ITS ACTION PLAN

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ITS Action Plan – Action 1.2
"Optimising the Collection and Provision of Road Data"

D4 Final Report

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EUROPEAN COMMISSION
Directorate-General Mobility and Transport
Unit C3
Rue De Mot 28, 4/37
B-1040 Brussels
Belgium

Nabil Abou-Rahme
nabil.abou-rahme@rapp-trans.co.uk

Administrative contact:
Rémi Tempier
remi.tempier@algoe.fr

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CONTRIBUTORS

Name	Company
Nabil Abou-Rahme	Rapp Trans UK
James Long	Rapp Trans UK
Tom van de Ven	Rapp Trans NL
Ian Wilkinson	Rapp Trans UK
Didier Gazagne	Alain Bensoussan Avocats

E X E C U T I V E S U M M A R Y

The European Commission's vision for transport includes the creation of a seamless journey experience for travellers across different countries and regions. However, the approach to harmonisation through gradual alignment has been rather slow, due in part to the organisational diversity within and between countries, and also the specific issues faced by local traffic managers.

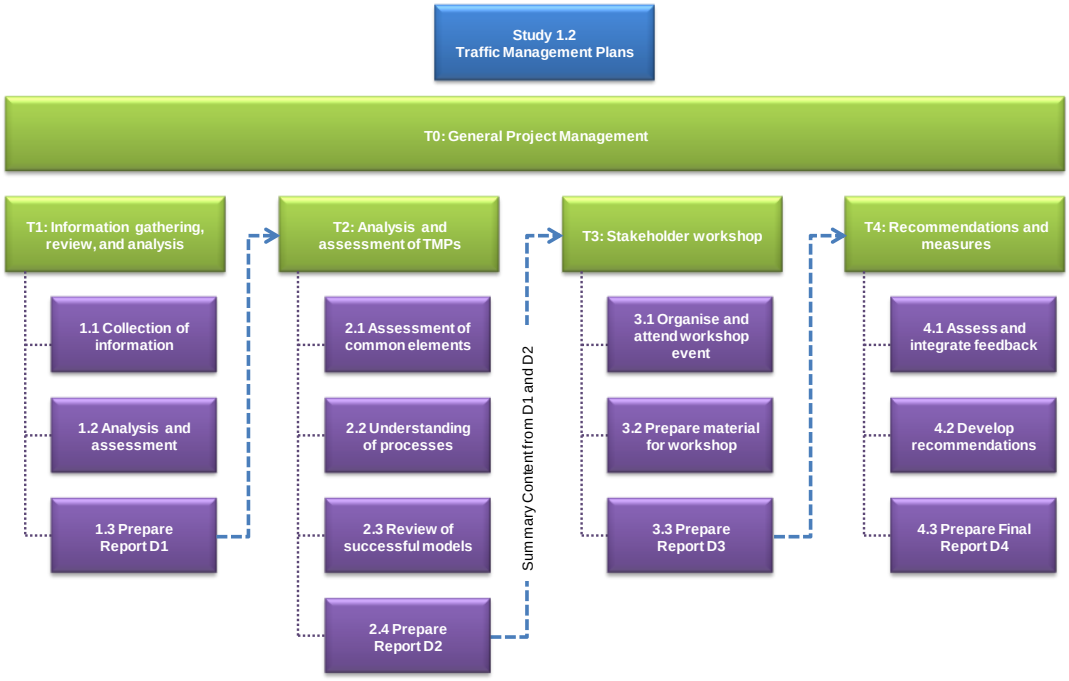
On 16 December 2008 the EC adopted an ITS Action Plan (COM(2008) 886) for road transport and its interfaces with other modes. The aim of the Action Plan is to accelerate and coordinate the deployment of ITS applications. With the adoption of the ITS Directive (2010/40/EU) on 07 July 2010, the EU has made further provision for measures which will help secure this vision of seamless travel.

Action Area 1 in the ITS Action Plan is 'Optimal Use of Road, Traffic and Travel Data', and this present study is formulated under Action 1.2. The study is called "*the optimisation of the collection and provision of (restrictive) road data and traffic circulation plans, traffic regulations and recommended routes (in particular for heavy goods vehicles)*". The focus is on the availability of existing data by the public sector, facilitation of exchange between affected stakeholders, and timely updates by service providers to the end users (in others words, opening up the data value chain).

The study followed an investigative format, beginning with a state of the art review, followed by an assessment and analysis of the findings, a workshop for consultation with stakeholders on an early proposal, and preparation of a set of conclusions and recommendations derived from this process. The relationship between the tasks is shown in the figure below.

The study objectives led to an initial focus on technical approaches and methodologies, the 'how' of data exchange, and examples of best practice which may inspire more widespread implementation across Europe. However, through engaging with the experts and stakeholder community it was clear that the technical issues are secondary and that the barriers to data exchange are based on more subtle elements. These include funding and prevailing culture in the public sector, and concerns about ownership and commercial advantage in the private sector.

The state of the art in optimising the collection and provision of road and traffic data across Europe is highly variable, and the coverage is patchy. Data availability remains the most pressing issue at all levels. Where data is available, the next most pressing issue is quality (sufficient for re-use through the value chain). The question of quality must be accompanied by a review of purpose for which the data needs to be accessed and 're-used'.



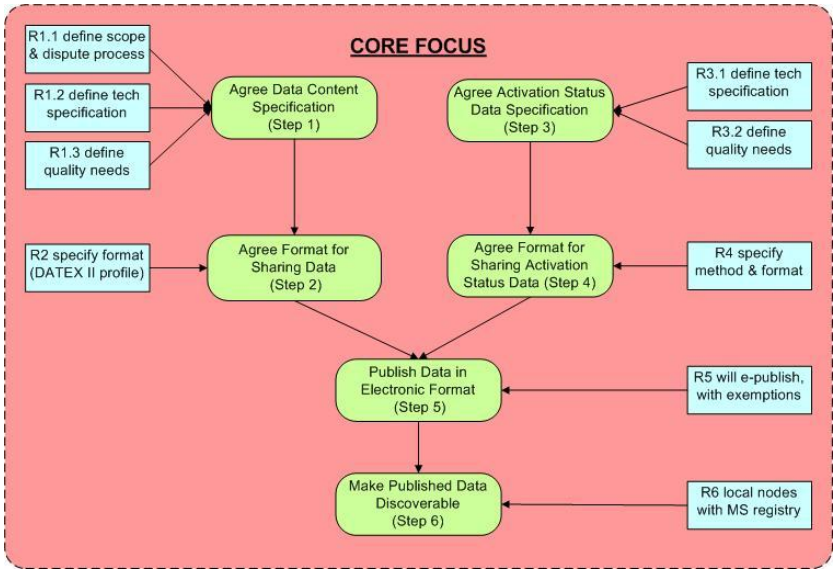
The principal findings of the study are that there are different "pathways" a road authority can take towards sharing road and traffic data (both with other public sector bodies and with commercial third parties). The pathways share a common end point; that is, where clearly defined road and traffic data elements are shared electronically with other organisations, in a common format, along with a dynamic activation status. The study team proposes that the common end point can be achieved through the following steps:

1. Agree the data content specification (for 'road and traffic data') which falls within this scope (including details on any potential measures that could be applied at each location)
2. Agree on the (preferred) format(s) for presenting these in-scope 'road and traffic data' elements electronically (static and context information)
3. Agree the data elements that describing the activation (or application) status of traffic management measures identified in Step 2.
4. Agree on the (preferred) format(s) for presenting these associated status updates electronically (dynamic and near real-time information)
5. Ensure electronic publication of all elements captured under Steps 1-4
6. Ensure published information described in Step 5 is discoverable by other public bodies and by ITS Service Providers (as required in the ITS Directive)
7. Monitor implementation of Steps 1-6, and engage in a programme of supporting activities to facilitate smoother progress towards the desired outcome

The recommendations were drawn from a broader set of options, using the following rationale:

- if the data sharing objectives envisaged by the ITS Directive are to be achieved in a timely manner (or at all), the EC will need to make some intervention on publication of road and traffic data (traffic circulation plans, traffic regulations and recommended routes)
- the question of formats has been examined as part of this study, and there are advantages in keeping the location and context information in the same format as the activation status for measures, namely DATEXII (this is not in conflict with improvements related to INSPIRE, such as TN-ITS)
- the question of quality needed to be owned by the stakeholder community, through seeking further clarity on what services are envisaged and the marginal costs involved for provision of data at each quality increment

The study has described what is possible and proposed a path to a workable solution. The recommendations for intervention are summarised here. The relationship between the recommendations and Steps 1 to 6 is summarised in the figure below.



[R1.1] Publish a definition of the intended scope for traffic management measures and provide a dispute resolution facility.

Public authorities will need to be able to correctly identify information about changes affecting their networks which would occur if they implemented a planned traffic management measure. They would also need to communicate such changes in a timely manner as they occur. For this study the in-scope traffic management measures were defined as "*any which contain a traffic circulation plan, a traffic regulation or a recommended route*".

[R1.2] Provide a binding technical specification of the data contents describing the relevant traffic management measures and their impacts.

The specification will require a definition of all time-related aspects of the traffic management measure (e.g. start date/time), as well as the way the data elements are expressed (e.g. units of measurement). It may also be necessary to agree the method used to derive certain data (e.g. estimated new traffic speed). It will be necessary to ensure compliance with this specification across MS, for which purpose it will need to be binding, and hence it will need to be highly credible internationally. It is recommended that the EC appoints CEN experts to develop the technical specification.

[R1.3] Organise a forum for relevant stakeholders to define quality requirements for the key road and traffic data elements that are to be described in the technical specification, and add these to the specification.

If there are no quality requirements or if different stakeholders define quality in different ways, the data recipients may not be able to use the data, or incur significant costs understanding it. The relevant stakeholders will need to agree which data elements are most critical and then negotiate an acceptable compromise solution for each because the costs and benefits of meeting the quality requirements for these data are likely to be distributed asymmetrically between them. It is recommended that the EC asks the European ITS Advisory Group to undertake this task of facilitating the negotiation process.

[R2] Specify the adoption of a profile using DATEXII

To ensure effective electronic communication between stakeholders it is essential to define not only the content, but also the format for sharing information. The greater the number of alterative formats in use, the greater is the costs to the stakeholders, and the greater are the barriers to the emergence of an efficient, sustainable market for ITS services. It is recommended that the EC specify that in-scope road and traffic data relating to traffic management measures should be formatted using a DATEX II profile (promoted for adoption by CEN in due course).

[R3.1] Provide a binding technical specification of the activation status data contents

This activity is concerned with setting out clearly all the data elements that need to be communicated in order for any other party to properly understand the activation status and hence relevance at a specific moment in time, of any published data set about potential traffic management measures. It will be necessary to ensure compliance with this specification across all MS, for which purpose it will need to be binding, and hence it will need to be highly credible internationally. It is recommended that the EC to ask CEN experts to develop the technical specification.

[R3.2] Organise a forum for relevant stakeholders to define quality requirements for activation status data elements that are to be described in the technical specification, and add these to the specification

The relevant stakeholders will need to agree which activation status data elements are most critical and then negotiate an acceptable compromise solution. It is recommended that the EC asks the European ITS Advisory Group to facilitate this negotiation process, and that the agreed quality requirements are provided to those who are tasked with developing the technical specification.

[R4] Specify the adoption of a particular method and format for communicating activation status data consistent with [R2]

[R2] recommended that in-scope road and traffic data relating to traffic management measures should be formatted using a DATEX II profile. This approach allows third party users of such data sets to subscribe to a data feed issued by the traffic management authority, which can use the provisions in the existing suite of DATEX standards for notifying subscribers of changes. It is recommended that the EC ask the experts undertaking [R2] and [R3.1] to explore the potential for formatting and sharing activation status data using DATEX II and its associated profile subscription management services, and if so, incorporate suitable provisions in their respective technical specifications.

[R5] Specify the requirement to publish all relevant data about traffic management measures (as defined in earlier recommendations), in electronic format and in a timely manner, with exceptional exemptions managed by MS to EC guidelines

It is recommended that an obligation is placed on all traffic management authorities across Europe to publish all in-scope data as a matter of course, in a timely way, using the agreed electronic formats. An expert group of traffic management authorities should be tasked with developing a proposed set of conditions for the re-use of these published data, which the EC can then use as the basis of a consultation with other stakeholders.

[R6] Specify use of local nodes with a registry of services at the MS level

It is recommended that traffic management authorities publishing in-scope data are obliged to supply their data in the requisite format through a local node to which third parties can subscribe in order to receive that authority's data. The MS should be required to maintain a registry listing all node locations nationally.

T A B L E O F C O N T E N T

1. Introduction to the Study 11

1.1. Study Context 11
1.2. Road and Traffic Data in the ITS Directive 13

2. Management Section 16

2.1. How This Study Contributes 16
2.2. Answering the Key Questions 17
2.3. Process, Workflow, Deliverables 21

3. State of the Art 25

3.1. The European Context 25
3.1.1. The Data Value Chain 25
3.1.2. Stakeholder Community 25
3.1.3. Spatial Road Data 27
3.1.4. Dynamic Road Data 29
3.1.5. Road Data and Freight 31
3.1.6. Summary for European State Of Art 33
3.2. Data for Traffic Management 35
3.2.1. Urban Access and Mobility 35
3.2.2. Recommended Routes for HGV 36
3.2.3. Large Scale Platforms for Data Exchange 38
3.2.4. Best Practice from EasyWay 41
3.2.5. Representative Case Studies 42
3.2.6. Developing an EC TMP Guidance Note 44
3.3. Study 1.2 Stakeholder Workshop 47

4. Consideration of Findings 51

4.1. Data Availability and Access 51
4.2. Overcoming a cultural obstacle 52

4.3. Public Sector Constraints 54
4.4. Towards A Solution 55

5. Recommendations 57

5.1. Step 1: Agreed Data Scope 57
5.2. Step 2: Common Formats 59
5.3. Step 3: Sharing Activation Status 60
5.4. Step 4: Common Format for Activation Status 61
5.5. Step 5: Publish Data in Electronic Format 62
5.6. Step 6: Make Published Information Discoverable 63
5.7. Step 7: Supporting Actions 64

ANNEX 1 – EC TMP Guidance Note 66

A1.1 Introduction 66
A1.2 Best Practice for TMP 67
A1.3 Defining the Traffic Management Plan 68
A1.3 Identifying the TMP Stakeholders 72
A1.4 Agree TMP 72
A1.5 Document TMP 73
A1.6 Publishing the Key Elements of the TMP 73
A1.7 Publishing the Traffic Management Activation Status 74
A1.8 Ongoing Management of the TMP 75

ANNEX 2 – Template Data Sharing Agreement 76

ANNEX 3 – Background to the Recommendations 83

ABBREVIATIONS AND ACRONYMS

ADAS	Advanced Driver Assistance Systems
BASt	'Bundesanstalt für Straßenwesen', the Federal Highway Research Institute of Germany
CALM	'Communication Access for Land Mobile', a communication standard iniative from International Organization for Standardization
CEN	European Committee for Standardisation
DATEX II	Data Exchange Standard (for dynamic traffic and travel related information in Europe)
EC	European Commission
EU	European Union
EW	EasyWay (Project)
EWTCII	East West Transport Corridor II (Project)
FDMS	Freight and Distribution Management System
FJP	Freight Journey Planner (by Transport for London)
HGV	Heavy Goods Vehicle
INSPIRE	Shorthand reference to a directive that aims to create a European Union (EU) spatial data infrastructure
ITS	Intelligent Transport Systems
LEZ	Low Emission Zone
TERN	Trans-European Road Network
TISA	Traveller Information Services Assocation
TMP	Traffic Management Plan
TN-ITS	Transport Networks – ITS (a subtheme within the transport networks theme, developed within INSPIRE)
TPEG	Transport Protocols Expert Group
UTMS	Urban Traffic Management System

1. Introduction to the Study

1.1. Study Context

The European Commission defines Intelligent Transport Systems (ITS) as those systems in which Information and Communication Technologies (ICT) are applied in the field of road transport (including infrastructure, vehicles and users), and in traffic management and mobility management, as well as for interfaces with other modes of transport. Such systems can become enablers for transport policy goals, and for the European Commission this includes the movement of people and goods without restriction across the EU.

As well as supporting investment by Member States in the deployment of ITS, the European Commission has also sought to create a seamless journey experience for travellers across different countries and regions. The approach to harmonisation through gradual alignment has understandably been rather slow, given the organisational diversity both within and between countries and the specific issues faced by local traffic managers (population, urban density, geographic terrain, international demand from freight for particular routes, cross border challenges and so on). To date, this “bottom-up” approach has not yet met the vision of seamless travel across Europe.

With the ITS Directive 2010/40/EU[1], the European Commission has taken a more pro-active approach and is considering measures which might be more effective in achieving the vision. These measures might involve a more direct management of the situation and possibly some regulatory instruments designed to accelerate the deployment of interoperable systems and services. This is a more “top-down” approach, and will inevitably be faced with caution by the Member States, in the context of their independence.

Article 2 of Directive 2010/40/EU sets out four priority areas; the first of which is ‘*Optimal Use of Road, Traffic and Travel Data*’. Article 3 of the same directive sets out six priority actions for development and use of specifications and standards, (to drive the four priority areas forward). Annex 1 of the same directive describes how these priority actions are related to the priority areas, and presents further detail of the scope for specifications and standards in each case. The priority area ‘Optimal Use of Road, Traffic and Travel Data', for example, will be affected by specifications and standards coming from the first three priority actions (a), (b) and (c).

The ITS Directive builds on the “Action Plan for the Deployment of. Intelligent Transport Systems (ITS) in Europe” (COM(2008) 886), a programme for introducing a series of policy instruments to help secure implementation. Action Area 1 in the ITS Action Plan is

[1] http://ec.europa.eu/transport/themes/its/road/action_plan/

'Optimal Use of Road, Traffic and Travel Data', and this present study is formulated under Action 1.2. A more detailed description of the terms of reference is set out in Section 2.1 below.

The European Commission's latest White Paper on Transport[2] was issued in December 2011, and contained a roadmap of initiatives intended to increase mobility and remove barriers. In particular, the Commission sets out the vision for a Core Network for the TEN-T, to be completed by 2030. The policy is for integration of all transport modes, initially along 10 multimodal corridors (to prioritise for high demand), to be supported by various policy and finding instruments. The corridors encompass a number of key nodes, including "urban main nodes" (capital cities of Member States, all "Metropolitan European Growth Areas", other large conurbations or multimodal terminals, and the most relevant border crossing points).

This inclusion of urban areas in the TEN-T Core Network is an important step forward for 'end-to-end' planning, and signals strong intention for greater integration between major urban centres and the interurban network.

In addition to this core vision for the TEN-T in the EC Transport White Paper, and the adoption of the ITS Directive and associated Action Plan, three other European policy frameworks have a strong bearing on this study:

- the Action Plan on Urban Mobility[3], in particular for the introduction of 'Sustainable Urban Mobility Plans', the findings of the Access Restriction Study, and the focus on better integration for public urban traffic management systems with freight operator management systems;
- the Public Service Information (PSI) Directive[4] mandating that information collected using public sector spending should be made openly available for effective 're-use', by citizens and other entities to the benefit of society;
- the INSPIRE Directive[5], mandating a common approach to geospatial data, national implementation projects involving various levels of public authority, being supported by other initiatives such as ROSATTE to ensure a platform for road data

The focus of this current study has been on 'road and traffic data' (as described in the next section) and the scope includes traffic management on both urban and interurban networks.

[2] http://ec.europa.eu/transport/strategies/2011_white_paper_en.htm
[3] COM 2009 (490)
[4] European Directive 2003/98/EC
[5] European Directive 2007/2/EC, see also http://inspire.jrc.ec.europa.eu/

1.2. Road and Traffic Data in the ITS Directive

The ITS Directive establishes a framework to support the coordinated deployment and use of Intelligent Transport Systems in the European Union. The requirement for a harmonised and efficient operation of the data value chain will contribute to this objective.

Annex 1 of the ITS Directive gives a clear message to the community regarding the availability of existing data, facilitation of exchange, and timely updates by service providers to the end users (in others words, opening up the data value chain). Under the section entitled "Optimal Use of Road, Traffic and Travel Data", there are references to '*availability and accessibility of existing and accurate road and real-time traffic data*' to ITS Service Providers (as a point of interface to the end user, the EU Citizen). However, this is to be done '*without prejudice to safety and transport management constraints*', indicating an awareness of local challenges.

The stakeholder context of primary interest to this study is that described in the third paragraph under Priority Area I.

> "Specifications for priority actions (a) and (b)
> - The **definition of necessary requirements for the collection** by relevant public authorities (and/or) where relevant by the private sector of road and traffic data (i.e. traffic circulation plans, traffic regulations and recommended routes, notably for heavy goods vehicles) **and for their provisioning to ITS service providers based on**:
>   - **Availability** to ITS service providers **of existing road and traffic data** collected by the relevant public authorities and/or the private sector
>   - **Facilitation of the electronic data exchange** between relevant public authorities and the ITS service providers
>   - The **timely updating**, by the relevant public authorities and/or where relevant the private sector or road and traffic data
>   - The timely updating **by the ITS service providers** of the ITS services and applications using these road and traffic data"

The obligation on the public sector (and where relevant, the private sector supporting the public sector in meeting objectives), is to collect data according to a set of requirements that support provision of data to the ITS Service Providers. The first step is making existing data available, the second step is establishing an exchange, and the third step is providing timely updates going forwards. This requires the data collection, storage and dissemination process to begin with the end goals in mind, (namely availability and accessibility).

However, the ITS Service Provider also has an implied obligation on receiving such data, namely to make timely updates to the road users subscribing to the relevant services.

Article 4 of the ITS Directive includes the following definitions:

Term	Meaning (in Article 4)
Road Data	"Data on road infrastructure characteristics, including fixed traffic signs or their regulatory safety attributes;"
Traffic Data	"Historic and real-time data on road traffic flow characteristics, as distinct from 'Road Data';"

The scope of the terms in isolation has been explored under two previous ITS Action Plan Studies, namely 1.1 for real time traffic data and 1.3 for static road data for digital maps. However, traffic management (in both urban and interurban contexts) often involves additional data elements that overlap with (or fall somewhere between) these definitions. Annex 1 of the ITS Directive makes an association between the combined phrase '*road and traffic data*' and three key sub-elements, '*traffic circulation plans, traffic regulations and recommended routes'*. In order to give more specific focus for this present study, the following working definitions are proposed for these data elements.

Term	Meaning (in this Study)
Traffic Circulation Plan	Diversion routes (strategic or tactical, as deviating from the primary network), and normally • a key subset of a Traffic Management Plan • pre-agreed with relevant stakeholders and recorded in a local agreement • activated during incident management and maintenance works.
Traffic Regulation	Application of local legislation developed to govern the movement of traffic (usually in line with policy objectives).
Recommended Routes	A route deemed suitable for use by heavy vehicles, in terms of road classification and the absence of restrictions. Where urban restrictions are in place (especially to minimise noise pollution), an "approved route" is one that does not overlap with the excluded road network.

One commonly referenced definition for Traffic Management Plan (TMP) is taken from the EasyWay 2012 Deployment Guidelines[6], namely the "*pre-defined allocation of a set of measures to a specific situation in order to control and guide traffic flows as well as to inform road users*" and more importantly, "*measures are always applied on a temporary basis*". This definition is also useful for the study as in the short term much of the data required above will be contained within such Traffic Management Plans. This relationship is described further in Section 3.2.6.

[6] http://www.easyway-its.eu/

Whilst much of the best practice on traffic management plans has been documented in the interurban context, the methodologies are just as relevant for the urban context (where the emphasis on informing road users, whether directly or through the ITS Service Providers, is equally important).

The next section describes the flow and methodology of the study itself.

2. Management Section

2.1. How This Study Contributes

The study is concerned with trying to improve the free movement of people and goods throughout Europe by investigating how to open up the end-to-end process of collecting and providing (restrictive) road data and traffic management information impacting access and routing, particularly that relevant to freight transport.

The study is set in the context of the Action Plan for Deployment of ITS, in support of Action 1.2, "collection and provision of road data". The study is called "*the optimisation of the collection and provision of (restrictive) road data and traffic circulation plans, traffic regulations and recommended routes (in particular for heavy goods vehicles)*". The additional focus on heavy goods vehicles is primarily because of their more extreme physical parameters and environmental impact, leading to greater challenges for traffic management (in terms of applicability of access restrictions and the penalties associated with straying from recommended routes). However, the outcome of improving the availability and accessibility of road data will be beneficial for all users and stakeholders.

The Commission required the investigation to focus on *two key themes,* namely

- *The availability of, and access to, (restrictive) road data and regulations*. This is a data sharing issue, examining the relationship of the traffic authority with the rest of the data value chain; and
- *The drafting and operational use of traffic management plans*. This is a best practice issue, exploring whether the traffic management plan could be an effective instrument for improving cooperation between the public and private sector (not just within the public sector), with a view to sharing 'road and traffic data' with service providers.

In order to achieve this goal, the European Commission set the following broad objectives for the overall study:

- To assess and report state of art in availability and access to (restrictive) road data, traffic regulations, traffic circulation plans and recommended routes in Europe;
- To assess and report state of art in the elaboration, publication and operational use of Traffic Management Plans, covering the road transport system and its connection to the complementary transport modes (including public transport);
- To assess the institutional issues related to the actors and stakeholders involved in road data, traffic regulations, circulation plans and TMPs, the procedures and decision making processes, and methods of communication (formats, channels);
- To evaluate, assess and define (organisational, functional, technical…) aspects and procedures to be fostered and to recommend action at European level.

In the context of multimodal travel information services, the interest from this study is with supporting the effective communication of timely and accurate road traffic information to users on other modes, to inform choices about modal transfer and foster co-modal transport planning. In this regard, some greater certainty on the status of road traffic management information would be highly desirable. Each of the transport modes has a coherent framework for implementation of next generation management, and these frameworks include preferred standards for encoding and publishing data for exchange. Publication of relevant road and traffic data in a common recognised format, discoverable in a local registry will make it possible for operators from other transport modes to obtain this kind of information as 'outsiders'.

The study objectives led to an initial focus on technical approaches and methodologies, the 'how' of data exchange, and examples of best practice which may inspire more widespread implementation across Europe. However, through engaging with the experts and stakeholder community it was clear that the technical issues are secondary and that the barriers to data exchange are based on more subtle elements. These include funding and prevailing culture in the public sector, and concerns about ownership and commercial advantage in the private sector.

2.2. Answering the Key Questions

The European Commission also identified the following key questions to be addressed, providing the outline structure for the study:

1. What is state of art regarding the availability and access to (restrictive) road data, traffic regulation and circulation (i.e. rerouting) plans and recommended routes in Europe?
2. What is the level of detail, the actors involved, the format/carrier used and the distribution channels applied or the effective use by third parties that is reported?
3. What is the state-of-the-art concerning the development, dissemination and operational use of Traffic Management Plans, their 'level of intermodality', the actors involved and the frameworks / decision-making procedures adopted?
4. What are the rules or procedures for the development, dissemination and operational use of Traffic Management Plans? To what extent are plans and procedures made available to service providers and road users, and what are the impacts and benefits reported/ the problems encountered so far?
5. What are the key issues at stake (in making restrictive traffic management information available, and in adopting good practice for the development and implementation of traffic management plans), what conclusions can be drawn from the study?
6. Which specific measures from a legal, organisational or technical viewpoint would be recommended? What action at European level would be recommended to increase the level of cooperation towards a unified approach?

The key study questions have been addressed as follows:

1. What is state of art regarding the availability and access to (restrictive) road data, traffic regulation and circulation (i.e. rerouting) plans and recommended routes in Europe?

The overall finding is that there is great variation in availability and access for these key data elements. Where there is greater availability and access, the following elements appear to be present:

- Some traffic management legislation that defines roles and *obliges collaboration* between different authorities towards common goals.
- A national initiative to address the gap between content generators and service providers (the management of content aggregation), for example the German Mobility Data Market Place (MDM), or the Dutch National Data Warehouse (NDW)[7].
- An active community of service providers covering a range of services from digital maps to real time traffic information, servicing a variety of modes, and broadcasting into a variety of channels
- Positive alignment in country with the spirit of initiatives such as the PSI Directive (for example, national leadership in provision of open data), INSPIRE Directive, ITS Directive and others
- Active contribution to expert groups, for example in development of standards such as DATEXII

2. What is the level of detail, the actors involved, the format/carrier used and the distribution channels applied or the effective use by third parties that is reported?

Where data is made available (either through the use of third party content aggregators or through direct publication), the level of detail is fit for purpose. The state of the art review identified examples where the full data value chain was engaged, but these were exceptions motivated by a particular funding programme or interest on the part of the individuals involved.

Both the INSPIRE Directive and the CEN DATEX II Standard offered possibilities for improving the collection and provision of road and traffic data across the value chain. However, when dealing with the broader collection of 'road and traffic data', there are data elements that fall outside the scope of INSPIRE. For example, access restrictions that are permanent or timetable based can be communicated through INSPIRE.

[7] These initiatives are discussed in more detail as part of Section 3.2.3

However, access restrictions triggered on the basis of environmental monitoring (for example) have a more dynamic status attribute along with a static location and context attribute. The service provider will either hold prior information about the location of the restriction, and receive updates about activation status (alone), or alternatively receive information about both location and activation status directly. As these methods become more widely tested, a further consultation with stakeholder would be appropriate.

3. What is the state-of-the-art concerning the development, dissemination and operational use of Traffic Management Plans, their 'level of intermodality', the actors involved and the frameworks / decision-making procedures adopted?

The study included some development of the definition of Traffic Management Plans, in order to align with the ITS Directive. The generic definition captured in the EasyWay Deployment Guideline is useful for traffic managers, and for supporting the exchange of information between traffic management centres. Where followed (such as Hessen Mobil), the result is award winning operational best practice. This is described in detail as part of D1 and D2, and also explored during the workshop D3. However, (as illustrated at the workshop) this is not the only model, and the scope is also largely confined to the interurban context.

The ITS Directive contains three subsets of data under 'road and traffic data', namely traffic circulation, traffic regulation and recommended routes. Significantly, these elements (alone or in combination) form the essence of traffic management plans at both the urban and interurban context. In addition to development of a new methodology for sharing the core information under traffic management plans, the study team also looked at dissemination of the wider elements under 'road and traffic data'.

4. What are the rules or procedures for the development, dissemination and operational use of Traffic Management Plans? To what extent are plans and procedures made available to service providers and road users, and what are the impacts and benefits reported/ the problems encountered so far?

Traffic Management Plans are developed within the context of the prevailing legal framework for traffic management within member states. Often the minimum requirement is satisfied and this results in some publication of the impact of plans (for example, notification that a particular link is closed, or that an access restriction is in operation).

The study covered the areas of data already being exchanged, for example digital maps on the one hand and traffic data on the other. In most cases, the missing area

was the plans and procedures agreed and documented by traffic management authorities. These were not considered necessary for publication. In the urban context, minimal information is available for access restrictions or recommended routes, and what is available is often complex. This has created a need for third party content aggregators who help organise the data on the one hand and provide a service to the road user on the other.

In comparison to the best practice example of Hessen Mobil, the study team also looked at the initiatives taken by the Federal Highways Authority and BMW for strategic route information. This open collaborative approach exploited the opportunities provided by the Mobility Data Market Place, and showed how the relevant information could be shared with ITS Service Providers without compromising safety or traffic management requirements for the public authority. In other words, the plans themselves did not need to be shared, but there was a method for conveying information about activation status by location to the end user.

5. What are the key issues at stake (in making restrictive traffic management information available, and in adopting good practice for the development and implementation of traffic management plans), what conclusions can be drawn from the study?

The key issues have been discussed in detail as part of this report, especially in Section 4. The study team has also developed an EC TMP Guidance Note, with a methodology for making traffic management information available between stakeholders (that also includes ITS Service Providers). The main conclusion of the study is that interventions are needed in order to open up the data value chain in a consistent and timely manner across Europe, and in particular for the data elements under 'road and traffic data'.

6. Which specific measures from a legal, organisational or technical viewpoint would be recommended? What action at European level would be recommended to increase the level of cooperation towards a unified approach?

The specific measures needed to align with the ITS Directive are described in Section 5. The recommendations are grouped under the following key steps:

- Agree the data content specification (for 'road and traffic data') which falls within this scope (including details on any potential measures that could be applied at each location)
- Agree on the (preferred) format(s) for presenting these in-scope 'road and traffic data' elements electronically (static and context information)
- Agree the data elements that describing the activation (or application) status of traffic management measures previously identified

- Agree on the (preferred) format(s) for presenting these associated status updates electronically (dynamic and near real-time information)
- Ensure electronic publication of all elements captured under the previous steps
- Ensure published information described in the previous step is discoverable by other public bodies and by ITS Service Providers (as required in the ITS Directive)
- Monitor implementation of the previous steps, and engage in a programme of supporting activities to facilitate smoother progress towards the desired outcome

2.3. Process, Workflow, Deliverables

The study followed an investigative format, beginning with a state of the art review, followed by an assessment and analysis of the findings, a workshop for consultation with stakeholders on an early proposal, and preparation of a set of conclusions and recommendations derived from this process.

The methodology for this study involves project management supporting four key tasks (each with relevant sub-tasks). The figure below shows the relationship between these tasks.

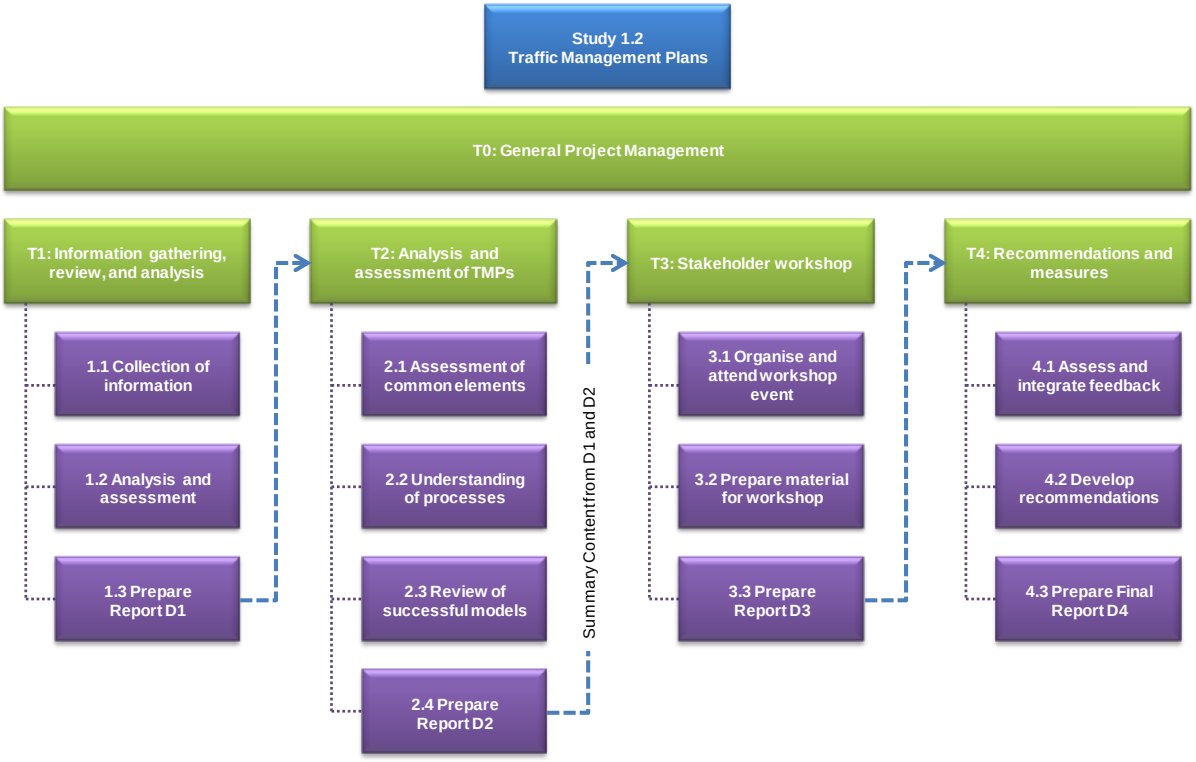


Figure 1: Work Breakdown Structure

The purpose of Task 1 was to generate and document *understanding and insight* on the organisational, contractual and technical issues involved in the generation and use of road data, traffic regulations and management plans, (and to review the operational, technical, and organisational solutions adopted so far). The collected information was analysed in more detail to allow consideration of emerging themes, areas of priority for the remaining study, follow up activity with key contacts, and identification of areas for development.

The study team examined the relevant policy framework, including directives and contemporary action plans. The review then moved on to relevant findings from ongoing and planned work under the ITS Action Plan Support Framework[8].

- Study 1.1, one of the first studies in this series to articulate the challenges of the data market in terms of availability and accessibility, but focused on dynamic information only.
- Study 1.3 deals with the fixed mapping data and the updates associated with planned changes to the network.
- Study 2.1, briefly reviewed for consistency on traffic management, and connectivity between traffic management centres.
- Study 3.5, relevant focus on stakeholder needs in the freight sector, including the benefits of making data on parking stops available across the trans-European Road network.
- Study 6.4, collaboration platform (the Urban ITS Expert Group), developing guidelines for multi-modal information, traffic management & urban logistics, (as well as smart ticketing).

The investigation included a survey of selected research projects with a prominent traffic management element, grouped as follows:

- Static Data Elements (ROSATTE, eMaPS, iMobility Forum)
- Freight Data Improvements (EuroRoads, HeavyRoute, eCoMove, iTetris, with additional inclusion of SmartFreight and FreightWise)
- Technology Applications (FeedMAP, Co-Cities)

The focus on ROSATTE and ITS AP Study 1.3 helped to provide a foundational understanding of the systems and procedures in place for collection, quality control and availability of road data and traffic regulations (as implemented by digital map makers, navigation service providers or other relevant commercial actors).

[8] http://ec.europa.eu/transport/facts-fundings/studies/index_en.htm

The terms of reference suggested a review of examples where mismanagement of traffic circulation plans or generation of erroneous navigation advice had created difficulties (or where road users received conflicting information from these sources). The study therefore included a detailed review of the UK SatNav Summit[9], both as a microcosm of the problem at the European Level, and a source of anecdotes motivating such a summit.

The purpose of Task 2 was to review the common and typical elements of a traffic management plan, in order to understand what made them successful in an operational context. The objective was to understand what motivated the development, implementation and publication of these plans, and whether there was scope of using them as instruments to improve access and availability of 'road and traffic data', as expressed by the ITS Directive.

Given the focus on traffic management plans, the information gathering also included a survey of the EasyWay Project. This involved a review of outputs from the 'Expert and Studies Groups' ESG1, ESG2 and ESG6 (as affecting the Deployment Guidelines), and a consideration of the momentum behind the 2012 Update. The implications of the TISA/ESG5 Collaboration (common demonstrator) were also within scope. The study team looked at the challenges of cross-boundary collaboration, and approaches being taken to improve communication here. The study team gained further insight on user needs (long distance travel) by reviewing material from the IRU, and discussing this during an EasyWay Workshop on Sustainable Freight.

The original method implicitly assumed critical issues would be structured around the inter-urban and cross-border information challenges. However, feedback from stakeholders pointed to the urban interface (and travel within the urban environment) as providing the greatest challenges (the last five kilometres, including urban access restrictions and recommended routes). Stakeholders perceived that gaining timely access to accurate information here would be more beneficial, as the inter-urban network was already well described.

The emerging content of the research therefore led to the conclusion that the effort allocated to these two tasks should be rebalanced to allow the study to explore issues concerned with the traffic information interface to urban centres. The outcome was a combined Deliverable D1&D2, reflecting state of the art identified in Task 1 and Task 2, along with a proposal for the development of a "TMP Guidance Note".

The Stakeholder Workshop (Task 3, Event D3) contributed to the learning process on Study 1.2, by validating the findings in Task 1 and Task 2. The study team was able to confirm the stakeholder perspectives previously identified in the literature, and acquire

[9] Workshop: Delivering the best information to all in-vehicle Satellite Navigation users, 06 March 2012, UK Dept for Transport (with ITS UK and ADEPT)

deeper insight on the issues being assessed. The proposal for the “TMP Guidance Note” was also reviewed as part of the Stakeholder Workshop.

At the commencement of Task 4, the study team held an internal workshop in order to consolidate learning from Task 1, Task 2 and Task 3, and assess the feedback and findings to date. The outputs were used to develop and refine a set of options and recommendations for achieving the desired goals under Action 1.2. The main deliverable for this study is D4 Final Report, which is the current document. The “TMP Guidance Note” is also presented as an annex to D4, written from the vantage point of the ITS Action Plan but building on current best practice.

3. State of the Art

3.1. The European Context

3.1.1. The Data Value Chain

In generic terms, the value chain for road and traffic data comprises content generators, service providers and service users.

The public authority operates within a policy and legislative environment, and organises their activities in order to meet duties and obligations defined by these frameworks. The creation of traffic restrictions (and authorisation of traffic management plans) will inevitably be accompanied by generation of information (records), whether that is in a physical format (paper) or digital format (and therefore potentially available online).

The open availability of such information may need to be motivated by certain aspects of the policy and legislative framework, but once other organisations are able to access the information in an efficient manner, new possibilities for applications and services are created. The value chain is affected by two main points of disconnection. The first is between content generators and service providers; this can be described as 'content aggregation management', and becomes the focus of 'data market place' initiatives. The second is between the service providers and the end user; this can be described as 'dissemination channels', and has as much to do with the diversity of products used as nomadic devices or integrated within the vehicle itself.

Historically, data collection and network monitoring function was fulfilled by bespoke installations through public investment, and information communicated to road users through roadside equipment, radio broadcasts and perhaps static websites. However, the traffic management centre can no longer operate effectively in isolation. As technology moves to the next generation, and further efficiencies are sought from the public sector operations, the traffic management centre is increasingly obliged to build relationship with private sector.

3.1.2. Stakeholder Community

Stakeholders can be identified in three groups, namely supply, demand and facilitation.

- Supply of the road data, involves the traffic management authorities (either national road authorities, urban traffic managers, or those with delegated authority such as a concessionaire), stemming from their duty to inform.
- Demand for the road data, can be generated by other public authorities (in order to plan their own operations), or road users (affected by change in network access). Impact on freight vehicles (and the customers for their services) creates a

multimodal dimension in terms of the predictability of disruption on competing modes, or between modes on a single journey.

- Facilitators include content providers (mapping and other route based information) for fleet management systems (larger operators) and truck navigation systems (smaller operators), in order to deliver a service which satisfies the demand for road data (where is it not directly supplied and published by the public authority in directly usable form).

The user needs perspective for freight is well represented by organisations like the IRU, the Freight Transport Association, the Road Hauliers Association and others. Freight operators expressed concern that the last five miles pose the greatest challenge, and the greatest risk in terms of unexpected charges.

- Urban interface is managed within country, through national frameworks and traffic management regulation
- Access to restrictive road data may be accelerated in the short term by making such information available through a web-based directory, but in practice this should emerge through implementation of INSPIRE.
- Applications demonstrating the integration of urban traffic management and freight management systems are on the increase, and these services should be encouraged to publish core information more widely.

The case for intervening to inform about access restrictions, reduce their application, and harmonise the approach across the European Union has also been made in research reports published by the EC. For example, the "Driving Restrictions for Heavy Goods Vehicles in the European Union" published by DG Move in 2010[10] includes a comprehensive survey of driving restrictions facing HGV in the EU27 and Switzerland.

That study included an impact assessment of these restrictions (showing relative financial impacts on freight operations, especially for unplanned restrictions), and the root of the challenge was inability to access information. Stakeholders maintained lists and sought to advise members, but the process of aggregation was manually intensive. The study included a detailed annex of web based information provided on a country by country basis (for 28 countries), which underscored the scale of the problem (very few websites portrayed information relevant to freight). The conclusions of that report were twofold, namely to reduce the complexity of restriction applied to the strategic road network, and to improve the minimum level of information available (using common language, and listing freight specific issues).

[10] http://ec.europa.eu/transport/modes/road/studies/doc/2010_12_driving_restrictions_for_heavy_goods_vehicles_in_the_european_union.pdf

3.1.3. SPATIAL ROAD DATA

The available literature on implementation of the policy frameworks and the most relevant research projects was screened for a specific focus on either spatial or dynamic road data, and with a particular emphasis on the needs of the freight sector. The findings are summarised here.

The INSPIRE Directive (2007/2/EC) creates a general framework for Spatial Data Infrastructure. The objective is to improve the approach used in data exchange, data sharing and data re-use. The INSPIRE Directive aims to ensure that the spatial data sets from different member states are compatible and of mutual use, and that common Implementation Rules are adopted (binding on Member States). These rules cover Metadata, Data Specifications, Network Services, Data and Service Sharing, and Monitoring and Reporting. The INSPIRE Directive requires Member States to provide update reports on implementation[11], and the INSPIRE Conference is a comprehensive collection of development insights and more detailed status updates[12].

According to the INSPIRE Implementation Roadmap[13], metadata for Annex I (including metadata for the Transport Network transport sector) should have been available for spatial data sets and services by December 2010. In addition, the Discovery and View services should have been operational by November 2011. The Data Specification for Transport Networks (v3.01) includes a number of spatial object types relevant to this present study[14] (in terms of ability to encode information about access restrictions).

The ROSATTE Project examined how to ensure access to road safety attributes across Europe, (in terms of specific road data like speed limits, traffic sign detail, carriageway and junction detail, physical access restrictions, and topography). ROSATTE developed methods for data coding, data publishing and updating, and location referencing, with procedures for exchanging information on road attributes between public authorities or road operators and digital map providers. The data specification elements for Transport Networks (INSPIRE DS TN) and the INSPIRE Network Services Architecture are closely related to road safety attribute objectives of ROSATTE. The INSPIRE DS TN is about exchanging data on the representation of the network itself, while ROSATTE focuses on exchanging data related to the network.

ROSATTE is relevant for traffic management as it provides a framework for the coding and location referencing of information that is either relevant to traffic management (speed limit, traffic signs), or produced as a result of traffic management activities

[11] http://inspire.jrc.ec.europa.eu/index.cfm/pageid/182
[12] http://inspire.jrc.ec.europa.eu/events/conferences/inspire_2012/
[13] http://inspire.jrc.ec.europa.eu/index.cfm/pageid/44
[14] e.g. AccessRestriction, RestrictionForVehicles, RestrictionTypeValue, AccessRestrictionValue.

(junction detail, access restrictions). However, the framework for exchange is suited to static traffic management plans, with limited scope for more dynamic updates.

The framework is a solution for the exchange of traffic and road map data between public authorities or road operators and map makers, and aligned with INSPIRE. Implementation is through a series of specific requirements for the provision and maintenance of the road transport network attributes. However, the scarcity of national and regional road databases across Europe identified by that project also underlines the urgent need to make progress on data availability. For example, the ROSATTE Organisational Survey[15] identified only 19 Regions with suitable databases in place, out of which only 12 were capable of publishing updates. The implication is that if these road databases are not yet available (and in an updatable form), then there is still much work to be done in having these accurately collected & managed and making (restrictive) road data available.

The ITS Action Plan Study on Action 1.3[16] investigated how publicly held road attribute and geometry data can be made available to digital map providers efficiently. The study recommended the creation of a TN-ITS Specification, by adopting the ROSATTE specifications for data coding and location referencing, and using the INSPIRE Organisational Model and Services Framework as a platform.

The supporting study for that action recommended the publication of all publicly held road data, both data originating from public authorities and data most efficiently sourced by public authorities, including:

- All road and traffic regulations that can be applied to individual road sections and nodes, such as speed limits, driving direction, access restrictions and parking restrictions;
- Position on the road network of traffic lights, traffic calming measures (such as speed bumps), and accident hotspots.

The study on Action 1.3 also recommended that value chains can best be organised at the level of Member State, and that the EC should adopt a set of conditions for common access and re-use of road data (in the broadest sense). In common with other studies under Action Area 1 'Optimal Use of Road, Traffic and Travel Data', this points to the establishment of commonly accepted data sharing agreements, which allow the data owner some control over how the data should be re-used after publication.

On a level of detail, public authorities should eventually publish changes to traffic restrictions (including access, weight, dimensions, vehicle type and class restrictions) at

[15] http://www.ertico.com/assets/Activities/Rosatte/DELRSTD6Organisational-aspects-and-expected-benefits.MAIN-REPORT.v20.pdf

[16] http://ec.europa.eu/transport/its/studies/doc/2011_12-availability-public-data-digital-maps.pdf

least one month in advance of them taking effect. However, an objective optional method to classify data quality of road data sets is still needed.

The successor to ROSATTE is the eMaPS Support Action[17], delivered through the Digital Maps Working Group in the iMobility Forum. The working group intends to establish an independent European platform for public authorities and mapmakers to collect, publish and use road and traffic data (traffic circulation plans, traffic regulations and recommended routes).

The INSPIRE Directive, (and those initiatives derived from it which are particularly relevant for road transport), has an undoubted influence on how Member States must organise and make such data available (where already collected). The impact for static road data is clear, in terms of being able to update maps when a physical change (or for example a reclassification of a road) is implemented. The challenge is in identifying how far these developments can support data sharing objectives, when the data elements comprise both static and dynamic elements.

One possibility is that the static (or near static) elements are taken forward as subsets of the TN-ITS Specification and published separately, while the dynamic elements are published under DATEX II (see the following section). So for the 'road and traffic data' described in Study 1.2, the fact that part of the network is 'affected' by a traffic regulation is reported through a static path, and the activation (or 'application') of measures (where not readily encoded in a fixed timetable format) might be communicated through the dynamic path. The TN-ITS Specification will be developed anyway as an extension of INSPIRE into transport, so content providers will have the opportunity to explore solutions that use both TN-ITS and DATEXII (for those 'road and traffic data' elements that require both static context and dynamic status updates). The work programme for the Digital Maps Working Group may be expanded to look at other platforms for handling the dynamic data elements, in order to cover the full scope of 'road and traffic data'. For example, there is another path that might prove more efficient for traffic management purposes, and that is to publish the status and location information together in the same format.. The study team later identified possibilities for presenting this combination under DATEXII, and believes it should also be further tested and developed.

3.1.4. DYNAMIC ROAD DATA

The methods for road and traffic data exchange are largely driven by the protocols developed in ICT (such as CORBA, HTTP and XML). In the road transport sector, there has been much investment in defining formal data structures that enable exchange of relevant information among road operators, and between road operators and service

[17] This Support Action was proposed by the Norwegian Public Road Administration and ERTICO, together with five other road administrations as well as Nokia and TomTom.

providers. DATEX II is described as “the reference for all applications requiring access to dynamic traffic and travel related information in Europe”.[18] The framework provides a core ‘traffic information language’ and a discoverable wrapper in the form of XML.

DATEXII essentially consists of documentation, data models and supporting tools. A substantial part of this collection is now being maintained by the CEN Technical Committee 278 (WG8)[19], and the first three parts of the CEN DATEXII series (CEN 16157) have been approved as Technical Specifications. These three parts reflect the most mature and widely used elements of DATEXII, and there is a road map for adoption of further elements in due course. This is a particularly important development, as there is leverage within the ITS Directive for requiring implementation using existing standards.

The specification consists of three parts, context and framework; location referencing; and situation publication.

- The user begins by defining the information service in functional terms (what is the road network, who are the parties involved in the exchange, and what information is being offered).
- The next step is to determine the operational level of that service (performance expectations), and the location referencing method (from a pre-selected list).
- Having registered the service and created a profile (or adopted a template), the user can then create further extensions in line with the standard.

These extensions have different levels of interoperability and definition constraints, but the one of specific interest to this study is the Core Model (Level A). The Core Model is suitable for most data exchange scenarios, and already contains extensive options for traffic managers to select when assembling data publications. It is the minimum set that all DATEX II systems must fulfil in order to assure interoperability.

A profile includes the possibility of defining a customised subset of options for a particular need. This means that DATEX II users are able to customise their implementations to include the functionalities that they require, to avoid being forced to implement all the features of DATEX II. The consequence of this is that if an authority was required to share their traffic circulation routes or recommended routes using DATEX II, they would not need to implement every feature of DATEX II, only implement the features required to support the specific profile.

DATEXII is of primary interest for this study, due to the widespread acceptance of this standard, the operational flexibility it offers and the status afforded through the ITS Directive. Traffic authorities should be able to use extensions within a profile to create and

[18] http://www.datex2.eu/

[19] http://www.datex2.eu/content/datex-ii-rules-procedure (see also http://www.itsstandards.eu/ and search for DATEX)

reference diversion routes (using the location referencing element). One particular profile identified in this study is the 'Data Model for TMP and Navigation Systems'.[20] This profile has been published for wider interest and testing, but it has not yet been proposed for inclusion within the CEN Technical Specifications. The significance of this profile (and the motivation therefore to support progress) is discussed later in this report.

3.1.5. ROAD DATA AND FREIGHT

The terms of reference for Study 1.2 required a review of existing research, in order to check the scope of activity in exchange of road and traffic data and identify any innovation which may inform our recommendations in this area. The following is a summary of the findings.

The **HeavyRoute Project**[21] focused on development of an advanced freight management and route guidance system. The scope included examination of the data collection and interpretation processes, and the final report was delivered in 2009. HeavyRoute's Applications were designed to work with two types of data, the quality of road surface (captured by road authorities on an occasional basis, for asset maintenance) and dynamic data (for example traffic conditions and weather). Information contained in existing road databases was considered sufficient for use in HeavyRoute, because of wide divergences in the scale of data collection and the frequency of update.

HeavyRoute's findings included the fact that geo-referencing of data remains largely non-standard and bespoke, despite initiatives such as EuroRoadS[22] (which had specified a comprehensive road data framework for adoption). Dynamic real time data was mainly clustered around traffic management and traffic information services, along with weather information. Most countries had a clear value chain from data capture through to dissemination of services, but the level of detail and coverage is varied. HeavyRoute demonstrated the benefit of combining periodic (actual road condition) and dynamic data (traffic, weather) with static (geospatial) data to tailor the navigation advice for HGV. However, as that project completed, the main limitation was the availability and capture of road and traffic data in the first place. This was a trend across the research projects, and confirmation to the study team that little progress was being made on this point across Europe.

The **SmartFreight Project**[23] (final report delivered in 2011), looked at how to achieve better integration between existing urban traffic management systems (UTMS) and freight

[20] http://www.datex2.eu/d2-profile/2012/11/06/380
[21] http://ec.europa.eu/research/transport/projects/items/heavyroute_en.htm
[22] http://www.euroroads.org (a solution for the cross-border use of RDS-TMC, the composition of national TMC Databases, and supporting control centre functionality)
[23] http://www.smartfreight.info/

& distribution management systems (FDMS) along with the benefit of accessing available traffic information to help with last mile. From a traffic management perspective there are benefits to a city authority in being able to manage (or influence) movement of individual freight vehicles.

SmartFreight specified, implemented and evaluated ICT solutions that integrate urban traffic management systems with the management of freight and logistics in urban areas The argument for mutual benefit seems compelling. UTMS is moving increasingly towards wireless, like FDMS. The benefit to FDMS is improved traffic information updates, to assist with delivery time estimation. The benefit to UTMS is of detailed freight movement information and improved network forecasting. Despite an enthusiastic forward look at the emergence of V2V and V2I communications, and greater coverage by wireless networks, the main inhibitor is the availability of data (with custodians of data unwilling to create, or rather maintain appropriate data sets).

The SmartFreight User Needs Review provides further verification of the end user perspective. The review identified that much of the freight specific information useful for mapping companies is held by local authorities, but often in paper format. Where electronic formats exist, these vary greatly. (The source for this information was the Freight Best Practice 2006, but contemporary anecdotal examples discussed at the UK DfT SatNav Summit in 2012 were almost identical). User needs for development of freight specific navigation systems included physical restrictions, legal restrictions, advance warnings (risk of grounding, adverse camber, gradients, high winds), added value (lorry parks, rest areas, recommended routes, public weighbridges).

The **FreightWise Project**[24] was the integration of EURIDICE and SmartFreight within a common framework. The project looked at the challenges for SmartFreight in aligning a 'logical architecture' for the freight management aspect with a more 'communication technology related architecture' for CVIS. The proposed solution was to place CALM[25] on top of the CVIS architecture, and this was tested for feasibility.

The **iTETRIS**[26] Project (final report delivered in 2011) looked more closely at the V2X (Vehicle to Network) element of traffic management, and in particular the question of how to detect traffic congestion in a distributed manner (and whether this was comparable to traditional detectors like indicative loops). The study questions were addressed using integrated wireless communications and road traffic simulation platforms to conduct large scale tests in an open environment. The project findings could help with dynamic communication of routing information, extending the principle of integrated urban traffic and freight management systems to light vehicles as well.

[24] http://www.freightwise.info
[25] Communications Access for Land Mobiles - ISO 15628:2007
[26] http://www.ict-itetris.eu/10-10-10-community/

The **FeedMAP**[27] project studied the commercial and technical feasibility of map deviation feedback from map users. The challenge was how to increase the frequency of updates for digital maps, with the operational needs of ADAS in mind. The project tested and validated a cooperative framework for map updates, and used it to assess the feasibility of map data corrections through a feedback loop. This framework was based on the standardised exchange formats and mechanisms developed by the ActMAP[28] project. The outcome demonstrated the possibilities for updating traffic management related base-data in the context of a cooperative vehicle platform.

Co-Cities is a contemporary pilot project, looking at how to incorporate traveller's feedback to existing mobility services, in order to generate a better transport information service. This will make an important contribution towards development of 'two-way information services', such as dynamic navigation, intermodal routing and real-time (not near real-time) travel information.

Traffic management, route planning and driver assistance all have a part to play in reducing the environmental impact of road transport. By integrating these systems together, it becomes possible to optimise between the needs of the different stakeholders involved (for example, the needs of a local traffic manager versus the needs of a freight operator). However, this presupposes availability of data and systems within the city environment, on a sufficiently large scale.

- The **FREILOT** Project developed a platform to examine the increase of energy efficiency in road goods transport in urban areas, through the use of cooperative ITS technologies.
- The **eCoMOVE**[29] Project took this platform and focused on integration for route choice, driving performance, and traffic management. One subproject is looking at fuel efficiency by analysing mission information, traffic management data, truck and driver models and routing system.

3.1.6. SUMMARY FOR EUROPEAN STATE OF ART

Emerging policy directions are aiming to encourage a 'door-to-door' approach to mobility, calling for greater availability of information about timing and routing alternatives, and also stressing the importance of better integration between long distance and "last-mile" freight transport, beginning with availability and access to information. The level of development of the public road data value chain differs substantially, both between Member States and between the different levels of government. A review of the literature will readily establish

[27] http://ec.europa.eu/information_society/activities/esafety/doc/rtd_projects/fact_sheets_fp6/call_4/feedmap.pdf
[28] http://www.ertico.com/actmap
[29] http://www.ecomove-project.eu/

the fact that there is still much work to be done on improving the availability of road and traffic data.

In terms of spatial road data, ROSATTE provides a framework for the coding and location referencing of information that is either relevant to traffic management (speed limit, traffic signs), or produced as a result of traffic management activities (junction detail, access restrictions). It provides a framework for the exchange of static traffic management plans and measures, and is therefore useful for the exchange of traffic and road map data between public authorities or road operators and map makers.

Data availability remains the most pressing issue at all levels. The implication from the research is that if road databases are not yet available (and in an updatable form), then there is still much work to be done in making a broader range of road and traffic data available. Where data is available, the next most pressing issue is quality (sufficient for reuse through the value chain). The question of quality must be accompanied by a review of purpose for which the data needs to be accessed and 're-used'. For public authorities there may be a connection between improving quality of data and improving implementation of policy objectives, which in turn justifies the additional spend.

Both the INSPIRE Directive and the CEN DATEX II Standard offered possibilities for improving the collection and provision of road and traffic data across the value chain. The preparation of the TN-ITS brings road data attributes closer to implementation through INSPIRE. The study team was initially interested in the possibility of extending this to handle traffic management issues such as urban access restrictions (and benefiting from the momentum behind the INSPIRE Directive). However, when dealing with the broader collection of 'road and traffic data', there are benefits in the convergence of static location and dynamic status information under one protocol. Notwithstanding the recommendations already being taken forward from Study 1.3 (and the existing momentum in development of the TN-ITS Specification), there is a parallel motivation for pushing forward with profiles under DATEXII. The pioneering operational models presented later in this report underline the benefit of this single channel approach in promoting further collaboration between the public authorities and the service providers.

3.2. Data for Traffic Management

3.2.1. URBAN ACCESS AND MOBILITY

For the Action Plan on Urban Mobility, a State of Play Report was published in February 2012[30]. Developments on Action 1, 6, 7, and 19 were significant for this study, and summarised here.

- Action 1 – References the Covenant of Mayors[31] (over 2000 local authorities across Europe) agreeing to Sustainable Urban Mobility Plans[32], plus the enabling lever of the next CIVITAS Programme. The emphasis on widespread adoption of such plans presents an opportunity to also incorporate the publication of information about access restrictions in particular.
- Action 6 - Notes that the ITS Action Plan aligns on delivery for traffic and travel information (a priority action) and also a major focus on multimodal journey planners (door-to-door, public competition)
- Action 7 - Motivation for the Study on Urban Access Restrictions[33], which also looked at how information about schemes is captured across the 417 cities in scope. The report describes an important survey of city schemes across Europe, highlights the scale and the nature of the problem, in terms of getting a common approach to sharing information about the type of access restriction in place. The study recorded interesting feedback on 'dissemination of information'. Whilst lots of scheme information was on the web, this is 'advertising and information', rather than a portal.
- Action 19 - Study on Urban Freight Transport (concluded April 2012, available through the UETR[34]), section on new technology makes the case for convergence between the traffic management solutions adopted by a municipality and the smart solutions adopted by individual freight operators (building on earlier recommendations by the FREIGHTWISE Project). This theme has important implications for getting dynamic information available online (for example into platforms for public transport movements), and allowing improved operational planning.

Within the ITS Action Plan, Action 6.4 is intended to help the EC promote ITS initiatives in urban mobility by setting up a collaboration platform for ITS. This includes an Urban ITS Expert Group and the collation and exchange of best practice and guidelines.

30 http://ec.europa.eu/transport/urban/urban_mobility/doc/apum_state_of_play.pdf
31 http://www.eumayors.eu/
32 http://www.mobilityplans.eu/
33 http://ec.europa.eu/transport/urban/studies/doc/2010_12_ars_final_report.pdf
34 http://uetr.eu/en/upload/docs/Study%20on%20Urban%20Freight%20Transport_210041R4.pdf

In the first phase of the supporting study, work focused on establishing the platform, the requirements for the guidelines and kicking-off expert groups. Each expert group is tasked with producing ITS guidelines within its theme, and is delivering recommendations towards the end of 2012. One of the expert groups is concerned with 'Traffic Management and Urban Logistics', and the following findings from that group are relevant.

- "The need for effective multi agency co-operation is critical in devising an ITS traffic management project"
- "The most successful ITS traffic management projects and systems are those that are focused on delivering relevant services and information to individual end users"
- "Urban authorities should be aware of the potential conflict between projects that they introduce to enhance the environment (e.g. Low Emission Zones) and the consequential detrimental effect that such initiatives may have on freight operations"

Once published, the "Guidelines for Urban ITS" will have an official status without binding recommendations (because of the subsidiarity principle in place). The intention is to promote urban ITS solutions and to support effective transfer of know-how amongst urban ITS stakeholders. The guidelines are intended to "foster interoperability and continuity of services" but without the leverage of binding recommendations. The guidelines would exist alongside other toolkits for urban development, with the intention of promoting urban ITS and encouraging local authorities towards a common approach for implementation.

Experience in road pricing and other ITS domains has been that this "transfer of know-how" alone does not foster interoperability or service continuity. Rather, it increases diversity as bespoke improvements are made to existing scheme designs to meet the specific needs and ambitions of the city or local authority funding the project. Such guidelines may need to be set within a specification for "minimum requirements".

3.2.2. RECOMMENDED ROUTES FOR HGV

The area of recommended routes for heavy goods vehicles is complex. Whilst some aspects of routing on the strategic road network are shared in traffic management plans, there is less information available when it comes to data for urban routes. Key restrictive road data such as traffic regulation orders, changes to road layout, and local authority route preferences are still difficult to obtain in a timely manner. One of the obvious challenges is that there are many actors involved, and there is great variation in the way that local authorities communicate with map providers. Some authorities still notify changes by paper, whereas others use online services**.** Some map providers offer an internet enabled self-service update function for key contacts within the local authority.

Transport for London has procured a Freight Journey Planner[35] (FJP), in order to better manage the issue of adherence to compliant routes through the urban environment of this capital city. The implementation of the service was motivated in part by the challenges of hosting the 2012 Olympics, and the need to ensure minimum disruption throughout. However, the service has longer term benefits and implications. The FJP takes all known restriction information into account (ranging from physical restrictions through to special restrictions such as for the Olympic Games), calculates the most appropriate route for the specified vehicle. For example, the route could be within the Congestion Charge Zone, the London Emission Zone or the London Lorry Control Scheme. The route is calculated using various road restrictions, and maximises the use of motorways. The FJP also offers information about the closest legal stopping points for commercial vehicles at the destination.

The Public Information Exchange (PIE) is the commercial service provider behind this facility, and offers other tailor made services to the private sector. PIE currently works with around 470 local authorities across the UK through its Freight Gateway Service (a free-to-use freight journey planner, accessible from local authority's website). The service helps define the freight routing priorities and other relevant freight data for the end user. The company cites a specific case study of working with the London Borough of Hackney[36], which included the technical and operational support involved in establishing the service.

The burden of effort is considerable. The data collection process involves handling paper-based records of Traffic Management Orders (TMO) and Traffic Regulations Orders (TRO), along with a range of other formats such as PDF, Digital CAD, and GIS in order to capture features on the road network (such as height, width, and stopping restrictions). Dealing with this historical backlog helps to tackle the inertia preventing the emergence of a public service. Having established the core content, the authorities are now able to set nominated routes, and vary them dynamically in response to other temporary changes (such as roadworks or special events).

The business operation described indicates the level of effort involved in collecting, processing and distributing this kind of restrictive road data. Companies like PIE are able to discern a commercially viable business model based on the fact that the aggregated data offers a basis for supporting a meaningful service, which in turn has financial value. It is difficult to envisage local authorities making this level of investment individually, but PIE delivers economies of scale through a managed service. Once the module has been integrated as part of the Local Authority's operation, there is a motivation for that local authority to supply subsequent updates and changes in a standard and timely manner.

[35] http://freightplanner.tfl.gov.uk

[36] http://gateway.thepieguide.com/hackney/

The aggregation of such data and expertise also enables PIE to offer services to the private sector (companies facing logistics challenges due to the complex restrictions in place), through the London Lorry Route Approver[37]. It is clear that the company is addressing a gap in the market and supporting public authorities in meeting operational needs. It is possible that such a gap in the market exists across Europe, on a state by state level rather than at a pan-European level, and that such commercial activity could also help catalyse the processes behind data availability.

Those parties directly involved in traffic management have established bilateral or framework agreements with other parties involved, and access to the information they need (for example, the existence of agreed diversion routes, available to those directly involved in or affect by their implementation). However, the motivation and detail for promoting (to the end user, through traffic information and suitable navigation advice) that information is less clear.

3.2.3. Large Scale Platforms for Data Exchange

The content aggregator has a key role to play in the data value chain, making data available in more usable forms for service providers. In some contexts, a strong initiative from the public sector, (such as a platform that encourages data exchange) helps ensure this part of the chain is working well.

The German Federal Ministry for Transport has taken initiatives to address gaps in the information value chain, in particular the gap between content generators and service providers. The solution (on a national scale for Germany) is the Mobility Data Market Place (MDM)[38]. Initially funded by the innovation programme of the German Government, MDM addresses the challenges of an unstructured market, where many bilateral agreements exist (thereby making data exchange inefficient).

MDM is a catalyst for content aggregation, motivating content generators to make data available to a known market place, and giving service providers the opportunity to interact with that same market place. The programme is funded by the Federal Ministry, and managed by BASt. Having established the MDM, the current focus is on encouraging local authorities to 'bring their data to market'. Initially this draws together city authorities of Bremen, Cologne, Düsseldorf, Frankfurt, Munich, Stuttgart, and the conurbation of Ruhrpilot (along with expressions of intent from Berlin and Leipzig). The industry and service providers involved include BMW, TomTom, and Siemens. The objective is to now define harmonised data profiles for different services, covering traffic management data at the urban interface, and strategic routing information for navigation and related services.

[37] http://www.londonlorrycontrol.com/

[38] http://www.datex2.eu/user-forum/2012/duf_2012_p3_datex_german.pdf

The National Data Warehouse[39] of the Netherlands brings various public authorities together in a collaborative effort to develop a database for traffic data. The purpose of this database is to support traffic management and enhance the provision of real-time traffic information. The database provides information on the current traffic situation on both urban and interurban routes in the jurisdiction of the participating authorities. The database also contains information on roadworks, opening status for bridges, and congestion reports.

Whilst both projects are in advanced development, little work has been published regarding the impact of the initiatives on the local market (beyond individual case studies), or comparative advantages of each model (as applicable to other countries within the EU27, for example). In the context of this present study on road and traffic data it is important to note that each model creates a different motivation for making data available to the service providers, but the outcome is positive in each case.

The NDW and MDM take slightly different approaches to data quality. The NDW takes responsibility for the quality of data made available on that platform, and those authorities participating seek to ensure their data meets this requirement. However, the NDW recently conducted a benchmark study with TomTom, comparing historical travel time data. The comparison was between a sensor based data set and a floating car data set, but in combination they lead to "traffic information that is of a higher quality and covers more of the road network"[40].

The MDM approach to data quality is expressed in their core principles. Data owners remain solely responsible for both the supply and quality. This visibility has a self-regulating approach on the quality, and further motivation is provided through positive case studies on collaboration. One significant case study used in this present study, that of the collaboration between the public and private sector on routing for navigation systems, was enabled by the effective functioning of the MDM. It is worth noting that the underlying philosophy of the MDM is similar to the UK Travel Information Highway[41] and would appear to be more readily replicated in other contexts across Europe.

A comparative review of these models is presented in **Error! Reference source not found.** below:

[39] http://www.ndw.nu

[40] http://www.businesswire.com/news/home/20121024006391/en/NDW-TomTom-cooperate-benchmark-historical-traffic-data

[41] http://www.tih.org.uk

	Netherlands: **National Data Warehousing**	**Germany:** **Mobility Data Market Place**
Summary	Local Authorities working together to develop and maintain a joint traffic data database, making this available to service providers to stimulate effective use of the data	Federal Government providing an environment which facilitates data provision and data acquisition between both the public and private sectors.
Goals	- To resolve the discrepancy between key data sources - To fill the gaps in the existing traffic monitoring system in terms of spatial coverage and information accuracy - To provide reliable and fast access to data on current traffic (for efficient traffic management and information systems) - To enable congestion forecasting	- To facilitate data provision and data acquisition - To simplify the business process for all actors - To encourage development of new services from private sector - To create future opportunities for public sector to benefit from exchanging data
Concept	- Provision of a central source of high quality traffic data and information on the road network status - Data owned and managed by local authorities - Local authorities responsible for the data quality - Data is made available to service providers	- Brings public and private content collectors and service providers together - Platform facilitates data provision and data acquisition - Data owner remains responsible for the data supply and quality - Contract set up between the data owner and the data receiver prior to data transfer
Advantage	- Reliability of traffic information - High quality data available to private service providers (at a cost) - Cost savings to the local authorities through joint collaborations - Wider availability of data to support traffic policies and scheme evaluations	- Environment encourages data provision and data acquisition between both the public and private content collectors and the service providers - Promotes competition between providers, to improve data quality
Comments	- Model seems more suitable for member states where the public sector already has a well developed data collection system in place. - Information provided to road users is uniform across all channels - Fully funded by the public sector	- Model seems more suitable for member states that do not have a well developed data collection system in place. - Promotes investment and participation by the private sector

Table 1 - A comparison of the national data exchange platforms in the Netherlands and Germany

3.2.4. BEST PRACTICE FROM EASYWAY

The EasyWay Project has brought together a substantial knowledge base and identified best practice for the development, implementation and operation of different ITS services, based on the experience of their partners and stakeholder network. The draft EasyWay Deployment Guidelines 2012[42] are currently in a phase of consultation and mediation with Member States, in order maximise the usability of the guidelines for the purpose they were intended. The three pillars of harmonisation chosen by EasyWay (namely interoperability, common look and feel, and common assessment criteria) represent a pragmatic approach to harmonisation of existing services.

Overall, the deployment guidelines have followed a natural and logical progression, from identification of good practice to the extraction of key requirements to align other schemes to this level of good practice. The current version includes a clearer framework of recommendations, with more prescriptive language to encourage implementation. The framework is robust in terms of seeking coordination and harmonisation. However the challenge remains with the 'voluntary adoption' of guidelines by those not actively involved in their creation.

The deployment guidelines are intended to support "adjustments to existing specifications and operational services", rather than function as detailed specifications (which makes them less beneficial for green field environments, where the level of existing service is minimal).

The EasyWay Project has considered the way that the formation of TMPs can be optimised, based on their review of best practice in Europe. One relevant output for the present study is a Deployment Guideline under the Traffic and Network Management (TMS) suite, which covers Traffic Management Plan Service for Corridors and Networks (TMS-DG07). TMS-DG07 focuses on the preparation, formation and implementation of Traffic Management Plans, and represents a decision making framework on how the TMPs might be formed, covering functional, organisational and technical provisions, as well as recommendations relating to the common look and feel of guidance and the definition of service levels.

The study team also considered developments in the ESG2 Support Action on 'TMP Rerouting', and the progress made by the ESG5/TISA Collaboration on how information may be more widely disseminated to end users with devices that have a limited scope for receiving updates.

In terms of implementation, EasyWay Members indicate to use their Deployment Guidelines only in the framework of co-funded projects relating to the TERN. Whilst the

[42] http://www.easyway-its.eu/deployment-guidelines/

knowledge base provides a very useful induction on traffic management, the status of that document is limited and the focus is primarily on sharing between public authorities. The following section will introduce two different models for information exchange, and then Section 3.2.6 will present a framework for an EC TMP Guidance Note.

3.2.5. REPRESENTATIVE CASE STUDIES

3.2.5.1. HESSEN MOBIL'S TMP BROKER

On a regional scale, the Hessen Road Traffic Authority[43] has a particular need to focus on cross border traffic management because the state handles a lot of long distance 'through traffic'. In order to be able to divert traffic for large areas in the event of disruption to the most important motorway junctions beyond the state borders, close cooperation between the German states is necessary.

In the event of disruption to the long distance corridors, previously agreed diversion strategies are activated and thus the effectiveness of the motorway network beyond the state's borders is fully utilised. Initially the strategy management was successfully tested for the Frankfurt-Cologne corridor and it has now been extended to other corridors.

Hessen RTA's method of exchanging TMP information is of interest to this study. At an architecture level, the 'TMP Broker' is integrated with a 'Geo Data Infrastructure', so that traffic information and active interventions can be displayed on a common map. In terms of system operation, the strategies are encoded into XML using DATEX II, and the traffic management centre publishes a unique TMP ID, the activation status, references to relevant task lists under that TMP, and any supporting 'situation information'.

A TMP is then accessed by a request from the control centre through the TMP Broker', which results in other listed parties automatically being notified and needing to agree to the request (after which, the relevant elements can be activated). A similar procedure is followed but in reverse for deactivation. If a service provider has already established an agreement that provides access to the context information, then there is a benefit in being able to subscribe to the 'StrategyXML Feed'.

'ISM Hessen' is an intermodal strategy manager, a project intended to support management of coordinated, intermodal transport strategies in major metropolitan areas. Key participants for strategic coordination and information exchange include the City of Frankfurt, the Rhine Main Public Transport Association, and Frankfurt Airport. The concept takes a decentralised approach to coordination, ensuring that responsibilities are generally retained because each partner concerned then remains accountable for identifying problems and activating strategies within their own spheres of responsibility.

[43] http://www.invest-in-hessen.com/mm/Congestion_Free_Hessen_2015.pdf

3.2.5.2. DATEX II ROUTING INITIATIVE

A project is currently being led by BASt in Germany that enables information relating to priority networks, traffic measures and route recommendations to be shared with Service Providers via a DATEX II feed from a Traffic Management Centre. The DATEX II profile for strategic routing found its origins in the German Mobility Data Marketplace, where a navigation provider (BMW) and content providers (road operators) agreed that there were mutual benefits in providing and sharing the information on strategic routes.

The collaborative initiative has created a DATEX II profile that enables strategic diversion routes to be developed and encoded using DATEX II. The first results were discussed at the stakeholder workshop, and the expectation is that the profile will be shared on the DATEX II website with the wider community.

The approach being taken by the DATEX II profile for strategic routing is based upon the existing provisions contained within the existing DATEX II specifications. The profiles builds upon the key traffic ontology from the DATEX II specifications, e.g. itinerary class, the situation model etc. The key changes result from the motivation for the profile which intends to support the development of strategic routes which can be picked up by navigation providers. The profile effectively applies some additional glue between the existing DATEX II constructs to ensure that they can be used in route based solutions that the navigation providers require.

In effect, the profile utilises the key building blocks from the existing DATEX II specifications such as the itinerary class and the situation data structure. However, it adds certain new terms to existing pre-defined extensions. For example, the cause of the incident already sits within the existing DATEX II specification but the new profile includes a term named in/out trigger which can inform routing applications of portions of a route which are no longer available. The in/out trigger would not be easily understood by those parties who were not using the profile, however it would not render the whole situation package unreadable.

BASt indicated that the developing DATEX II profile would be compatible with the EasyWay Deployment Guidelines for Traffic Management Plans for Corridors and Networks (TMS-DG07).

The first draft of the profile has been uploaded[44] on the DATEXII website, for use by the DATEX II community. On consultation with the project team responsible for the development of the profile, it appears that there are synergies between this profile and the objectives of the current study. The consultants provided an example from Dusseldorf in Germany of how the profile can be used for network management during periods when

[44] http://www.datex2.eu/d2-profile/2012/11/06/380

capacity is exceeded and traffic needs to be routed to other areas. In the local context, this means assigning the original route via the A52 Rheinkniebrucke with a preference weighting of 10%. The alternative route via Theodor-Heuss-Brucke (which would be identified by a predefined reference) would be rated with a preference weighting of 90%. The result of this change would mean that navigation/routing providers could automatically choose the most appropriate route for their users.

This process could have application for this study, in the sense that if a section of the road network was not available, then the preference weighting could be set to 0%, and the alternative predefined route could be weighted with 100%. In addition, the changes in weighting could be set to be automatically pushed to subscribers of the DATEX II feed.

3.2.6. DEVELOPING AN EC TMP GUIDANCE NOTE

3.2.6.1. GUIDANCE NOTE CONCEPT

In the context of traffic management involving multiple actors and possible cross border communications, the development and use of a traffic management plan provides a framework in which all parties can operate effectively and in a coordinated manner. The advantage of bringing stakeholders together within such detailed agreements is that this also creates a collaborative environment for data sharing in a clear context. In the short term, a considerable amount of relevant road and traffic data could be made available through better sharing of Traffic Management Plans with relevant third parties. This was the implicit assumption in the study brief and the methods for doing so are elaborated in this report.

A substantial amount of knowledge already exists in the domain of traffic management manuals, so the purpose of preparing a ‘guidance note’ is not to recreate this knowledge, but rather focus on straightforward guidance (based on best practices) for 'newcomers' and on the specific area of how data sharing may enhance operations. The consensus from best practice is that a Traffic Management Plan should be published in an open and interoperable manner, preferably in electronic form with a definition of measures to be deployed and the conditions under which they will be implemented.

One approach for sharing is for the majority of information to sit with the parties of a particular agreement, such that only the activation status is communicated (as illustrated in Section 3.2.5.1 above). Alternatively, the specific details of the plan could be encoded and communicated on an ‘as activated’ basis, allowing broader access for service providers so that end users may be informed (as illustrated in Section 3.2.5.2).

The following is a high level summary of the findings on Traffic Management Plans. The work already generated by the EasyWay DG07 is heavily referenced, but with important amendments on the area of data sharing. This was the most efficient approach for

generation of wide-ranging EC Guidance Note on Traffic Management Plans as part of the scope for Study 1.2.

3.2.6.2. GUIDANCE NOTE STATUS

- There is an opportunity to build on existing requirements, included requirements on the formation of TMPs
- Best practice analysis (in particular that reflected in the EasyWay Project) has already concluded that a checklist is a suitable tool for supporting the *formation* of TMPs
- Having set about forming the TMP, there is a need to develop new elements for the sharing of TMPs (both among public authorities, and between the public and private sector).
    - To encode locations and routes in a common manner (the recent provisions in DATEX II appear to cover this)
    - To encode restriction and traffic regulation information on routes (the recent provisions in DATEX II appear to cover this)
- There is a need to make third parties aware of the availability of a TMP (there are a range of methods that could be adopted for achieving this, all of which have benefits in being underpinned by a common data exchange mechanism such as DATEX II)

3.2.6.3. GUIDANCE NOTE SCOPE

The existing approaches and initiatives reviewed by the study team fall into three categories:

- Pre-selected operational partners, sharing static information, no scope for sharing beyond this
- Pre-selected operational partners, where static information, relevant updates and information flow about activation and deactivation is shared between partners and potentially made available to selected third parties
- An open scenario whereby any organisation can adopt a standardised specification/methodology to support a more interoperable system and to provide access to the data for third parties

The scope of the review was extensive, however the emerging conclusion is that any additional guidance should focus specifically on the steps needed to enhance the sharing of traffic management plans and the operational use of these with third party organisations (content aggregators or service providers), to facilitate traffic management objectives.

3.2.6.4. GUIDANCE NOTE STRUCTURE

The outline structure presented in TMS-DG07 reflects best practice, and can be adopted as a framework for the EC TMP Guidance Note. At the present time, that framework elaborates adequately on:

- The formation of a TMP,
- Use of the TMP by participating partners,
- The distribution of information to road users, when traffic management measures are activated.

However, the function that it does not appear to directly support is the sharing of the TMP with other groups (e.g. logistics providers, mapping and navigation providers, hauliers) who need to be aware of the plans prior to their implementation.

The following developments are therefore needed for the content to be referenced by the EC TMP Guidance Note:

- Requirement FR7 (which outlines the information structure to be used to describe the TMP scenarios) should be elaborated to:
  - Include a statement that identifies that location based information must be referenced using location referencing standards accepted by the DATEX II specifications (CEN EN 16157:2). This is of particular relevance to the coding of the traffic circulation routes (the routes can also be encoded using the provisions included in DATEX II using the “itinerary” class).
  - Identify the restrictions that apply to the new traffic circulation routes (by vehicle type, access restrictions, toll zones) and encode them using the provisions included within DATEX II (under the “NetworkManagement” class).
- A discussion on the merits of the common look and feel requirement (CL&FR5) for documenting the measures to be applied, and a requirement for this information to be shared with others on this basis (so in the language of the 2012 Deployment Guidelines, that would be an upgrade from ‘should’ to ‘must’)
- The information included in the TMP for traffic circulation must be coded and published using the CEN EN 16157 (DATEX II data exchange specifications) based on the ‘NetworkManagement’ package described within CEN EN 16157:3
- The TMP for traffic circulation plans must be made available to third parties
- Authorities publishing TMPs for traffic circulation plans must adopt a process to share the TMP content with other parties
- Adopt supporting procedures outlining:
  - The method of coding routes (using either the provisions included in DATEX II such as the itinerary class, or the emerging DATEX II profile on strategic diversion routes)
  - The process for sharing the TMP on traffic circulation with others

For completeness, Annex 1 of this report contains an outline procedure for preparation and use of a TMP. The content builds on the principles elaborated in EWDG07, but the high level steps point more directly to the importance of publishing relevant information in such a way that is readily accessible for relevant ITS Service Providers.

3.3. Study 1.2 Stakeholder Workshop

The workshop[45] was held with three objectives in mind

- Validate stakeholder requirements, especially the need for better access to road data & traffic regulations and the current barriers to doing so, and to share and validate examples of good practice;
- Provide the study team with additional 'real-life' examples of issues and developments in the area as well as extra information, perspectives and insights;
- Discuss proposed actions to foster effective cooperation among actors concerned and to realize pan-European harmonization in terms of principles, procedures, outreach and access to relevant sources of data.

The morning session provided a learning opportunity in terms of the challenges facing city authorities in optimising economic and environmental objectives through application of measures such as urban access restrictions. The study team was also made aware of a new initiative by POLIS to survey cities about Open Data.

Public authorities expressed concerns about sharing data but also identified the potential benefits of involving the market in disseminating information to travellers. The role of the private sector data aggregator also came into view, and the model seemed promising for addressing an important first step, namely helping the public sector data owner to order and organise the data into a useful form. Authorities who had achieved some level of organisation (even through outsourcing to a third party service) seemed more confident about embarking on collaborative ventures.

The discussions also helped to clarify the understanding of traffic regulations and (restrictive) road data, validating the boundary between static application (of regulations and associated road data, mainly falling under INSPIRE) and variable application (or regulations and associated road data, which is the focus of our study).

Delegates accepted the idea that data sharing between public and private sector led to operational excellence. However, the morning session highlighted the steps towards that model, namely that data sharing

[45] http://ec.europa.eu/transport/themes/its/events/2012-09-28-workshop_en.htm

- supports greater cost-effectiveness in meeting operational objectives (step change in affordability, difficult to justify 'informed traveller' initiatives funded by the public purse)
- creates affordable opportunities for further innovation in traffic management, and therefore
- contributes to operational excellence through securing mutual goals.

The afternoon session focused more on traffic management. The contrasting stories of Hessen Mobil (highly efficient collaboration between traffic management centres) and the BMW/BASt Collaboration (public sector and commercial service provider collaborating around compatible goals), was very helpful in framing the discussion. There is a strong correlation between the methodology deployed by Hessen Mobil and the EasyWay Deployment Guideline TMS DG07. Here, the path towards incorporating third party service providers in the traffic management model (through data sharing and publication) is not clear.

The study team had previously advocated expansion of the EasyWay DG07 Guideline, and this 'gap analysis' was validated (in terms of better sharing between public authorities). However, the stakeholders also elaborated that the path to sharing ‘road and traffic data’ using this method was unclear. In particular because this would involve sharing full details of the traffic management plan with commercial third parties. The new thinking came from the BASt/BMW Collaboration. This pointed to something more profound in terms of the alignment of compatible goals, a willingness to experiment, and the progress towards a truly open approach ('on the fly' development of route guidance information, shared openly with third parties through framework agreements).

The key building block is data, and the public authorities have a unique opportunity to influence the messages being given to end-users by providing accurate and timely data that reflect their operational objectives (for example disclosure of pre-agreed diversion routes, or accurate information about access restrictions). Although the creation of the traffic restriction itself will come from the local authority, the existence of it may be captured empirically as content by a commercial organisation, using open source or feedback from users of a service. As this shift continues, there is a risk that the ability of the public authority to manage traffic on the network is diluted and roadside instruction being in conflict with in-vehicle advice.

The feedback from stakeholders is that in the absence of public data, there are two possible scenarios. One is that content aggregators step into the gap, harvesting data in order to build a service. However, this model is not always scalable. The other is that service providers begin to generate their own content through data collection initiatives and increasingly sophisticated learning algorithms. Whilst incomplete, the de facto service

comes into conflict with roadside information (or public broadcast information), leading to frustration for road users.

These discussions helped the study team to think about an EC TMP Guidance Note, which would draw on established best practices but also be free to promote new thinking on the scope of traffic management activity and the approach to data sharing with ITS Service Providers.

This EC TMP Guidance Note needed to be

- Something useful for newcomers (in both urban and interurban contexts), introducing them to good practice on the TMP;
- Able to provide some detail on the lifecycle process (from agreeing objectives and designing the plans, through to operating, sharing, and refining);
- Expanded with requirements for publication (or part publication), using established standards that would be recognisable across Europe, both within the road sector and potentially in sharing information with other modes;
- Pointing to (or elaborating on) a Data Sharing Agreement (to safeguard the identified needs of both public and private sector parties involved).

The European Commission would like to ensure that the TMP Guidance Note contains the good practice captured in the EasyWay DG07 but is not limited to the co-funded projects of participating countries along the TERN.

The final presentation by the East West Transport Corridor II Project (EWTCII) focused on data sharing in a more systematic manner, this time highlighting the challenges of sharing across modes and national boundaries. The mutual concerns of stakeholders were amplified well, with a public sector concerns about misuse of data and the private sector concerned about remuneration and ownership rights. The subject of intermodality was introduced, underlining the goal of getting road data better organised as a mode, making it easier for multimodal journey planners to access this data (through directories or single points of access).

The Information Broker being implemented for the EWTCII is good example of how the content aggregation gap is addressed through a ‘market place model’. This has allowed the pooling of secondary information, for which the business case to aggregate alone might not exist, but which becomes attractive in the context of an existing market infrastructure. The issue of wider modal interface was only explored briefly by the stakeholders on this occasion, and the initial view was that publication of data in a recognised open standard would improve accessibility for authorities and operators of other transport modes.

The recurring theme of the workshop was more about data sharing than about the detail of traffic management. Clearly, the study falls within the broader area of Action 1, and the generic theme could be framed as "Optimal Use of... Data". The sheer scale of data being collected, aggregated, processed, shared and disseminated needs to be understood. Stakeholders expressed the following concerns about data sharing:

- Public authority wants autonomy to act, some sort of revenue stream, and confidence that data won't be abused, and fear obligation for data quality.
- Private company wants rights protected and payment, plus easy way of buying and selling. Stakeholders want to see open market with better service.
- Both groups were concerned about the duplication of effort around the same data sets, and the possible erosion of influence for traffic authorities to road users over time.

On the public sector side, there are concerns about the availability and completeness of the data (the most common challenge, because data is held in disparate formats and by different owners within the same entity). Where such data can be made available there are concerns about misuse in the private sector (or by individuals) to the detriment of meeting policy objectives.

On the private sector side, there are frustrations about the lack of access to such data, which could otherwise be useful in enhancing a service (either for operational purposes, or as presented to customers). The data often forms one part of a bigger picture but the absence of it (or availability in poor quality) leads to inefficiency and duplications as the private sector look for ways to collect the same data (again).

Overall, the discussions did not highlight any new or more significant examples to illustrate the themes of the study (beyond those already capture in the first analysis). Feedback from the IRU leaned towards better application of the PSI Directive, and the challenge to road operators to make more data available as an integral part of the service to the road user who is (directly or indirectly) paying for the road service.

In terms of the technical feasibility of using TN-ITS or DATEXII to address the communication of urban access restrictions, the conclusion was that both offered possibilities. The challenge would arise in the way public authorities currently organised the data internally, leading to a patchwork of implementation across Europe. For this reason, the study team has chosen to focus on alignment with DATEXII (and promote adoption of relevant profiles by CEN), in order to capture both location and status information on a single channel. However, this does not conflict in any way with the further development of TN-ITS Specifications, nor does it jeopardise any future interoperability between the two. The recently developed interface between DATEXII and TPEG provides a good reference for what is possible.

4. Consideration of Findings

4.1. Data Availability and Access

The state of the art and early assessment considered availability and access to 'road and traffic data', under the subthemes of traffic circulation plans, traffic regulations, and recommended routes.

- **Traffic Circulation Plans:** This data element is commonly captured as part of a 'traffic management plan', both in terms of encoding and activation status. However, the 'traffic management plan' as defined and used by traffic authorities often contains other information which may not be suitable for sharing or widespread publication. It is therefore essential to define the data elements necessary for satisfying the ITS Directive, rather than automatically requiring the publication of a TMP. The Hessen Approach reflects best practice within a public sector environment, but the underlying methodology makes it presently unsuitable for extending to ITS Service Providers. The use of DATEXII for Routing (as demonstrated by the BASt/BMW Collaboration) points to a different approach, where the necessary data is shared 'on the fly' satisfying the operational needs of the end users through the ITS Service Providers, without compromising on the concerns of the Public Authority. This model is taken forward for consideration in the analysis.

- **Traffic Regulations**: The main aspect considered within this study has been the application of urban access restrictions by public authorities. Definition of this data element will be critical in establishing a unified approach to sharing road and traffic data for both urban and interurban traffic management. Whilst some aspects can (and should) be addressed through INSPIRE (for the purpose of establishing accurate digital maps), the study finds that DATEXII has sufficient flexibility and status to accommodate requirements for sharing both status and dynamic information. It is possible that the TN-ITS Specification will be developed with a view on future interoperability with DATEXII, allowing public authorities to draw static information directly into a DATEXII profile, rather than recoding. However, the operational outcome is the same.

- **Recommended Routes**: This is about local authorities mandating that road users and HGV in particular take a particular route. The study reviewed how this information is currently conveyed through aggregators, and presented as a service to the freight sector (examples of the TfL Freight Planner to support compliance). The more strategic challenge of balancing the needs of long-distance and close-to-destination traffic will depend on the local authority's policy goals, but the need to communicate effectively with road users will be an important part of achieving these goals successfully.

The legal advisers in the study team provided an opinion regarding the relevance of the PSI Directive when it comes to sharing traffic management plans. The conclusion is that the PSI Directive does not in itself provide a legal basis for requiring traffic management authorities to *disclose* traffic management data.

The advice is that it may be possible to make binding requirements under the ITS Directive or by reshaping the definition of traffic management data such that it does fall within the scope of the disclosure requirements of the PSI Directive, (but that it does not do so at present). In other words, the ITS Directive provides the leverage to call for publication of relevant road and traffic data, and the PSI Directive will then govern the re-use of what is published. The recommendations from this study will concentrate on that publication process, while acknowledging the context into which such data will be published. The EC will then need to test the viability of binding requirements through development of draft specifications.

The legal review focused more specifically on the positive incentives offered by the operation of the PSI Directive. The key issue is in the application to the area of 'transport data', which until now has been excluded as a mainstream area. However, transport data is expanding rapidly, through convergence of disparate data sets and the overlap between data about travellers and data about network operations. Public authorities are starting to consider transport as an aspect of 'big data', and it is right to seek further endorsement of this through the proposed amendments to the scope of the PSI Directive.

In terms of downstream market enhancements, a more level playing field between the so-called hybrid public sector bodies and their commercial competitors could also increase the incentive for making data available. However, the key issue for the public sector will be the ability to meet costs. The study team believes that the PSI Directive provides enough scope for achieving this, and that the traffic management stakeholder community should take ownership of this process. Once the obligation of publish has been established, the affected stakeholders can then develop a set of recommended licensing provisions and guidance on price calculations for re-use, within the scope of the PSI Directive. These concepts are developed as part of the recommendation to publish, described in Section 5.

4.2. Overcoming a cultural obstacle

The aim of this work, taken from the ITS Action Plan, is about enabling effective traffic management while allowing road users to benefit from improved access to data. It is about finding the right balance between traffic management aims and user data access aims. It does not mean that the EC interventions should automatically seek to achieve the

availability of all traffic management data, nor that traffic managers should continue to be able to withhold such data from users as a default position.

The task assumes that there are barriers to the public sector sharing traffic management data with private sector service providers, and hence road users – as indeed the study has shown there are. It is also assumed that if this data was shared effectively with road users that mutual benefits would arise in terms of improved operations – as indeed the study has shown they can.

However, the picture is more complicated than this, which goes some way to explaining why this form of data sharing is not already widespread across Europe.

Effective traffic management requires that the traffic manager can accurately predict the responses by users and other traffic management authorities to the measures they put in place, including the information they share. The study has identified a concern amongst traffic managers that sharing of traffic management plans with ITS Service Providers (who in turn are influenced by market advantage) could make user responses much harder to predict, and hence reduce their ability to manage traffic effectively. The suspicion is that subscribers to commercial services would potentially demand 'exclusive guidance' which would take them away from the 'mainstream advice' being offered by the traffic management authority. The presentation by BMW at the Stakeholder Workshop was an attempt at addressing this concern, by illustrating the concept of 'compatible goals'. The traffic authority indicated which routes are preferred and supported, and the service provider balances the need to provide a perceived 'advantage' to the individual user with the need to maintain a credible and informed route through the scenario concerned.

The study team was not tasked with gathering evidence on whether this professional perception is factually correct, or to quantify such effects. However, the fact that the opinion appears to be so widely held by traffic managers across Europe is what matters, and this perception will form one of the bottlenecks to taking a more open approach. Until traffic managers have confidence that sharing traffic management plans with third parties will not dilute their ability to manage traffic effectively, they will not actively support or embrace steps to require that data be shared with users.

It is also worth stating that just because the risk of reduced ability to control traffic may be plausible, it does not follow that the risk is real or substantial enough to warrant the suppression of road and traffic data. This provides a direction for EC interventions, allowing it to focus on pursuing the disclosure of data such that it poses a low risk to the ability to manage traffic (through promoting associated conditions of re-use). Subdivisions may include early publication of low risk data (in particular that which helps with compliance, such as for access restrictions or recommended routes, or agreed traffic circulation routes), and/or potentially to selected users (such as HGV operators). These

options for implementation need to be worked out with stakeholders once the draft specifications are established, however the study has shown what is possible at this time.

The study has also confirmed that where coordination in data sharing between public and private sector can be achieved, it is possible to achieve higher levels of operational excellence in traffic management and in freight operations. The cooperation required that the public sector and the private sector information service providers shared mutual, compatible goals, that they understood their respective concerns and limitations to the point that they could share data safely and responsibly. Such initiatives tend to emerge where there is both vision and finance, and examples of best practice are being documented.

4.3. Public Sector Constraints

The study found that public sector representatives from across Europe are under pressure to achieve more with ever-dwindling resources. They are concerned that there is no cost-benefit assessment they can use to justify public investment in organising and publish core roads data, let alone traffic management data. Although individual authorities vary in this regard, there was certainly some indication that there are quite widespread problems in terms of accuracy and currency of public roads data, its organisation, location and format. If data are in disarray it discourages or prevents data sharing with others.

The study also found reluctance on the part of public authorities to invest in sorting out their roads data because of the lack of a business case, of clearly agreed standards for presenting data (even within the public sector), and because of uncertainty about quality expectations (and hence possible usability / liability issues). Finding a solution to the issues of organising and defining quality of existing data is critical to the success of Action Area 1.

The study was able to highlight the work of at least one successful private sector data aggregator which undertakes this work for the public sector at little cost, on the basis of a licence to exploit the data once it has been organised and formatted correctly. This suggests the problem is fixable, and affordably so, given the right market conditions and/or suitable facilitation measures. For example, the private sector organisation cited above is able to achieve cost savings and economies of scale in exploiting its licences by applying its own data quality and interface standards.

However, the motivation behind the ITS Action Plan and associated Directive was to move beyond the emerging patchwork of good local solutions, towards a broader and more consistent implementation. Creating an obligation to publish data in a common standard will introduce new motivation for the public sector to organise resources towards a greater good, and to begin experiencing the benefits of having data available in

electronic and interoperable format. Private sector data aggregators can certainly continue to be catalysts for implementation, for example in helping smaller public authorities to meet obligations as part of a bigger solution.

This provides a potential direction for EC interventions targeted at stimulating the public sector to focus on getting its traffic management (and ideally other) data in order. An approach based on binding specifications would be necessary to make sure MS acted, while also allowing the Commission to argue that it was helping to reduce operating costs of the public sector in the EU collectively by moving everyone to common technical standards for the quality of data and the way it is formatted and published in a discoverable location. It could also highlight potential operational efficiencies by using the same interfaces for internal systems (e.g. to VMS) once TMPs are activated, as well as to external (public sector) bodies.

4.4. Towards A Solution

The state of the art in optimising the collection and provision of road and traffic data across Europe is highly variable and the coverage is patchy. This section of the report has presented a consideration of the findings to date, in order to identify the themes for further intervention. The findings are that there are different “pathways” a road authority can take towards sharing road and traffic data (both with other public sector bodies and with commercial third parties). The pathways share a common end point; that is, where clearly defined road and traffic data elements are shared electronically with other organisations, in a common format, with an activation status. The study team proposes that the common end point can be achieved through the following steps:

1. Agree the data content specification (for ‘road and traffic data’) which falls within this scope (including details on any potential measures that could be applied at each location)
2. Agree on the (preferred) format(s) for presenting these in-scope ‘road and traffic data’ elements electronically (static and context information)
3. Agree the data elements that describing the activation (or application) status of traffic management measures identified in Step 2.
4. Agree on the (preferred) format(s) for presenting these associated status updates electronically (dynamic and near real-time information)
5. Ensure electronic publication of all elements captured under Steps 1-4
6. Ensure published information described in Step 5 is discoverable by other public bodies and by ITS Service Providers (as required in the ITS Directive)
7. Monitor implementation of Steps 1-6, and engage in a programme of supporting activities to facilitate smoother progress towards the desired outcome

The study team considered a broad range of options, and the background information on this consideration is recorded in Annex 3. The underlying rationale behind the drafting of recommendations from these options was that:

- the definition of scope was already apparent from the work done to date on the ITS Directive and the ITS Action Plan
- if the data sharing objectives envisaged by the ITS Directive are to be achieved in a timely manner (or at all), the EC will need to make some intervention on publication of road and traffic data
- the question of formats has been examined as part of this study, and there are advantages in keeping the location and context information in the same format as the activation status for measures (this is not in conflict with improvements related to INSPIRE, and could prompt future interoperability)
- the question of quality needed to be owned by the stakeholder community, through seeking further clarity on what services are envisaged and the marginal costs involved for provision of data at each quality increment

The recommendations for intervention are presented in the following section. The overall argument is intentionally similar in form to that already presented on other studies within Action Area 1, 'Optimal Use of Road, Traffic and Travel Data'. The study has described what is possible and proposed a path to a workable solution. Experts involved in development of specifications for action (a) and action (b) can draw on these recommendations, and develop a more detailed schedule of data elements and associated quality requirements through consultation with stakeholders.

5. Recommendations

The recommendations are presented here in the context of Steps 1 to 6, in progress toward the common end point (as described in Section 4.4). A set of proposals for Step 7 (Supporting Activities) are also included for future reference. The relationship between the steps and recommendations is summarised in Figure

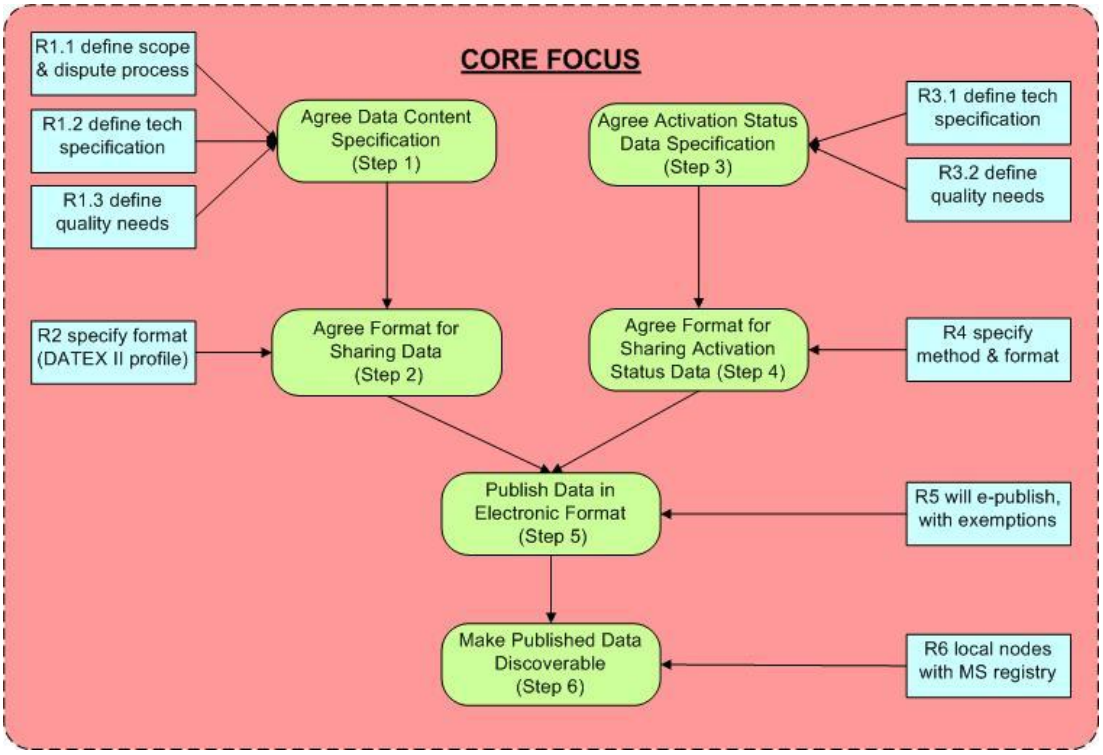


Figure 2 - Review of key steps for achieving the common end point

5.1. Step 1: Agreed Data Scope

[R1.1] Publish a definition of the intended scope for traffic management measures and provide a dispute resolution facility

To ensure they comply with the EC's requirements, traffic management authorities will need to be able to correctly identify information about changes affecting their networks which would occur if they implemented a traffic management measure that they have planned. They would also need to be able to communicate in a timely way the fact that

such changes had taken place, or had been reversed. It is recommended that the EC issues a clear definition of the traffic management measures and types of related road and traffic data that fall within the intended scope of this action.

For this study the in-scope traffic management measures were defined as "*any which contain a traffic circulation plan, a traffic regulation or a recommended route*", and the in-scope data were defined as "*those not already covered within the static data elements for INSPIRE*". This will need to include any measure currently in place, or planned to be put in place, or for which plans exist in the event of certain circumstances arising.

A traffic management authority might believe that its planned traffic management measures do not fall within this scope, and therefore that the requirements of EC action in this area did not apply to those activities. This judgement could be disputed by other stakeholders, who might reasonably expect a degree of consistency in how the requirements are interpreted and implemented across MS. For this reason it will be necessary to establish clear procedures for resolving any disputes. It is recommended that the EC establishes a technical committee to act as ultimate arbiter where necessary.

[R1.2] Provide a binding technical specification of the data contents describing the relevant traffic management measures and their impacts.

This activity is concerned with setting out clearly all the data elements that need to be communicated in order for any other party to properly understand the impact of any planned traffic management measure on the network and traffic parameters. The precise content may depend on the type of traffic management measure and whether the data are describing a traffic regulation, traffic circulation plan or recommended route. It will be necessary to define the time-related aspects of the traffic management measure (e.g. start date/time), as well as the way the data elements are expressed (e.g. units of measurement). It may also be necessary to agree the method used to derive certain data (e.g. estimated new traffic speed).

To ensure consistency of user experience, it will be necessary to ensure compliance with this specification across MS, for which purpose it will need to be binding, and hence it will need to be highly credible internationally. This is a specialised task requiring the involvement of experts, for which reason it is recommended that the EC appoints CEN to develop the technical specification.

[R1.3] Organise a forum for relevant stakeholders to define quality requirements for the key road and traffic data elements that are to be described in the technical specification, and add these to the specification

Third parties aim to provide a consistent quality of service to their users. The challenge they face is in understanding the quality of others' data used in their services. If there are no quality requirements or if different stakeholders define quality in different ways, the data recipients may not be able to use the data, or incur significant costs understanding it. This impedes the emergence of a consistent and cost-effective service to road users.

This task involves defining important data quality requirements in a common way, including how to describe the currency of the data content (e.g. when last updated, duration of validity), as well as whether to describe quality requirements for individual data elements (e.g. distance accuracy), for whole data sets, or even for whole organisations.

The relevant stakeholders will need to agree which data elements are most critical and then negotiate an acceptable compromise solution for each because the costs and benefits of meeting the quality requirements for these data are likely to be distributed asymmetrically between them. It is recommended that the EC asks the European ITS Advisory Group[46] to undertake this task (or failing that another suitably constituted forum representing the different stakeholder interests participating in this study) to facilitate this negotiation process. It is also recommended that the agreed quality requirements are provided to those who are tasked with developing the technical specification (see [R1.2]) for incorporation as a normative annex. This will ensure that the agreed quality requirements are met and hence that reliable user services can be developed.

5.2. Step 2: Common Formats

[R2] Specify the adoption of a profile using DATEXII

To ensure effective electronic communication between stakeholders it is essential to define not only the content, but also the format for sharing information. The greater the number of alterative formats in use, the greater is the costs to the stakeholders, and the greater are the barriers to the emergence of an efficient, sustainable market for ITS services. Such diversity also complicates communications between traffic management

[46] Established under the provisions of the ITS Directive

authorities and potentially internally within a traffic management authority, in terms of interfacing with infrastructure systems (e.g. VMS). It also dilutes the relative value of knowledge of any one of the formats.

In relative terms, commercially, this is a niche market. To give it the best chances of developing efficiently and cost-effectively, to deliver wider benefits to the traffic management community and to sustain the value of related technical skills, it is therefore recommended that the EC specify that in-scope road and traffic data relating to traffic management measures should be formatted using a DATEX II profile.

To maximise the benefits, this profile needs to be used by all relevant stakeholders involved in sharing such data, for which reason it is recommended that this technical specification should be binding, and that this should be achieved by incorporating the DATEX II profile as a CEN standard.

5.3. Step 3: Sharing Activation Status

[R3.1] Provide a binding technical specification of the activation status data contents

This activity is concerned with setting out clearly all the data elements that need to be communicated in order for any other party to properly understand the activation status and hence relevance at a specific moment in time, of any published data set about potential traffic management measures. The precise content may depend on the type of traffic management measure (some are activated in response to largely unpredictable incidents, others such as night-time lorry restrictions, are enabled routinely by the clock). There may also be a need to define the time-related aspects of the activation status (e.g. how quickly it needs to be communicated), the way the data elements are expressed (e.g. units) and the processes used for communicating activation status information in a timely fashion.

To ensure consistency of user experience across Europe and to help ensure a skill base can develop to support this activity, it will be necessary to ensure compliance with this specification across all MS, for which purpose it will need to be binding, and hence it will need to be highly credible internationally. This is a specialised task requiring the involvement of experts, for which reason it would make most sense for the EC to ask CEN to develop the technical specification.

[R3.2] Organise a forum for relevant stakeholders to define quality requirements for activation status data elements that are to be described in the technical specification, and add these to the specification

Third parties aim to provide a consistent quality of service to their users. The challenge they face is in understanding the quality of others' data used in their services. If there are no quality requirements or if different stakeholders define quality in different ways, the data recipients may not be able to use the data, or incur significant costs understanding it. In the context of activation status data, this has the potential to affect the timeliness of the data and hence its ultimate utility. This impedes the emergence of a consistent, cost-effective and potentially timely and useful service to road users.

This task involves defining important data quality requirements in a common way, including how to describe the currency of activation status data content (e.g. when last updated, duration of validity), as well as whether to describe quality requirements for individual data elements, for whole data sets, or even for whole organisations.

The relevant stakeholders will need to agree which activation status data elements are most critical and then negotiate an acceptable compromise solution for each because the costs and benefits of meeting the quality requirements for these data are likely to be distributed asymmetrically between them. It is recommended that the EC asks the European ITS Advisory Group to undertake this task (or failing that another suitably constituted forum representing the different stakeholder interests participating in this study) to facilitate this negotiation process. It is also recommended that the agreed quality requirements are provided to those who are tasked with developing the technical specification (see [R3.1]) for incorporation as a normative annex. This will ensure that the agreed quality requirements are met and hence that reliable user services can be developed.

5.4. Step 4: Common Format for Activation Status

[R4] Specify the adoption of a particular method and format for communicating activation status data consistent with [R2]

To ensure effective electronic communication between stakeholders it is essential to define not only the content, but also the format for sharing information. This issue is very

similar to that described in [R2] above, but here the focus is on how to consistently communicate activation status electronically between the many traffic management authorities and potential recipients of traffic management measure data sets, thereby achieving economies of scale in what is otherwise a niche market (in terms of commercial potential and sustainability of skills and knowledge).

[R2] recommended that in-scope road and traffic data relating to traffic management measures should be formatted using a DATEX II profile. This approach allows third party users of such data sets to subscribe to a data feed issued by the traffic management authority, which can use the provisions in the existing suite of DATEX standards for notifying subscribers of changes.

It is recommended that the EC ask the experts undertaking [R2] and [R3.1] to explore the potential for formatting and sharing activation status data using DATEX II and its associated profile subscription management services, and if so, incorporate suitable provisions in their respective technical specifications.

5.5. Step 5: Publish Data in Electronic Format

[R5] Specify the requirement to publish all relevant data about traffic management measures (as defined in earlier recommendations), in electronic format and in a timely manner, with exceptional exemptions managed by MS to EC guidelines

There is no consistent requirement across Europe for traffic management authorities to (a) publish in-scope road and traffic data associated with traffic management measures, (b) in a timely way, (c) in electronic formats that are most useful (quick and efficient) for third parties involved in the ITS information service value chain such as data aggregators, navigation and information service providers. In some circumstances there are good reasons why such data should be withheld from publication (e.g. effective management of safety, security incidents), but these exceptions should not prevent the dissemination of the vast majority of other in-scope data that is potentially routinely very useful for road users. Additionally, to the extent that information is provided, a wide range of channels are used at present that generally reflect the media most accessible to end users and do not support the efficient and timely provision of ITS services to road users by third parties.

To achieve the aims of the ITS Directive in this domain, it is recommended that an obligation is placed on all traffic management authorities across Europe to publish all in-scope data as a matter of course, in a timely way, using the agreed electronic formats described in the previous recommendations - unless there are sufficient grounds for

exempting certain data from publication. It is recommended that MS should be responsible for establishing whether there are sufficient grounds for exempting certain in-scope data from publication according to guidelines defined by the EC, which should be developed by the European ITS Advisory Group.

In addition, and consistent with the provisions of the PSI Directive, it is recommended that an expert group of traffic management authorities[47] should be tasked with developing a proposed set of conditions for the re-use of these published data, which the EC can then use as the basis of a consultation with other stakeholders (potentially via the stakeholder forum in [R1.3] and [R3.2]) in order to establish the rules under which permissions are granted to third parties to access these data electronically in the prescribed formats.

5.6. Step 6: Make Published Information Discoverable

[R6] Specify use of local nodes with a registry of services at the MS level

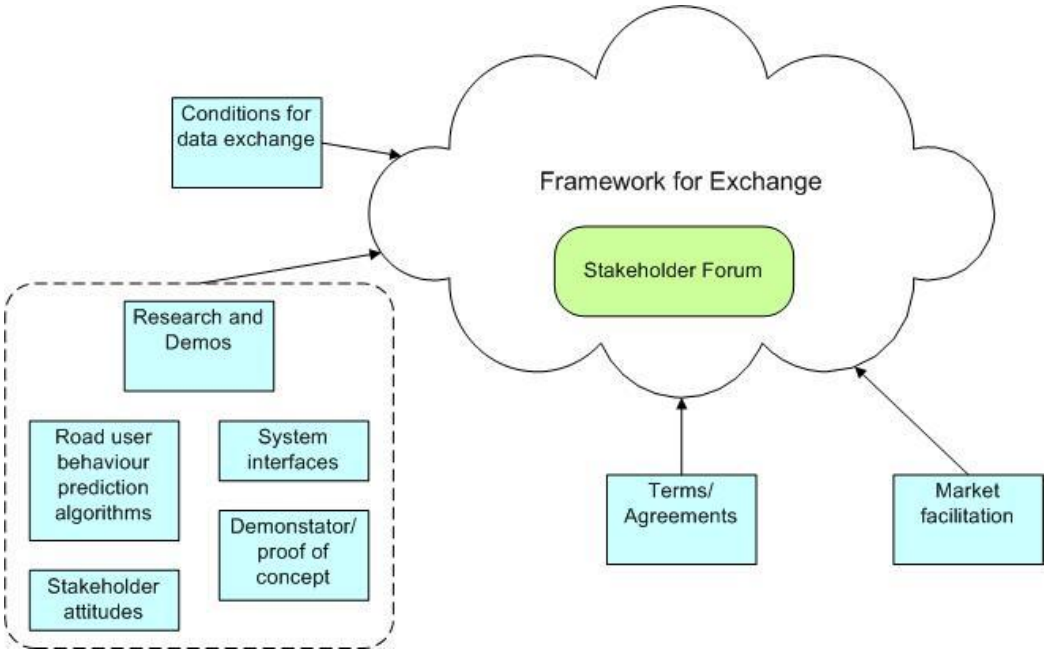
Even where data is published, third party service providers sometimes face considerable challenges in accessing it because they need to know (a) who publishes what data, (b) how to be notified of changes to activation status and (c) how to be notified of changes to the data itself. Currently third parties still spend significant effort on identifying the operators who have published in-scope data, and on negotiating how to access them.

To overcome these inefficiencies and facilitate market development, it is recommended that traffic management authorities publishing in-scope data are obliged to supply their data in the requisite format through a local node to which third parties can subscribe in order to receive that authority's data. In addition, it is recommended that the traffic management authority be required to provide the MS with the location of its node, and the MS is obliged to establish and maintain a registry listing all node locations nationally.

Note that this will result in 'accessibility in principle' only, since the right to actually access and use the data will be governed the terms of use defined under [R5].

[47] To address this requirement effectively it is essential to move beyond the historical sub-division of traffic management authorities into "urban" and "inter-urban" to consider their needs as a whole, and this is likely to require representation on an equal footing drawn from, for example EasyWay, Polis, CEN TC278 WG8. The relevant attendees at the study workshop provide a good starting point and potential sounding board for this.

5.7. Step 7: Supporting Actions



Whilst no specific recommendations are made under this step, the suggestions put forward could be enablers for more effective implementation

- Establishing a requirement to share all published traffic management data and activation status information with road/traffic authorities (at any level) that share a geographical boundary with the originating public authority.
- Exploring the need for a wider requirement to share with other public sector and/or private sector organisations, and whether this requires legislation at MS level to ensure consistency
- Encouraging development of interfaces to traffic management equipment / systems (e.g. VMS) that can use traffic management data and activation status information as it is published to convey pre-defined information to road users directly
- Exploring the scope for using the PSI Directive to provide much of the framework for enabling private sector / user access to and use of traffic management data and activation status information once it is made available as described above on a public to public basis
- Market-making measures, such as steps to establishing a data sharing marketplace, publicising progress in implementing Steps 1-6 across the EU, developing data sharing agreements
- Defining terms and conditions for accessing and use of the published data, potentially as necessary covering licences, fees, payments, conditions to be met by the accessing organisation, confidentiality,…

- Research into attitudes of traffic managers to sharing traffic management data, and into the identified risks of misuse, and whether there is any evidence of this happening in practice (e.g. deterioration in the ability to manage traffic due to less predictable user responses)
- Encouraging development of algorithms for better predicting the behaviour of road users who have access to smarter navigation technology / traffic advice services
- Local or regional demonstrator implementing the whole set of specifications, etc. in this area and seeing evaluating what are the effects on traffic management and user experience
- Establishing and facilitating a forum for discussion between public and private sector organisations designed to tackle the cultural obstacles to sharing TMPs with private sector / users, working out what the framework for data exchange is, and how it should best be governed.

ANNEX 1 – EC TMP Guidance Note

A1.1 Introduction

One of the most commonly referenced definition for a Traffic Management Plan (TMP) is taken from the EasyWay Deployment Guidelines:

> "A TMP is a pre-defined allocation of a set of measures, to a specific situation, in order to inform and control traffic. These measures are always temporary, and may have an impact on the wider network. Usually involves more than one party, hence the need to coordinate activities within a framework and to agree on decision-making procedures and supporting tools, including communication."

The scope of such a definition is not limited to the interurban environment, as traffic in the urban context is also managed in this way and in collaboration with multiple stakeholders (such as neighbouring traffic authorities, emergency services, or operators for modes other than road). Some of the measures (such as urban access restrictions or recommended routes) are part of the core planning for sustainable urban mobility, and sharing information can enhance the chances of increasing compliance.

The consensus from best practice is that a Traffic Management Plan (TMP) should be published in an open and interoperable manner, preferably in electronic form with a definition of measures to be deployed and the conditions under which they will be implemented.

A substantial amount of knowledge already exists in the domain of traffic management manuals. The purpose of this EC TMP Guidance Note is to promote the principles of developing, deploying and operating a traffic management plan based on knowledge of current best practice. The emphasis will be on how to improve data sharing with ITS Service Providers, in order to improve operations.

This EC TMP Guidance Note is intended as:

- Something useful for 'newcomers', as a starting point for good practice on TMP;
- Able to provide some detail on the lifecycle process (from agreeing objectives and designing the plans, through to operating, sharing, and refining)
- Expanded with requirements for publication (or part publication), using established standards that would be recognisable across Europe, both within the road sector and potentially in sharing information with other modes

The success criteria for a TMP can be drawn from three generic themes, namely the preparation phase, operational phase and communicability.

- Preparation Phase: Checking that the TMP is viable in terms of network features and definable in terms of acceptable roles for all parties involved
- Operational Phase: Ensuring the TMP has appropriate decision support, can be activated and deactivated in a timely manner, and is sufficient to address the scenario concerned
- Communicability: Describing the TMP in a publishable form, such that information can be shared within the value chain, and disseminated (either directly or through third parties) to affected road users

This guidance note will focus on the measures needed to foster better sharing of 'road and traffic data', which constitute the core operational elements of traffic management plans (in both the urban and interurban context).

A1.2 Best Practice for TMP

Much of the current best practice in the interurban context is well documented by the EasyWay[48] Project. The formation of traffic management plans, and the ways in which this can be optimised, are presented as a Deployment Guideline (TMS-DG07), representing the maturing insights over a three year period.

The content of this section builds on the work presented that Deployment Guideline. It is important to clarify that the phrase "pre-defined allocation of a set of measures to a specific situation in order to control and guide traffic flows" from the definition above needs to encompass traffic circulation plans, traffic regulations and recommended routes. (for both the urban and interurban environment).

At the present time, the Deployment Guidelines support (and may therefore be referenced for):

- The formation of a TMP,
- Use of the TMP by participating partners,
- The distribution of information to road users (through traffic information centres) as and when the TMP is brought into use.

However, the Deployment Guidelines do not appear to directly support is the sharing of the TMP with ITS Service Providers, (logistics providers, mapping and navigation providers) who need to be aware of the plans prior to their implementation (or have some means of integrating the temporary changes to the road network, so that subscribers receive accurate information).

[48] "TMS-DG07 – Traffic Management Plan Service for Corridors and Networks"

In order to align with the core requirements for road and traffic data, expressed in Annex 1 of the ITS Directive, some changes are needed to:

- the **broader definition of a TMP**, to include traffic circulation plans, traffic regulations and recommended routes (pointing to Chapter 1 of DG07)
- further **guidance on how a TMP is shared** with third party service providers (including both the operational models for sharing, and the technical guidance for doing so, pointing to Chapters 4, 5 and potentially 6 of DG07)

In the short term, a considerable amount of relevant road and traffic data could be made available through better sharing of Traffic Management Plans with relevant third parties.

A1.3 Defining the Traffic Management Plan

A1.3.1 TMP Definition

TMPs can be developed to manage a number of different scenarios for example 'time based access restrictions'[49] and responses to incidents[50], in order to assist road operating organisations with the daily management of the road network.

As a minimum, the 'set of measures' mentioned above must encompass all agreed 'traffic circulation plans, traffic regulations and recommended routes'. These will have a static element (location and context) to be communicated, along with a dynamic element (activation of plans or application of restrictions) which is required in near real-time.

A1.3.2 TMP Development

The TMP development can be broken down into four high level stages:

- **TMP Feasibility**: During this stage of the development, the road operating organisation determines whether it is possible to define the TMP for the given scenario and which stakeholder(s) will be impacted by the activation of the TMP.
- **TMP Development**: During this stage of the development, the road operating organisation, in conjunction with the impacted stakeholder(s) prepares the TMP for the given scenario (including decision making process and steps for conflict resolution). Once developed, approval for the TMP is sought from the relevant stakeholder(s).

[49] Time-based Access Restriction TMPs are TMPs that allow vehicles limited access, during certain periods of the day, to sections of the network due to local/ national transport policies, to protect the environment and to reduce the impacts of congestion.

[50] Incident: situation on the road that is not expected, foreseen, and which may or may not lead to an accident (collision) but impacts on the safety and/or capacity of the road network for a limited period of time.

- **TMP Deployment**: The road operator informs all interested parties of the availability of the TMPs and the conditions under which they will be implemented. The road operating organisation should also inform all interested parties of changes in the TMP status (activation/ deactivation).
- **TMP Feedback**: A mechanism will be required whereby the road operators can receives feedback on the effectiveness of the activated TMP, thus enabling them to utilise this information to improve the TMP's effectiveness.

The progression between these stages is shown in Figure A2 below.

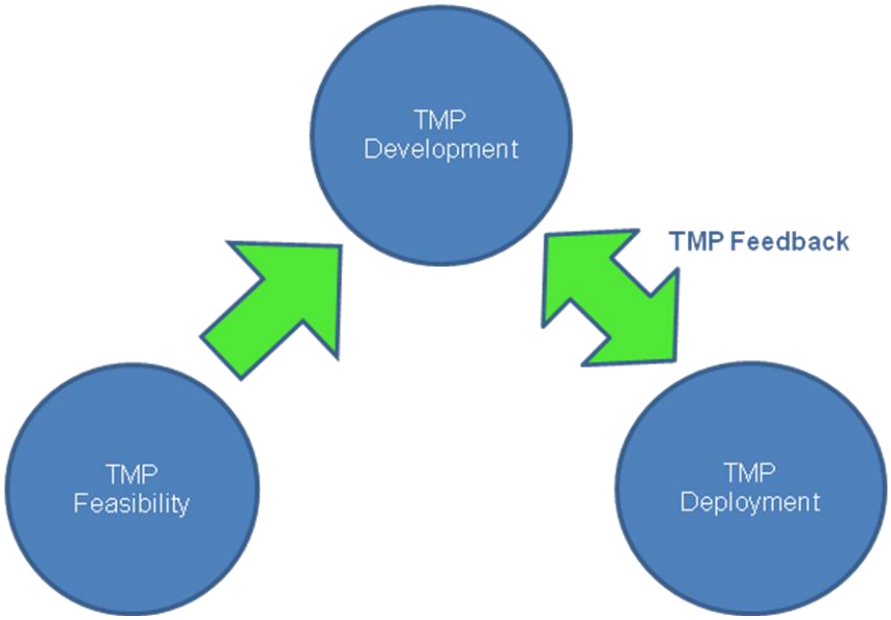


Figure A2: - TMP Development Cycle

TMS-DG07 has recognised the value of presenting TMPs in a common manner, and the fact that it facilitates the understanding of the TMP document between the affected parties. The approach taken in TMS-DG07 was to define a common look and feel against a set of criteria. This is documented in Table 2 below.

Chapter	Objectives	Content
1. Objectives and territorial TMP area	Define TMP Objectives and TMP area	- Main TMP Objectives - TMP area, identification of network covered by the TMP and associated rerouting network
2. TMP generalities	Provide a synthetic TMP view in order to facilitate the comprehension	- Authorities involved - Operational organisation - Main issues regarding: - User's information - Traffic management measures to be implemented
3. Operational organisation	Describe the operational organisation to put in place for the operational TMP running	- Authorities and actors - TMP activation responsible and procedures - TMP running - TMP deactivation procedure
4. Organisation of user's information dissemination	Describe the organisation to put in place for the dissemination of user's information	- Main entities in charge of elaboration of the information to be displayed in case of crisis situation - Medias to be used (VMS, radio, broadcaster) - Transmission means
5. TMP technical management	Provide technical decision tool to authorities and actors involved in order to facilitate the choice of the adapted scenarios, measures and actions to be taken face to a specific situation	- Technical Guide - Map, location of events - Decisional table - List of scenarios, measures and actions - Main alternative roads - Actors to be contacted
6. Contact list	Provide an updated actors' TMP contact list	- Details of actors (tel, email, fax…)
7. Annexes	Provide any other complementary information	- Memorandum of understanding - Technical data…

Table 2 – A Proposed Structure for a TMP Elaboration Document (Source: EW TMS DG07)

This outline provides the shared information with a common structure, which makes it easier for third parties to quickly identify the information that (a) is relevant to them, and (b) has changed. This becomes particularly important because service providers potentially need to deal with authorities in 27 Member States, using a number of different languages.

The Deployment Guidelines represent a decision making framework on how the TMPs might be formed, covering functional, organisational and technical provisions, as well as recommendations relating to the common look and feel of guidance and the definition of service levels. The table below provides a summary of the content of the TMS-DG07 requirements:

Functional	The formation and development of the TMP, covering: • Execution of feasibility studies for the TMP, • Development of the supporting framework, • Utilisation of that framework to identify appropriate measures and scenarios The application of the TMP describing the manner in which: • The Events/incidents are detected and verified • The methodology for adopting an appropriate scenario to react to the incident • The activation of measures • The method of informing road users of the changes (e.g. using Traffic Control Centres or Traffic Information Centres)
Organisational	The organisational requirements identify : • The organisations and roles that should be involved and considered in the development and formation of TMPs • The processes needed for the feasibility study and development of the TMP • The development and application of Memorandum of Understanding (MOU) between the parties involved in the delivery of the TMP • The organisational model that could be adopted
Technical	The technical requirements cover: • The standards that can be applied for certain interfaces • Identification of the communication pattern for the activation/deactivation of the TMP
Common look and feel	The common look and feel requirements include: • The uniformity of re-routing signage • The consistency of the TMP document structure
Level of service	The level of service definition outlines: • The criteria for identifying the levels of service against different categories • The level of service criteria relating to the operating environment

Table 3: TMS-DG07 suggested requirements and scope (adapted from TMS-DG07, EasyWay, 2012)

The way that the requirements should be applied is communicated using a checklist of the requirements. The checklist describes each set of requirements, along with an indicator which identifies whether the requirement is a ‘must, a ‘should’ or a ‘may’. A checklist offers an effective way of supporting the development of TMPs. This is because of the benefits derived from creating a more standardised TMP, so that different operational partners can easily understand multiple sets of TMP. Hence this becomes increasingly relevant in a multi-stakeholder environment.

A1.3 Identifying the TMP Stakeholders

The TMP stakeholders are defined as the groups / organisations that have an interest in or might be affected by the deployment of the TMP. Examples of potential stakeholders include:

- National / Regional Highway Traffic Authorities
- Road Operators (managing the road infrastructure)
- Enforcement Agencies
- Emergency Services
- Public Transport Organisations
- Transport Authorities (Railway, Airport, Ports)
- Commercial Service Providers and Adjacent Organisations e.g.
    - Media Organisations
    - Travel Information Service Providers
    - Content Aggregators

Supporting information can be found in Section 2.3.1 of the EasyWay TMS-DG07. Stakeholders also become subscribers in the context of data sharing. When the relevant road and traffic data is published, the re-use of such data by ITS Service Providers can be governed through an agreement (consistent with the provisions of the PSI Directive).

Involving stakeholder representing complementary or interconnected modes and being able to publish road information in a recognised and accessible format would further enhance the interconnectedness of the transport network.

A1.4 Agree TMP

In order to ensure the successful implementation of a TMP the organisations involved need to work together. These organisations can, in some cases, be a combination of both public and private organisations, potentially operating to different rules and regulations, depending on where they are located.

In order to achieve a successful TMP implementation, these organisations will need to both define and agree upon the level of co-operate necessary. This agreement will then need to be documented (in the form of, for example, a Memorandum of Understanding (MoU)) and signed by the organisations concerned.

Typical questions to be considered when preparing an agreement can be found in Section 2.3.3 of the EasyWay TMS-DG07.

A1.5 Document TMP

A1.5.1 Make Key Elements of the TMP Visible

There is a need to make third parties aware of the availability of a TMP (there are a range of methods that could be adopted for achieving this, all of which have benefits in being underpinned by a common data exchange mechanism such as DATEX II).

All organisations that manage TMPs need to adopt a standardised protocol that is not restricted to a specific network, or group of operating partners. Enabling third parties to receive updates from multiple organisations in a similar format. These organisations will need to:

- Develop mechanisms (e.g. websites) that facilitate easy access to the TMPs.
- Provide a subscription service for all interested parties, providing them with details of any changes to the TMPs.

A1.5.2 Identify Parties for Data Sharing

The TMP must[51] be shared with all of the parties that have an interest in or might be affected by the deployment of the TMP, via a subscription service. This includes both operational partners and ITS Service Providers with customers using the affected network.

The information included in the TMP for traffic circulation must be coded and published using the CEN EN 16157 (DATEX II data exchange specifications) based on the 'NetworkManagement' package described within CEN EN 16157:3.

The TMP should adopt supporting procedures outlining:

- The method of coding routes (using either the provisions included in DATEX II such as the itinerary class, or the emerging DATEX II profile on strategic diversion routes).
- The process for sharing the TMP on traffic circulation with others.

A1.6 Publishing the Key Elements of the TMP

Publication makes the plan available. However, the authority can still govern the terms of re-use through various agreements. Road operating organisations should therefore publish the core elements of a TMP in an open and interoperable manner, preferably in electronic form with a definition of measures to be deployed and the conditions under which they will be implemented.

[51] In the language of DG-07, that would be an upgrade the requirement of Common Look and Feel Requirement 5 from 'should' to 'must'.

Within the DG-07, the Function Requirement FR7 (outlines the information structure to be used to describe the TMP scenarios) should be elaborated to:

- Include a statement that identifies that location based information must be referenced using location referencing standards accepted by the DATEX II specifications (CEN EN 16157:2). This is of particular relevance to the coding of the traffic circulation routes (the routes can also be encoded using the provisions included in DATEX II using the "itinerary" class).
- Identify the restrictions that apply to the new traffic circulation routes (by vehicle type, access restrictions, toll zones) and encode them using the provisions included within DATEX II (under the "NetworkManagement" class).

The information included in the TMP for traffic circulation must be coded and published using the CEN EN 16157 (DATEX II data exchange specifications) based on the 'NetworkManagement' package described within CEN EN 16157:3

A1.7 Publishing the Traffic Management Activation Status

The core operational information from a TMP should be published in an open and interoperable manner, preferably in electronic form with a definition of measures to be deployed and the conditions under which they will be implemented.

The contemporary debate is no longer about whether to publish, but around the extent of publication and about how this enhances operation. Broadly speaking the existing approaches and initiatives reviewed by the study team fall into three categories:

- [Category 1] Pre-selected operational partners, sharing static information, no scope for sharing beyond this
- [Category 2] Pre-selected operational partners, where static information, relevant updates and information flow about activation and deactivation is shared between partners and potentially made available to selected third parties. This approach illustrates
    - the way that multiple operational parties can agree on a method of developing TMPs using a commonly agreed platform
    - the way that the activation (and deactivation) of a TMP can be communicated to others using a specific protocol
    - the limitations for more widespread sharing, due to the challenges of sharing the full details of the traffic management plan, and ensuring all subscribing parties have the latest version
- [Category 3] An open scenario whereby any organisation can adopt a standardised specification/methodology to support a more interoperable system and to provide access to the data for third parties. Where the details of traffic circulation, traffic

regulation or recommended route are being shared directly, the status can be shared along with information (using location referencing). This approach illustrates:

- the traffic management centre or road operator is able to create a TMP using a local instance of the protocol
- third parties can subscribe to the broker service to receive the TMP changes/updates
- the interface that third parties use to receive the updates from one scheme, is the same as any other scheme adhering to the standardised protocol
- the scalability of this approach and adaptability for involving service providers.

Although [Category 2] is common for exchange between public bodies, this guidance note recommends development in line with [Category 3], as this more readily facilitates sharing of road and traffic data between public bodies and relevant ITS Service Providers.

A1.8 Ongoing Management of the TMP

Road operating organisations will need to demonstrate that processes and procedures are in place to manage the expectations of those organisations that subscribe to their services. This includes:

- TMP reviews, as part of the TMP development cycle.
- Providing a mechanism that allows those impacted by the TMP activations to leave feedback/ initiate a dialogue.
- Monitoring and reviewing of the feedback received.
- Updating the TMPs to improve their effectiveness.
- Prompt publishing of all TMP updates to all that have subscribed to receiving this information.

This can be achieve this via a Quality Management System which is a system by which an organisation aims to reduce and eventually eliminate non-conformance to specifications, standards, and customer expectations in the most cost effective and efficient manner.

ANNEX 2 – Template Data Sharing Agreement

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and is between [*name and address of organisation]*

and *[insert name and address of licensee]*

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- quickly put right any difficulties or answer any queries which you may have;
- handle all Licences in a way that is fair and consistent;
- give you details of any changes to this Licence;
- if you are dissatisfied with the standard of service you receive from us, you can make a formal complaint. We will deal with it by following our complaints procedure. You can find this on our website at *[insert]* or please e-mail us at *[insert]* or telephone *[insert]* and we will send you details.

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7.1 We may list the names and addresses of all Licence holders on our website because we want:

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10 VAT *All licences involving payments*

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We will send you an invoice for the amount that you are due to pay to us.

You must pay all invoices within 28 days of the invoice date. Make your cheques payable to *[insert details]* and send them to:

[insert details]

We have the right to charge interest on any amounts that are not paid within the 28 days at a rate of 2% a month above the minimum-lending rate.

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You must send us a Statement within 90 days of the end of each Accounting period so that we can calculate the payment due.

13. Inspection of accounts *Royalty licences*

We, or our representative, may inspect your records for Sales income and royalties payable to us.

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- at any time if there is a significant breach of the terms of this Licence and you do not put this right within 60 days of our telling you in writing or by e-mail.

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16. Changes to the terms of this Licence

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Name in block capitals ……..
for the *[insert name of organisation issuing the Licence]*

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Job title ..…….
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…….. *[date of final signature]*

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ANNEX 3 – Background to the Recommendations

Step 1: Defining the key 'road and traffic data' elements to be communicated

Activity 1.1: Define relevant scope

In the absence of defining TMPs as the definitive starting point, this activity is concerned with setting out clearly the traffic management measures and data types that fall within the intended scope of this action.

For this study the in-scope traffic management measures are any measures planned or taken by a traffic management authority, which contain what could reasonably be construed as a traffic circulation plan, a traffic regulation or a recommended route (as defined in Section 1.2).

Traffic circulation plans, traffic regulations and recommended routes (contained within in-scope traffic management measures) can be described using certain road data and traffic data. Such data may consist of both static (context and location) data and dynamic (status) data.

The EC will need to define and explain clearly what it intends should be in-scope and what should be out-of-scope for the purposes of its intended interventions in this domain, and to establish clear procedures for dealing with any disputes. There are several options for EC intervention to achieve this end (option selected for development into a recommendation is underlined):

- Do nothing
- EC publishes a definition of the intended scope and a default presumption in favour of inclusion in the event of any ambiguity or uncertainty
- EC publishes a definition of the intended scope and leaves it to MS to clarify any uncertainties / resolve disputes locally
- <u>EC publishes a definition of the intended scope and provides a dispute resolution facility (e.g. via a technical committee)</u>

Choosing between these options is essentially about trying to achieve consistency of user experience across Europe, particularly for HGV operators regularly encountering diverse practices, particularly in urban areas. This requires a degree of consistency in how the requirements of this action are interpreted and implemented within MS.

Note that the issue of clarification around static v dynamic data could potentially be mitigated by coordinating activities with actions arising from ITS Action Plan task 1.3, which is focused on managing static road and traffic data.

Activity 1.2: Define the required data content

This activity is concerned with setting out clearly all the data elements (taken from TMPs) that need to be communicated in order for any other party to properly understand the impact of any individual TMP on the network and traffic parameters.

The precise content may depend on the type of traffic management measure (e.g. low emission zone, HGV recommended route, congestion charging scheme) and whether the data are describing a traffic regulation, traffic circulation plan or recommended route. There will also be a need to define the time-related aspects of the traffic management measure (e.g. start date and/or time).

This task is also concerned with agreeing the way the data elements are expressed (e.g. units of measurement) and may need to include agreeing the method used to derive the relevant data (e.g. planned end date / estimation of average traffic speed).

The options available for EC intervention are (option selected for development into a recommendation is underlined):

- EC does nothing
- EC provides non-binding guidance for use by interested road operators on what are the data contents for describing relevant traffic management measures and their impacts
- <u>EC provides a binding technical specification (e.g. a CEN standard) of the data contents for describing relevant traffic management measures and their impacts</u>

The EC may choose to intervene in this area to ensure at least its requirements (set out in the ITS Directive and Action Plan, and for which there is therefore a clear and agreed mandate) are properly and consistently captured for future use. It seems unlikely that this will happen without EC intervention. In this regard, the do nothing option does not appear to do anything to deliver the requirements of the ITS Directive.

Issuing guidance may be helpful to those already interested in communicating their / receiving others' TMP data, potentially reducing the diversity of specifications in the marketplace.

Trying to make sure binding specifications are used by road operators may prove problematic unless or until there is also a requirement for them to make such data available to others, at which time it will become invaluable in ensuring operators and data recipients speak a common language. As, in economic terms, this is a niche activity, this measure should also help to ensure that a market / skill base can develop to support the needs of road operators in describing their TMP data correctly.

Activity 1.3: Define the quality requirements for traffic management data content

As explained above, the challenge for third parties aiming to provide a consistent standard / quality of service to their users, is that in order to utilise others' data, they need to understand the quality of the material they are working with.

Quality requirements could be described for individual data elements (e.g. distance accuracy), or for the data set as a whole, or even the road operator as a whole.

If there are no quality requirements, or the methodology for defining the quality of data (e.g. as a whole or individual elements) varies between stakeholders, it means that the third parties need to undertake extensive discussions with the road operator to understand the background to the kind of traffic management information they can expect. This is an impediment to the emergence of a consistent and cost-effective service to road users.

This task is also likely to need to define a means for describing the currency of the data content (e.g. how recently it has been updated, how long it as valid for)

The EC could choose to intervene as follows (option selected for development into a recommendation is underlined):

- EC does nothing (i.e. allow operators to determine their own quality requirements)
- <u>EC supports further research on how to define and attain quality levels with the community</u>
- EC defines the quality requirements

If the EC does not take any action in this area then third parties such as navigation providers will continue to follow the status quo of liaising with multiple operators to understand the implications of traffic management measures, and any associated quality levels.

If the EC supported further research and facilitated the collaborative definition of quality indicators/criteria then it would allow the MS/operators to take a greater level of ownership.

Step 2: Defining the format for presenting electronically the key road and traffic data

Activity 2.1: Specify a format for sharing road and traffic data electronically

There have been a number of initiatives that have considered the way in which the content of a TMP could be presented in a common format. These have been discussed in some detail in earlier deliverables in this study (D1-3). The EasyWay DG07 guidance goes some way to defining a common structure for TMPs, and the example of strategic traffic management by the state of Hessen has demonstrated how it is possible to share whole TMPs with others to deliver significant operational improvements. In contrast the BASt/BMW example showed how it is possible to extract from the TMP the key data elements required by others and to present and share these using a DATEX II profile.

The study has illustrated some of the benefits of operators adopting a common structure for communicating TMP data and activation status to their own systems (e.g. VMS), other operators and service providers. It has also highlighted the impediments to market development and the emergence of ITS services for road users caused by too much diversity in how such data is formatted.

The challenge to the EC is therefore to consider the most appropriate interventions for supporting the emergence of consistent formats for TMP data, ideally in a way that builds on previous European standardisation and harmonisation initiatives. The choices include:

- Do nothing (allow operators to continue to present data in a wide variety of formats)
- Promote the DATEX II profile as best practice
- Specify the adoption of a profile using DATEX II

The findings of this study are that formatting data in a DATEX II profile is well-suited to the requirement for sharing core road and traffic data (such as traffic circulation routes).

Trying to make sure binding specifications are used by road operators may prove problematic unless or until there is also a requirement for them to make such data available to others, at which time it will become invaluable in ensuring operators and data recipients speak a common language. As, in economic terms, this is a niche activity, this measure should also help to ensure that a market / skill base can develop to support the needs of road operators in presenting their relevant road and traffic data in a usable format, and for recipients to efficiently gather and utilise such data from a wide variety of sources.

Step 3: Defining the key data elements describing the activation status of traffic management measures

Activity 3.1: Define the required activation status data content

This activity is concerned with setting out clearly what data elements need to be communicated in order for any other party to properly understand the activation status, and hence relevance at a specific moment in time, of any published data set.

The precise content will depend on the type of traffic management measure (some are activated in response to largely unpredictable incidents, others such as night-time lorry restrictions, are enabled routinely by the clock). There may also be a need to define the time-related aspects of the activation status (e.g. how quickly it needs to be communicated) and the way the data elements are expressed (e.g. units).

Options for EC intervention are:

- EC does nothing
- EC provides non-binding guidance for use by interested road operators on what are the activation status data contents
- EC provides a binding technical specification (e.g. a CEN standard) of the activation status data contents

The EC may choose to intervene in this area to ensure at least its requirements (set out in the ITS Directive and Action Plan, and for which there is therefore a clear and agreed mandate) are properly and consistently captured for future use. It seems unlikely that this will happen without EC intervention. In this regard, the do nothing option does not appear to do anything to deliver the requirements of the ITS Directive.

Issuing guidance may be helpful to those already interested in communicating their / receiving others' traffic management activation status, potentially reducing the diversity of solutions in the marketplace.

Trying to make sure binding specifications are used by road operators may prove problematic unless or until there is also a requirement for them to make activation status data available to others, at which time it will become invaluable in ensuring operators' and data recipients' services are properly coordinated in terms of accuracy of content at any given time. As, in economic terms, this is a niche activity, this measure should also help to ensure that a market / skill base can develop to support the needs of road operators in communicating their traffic management activation status correctly.

Activity 3.2: Define the quality requirements associated with the activation status data content

As explained above, the challenge for third parties aiming to provide a consistent standard / quality of service to their users, is that in order to utilise others' data, they need to understand the quality of the material they are working with.

Quality requirements could be described for individual data elements, or for the data set as a whole, or even the road operator as a whole.

If there are no quality requirements, or the methodology for defining the quality of data (e.g. as a whole or individual elements) varies between stakeholders, it means that the third parties need to undertake additional (potentially time-critical) discussions with the road operator to understand the background to the activation (or application) status. This is an impediment to the emergence of a timely, accurate, consistent and cost-effective service to road users.

This task is also likely to need to define a means for describing the currency of the activation status data content (e.g. how recently it was updated, how long it is valid for).

The EC could choose to intervene as follows:

- EC does nothing (i.e. allow operators to determine their own quality requirements)
- EC supports further research on how to define and attain quality levels with the community
- EC defines the quality requirements

If the EC does not take any action in this area then third parties such as navigation providers will continue to follow the status quo of liaising with multiple operators to understand the TMP activations status and the associated quality levels.

If the EC supported further research and facilitated the collaborative definition of quality indicators/criteria then it would allow the MS/operators to take a greater level of ownership.

Step 4: Defining the format for presenting electronically the key data elements about activation status for traffic management measures

Activity 4.1: Specify a format for sharing activation status data electronically

This is an activity where the focus is on how to consistently communicate activation status electronically between the many road operators and potential recipients of road and traffic data sets across Europe, thereby achieving economies of scale in what is otherwise a niche market (in terms of commercial potential and sustainability of skills and knowledge).

The study has illustrated some of the benefits of operators adopting a common structure for communicating traffic management data and activation status to their own systems (e.g. VMS), other operators and service providers. It has also highlighted the impediments to market development and the emergence of ITS services for road users caused by too much diversity in how such data is formatted.

The method taken in the Hessian approach to TMP management is for all operational partners to subscribe to a common protocol whereby the adopted strategic response is activated and deactivated by an XML protocol. This is pushed out to all operational partners. In contrast, the DATEX II profile for strategic routing (developed by BASt/BMW) includes a method for activating the adoption of particular routes. This is achieved by third parties subscribing to the DATEX II feed issued by the operator. The developed profile enables the operator to not only activate/de-activate a strategic route, but also to 'weight' the route depending on desired traffic flows. There are provisions included in the existing suite of DATEX standards for notifying subscribers to the activation of routes.

Due to the importance of notifying third parties of the activation status, the challenge to the EC is therefore to consider the most appropriate interventions for supporting the emergence of consistent formats for activation status data. The potential choices include:

- Do nothing
- Issue non-binding guidance (e.g. promoting the DATEX II profile as best practice)
- Specify the adoption of a particular method (e.g. specify the adoption of a profile using DATEX II)

It should be noted, that if the EC decided to promote the adoption of a DATEX II profile for road and traffic data formatting, then the method of operators notifying third parties about the activation status of their strategic routes would already be covered.

Trying to make sure binding specifications are used by road operators may prove problematic unless or until there is also a requirement for them to make activation status data available to others, at which time it will become invaluable in ensuring operators' and data recipients' services are properly coordinated in terms of accuracy of content at any

given time. As, in economic terms, this is a niche activity, this measure should also help to ensure that a market / skill base can develop to support the needs of road operators in communicating their traffic management activation status correctly.

Step 5: Ensuring electronic publication of the key road and traffic data, including activation status for traffic management measures

Activity 5.1: Requirement to publish electronically

There is currently a wide diversity of approaches in use across Europe in terms of the mixture of channels used for publishing information about relevant traffic management measures and their activation status. This can even vary within a given road operators according to the nature of the traffic management measure.

Typically the channels used might include some, all or none of the following: VMS, temporary roadside signs, printed leaflets, call centres, websites, and (normally via third party data aggregators) traffic news broadcasts on radio and TV. These channels reflect media that are currently accessible to relevant user groups.

The interfaces used for communicating with third party data aggregators across Europe are still many and varied. As the market for communication of road and traffic data (including dynamic activation status) is still relatively small, there is currently no consistent requirement or expectation that road operators will publish timely information in other formats, such as those that are potentially most useful to road user navigation and information service providers.

This activity is therefore concerned with the most effective ways of ensuring road operators publish the full collection of road and traffic data elements (including dynamic activation status) through electronic channels such that they could be used by others quickly and efficiently.

There may be good reasons (e.g. effective management of safety and security in extreme circumstances) where particular background data about traffic regulation (or perhaps routing information) should not be published. As discussed above, this is often the argument put forward by traffic managers for withholding publication of traffic management data at present, and the EC is seeking to reach the right balance between traffic management needs and road user needs in order to deliver greater benefits for all. This might make it necessary for there to be some system of accountability for traffic managers seeking/deciding not to publish – either within their own organisation, at MS level to their own rules, or at MS level to guidelines / rules defined by the EC.

The challenge to the EC is to consider the most appropriate interventions for supporting the emergence of requirements for the electronic publication of road and traffic data, and how best to allow exemptions, if any. The potential choices include:

- Do nothing
- Provide guidance on electronic publication of all relevant traffic management data and promote it as best practice
- Specify the requirement to publish all relevant traffic management data electronically, with traffic managers able to exempt certain data elements from publication as they consider necessary (potentially managed within the hierarchy of their own organisation)
- Specify the requirement to publish all relevant traffic management data electronically with exemptions managed by MS to their own rules
- Specify the requirement to publish all relevant traffic management data electronically with exemptions managed by MS to guidelines issued/published by EC
- Specify the requirement to publish all relevant traffic management data electronically without exemptions

Step 6: Ensuring the published information is discoverable by public bodies and ITS Service Providers

This study (and other ITS Action Plan Priority 1 actions) have demonstrated the challenges that exist in accessing data. Many of these issues are linked to (a) identifying who has data, and (b) how to access that data. These issues also apply to the sharing of traffic management data. In the context of this study, it is a case of third parties knowing (a) which operators publish the required road and traffic data, (b) how to be notified of changes to activation status, and (c) how to be notified of changes to the data itself (for example a change in agreed traffic circulation routes).

The problem of how to ensure discoverability to the right parties was addressed for travel information under Study 1.1, and the framework translates well for road and traffic data. There are several interventions that the EC could consider:

- Do nothing
- Local nodes (address book listing),
- Local nodes with a registry of services at a MS level
- Local nodes with a registry of services at a European level
- Central data repository at MS level

If the EC chose to take no action in this area then the status quo would be maintained. The result of this is that third parties would still need to spend significant effort on

identifying the operators who have published traffic management data, and negotiate a way of accessing them.

If a series of local nodes were set up, then third parties would still need to identify establish which operators they needed to connect with and then subscribe to their local node. To aid the process of establishing which operators the third parties need to connect with, a registry could be set up to list the location of the various local nodes. This directory could be maintained either at a MS level (in which case third parties need to look at 27 locations to be made aware of the local nodes), or at an EU level (in which case there would be one single repository for the details of the different local nodes).

If the 'central data store' approach was taken then it would require all parties that fall within the scope of a specification (e.g. based on network coverage) to provide the relevant road and traffic data to a central data body. Third party organisations would then have a single point of access to the material. The data would still be exchanged via a common exchange methodology such as DATEX II (including any associated processes such as the subscription model required by the DATEX II specifications). The development and adoption of a central data store would require investment in a data store, plus the ongoing maintenance to ensure that all contributors adhered to the agreed format.

The end result is an 'accessibility in principle', since the right to actually access and use the data is likely to be governed by certain conditions being met or controls being in place (for example, conditions of re-use or data sharing agreements).

Step 7: Defining the conditions for access and re-use of published information for a stated purpose

The preceding steps have been about building the capacity to share, and doing so efficiently. The evidence from the state of the art review was that data availability was a more pressing issue, and that where data was available and accessible, opportunities to publish and share were being exploited. However, there is scope for further development of the environment within which such data is exchanged.

Looking at the reports by Member States on ITS, INSPIRE and the PSI Directives, it appears that where the following elements are in place, significant progress can be made in the areas of data availability and exchange.

- Some traffic management legislation that defines roles and obliges collaboration between different authorities towards common goals (thereby motivating capture and dissemination of diverse road and traffic data).

- A national initiative to address the gap between content generators and service providers (the management of content aggregation), for example the Mobility Data Market, or the National Data Warehouse (a comparison of these models is beyond the scope of this study)
- An active community of service providers covering a range of services from digital maps to real time traffic information, servicing a variety of modes, and broadcasting into a variety of channels (strong market for ICT)
- Positive alignment in country with the spirit of initiatives such as the PSI Directive (for example, national leadership in provision of open data), INSPIRE Directive, ITS Directive and others
- Active contribution to expert groups, for example in development of standards such as DATEXII

Step 7 is about establishing a framework for the exchange of data which safeguards appropriate interests of the originator, while allowing the recipients to use the data for the benefit of themselves and others. The recipients of the data may be public sector organisations (e.g. neighbouring road authorities) or private sector organisations (e.g. navigation service providers supplying information to road users). This represents an important dichotomy which can be used to make swift progress in this domain.

Many road operators are culturally averse to sharing their plans with the private sector because of the risk that the information will be exploited in a way that makes their task harder – for example, that user responses will become less predictable, and their ability to manage traffic is diluted. However, they are much less concerned about the risks inherent in sharing their plans with other road operators (indeed many frequently do so to coordinate efforts across authority boundaries), who better understand and often share their needs.

The study team proposes that the EC considers pursuing actions in this area along two tracks (both of which require Steps 1-6 above to happen):

- A: Public-Public - Pursue measures to stimulate the sharing of TMP data between public sector organisations using the means described in Steps 1-6, and fast-track the development of a framework for exchange of data between public sector organisations under Step 7
- B: Public-Private - Work on building the framework for exchange of data between public sector originators and the private sector recipients (typically data aggregators and navigation service providers). This will take longer, but if and when agreed could move quickly to take advantage of the infrastructure (see Steps 1-6) established and refined in the more active sharing of traffic management data within the public sector.

The study team considers that the main blockages to the EC being able to achieve its objectives under Action 1.2 lie within the scope of Steps 1-6. However, a number of possible actions are set out below.

Possible interventions for the EC to consider include:

- Establishing a requirement to share all published traffic management data and activation status information with road/traffic authorities (at any level) that share a geographical boundary with the originating public authority.
- Exploring the need for a wider requirement to share with other public sector and/or private sector organisations, and whether this requires legislation at MS level to ensure consistency
- Encouraging development of interfaces to traffic management equipment / systems (e.g. VMS) that can use traffic management data and activation status information as it is published to convey pre-defined information to road users directly
- Exploring the scope for using the PSI Directive to provide much of the framework for enabling private sector / user access to and use of traffic management data and activation status information once it is made available as described above on a public to public basis
- Market-making measures, such as steps to establishing a data sharing marketplace, publicising progress in implementing Steps 1-6 across the EU, developing data sharing agreements
- Defining terms and conditions for accessing and use of the published data, potentially as necessary covering licences, fees, payments, conditions to be met by the accessing organisation, confidentiality,…
- Research into attitudes of traffic managers to sharing traffic management data, and into the identified risks of misuse, and whether there is any evidence of this happening in practice (e.g. deterioration in the ability to manage traffic due to less predictable user responses)
- Encouraging development of algorithms for better predicting the behaviour of road users who have access to smarter navigation technology / traffic advice services
- Local or regional demonstrator implementing the whole set of specifications, etc. in this area and seeing evaluating what are the effects on traffic management and user experience
- Establishing and facilitating a forum for discussion between public and private sector organisations designed to tackle the cultural obstacles to sharing TMPs with private sector / users, working out what the framework for data exchange is, and how it should best be governed.