



ENABLING VEHICLE INTERACTION WITH
TRAFFIC MANAGEMENT

TF on Exchange of Best Practices on deploying TM 2.0

Interim Report

January 2016

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Introduction

Outline of the TF activities

The activities of the TM2.0 Task Force on “TF on Exchange of Best Practices on deploying TM 2.0” started in October 2016. The initial aim of the TF has been to concentrate on the following aspects:

- Exchange of Best Practices on deploying TM2.0 at city and region level
- Speed up the development of innovative solutions for advanced active traffic management by supporting the TM2.0 Innovation Procurement process
- Implementation of the TM2.0 market place focusing on new solutions for advanced active traffic management

The main outcome would be an inventory of best practices and a classification at city, services and objectives level.

The above-mentioned objectives, initially set by TM2.0, have been clearly defined during the initial meetings of the TF members (Annex I), so that the final set of objectives and action points have been defined as follows:

- Exchange of Best Practices on deploying TM2.0 at city and region level
- Speed up the development of innovative solutions for advanced active traffic management by supporting the TM2.0 Innovative Public Procurement process, with focus on currently ongoing initiatives in Netherlands and Austria
- Synergies with relevant market places and innovation platforms, such as Mobinet and MaaS Alliance

Dependencies with activities of other TFs have been identified early on, which resulted to a close cooperation and content exchange with the TF “Deployment steps”, as well as with the merging with the TF “TM2.0 on real traffic”, which occurred in December 2016.

TF approach

The TF has designed a questionnaire (Annex II), aiming to collect information on best practices concerning TM2.0, implemented either as a whole or partially. The questionnaire included the following areas:

- General description of the implementation
- Partnership and costs
- Results
- Data exchange issues
- Lessons learnt

The questionnaire has been distributed to approximately 20 relevant authorities, including cities, ministries and TMCs. The response rate has been moderate, as expected, with seven responses received until the date that the present report has been prepared. However, the moderate response rate has been expected.

The results of the responses to the questionnaire are presented in the following section.

Responses to the questionnaire

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 vehicles and roadside systems, aiming to stimulate the deployment of projects based on the cooperation of public and private parties (using specific use cases, day 1 & 2 services, enhancing the ITS Corridor). The system is already running while in Q1 2017 the specifications baseline will be updated. Starting in Q2 2017 the updated baseline will be rolled out along 70 kms of urban and inter urban roads and highways. The implementing organization is the ITS Bureau BrabantStad and the technology used includes:

- Cellular technologies.
- 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.

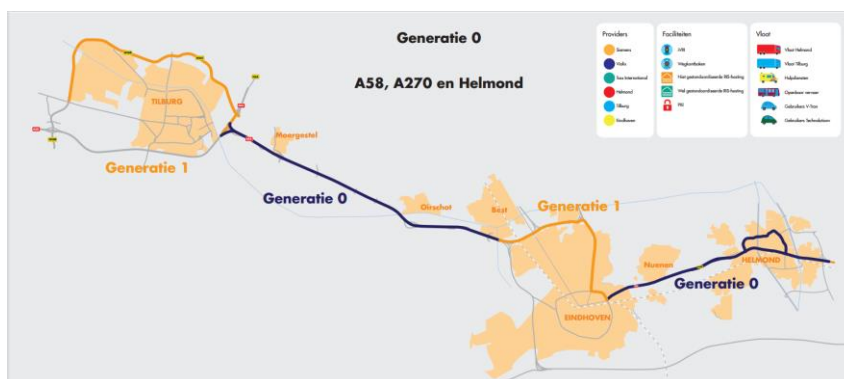


Figure 1 – Description of the System

As regards the participants involved, there is a wide range of stakeholders including the automotive industry, ITS suppliers of roadside 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 (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 Euros for 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 learned 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 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 learned' 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 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 test 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 maturity 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 Breda is an application focusing on traffic and travel information provisioning. Rijkswaterstaat (The Dutch Ministry of Environment and 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 Center (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 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.

Conclusions and planning of next steps

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 pilot projects presented in this interim report do not provide an exhaustive list of projects using aspects of the 'TM 2.0' concept on interactive traffic management. What one can however 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.

The collection of best practices is an on-going process. Therefore, it is expected that additional best practices and additional results coming from the on-going activities of the TM2.0 Task Force on Best practices exchange will be reported in the final TF report during summer 2017.

The next steps of the TF's members will include the topics of

- innovative public-private partnerships
- the new role of TMCs, TMC as a service
- relevant technology platforms currently developed across Europe

The final results will be submitted for presentation at the ITS Europe Congress of Strasbourg in 2017.

Annex I: Members of “TF on Exchange of Best Practices on deploying TM 2.0”

Representative	Organization
German Herrero	ATOS
Martin Dirnwoeber	AustriaTech
Ulrich Fastenrath	BMW
Evangelos Mitsakis	CERTH-HIT
Panagiotis Iordanopoulos	CERTH-HIT
Gert Blom	City of Helmond
Luc Jansseune	Continental
Nuno Rodrigues	DYNNIQ
Giacomo Somma	ERTICO
Suny Borges	HERE
Jaap van den Hoek	Inrix
Yvonne van Velthoven	ITS Agency BrabantStad
Karl Rehrl	Salzburgresearch
Sykora Robert	SIEMENS
Laura Cocone	SWARCO
Jop Spoelstra	Technolution
Johanna Tzanidaki	TomTom
Erlend Deckers	TNO
Frans Van Waes	Vialis

Annex II: Questionnaire for collection of information on best practices across Europe

Template for the reporting of best practices on aspects of the TM 2.0 concept

TM 2.0 and its scope

Traffic Management 2.0 (TM 2.0) stands for an evolved collaborative concept for Traffic Management and Control. In this evolved system the vehicle and the TMC, through the use of new technologies and sensors exchange travel information and achieve fast, efficient and effective travel at low cost. The entire data supply chain is involved in this concept while the legacy is also supported. New opportunities for Traffic Management and Control are expected to result from the implementation of this interface, making mobility cheaper and more efficient for the road operators, and, at the same time more cost-effective for the users.

The TM2.0 platform is an open group of significant actors from the global traffic management and mobility service market who joined forces driven by the common vision and belief to “Enable vehicle interaction with traffic management”. The public-private platform represents 22 members from traffic management solution providers, mobility service providers as well as traffic managers and road operators.

The scope of TM2.0 platform includes business models, deployment steps, public-private cooperation concepts, organisational architecture, and data exchange principles related to the interaction of the following type of services:

- Mobility services: Individual routing, Individual information and advice, High quality real time and reliable services, Interface to other modes of transport
- Road traffic management: Traffic management and control strategies, Collective routing, Adaptive and dynamic Traffic control, Traffic Management Procedures and Plans, Interface to other modes of transport

Adoption of specifications and standards, use of specific communication technologies and Vehicle-to-Vehicle (V2V) communication are NOT in the scope of TM2.0 unless the stakeholder cannot find the relevant body to liaise with.

Questionnaire

area on which aspects of TM 2.0 concept are implemented	<input type="checkbox"/> Traffic & Travel Information <input type="checkbox"/> Traffic & Access Management <input type="checkbox"/> Smart Ticketing <input type="checkbox"/> Urban Logistics <input type="checkbox"/> Other:
TITLE OF THE ITS application	

1. General description	
Traffic management Problems addressed & Objectives	Traffic Management Issue(s) encountered:
Start of ITS system or service/ aspect of TM 2.0 concept	
Location	<input type="checkbox"/> single road/line <input type="checkbox"/> city district <input type="checkbox"/> whole city <input type="checkbox"/> urban region <input type="checkbox"/> Sub-urban region <input type="checkbox"/> highway <input type="checkbox"/> other: (please specify)
Transport mode(s) targeted	<input type="checkbox"/> public transport <input type="checkbox"/> rail <input type="checkbox"/> road <input type="checkbox"/> car-sharing <input type="checkbox"/> bicycles <input type="checkbox"/> pedestrians <input type="checkbox"/> multi-modal <input type="checkbox"/> other: (please specify)
Implementing organisation	
System / service description	
Technologies used	
Standards used	

2. implementation	
Partners involved	<input type="checkbox"/> Public authorities: <input type="checkbox"/> Private stakeholders: <input type="checkbox"/> Others:

Organisational model	<input type="checkbox"/> Management body: <input type="checkbox"/> Operating body: <input type="checkbox"/> Financing body:
Business model	<input type="checkbox"/> Public investment: <input type="checkbox"/> Private / commercial framework: <input type="checkbox"/> Public-private partnership:
Investment costs	
Operating costs	

3. Results	
Technical performance	
Implementation of ITS application/ TM 2.0 aspect	
Safety impacts	
Efficiency impacts	
Environmental impacts	
Socio-economic impacts	
Revenue generation	
User acceptance	
easiness of replicability	<input type="checkbox"/> easy <input type="checkbox"/> difficult

4. Data requirements and Data exchange	
Short description of the data sets needed	
Data elements in the data set	

Source of the data	
Receiver of the data	
Is there a willingness to share these data and who is willing to share it	
Preferred way of exchange of data (raw data, aggregated data, service)	
Service which is facilitated by the data set or to which the data set will contribute	
Time frame for realisation of a data exchange (near term /mid term)	
Are standards already available	
Possible sharing models	

5. Lessons learnt	
Factors for success	
Obstacles	

6. More Information	
Contact Person	Name: Function: Company: Email: Phone:
Web link (if available)	