data, and in many cases also host the tool.

5 Sustainability strategy on the tool in place

During the project, the UVAR Box Tool has been made available as a web application, hosted by ARMIS. After the end of the project, as a short-term solution, the tool will continue to be available on the ARMIS

server. In the medium-term, the tool will be hosted through the SDG. There are currently no defined timescales for this, however the approach is to hand over the tool to the SDG as soon as possible. The approach of how the tool will be made available in the future is a key aspect of the sustainability strategy of the tool. This chapter draws on the elaborated reflections on different deployment scenarios for the tool, as well as the experiences and described proposed strategies of the Member States participating in the UVAR Box project regarding the use of the UVAR Box Tool and the UVAR DATEX II model, to make recommendations on a sustainable future strategy for the UVAR Box Tool in place.

5.1 Recommendation on sustainable strategy on making the tool and DATEX II model available in the future

5.1.1 Making the tool available as an open-source software

The UVAR Box Tool will be made available as an open-source software. Currently, the software code behind the tool is hosted through ARMIS. For the following steps regarding the software code of the tool, three options were explored. The first option was making the software code available without restrictions via an open-source repository, such as "GitHub"[53]. This would allow any party, including NAPs and the European Commission, to host the tool or to integrate it in their existing software. However, several issues were identified with making the software code available without restrictions. After the UVAR Box project ends, there is currently no party overseeing the software code and anyone could further develop it. Without a host or governance activity of the software code in place, control over the software would be lost. Given this, it is questionable whether authorities would trust the software. The second option was making the software code available via GitHub for selected users only. The third option was making it available via the German NAP with restricted access. The advantages of the two latter options is that they allow selected users such as the EC, NAPs or selected digitisation tool providers to integrate and develop the software while those doing so are aware of the remaining ongoing development of the software and make the appropriate accommodations and updates. While it does not allow cities and the wider community to integrate the software, this would be anyway a longer-term action which is better undertaken once the software has reached a stable version. The decision after evaluating the three options was that the software code will be published and made available to everyone as soon as possible.

5.1.2 Making the tool and DATEX II model available for UVAR Box project Member States

As described based on the experiences of Member States during the UVAR Box project, the participating Member States have different contexts and, therefore, strategies for the future use of the UVAR Box Tool, including the hosting of the tool – often by integrating into the NAP[54] - and integrating the established DATEX II model in current processes and tools. Therefore, it is recommended that in the long-term future, the tool is made available on a Member State level, hosted, for example, by the NAP. In addition, it is

53 https://github.com/

54 but not always, for example Germany is discussing the Federal Environment Agency as the host.

recommended to have an organisation or project in place maintaining the tool and supporting Member States in implementing the tool into their processes. This could be a neutral organisation nominated by the European Commission - perhaps NAPCORE, or through a follow up activity of the UVAR Box project, although this would need to be a long-term process, rather than a project-based one.

The DATEX II model should support the authorities in digitising UVAR data in ways which suit the different authorities and specific UVARs. The experience from the Member States from using the UVAR Box Tool and the eagerness of the participating Member States to further implement the UVAR DATEX II model, indicates a need for further developing the UVAR DATEX II model. This is necessary for sustainability of the DATEX II model to ensure that authorities are not limited in their implementation of UVARs by the capabilities of the tool or the DATEX II standard in producing and publishing UVARs. This aspect will further be elaborated on in chapter 6 in context of a sustainability strategy for the use of the DATEX II model for UVAR data exchange.

5.1.3 Making the tool and DATEX II model available for other European Union Member States

It is necessary to also address other EU Member States than those on which the UVAR Box project has focused. The Member States which participated in the project gathered much experience and knowledge through the project to be able to develop the strategies for further use of the tool and DATEX II model, as described above. However, enabling other Member States to use the tool requires additional considerations.

Other Member States may not have current processes in place for UVAR digitisation, and may lack resources and knowledge for implementing such processes, the UVAR Box Tool, and the DATEX II model. It is recommended that the UVAR Box Tool is further developed and maintained, to offer to be used by other Member States and in other languages. Especially for Member States without tools in place, offering the tool is a way to enable digitisation of UVARs, which requires less resources. However, the way of making the tool available as well as other maintenance aspects need to be considered.

As mentioned, the recommended strategy is to make the UVAR Box Tool available on a Member State level together with coordination of the national versions of the tool to ensure consistency. As other Member States lack current knowledge of the tool, it is unlikely that they would be able to host the tool on a national level by themselves. In this context, it is also recommended to have an organisation or project in place maintaining the tool and supporting Member States in implementing the tool into their processes. Cities in a number of countries – particularly the smaller authorities - use third-party tools to manage their traffic regulation orders and/or digitisation processes. It may therefore be advantageous if these third-party tools incorporated the UVAR Box Tool or the UVAR DATEX II standard, and work to raise awareness amongst the tool providers would help support this.

In addition to making the tool available, Member States will need support in using it and integrating it in their processes. The experience during the UVAR Box project showed that cities and municipalities may struggle with lack of required resources and specific knowledge for using the tool to digitise UVARs. Although the tool has been established, in order to use it, new Member States need to define their

requirements regarding UVAR digitisation and integrate those into the tool. Here, knowledge of the DATEX II standard is required for creating profiles and templates for the tool. Therefore, it is recommended that in each Member State, there is at least one person implementing the tool in the Member State who has the DATEX II knowledge for implementing the necessary profiles. However, the results of the stakeholder questionnaire conducted as part of work package 3 suggested that knowledge of DATEX II is relatively low with the respondents from participating Member States. This suggests that DATEX II training is required to ensure that all Member States have personnel with the necessary DATEX II knowledge, and/or Member States could potentially delegate this responsibility.

The experiences of using the UVAR Box Tool for different Member States during the project also highlighted that the tool itself needs to be further developed and made easier to use, in order for it to be effectively used by cities. This was reflected on in D2.4, and the following section provides examples and recommendations regarding further development. It must be noted, however, that further maintenance and development of the tool is also highly important in the context of making the tool available for additional Member States. In addition, to scale the use of the tool beyond the Member States involved in the UVAR Box project, it is important to integrate requirements of other Member States in the tool.

Short-term and medium-term options for the tool before the long-term strategies are in place.

These strategies will take time to implement. In the short term the tool webserver will continue to be hosted by ARMIS and the tool will remain available on the ARMIS website until a medium-term solution is implemented. The medium-term option decided on is that a the tool webserver will be hosted by the SDG, until all Member States take a national version, once there is a stable version of the UVAR Box software. This will enable it to come from a central impartial source and enables a single webserver before it is taken to the separate Member State level.

5.2 Recommendations on further development of the tool to ensure quality of data and sustainable scaling of tool

As described, it is recommended that the UVAR Box Tool is made available to enable Member States to use it for digitising UVARs. Nevertheless, to ensure sustainable scaling of the tool and to ensure high quality of data in the future, it is necessary that the tool is further maintained and developed. The experience during the project generated valuable input for further development of the tool. The following sections will describe the valuable insights that have been gained from using the UVAR Box Tool during the UVAR Box project, which can be used to develop the UVAR Box Tool further and enable sustainably scaling the use of the tool in the future.

One finding from testing the tool during the project, was that Member States seem to interpret parameters in the tool differently. During the project, actors from the different Member States learned to use the tool separately to create UVARs. It seems, that there are differences in how individual countries used the tool and profiles, and consequently, there are differences in how individual Member States entered UVAR data. An example of this is shown in Figure 4, in the category "Permit Subject to Fee",

where the user may input the cost of parking in the "Amount Due" field. There is no explanation in the tool indicating for which duration the cost should be inputted, or no option for the user to indicate, for which duration they are inputting the cost for. As a result, depending on the city, the value given may be for a 30 minute or 1 hour time frame. This is also the case for the input fields "Permitted standing time" and "Permitted parking time", where the user may input the permitted standing or parking duration, as there is no indication in the tool as to in which format (minutes, hours) they are inputting the duration for.

Figure 4: Capture of the Amount due-field in the UVAR Box Tool

In order to get a comprehensive understanding of the differences between how different Member States have created UVARs during the project, it may be beneficial to create a comparative analysis of UVARs created in different Member States, which analyses the frequency and ways of using different attributes in the Member States. An example of how such a comparative analysis could be conducted is shown in Table 2. This comparative analysis would reveal whether and how the data entered differs between Member States and Municipalities for different UVAR types (LEZ, LTZ, PAR, PED). The results of the comparative analysis could be used by country coaches, or the person responsible for the tool in the Member State, to align details on how to create UVARs to improve the UVAR data quality in each Member State and as insights for future training and developments of the tool. Based on the comparative analysis, service providers could also be informed about which attributes in the UVAR data are specifically important for each Member State and any divergences remedied through improvement of the tool.

Table 2: Example of potential comparative analysis of input of UVARs in tool by different Member States

Path	Attribute	Usage Country A (1 … always, 4… never)	Usage Country B (1 … always, 4… never)	Comment
ZT/TRO/TR/StandingorParking	PaidParking	1	4	Only used by some countries
ZT/TRO/TR/StandingorParking/ Condition/Period	Recurring time period of day Start and End	2	2	-
ZT/TRO/TR/StandingorParking/ PermitSubjectToFee	Amount Due	3	1	CountryA uses €/Hour, CountryB uses €/30Min
……				

To improve the data quality and unity, it is recommended that minimum standards are set for the input of UVAR data in the tool, either on an EU level or a Member State level. These standards could involve guidelines on collecting input data on which data to input in the tool and the manner in which to input it, as well as standards on validating the data. Specific recommendations for these steps based on the experience using the tool during the project include:

- To collect input data, it is recommended to use a questionnaire format or a standardised list of necessary input data. For inputting geographic data, it is recommended to use the shapefile format with the correct projection (ETRS89/WGS84).
- For inputting data, it is recommended to align between Member States on how to input data. To create such alignments, a comparative analysis, as described above, could be used as input. For validating data, it is recommended that a process is put in place for checking the quality of the data.

This work would need to be done by a body overseeing the different versions of the tool in the different Member States.

Beyond aligning UVAR creation in the tool between different Member States and setting standards for UVAR creation within Member States, there is much potential to further develop the tool itself to reduce the likelihood of human errors occurring with users using the tool, as well as to improve the overall usability, and therefore effectiveness of the tool. For example, the explanations of attributes should be improved. As shown in the example regarding the "Amount due"-field, currently, attributes are not always clearly defined in the tool, therefore leaving much to the interpretation of the user. During the project, under the framework of task 2.3, ARMIS has collected feedback from users of the tool and improvements to the tool were made based on it. Additional actions could be taken to evaluate where further usability improvements are needed:

- Including a process of manual reviewing of the UVARs created in the pilot phase for common errors made by users, likely at a Member State level, but potentially also at an EU-level to identify systematic divergences between Member States.
- Evaluating the usability of the tool through methods, such as usability testing of the tool with representative users or an evaluation of the usability (heuristic evaluation).

Nevertheless, as the tool relies on data input by UVAR data creators, there will be some human errors in the data inputs, despite of usability improvements. Currently, there is a validation in place in the tool which validated the UVAR being created against the DATEX II UVAR profile. It is recommended that a process for further validation of the created UVAR data is established. D3.2 describes several validation processes, presenting how data can be validated along the UVAR data value chain. This covers validation in the tool and in the NAP, a feedback loop between service providers and UVAR data creators, as well as validation of the data output of service providers.

6 Sustainability strategy concerning the use of the DATEX II Model for UVAR data exchange

Within the UVAR Box project, the DATEX II model for UVAR data exchange has been developed. Utilising this established standard, which is used throughout Europe, follows the recommendation of the Delegated Regulation (EU) 2015/962 on real-time traffic information services (RTTI) and envisages a long-term perspective. By using a standardised format, interoperability and cross-border continuity of ITS applications, systems and services, will be increased. The UVAR DATEX II model was developed to meet the requirements on the data structure for the defined project UVAR types low emission zones (LEZs), diesel ban zones, congestion charging schemes and urban road charging schemes (CS), limited traffic zones (LTZs), pollution emergency schemes (EMERG), restricted parking zones (PARK) and pedestrian zones (PED). The DATEX II model developed for UVAR data exchange is the basis for the necessary interfaces and especially the derived DATEX II profiles, which allow the exchange of data. The elaborated profiles are core elements, upon which the UVAR Box Tool relies. The template used in the tool for collecting the UVAR related data eases the process for stakeholders to convert their UVAR data into DATEX II. Detailed information on the developed DATEX II model can be found in the WP1 deliverables.

Work should be carried out on a European, national and local level to harmonise the DATEX II standard used, but also to ensure that DATEX II profiles and templates fit local contexts. On a European level, there should be further development of an established DATEX II and artefacts. Areas of further development include, for example, ensuring backwards compatibility of the model, as currently, there is no backwards compatibility between DATEX II Version 3.x and DATEX II Version 2.x. Or in the event that this is not possible, conversion tools between the different versions used within Europe. However, not each DATEX II user will immediately shift to a new standard version. Further development should also focus on flexibility of the model, to ensure that cities and municipalities are not limited by the possibilities of the model in defining best practice UVARs. The model will be taken over by the SWG 4.2 of NAPCORE, who will take on ownership and responsibilities of further development of the model. It is currently under discussion, whether training national experts can be an integrative part of the SWG 4.1. Here the "train the trainer"-concept would be used for applying the UVAR DATEX II model and artefacts.

On a national level, it is recommended that UVAR DATEX II profiles, templates and artefacts are established by Member States. Stakeholder dialogue is needed with the software and service providers as well as national authorities to ensure that the format required at national levels is DATEX II, and not diverging standards. On a local level, cities and municipalities should begin to use the DATEX II model to digitise their UVAR data establish UVAR DATEX II templates for their city. Local authorities may use the UVAR Box Tool to do this, or incorporate the DATEX II model into existing municipality digitisation tools of cities and municipalities, as those cities already using digitisation tools are unlikely to want to change tools.

The UVAR Box project identified that currently, DATEX II knowledge is quite low. National stakeholders involved in TEN-T activities, such as motorway road operators, are mostly aware of DATEX II. With some exceptions, on a city and municipal level, the use of the DATEX II standard is minimal, and awareness of

DATEX II is relatively low. It is therefore necessary to raise awareness of the model and the benefits of using a standardised, EU-wide standard, such as DATEX II to produce machine-to-machine readable data, as well as the advantages for developing services and integrated mobility and traffic management. Different ongoing initiatives, such as NAPCORE, address the Member State, regional and city levels to increase knowledge on the requirements formulated in the related Delegated Regulation and raise the awareness of obligations regarding the legal framework and revision of requirements. This established dialogue needs to be further strengthened. Nevertheless, in addition to raising awareness, it is also necessary to educate and train national users to use DATEX II (especially the NAP representatives) in regard to the model, to ensure that users have the required expertise. This should include training on the configuration management and the support to produce national profiles. Resources are needed on both a national and local level to educate authorities and improve their knowledge of the DATEX II standard. Given that the NAP has until now focused on the TEN-T road network, increasing the understanding of the NAP representatives on UVARs and the urban context in general will also help extend the digitisation and DATEX II data to the urban level and enable them to better talk with stakeholders focused on the urban area.

It is recommended, that the DATEX II website is used to share information and training on the model. For example, the national profile registry could be further used to disseminate UVAR DATEX II profiles. The website could also provide different options for integrating the scheme and artefacts. The UVAR Box deliverables could be used to provide guidance for best practices via the DATEX II website. In particular, the deliverables from WP1 on the developed DATEX II model, and the guidance document created in WP2, are a solid basis for further engaging stakeholders, therefore, the information should be made available. In adding this information to the DATEX II website, the opportunity should be made to make the information more easily accessible to those coming from a non-DATEX II background, as the information currently is far from accessible or user-friendly. The information provided by UVAR Box can give some ideas on how this might be done.

7 Recommendations at a European Level to ensure sustainable UVAR data access

This chapter outlines recommendations on a European level to ensure sustainable UVAR data collection, production, publication and accessibility in the future, including the take-up of UVAR data by service providers.

7.1 UVAR data collection

Currently, there is no harmonised approach regarding UVAR data collection across, and rarely within, Member States. To lay the foundation for unified UVAR data collection across Member States, transparent requirements should be defined on a European level regarding data categories and attributes, as well as data quality and format. Similarly, further development of the UVAR DATEX II model should be undertaken. In addition, exchange of experiences on implementing the requirements laid

down in the European legislation should be encouraged between Member States to support EU-wide learning and establishing best practices.

To ensure that service providers use the data, it is recommended to collaborate further with service providers in the development of EU-wide requirements on UVAR data categories, attributes, quality and format, as well as in the development of UVAR data management processes on Member State levels.

7.2 UVAR data production

UVAR data is currently produced differently in different Member States. Some Member States have existing tools and processes for producing digitised UVAR data, while others lack such tools or processes, and digitise only little UVAR data. Additionally, even within Member States, there are differences between regions and local authorities with regard to producing digital UVAR data. To encourage the generation of UVAR data, it would be beneficial to promote the UVAR Box Tool, focusing on the possibilities of generating UVAR data with it, to the national authorities in charge of implementing Directive 2010/40/EU and Regulation (EU) 2022/670 and further to the UVAR local authorities themselves. The exchange of implementation experience is also relevant in regard to UVAR digital data production, as Member States and local authorities can learn from the experiences of others.

7.3 UVAR data publishing

As there is currently no harmonised EU-wide approach to publishing UVAR data, to ensure sustainable UVAR data publication and accessibility of data, steps to harmonise the approaches are recommended. To enable better accessibility of the published UVAR data through the NAPs, a harmonised UVAR metadata description should be established which ensures easy access and identification of relevant UVAR data EU-wide. This is currently being undertaken by NAPCORE, however, the timescales for this to be completed are 2024. In the future, as these metadata descriptions are based on DCAT-AP, this will enable machine-to-machine access to UVAR data across different NAPs. In addition, the UVAR Box Tool and the advantages of using it and producing harmonised machine to machine readable UVAR data should be promoted to make authorities aware of the tool and use it as well as the data they can access in it.

End-users expect to receive a complete picture about active UVARs; they expect that accurate and complete UVAR information is integrated into their end-user-services. Here, along the overall service-chain, two main stakeholders are key to fulfil this expectation: public authorities and RTTI and navigational service providers. Public authorities often struggle with providing the required quality of the data they provide with regard of 100% correctness and 100% completeness – public authorities even have the fear to become responsible for incomplete or even wrong information. Here guidance is needed on possible consequences of providing incomplete or even partly wrong or outdated information, and an indemnity of local authorities to the consequences of the results of any actions taken upon the data provided would help increase the data provided by public authorities. In addition, service providers need to be encouraged to integrate UVAR data into their services as without this, the advantages of the

digitisation process for both public authorities and road users are minimal. This is especially because UVAR data is currently used for information purposes only and in a non-machine to machine readable format, which often hinders the uptake of UVAR data by service providers, as they cannot use the format and cannot rely on correctness of the data. Therefore, further work on the quality and correctness of UVAR digital data is needed. Making a step towards a digital publication of UVAR regulations might be a way forward, and also enable the understanding and publication of much of the data created within the UVAR Box project that has not yet been validated by the UVAR authorities. Having a kind of digital "authority seal", which indicates the correctness and completeness of data, might help authorities to publish UVAR data faster, as there are two categories of data: checked and validated data indicated by the "authority seal" and UVAR data which might be complete, but has not been finally approved and validated by the UVAR authority so far. Such an "authority seal" may also help to overcome the issue of uptake by service providers, as they could rely on correctness of the data. Published and validated UVAR data would still have an informational purpose, but would be indicated as "official authority data". In a long-term perspective, this approach might even help to publish UVAR regulations digitally via an authority-sealed data set, where the digital regulation is also legally valid in addition to physical publication of regulation. Although realising the legally valid digital publication will require time, especially as national traffic laws need to be adapted, this would be an important step to support cooperative, connected and automated vehicles in future.

8 Recommendations on national and city levels to ensure sustainable UVAR data access

This chapter outlines recommendations on a national and city level to ensure sustainable UVAR data collection, production, publication and accessibility in the future.

8.1 UVAR data collection

Member States are encouraged to start the digitisation process for UVAR data within their countries. Currently, processes regarding UVAR data provision are lacking in most Member States. To ensure sustainability in the future, it would be beneficial to establish digitised processes for UVAR data management where such processes are lacking on a national, regional and local levels. In regard to UVAR data collection, where feasible, these processes could include requirements for traffic regulation orders being created in digital form, or requirements for a minimum set of data that should be included in traffic regulation orders. Within these processes, transparent responsibilities should be set regarding data generation. Another important action on a national level States to enable UVAR data collection in a harmonised digital format is establishing national UVAR DATEX II profiles, templates and artefacts. In some Member States it may be useful to work with the traffic regulation and digitisation third party tool providers to incorporate UVAR Box or the UVAR DATEX II standard into their services.

8.2 UVAR data production

For harmonised UVAR data production within Member States, awareness should be raised with regional and local authorities about the importance and advantages of digitising UVARs.Cities and municipalities should be supported in gaining expertise in digitising UVAR data and getting to know the DATEX II standard, or digitising the data for municipalities. For example, support programmes for digitising UVAR data in DATEX II have taken place in the Netherlands and Sweden. Member States could give cities and municipalities incentives and funding for digitising UVAR data, or requirements could be set to obligate digitising UVAR data. Where requirements on digitising UVAR data are set, they should also be enforced, for example by checking the completeness of data. In addition to considerations related to SUMPs (see chapter 9), on a local level, cities and other UVAR authorities should also take action to create harmonised digital UVAR data in DATEX II format. For example, cities should invest in improving knowledge and use of the DATEX II standard. Cities should digitise their UVARs in DATEX II, utilising as one option the UVAR Box Tool, but other options include using the DATEX II model directly or incorporated into internal or third-party digitisation tools. It should be noted, that in order to use the tool effectively, for example to create new profiles in the tool for new regulations, knowledge of DATEX II is needed.

It is also recommended to establish processes for digitised UVAR data management at a local level, and local authorities should establish UVAR data validation and maintenance processes. Within D2.4, UVAR related data-flows for data generation, collection and data maintenance were analysed, and different types of validation processes were defined in D3.2. The procedure to validate the output is different between cities and countries of the pilot Member States due to different reasons, such as the amount and type of UVARs or different roles in the process of collecting and digitising the data. The confirmation of the validation by data holders is an important building block of a sustainable data maintenance process. One obligation for future data holders could be to confirm the validation of each generated UVAR data set according to the in advance defined procedure. Overall, it is important that the processes for validating the UVAR data align with the requirements formulated in the Delegated Regulation (RTTI) Article 12. The collected and generated UVAR data should be used for required reporting in alignment with the Delegated Regulation (RTTI) Article 13. It is recommended that cities manage UVAR data themselves, or supervise its management, to ensure completeness and correctness of the data and to ensure UVARs are up to date. It should also be ensured that there are no conflicts between different UVARs. Here the UVAR Box Tool can help to identify possible conflicts. Exchange between local authorities within the Member State and across Europe as a whole may be valuable to support mutual learning in managing UVAR data.

8.3 UVAR data publishing

In regard to publishing UVAR data, a crucial aspect for fulfilling Delegated Regulation (EU) 2022/670 is that all Member States take action to make UVAR data available via the NAPs. Thus, Member States need to activate local authorities and regions to make UVAR data available to the NAP. In countries where NAPs are less established, the NAPs should be further developed to enable publishing UVARs. It is important to note, that while the data should be accessible via the NAP, NAPs do not necessarily store

the data. Rather, NAPs may simply be linking to the data source. In addition to publishing the data via the NAP, to make data easily accessible, it is also recommended to make it available via open E-government platforms and city websites. Publishing data on these national and city portals also increases the accessibility of the data.

Further, metadata descriptions should be provided for UVAR data categories on a national level. Currently, these metadata descriptions are being harmonised between all NAPs on European level within the NAPCORE initiative. Until the finalisation of the harmonisation work in NAPCORE, UVAR data should be provided on the NAPs using existing relevant data categories. Member States should encourage data holders to make their UVAR data available via their NAP in machine-readable form and the SDG in human-readable form – which will be able to be easily and automatically converted from machine-readable DATEX II format data. Once the NAPCORE metadata specifications are available, they should be implemented, to ensure the highest level of interoperability. As the metadata descriptions are based on DCAT-AP which enables machine-to-machine access to data across different NAPs, the envisioned future is that UVAR data is made available in each Member State via the NAP, and data is accessible across different NAPs. This will allow fulfilling requirements of service providers and Member States, where conflict has been identified. Whereas service providers want to be able to access a single European data set, from a Member State perspective, this is problematic. For example, Austrian data needs to be accessed in Austria. One reason for this is that it makes monitoring data and its usage possible. Through machine-to-machine access to UVAR data across NAPs, the UVAR data across Member States will be easily accessible, even though it is not available as a single European data set.

The data used by service providers should also be tracked to monitor the uptake of UVAR data as well as to identify where further collaboration and improvement is needed in regard to providing UVAR data to service providers and to give incentives to the cities to digitise data (if uptake rates are significant).

Within the topic of UVAR data publication and accessibility, there are crucial aspects related to data ownership, access and usage conditions which need to be clarified. Currently, UVAR data is owned by numerous different entities across Member States. In the context of UVAR data being stored and published, it is recommended that local authorities, which would publish their own UVAR data via the NAP, their website or an open E-government platform, clarify the implications for data ownership. Another basic requirement towards data holders and Member States is establishing transparent and comprehensible rules for usage of UVAR data. It is up to each Member State or data owner to define these in accordance with the European recommendations. A feasible approach would be to use Creative Commons licences (CC BY 4.0), which are used for many data sets provided by national open data platforms. Cities may be concerned about producing machine-to-machine readable data, if they think there may be errors in it that they would be held responsible for by drivers and potentially sued for. The UVAR Box Tool may help reduce this concern by making data production easier, therefore less likely to contain errors. Disclaimers on the data may also be helpful, if possible and appropriate, as well as indemnity for authorities in terms of any action taken on behalf of the data provided.

To ensure mutual learning and exchange, a representative or organisation should be nominated on a National Level as a central contact point for UVAR activities on regional and city level. This could link in with the NAP and or the SDG contact point. In some cases, Member States have existing structures that can be built on, and so this is detailed further by focus country.

All Member States will have to either put the Single Digital Gateway requirements into national law or provide other mechanisms to ensure that the data is provided on the SDG by the 31st December 2023. As providing the SDG data can be done by first creating the data in DATEX II format, it may be beneficial to require the data to be in DATEX II format, which is then converted into the SDG format. Member States can achieve this in different ways, depending on the structures available, from requiring the data to be provided by law or in guidance, requiring data in order to gain permission to operate UVAR camera enforcement, delegating agencies or paying consultants to create and collect the data, funding and supporting local authorities to provide the data, facilitating the inclusion of DATEX II export in existing digitisation tools used by local authorities and spreading the advantages to local authorities of creating the digital data.

9 Proposed updates of the UVAR SUMP guidelines

This chapter introduces recommendations for updating the UVAR SUMP guidelines regarding the data collection process, derived from the identified challenges cities and municipalities face.

As a first step, it is recommended to go more into detail about UVARs in the SUMP guidelines. Although UVARs can support many tasks of SUMPs, UVARs appear only sporadically and superficially in the guidelines, and although there is a SUMP UVAR Topic Guide on UVARs, it is a high-level document. According to the Evaluation of the 2013 Mobility Package (SWD) 2021/47 final[55] it was discovered, that while SUMPs are one of the most recognisable tools, it seems that the awareness and use of the guide document on UVARs is low. The low level of guidance, coupled with the non-binding character of the SUMP guidance may contribute to uncoordinated implementation of UVARs across the EU. This could be reduced if providing digital UVAR data in DATEX II format is included in the SUMP Guidance.

The usage of DATEX II offers a great opportunity for harmonised processes, allowing for data exchange across Member States. For this reason, it is recommended that the need to make UVAR data available in the DATEX II model is included in the updated SUMP guidelines and UVAR Topic Guide. An opportunity to do so in the short term may be available by adding it to the recent draft SUMP UVAR Topic Guide Annex produced by the Dynaxibility project. This was produced as an additional document, as there was a feeling by the Commission that it would prefer not to change the current reviewed SUMP UVAR Topic Guide at the current time, however this may be revised.

55 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0047&from=en

The New Urban Mobility Framework (COM) 2021/811[56] foresees that cities should provide data in standardised formats on urban and regional vehicle access schemes. This provision can, and should, be done via UVAR DATEX II. In addition, as new mobility and transport services continue to emerge, such as Connected Cooperative Automated Mobility (CCAM) or Urban Air Mobility (UAM), the New Urban Mobility Framework also envisages integrating them into the SUMP framework from the outset and UVAR DATEX II can contribute to this implementation for a facilitated and uniform process.

There is a need to further develop and enhance existing UVAR guidelines through the incorporation of measures and objectives, providing financial support and tools for the development, implementation and data collection of UVARs as well as providing support for cities and regions. This is also mentioned earlier in this deliverable and in the result of the Executive Summary of "The fact-finding Study and future Needs regarding Low- and Zero Emission Urban Mobility" (EU) 2021[57].

10 Conclusions

This deliverable focuses on sustainability of UVAR data collection and accessibility. It combines work from WP4.1 and WP4.2 to analyse and make recommendations regarding sustainable UVAR data provision.

EU legal framework

To begin with, this report analyses the legal framework relevant for digital UVAR provision. It is apparent, that the proposed revision of the European ITS Directive and the supporting Delegated Regulation (EU) 2022/670, are highly important in the context of UVAR data provision. Other relevant directives, regulations and legal frameworks include the SDG regulation, the EGD, INSPIRE and the Open Data Directive.

The most important implications of the legal framework for UVAR data provision relate to the obligation to provide digitised UVAR data and to make such available data accessible. While there is currently no obligation to digitise UVAR data, the proposal on the revision of the ITS Directive[58] includes the obligation to make certain data available in a digital format. This obligation would potentially apply to UVARs, as the proposal states that "boundaries of restrictions, prohibitions or obligations with zonal validity, current access status and conditions for circulation in regulated traffic zones" are important and may be included in the types of data that would need to be provided in a digital format. If a revision of the Directive is published including this obligation for UVARs, Member States will need to ensure that digitised UVAR data is created and available. If this approach changes and no such obligation is set in the ITS directive,

56 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, The New EU Urban Mobility Framework. {SWD(2021) 470, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0811&from=EN

57 https://op.europa.eu/en/publication-detail/-/publication/55c6afbd-5eec-11ec-9c6c-01aa75ed71a1

58 Proposal for a Directive of the European Parliament and the Council amending Directive 2010/40/EU on the framework for the deployment of intelligent transport systems in the field of road transport and for interfaces with other modes of transport, published Strasbourg, 14.12.2021 COM(2021) 813 final, 2021/0419(COD), European Commission, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021PC0813&from=EN

alternatively, the SDG could provide the legal basis to require Member States to require UVAR authorities to both *create* and *publish and make* available harmonised digital UVAR data, as the SDG requires UVAR information to be published on "YourEurope" by the 31st of December 2023 at the latest, and the DATEX II format data can be easily and automatically converted into SDG format. Doing so also contributes to additional European aims, including the European Green Deal. In regard to making available data accessible via NAPs, the ITS Delegated Regulation (EU) 2022/670 requires that Member States need to make existing UVAR data available via NAPs in the DATEX II standard by 2025.

European level support for digitisation

Inclusion of the issue of digitising UVARs and the benefits for local authorities in SUMP guidance could help encourage UVAR authorities to publish digital data. One of the deliverables of the Dynaxibility project[59] is being discussed as an Annex to the UVAR SUMP Topic Guide, and inclusion of the issue of digital UVAR data in this document, if it is added as an Annex, may be a short-term option for SUMP guidance, as could be an update of the existing UVAR SUMP Topic Guide. The new 2021 Urban Mobility Framework also foresees that cities should provide UVAR information and data in standardised formats to drivers, including non-resident drivers. At both EU, national and regional level, making the UVAR authorities aware of the advantages of digitising their UVAR data will help persuade local authorities to do so. There are also advantages to RTTI and navigational service providers which should also be disseminated, to help encourage them to include UVARs in their offerings, and so realise the benefits to both road users and UVAR authorities.

Advantages of digitising UVAR data for all levels

It can be helpful for those wanting to disseminate the advantages of digitising UVARs, to have the considerable advantages identified within the UVAR Box project outlined. This could be included at EU, Member State, regional level, as well as through the SUMP guideline documents and ReVeAL guidance. The advantages for UVAR authorities, service providers and road users are outlined below.

For UVAR authorities, greater awareness of their UVARs by road users, leads to greater compliance and impact of the UVAR, therefore resulting in less enforcement work, and fewer complaints and queries, therefore, less work for the authority (providing service providers place the UVAR data in their services). As UVAR data needs to be placed on the Single Digital Gateway, local authorities will have to provide data in a suitable format. Data in DATEX II format can be imported into the SDG format, meaning that the authorities only have to provide data in a single format for both ITS and SDG Directives. This is a benefit, as currently, service providers are increasingly contacting cities for their UVAR data, often in the service providers own format. If cities provide the data to one service provider, they need to provide a similar service to subsequent service providers. UVAR data in DATEX II format means that the city only needs to provide the data once in one format on the NAP (as well as their own website if they wish), and the data will be available to all. The UVAR Box Tool helps UVAR authorities digitise their UVARs that they are doing as part of the general existing digitisation processes. Additionally, the UVAR Box Tool helps

59 https://www.interreg-central.eu/Content.Node/Dynaxibility4CE.html

Member States comply with their requirements as part of EU requirements, including the proposal for revision of the ITS Directive, the Delegated Regulation supplementing the ITS directive and the SDG. Digital UVAR data is also needed to support future options such as geofencing, connected and automated vehicle deployments.

For service providers, including UVAR data in their offerings will ease the provision of UVAR data in their services, as UVAR data will be better accessible. UVAR data is increasingly being wanted by road users in their navigation tools. As some service providers are including UVARs in their offerings, sometimes through their own data collection mechanisms, there is additional pressure on others to also do so. Providing easy access to the data increases the ease of doing so. There is a chicken and egg aspect to this: the more data available the more service providers will include it in their offerings, the more service providers include the data, the greater incentive for UVAR authorities to digitise their UVAR data. The use of a single EU-wide format, DATEX II, avoids the issue of service providers using differing formats – and it is also a format in which a lot of other traffic data is freely available. The creation of digital UVAR data, and particularly LEZ data in the 5 focus Member States which comprises over 80% of all European LEZs at the time of starting this project in DATEX II format through the UVAR Box project will help 'kick-start' this cycle.

For road users the benefit if UVAR data is included by service providers is easier and smoother navigation around Europe, and a better understanding of where they can and cannot drive, and in which vehicles. As a result, there will be fewer complaints from and penalties issued to road users. This will result in more sustainable transport, as mileage will be reduced, as drivers will not drive up to, or into UVARs into which they are not permitted to drive, and the UVARs will be more effective in achieving their goals.

Member State organisational and legal framework analysis

In addition to the analysis of the overall legal framework, the organisational and legal frameworks, as well as challenges faced by the Member States participating in the UVAR Box project were analysed and conclusions drawn. This analysis highlighted, that the organisational and legal frameworks differ between Member States and there is generally little knowledge of DATEX II at city level. Additionally, Member States are in different stages of digital provision of UVAR data. In the Netherlands, appropriate procedures and tools are in place and all the LEZs have been digitised in DATEX II format through a national program. In Austria, processes and tools are in place at 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 by cities. In Belgium, initiatives of the large cities are the main drive towards the digitisation of UVAR data, but DATEX II has not been used by cities, 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 within Member States, 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 with 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 Delegate Regulation (EU) 2022/670, the SDG requirements 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.

The Member States are responsible for ensuring that cities and regions meet the requirements of the EU legal requirements, most relevantly the ITS Delegated Regulation and the SDG. Member States, therefore, need to implement these requirements for the UVAR authorities. These will be different depending on the individual Member State context or perhaps legal and organisational frameworks. There are a number of potential routes for this depending on the national context, including funding data creation and collations by cities, agencies or third-parties, legally requiring the creation – perhaps as part of the process to gain permission to implement an UVAR or its enforcement technology, placing the requirement in guidance or roadmaps, delegating agencies or regions to create and collate data, encouraging authorities by dissemination of the benefits, facilitating the inclusion of DATEX II export in existing digitisation tools used by local authorities or action plans that include all of these. Compliance or achievement of this, as well as data quality and validation need to be monitored and enforced at national level. Funding, resources, expertise of local authorities are a theme across many Member States, as is dissemination of the benefits to UVAR authorities of digitising UVARs.

Sustainable strategy for the UVAR Box Tool

Currently, the UVAR Box Tool is available as a web application hosted by ARMIS. This report assesses different ways in which the tool could be made available in the future. It also elaborates on Member State strategies for future UVAR data provision and use of the UVAR Box Tool, where future steps for UVAR digitisation and the UVAR Box Tool have been identified. Based on an assessment of different ways of making the tool available in the future and the identified Member State strategies, this report derived the recommendations for a sustainable strategy for the tool. Firstly, for the future it is recommended that the tool is made available on a Member State level and an organisation or project shall be put in place for maintaining the tool and supporting Member States in implementing the tool on a national level. Secondly, it is recommended that the tool is further developed in order to scale its use and to be effectively used by cities.

However, these options will take time to implement. In the short term the tool will continue to be hosted by ARMIS until a medium-term solution is implemented. A medium-term solution for a central host has been identified as the SDG, enabling data to come from a central impartial source for selected users. This enables the required continued development of the tool as well as testing by digitisation service providers, before it is taken to the separate Member State level with coordination of an appointed organisation or project.

The short-term option for hosting the software code behind the tool is again through ARMIS. However, the plan is to make the software code will available as an open-source software without restrictions as

soon as possible. This allows users such as the EC, NAPs, digitisation tool providers, cities and the wider community to integrate and develop the software.

The report also elaborates a sustainability strategy for the developed UVAR DATEX II model. It is recommended, that further work should be undertaken to harmonise the DATEX II format, also to enable backwards compatibility – or conversion tools for this. 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. Until the data model is able to be handed over to NAPCORE, the data model will remain with the consortium.

Recommendations to ensure sustainable UVAR data access

As part of this work, recommendations have been formulated on a European, national and local level to ensure sustainable UVAR data access. At the European level, these include the recommendation to establish transparent standards for UVAR data collection regarding data categories and attributes, quality and format. Furthermore, it recommends to establish a harmonised UVAR metadata description and overall coordination and harmonisation of the different Member State 'versions' of the tool, profiles and templates to be undertaken within the NAPCORE initiative. It also recommends to clarify possible consequences of incomplete or incorrect information, specifically disclaimers and indemnity, as currently public authorities are concerned of being held responsible for action taken upon incorrect UVAR information. On a national and city level, recommendations include ensuring that NAPs enable publishing UVAR data via the NAP, raise awareness about and improving knowledge of DATEX II and the advantages of creating data in it, encourage cities and regions to digitise UVAR data in DATEX II and make it available via the NAP, as well as 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.

As with the tool, this will take time to implement. In the short term the data will remain accessible via the ARMIS website marked with "test data", until a medium-term option of hosting on the SDG is in place. This makes the data available from a trustworthy and impartial source, albeit with risks associated with the data sources and validity – however due to the processes undertaken to validate the data within the UVAR Box project these will be minor, especially compared with the accuracy of not including the UVARs at all, or not making the data produced available at all until the long-term strategy has been implemented.

Recommendations for UVAR SUMP guidelines

The final area where this report makes recommendations, is regarding updating the UVAR SUMP guidelines. It is recommended that the SUMP UVAR Topic Guide is updated to include the need to publish UVAR data in DATEX II, as well as that need being specified in the overall SUMP guidelines. Through this, the SUMP guidelines can raise awareness of UVAR provision and DATEX II.

Glossary

Term	Definition
Agid	Agenzia per l'Italia Digitale
APIs	Application Programming Interfaces
ARMIS	ARMIS Group is a Portuguese consulting company developing and implementing complex digital solutions in the areas of Information and Technology, Intelligent Transport Systems, Digital Sport, Financial Technology and Ozono.
ASFiNAG	Autobahnen- und Schnellstraßen-Finanzierungs-Aktiengesellschaft - Motorway and Expressway Financing Corporation
AVG	Allgemeines Verwaltungsverfahrensgesetz - (General) Administrative Procedure Act
BASt	Bundesanstalt für Straßenwesen – German Federal Highway Research Institute
BMDV	Bundesministerium für Digitales und Verkehr – German Federal Ministry for Digital and Transport
BMF	Bundesministerium für Finanzen – Austrian Ministry of Finance
BMK	Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie – Austrian Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology
CaaS	Container as a Service is a cloud service that allows software developers and IT departments to upload, organize, run, scale, manage and stop containers by using container-based virtualization.
CCAM	Connected Cooperative Automated Mobility
CCISS	Centro di Coordinamento per le Informazioni sulla Sicurezza Stradale – Italian Road Safety Information Coordination Centre
CCs	Country Coaches
CC	Creative Commons Licences
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.
CIRB	Central Institutional Review Board
COM	European Commission
CPSV	Core Public Services Vocabulary is a simplified, reusable and extensible data model that captures the fundamental characteristics of a service offered by public administration.
CS	Congestion charging Scheme
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 data sets in Europe.

EC	European Commission
EGD	European Green Deal
EMERG	Emergency scheme
EN 16157	European standard for Intelligent transport systems. DATEX II data exchange specifications for traffic management and information.
EU	European Union
FAIR	Findable, accessible, interoperable and re-usable conditions
geoJSON	Geographical JavaScript Object Notation is an open standard format designed for representing simple geographical features, along with their non-spatial attributes, based on JSON.
GHG	Greenhouse Gas
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.
IT	Information Technology
ITS	Intelligent Transport Systems
ivm	Integriertes Verkehrs- und Mobilitätsmanagement Region Frankfurt Rhein-Main - Integrated traffic and mobility management Frankfurt Rhine-Main Region
JSON	JavaSkript Open Notation
K-AGO	Carinthian General Municipal Code
LEZ	Low Emission Zone
LTZ	Limited Traffic Zone
MDM	Mobilitäts Daten Marktplatz – Mobility Data Marketplace
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 Road Data Portal
NGI	National Geographic Institute
OGP	Open Government Platforms
PARK	Parking Regulation
PED	Pedestrian Zone
PRISMA	Austrian consulting company
PSI	Public Sector Information
RDW	Netherlands Vehicle Authority in the mobility chain
RIS	Legal Information System of the Republic of Austria
RTTI	Real-Time Traffic Regulation
SaaS	Software as a Service
SDG	The Single Digital Gateway is a 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.
SPA	Single Point of Access
StVO	Straßenverkehrsordnung – Road Traffic Regulations
SUMP	Sustainable Urban Mobility Plan
SWD	Staff Working Document
SWG	Sub-Working Group
TEN-T Network	Trans-European Transport Network
TN-ITS	Transport Network ITS Spatial Data Deployment ERTICO innovation Platform
TR	Traffic Regulation
TRO	Traffic Regulation Order
UAM	Urban Air Mobility
UBA	Umweltbundesamt – German Environment Agency
UVAR	Urban Vehicle Access Regulation
UVAR Box Tool	Tool enabling the digitisation of UVARs
VNG	Vereniging van Nederlandse Gemeenten – Association of Netherlands Municipalities
VRS	Verkehrsbund Region Stuttgart – Stuttgart Region Transport Association
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.
ZT	Zone Table

11 References

Legal documents

Annexes to the Proposal for a Directive of the European Parliament and the Council amending Directive 2010/40/EU on the framework for the deployment of intelligent transport systems in the field of road transport and for interfaces with other modes of transport: https://eur-lex.europa.eu/resource.html?uri=cellar:26277bcb-5db8-11ec-9c6c-01aa75ed71a1.0001.02/DOC_2&format=PDF

Austrian General Administrative Procedure Act: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10005768

Austrian Road Traffic Act: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10011336

Carinthian General Municipal Code: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=LrK&Gesetzesnummer=10000276

Commission Delegated Regulation (EU) 2015/962 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide real-time traffic information services: https://eur-lex.europa.eu/legal-content/DE/ALL/?uri=CELEX%3A32015R0962

Commission Delegated Regulation (EU) 2022/670 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide real-time traffic information services: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R0670&qid=1657370808197

Commission Delegated Regulation (EU) 2017/1926 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide multimodal travel information services: https://eur-lex.europa.eu/eli/reg_del/2017/1926/oj

Evaluation of the 2013 Mobility Package (SWD) 2021/47: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0047&from=en

The proposal on the revision of the European ITS Directive: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021PC0813&from=EN

Review of the Intelligent Transport Systems: https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/694240/EPRS_BRI(2021)694240_EN.pdf

The Concept for Sustainable Urban Mobility Plans (COM) 2013/913: https://eur-lex.europa.eu/resource.html?uri=cellar:82155e82-67ca-11e3-a7e4-01aa75ed71a1.0011.02/DOC_4&format=PDF

The European Green Deal (COM) 2019/640: https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

The European Single Digital Gateway Regulation (EU) 2018/1724: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.295.01.0001.01.ENG

The INSPIRE Directive (EC) 2007/2: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007L0002&from=EN

The New Urban Mobility Framework (COM) 2021/811: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0811&from=EN

The Open Data Directive (EU) 2019/1024: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L1024#d1e1727-56-1

Cities' websites

Knittelfeld: https://knittelfeld.gv.at/leben-in-knittelfeld/lebensbereiche/verkehr-und-parken/

Regional websites

Digital Flanders: https://www.vlaanderen.be/digitaal-vlaanderen

Stuttgart Region Association (VRS): https://www.region-stuttgart.org/

The Brussels Regional Information Centre (BIRC): https://cirb.brussels/

National websites

Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation, and Technology: https://www.bmk.gv.at/

Austrian Federal Ministry of Finance: https://www.bmf.gv.at/

Austrian Graph Integration Platform: https://www.gip.gv.at/

Austrian Open Government Platform: https://www.data.gv.at/

Digitalization of governmental organizations in the Netherlands: https://dutchmobilityinnovations.com/organisatie-smart-mobility

German Environment Agency: https://www.umweltbundesamt.de/

German Federal Highway Institute: https://www.mdm-portal.de/?lang=en

German Federal Highway Institute: https://www.bast.de/DE/Home/home_node.html

German Ministry for Digital and Transport: https://www.bmvi.de/EN/Home/home.html

German National Access Point: https://mobilithek.info/

Government of the Netherlands: https://www.government.nl/ministries/ministry-of-infrastructure-and-water-management

Government of the Netherlands Mobility information: https://www.rijksoverheid.nl/onderwerpen/mobiliteit-nu-en-in-de-toekomst/nederland-als-testland-voor-mobiliteit

Italian Ministry of Infrastructures and Sustainable Mobility (MIMS): https://www.mit.gov.it/en

Italian Road Safety Information Coordination Centre (CCISS): https://www.cciss.it/web/cciss/homepage

Legal Information System of the Republic of Austria: https://www.ris.bka.gv.at/

National Access Point of the Netherlands: https://nt.ndw.nu/#/home

National Geographic Institute of Belgian: https://www.ngi.be/website/

Netherlands Vehicle Authority: https://www.rdw.nl/over-rdw

mCLOUD: https://www.mcloud.de/

PA Digitale 2026: https://padigitale2026.gov.it/misure/

PNRR information on Italian Government Website: https://www.governo.it/it/approfondimento/pnrr-gli-obiettivi-e-la-struttura/16702

Other

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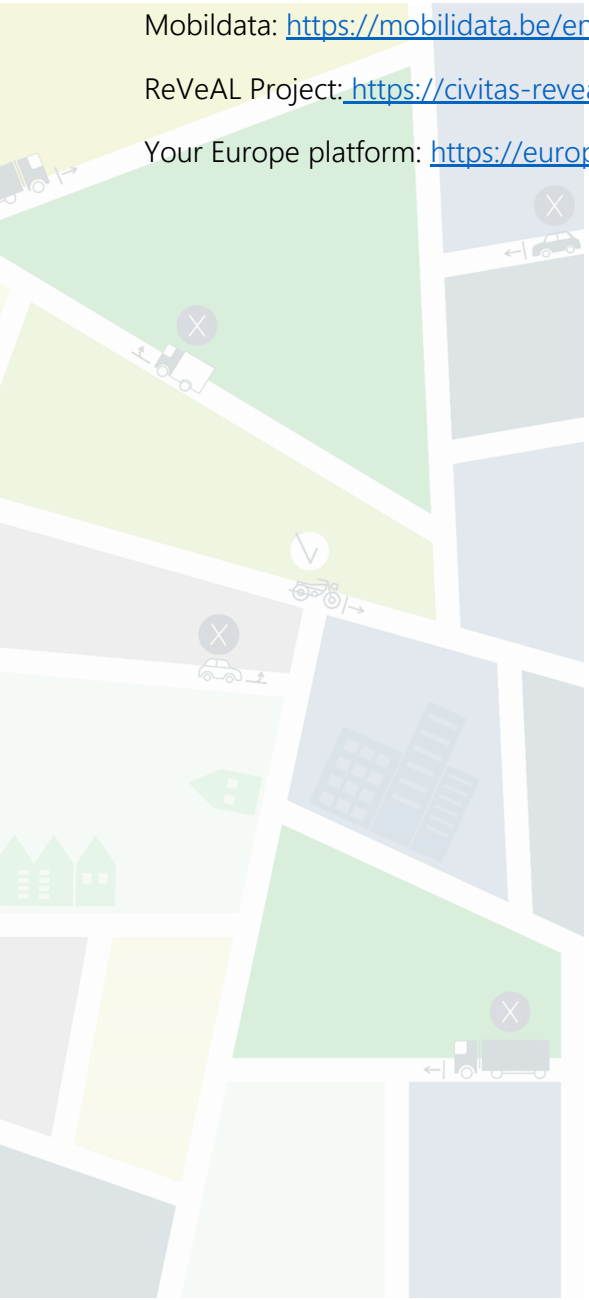

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