



UVAR and SUMPs

Regulating vehicle access to cities
as part of integrated mobility
policies

IMPRINT

About

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Title

UVAR and SUMP's Regulating vehicle access to cities as part of integrated mobility policies

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1. Introduction

1.1 About this document

This document, describes to an audience of urban transport professionals and planners, how to relate Urban Vehicle Access Regulations (UVARs) to Sustainable Urban Mobility Planning processes. It is part of a series of guidance documents that detail the SUMP process and SUMP measure implementation.

The document also relates to EC's DG MOVE's activities on UVARs:

- In 2017, the EC's DG MOVE published the study Urban Vehicle Access Regulations.¹
- During 2018-2019 a co-creation process took place involving road users, industry, NGOs and authorities (national, regional and local), etc involved in or affected by the deployment of Urban Vehicle Access Regulation schemes throughout Europe. It concluded in February 2019. Five working parties developed conceptual frameworks along five strands: information to end-users, UVARs as part of an integrated approach, enforcement, technical implementation (referring to technology options for UVAR management) and best-practice collection.
- In June 2019, the EU Horizon 2020 project ReVEAL started. ReVEAL will look into urban transitions affecting UVARs.

The topic guide starts with setting the scene: the UVAR concept is defined, and a typology is introduced. The relation between the policy objectives a city wants to achieve and the UVAR type is explained. (section 1.2). The close interdependency between UVAR and SUMP is explained in section 1.3.

In chapter 2, the UVAR is put in the context of the 8 SUMP principles: planning for the functional city (2.1), developing a long-term vision and clear implementation plan (2.2), assessing current and future performance (2.3), developing all transport modes in an integrated manner (2.4), cooperation across institutional boundaries (2.5), citizen and stakeholder involvement (2.6), monitoring and evaluation (2.7) and quality assurance (2.8).

In chapter 3, the UVAR is related to the SUMP steps, with a phase of set-up and analysis (3.1), strategy and development (3.2), measure planning (3.3) and implementation and monitoring (3.4).

Finally, in chapter 4, 6 topics related to UVAR are detailed: stakeholder ownership, acceptance and buy-in (4.1), UVAR as part of an integrated package of measures (4.2), UVARs and freight (4.3), UVAR and occasional visitors (4.4), UVARs and SUMP funding (4.5) and finally: how UVARs might evolve (4.6).

The document concludes with case material and a glossary.

¹ https://ec.europa.eu/transport/themes/urban/studies_en, authored by ISINNOVA and PWC

1.2 What we mean when we talk about UVAR

UVARs can be broadly defined as: 'measures to regulate vehicular access to urban infrastructure. As such, several techniques and typologies have been adopted across urban areas to regulate the vehicles access to urban infrastructure².

It is now widely agreed that UVARs should be integrated into a larger transport and mobility plan. A local or regional Sustainable Urban Mobility Plan (SUMP) serves as the ideal vehicle for them. UVARs aid the promotion of sustainable mobility measures, regulating traffic flows and compliance with air quality legislation, both key SUMP goals.

Good practice: UVARs in Stockholm have made the city more accessible – reducing queueing time by between 30% and 50%, and traffic volumes by between 20% and 25%. In addition, reductions in dangerous emissions such as carbon monoxide (14%), PM10 (13%) and volatile organic compounds (13%) have resulted in air quality improvements across the city (DG MOVE, 2017).

In the framework of SUMPs, the following ways of classifying UVARs can be useful as example:

² COMMISSION STAFF WORKING DOCUMENT A call for smarter urban vehicle access regulations Brussels, 17.12.2013 SWD(2013) 526 final

Scheme objectives	<ul style="list-style-type: none"> - Air quality improvement - Congestion reduction - Urban landscape preservation (historic town centres) - Climate change mitigation - Quality of life - Noise mitigation - Road safety - Redistribution of road space - Raising revenues - ...
Targeted traffic	<ul style="list-style-type: none"> - Freight and service transport - Passenger transport, either private car use, or collective systems - Type of vehicle Pollutant Classes - Type of Vehicle Dimensions and Weight (quads, trucks, +3.5 tons etc.) - Trip purpose (commuter, delivery etc.) - Type of road user (residents, taxis etc.) - ...
Type of access regulation	<ul style="list-style-type: none"> - Ban/limitation - Charging - Limit of permeability of area - Controlled parking area - Advisory³ - ...
Scheme design	<ul style="list-style-type: none"> - Toll ring - Distance or time based - Area licence/permit based - Point based - Cordon based - Superblocks: neighbourhood level access scheme - ...
Time period	<ul style="list-style-type: none"> - Permanent - Working day - Seasonal - Peak times - Reactive, e.g. during high pollution episodes - Occasional (e.g. events etc.) - ...
Technological options for implementation and enforcement (often used in combination)	<ul style="list-style-type: none"> - Manual inspection and windscreen stickers/ manual toll collection - Automated Number Plate Recognition (ANPR) - Dedicated short range communication (DSRC) - Global Navigation Satellite System / Cellular Networks (GNSS/CN) - ...

³ E.g the Stuttgart Feinstaub alarm scheme invites vehicles to not enter the city. The voluntary aspect of advisory schemes limit their effectiveness.

While Low Emission Zones are currently in the heart of the debate in many countries in Europe when discussing UVARs, pedestrianisation of neighbourhoods and city districts, traffic circulation and road space arrangements that limit through-traffic in cities (maintaining access, but reducing permeability) such as loop-based urban road networks and superblocks are important practices that can support the overall urban mobility policies of a city. Looking at the history of UVARs, these have often been the starting point: measures to preserve historical centres, increase liveability and reduce congestion. Removing (public) road space can be enabled by UVARs (e.g. more space for bus lanes or amenity space due to reduced congestion), or an alternative to limiting traffic or emissions.

Specific UVAR types can support different policy objectives, as the table below describes.

Policy objective	Type of UVAR
Air quality improvement	Low Emission Zone Ultra Low Emission Zone Zero Emission Zone Pedestrian zone
Congestion reduction	Congestion Charge or Tax Limited Traffic Zone Superblocks, traffic routing Pedestrian zone
Urban landscape preservation (historic town centres)	Limited Traffic Zone Pedestrian zone
Climate change mitigation	Zero Emission Zone Limited Traffic Zone Pedestrian Zone
Noise mitigation	Pedestrian Zone Limited Traffic Zone Superblocks, traffic routing Q-zones Lorry bans / delivery time windows
Road safety	Pedestrianisation Superblocks, traffic routing Lorry bans / delivery time windows
Redistribution of road space	Congestion charge Pedestrian Zone Limited Traffic Zone
Raising revenues	Urban road toll or kilometre charge
Quality of life	All the above

Cities are constantly undergoing a change in their appreciation of public space. Due to growth in the urban population, economic activity, amenity space, the need for mobility and the multiplication of new mobility providers (with new vehicle concepts), urban space becomes the city's scarcest resource. After air quality and noise, congestion and climate mitigation could rise on the ranking of problems to solve by means of regulatory measures. The overall energy use of the mobility system is also becoming a pressing issue. Climate neutrality visions are being formulated across Europe.. Modal shift might rise in the policy agenda-setting of UVARs.

Good practice: Modal shift targets of European cities: By 2041 London aims at 80% journeys by public transport, walking or cycling. The Antwerp transport region aims at a modal split of 50% private motorised use combined with 50% walking, cycling or public transport by 2030. The Antwerp figures are based upon the projected growth of mobility in view of then available infrastructure: Antwerp is going through a substantial infrastructure investment programme, but even then, the infrastructure will only cope with demand if a high number of private motorised trips is shifted to more space-efficient modes.

This brings a new generation of UVARs that are starting to be seen: Kerb side management, Dynamic space/price management, Ultra Low Emission Zones, Zero Emission Zones, Hybrid schemes, combining Congestion Charge with Emission requirements etc.

Temporary, punctual and single-street-level measures such as cycle streets, living streets, and school streets are not addressed in this document, which is more focusing on traffic regulation schemes that target several streets, neighbourhoods or entire city districts. While parking forms part of the tools to regulate access to urban areas, it is not covered in this document, as it is already and more fully covered elsewhere⁴. In terms of UVARs, if access is restricted, then the parking places, the parking policy and the control and payment system should be aligned and supportive of the UVAR.

1.3 Discussing UVARs in the framework of SUMP

There is a factual interdependency between SUMP and UVARs. For a high-impact and sometimes controversial measure such as an UVAR, it is beneficial to rely on the framework of an integrated, long-term plan. SUMP provides the framework to ensure that the UVAR is integrated and supported by the cities joined-up transport policy. If planned and communicated jointly, it enables the UVAR to be developed with sufficient parking or buses to support it or to encourage use of sustainable modes or freight solutions, as well as actions to mitigate any potential negative impacts. This supports the overall acceptance and ownership of the UVAR scheme.

On the other hand, SUMP objectives might only be met by introducing a scaled solution that can reduce the number of (certain types of) vehicles within a given area of the city. Integrated solutions consist of a pull and push elements: measures that persuade and incentivise sustainable behaviour is combined with measures that actively prevent undesired behaviour.

⁴ SUMP Practitioners Guide on Parking

UVARs might originate from other policy fields, for instance environment and climate. Still the implementation and effects are situated in the mobility sector.

These are some of the objectives that can be achieved by implementing UVARs:

- Space reallocation for Public transport, cycling, walking and other urban functions (greenery, retail, restaurants and bars)
- Road safety, e.g. by means of time windows or zonal regulations for Heavy Goods Vehicles (HGVs)
- Air quality improvement, through Low Emission Zone, Ultra Low Emission Zone, Zero Emission Zone or traffic limited zone, in order to reach EU legally required or WHO advised limits
- Quality of life improvement, through maintaining access to but reducing the ability to drive through a district (reduced permeability), e.g. superblocks approach
- Reducing congestion, also resulting in several secondary benefits (better air quality, energy use, less noise etc.)
- Economic development, by means of congestion relief, market creation for new freight operational models etc.
- Noise reduction, e.g. by HGV restrictions at night
- City image and attractiveness improvement, by means of overall reduction of car dependency and use
- Working towards climate goals
- Overall effects on public transport use, fleet characteristics, sustainable mobility and freight operations.

Often, UVARs serve a combination of objectives.

Good Practice: Vitoria Gasteiz's (ES) 'Superblocks' scheme aims at enhancing mobility as well as citizens' quality of life by reducing the negative impacts caused by the extensive use of private cars and through better use of public space. A Superblock is a delimited city area designed and regulated to ensure the safe co-existence of pedestrians, cyclists and private car traffic. The Superblocks scenario allocates up to 70 per cent of public space to pedestrians and cyclists. It has demonstrated great potential to reduce levels of harmful emissions, as well as noise.

Good practice: Groningen is an interesting example of traffic scheme introduced in 1976 (first city on the continent to implement the Buchanan principles) leading to restricting of through traffic in the city centre, creating a more bike friendly environment,. The traffic scheme can be seen as the starting point for Groningen to evolve to (one of) the most bike oriented cities in Europa (modal share around 60%).

2. The 8 SUMP principles in the context of UVAR

2.1 Plan for sustainable mobility in the 'functional city'⁵

Cities normally apply UVARs in the most dense, congested and polluted city sectors – often the city centre. In some cases, measures can be ‘nested’ at neighbourhood level because severe problems appear. Superblocks are a measure that can be implemented in such circumstances, or a tighter LEZ within a less strict LEZ. The UVAR is often best applied to a ‘recognised area: a territory with clear, historical or infrastructural boundaries. This facilitates the communication, routing, signage and digital mapping of the zone.

However, while the actual UVAR is usually applied only in a part of the functional urban area, the impacts for travellers and hauliers go far beyond. Measures that help to maintain the level of mobility and access (so called ‘accompanying or supporting measures’) as well as information schemes need to be designed for the full functional urban area (or even beyond).

The fact that certain vehicles cannot enter a designated zone can have positive and negative boundary effects: e.g. parking pressure or detouring traffic just outside the zone can cause additional burden to inhabitants. On the other hand, modal choice, travel behaviour or vehicle choice can be made at origin, and will relieve the problematic traffic situation for the whole functional area. In this sense, the access regulation scheme, however sized, will impact on modal split beyond the areas of high pollution or ‘hot spots’ where it is located.

With the competence to manage local roads, comes great responsibility. Cities indeed hold the competence to manage local roads, regulate traffic and local taxes. They have the responsibility to safeguard the quality of life and health of their citizens. When implementing UVARs, they should be aware of the broader impacts outside their territories, on road users from outside their territory. Some city centres are the only regional attraction pole for jobs, education, health care... Other cities (e.g. cultural or tourism centres) attract travellers from far beyond the borders.

The impacts of UVARs on the peri-urban and rural hinterland should be carefully considered. An understanding of the actual origin and destination of trips in the functional urban area should be present, as well as an appreciation of trip purposes. This can help to design a better optimised and fairer UVAR scheme. This also means that in the preparation of the UVAR, the simulations and Air Quality/Traffic models should (if possible) forecast impacts beyond the central UVAR zone – particular for larger urban areas. It is also these models that can help provide an evidence base for determining the actual size of the zone where the UVAR applies, as well as its impacts. Needless to say, any other impact assessments done would also benefit from including the larger area.

2.2 Develop a long-term vision and a clear implementation plan

UVARs are implemented to solve immediate and urgent problems with regards to aspects such as road safety, air quality or congestion. The acceptance of the UVAR by road users is

⁵ EUROSTAT/OECD: a functional urban area consists of a city and its commuting zone. Functional urban areas therefore consist of a densely inhabited city and a less densely populated commuting zone whose labour market is highly integrated with the city (OECD, 2012).

dependent on understanding and experiencing the need and urgency. So how can UVARs play their role within a long-term vision?

Such a long-term vision will not only look at air quality, modal shift, quality of life and use of urban space. In addition, it provides the perspective to offer multi-modal access to city dwellers in a context of demographic growth. Cities face an increased demand for mobility of people and goods – but usually without the possibility or desire to expand the road network.

Early adopters of traffic limitations for through- traffic as well as pedestrianisation schemes, have over 20 years of experience. Those with LEZ schemes, and congestion charge implementers have over 10 years experience. These schemes show long term positive effects. The documented change that is experienced by these frontrunners can serve as an example to those cities looking into UVARs now. The implementation timeline for a first phase of UVAR deployment ideally does not go beyond a local legislative period, in order to create a coherence between the local policy vision and the actual measure implementation.

With regards to the implementation plan, ideally this is concise and simple. There are advantages to a scheme being simpler, in implementation, understanding by decision makers and institutional stakeholders, as well as end users. This leads to better compliance.

The long-term vision for UVARs relating to Air Quality

The broader framework in which many air quality-focused UVARs are set is the EU vision on changing urban fleets as described in the EU's White Paper on transport (COM/2011/0144 final): halve the use of 'conventionally fuelled' cars in urban transport by 2030; phase them out in cities by 2050, achieve essentially CO₂-free city logistics in major urban centres by 2030. UVARs addressing specific vehicle categories in view of air quality can be seen as first steps to accomplish this vision. These same UVARs can then be extended to address other goals.

UVARs are often best designed in a phased approach, where – depending on the extent of the air pollution issue - criteria to enter the zone first ban older diesel vehicles, potentially starting with heavier or delivery vehicles or in a smaller area, and progressively ban more recent vehicles or higher EURO/Euro Class vehicles (including petrol). The geographical coverage of the area can also be extended over time. Phasing also gives vehicle operators time to adapt, and tackles the worst offending vehicles first. A longer vision (2030 and beyond) could include a total phase out of internal combustion engine vehicles. This phased approach should be communicated early on in the process of UVAR planning, so that all stakeholders can prepare and comply, and enable them to make a choice that will give the longest compliance (and the most beneficial scheme impacts). The accompanying measures should be tailored to accommodate the phased schemes. Tighter standards can be implemented in smaller areas, in nested schemes, where they suit the purpose. The timing of the phases should be carefully matched with the availability of vehicles, retrofit options or alternative transportation offerings, in order to encourage optimal compliance decisions to be taken.

Although the overall and average fleet characteristics will evolve positively over time, UVARs related to air quality can speed this up, and play an important role to ensure the local air quality situation.

2.3 Assess current and future performance

Due to the fact that access regulations can be very politically sensitive, require up front investment, and come with the ability to have high impacts, the appraisal of future schemes has been well studied and documented. Cities can definitely look at practices in other cities, in publicly available documents to help gain support and confidence in such schemes, as well as learn from best practice to enable 'learning shortcuts' and avoid potential pitfalls.

The assessment of potential impacts before a mobility measure is implemented is a complex matter. Impact should be assessed quantitatively as well as qualitatively. Distinguishing between factors influencing impacts can be difficult. Often local issues and traffic measures (LEZ/road works/freight restrictions/incentive schemes) coincide, and society as a whole is changing in parallel (e.g. e-commerce, employment, demography, national policy etc.).

Parameters related to issues which the UVAR aims to tackle should be monitored over time both inside and outside the zone in question – and ideally be in place as long as possible before the scheme starts. Beyond official monitoring data, appropriate and trustworthy measurements carried out by third parties (e.g. citizens measuring air quality) where available, could be taken into account to identify possible inconsistencies and needs for additional official measurements.

Cities have access to a variety of methods to pre-assess the implications of a UVAR: Impact assessment (determining what effects will be), feasibility study (determining the financial and practical issues relating to UVAR implementation), cost-benefit assessment (mapping societal costs against societal benefits), cost-effectiveness assessment (mapping at what cost the UVAR's goals can be met), ...

'Paralysis of analysis' where the duration and detail of the studies before coming to a decision delay and hamper the actual implementation, postponing the solution for urgent problems, should be avoided. The assessment should be appropriate and proportional to the size of the scheme and city, to its expected implementation cost, impacts as well as to its controversiality. A large complex scheme in a major city would require more assessment than a fairly minor standard scheme covering a few streets in a small town.

Future performance can also be shown by means of experiments: temporary zonal access management, alternative use of street space, events impacting on motorised traffic circulation, car free day etc. They all can give an impression of how a city changes when less motorised traffic is running in its streets. Experimental schemes should be carefully planned, documented and monitored, according to the expected impacts, targets chosen and indicators selected.

It is clear that the performance should be assessed against the policy goals (e.g. EU AQ directives targets), but there is more: UVARs are challenged for their adverse negative impacts: decreased mobility or access, deteriorating local economies etc. These issues should also be captured somehow in measurable indicators where possible.

2.4 Develop all transport modes in an integrated manner

UVARs are by excellence multi-modal measures. UVARs are put in place to enable behavioural change: modal shift, re-routing, using other vehicle types. While access to the zone might be regulated and limited for (specific) motorised vehicles, it may remain open to

other modes, that may find more space and become the alternative way to enter the zone. Not all UVARs induce modal shift however. Low Emission Zones target the exclusion of certain polluting vehicles, and impact on modal choice is not documented. A shift to cleaner vehicles can be expected.

Most UVARs include packages of accompanying mobility measures to compensate those who would need a significant or costly change of behaviour both directly (by grants for retrofitting) and more importantly 'indirectly' by offering and improving alternative modes, facilities or options. These solutions are using modes other than those affected by the UVAR. UVARs in this way can also be enablers for new mobility services, and new operational models for moving goods and people. Single ticketing and simple payment solutions for public transport and shared mobility services (or Mobility as a Service) can encourage multimodality and offer viable mobility alternatives in urban areas with access restriction. If presented in an appropriate way, the UVAR can provide the additional push that can make new mobility services attractive to use.

The modal integration applies to movement of people as well as the movement of goods. Although 'goods don't vote', the overall traffic and economic performance of cities (and city centres' in particular) depends highly on how last/first mile, local freight and logistics flows are organised, and UVARs can provide an enabler to improve this, if carefully planned. Inspiration on this issue can be found in the topic guide on urban freight/Sustainable Urban Logistics Plans.

2.5 Cooperate across institutional boundaries

The most important inter-institutional cooperation with regards to UVAR is the UVAR implementers compliance with European, national and regional legal requirements with regards to management of the road network. UVAR measures need to be compliant and coherent with national and EU law⁶.

Cooperation between different governance layers at national and European level is key, and should be fostered to make the UVAR a success in many regards, enforcement not the least. Enforcement of foreign vehicles will often need cooperation with the national level, as well as other Member States. Scheme compliance will also be better if the message about the UVAR is communicated to the right audiences – thus including audiences outside the own city boundaries. National frameworks can support the implementation of UVARs, and potentially restrict the variation within a country – with the advantages and disadvantages that brings. National laws – or absence of them – can hinder some schemes.

Cities are also dependent on the institutional setting with regards to the accompanying measures: does the city that implements UVARs have the actual competence or leverage to enable all the alternatives? In case that the city is part of a broader Public Transport Authority, the additional public transport offer will need to be negotiated. The same applies to park and ride (P&R), which could be situated outside the municipal boundaries, but could determine the success of the functional urban area's access policy. In case of commercial services, such as

⁶ EU legal issues: Freedom of Movement, Proportionality, and non-discriminatory. UVARs can affect the TEN Network (eg Austrian motorway LEZ), but there are significant restrictions to this, and it must be done carefully, and in consultation with the Commission.

those operating new or shared mobility services, or freight facilities, there might be the need to actively attract the additional required capacity on offer.

Institutional cooperation should happen also within the city services. The UVAR planning and implementations makes cooperation between departments dealing with spatial, mobility and air quality planning necessary. This coordination should be carefully crafted and can be part of a bigger interdepartmental and inter-agency / authority coordination within the framework of the SUMP.

Data management and sharing is an essential part of the institutional cooperation. Information on UVARs needs to be disseminated to all stakeholders that may be affected, be they near or far, regular or irregular – those who do not know about the scheme cannot comply with it. Under the ITS Directive, countries are establishing National Access Points (NAP)⁷ for traffic data, that will in time also carry UVAR related information to help disseminate the information more widely. But also locally, data needs to be shared in an open setting – essential to properly inform users inside and outside of the UVAR zone. The UVAR systems have the potential to generate interesting mobility data, that can be exploited by third parties. This can help increase knowledge and compliance of schemes, and reduce complaints.

Finally, the city will also have to cooperate beyond the public sphere, and create partnerships with the private sector, as a generator of trips, handler of goods or provider of mobility solutions. These partnerships can help to take the UVAR into a solution-oriented environment by facilitating improved mobility options.

Good practice: London (UK). The Mayor of London issued an Environment Strategy in 2017. It ensures that London is 'greener, cleaner and ready for the future and looks at every aspects of London's environment, including a.o. air quality, climate change and energy ambient noise. The document provided the framework for the Mayor's Transport Strategy 2018, including the establishment and continuation of the London Congestion Charge, Low Emission Zone and Ultra-Low Emission Zone.

2.6 Involve citizens and relevant stakeholders

The general rule in policy making applies to UVARs in particular: Communicate well!

The UVAR scheme should include a thorough, well-developed and well-resourced (in budget, skills and mandate) public involvement strategy that covers the planning phase and continues after implementation. There is a simple reason for why citizen and stakeholder involvement is important: it makes better schemes! Well designed and communicated schemes also lead to higher acceptance, compliance, and thus higher impact and less resistance.

Here as well the scale of the UVAR will shape the participation process. It should be proportional to the size and scope of the UVAR scheme. It is generally recommended not to design specific procedures for the UVAR planning and implementation, but to follow existing

⁷ https://ec.europa.eu/transport/themes/its/road/action_plan/nap_en

procedures. In this way, legal certainty is assured, and UVARs are treated as any other planning or traffic measure.

The strategy should cover, in consecutive order:

- A stakeholder map, establishing a full picture of who is affected by or involved in the UVAR implementation. These stakeholders should cover all modes, all trip purposes, and include professional as well as private road users, as well as those who will benefit from the scheme – including those that may not need to change their behaviour. Stakeholders can be situated within and outside the UVAR zone and the city. Here the functional urban area can be seen as a logical outreach area (see section 2.1).
- For some of these stakeholders, there may be existing communication channels; neighbourhood committees, or committees that bring together local business and retailers with the public sector, communication channels with the freight sector, motoring clubs, trade bodies etc. Such channels can be purposed to support the dialogue on UVARs. A specific, and important group are priority vehicle users (fire brigade, police and ambulances). These vehicles should keep access at all times and places.
- A user needs/concerns assessment can be conducted, to gather views of road users / citizens / stakeholders.
- The public involvement should be phased:
 - o starting with gathering representatives from key stakeholder groups at the earlier planning stages to raise key concerns;
 - o followed by formal consultation at a later stage. In the formal consultation. It is recommended to focus on the detailed design of the scheme, not on the overall need for access regulation;
 - o once the scheme is confirmed, the communication should focus on informing drivers about the scheme – as long before the implementation as possible to give them time to adapt;
 - o an approach for continued up-to-date information to drivers and citizens once the UVAR is up and running should be developed. This is key to the compliance with UVAR schemes.
- The communication strategy should ensure a good mix of communication channels. Information on trends in the key indicators that track the UVARs performance can help increase support. Stakeholders should receive a sufficiently developed framework to provide informed input, but this framework should not entail that there is the perception that everything is decided.
- Communication and information dissemination should also include the visibility of the UVAR in the digital sphere Integration of information in route planners and navigation devices should be explored. The above mentioned National Access Point for digital transport data will enable machine-readable, standardised information on UVARs to be available to other service providers, such as Satellite Navigation Devices, route planners, Apps or websites to help facilitate this. The UVAR requirements of the Single

Digital Gateway (SDG)⁸ to provide UVAR information on national and city websites linked to and searchable through MyEurope, will help to coordinate the information available EU-wide. For this to work, each city needs to provide good quality UVAR information on their website, as well as national UVAR websites. The European UVARs Portal helps disseminate information around Europe⁹, (especially until the SDG and NAP have complete data for UVARs).

Where schemes are reactive (e.g. emergency pollution schemes), special attention is needed on disseminating the daily information.

2.7 Arrange for monitoring and evaluation

The monitoring and evaluation issue is closely linked to the ex-ante assessment of the UVAR (the cost-benefit analysis, feasibility or cost-effectiveness assessment). Policy objectives, targets and indicators that are selected there, should be maintained in the monitoring and evaluation and should be planned from the onset of the UVAR planning and design. The principle that core indicators as well as circumstantial indicators (relating to economic performance, tourism, retail etc.), should be tracked also applies to this SUMP principle. Indicators relating to perception and opinions could also be collected, e.g. through surveys or focus groups.

This raises an important question: When is a UVAR a success? Is it through the compliance – shown by low number of infringements? In high acceptance – when the measure is liked and appreciated? In general, the advice is to see the UVAR as a mainstream measure, without the need to invent a new monitoring and evaluation system. This should be part and parcel of the overall SUMP evaluation approach and culture. It would not be productive to only monitor and evaluate the UVAR, and not the rest of the SUMP measures. The integration of the evaluation and monitoring in the overall SUMP Evaluation and Monitoring approach, can also help to understand different effects of coinciding measures, and the relation between the UVAR and its accompanying measures. Identifying the impact of a single SUMP measure such as an UVAR can be difficult. There are different methods that have been used¹⁰, and guidance for assessment may be available at national level.

If applicable, an independent evaluation should be considered, e.g. by a representative panel of stakeholders and experts, or by a specialised university or a laboratory to measure air quality. This will help to understand whether the UVAR schemes are appropriate and deliver expected results. The applicability of such an independent panel depends on the controversy of the measure in operation, and again, about the proportionality of the whole evaluation effort.

Scheme evaluation results should be transparent, understandable and publicly available. They should also be useful. In coordination with the communication team, a realistic pace of reporting should be established: What is a reasonable timeline to see the evolution of indicators, when is it too early to draw conclusions etc.?

⁸ https://ec.europa.eu/growth/single-market/single-digital-gateway_en

⁹ <http://urbanaccessregulations.eu/>

¹⁰ ADEME Study, Sadler Consultants, 2011

Good practice: The Antwerp Low Emission Zone (LEZ) is evaluated with an annual comparison of the vehicles entering the LEZ against the Flemish regional fleet composition. (fuel and euro-norm). This evaluation provides information on the shift and transition that the implementation of the LEZ is creating. The city has also extended its network of reference air quality measurement stations, in cooperation with the VMM (the Flemish Regional Environmental Agency), responsible for the EU-legally required air quality measurements).

Good practice: Cracow (PL)

A study, assessing the results of the implementation of restrictions on traffic and parking of cars, introduced over the last decade in several locations in the city centre of Cracow was conducted by the Cracow University Comment: when?. The information obtained and own observations show that the transformation of car parks into city squares attracted new entrepreneurs who wanted to invest in these areas, and a greater number of facilities and the presence of other attractions resulted in an increase in the number of visitors to these areas, who stayed there longer.

Based on the results of research on the changes in the size of income of the owners of the facilities, it can be concluded that the application of restrictions generally did not cause significant changes in the size of income or the changes in income are not identified with the restrictions. And even if the implementation of the restrictions did not produce a significant increase in the income of the owners, it generally did not cause negative impact on the revenue and this is what the owners are always most concerned about. In the case of facilities located at Grodzka Street this conclusion is confirmed by the data obtained from the Tax Office in Cracow. What is more, the increase in income, coincides with the highest activity in the city centre.

Important is that a very high percentage of owners - 75% for all locations in total, would not want to restore the previous state without vehicle access regulation. A very high degree of satisfaction with the quality of analysed areas (on average 83%) is also observed among the customers of the facilities located in these areas. They are primarily satisfied with the absence of cars in these areas, while enjoying the presence of structural landscaping and historic buildings, as well as a unique atmosphere of the place. Moreover, only a negligible share of respondents see problems in accessing these facilities. Currently, respondents get to these facilities mainly on foot or by public transport, visiting facilities less frequently than once a week, or occasionally, when carrying out other activities in this area of the city.

2.8 Assure quality

The quality of the UVAR has many dimensions: Does it help to accomplish policy goals beyond its current objective? Can it solve urgent, current problems, but also enable longer-term effects: modal shift, better quality of life, or a different city image?

An element of quality is the ability to change the scheme on the basis of monitoring and evaluation results. This means there should be sufficient political, regulatory, operational and

technological room of manoeuvre to adapt the scheme in order to improve it. This adaptation can be made to the UVAR itself, but also apply to the way it is communicated, or how accompanying measures are shaped and scaled.

The compliance, the number of appeals and complaints can be a good indicator for the quality of design, communication and handling of the enforcement process. Overall, it is clear that a transparent, understandable and swift process of handling appeals against fines or retributions is part of a qualitative scheme. Specifically for the quality assurance, external inputs can be of great value. External expert panels can help to avoid tunnel vision and bring facts and methodologies that are not available within the city services.

3. SUMP steps for UVARs

3.1 Set up and analysis

In this phase, the measures that will be part of the SUMP are not yet on the table. To ensure that a UVAR could be part of the eventual action plan mainly requires an open attitude towards UVAR as a building block for local mobility policies.

The following should be considered:

- Conduct a broad scoping of problem areas relating to urban mobility. Other policy departments might encounter problems that find their solution in regulating access: the LEZ has been mentioned as a tool to solve air quality (AQ) issues, but access to culture and heritage sites in the city centre could also benefit from a well-designed pedestrianisation, coach routing and parking or access scheme. Safe travel to school might be a factor to take into consideration as well. A close cooperation and further cooperation between different departments might be required.
- When brainstorming and compiling the toolbox of all potential measures and solutions trajectories for the SUMP, it should contain solutions that include pull as well as push measures. Persuasive measures based on an increased availability of transport services and transport infrastructure should be accompanied by measures that regulate and limit motorised transport.
- Collection of data that is relevant for problems that can be solved by UVARs, and that relates back to the policy objectives mentioned in section 1.2.
- It might be useful to check to what degree the city is ready for UVAR planning and deployment, and this in several areas:
 - Governance: Are the policy priorities clearly defined? Is the legal context in place for UVARs? How can the UVAR be financed?
 - User needs: What is the current/desired mobility behaviour? What is the vehicle ownership rate, and what types of vehicles are owned by our citizens, businesses and visitors? What is the attitude, availability and current uptake of alternatives of private vehicle use? How is this affected by the demography and socio-economic situation of the travellers?
 - Mobility solutions: What is the current modal and space split? What is the availability and cost of alternatives? What is planned over the coming years in terms of improvements in this field?
 - System design/ technologies: What data is available for the city to take informed decisions? How connected are the users, and the vehicles using the urban road network? Are there technology or ITS systems in place – owned by the city – that can be used to deploy the UVAR?

3.2 Strategy and development

This will be the phase where the planner should consider if the UVAR is needed, or whether other measures may be more or as effective, at a similar cost. Citizen- and stakeholder involvement is key for this phase, as the ground for future buy-in and acceptance will be

created here. It is the phase where the planner needs to ensure that push and pull elements of the SUMP are well balanced and that an UVAR is incorporated and integrated with the SUMP, and does not stand alone.

It may be challenging to make the relation between the vision and the access regulation explicit. The planner will have to explain that the positive, motivating image that is created for the future mobility system in a city, can only be met when certain vehicles types and numbers are rerouted or excluded from certain areas in the city. This relation can be made explicit by introducing UVAR aspects into the scenario building that encompasses this phase, including the modelling of policy measures packages.

3.3 Measure planning

The following actions should be taken into account in the measure planning phase of the SUMP if a UVAR will be part of the SUMP action plan. Based on the strategy and other implementation factors, a time plan to implement the different phases of the UVAR should be developed. This supports the process of reaching more ambitious goals with the UVAR as time progresses.

- The boundaries/zone to which the UVAR will apply should be determined (see section 2.1).
- The access characteristics should be defined and tested for effectiveness.
- The action plan should include the necessary accompanying measures (see section 2.4 and 4.2).
- The legal basis and enforcement mechanisms should be clarified and published.
- The institutional stakeholders outside the city should be involved in a coordination of communication and accompanying measures to make the UVAR a success. (see section 2.5)
- It can be very beneficial, particularly for large and more complex schemes, to model different UVAR scenarios to identify the scheme to adopt, This scheme (which may be a combination of the different scenarios) then needs to be modelled to assess its impact
- The technologies used to manage and enforce the UVAR should be selected. In terms of enforcement mechanisms, automated enforcement may be more expensive to implement but more effective and cheaper for good compliance. Manual enforcement can be cheaper and quicker to implement, but expensive and difficult to implement in an effective way.
- A data strategy defining the conditions and parameters for collection, storage and exploitation of the UVAR related data should be established.
- A communication, consultation and stakeholder involvement strategy should be established.

As part of an overall approach, it is important not just to consider managing certain types of vehicles, but instead to manage the allocation of road space for all road users. For example, if only freight vehicles are targeted by means of delivery windows, then the road space they free up could fill with other vehicles, potentially making congestion and air quality worse. Given this

fact, it is crucial that urban freight policy is considered together with other urban mobility policies, with policy makers seeking to strike a balance between all road users.

3.4 Implementation and monitoring

When starting the UVAR's actual roll-out, a trial period can be considered. This can be useful in some cases to test systems and procedures, and measure initial impacts. The trial needs to be very carefully planned and sufficiently funded, as a poorly implemented trial could backfire. The implementation should be preceded by an appropriate media outreach to inform the users of the urban road network to which access conditions will change. This can be best combined with the abundant provision alternatives before implementation: road users can experience the alternatives and start to change behaviour before the UVAR is in effect.

The implementation needs to be considered in the planning, in terms of feasibility etc. Timescales also play a role here, to make sure that what is planned is possible to implement, either within the electoral period of those deciding on the scheme, or with sufficient cross-party support to be implemented over several electoral periods.

The evaluation and monitoring aspects of the UVAR have been described in section 2.7. It is important that the evaluation is appropriate and proportional to the measure's scale and level of sensitivity. Authorities should be clear about the indicators that will be tracked, presented in a reasonable timeline of outputs. Given the fact that UVARs are part of integrated packages of measures, it might be difficult to assign specific impacts to specific measures in the package of mobility measures. The importance is to deliver an efficient and effective system.

An ongoing monitoring of media coverage and social media feedback on the scheme could be pursued, as well as direct dialogue with a selected user panel to collect feedback about the implementation.

Most importantly, in the case of low-emission zones, pollutant concentration (mainly NO₂ and PM) within and outside the LEZ should be monitored and evaluated against the limit values set out in the Ambient Air Quality Directive.¹¹ This should be done primarily thanks to data collected by official monitoring stations, but citizen science measurements – although not as accurate - can indicate trends on a wider scale about the evolution of pollution in specific areas.¹² For instance, the Netherlands are exploring ways to take citizen measurements into account in their policy-making, including via an interactive map.¹³ Similarly, Bologna invites citizens to measure air quality themselves, in order to expand their knowledge of the issue while raising awareness about air pollution.¹⁴

Additionally, remote sensing technologies such as already deployed in several European cities¹⁵ will help monitor real-world emissions of cars entering the low-emission zones. This

¹¹ <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32008L0050>

¹² For recent activity from the JRC on this issue: <https://ec.europa.eu/jrc/en/publication/evaluation-low-cost-sensors-air-pollution-monitoring-effect-gaseous-interfering-compounds-and>

¹³ <https://samenmeten.rivm.nl/dataportaal/>

¹⁴ <http://www.fondazioneinnovazioneurbana.it/laboratorioaria/>

¹⁵ <https://www.trueinitiative.org/>

way, the highest emitters can be identified and action taken accordingly on the basis of real-world data.

4. Specific points of attention with regards to UVARs

4.1 UVAR: stakeholders ownership, acceptance and buy-in

The stakeholder ownership, acceptance and buy-in of UVARs is closely related to the item 2.6 “Involve Citizens and relevant Stakeholders”. There are several good reasons to carefully look into the acceptance of the planned UVAR: Firstly, Local policy makers want to take measures that are positively appreciated by the electorate. Secondly, poor acceptance or even resistance can stop the UVAR – a scheme representing an important public investment. These schemes are implemented for their substantial positive impact. In this sense, it would be problematic if the UVAR would be stopped before reaching its goal, or before other solutions for the problems the UVAR solves are put in place. . By ensuring a cross-party and society-wide acceptance of the UVAR, its continuation across local legislative periods can be ensured.

There are several ways to improve the acceptance:

- The UVAR should address a clear and recognised objective, either solving a problem or creating opportunities.
- Before deciding upon UVAR implementation, an assessment should look at different measures and the necessity of the implementation of a UVAR. The appropriateness and proportionality should be the starting point and should be addressed in dialogue with the stakeholders.
- The scheme should be well-designed. Several design requirements have been mentioned in chapter 3. The design of the package of accompanying measures is crucial in this regard. The availability of good alternatives to the ‘old’ travel option, is the most crucial step towards publicly accepted UVARs. The design should also allow for adaptability, to adjust and improve the UVAR and its package of accompanying measures, to face new or un-expected issues that can reduce acceptance.
- The scheme should be well-communicated. Several communication requirements have been mentioned in the chapter 3. The communication should consist of making positive impacts clear to all stakeholders (businesses and public) concerned by the UVAR. Once the scheme has been decided on, good communication is essential so it can be complied with. Communicating the impacts can help acceptability.
- Key politicians or other persons that enthusiastically supports the UVAR (so-called ‘champions’- for instance trusted stakeholders or community groups), can help rally support for the scheme and facilitate the scheme to be implemented.

Beyond acceptance

Stakeholder or user acceptance conveys the idea that the UVAR planner is mainly concerned by the reaction of users to a solution that is already designed and implemented without the stakeholders’ involvement.

It is clear that proper UVAR planning should go beyond this, and start from an early involvement, and anticipation of user needs and views.

- Demonstrations, trials and experiments can sometimes help create an understanding of why the UVAR is necessary and what its impact will be. Positive impacts can be highlighted and experienced.
- Citizens and stakeholders should experience that the system is fair and transparent: fair means that the enforcement is balanced and reasonable, and that the exemptions to the UVAR exist and are granted in a justifiable manner. Transparency means that there is clarity about the use of revenues (if any) and that the UVAR is implemented to reach its objectives, and not seen as a hidden tax. Positive impacts should also be made visible to the citizens and stakeholders.
- The phasing of the UVAR, with tightening standards or expanding zones can help acceptance. The idea that citizens and road users can gradually adapt their behaviour, and that fleet owners can plan for improved vehicle characteristics, makes the scheme more acceptable.

What car drivers want from UVARs

- An evaluation of alternative measures should be envisaged to see if the UVAR is the appropriate solution.
- The government implementing the UVAR should create an understanding of regulations, costs and impacts.
- The rules for the UVAR should be transparent.
- Occasional and foreign users should not be discriminated against.
- There should be information available to assist trip planning. (Information provided by the FIA)

How to assess acceptance? There are several methods (surveys, focus groups, (social) media screening etc.). It is important to regularly address the overall appreciation of the UVAR as part of UVAR planning and project meetings. Different parties involved in implementation (not the least local politicians, on a daily basis in contact with city-related stakeholders) can bring together their views on this. The public participation activity is also an important channel to collect stakeholders views.

This being said, UVAR implementers must accept that ‘there will always be an opposition’. It is the art of the deal to keep communication lines open – even with those that oppose the measure, to be factual and transparent, and to run a UVAR scheme that actually delivers the policy goals. Once the scheme is decided, communication and discussion needs to focus on compliance, rather than whether the scheme should be there.

4.2 UVAR as part of an integrated package of measures

The SUMP aspects of UVAR come into complete perspective when looking at the integrated packages of measures that accompany the UVAR. The SUMP will match the regulating and restrictive push factor of the UVAR with measures that create incentives for change, being mobility management or infrastructure adaptations. The combination of the UVAR with other measures, can help the political negotiation and increase the public acceptance. This issue is closely linked to the principle ‘Develop all transport modes in an integrated manner’ developed in section 2.4.

The right package of measures, together with the right timing, can increase the impacts. It can also improve the techno-practical feasibility of UVAR (e.g. the fact that there is sufficient

capacity in public transport and that new/smart mobility services can absorb the share of motorised users that chooses not to pay a congestion charge). A balanced packages of compensating measures shows to the citizens that policy makers look after those that are asked to change their behaviour. It brings more fairness to the system. Finally, for those UVARs generating revenue, the accompanying package can be funded by the ring-fenced revenue of the scheme. Road users then see how their contributions return to the transport system and making it better.. It should be noted that most UVARs do not generate revenue, but will cost to implement and run, as the city would prefer compliance to meet the objectives than fines paid.

An important question is how to distribute the compensating or accompanying measures across the modes, and to choose whether to allocate additional resources to new or upgraded infrastructures (park and ride, bicycle paths, improved public space, interchanges) or improved services (public transport offer, new mobility services, shared bikes etc.). The balance (or split) between capital and revenue spending needs to be well-planned. Modelling or other assessment methods can show the measures in the long list of options that are the most (cost-) efficient.

Accompanying measures may also be situated within the competences of regional or national authorities. For example, grants for retrofitting vehicles or to support modal change have been used in a number of cities, regions or countries.

Specific attention should go to accompanying measures for the freight sector. Measures such as consolidation, or last-mile solutions require specific location that need to be linked to zone design. These freight schemes entail more complex value chains than passenger transport: the UVAR may be one element that can drive their deployment, but integrated freight strategies are needed. An ongoing dialogue between the city authorities and the freight sector can help.

In the ideal case, the UVAR scheme includes an up-front provision of alternatives: Users can then experience the new travel and transport options before implementation.

4.3 UVARs and freight: ideas for mitigating solutions

The EC's study on urban freight¹⁶ included a specific sub-report on UVARs and freight. Stakeholders identified two preferred UVAR schemes for addressing local challenges related to urban logistics: Low Emission Zone (LEZ) and Congestion Charging (CC). The study defined mitigating solutions:

- Urban Consolidation Centre (UCC);
- Cargo bike (CB);
- Off-hour deliveries (OHD).

As a first guiding solution, Urban Consolidation Centres are proposed. UCCs are defined as a logistics facility situated in relatively close proximity to the geographic area that it serves (e.g. a city centre, an entire town or a specific site such as a shopping centre complex), to which many logistics companies deliver goods, and from which consolidated deliveries are carried

¹⁶ 2018, Study on urban logistics – “the integrated perspective” as consulted on https://ec.europa.eu/transport/themes/urban/studies_en

out to businesses within that area. Within the UCC, a range of other value-added logistics and retail services can be provided.

The effectiveness of UCCs seems to depend heavily on the presence of appropriate local regulations, including vehicle access rules for the zone covered by the UCC and benefits accorded to UCC operators. Public authorities can put legislation or other regulations into place to promote the use of the system that is being offered. These regulations can be restrictive (requiring or strongly inducing vehicles to use UCC) or founded instead on advantages accorded to users. It should be stressed that this should be linked to dialogue with stakeholders.

Cargo bikes are used for final freight delivery to reduce congestion in cities, and are a second mitigating solution for logistics activities in UVAR schemes. Given the advantages (no greenhouse gases emission, low kerbside space, easy to manoeuvre), and disadvantages (limited payload weight, low travel speed) of cargo bikes, it would appear that they are best suited for the distribution of products with a relatively low bulk density and size and which demand simple storage or handling requirements.

Suppliers schedule deliveries to meet the demands of their clients. If the retailers require deliveries during normal working hours, most lorry traffic will occur during the most congested daytime traffic periods. If a critical mass of businesses is able to adjust their schedules to accept deliveries when there is less traffic congestion, it could enable transport companies to deliver goods more quickly and at lower cost. This could result in less traffic congestion, reduced cost of goods, economic benefits and would be better for the environment.

Off-hour delivery (OHD) is therefore a third solution. It is a simple concept, but it can be challenging to implement because the benefits and costs are not always evenly distributed. Carriers generally like the idea because it can save them time and money, but customers often resist it because it can add costs. Communities will benefit from lower congestion but may have concerns about night-time noise. Sometimes, special incentives are needed to encourage businesses to participate, or requirements to mitigate noise disturbance. An OHD programme needs to be designed in a manner that balances the benefits and costs to make it practical for shippers, carriers, customers and the community.

The NOVELOG SULP (Sustainable Urban Logistics Plans) guidelines specify the creation of a multi-stakeholder platform for freight issues in a city: it is a mechanism for industry and local governments to work together in partnership to produce a tangible outcome to localised freight transport problems. This platform should be established to discuss all freight transport related issues, not only the UVAR. Ideally the UVAR should not be the first issue the group has to tackle, but has been in existence long enough to create trust and a productive working environment, that can deal with a major project such as a UVAR scheme implementation.

4.4 UVARs and occasional visitors (tourists, non-resident road users)

Particular attention to certain aspects of UVARs can be helpful from the point of view of occasional visitors and foreign vehicle drivers:

- Pre-registration of vehicles (i.e. online registration) is while unfortunate, often needed to identify foreign vehicles in the absence of an EU-wide solution.

- The possibility of post-registration opportunities for those accidentally entering the zone when they were not previously aware.

Within the category of non-resident road user, a specific user category to consider are tourists. These may be national or often foreign vehicle drivers that might speak a different language than the local language, and might be not acquainted with the local access regulation policy. On the other hand, tourists have actively chosen to visit a specific city, they appreciate the protection of historical sites, welcome the leisurely qualities of city centres, are often open for multi-modal solutions (if they add to the travel experience) and might have a certain willingness to pay for the appropriate answer to their needs (parking, entry tax etc.).

Cities that carefully plan their communication strategy should make sure it involves tourist actors (tourism board, hotels, points of interest etc.)

Also international or long-distance coach travel should be specifically looked at: this fast growing sector has currently a limited number of technology option to 'clean-up'; A specific coach routing, parking and access plan could be considered in order to meet the needs of the various audiences making use of coach services, as well as the possibility to retrofit to meet e.g. safety or emissions requirements..

Best practices: communicating with non-resident vehicle owners - Antwerp (BE)

In Antwerp vehicles who need to register before coming to the city entering the LEZ such as compliant foreign vehicles (<https://www.slimnaarantwerpen.be/en/LEZ/registration/overview>), but forgot to do so, can register 24 hours after entry. You can do this online or at one of the LEZ machines (<https://www.slimnaarantwerpen.be/en/LEZ/register-your-vehicle>).

In 2020 the euro emission standards for entering the LEZ will be tightened. An elaborate communication campaign to inform people about this will start end of 2019. This campaign will not only focus on our local population but also towards neighbouring countries, the UK etc.. Different channels will be used (radio, SEA google, signage at petrol stations, Ferry/ train from UK,..) . The signage at the higher road network entering our city is not managed by the city. We have explicitly asked the responsible government to implement and/or enlarge the LEZ signage on the road infrastructure surrounding our city. My comment: This box is a copy of an e-mail. Please rephrase.

4.5 UVARs and SUMP funding

An important myth about UVARs is that it brings cash to the city accounts¹⁷. Unless the scheme is specifically aimed at raising revenue (e.g. the Nordic infrastructure packages) or taxes frequent behaviour (e.g. congestion charges), UVARs generally don't bring substantial funding to the city accounts. On the contrary, they more usually cost to implement.

Some forms of UVARs, including LEZs, ideally do not bring any revenue. With the target being clean air the ideal situation is to have the least number of infringements as possible. The

¹⁷ As stated by CIVITAS SATELLITE UVAR Advisory Group members

revenues also decrease over time, as compliance to the set standards grows and fleet characteristics improve.

As mentioned before, the money flows surrounding the schemes, being investment, operation, revenue (through charging or fines), should be transparent. The societal benefits stemming from the UVAR can be monetised, although this is not always straightforward, and the beneficiary of the societal gains will not always be the local authority. For example, the societal benefits of road safety improvements, measured in the reduction of road fatalities, injuries or crashes, return to the individual, as well as the governance level that funds the health services.

UVARs should be managed in an economic and efficient way: the fact that up-front funding is required to finance the system as well as the accompanying measures needs to be depreciated over time, and needs to be budgeted. The system used to manage the scheme might be shared between several of them or by different traffic-related public services.

4.6 UVAR2.0: how UVARs might evolve

The timeframes of technological evolutions such as automation, vehicle fleet conversion (hybrid, electric, etc.) start to coincide with the plan horizon of SUMP (5 to 10 years). This has the consequence that when planning UVARs to solve current urgent issues, the future has to be prepared and taken into account in the schemes design

These are technological trends to take into account:

- The overall environmental performance of the vehicle fleet will improve, leading to better AQ legislation compliance, and requiring ever stricter LEZs if the AQ standards are still not met. Climate Change is an increasing factor in cities UVAR decisions and plans. At the same time, several Member States have stated target dates for phasing out conventionally fuelled vehicles. UVARs may evolve and be used for a different objective than for which they originally were designed.
- Vehicles will increasingly become connected, with each other, but also with urban infrastructures. Solutions such as geofencing¹⁸ start to appear on urban streets: It is being trialled in a number of places, and may in the future be relevant for Zero Emission Zones, or for the routing of Long Heavier Vehicles (Ecocombi), which due to their weight and length require specific infrastructure characteristics.
- The improved routing based on connectivity can make (temporary) access regulations 'embedded' or 'forgettable' as the driver has not to intervene to avoid the consequences of the UVAR: the vehicle will be re-routed, slowed down or switch to clean fuel mode (in hybrid operation) based on its location.

¹⁸ within specific zones, hybrid vehicles are switch to electric mode; trucks are slowed down in the neighbourhood of schools; trucks are rerouted away from bridges where they cannot pass due to their height.

Good practice: Oslo's (NO) Climate Budget is a key governance tool for reaching the targets adopted in Oslo's Climate and Energy Strategy. It budgets the city's CO2 emissions in a similar manner to the city's finances. This means that the overall emissions for transport are capped, and that measures are taken accordingly. Tolling is implemented to achieve this goal.

5. Case material

5.1 Early adopter: 1965: the closure of the old town of Siena (IT) to traffic: Limited Traffic Zone

Between the late 40s and the early 50s, in Siena there was a disorderly building expansion, which saw the construction of buildings even close to the medieval walls. With the advance of mass motorization, the situation quickly became unsustainable starting precisely from Siena, which, like few other Italian cities, had kept the medieval fabric of alleys and narrow streets.

In July 1962, the mayor Ugo Bartalini prohibited parking and circulation in the upper ring of Piazza del Campo, in addition to limiting the circulation of tourist buses. It was of the first concrete measure taken to contain traffic. The problem of cars in historic centres was not only in Siena or Italy, but in all of Europe. It was therefore necessary to eliminate the crossing traffic in the historic centres, allowing limited local circulation.

The council decided to intervene in 1965. The project for the new traffic regulation in the city centre was based on two key principles:

- create a central area reserved for pedestrian traffic,
- abolish the flow of vehicles in the historic centre, creating separate circulation loops: one north and one to the south.

After a change in local government, the traffic of crossing was partially reopened starting from September '66. However, the closure of the centre with the creation of the pedestrian island was not called into question and indeed in the following years the extension of the island began.

In August 1972 ,a new mayor extended the closed area, prohibiting entry to the city and resuming a course that with subsequent provisions has reached the present day.

In the 1980s and 1990s the Limited Traffic Zone (LTZ) was established on almost all the rest of the historic centre, divided into circulation and parking areas reserved for residents only. To the residents, the only ones authorized to parking in the centre, a permit of 50,000 lire a month was requested to be allocated to the increase in public transport, a very high cost. Again, this was an innovative experiment at national level. Construction of interchange parking lots in the suburbs was also started, creating a minibus network.

Since 1990 , after several years of closure of the historic centre to buses, the Municipality of Siena, in agreement with the transport company Train, introduced a minibus in the heart of the city called "Pollicino" to allow access to the narrow city streets, building on previous schemes, starting from interchange parking lots, where it would have parked the car who came from outside.

5.2 Madrid (ML)¹⁹²⁰: offering alternatives in view of vehicle regulations (Madrid Central)

In the past few years, Madrid has struggled with problems such as air pollution and heavy traffic. To approach the issue, Madrid plans to reduce the number of cars in the city, and to promote public transport and active mobility modes, also by introducing new mobility solutions.

- The BiciMAD bike-sharing scheme provides 2,028 electric bicycles on 165 stations across the city centre. The bicycles are available throughout the year.
- The two electric car-sharing providers, emov and Car2Go have 160,000 and 166,000 subscribers respectively. Together, they maintain over 1000 electric cars.

The access regulation measures include

- Reducing the space dedicated to cars in favour of more sustainable modes
- Parking permits related to pollutant level
- Social public transport prices
- Introducing alternative modes while removing parking

Madrid is actively encouraging a shift to cycling. It has doubled the number of shared bikes and extended docking stations beyond the M30 ring road for the first time.

EMT is seeking to position itself as a provider of sustainable mobility services of the future. The city has created its own Mobility as a Service application, MaaS Madrid, which aims to provide high quality and updated information on public transport and additional services in the Spanish capital.

In the smartphone application, MaaS Madrid, EMT gathers all of the mobility service providers operating in Madrid in a single interface. With the new app, the city of Madrid aims to position itself as a pioneer in mobility sharing and multimodal transport. It is part of measure 21 of Plan A for Air Quality and Climate Change of the Madrid City Council, which supports shared and multimodal mobility initiatives.

MaaS Madrid was launched in spring 2018 as a smartphone app. It provides users with different, more efficient and eco-friendly ways to travel across the city. It contains georeferenced information, allowing users to identify all of the mobility services available in their surroundings. Initially, it will contain public transport and the sharing services Bicimad, Car2Go, Emov, Zity, Muving, eCooltra, loscoot, Obike and OFO. It will also facilitate access to taxi services. EMT will gradually include more features, such as the calculation and comparison of routes, more customised options and the possibility to book seats, purchase tickets, etc.

By selecting the origin and destination of their journeys in the “MaaS Madrid” app, users can visualise the a range of options according to their preferences (the fastest, the cheapest, the least polluting trip, etc) and complete all of the necessary reservation processes, directly or through the provider’s app.

¹⁹ <https://www.h3bconnected.com/now-for-plan-a/>

²⁰ https://www.madrid.es/UnidadesDescentralizadas/Sostenibilidad/CalidadAire/Ficheros/PlanAire&CC_Eng.pdf

Gradually other services will be incorporated, such as the station-based car clubs Respiro and Blumove, with which the EMT is working technically to differentiate them from free floating car sharers. EMT practises an open approach and invited further companies to join the system.

In addition to serving the citizen, the city and the different operators that participate perceive the tool as an opportunity to develop their services and to extend public-private collaboration further. Ultimately it might even lead to a new model of urban mobility.

EMT also operates an extensive open data portal, providing statistical, dynamic and real-time data about the different services it provides (bus, public bike, mobility, parking), as well as instructions on how to integrate with your own applications.

5.3 Tolling for infrastructure investments: Trondheim²¹

Trondheim is one of the Norwegian cities that has the experience of more than a decade to invest in transport infrastructure and operation by means of revenue from a congestion charge. The results are positive, and the city has negotiated its third package of measures.

In 2008, Trondheim was a city beset by traffic problems and lacked funds to build new infrastructure. In the same year the Norwegian parliament adopted new targets to make Norway climate neutral by 2030. Local politicians in Trondheim decided to take action. Half of the city's greenhouse gas emissions were transport-related. Traffic had to be reduced. The City of Trondheim decided to set up a leading-edge and cross-administrative project involving Trondheim Municipality, South-Trøndelag County Authority and the National Road Authority. The Green Partnership Agreement was born. Miljøpakken or Greener Trondheim is a partnership for sustainable transport. The main goal is to cut greenhouse gas emissions through a suite of measures including reducing car traffic. At the same time, Trondheim is gaining some 3000 new inhabitants every year. The corresponding growth in transport demand must in practice be covered by walking, cycling or public transport.

The first measures were implemented already in the summer of 2008 with bus lanes being regulated in the city centre. The effects were immediate. Buses arrived at their destinations more quickly and car traffic was reduced. The Norwegian parliament approved Miljøpakken in 2009. This gave Trondheim the possibility to receive financial support from the state towards implementing the program. The most controversial measure was the re-introduction of a toll system with double charging for rush-hour traffic. Half of the income from the toll system goes to improving the road network while the other half goes to developing green transport solutions. This was an explicit policy goal to transfer funds from motorists to those who use environmentally-friendly forms of transport.

To date, the results have been impressive. The number of car trips has fallen from 58% to 52.9%. Traffic measured at the city's toll stations is 17% lower today than in 2010. Use of public transport is up by 60% since 2008. Number of cyclists commuting to and from the city centre has increased by 50% since 2010. The number of people walking to and from the city centre has increased by 28% since 2010. Finally, local air quality is better now than it has been in 20 years.

²¹ ThinkingCities, October 2016

Proposing Miljøpakken was a brave move for the politicians. Although these restrictive measures were unpopular as at the beginning, a recent survey conducted by a local newspaper showed that public opinion has turned in favour of these measures.

Miljøpakken is soon entering its third phase in 2017. Earlier this year, Trondheim signed the first Urban Environment Agreement among Norwegian cities. This agreement between the national and local authorities will bring more financial resources for green mobility in Trondheim.

6. List of references and links

6.1 Key sources

EU-wide Website on Urban Vehicle Access Regulations: www.urbanaccessregulations.eu

<http://www.eltis.org/resources/tools/study-urban-logistics-integrated-perspective>

https://ec.europa.eu/transport/sites/transport/files/themes/strategies/doc/2011_white_paper/white-paper-illustrated-brochure_en.pdf

<https://civitas.eu/content/civitas-insight-06-access-regulations-facilitate-cleaner-and-better-transport>

6.2 Guidance

<http://www.eltis.org/discover/case-studies/stockholm-achieving-sustainable-mobility-using-urban-vehicle-access>

NOVELOG guidelines for the Planning and Development of Sustainable Urban Logistics Plans (SULPs)

<https://civitas.eu/content/civitas-insight-06-access-regulations-facilitate-cleaner-and-better-transport>

<http://www.trafficintowns.org/>

6.3 Best practice

http://www.toscananovecento.it/custom_type/1965-la-chiusura-al-traffico-del-centro-storico-di-siena/

Berlin: https://www.berlin.de/senuvk/umwelt/luftqualitaet/umweltzone/download/touristeninfo_en.pdf

Rotterdam:

<https://www.rotterdam.nl/loket/documentenkcc/OVVmanualRegistrationExemptions.pdf>

<http://www.eltis.org/discover/case-studies/giving-back-public-space-pedestrians-and-cyclists-vitoria-gasteiz-spain>

A ; Szarata et al, 2017, The impact of the car restrictions implemented in the city centre on the public space quality – available through [Sciencedirect](https://www.sciencedirect.com)

<https://www.london.gov.uk/get-involved/mayor-london-draft-strategies-and-consultations>

http://ec.europa.eu/environment/europeangreencapital/wp-content/uploads/2018/05/Oslo_Climate_Budget.pdf

Glossary

To be completed

ULEZ: Ultra Low Emission Zone is the terminology used in London for a Euro 6 diesel, euro 4 petrol LEZ. In Germany these have been termed 'diesel bans', and in Belgium as a later phase of the LEZ.

ZEZ: Zero Emission Zone

Congestion Charge

Living streets

Permeability

Push and pull

SDG

NAP

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