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Traffic Management 2.0 – The Win-Win

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Abstract

The TM 2.0 ERTICO Innovation Platform members are cooperating under the common belief that interactive traffic management and the alignment of the individual driver's objectives to those that the Traffic Management Centre (TMC) should adhere to is both feasible and advantageous to all stakeholders involved. As traffic operators, acting usually on behalf of the public authorities are challenged to keep the traffic flowing, reduce environmental and noise pollution and keep up with new mobility demands on the existing transport infrastructure, the users (drivers and passengers alike) are seeking more and more information that is tailor-made and relevant to them and their mobility requirements. In the era of TM 2.0, vehicles should be able to interact and exchange information with the TMCs so that tailor-made traffic information can be provided to the tax-payers and services payers while having a better picture of the traffic status without needing expensive investments in equipment and related infrastructure. Service providers and the automotive industry are seeking ways to facilitate the evolution of traffic management to the next level while ensuring business viability. It is all about the Win-Win. The paper discusses the value proposition of the TM 2.0 concept and uses four urban regions as deployment paradigms to prove that even every region has unique needs and characteristics; there is still a set of basic principles that need to be covered when it comes to ensuring a good business case.

Keywords:

Traffic Management 2.0, Real-time Traffic Information, Public-Private Collaboration, Win-Win

Traffic Management 2.0: The Evolution

The TM 2.0 ERTICO Innovation Platform which was formally established during the 2014 ITS Europe Congress in Helsinki, focuses its work on discussing new solutions for advanced active traffic management. It aims to agree on common interfaces, data sharing principles and business models which can facilitate the exchange of data and information from the road vehicles and the Traffic

Management and Control Centres (TMC), and back, improving the data value chain for consistent traffic management and mobility services as well as avoiding conflicting guidance information on the road and in the vehicles.

Traffic Management today falls under the responsibility of road operators who have to execute the planning as this is agreed by the public authorities aiming at a general public benefit. Road operators and public authorities, for example, increasingly aim at environmental-friendly traffic management solutions. On behalf of the public authorities, road operators or traffic management centres (TMCs) are delivering services being paid by tax-payers as part of the general state/city budget. On the other hand, traffic service providers, including the road network infrastructure industry, the traffic information service providers and the automotive industry, aim at keeping their customers satisfied. Profit and customer satisfaction is what gives to the industry competitive advantage in the market. Benefits for the general public rank lower than individual demand for fast and efficient service.

Until recently, these two stakeholder groups (the publicly funded TMCs and private traffic information service providers) in their quest for user satisfaction and support, went on separate and sometimes conflicting ways. The TMCs focused on monitoring and informing the mass of drivers using their road infrastructure while traffic information service providers aimed at guiding drivers towards alternative and better suited routes addressing their individual requirements (points of interest, avoiding tolls etc.).

The 26 members of the TM 2.0 Platform share a common vision on the TM 2.0 concept. The latter is perceived to be key towards providing a holistic information loop between the vehicle, the service providers, the infrastructure and the TMCs which will enable the traffic information service providers or the TMCs (depending on who assumes the role of alignment and coordination) to inform and guide the road network users to their destination while at the same time optimizing the road network throughput responding to the prevailing traffic conditions.

The evolved scheme of TM 2.0 aims at building trust among the various transport actors involved and at the same time supports the creation of new business models and efficient services. Innovation is key in order to ‘do things out of the box’ which until recently prevented the road-network stakeholders from cooperating. New trends on Mobility and Transport, such as self-driving vehicles, mobility as a service, green mobility etc. necessitate a change, not only in technology but also in the user’s acceptance and the way business is conducted aiming at profit and also in the way public services are offered, the latter usually not taking into account pertinent financial loss.

Four Case Studies: Thessaloniki, Helmond – Eindhoven – Tilburg, Salzburg, Barcelona

The TM 2.0 ERTICO Innovation Platform Task Force (TF) on Value Proposition consists of both traffic management representatives and traffic information service providers. Managing traffic efficiently is agreed to be a service and as such it has to service customers’ needs rather than just answer general policy related requirements. Delivering state of the art services in traffic management has to focus on responding to the very specific needs faced by the cities and regions where the TM 2.0 will be implemented / deployed. In order to assess the diversity of needs, the TF on Value Proposition agreed to examine four regions in Europe, namely Thessaloniki, Helmond – Eindhoven – Tilburg,

Salzburg and Barcelona.

Thessaloniki

Thessaloniki, the second largest city in Greece, accommodates for nearly 1 million citizens. Due to its geographical position, Thessaloniki plays an important social, financial, and commercial role in the national and greater Balkan region. The transportation hub within the city's limits caters for a total number of more than 777.544 vehicles (including private cars, heavy vehicles and motorcycles).

Figure 1 – Traffic Management Centres in Thessaloniki (peripheral, urban and central)

Research shows that among various trip purposes, 47.6% of the trips are conducted for work and 26.8% for leisure (Mitsakis et al., 2013). The modal split analysis shows that the majority of trips is conducted with private vehicles (67% private cars, 4% motorcycles and 4% taxis), while 23% is conducted with public transport and 2% with non-motorized modes of transport. With single occupancy vehicles at 65%, only 28% and 6% of the vehicles travel with 2 and 3 passengers respectively. The peak hours are indicative of the commercial hub as the city serves in the greater Balkan area (between the 08:00-09:00 and 16:00-17:00 on typical work days).

Currently there are three TMCs in Thessaloniki (Table 1), which are hosted by the Region of Central Macedonia. The latter is responsible for the management of the traffic lights and the surveillance systems of the central arterial and the peripheral ring road.

Table 1 – Characteristics of the three ITS systems deployed in the Thessaloniki area

Peripheral ITS	**Urban ITS**	**Central ITS**
Area: Peripheral ring road expressway network (13 kms) **Traffic**: ~3.700 veh/h/dir during peak hour **Services**: Traffic management,	**Area**: Wider urban area of Thessaloniki **Traffic**: 94.000 veh/h during peak hour **Services**: Traffic lights control,	**Area**: Central Business District of Thessaloniki **Traffic**: ~30.000 veh/h **Services**: Adaptive signal control, incident management, real-time

congestion and incident detection and warning **Equipment**: Cameras, VMSs, Traffic Control Centre	centralized plan selection **Equipment**: ~200 signal controlled intersections, ~800 loop detectors	advanced traveller information system[1] **Equipment**: automatic incident detection & pan-tilt-zoom, VMSs, traffic detection radars and cameras for 68 lanes

In addition to the ITS systems, Thessaloniki has implemented two cooperative services, one in the city centre provided through LTE and one along the Peripheral Ring Road provided through G5. RSUs have been installed along the Peripheral Ring Road of Thessaloniki, either on pillars and traffic cameras or on top of VMS. From its part, CERTH-HIT has implemented and operates a Mobility Management Centre (MMC) at the mobility laboratory. Two innovative data sources are monitored in the MMC, floating car data (FCD) from a fleet of 1,200 taxis providing traffic status (speed) in almost the whole network in real time and a network of more than 40 Bluetooth detectors tracking trips along the main routes of the city also in near real time. In addition, data coming from social media (tweets and Facebook check-ins) is being collected and it will be added soon to the MMC capabilities. The MMC is composed by hardware (2 large screens) and software responsible for filtering and analysing the data to be monitored as well as to generate the respective alerts when necessary.

The shift from TM 1.0, which is what is currently being used to manage traffic in Thessaloniki, to the evolved concept of interactive traffic management, TM 2.0, will take place by connecting the drivers with the traffic managers and thus providing them with the measures of the traffic management plans along the Peripheral Ring Road at a first stage and within the City Centre at a second stage.

Helmond – Eindhoven – Tilburg

The region Helmond – Eindhoven – Tilburg is the Dutch deployment site to continue operating the C-ITS services that have been implemented, operated and evaluated in the frame of the EU co-funded project Compass4D. The ultimate goal is to move from pilot to large scale deployment for a self-sustained market. This activity is set up as an ERTICO Partnership Activity through a "Compass4D Memorandum of Understanding", a "Compass4D Support Activity Agreement" and of a "Compass4D Deployment Site Agreement" for each of the participating cities, and it is coordinated by ERTICO – ITS Europe.

On the A58 motorway between Eindhoven and Tilburg 34 WiFi-P beacons have been placed as part of the Shockwave traffic jams A58 project. On top of this an IT infrastructure containing open connecting interfaces and data enhancers is been available to enable service providers to roll out traffic services over the whole road section. The Traffic Innovation Centre in Helmond, an experimental and development area within the South Netherlands traffic centre was founded to facilitate the transition to TM 2.0.

[1] http:// www.mobithess.gr

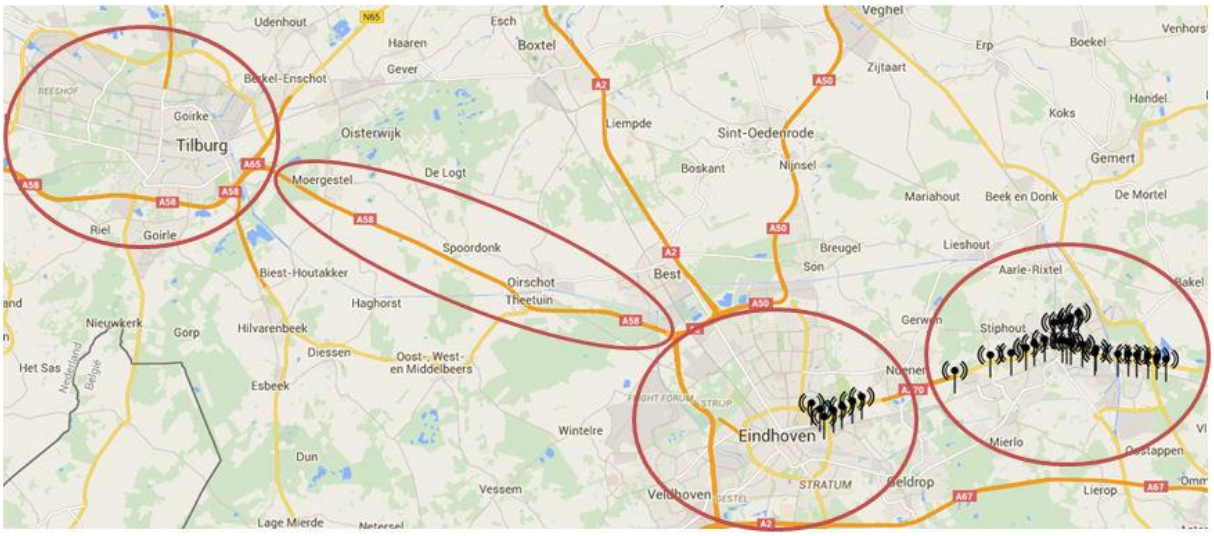

Figure 2 – ITS deployment in the region Helmond – Eindhoven - Tilburg

The Energy Efficient Intersection Services will continue to be operated as a C-ITS service in Helmond. An extension of these services is foreseen in Eindhoven and Tilburg. Other related services in the domain of road safety and fuel efficiency are Red Light Violation Warning and Road Hazard Warnings. The main goal of providing TM 2.0 services for the A58 Motorway is to subdue traffic jam shock waves. The research question is to investigate whether the provision of in-car speed advice to road users can reduce or even prevent the occurrence of shockwaves and the growth of traffic jams. The reliability of such a service experienced by road users ultimately depends on the consistency between the information and advice they receive and the actual situations they encounter on the road. The social importance of a stable supply of information to road users will therefore necessitate public-private coordination and supervision. TM 2.0 creates a framework for this cooperation. As second service a Road Works Warning service is planned.

Salzburg

The case of Salzburg is different. As one of the nine federal states in Austria, Salzburg is located in the north-western part of Austria and immediately adjacent to the German border. The federal state's capital is the City of Salzburg, a mid-sized historic city with around 150.000 inhabitants while its city-centre is a world heritage site.

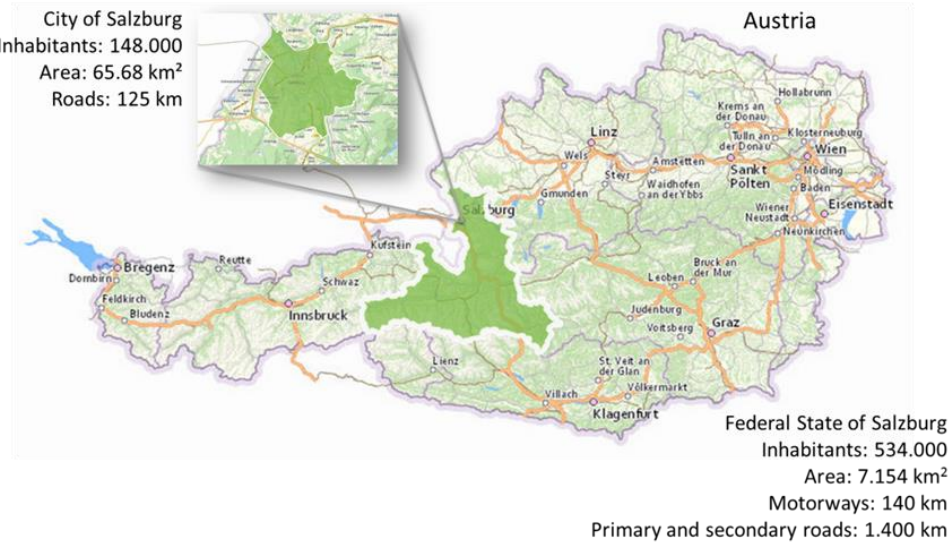

Figure 3 – The Austrian Federal State of Salzburg with the City of Salzburg

With high commuter traffic from the northern parts of the federal state reaching the city on weekdays, it is also a significant share of tourist traffic aiming at the historic city centre that the city has to tackle as the possibilities to optimize traffic capacities are limited. The main public transport infrastructure in the city is the trolley bus system with a share of 14.7% of all trips. In addition, bicycles are used for approximately 19.6% of all trips and 20% of all trips are walking trips (Herry & Tomschy, 2014).

Over the last years several initiatives on implementing intelligent traffic management have been realised:

- Region-wide real-time traffic state estimation system using Floating Car Data (FCD) technology (Floating Car Data Testbed Salzburg)[2], also covering public transport
- Region-wide network of loop detectors
- Adaptive traffic lights in the City of Salzburg
- Traffic-adaptive network control (provided by Gevas software GmbH)[3]
- Dynamic speed adaption and variable message signs on the motorway ring (A1 and A10) around the City of Salzburg (operated by ASFINAG)

With regards to the challenges the city is faced with traffic management- wise, it is the summer touristic season that TM 2.0 can bring added value to the existing solutions. On rainy days during summer, a high number of tourists visit the city centre with limited car capacity due to its historic nature. On such days, most of the tourists reach the city centre by private car, and this regularly results in traffic collapses which have a snow-ball effect. As a result of these high traffic volumes, also the public transport system collapses, since the trolley buses share the road network with individual transport and not all roads are equipped with bus lanes. The overall traffic management strategy on these days is to guide tourists to P+R facilities outside the city centre where a bus line brings them to the city centre. However, this traffic management strategy has not the desired effects. The target group

[2] http://www.fcd-modellregion.at/home?lang=en

[3] http://www.gevas.eu/1/news/news/article/sens-netzsteuerung-in-salzburg/

(tourists with city centre destination) cannot be efficiently informed. Closing the city centre for foreign cars (based on number plate selection) is not an optimal solution. Local VMS signs are not able to fully reach the drivers who are mostly guided by navigation systems. The latter are not aware of the city's traffic management plans and route users to closed roads. Most of the times, tourists are guided to P+R facilities at police checkpoints but leave the indicated route at the next junction and follow the route to car parks in the city centre again as indicated by their navigation system. This is a phenomenon that has become worse over the last years with the increased penetration rate of navigation systems in vehicles.

Shifting TM 1.0 to TM 2.0 in Salzburg means to establish the link between the city administration authorities and the traffic information service providers. By sharing the traffic management strategy that is decided by the city administration with navigation and traffic information services providers, the chain of 'informing-guiding-managing traffic' is complete. The information reaches the driver directly via the in-vehicle system (using the in-dash or portable device in the vehicle). The challenges for the City Administration have already been identified. The road operating authorities have to agree on a standard format (preferably a common European one) for sending information to different service providers. Possibly the national access points, as these are set by the EU Delegated Regulation on Real-Time Traffic Information[i], can deliver the information to different service providers.

Barcelona

Barcelona is the capital city of Catalonia with a population of 1.6 million within its administrative limits. Its urban area extends beyond the administrative city limits with a population of around 4.7 million people, being the sixth most populous urban area in the European Union after Paris, London, Madrid, the Ruhr area, and Milan. As most big metropolitan areas in Europe, Barcelona is heavily affected by congestion and CO_2 pollutants caused by, among other factors, the thousands of commuters that drive to the city on a daily basis. In order to tackle these issues the Catalan Traffic Service (SCT)[4], which is the public body in charge of traffic management and road safety in Catalonia, launched back in 2009 a variable speed traffic management system in the following access corridors to Barcelona.

Variable speed is a traffic management tool that dynamically reduces the allowed speed limit by informing the drivers via VMS. The advised speed limits depend on congestion levels; incidents (such as accidents and road works); bad weather (heavy rain, fog, wind); pollution. The advantages of this management tool of variable speed include: precision and efficiency in managing road incidents (foreseen and unforeseen) through speed management; reduction and minimization of the severity of congestion; reduction of the "stop & go" of vehicles, thus enhancing traffic flow and as a result reducing emissions; improvement of road safety and reduction of accidents due to the homogenised vehicle speed on the road network.

[4] http://transit.gencat.cat/ca

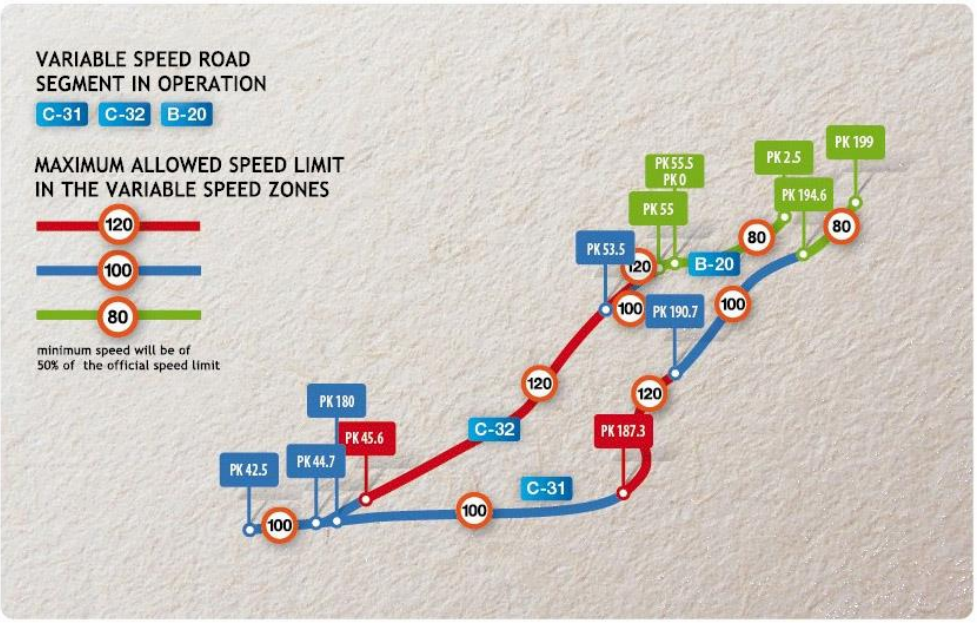

Figure 4 - Schematic map of the three access corridors to Barcelona where the variable speed traffic management system is currently implemented

Currently, detection of congestion in the city of Barcelona and its access corridors is based on inductive loops measuring traffic volumes, and thus allowed (variable) speed limit is informed to the drivers through VMS, plus enforcement reinforced by means of speed cams. However, detection of congestion through inductive loops is a rather old-fashioned methodology. Precision and accuracy of the data provided by this type of sensors is limited and maintenance of the system is expensive. Besides, congestion and pollution caused by heavy traffic does affect other roads and highways where variable speed TM is currently not implemented. Deploying / extending variable speed TM to further access corridors to Barcelona would require installation (and further maintenance) of more roadside ITS infrastructure.

The shift from TM 1.0 to TM 2.0 for Barcelona means unlocking the potential for improved TM strategies through the dynamic exchange of data / information between the traffic managers and the users enabled by Floating Car Data (FCD). Deploying TM 2.0 will empower the drivers to be informed on the best commute option based on highly accurate and updated travel time estimations. Real-time information will flow both ways: to and from the driver, to and from the traffic managers via the traffic information service providers- using an in-vehicle navigation device or an app. TM 2.0 facilitates the provision of highly relevant, targeted and updated information directly to connected drivers, in a simple and timely manner, with the goal to contribute to a smoother traffic flow as part of a global traffic management strategy.

Learnings from the four case studies and value proposition for TM 2.0

The four case studies examined in this paper share a common vision how TM 2.0 can help in facing the different challenges in their traffic management practices. The following elements have been identified as key to enable a more efficient and effective traffic management:

- TM 2.0 can establish a new bi-directional communication channel between users (as well as

their service providers) and TMCs. In some cases this will be through road-side infrastructure (i.e. V2I, and Infrastructure to TMC, and vice-versa) or through mobile communication networks (i.e. Vehicle to TMC, and vice-versa). Irrespective of the configuration at each pilot-specific application, communication will be supported by already existing industry standards (LTE, V2I – I2V) while there is a need to agree on common formats for the exchange of specific contents between the different stakeholders, so that TM 2.0-compliant applications are interoperable EU-wide.

- Some contents to be shared among the different stakeholders in the TM value chain are already well defined and there are standards available to format them (e.g. DATEX II for many TM-related concepts; or the widely accepted "Floating Car Data" specification etc.). At the same time, there are other contents the definition and formatting of which, will need to be commonly agreed (e.g. traffic management plans), this specific aspect being tackled by a dedicated task force within the TM 2.0 platform. The different pilots discussed in this Paper, share the common view that the communication channel between vehicles/users and TMCs can be as well used to target specific user groups with tailored information/instructions (e.g. Thessaloniki to target taxis under certain congestion conditions; Salzburg to foster tourists to use park and ride facilities and enter the city center by public transport; Barcelona to convince commuters to adapt their speed or take alternative routes). Specific contents to support each pilot-specific use case/scenario will need to be clearly defined and formatted using a commonly agreed protocol (e.g. location of park and ride facilities and available parking lots for the Salzburg case study).
- The four regions share the common vision that TM may not end with road traffic management only. Specifically, the vision is that efficient traffic management must integrate and exchange information from other modes of transport as well (e.g. guiding tourists to P+R locations, then continue the trip to the city center using PT; Barcelona to provide very accurate travel time to destination to support inter-modal travel planners). This vision adds additional stakeholders to the value chain - i.e. PT operators - and extends the need to agree on common interfaces for the exchange of data and related formats/protocols.
- Common to the four regions is the need to elaborate viable business cases for the deployment of win-win scenarios for all actors involved aiming at the shared goals of reducing congestion and pollution, improving road safety and being cost-effective at all levels. The public benefit ranks equally with the private driver's satisfaction in the TM 2.0 concept.

To foster the development of viable business cases, the main benefits of TM 2.0 with respect to different stakeholder groups have been identified as well (Table 2).

Table 2 – Benefits of TM 2.0 from the perspective of different stakeholder groups

Stakeholders	**Benefits of TM 2.0**
City administrations / traffic managers	• Avoiding congestion and traffic collapse • Avoiding unnecessary emissions (smoother traffic flow)

	• Improve traffic management plans (FCD complementing or replacing loop detectors and enhancing accuracy in traffic information) • Traffic management plans measures are reaching the driver directly (in-vehicle) • FCD-enabled traffic management being easily scalable to roads where there is currently no ITS infrastructure installed with very little investment, maximizing the benefits of the overall system
Drivers	• Avoiding congestion: more relaxed driving • Receiving relevant regional information in-vehicle • Improved road safety through smoother traffic flow • Best route options aligned with traffic management plans
Traffic information service providers	• Provide the best route option to the destination for their customers (not only the fastest or shortest car route) • Provide added value to their customers with information that goes beyond congestion (potential for new business opportunities) • Provide a solution (= best route option) not the problem (= congestion information) well in advance • Regional information becomes part of an integrated service • New business opportunities with the public sector (traffic managers)

TM 2.0 provides an important framework for real-time traffic data to become available to road network operators. This additional real-time information is key for improved traffic and asset management. Traffic planners and road operators can make use of floating car data for estimating traffic flow, deriving origin-destination matrices and for studying traffic mobility patterns.

On the other hand, making traffic management plans and strategies available to service providers is expected to bring in-depth knowledge about TMC operations to service providers and their customers. This knowledge provides new insights into how the road-network is managed and what would be the optimal ways to ensure the end-to-end efficient movement of people and goods. The success of the TM 2.0 concept lies on the fact that it aims to consistently combine and align the sets of objectives that the traffic stakeholders aim to satisfy: public benefit (environmental, congestion, prioritisation policies) and private (fast and efficient routing) in every step of the TM chain.

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