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Deployment Steps and Best Practices on Traffic Management 2.0

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Introduction

Due to the growth of the urban areas and related mobility issues, cities are beginning to outline clear targets across the three pillars of sustainability (environment, quality of life and welfare) [1]. In addition, initiatives such as the Covenant of Mayors, an agreement signed by 3.721 cities that aims to enhance the energy efficiency and the exploitation of renewable energy sources in cities are trying to help city authorities address the objective of the 20% CO2 reduction until 2020. Along the same line, the European Commission has delivered the Strategic Energy Technology Plan (SET-Plan) that establishes an energy technology policy for Europe and other initiatives that have an impact on transport, environment and social aspects.

Thus, both the EU and the national city administration authorities have identified the environmental and societal needs to deliver next generation transport management, in order to effectively manage the 'why, how, when and where' people and freight plan to travel. The use of the transport network, which involves traffic predictions and routing options created by the Traffic Management Centres (TMCs) and Mobility Service Providers (MSPs) respectively, can be optimised through real time cooperation between the two (TMCs and MSPs), in order to meet the public policy objectives of sustainability (reduced energy use and lower CO2 emissions), cost efficiency and reduced congestion.

The concept of 'TM 2.0' [2] is based on this kind of real time cooperation between the TMCs and MSPs. It builds upon the deployment of connected vehicles and travellers, in order to achieve convergence of mobility services and traffic management, combining actions of the individual travellers with the collective mobility objectives. This way, TM 2.0 connects the innovative

developments in the vehicle and on the road, while improving the value to the legacy systems and, at the same time, creating new business opportunities.

The 'TM 2.0' concept is the result of the work undertaken by the TM 2.0 ERTICO Innovation Platform, which has been set up in 2014 by TomTom and SWARCO Mizar, now involving more than 30 members from all ITS stakeholder groups (research; industry; public authorities; road operators; service providers; users; OEMs) that work together on new solutions for advanced interactive traffic management. The TM 2.0 Platform aims to agree on common interfaces to facilitate the exchange of data and information from all the road users (from vehicle's drivers to public transport users) and the TMCs, and back, improving the total value chain for consistent management and traffic services as well as avoiding conflicting guidance information on the road and in the vehicles [3].

The overall objective of TM 2.0 for the past three years was to provide a discussion forum around the topic of interactive traffic management for all relevant stakeholders, in the entire Traffic Management value chain [4]. The Platform members have aligned on important terms and have better defined what the 'TM 2.0' concept entails, as it is the basis for the current deployment plans and projects by the Platform members.

The members of the TM 2.0 Platform work within Task Forces, where important aspects of the concept and its deployment are studied and analysed. The resulting Reports are published on the library page of the TM 2.0 website and are available for all interested stakeholders. More to that, there is a permanent link with the EU Commission (DG MOVE), which is able to tap into the results and recommendations of the TM 2.0 Task Force published Reports, when discussing relevant policy issues.

In order to enhance the focus and objectives of the 'TM 2.0' concept, two Task Forces on Deployment Steps and on Best Practices have been set up with the aim to identify current traffic management systems and tools that incorporate the next generation concept of 'TM 2.0' either as a whole or partially as well as the steps envisaged towards the deployment of the TM 2.0 vision. This Paper is based on the Reports of the above-mentioned Task Forces and aims to provide an overview of what are the TM challenges and envisaged solutions, who are the stakeholders that shall be engaged, and how 'TM 2.0' and its components are currently being deployed in Europe.

The Paper describes the general approach followed for stakeholders engagement and then provides an overview of reference ongoing initiatives, which can be considered as best practices. There are 7 relevant projects currently underway in Europe, which include aspects of the TM 2.0 concept in their project specifications: 1) Hybrid Testbed; 2) C-The Difference; 3) Traffic management in Breda; 4) Evergreen on Bike; 5) NordicWay Coop., 6) C-ITS in Verona and 7) i-mile. For each of the identified projects a description of their main elements is being presented in this Technical Paper. The Paper finally draws some conclusions from preliminary lessons learnt and envisaged next steps.

Stakeholders Partnerships

Needs for functioning partnerships were investigated by identifying stakeholders' groups, their roles, tasks and interactions in different cities/regions, both looking at the current situation and in view of the TM 2.0 roll-out, including possible synergies, win-win situations, and current vs. future value chains.

Hybrid Testbed, Dutch Mobility Testing Grounds (Netherlands)

The Hybrid Testbed, Dutch Mobility Testing Grounds is a cooperative smart mobility and enhanced Advanced Driver assistance systems test environment that will enable 'learning by doing'. The testbed facilitates the development and testing of ITS solutions at the following levels:

- Functionality
- Roles and responsibilities
- Business models

It offers a real-life test environment with cooperative and connected functionality, equipped with the latest technology to facilitate rapid exchange of data between on-board vehicles and road-side systems, aiming to stimulate the deployment of projects based on the cooperation of public and private parties (using specific use cases, Day 1 & 1.5 services, enhancing the C-ITS Corridor NL-DE-AT). The system is running and in Q1 2017 the specifications baseline has been updated. As of Q2 2017 the updated baseline is being rolled out along 70 km of urban and inter-urban roads and highways. The implementing organization is the ITS Bureau BrabantStad and the technology used includes:

- Cellular technologies.
- ITS-G5 Wifi-P technologies as standard service (ETSI compliant) as generation 0 and in addition planned as generation 1.
- Wifi-P services available through R-ITS-S mounted in Intelligent Traffic Light Controllers and autonomous beacons.
- PKI fully conforming ETSI, including interoperable PKI certificates distributed by Certifying Authority.

As regards the participants involved, there is a wide range of stakeholders including the automotive industry, ITS suppliers of road-side technologies, on-board unit (OBU) suppliers, traffic management suppliers, telecom suppliers, data providers, service providers and knowledge organisations. The management body is the Province of Noord-Brabant while the financing body for the start-up phase is Province Noord-Brabant and its program Beter Benutten (Rijkswaterstaat, Dutch Ministry of Infrastructure & Environment). For the operational phase a public-private investment is foreseen. The business model is a collective public-private partnership model with a total budget of 11 million Euro for the period 2016-2021.

The technical performance of the system includes high availability, integrity and guaranteed conformance standards. As regards the safety impacts, it accelerates the development and innovation of new public private traffic management solutions and helps ensuring interoperability and conformity. Concerning efficiency impacts, it accelerates the innovative traffic management solutions exploiting the opportunities that new mobility concepts and technologies such as MaaS, intelligent vehicles and ubiquitous communications provide. As regards revenue generation, mobility, safety and durability improvements count for a collective benefit. Private companies can sell competitive solutions and become profitable. As the test-environment allows assessing the user acceptance at early stages in the

product life cycle, the outcome can benefit from increased user acceptance.
Datasets needed include iVRI data including information on timing and phasing, local map data and cloud services as defined in RFP1.0 Innovation Partnership. Basic use case data include SRM, SSM, CAM, DENM, IVI as well as information on maximum speed, advised speed, green wave and priority. Sources of data are multiple, including TLC, NDW, Innovation Partnership cloud services, in-vehicle data and Service Provider specific data. In the production environment of traffic management solutions open data and commercially available data are being used.
As regards the lessons learnt so far, there is a collective ambition among the participant stakeholders to be a front runner to build a competitive ITS ecosystem and trust between partners to cope with obstacles. The system is very much using the very same core principle of public-private real-time cooperation in traffic management upon which the 'TM 2.0' concept is built upon. As such, this project deploys aspects of the 'TM 2.0' concept. In the start-up phase of the project several obstacles have been tackled by the project participants and these are taken by the TM 2.0 Platform under consideration as 'lessons learnt' when planning for 'TM 2.0' concept deployment by the Platform members:

- Definition of a collective meaning of words and shared vision of ITS Roadmap
- Definition of business and exploitation model Hybrid Testbed
- Problems for investing public and private partners
- The public authorities' "fear" of losing control over public assets.

C-The Difference (Netherlands, France)

The C-The Difference pilot project assesses the impact of C-ITS services in a real-life urban transport environment. The pilot is organized in two implementation and evaluation phases and two pilot sites, Bordeaux and Helmond. The objectives of the pilot are to:

- Assess the benefits of piloted C-ITS services based on an enhanced evaluation methodology with respect to road safety, reduction of traffic congestion, reduction of fuel consumption and emissions, increased efficiency in logistics operations by means of tangible and quantifiable evidence gathered from pilots in real-life conditions
- Present harmonised and consolidated results for the two pilot sites and at the same time take into account other project results and expert knowledge in order to extrapolate effects at larger scale.

The C-The Difference project:
1. Implements urban C-ITS services according to EC priority list (Day 1 and Day 1.5). These services could be evaluated in piloting conditions and the best expected cost/benefit ratio, based on experience from past and ongoing C-ITS piloting.
2. Operates C-ITS services for a period of 18 months in Bordeaux and Helmond. These services are available to a large group of private and professional users and a complete set of data for impact assessment will be collected.

3. Demonstrates matureness of C-ITS services by validating robustness, interoperability and continuity of service provision in real life conditions.
4. Assesses the benefits of piloted C-ITS services on road safety, reduction of traffic congestion, reduction of fuel consumption and emissions, increased efficiency in logistics operations from data collected in real life conditions.
5. Raises awareness of local policy makers and decision makers on C-ITS benefits also by means of twinning programmes.
6. Builds long-term engagement partnerships between public and private stakeholders involved in the C-ITS service chain from implementation to operations
7. Develops C-ITS in urban environment deployment recommendations and proposed deployment scenarios that can be customized according to urban policy framework

The main aspects of the C-The Difference project concerning interoperability, sustainability, scalability, replicability and reliability are summarized in Table 1 below.

Table 1 – TM 2.0 aspects of both Pilot sites under C the Difference project

Interoperability	Use of hybrid communications (G5 and 3G/4G) on both pilot sites. Implementation and operations of C-ITS services using road side and on board equipment from different system suppliers.
Sustainability	Piloting activities in Bordeaux and Helmond strengthened and sustained cooperation between local/national/international actors from public and private sectors and promoted C-ITS benefits to other cities. In the long run, operation of C-ITS services will contribute towards gaining more knowledge on viable business models and will support the development of the European-wide C-ITS market.
Scalability	Adoption of a two-stage approach is the way to demonstrate capacity to upscale C-ITS service Implementation and operations in real life in both pilot sites. Scalability is addressed in a complementary manner in the two pilot sites, by upgrading existing services and increasing the number of vehicles in Helmond and by adapting existing services with the use of cellular communication to reach large number of users in Bordeaux. Both pilot sites implement additional C-ITS services.
Replicability	Promotion of C-ITS benefits and knowledge sharing with interested cities through city twinning programmes fosters replicability.
Reliability	Bordeaux Metropole and the city of Helmond will share their experience in the adoption of C-ITS potentials in their respective transport policies and also in their respective integration of C-ITS services into their urban transport planning and investment.

At the end of the C-The Difference project, four impact categories will be assessed (quantitative and/or qualitative):

- Safety (mainly qualitative)
- Traffic efficiency

- Fuel / emission
- Business (Logistics)

The C-ITS services, which involve TM2.0 aspects that will be piloted within the framework of the C-The Difference project are listed in Table 2 below.

Table 2 – Proposed C-ITS services/TM 2.0 aspects to be piloted under the C the Difference project

Pilot Site C-ITS services	List of proposed C-ITS services to be piloted and evaluated in C–The Difference pilot project	
	Bordeaux	**Helmond**
Emergency vehicle approaching	**X**	**X**
Road works warning	**X**	**X**
Weather conditions	**X**	
In-vehicle speed limits	**X**	
Probe vehicle data	**X**	
Signal violation / Intersection Safety		**X**
Traffic signal priority for designated vehicles		**X**
Green Light Optimal Speed Advisory (GLOSA)	**X**	**X**

Traffic management in Breda (Netherlands)

Traffic management in Brenda is an application focusing on traffic and travel information provisioning. Rijkswaterstaat (Dutch Ministry of Environment & Infrastructure), the Province Noord-Brabant and the local government in Breda have created a number of scenarios informing the drivers regarding traffic and congestion and providing alternative routes to congested areas and roads in the city of Breda. All three organizations work together as the involved road network around Breda is a quadrant of highways with five junctions providing access to the urban road network of Breda and into the city of Breda. The application is focusing on covering the sub-urban region and the highways and is mainly targeting private transport. The implementing organizations include, apart from the ones mentioned above, also commercial companies. The communication standards used for traffic management are DVM exchange, intelligent traffic lights, floating car data or similar. These are all aspects of the 'TM 2.0' concept. The entire TM 2.0 concept will be incorporated in 2017 and is expected to utilize additional technologies and standards. With regards to the expected result of the traffic management in Breda, through the in-vehicle information for the best route, better distribution of all the traffic within the total network will have an immediate effect. This will consequently have positive safety, efficiency, environmental and socio-economic impacts. The user acceptance is expected to be high, making the system easily replicable. Finally regarding data sets needed, real time traffic information, prognostic data and destination-data are required to be fed to the system from vehicles and MSPs.

Evergreen on Bike (Netherlands)

Evergreen on Bike is a traffic and travel information provisioning system for cyclists. It provides an

estimated time to the green light so they can adapt their speed, in order to seamlessly cross a downstream intersection. The system is directed to single road/line and is targeting bicycles. The launch of the system is expected to take place during mid-2017, depending on the intelligent traffic light system availability. The implementing authority is the local government of Breda (Gemeente Breda) and the technologies used include GPS, time to green and Vlog3. Regarding the expected results the system will provide comfort to cyclists, while at the same time it will contribute towards enhancing their safety. The system can be easily replicated and the data sets needed include GPS, traffic lights information and distances to the intersection by the cyclists. Evergreen on Bike is using aspects of the TM 2.0 concept for the benefit of both cyclists and vehicle users, as it is based on travel and traffic information from both user groups.

NordicWay Coop. – Safety Related Traffic Information utilizing cellular Cooperative ITS (Finland, Sweden, Norway, Denmark)

NordicWay Coop – Safety Related Traffic Information utilizing cellular Cooperative ITS – is a traffic and travel information system. As the hazardous location and weather warnings delivered at the right time in the right place for road users could prevent and mitigate road crashes the objectives for this piloted C-ITS system are: to enhance traffic safety, to speed up the deployment of scalable Day 1 C-ITS services utilizing the existing cellular network and to evaluate its performance and impact. The system includes mobility services and it therefore relates directly to the 'TM 2.0' concept. The provisioning of individual information and advice as well as the provisioning of high quality real time and reliable services, and road traffic management are based on traffic management and control strategies, collective routing and adaptive and dynamic traffic control as these are handled by TMCs. It is targeting professional drivers such as taxis, transport service provider busses, logistics companies trucks, etc. The NordicWay project is implemented by National Road Administrations of Finland, Sweden, Norway and Denmark together with OEMs and service providers.

More specifically, the end-user side of the Finnish Coop pilot's service is an Android mobile application developed by HERE, which utilizes the existing cellular network. Users using this service can send and receive Safety Related Traffic Information (SRTI) messages to/from other road users. The SRTI message includes the location of an accident, obstacle or an animal on the road or reduced visibility. Users may also receive SRTI messages about road works, weather and slippery road warnings from the Traffic Management Centre (TMC). Users will receive warning of the location in distance of 2 km when approaching for example an accident location. The system utilizes the existing 3G and 4G/LTE cellular networks and uses Global and European C-ITS standards for relevant parts, TMC bilateral communication in DATEX II standard. The involved partners in this Finnish Coop pilot are the Finnish Ministry of Transport and Communication, the Finnish Transport Agency (FTA), the Finnish Transport Safety Agency Trafi, and the consortium is led by HERE. It is a public-private partnership with Public investment by the FTA and Trafi including direct piloting costs such as fleet and TMC User Interface while the service development is conducted by HERE.

As regards the data sets needed, SRTI information is exchanged between the end-users, the HERE

cloud and the TMC. The messages exchanged with the road test users and the HERE backend are based on DENM messages. Messages exchanged between the TMC and the HERE cloud are standard DATEX2 SRTI messages.

In the Finnish Coop pilot, the following SRTI types are exchanged:

- Temporary slippery road
- Animal, people, obstacles, debris on the road
- Unprotected accident area
- Short-term road works
- Reduced visibility
- Wrong-way driver
- Unmanaged blockage of a road
- Exceptional weather conditions

The messages include, among others, location (GNSS), event type and expected duration.

The sources of data include the Coop service road user sending the SRTI messages and TMC SRTI messages. Coop service's road user near the location of the event, TMC and HERE service centre are the receivers of the data. The NordicWay is still ongoing and pilots are running in January 2017. The data is shared only among the NordicWay public and private partners. This data sharing is demonstrated using NordicWay Interchange server, a cloud based solution providing a node where all the National Road Authorities (NRAs including TMCs) as well as OEMs and service providers may connect and share SRTI messages utilising the DATEX II and AMQP standard solutions. During the pilot phase of the Finnish Coop pilot and the NordicWay Interchange server, only raw SRTI message data is shared. The NordicWay Interchange server in the Finnish Coop pilot is based on the ongoing data exchange between the service users and TMC. The interoperability between OEMs and National Road Authorities is tested under this pilot project and it will be demonstrated during spring 2017.

C-ITS in Verona (Italy)

The City of Verona, as the implementing organization, with the technological support of SWARCO and Telecom Italia are implementing C-ITS services, aiming to optimize traffic flows and reduce road transport induced CO2 emissions within the entire area of the city of Verona, Italy. The C-ITS systems deployed include:

- Traffic Light Assistant (broadcast of SPAT/MAP messages at intersections)
- Real Time Traffic Information (broadcast of DENM messages)
- Road Works Warning (broadcast of DENM messages)
- Public Transport Prioritization

The services rely on ETSI G5 and LTE telecommunications technologies, while data and information exchange is realized with the use of standardized C-ITS messages (SPAT/MAP, DENM, CAM) and the DATEX protocol.

Results currently available indicate that at technical performance level the Traffic Light Assistant service is active on all intersections in the city, both centralized and isolated. In-vehicle information

reaches the driver with a delay of <3s and event information is being transmitted in-vehicle through DENM messages. C-ITS Verona is an enabler of the 'TM2.0' concept, as it supports the direct involvement of the vehicle in the Traffic Management Loop. The exchange of information regarding the Traffic Lights represents a basic exchange of Traffic Management Plans.

As far as impacts are concerned, safety levels increase due to trips becoming smoother and better distributed along the network and therefore incident risk becomes lower, efficiency is improved as all deployed services enable smoother journeys (translated to an energy consumption reduction), environmental pollution is reduced as the reduction of Stops/Starts contributes to reduced CO2 emissions, while at socio-economic level the improved mobility management will contribute to better life quality. At user acceptance level, results are positive, especially concerning professional drivers.

i-mile (Greece)

The 'i-mile' project, located in Thessaloniki, Greece, will create a Living Lab and application platform for transportation innovation within a real-world complex transportation system. i-mile is a multimodal transport testbed for passenger and freight transport services, connected and automated vehicles and machines. It will operate with high-end technology equipment as well as open interfaces to future technologies. The i-mile will also include a Certification and interoperability test bed, forming an integrated network of existing research and industrial infrastructures for supporting standardisation and interoperability of new technologies as well as products and services testing against specifications, thus enabling quick proof and take-up of innovative transport and logistics solutions by the domain stakeholders in accordance to their needs. I-mile will also host the first certified autonomous drive site. The connected vehicles and infrastructures use case (C-ITS) will focus on testing, validation and assessment of novel applications in the connected vehicles and infrastructures research and innovation domain. i-mile will support plug-and-play installations of new equipment, sensors and services both at roadside and at vehicle level, supporting research and testing activities to assess connected, automated and autonomous vehicles (from SAE 1 to SAE 5) and intelligent infrastructures, exploiting advanced capabilities offered by the real-world HERMES C-ITS testbed. C-ITS services will include, but are not limited to, extended Green Light Optimal Speed Advise, innovative bundled cooperative mobility services, dynamic speed advice, transitions between various automations levels of commercial and private vehicles, safety applications, and energy/consumption related services, incorporating the major aspects of interoperability, collaboration and information exchange among multiple stakeholders, as proposed by the 'TM2.0' concept. Furthermore, use cases will be supported by in-vitro simulation environments already in place, including both vehicle simulators and dynamic microscopic simulation environments, assisting interested users in holistic assessment scenarios. Assessment related to human factors studies for investigating a) the short-and long-term effects of automated transport on drivers and b) the interaction of drivers and other road users will also be enabled by this use case. Furthermore, use cases related data and process analytics will be exploited to develop neutral platforms, which will form the basis for research and development of MaaS services. i-mile will support the development of MaaS

technologies assessment, as well as detailed analytics of users' acceptance and behaviour aspects. MaaS use cases will enable the provision of seamless mobility services, allowing travellers connectivity with all modes, data transfer and transactions security, single-trip-identity use, assessment of various financial schemes, as well as possibilities for exploiting MaaS collected datasets to improve transport systems operations. Open APIs will enable plug-in-tests and pre-commercial operational capabilities for interested third party mobility service providers.

Deployment Steps for TM 2.0

The projects described in this Paper can be considered as representative for a number of medium-sized pilots across Europe, where public authorities are called to handle traffic and mobility related challenges, such as pollution, expansion of complex urban areas, related land use issues, economic and sustainability factors at (inter-) regional level, especially in areas concerned by maritime and/or cross-border transport, main highway corridors, or intense touristic flows. For the deployment of TM 2.0 the following recommendations can be drawn:

1) Traffic Management status and solutions:

- Investments on the physical and digital infrastructures shall be considered in a strategic and balanced way, with digital and technology solutions to be deployed using common standards and reference architectures, which can support retrofitting as well as technology evolution, thus catering for the needs of human road users as well as of future automated vehicles;
- Solutions implemented in different countries are mainly based on C-ITS – with different telecom technology (e.g. wireless ITS-G5, mobile 4G/5G) and their hybrid combination, while other ICT solutions are also being deployed – especially web-based, such as cloud computing, social media and others. Consequently, there is a need for technology-neutral solutions and for making different types of technology and service solutions work together in a seamless way, so as to avoid lock-in and fragmentation and achieve seamless service continuity for different end-user categories (drivers - professional and non, vulnerable road users, travellers, etc.);
- Open data sharing and management (supported by Big Data techniques and increased computational power) as well as harmonised evaluation methodologies of services deployed (including clearly defined Key Performance Indicators to compare impacts and benefits resulting from different implementations) are key elements to move from pilots to large scale deployments; these elements are crucial both for improving the service level and for engaging with large numbers of public and private stakeholders, including end-users;
- A need to spread know-how and define best practices about (C-)ITS solutions among local traffic managers and other value chain actors about: installations → OBU / RSU configuration → programming → maintenance / upgrade, use of open standards for interoperability;
- A need to extend TM to all transport modes, so as to reach an optimal balance across the entire road network for all road users / travellers; this requires close cooperation between different authorities (e.g. highway and city TMC) based on new political/organisational agreements;
- Involve individual travellers as an active element of the TM loop (e.g. by crowd-sourcing), in

which users and TMCs share information e.g. via cooperative V2X systems or IoT to achieve individual and collective mobility goals in an optimal way;

- More in general, TM 2.0 will imply a change of roles among public and private stakeholders, where policy goals and objectives will continue being the domain of public authorities, while private companies might run TM operations in a (semi-) automated way (conversely to current practices according to which TM operation is task performed manually at TM control room).

2) Stakeholders partnerships and engagement:

- A clear definition of key stakeholders groups is needed, with their role, area of interest / action to set truly functioning public-private partnerships, addressing governance structures and legal aspects as well as heterogeneous needs for business and market roll-out;
- The raise of policy makers and end users awareness and change of approach to and perception of TM aspects (with focus on mobility, not on individual vehicle driver) is crucial; front-end runners can play a crucial role as ambassadors and in defining best practices on TM 2.0; the current learning-by-doing approach shall lead to clear and coherent reference organisational architectures (i.e., roles, responsibilities, interactions, ...) for deploying future TM 2.0 Centre.

3) Deployment steps and future perspectives:

- V2X cooperative systems and Day-1 C-ITS services are quite mature and proved benefits for road traffic efficiency and safety, but need to be integrated with TM procedures and systems;
- Existing physical infrastructure will be “virtualised” thanks to V2X communication systems (wireless ITS-G5 and mobile 4G/5G), digitalisation as well as crowd-sourcing; both traffic managers and other connected users in the vicinity will be able to feed real-time information; the transition from “road-side” based collective information towards “individual device” based personalised information is crucial to enable information exchange with automated vehicles;
- However, integration and implementation will require, among others, to:
  - Address governance and regulatory aspects to be defined at European level and enforced by public authorities, so as to ensure common standards and correct access/use of data;
  - Define a framework for data privacy and (cyber-) security to prevent abuses or disruption;
  - Evolution from real-time to predictive TM through data intelligence / big data techniques.

  These are a crucial aspects to TM allow traffic managers being able to perform their duties also in the evolving context of end users’ needs and wants as well as available (multi-modal) transport solutions for both people and goods; linked to mobility services (e.g., Uber, MaaS), new forms of vehicle sharing, coexistence of conventional traffic with automated driving, service level agreements and business models;
- These radical changes and the new tools available through personalised information sharing (such as dynamic payment, availability / accessibility management, etc.) will need to be sustained by a sound, future-proof TM 2.0 regulatory framework;

Conclusions

The projects and pilots currently running in Europe with regards to ITS, C-ITS and traffic

management are not deploying the entire TM 2.0 concept yet. The 7 pilot projects presented in this paper do not provide an exhaustive list of projects using aspects of the 'TM 2.0' concept on interactive traffic management. What one can however immediately conclude is that there is a specific set of characteristics that these pilots share with the 'TM 2.0' concept: rapid exchange of data between vehicles and roadside systems, public-private partnership in traffic management operations, Intelligent Traffic Light Controllers and 'Green Waves' for more than one user category of the transport network, the core idea of the 'TM 2.0' concept of win-win for all stakeholders and the combination of open data and commercially available data in informed routing and re-routing. More best practices and additional results coming from the ongoing activities of the TM2.0 Task Force on Best practices exchange (including innovative public-private partnerships, the new role of TMCs, TMC as a service as well as relevant technology platforms currently developed across Europe will be presented during ITS Congress. From a deployment perspective, it is ripe time for a common pan-European testing programme including validation in real-life conditions of existing solutions in different settings (urban, interurban, cross-border) in complex environments (highly dense or sparse population, compact cities with widespread outskirts, isolated or rural areas) and with large, different end-user groups (i.e. drivers, pedestrians, cyclists, etc.). Reference implementation measures shall be defined in the transition phase towards TM 2.0 phase, in which policy / legislation enforcement and infrastructure deployment are expected in the medium-long term, while operational implementation measures are needed to be gradually introduced in the short term. The establishment of business partnerships is a key element for a coherent large scale deployment and a positive market roll-out. Innovation procurement is a key enabler to achieve to avoid fragmentation and shape these partnerships around EU-wide strategies and policy goals and MaaS principles.

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