Future of Roadside Traffic Management Assets
Fact Sheet

Introduction

The CEDR TNM WG Fact Sheet on Future of Roadside Traffic Management Assets is based on the proceedings and outputs of the CEDR Traffic & Network Management (TNM) Working Group survey of CEDR members on Future of Roadside TM Assets, coupled with the results of the TNM WG Workshop held at Vienna on 21-22 September 2022 and further workshops in March and May 2023.

The scope of the Fact Sheet is limited to the visions and outlook of NRAs towards the future of roadside TM assets highlighting NRA's and road operators' perspectives towards the needs and requirements for continuing usage and expansion of current roadside TM assets. It also includes issues related to deployment of new roadside assets and the level of transition and/or complementarity of some TM services from roadside to alternative communication channels including in-vehicle systems managed mostly by private service providers and OEMs where NRAs have limited influence. The Fact Sheet highlights key results of the CEDR-wide survey on future of roadside TM assets covering 19 national road authorities and road operators and highlighting best-practice case studies in optimal usage of roadside TM assets in the near, medium and long-terms, including partnerships with service providers to provide, complement and/or integrate coherent road-user services. The Fact Sheet aims to summarize NRAs' perspectives with focus on impacts and factors related to TM services through roadside assets and give recommendations and arguments for NRAs on how best to continue, improve and integrate roadside TM assets with alternative non roadside communication channels and services in the short-, medium and long-term horizons.

The Fact Sheet will not include basic concepts or technical deployment guidelines of roadside TM assets, as these guidelines are well known and published in previous CEDR TNM WG Fact Sheets on Hard Shoulder Running (HSR), Incident Management and integration of Traffic Information Services with Traffic Management Systems and are well published and referenced in European ITS Deployment Guidelines for various traffic management and traffic information services within the Reference Handbook for Harmonised Core ITS Service Deployment in Europe (https://www.its-platform.eu/achievement/reference-handbook/) hosted by European ITS Platform (EU EIP)[1].

Scope of Roadside Traffic Management Assets

Roadside TM assets are those physical assets that are owned and operated by NRAs and road operators to detect, manage and control road traffic and provide necessary traffic information and guidance to road users in their networks through Traffic Management Centers (TMC).

Roadside TM assets include but are not limited to:

1- Traffic detection: in-road sensors, loop detectors, overhead cameras, automatic incident detection (AID), radar, Bluetooth, ultrasound, roadside units (RSU)
2- Enforcement systems: speed cameras, weigh-in-motion (WIM), over-height, wrong-way driving sensors

[1] With the support of the European Commission under the CEF program, the EU ITS Platform (https://www.its-platform.eu), active 2016 till 2021, is the place where Member States, road authorities, road operators and partners from the private and public sectors cooperate to encourage, accelerate and optimize ITS deployments in Europe in a harmonized way.

3- Lane control: HSR, lane control systems (LCS), speed control
4- Network Control: Variable message signs (VMS), route guidance
5- Access Control: ramp metering, traffic signal control
6- Mobile VMS Trailers
7- Incident warning and traveller information: VMS

Other user communication channels as websites, mobile apps, radio and in-vehicle systems are often used to complement roadside TM assets in provision of road-user TM and Traveler Information Services. Such a definition of roadside TM assets will be used throughout this Fact Sheet.

Motivation and Basic conditions

NRAs and road operators are currently facing increasing pressure not to expand and sometimes start phasing out deployment of roadside traffic management assets as pressure grows on resources for maintaining and continued operation of TM assets. Other causes can be public perception of low or unclear effectiveness of roadside TM deployments as congestion grows on motorways coupled with continual lack of capacity improvements to accommodate urban, regional and international traffic flows.

On the other hand, alternative communication channels and technologies as websites, in-vehicle guidance systems and C-ITS offer a more user-oriented approach optimizing user specific traveler information and guidance.

The premise of this Fact Sheet is to identify the basic conditions and requirements for continuing usage of roadside TM assets while at the same time providing the requirements and conditions for expansion and deployment of existing/new alternative communication and technology channels to provide an integrated traffic management environment for the road users involving coherent partnerships between road operators and public or private service providers.

Status and Future of Roadside Traffic Management Assets: Key CEDR Survey Results

All CEDR members have operational roadside TM deployments on motorways, at different levels of maturity and levels of deployment. For traffic state and incident detection, in-road sensors as loop detectors and plates and overhead sensors as cameras, laser detectors and radars are used. Traffic enforcement is mostly done through overhead cameras, laser and radar with 7 out of 19 CEDR members deploying weigh-in-motion. Speed and lane management is done though lane control, coupled mostly with overhead sensors for traffic detection and enforcement. Six out of 19 CEDR members deploy hard shoulder running in some motorway sections coupled with lane control systems. Almost all CEDR members deploy Variable Message Signs for traveler information and/or route guidance. Traveler information on VMS relates to incident warning, traffic information, road works and weather and event information. Ramp metering is deployed in 5 CEDR countries. Traffic dosing or gating measures to control traffic flow access from motorways to adjacent urban networks through traffic signals is reported to be deployed in 2 CEDR countries out of 19 surveyed.

Road safety is ranked as top priority for operating roadside TM assets followed by traffic efficiency, road user awareness and sustainability. The most frequently displayed roadside information contents are incident warnings followed by road works information and weather/road condition information at roadside. NRAs surveyed use a combination of operator and automated control to activate TM strategies on their networks. Roadside TM assets are largely deployed at network interchanges, incident hotspots and congested road sections. Ten out of 19 CEDR members surveyed perform evaluation of traffic management

systems in terms of safety, capacity and environmental impact with some assessing level of road-user compliance to and satisfaction with deployed TM assets.

With varying degrees of maturity in TM deployments across CEDR members, 10 out of 19 CEDR members surveyed acknowledge that deployment of new or continuation of existing roadside TM assets is facing challenges, with only 7 NRAs noting little or no challenges to continue deployment of roadside TM assets in their networks. High deployment and maintenance costs are the main challenges, as stated by most surveyed CEDR members, facing continued and expanded deployment of roadside TM assets. 15 CEDR members surveyed have a clear view of the level of operation of roadside TM assets in their networks over the coming 5-10 years, with only 5 CEDR members having a clear view of roadside TM deployments in the coming 10-15 years. Roadside traffic sensors and lane control and incident warning measures will continue operations and expanded upon in the coming 5-10 years with most CEDR members undecided and/or no clear knowledge of the level of deployment of roadside TM assets beyond 10 years, apart from roadside deployments in critical road sections as tunnels, congested sections and blackspots on the networks that can continue to be deployed beyond 10 years.

In terms of transition from roadside to in-vehicle systems, most NRAs surveyed are undecided and/or have no clear knowledge of the degree of replacement on roadside traffic sensors and network control by in-vehicle systems. Almost all NRAs are undecided on the removal of roadside TM assets at the end of system life, with most CEDR members surveyed opting for the renewal of roadside traffic information, lane control, incident warning and traffic sensors in the coming 5-10 years and incident warning and lane control over 10 years. Road safety followed by traffic efficiency figure highly on the factors behind any possible transition from roadside to in-vehicle systems.

For current TM deployments, 13 out of 19 NRAs surveyed use alternative communication channels in addition to roadside assets for traffic management on their networks with websites, radio, public mobile apps and social media being mostly used at the moment for traveler information and road works information. C-ITS is used as alternative communication channel by only 5 CEDR members surveyed mostly infrastructure-to-vehicle/vehicle-to-infrastructure, with only 2 NRAs currently reporting to deploy vehicle-to-vehicle C-ITS.

For future TM deployments, 14 out of 19 NRAs plan to use alternative communication channels in addition to roadside assets, with the rest of the surveyed NRAs undecided. Beside currently used alternative communication channels as website, radio and public mobile apps, most NRAs surveyed plan to expand on the use of mobile apps operated by private service providers in addition to C-ITS.

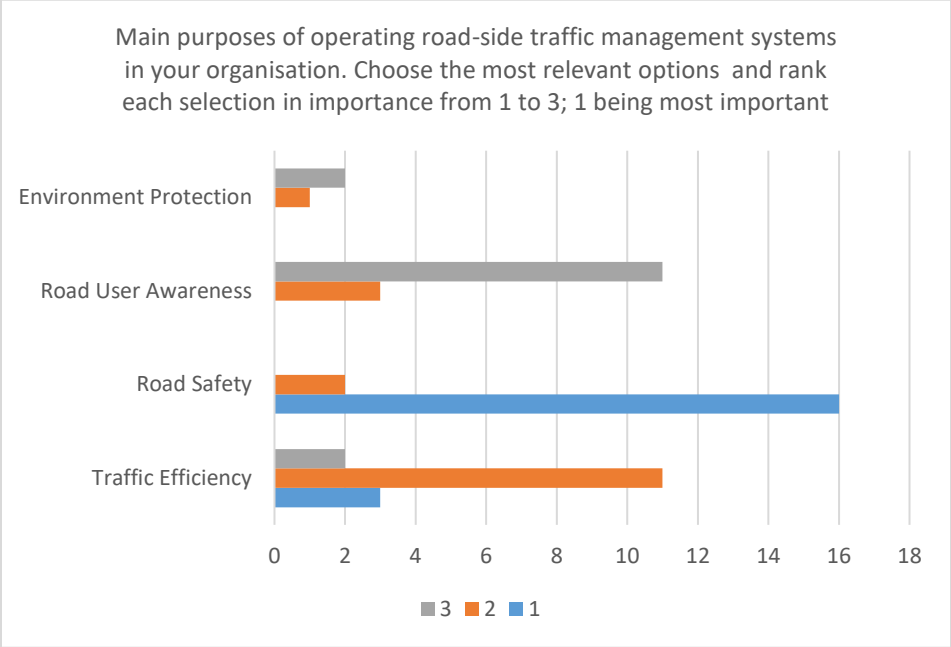
Conclusions of WG TNM on Future of Roadside TM Assets

NRAs have different deployment contexts, conditions and maturity levels and therefore there can be no uniform perspective for the future of roadside TM assets across Europe. The following are the main conclusions of the TNM Working Group based on the survey results:

1. NRAs need to continue to play a major role in traffic management on their networks to maintain a sharp focus on the highest prioritized areas as traffic safety, efficient traffic flow and sustainability. Improving road safety including traffic regulation implementation, followed by ensuring traffic efficiency in a limited capacity expansion environment continue to play a key role for continued deployment and operation by road operators of roadside TM assets across Europe. Such a main role for road operators is mainly done by providing safety-critical, sustainable and efficient traffic detection and traffic control measures in critical network areas as blackspots, tunnels, bridges, road work zones and congested road sections. Accordingly, investments in roadside TM assets in safety critical and congested locations are expected to continue in the coming 10 years. The capacity of the road network is limited and cannot grow as

quickly as the increase in demand, but in many countries, it is also being discussed if that is the right way to go. It is becoming increasingly important to make even better use of existing capacities and infrastructure and to avoid disruptive influences, such as rerouting unnecessary traffic into low capacity roads and provision of inconsistent and untimely road user information, as much as possible.

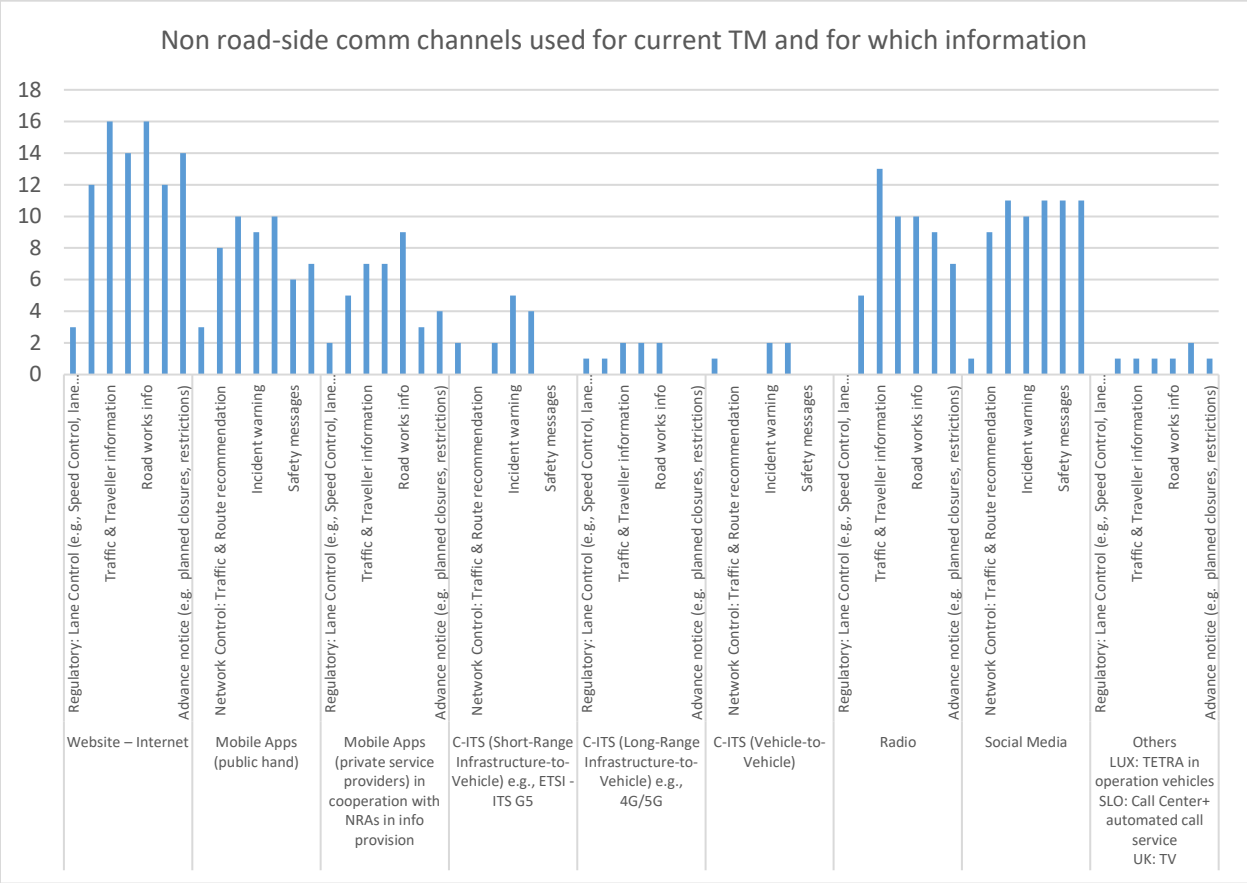
Apart from traffic safety and traffic efficiency as main objectives of operating roadside TM assets in the survey,, road user awareness and environmental protection aspects are increasing in significance with no possible high expansion of existing road network and the increased use of existing TM assets.



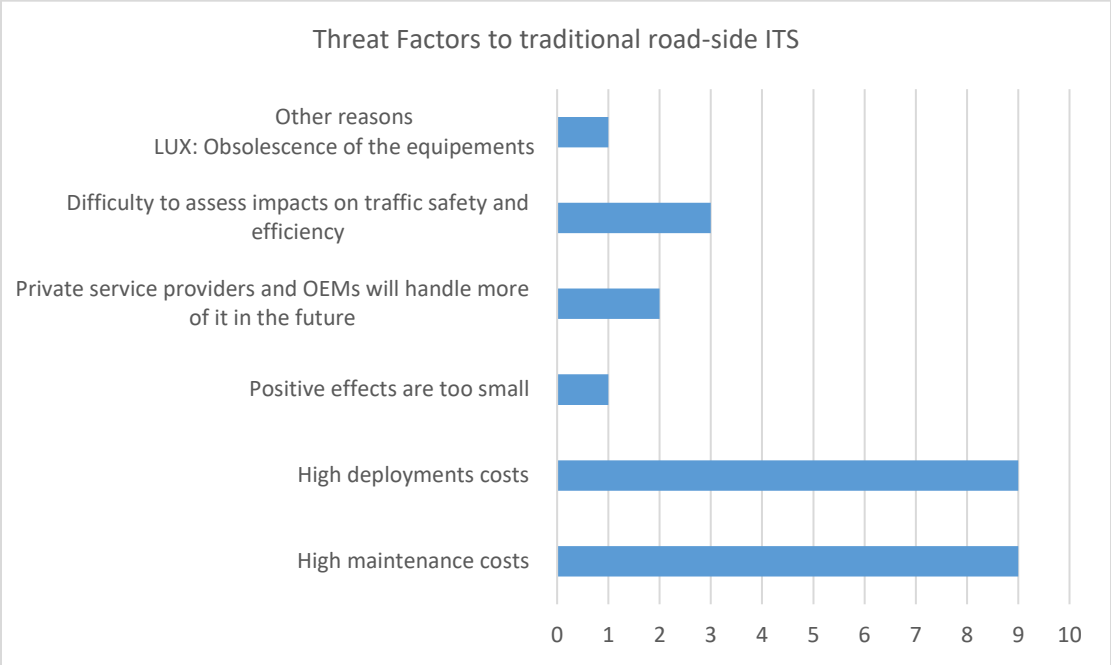
2. Digitalization and standardization of roadside TM assets is a crucial element to open the possibilities for:
    - Integration of roadside and in-vehicle services
    - Continuity of services for the road users.

   A standardized database framework for consistent storage and management of roadside TM assets in terms of type, location, dynamic content, control framework, etc., should be set up at national and regional levels to allow a consistent application and management of roadside TM assets by all parties.

3. Alternative communication channels as websites, mobile apps and in-vehicle services provided mostly through private services providers are increasingly being used by road users. Without proper agreements, shared responsibilities and partnerships between road operators, service providers, automotive and other key stakeholders as traffic police and regional road authorities, risks an increase in conflicting information coupled with sometimes negative overall impacts in main and secondary networks.



4. Finding the right balance in optimisation of service levels at individual/singular road-user level, as mostly advocated by private service providers on one hand and overall common/collective network traffic, safety and environmental impacts as mostly advocated by public road authorities on the other hand, is not a straight-forward exercise and needs to be assessed and carefully planned and developed on a case-by-case basis.
5. Different levels of maturity in public-private partnerships exist across Europe making the transition scope and time frames vary differently between countries and can be made on a case-by-case basis but within an overall agreement framework needed. To facilitate large scale traffic management deployments, a more extensive and focused public private cooperation is needed.
6. In this regard, exchange of info and best practice between CEDR members can be seen as valuable for knowledge transfer and to mutual benefits.
7. Pressure on roadside TM assets and degree and scope and time horizons of transition of some TM services from roadside assets to alternative communication channels has no common benchmark yet. It is quite dependent on the actual level of deployment and coverage of roadside assets, type of services and functionalities needed on the network and degree of partnerships and agreements with service providers. Level of TM services provisions through alternative non-roadside communication channels across Europe is resulting in different viewpoints, strategies and priorities.



8. Roadside TM assets need to be continually improved in terms of compliance to European standards and reference ITS system architecture, as well as open standard technologies and interfaces, to allow NRAs higher flexibility in generating and providing higher and consisent TM service levels on their networks.
9. Traffic information services are the TM services with highest potential for faster complementarity and easier transition between roadside assets and alternative communication channels through data share agreements implemented at national and trans-European levels focusing on quality, effectiveness and timeliness of information.
10. Three main scenarios are envisioned for continued deployment and transition of roadside TM assets to in-vehicle systems:
    a. Continued use and expansion of roadside TM assets at critical road network sections
    b. Complementary use and integration of roadside assets with in-vehicle systems and alternative communication channels to provide higher added-value in selected TIS/TMS services
    c. Replacement by in-vehicle and alternative communication channels in network areas with little or no roadside assets and having no potential safety issues.
11. The development for roadside TM assets in each individual country will most likely happen at different paces and with different priorities. However, NRAs should continue to share knowledge regarding the points above, coordinate and cooperate whenever it is possible and relevant, not only to ensure better manage their own core business but also to coordinate regarding international and cross border traffic.

Recommendations and Next Steps

Considering pressures faced by NRAs on continued and expanded deployment of roadside TM assets, the following recommendations and next steps, proposed by the TNM Working Group, are highlighted:

- A coherent view of the type and mode of transition between traditional roadside TM measures and alternative communication services need to be identified in the short, medium- and long-terms over 15 years' horizon by NRAs and road operators at the trans-European levels. CEDR could provide

a platform for developing such a framework and road map to be agreed by all CEDR members on a way forward and modes of partnerships needed with other public and private players in the traffic information and traffic management services.

- Partnerships and more extensive cooperation are needed between NRAs and road operators on one hand and private service providers on the other hand to guide and align on the scope and level of deployment of alternative communication channels for traffic management and information services to road users.
- No full replacement of roadside TM assets by alternative communication channels as in-vehicle or C-ITS is foreseen in the near and medium-terms over the coming 5-15 years. A large % of CEDR members surveyed are not decided on the pace of transition from roadside to in-vehicle systems suggesting no clear knowledge of time scale of full-scale replacement. Road safety and traffic management measures at critical road sections continue to be highest priority for continuing and expanding on roadside TM assets by NRAs. In addition, ensuring alignment in traffic flow between motorways, regional roads and urban networks is a leading issue for NRAs in ensuring balanced traffic flows across networks. Such a role should continue to be main role of NRAs independent of the channels used. . .
- NRAs should take a more leading role in the deployment of short-range and/or long-range infrastructure-to-vehicle C-ITS , in addition to vehicle-to-vehicle C-ITS on their networks and have a more defined role in the deployment of necessary roadside infrastructure in C-ITS deployments, in cooperation with C-ITS service providers. There are also many considerations on how C-ITS is best integrated in the daily operations in TMCs to create added value. In this regard, more cooperation between the CEDR TNM and CAD Working Groups is required.
- Transition and/or complementarity between roadside TM asset and alternative communication channels should be guided according to type and level of road user functionalities and services required. Alternative communication channels such as mobile apps and in-vehicle systems will continue to be expanded in deployment and provide a high complementary value to roadside TM assets in terms of traffic and traveler information services, road works information and route guidance in cooperation with NRAs.

Contribution

This fact sheet was compiled by CEDR WG Traffic and Network Management.

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CEDR Future of Roadside TM Assets Workshop presentations are available in the Members' Area under FA3.3 on the CEDR website (www.cedr.eu).

ANNEX 1- Summarised survey results

File with main survey results attached.