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The exchange of traffic management plans in TM 2.0

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Abstract

Traffic Management operations in general and exchange of traffic management plans in particular are very heterogeneous across Europe in terms of availability and quality. These can be explained by the different levels of available facilities (ICT infrastructure), tools or processes and the lack of standards in place within road infrastructure providers responsible for implementation of traffic management plans.

The TM 2.0 concept on the exchange of TMPs aims to enable, facilitate and accelerate the information exchange among traffic management stakeholders and in particular the access to policy and strategy based plans and actions as these are set by the public authorities and road operators.

Keywords:

TRAFFIC MANAGEMENT, TRAFFIC MANAGEMENT PLANS, TRAFFIC MANAGEMENT CENTRE, TM 2.0, ITS DIRECTIVE, TRAFFIC INFORMATION SERVICES, PUBLIC AUTHORITIES, ROAD OPERATORS

Introduction

The ERTICO Innovation Platform on interactive traffic management, TM 2.0 was launched at the ITS Europe Congress in Helsinki in 2014. It groups together members coming from the traffic management stakeholders, such as OEMs, Traffic Information Service Providers, Road Infrastructure providers, Public authorities and Road Operators for cities and regions in Europe responsible for the management of urban as well as interurban traffic, ITS research centres and road-network users associations. Nonetheless, TM 2.0 is both a concept and a platform. The TM 2.0 concept focuses on enabling vehicle interaction with traffic management plans and procedures. By discussing business models and "enablers", the TM 2.0 Platform aims to pave the way for the TM 2.0 concept to be implemented in

various cities and regions around Europe based on the win-win of its actors. By way of issuing a series of recommendations the TM 2.0 Platform serves as a catalyst that accelerates the current activities in the field of Traffic management by both the Industry and the public authorities towards providing innovative Traffic Management practices.

The 26 members of the TM 2.0 Platform believe in cooperation among traffic stakeholders and in adapting the organizational architecture of traffic management to be deployed to the specific region or city in focus. Individualities are important when one aims for functional- tailor-made traffic management. Minimum required sets of data to be used in providing TM 2.0 services to drivers and traffic management centres along with reliability and quality of data used in the process are issues being tackled by the Task forces of the Platform. The TM 2.0 Platform members are in the process of agreeing common interfaces which can facilitate the exchange of data and information from the road vehicles and the traffic management centre and back, improving the total value chain for consistent traffic management and mobility services as well as avoiding conflicting guidance information on the road and in the vehicles themselves.

Under the TM 2.0 concept, the different priorities of the actors involved in traffic management are being balanced and the roles and responsibilities of the stakeholders align in making the traffic information that reaches the vehicle on the road, consistent. The exchange of information between Traffic Management Centres and Traffic information Service providers plays a pivotal role within the TM 2.0 concept. For example, when there is a football game in the area where the vehicle user is driving to and the Traffic Information Service provider (including in-dash navigation service providers) is aware of this and is also informed about the Traffic management Plans (TMPs) the local Traffic Management Centre will be implementing in order to de-congest the area, the routing of traffic by traffic information service providers can be aligned to the goals and objectives of the TMCs and the win-win is shared among all traffic partners. Safety on the road network is coupled with the efficiency of traffic information provision via the navigation system in the vehicle. As a result, there is also convergence between the actions of the individual driver's objectives (for fast and efficient travel) and those of the public authorities (for adherence to set collective/societal objectives0 such as CO2 emissions, prioritization of one road user group over the other (pedestrians over cars depending on policy) or other.

The TM 2.0 ERTICO Innovation Platform Task Forces work on issues that enable the deployment of the TM 2.0 and the exchange of Traffic Management Plans is one of them. Accordingly, the TM 2.0 Task Force (TF) on the exchange of Traffic Management Plans (TMPs) aims to define the concept of TMP (decisions, procedures and strategies) as it is key for the better understanding and development of TM 2.0. What is included in TMPs and how to exchange it, are the focus of the work of this TF. As the term 'TMPs' is also used in the latest EU Specifications on Real Time Traffic Information (priority Action B), the work of the TF can contribute to the better implementation of the EU Com Specs.

The European Commission has adopted on December 18th 2014 the set of specifications for priority action B under the above-mentioned ITS Directive, namely the Delegated Regulation on the provision

of EU-wide **Real-Time Traffic Information (RTTI)** services. Real-time traffic information services aim to provide road users with accurate and up-to-date information related to their journeys. This can include information about the road network, traffic regulations (such as speed limits and access restrictions), officially recommended alternative routes, expected delays and estimated travel times, information about accidents, road works and road closures, warnings about weather conditions and any other relevant information (e.g. information about road tolls and availability and cost of parking places at the destination). Real-Time Traffic Information, according to the EU Commission Specifications can be delivered to drivers through various channels, such as variable message signs, variable speed limits, radio traffic message channels, smartphones, navigation devices, etc. Although the RTTI specifications (http://ec.europa.eu/transport/themes/its/news/doc/2014-12-18-rtti/c(2014)9672en.pdf) are not focusing on Traffic Management as such, but rather on encouraging the cooperation between road operators and service providers and digital map makers in ensuring the accuracy of data and timely upgrade, it also bears mention to the possibility of road operators keeping data service providers informed of their decisions on changes on the road network.

This is a two-way process according to the EU Commission Specification and it aims to benefit the road network users, the travellers. Data quality and quality in services is what both the road operators and the service providers aim to achieve. Additionally, safety related traffic information (SRTTI according to the Priority C specifications) is fed by traffic information service providers into the traffic information system directly due to its urgency. However, this is not the case for other kinds of information pertaining to TMPs. The EU Specs on Priorities C and B aim to on the one hand ensure driver access to safety related information (priority C) and on the other hand, promote possible cooperation between public authorities and private traffic information service providers, without either specifying the framework or explicitly defining what the term TMPs encompasses. Access to these relevant data sets will ensure that the actions of the road network users will work in synergy with the collective mobility objectives.

Harmonised standards/interfaces have been identified by the TM 2.0 ERTICO Innovation Platform and its Task Force *on enablers and barriers* during its first phase (2015) as an enabler in this exchange of traffic information between service providers and traffic management centres/road operators. As acknowledged in the EU RTTI specifications, the use of real-time traffic information services generated by service providers can represent a cost-effective way for public authorities to improve traffic management as well as infrastructure management and maintenance. It is acknowledged by both the EU Commission and TM 2.0 member organisations alike that all traffic management stakeholders will be able to benefit from the exchange of TMPs and the synergy between the public authorities and private traffic information service providers in brining traffic management to the next step, that of TM 2.0.

The TM 2.0 TF on the exchange of TMPs intends to closely work with TISA, the Travellers Information Services Association on defining and recommending possible harmonised standards on the format of TMPs. As TMPs have to be able to flow between traffic information service providers and traffic management centres/road operators, the format should be cost-effective and widely

acceptable. TISA has great expertise in bringing the traffic stakeholders together (private sector and public authorities alike) and setting commonly agreed standards in the field of traffic information. As working and setting standards is out of the scope of the TM 2.0 Platform, TISA has been identified as the best partner to aid with this task.

Definition of Traffic Management Plans

Traffic management solutions are often not directly interchangeable between different urban areas or regions. It is, therefore, necessary that they are tailored to local requirements and should be reflective of local priorities and sensitivities. Traffic management requirements often have direct policy implications. Thus policy decision makers will be fully involved in decision making regarding traffic management strategies and actions.

See report on urban its expert group guidelines for its deployment in urban areas: http://ec.europa.eu/transport/themes/its/road/action_plan/doc/2013-urban-its-expert_group-guidelines-on-traffic-management.pdf

Traffic Management Plans contains different elements:

- (Where) description of the geographical context;
- (What) description of the traffic situation that might or (in case of events and road construction works) will occur;
- (Why) this traffic situation needs to be managed and what enhancement in traffic this management needs to bring;
- (When) moments in time when these traffic situations are expected (e.g morning rush hours, tunnel closure, football match, et cetera);
- (Who) the target groups on which the traffic management actions will focus (e.g. motorists traveling from the south towards the city centre, or cyclists in order to give them a better position in the traffic flow), or a prioritised combination of these groups in certain circumstances;
- (How) what traffic services will be activated and deactivated (on what triggers and where on the road network) in order to manage traffic. Traffic services can be groups in 4 classes: reduce inflow (influx), increase outflow (outflux), increase throughput and reroute traffic.

The ‘where’, ‘what’ and ‘when’ is needed to get an understanding of the needs of the traffic manager (read: the collective of road users). The ‘who’ is needed to get an understanding on who to approach and guide or support. In the ‘how’ the transition from TM1.0 to TM2.0 becomes clear. In TM 1.0 the traffic services will be translated in configurations of road side instruments such as traffic signal controllers’ ramp meters, variable message signs, or even road closures using barriers. In TM 2.0 the services can be implemented via information, advices and warning appearing on the human machine interface of the navigation device.

Current scene in traffic management plans

Identification of Stakeholders

Previous work by members of the TM 2.0 platform [6] has identified the following stakeholders as regards the Traffic Management services provision, the Road Infrastructure Owners, Road Side Service Providers, Content Service Providers, In Car Service Providers and Service Consumers. The high-level requirements per category of stakeholders have been analysed within the members of this task force and are presented below.

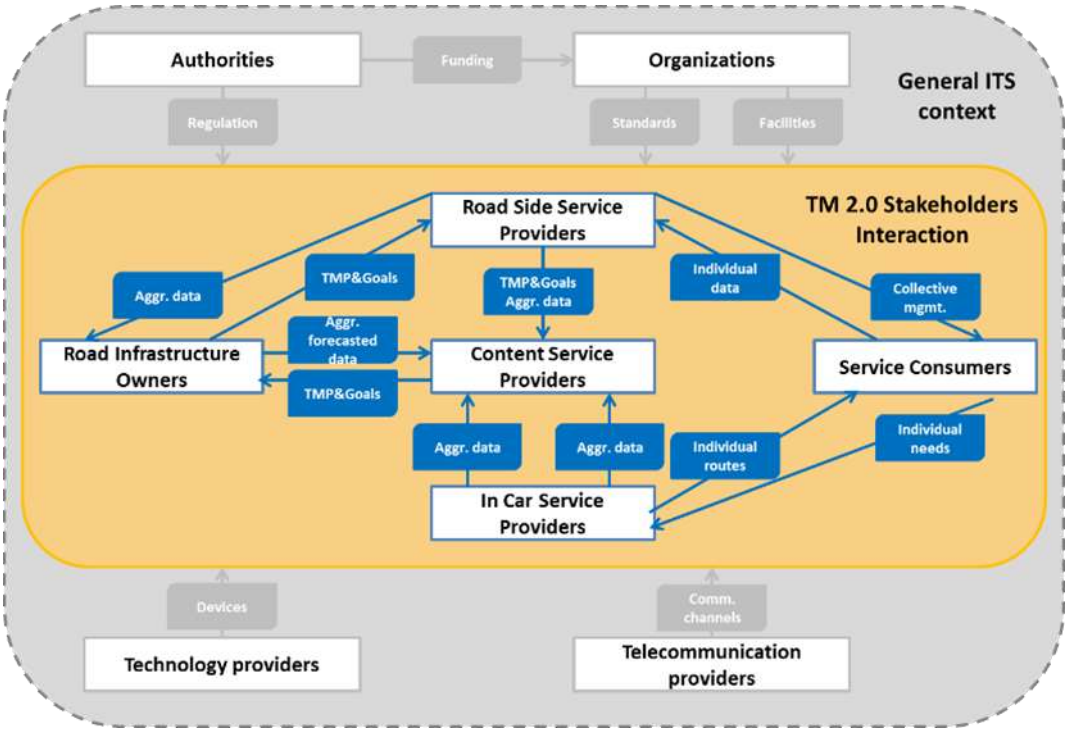

Figure 1 - TM 2.0 organizational reference architecture

On the private entity side of traffic management plans, several stakeholders arise that can provide traffic management data from their services and/or can benefit from using data as provided by public entities. Below, some of the entities are explained by describing general service characteristics, their business case and the possible benefits that could be reaped by being involved in traffic management data exchange.

Content service providers are considered the most dominant private parties involved in traffic management data exchange at this moment. Especially content service providers with higher numbers of active users have a broad and real-time data source for monitoring the status of the road infrastructure and (given the amount of trips that are pre-planned), even know where traffic is to be expected. Currently, these service providers provide their navigation based on a combination of their own monitoring and use of publicly provided open data on travel times, congestions, roadwork, etc. Their business case is twofold. It can be a business-to-consumer business case based on paying customers (e.g. TomTom and Garmin) expecting the best navigation advices and being willing to pay for either the navigation box, or a subscription to the service. It can also be business-to-business

business case based on retrieving valuable information for businesses from community data (e.g, Google Maps).

As for the road infrastructure providers, public entities (Traffic and Transport authorities and administrations) and private road operators can be distinguished. In the same region public entities are involved in several forms and on several levels (with corresponding policies) and possible private road operators (e.g. a toll tunnel or toll road). The complexity of traffic management in a region is that these entire road infrastructures together provide one road network that is used by road users to travel from origin to destination, but every entity by itself has its own issues to manage. For a motorway operator this is a smooth and safe traffic flow over the motorway 'pipelines'. For urban road infrastructure providers this is (in addition) balancing flows of motor cars, cyclists and public transport over the same streets and intersections in the city centre. It cannot be said that there is a general hierarchy in that the priorities to keep high level infrastructure open and flowing are more important than the priorities of the level below. The levels are intertwingled. Urban trunk roads that become saturated might lead to blocking back effects towards the motorway and in the end congestion on the motorway. Vice versa, congestion on the motorway might block traffic from on the slip on roads and as such might block back traffic on urban trunk roads. Balancing all these interests can be done via region wide collaboration and TMPs.

TMPs that can be picked up by in-car service providers that can contribute in this way to a better traffic performance in the region. In-car sservice providers could both improve their service in two ways. They can share the intentions of their service users (e.g where they come from and are heading to and/or selected route) anonymously with road infrastructure providers (traffic managers), who can use this data in designing and triggering TMPs in a much better way. The other way around they can pick up the TMPs from the road infrastructure providers and incorporate the traffic services that are or will be activated following the TMPs in their route guidance.

Complicating issue for service providers is the multitude of traffic management centres, from which road infrastructure providers bring their traffic management in practice. Most highways agencies have several traffic management centres and within one region there can be a traffic management centre from then highways agency, or of the regional department and one or two of the main cities. In-car service providers have to retrieve the TMPS from all these traffic management centres and incorporate the full set in their route guidance. Content service providers have to retrieve (if possible open and streaming) traffic data from all these traffic management centres. Sometimes road operators have a corporation in a data warehouse for traffic data. This improves the efficiency of data exchange in both ways.

An emerging group is the roadside service providers. Road infrastructure providers can outsource their traffic management activities to these service providers. The other way around, road side service providers can deliver their services to a multitude of road infrastructure providers.

Last but not least, there are the service users. In traffic management nowadays the emphasis (too)

often is on motorists. With the climate goals of cities cyclists will become a group of growing significance. This will change the game of traffic management in the sense that there is a growing need for bicycle traffic data, plus cyclists get an explicit position in TMPs.

Traffic Management operations in general and exchange of traffic management plans in particular are very heterogeneous across Europe in terms of availability and quality. These can be explained by the different levels of available facilities (ICT infrastructure), tools or processes and the lack of standards in place within road infrastructure providers responsible for implementation of traffic management plans. On one extreme, there are several European traffic authorities which have processes to elaborate and make available planned and unplanned accurate TMP information in digital and (almost) real time manner to content and traffic information services providers, via websites or digital feeds. But on many cases, we still find European traffic managers which still develop and implement their traffic management plans and activities on ad hoc manner, lacking of qualitative plans, only available on paper, based on TM processes still dependent on high level of interaction and participation of (specific expert) traffic managers, in a non-standardized manner.

The success and efficiency of TM2.0 lies very much on success of harmonization of the quality and availability of Traffic Management Plans across Europe. The challenge is not only related to the interaction between road authorities and services providers, but also to achieve cooperation between road authorities where the consistency and harmonization between TM plans, principles and measures are developed and agreed beforehand, and implemented in an uniform way.

TM 2 .0 approach for exchange of traffic management plans

TM 2.0 is based on interactive traffic management. The concept responds to the environmental and societal objectives of sustainability (reduced energy use and lower CO2 emissions), cost efficiency and reduced congestion. Ideally information about how, when and where people and freight plan to travel or are travelling travel will form part of the data exchanged between TMCs and SPs so that the (re)routing options offered to the travellers can both meet the above mentioned objectives and the individual traveller's needs. This concept of evolved traffic management opens new business opportunities for all the stakeholders involved along with new forms of synergies organisational wise.
In particular, the three main actors in the mobility field, Traffic Management Systems suppliers, Navigation Service Providers and the automotive industry, are called to join effort to tackle this business challenge addressing the new market demands in traffic management.

The TM 2.0 concept on the exchange of TMPs aims to enable, facilitate and accelerate the information exchange among traffic management stakeholders and in particular the access to policy and strategy based plans and actions as these are set by the public authorities and road operators. In this way, and by making sure that cooperation and exchange of information is based on a win-win model for each participant vehicle interaction is added into the traffic management loop. As the fundamental aim of an evolved traffic management strategy is to ensure smooth flows of vehicles across the entire road network, where vehicles travel at a steady and optimum speed so that fuel consumption and CO2

emissions can be reduced to a minimum, traffic management ensures a minimum number of stops per driver, optimal routing of vehicles across the network and real time traffic information that enhances a 'good' driving behaviour (i.e. without unnecessary acceleration, deceleration, gear changes, etc.) which in turn favours the safety of all users within the road network and mitigates congestion.

According to how navigation in-car systems currently function, the driver submits his destination to the in-car device and expects to be advised in the best routing. The driver's destination and request for routing goes to the traffic information service Provider's (be it an OEM or a navigation service provider) back end and she is immediately provided with route options based on real-time conditions with regard to congestion and the weather conditions in the identified area.
Thanks to the data exchange enabled by TM 2.0, the traffic information service provider, when receiving the destination the driver wishes to reach, will be able to cross-check and cross-fertilise the destination data plan with what the Traffic Management Plans (TMP) provided by TMC. The TMP will be those relevant to the a) area of destination identified by the driver and also b) those relevant to the routing towards reaching this destination (i.e. football games, demonstrations, safety management action etc). The traffic information service provider, then after cross-checking and cross-fertilisation of the TMPs available to it will be able to send better informed advice to the driver by suggesting a 'better calculated' routing option. The traffic information service provider can include a short information text on explaining the motivation (optional).
Then the driver selects the 'better informed advice' in her Navigation (portable or in-dash) device and enjoys a more relaxing, efficient, effective and low cost drive.

Accessibility to the TMPs information, as this is agreed and defined by public authorities and road operators is also key to better traffic flow in its totality. The driver, when selecting the 'better informed advice' provided by the traffic information service provider, takes a further action to allow (privacy restriction withdrawn by the driver herself in the interest of helping the community of drivers in their travel and enhancing collective traffic management- could be the way to do it), the use (send back to the TMC) of this information (that the driver by following the 'better informed advice' will be avoiding those areas where specific actions based on the TMPs apply). As a result, when that information reaches the TMC, the latter acquires a better informed view on the road network traffic. The TMC then can initiate the procedure of enhanced traffic management with collective effects (as the infrastructure communication channels to the collective/mass of drives are consequently now better informed).

The paper identifies three pilot cases examples of exchange of Traffic management plans between service providers and Infrastructure operators:

Salzburg on rainy days during the summer touristic season has to accommodate for a high number of tourists who wish to visit the city centre. The city centre does not offer optimal 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 centres where a bus line brings them to the city centre. However, this traffic management strategy does not work. The target group (tourists with city centre destination) cannot be efficiently warned as there is not direct access of the city's TMPs to the in-vehicle traffic information system (be it a in-dash provided by OEMs or portable navigation device). The exchange of TMPs as part of the TM 2.0 concept for Salzburg would establish the link between the city administration authorities (public authorities and road operators) and the traffic information service providers. By sharing the traffic management strategy and actions (TMPs) that is decided by the city administration with the 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). As the traffic management strategy is dynamic information, it becomes part of the real-time traffic information provided by the navigation device.

The Dutch Ministry of Transport has announced an Action Programme "Better informed on the Road" 2013-2023 consisting of a Roadmap and an Implementation Agenda in which the business sector, public authorities and knowledge institutes all collaborate closely in order to further develop the services required to provide road traffic/travel information and traffic management.

DVM-Exchange [1] is an interface standard for traffic management systems in the Netherlands, especially focussing on so-called Network Management Systems, that manage traffic in networks instead of in single nodes. The standard is successfully implemented by a growing group of companies in the Dutch traffic management industry, using an open process. A key feature of the standard is that the interface is expressed in effects on traffic, i.e. in traffic management terms. This traffic-level interface is then translated into an IT-technical interface within the framework of Web Services, which contributes to its future extensibility.

On the A58 motorway between Eindhoven and Tilburg 34 WiFi-P beacons have been placed as part of the Shockwave traffic jams A58 Motorway 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. The A58 Motorway is being managed from this traffic centre. 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. Service providers already receive the actual state of the lane signs at the gantries of the A58 Motorway to take into account with the information to deliver to the road users. The exchange of TMPs will be the next step. Road authorities and service providers in the Netherlands have agreed to make data from Traffic Management systems to the roadside open and available for service providers as regards Road Works, Location reference,

Maximum Speed, the requested time to solve an incident, Traffic Management plans, Parking data, Data from Traffic Light Controllers, Data from bikes, Blue wave (bridges) [3]. Work is currently ongoing due to the complexity of involved issues.
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. It will be an enabler to exchange information (traffic management plans etc.) between the traffic management centre and the service providers.

In Germany a research project investigating cooperation between public traffic management and private navigation service providers has been carried out. Project partners were Hessen Mobil (the traffic management authority of the state of Hessen), Momatec (a traffic consultancy), and TomTom. BMW and the City of Frankfurt were associated with the project. The project was concluded by end of 2014.
On basis of an analysis of differences in route guidance between public traffic management and navigation service providers a “strategic concept” was developed. The concept defines different levels of cooperation, which differ in the level of bindingness – starting from the optional consideration of public strategies to the mandatory takeover of routes from the public traffic management in individual route recommendations.
In addition to the “strategic concept” also a “technical concept” was developed to allow the provision of strategic route recommendations. An extended DATEX II profile for strategic compliant routing was proposed and has been proved during a validation phase, so that the technical basis for the exchange of strategic routes is available. The availability of data and data quality aspects have been identified as essential requirements for collaboration. The next step would be a field trial, which includes also the presentation of information to end-users.

Challenges and Next Steps

The upcoming challenge is to come to a common agreement on the definition of TM by all stakeholders. Also the Quality of data, Interoperability and seamless connectivity, and continuity of service should be enhanced. Users’ privacy concerns should also be respected. From the results of the Task Force on Barriers and Enablers, it is expected that the provision of services will be greatly facilitated by the high penetration of navigation devices in vehicles and nomadic devices and by the increase in availability of reliable traffic information provided by connected mobile users as well as by the progress already made in Europe as regards cooperative ITS data. Probe data as well as the interface for data transfer between navigation systems and Traffic Management plans will need to be standardised and secured by a security infrastructure. The TM 2.0 TF on the exchange of TMPs intends to closely work with TISA, the Travellers Information Services Association on defining and recommending possible harmonised standards on the format of TMPs. In the future, cooperation of public authorities and alignment of TM among them will be needed. It was concluded that cooperation has large potential benefits for both public traffic management and private navigation service providers and that effective results could be achieved even without high technical effort.

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