CEDR

Conférence Européenne
des Directeurs des Routes

Conference of European
Directors of Roads

Reducing congestion with integrated network management (INM)

April 2017

Authors

This report was compiled by **CEDR task group N6 (Congestion).**
Task group leader and main author: **Christian Ebner (Austria)**

Group members:

Country	Contributor	Organisation
Austria	Michael Schneider Khaled El-Araby	ASFINAG
Denmark	Claus Lund Andersen	Vejdirektoratet Trafiktårnet
The Netherlands	Ronald Adams	Rijkswaterstaat
Slovenia	Ulrich Zorin	DARS
Switzerland	Roger Siegrist	ASTRA

Approved by the Governing Board of CEDR: April 2017
Edited and published by: CEDR's Secretariat General
Ref.: CEDR report 2017/01 Reducing congestion with integrated network management (INM)
ISBN: 979-10-93321-23-3

Executive summary

There is a clear link between growing mobility problems such as congestion and the widely acknowledged potential of smart mobility solutions. Smart mobility solutions such as integrated network management (INM) can help reduce congestion, ensure more efficient, safer, and cleaner transportation, and improve services for road users. When viewed from this perspective, integrated network management is defined as 'an approach that includes both traffic management and traffic information measures integrated and managed within a transport network' and is seen both as essential for the effective reduction of congestion and a no-regrets development.

Many NRAs are in the process of moving from single road management towards integrated network management that covers different modes, regions, borders, and/or networks. While the promises and potential of smart mobility solutions such as integrated network management are considerable and politically very popular, the implementation of these solutions is complex and has many operational, tactical, and strategic consequences that can be characterised at the very least as being challenging for the different stakeholders involved.

NRAs, road operators, and public transport operators must continue to work closely with one another to cope with the growing mobility of a changing society and increased congestion on roads. Existing and new ITS tools as well as data management and exchange will play a role by enabling active, integrated traffic management on the overall road and transport network (relation to TEN-T and to European corridors). In general, other players on the market will play a greater role with effects on traffic management and congestion.

The results of the work of task group N6 (Congestion, TG N6) during CEDR's Strategic Plan 2013–2017 are presented in this report.

The amount of available data for traffic management is increasing rapidly, as is the number of different operating systems. Consequently, the analysis and exchange of data, strategies, and measures between different systems are important factors for a comprehensive, co-operational network-wide management.

In order to support and promote integrated network management (INM) with a view to ensuring optimum handling of traffic problems in the future, TG N6 makes the following recommendations:

- **Close cooperation is a key necessity**

  Smart mobility requires connected networks. When considered from this perspective, integrated network management can be seen as key to making our roads less congested and transport more efficient, safer, and cleaner. Positive basic conditions and frameworks need to be created to ensure that all partners with different responsibilities are willing to cooperate. It is therefore important that ALL CEDR members keep working on integrated network management and cooperate closely with each other so that they can deal with any impacts that may arise and in order to ensure that they are adequately prepared for new scenarios (e.g. cooperative systems and automated driving). This N6 report is meant to support CEDR members who are and/or who want to become active in INM.

- **A clear definition and consistent framework and a roadmap for INM are helpful**

  Integrated network management is a new and broad term. Using one definition of INM ('a traffic management approach that includes both traffic management and traffic information measures integrated and managed within a transport network') and a framework for deployment can help NRAs deploy and operate INM successfully. It is important to communicate the definition and framework within CEDR and start working with them actively. In addition, for those countries that are willing to adopt integrated network management, a

step-by-step approach, including early testing phases, is useful for the smart deployment of INM with reasonable cost-benefit effects.

- **A platform for knowledge exchange based on case studies is highly beneficial**

  A full-scale integrated network management approach is a relatively new part of most national traffic and transport policies. It can, therefore, be very helpful and cost-effective to provide a platform for knowledge exchange based on a rich knowledge base of traffic management case studies across CEDR members. Countries with little experience of INM can benefit hugely from a knowledge transfer based on best practice and relevant case studies. Consistent assessment results across case studies is quite helpful for knowledge transfer and needs to be enhanced in future phases.

- **Strengthening public-private cooperation for INM**

  In most cases, integrated network management requires cooperation between public and private partners. Different road authorities and stakeholders can have different—and sometimes conflicting—traffic policy goals, which can complicate efforts to find the optimum solution. Furthermore, private partners and service providers may play a bigger role and influence traffic management in a direct or indirect way. If NRAs/operators want to keep playing a strong, active role in the future, they need to be flexible to handle interaction with other key stakeholders such as suppliers, service providers, and the automotive industry and also to handle innovative measures such as cooperative systems and automated driving. A clear understanding of the proper mix and deployment time scales between conventional and innovative measures needs to be outlined, together with identification of relevant case studies, to enable a smooth transition. This calls for further strengthening of public-private cooperation, not only at strategic but also at tactical and operational levels. Public-private cooperation requires sound business cases. INM can be seen as a tool for the better utilisation of funds.

- **INM requires complete, high-quality data**

  Data completeness and quality are key aspects of the successful deployment and operation of INM schemes. Supplementary data sources such as crowd sourcing and floating car data (FCD) together with traditional data sources coupled with data quality schemes are necessary to ensure adequate quality of information. Use of supplementary data requires the opening up of cooperation with what are mostly private service providers. As a follow-up, a national database and consistent standards need to be set-up in each member country to allow for data integration and consistent exchange of data between national access points at cross-border levels.

- **Consistent delivery of services needs to be ensured**

  With more traffic information measures taken up by private players, service level agreements (SLAs) need to be integrated at operational level to ensure consistent delivery of services within agreements between NRAs and service providers. Case studies incorporating such SLAs should be investigated in order to come up with the right mix of traffic service quality related to level and scope of utilisation with the reduction of conflicting priorities among public and private players.

Regarding all developments on information and automation level, traffic management will continue to be the tool for handling traffic in the future and maintaining an active role for NRAs. A specific task group for traffic management can capitalise on the CEDR structure for bringing about different projects and programmes across European countries and across public and private partners in the right way and according to sound business models. Within AP2017–2019, such a framework can serve as a cooperation and knowledge exchange platform for the collection and dissemination of best-practice case studies through participation of more European countries in the working group.

Table of contents

List of abbreviations

AP2017–2019	CEDR's Action Plan 2017–2019
ASFINAG	state-owned company that plans, finances, builds, maintains, and operates Austria's entire primary road network and collect tolls on these roads
ASTRA	Swiss Federal Roads Office
CEDR	Conference of European Directors of Roads
DARS	Slovenia motorway company
EB	CEDR's Executive Board
FCD	floating car data
GB	CEDR's Governing Board
INM	integrated network management
ISO	International Organisation for Standardization
IT	Information Technology
ITS	Intelligent Transportation Systems
KPI	Key Performance Indicators
NRA	national road authority
PPP	public-private partnership
QoS	Quality of Service
Rijkwaterstaat	Part of the Dutch Ministry of Infrastructure and the Environment and is responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands (main road and waterway networks and the main water systems).
SLA	service level agreements
SP	CEDR Strategic Plan
SP3	3rd CEDR Strategic Plan (2014–2017)
TCC	Traffic Control Centre
TEN-T	Trans-European Network for Transport
TG	task group
TG N6	CEDR ask group N6 (Congestion)
TG N7	CEDR ask group N6 (ITS for NRAs)
TM	traffic management
TMC	Traffic Management Centre
TMPs	Traffic Management Plans
VMS	variable message sign
WG	working group

1 Introduction

1.1 Traffic problems

Road users on European road networks face three traffic problems: delays, safety, and pollution. The economic impact of these problems is significant. For example, traffic problems are hampering accessibility for just-in-time deliveries in commercial and industrial areas and reducing the value of residential areas. The cost to society of traffic delays on Europe's main roads is estimated at €15–20 billion per annum. Although no accurate estimates exist for Europe (only Dutch figures extrapolated to Europe), it is estimated that traffic delays on urban and rural roads also cost approx. €15–20 billion p.a.[1]

In recent years, CEDR member countries have experienced increasing traffic volumes and more traffic problems in the form of increasing congestion and a higher impact of incidents on traffic flow. This trend is very clear, especially on motorways, and there is no immediate prospect of any major change in this development. Most delays and pollution in Europe occur in and around major conurbations. As cities grow, so too do their traffic problems. In and around major conurbations, there are often several (or many) road operators and public transport operators, each responsible for its specific part of the transport system. Traffic policy goals can vary from one road authority to another at urban and national levels and across Europe. Cities in particular can have very different traffic policy goals to NRAs.

Figure 1: Congestion during peak hour in Vienna

Safety problems and measures to reduce them are generally local in orientation. Although delays, pollution, and economic problems are often caused locally, they can be reduced both locally and at network level (e.g. by improving the distribution of traffic flows across the network or over different time periods or modes).

[1] Dutch figures extrapolated to Europe.

However, most current measures to reduce congestion are local, while relatively few exist at network level. Although local measures can always be improved, improvement is difficult and costly due to the relatively dense deployment of local traffic management measures. There is much more room for improvement at network level. On average (over time, space, and modes), the capacity of the European transport system is certainly more than sufficient. It is the concentration of traffic on roads around conurbations in specific peak periods that is causing the greatest problems.

Traffic management and information measures at network level, including smart mobility measures in the form of cooperative systems and automated driving, are generally economically viable and can deal effectively with such problems. In general, existing innovative local measures are coordinated and optimised for use over the network. The costs relate mostly to coordination and centralised software and less to local deployment. The main difficulty in network-wide management (integrated network management, INM) is that organisations may need to cooperate to ensure a harmonised level of service to the user across modes, regions, and borders. This means first and foremost sharing some of the responsibilities and infrastructure. Secondly, it might mean an increase in traffic problems and costs for some of the cooperating organisations, while others experience the (greater) benefits.

The aim of this document is to help decision-makers introduce harmonised INM conditions, to demonstrate the potential of innovative smart mobility solutions and INM and the benefits that have already been achieved because of them, and to stimulate and support further adoption and effective deployment of INM measures.

Case studies highlighting specific integrated network management deployment, requirements, and key challenges encountered, were collected from across Europe to provide the platform for knowledge exchange between European partners to ensure effective planning and deployment.

1.2 Current state of traffic management and INM in European countries

National road authorities (NRAs) and road operators are increasingly working with all kinds of traffic management measures. Because of tighter budgets, a scarcity of space, and new policies, the role of Intelligent Transport Systems (ITS) and traffic management is increasing.

During its second Strategic Plan (2009–2013), CEDR set up a task group (T12) to gather and condense knowledge and experience on traffic management so that a common understanding could be reached by CEDR members. In the group's final report, a traffic management strategy was proposed. Based on a problem-oriented approach, the T12 report suggested eight steps for moving from high-level goals to the implementation of measures and control scenarios (*Traffic Management to reduce congestion, CEDR Final report Task group 12*). The eight-step process described in the T12 Final Report can help traffic engineers find and establish the right measures and implement the most effective control scenarios.

However, these measures and control scenarios focused mainly on motorways and on single points and sections. To gain further positive effects and benefits in terms of traffic flow, travel times, and environmental aspects, it is necessary to link single measures and consider the transport network as a whole, covering various modes, networks, and stakeholders. A lot of work has already been done on traffic management and traveller information services. However, the integration of such

measures on a wide-scale across regions, borders, networks, and modes is not widespread in Europe.

Further work is needed to assess the broader picture of traffic management across borders, modes, measures, and networks. Case studies and best-practice examples of integrated network management are not uniformly reported, and there is a need for a knowledge base of European best practice in order to gain knowledge on how to effectively plan and deploy integrated network management across a variety of operating contexts.

In order to get a better overview of the current situation in different member countries, a survey was conducted between June and November 2015. For this survey, CEDR members were sent a questionnaire and asked to provide information about their views on and experience of current traffic management and integrated measures.

The final version of the questionnaire can be found in Annex A.

A notable element of this questionnaire is the need for and understanding of effective integrated network management. Some countries have specific needs regarding integrated network management across regions and borders; others have more complex needs involving urban and rural networks and covering road and non-road modes. Some have a national traffic management strategy and highlight the potential of integrated/coordinated traffic management strategies and measures to make the transport system more efficient.

During CEDR's third Strategic Plan (2013–2017), CEDR's task group N6 (Congestion, TG N6) worked on a general theoretical basis to develop the definition and framework conditions for INM to reduce congestion and tried to validate this framework through concrete case studies and survey results to make INM as clear as possible. TG N6 developed a framework for defining the basic conditions for effective integrated network management. Using this framework, a knowledge base of network management practices used to reduce congestion in various European countries coupled with the developed knowledge base of concrete case studies reported by the participating NRAs was established in the survey.

The results, as outlined in this report, provide a good overview of current practice in integrated network management and serve as a good starting point in the search for greater knowledge of effective network management measures. It is therefore necessary to broaden cooperation on future activities. The main points in continuing the work, within Action Plan 2017–2019 (AP2017–2019), is to help other countries understand and introduce INM in a more consistent manner and, even more importantly, to help each other move in the right direction together. Within the coming Action Plan, more case studies involving more European countries and stakeholders, coupled with a more thorough assessment of results and best practice, would promote INM even further and ensure coordinated deployment. There needs to be a greater concerted effort to disseminate and share knowledge of such case studies across Europe.

1.3 Goals and strategy for reaching TG N6's goals

Within CEDR's third Strategic Plan (2013–2017), the Thematic Domain Network Management focused on the role of NRAs in safely reducing congestion, efficiently managing and operating the road network, and developing and providing a service to road users and others who may be

affected by the operation of road networks. To achieve this goal, seven task groups were set up within this thematic domain. These groups focused on performance, asset management, winter operations, heavy vehicles, road safety, congestion, and ITS. TG N6 dealt with congestion and integrated network management on a more tactical and operational level, while CEDR's TG N7 (ITS for NRAs) sought to identify NRAs' concerns and requirements regarding ITS measures on a more strategic level in line with key European actions and policies relevant to NRAs.

> **'The goal for Task Group N6 was to continue the work of Task Group T12 in a way of considering the whole transport network, to find a common definition of integrated network management as well as find best practice examples to summarize and structure existing knowledge on frameworks, success factors and recommendations to realize harmonized network operation services. And to recommend concrete further steps for continuing the work in the next CEDR Action Plan to enable effective network management measures in the future.'** (source: CEDR SP3, 2014–2016)

Right from the word go, close cooperation between task groups N6 and N7 was necessary for two reasons. Firstly, because most integrated network management strategies and measures are heavily influenced by ITS deployment on the road networks and secondly, because ITS deployment needs to be integrated across a number of dimensions in order to achieve maximum effectiveness on road networks.

In this respect, TGs N6 and N7 coordinated their activities and reporting (one NRA was represented in both groups) and held joint meetings to exchange knowledge and output. The first joint N6/N7 meeting took place in Copenhagen on 16 September 2015; the second in Vienna on 24 February 2016. The two groups worked together to identify case studies that relate traffic management measures to European ITS Actions as reflected in the European ITS Action Plan Directive. In this respect, TG N6's main focus was on operations and the deployment of concrete traffic management measures from the perspective of NRAs, while TG N7's focus was on ITS policy and strategy, taking into account innovative ITS measures as cooperative systems, automated driving, and widely deployed ITS measures. This distinction between operation and strategy needs to be maintained in AP2017–2019 in order to give both aspects the attention they need and deserve. At the same time, however, close cooperation should be maintained in order to achieve complementarity at strategic, technological, and operational levels.

Integrated network management (INM) is a relatively new approach in most national traffic and transport policies. Some countries/regions with high congestion levels and dense road networks have gained initial experience with inter-network traffic management. Other European countries have either not yet encountered such problems or have not recognised the need to deploy and operate integrated traffic management measures and the opportunities presented by them. This means that there are significant differences in the amount and type of integrated measures or concepts in the field of traffic management and control, across modes, sectors, and stakeholders.

Based on the knowledge and expertise of the work undertaken at international and at member country levels, TG N6 provides a common CEDR understanding on the needs and requirements of NRAs regarding harmonised network operation services to prevent and reduce congestion.

2 Scope of the report

This final report provides an overview of the work done and the final output of TG N6 in SP3. It explains the approach used to develop a consistent definition for integrated network management and a framework for the effective deployment of INM measures to reduce congestion. The final report provides an outline of the scope, coverage, and best-practice case studies in the European countries represented by participating NRAs in the CEDR survey. The final report concludes with the results and conclusions of the extensive survey of 15 CEDR member countries and case studies supplied by 19 NRAs. It also contains a summary of the collaboration between TGs N6 and N7 on ITS for NRAs to survey the interaction between traffic management measures on the one hand and European ITS actions and innovative measures on the other across several CEDR members. The conclusions and recommendations in this final report do not, therefore, provide a pan-European view at this stage, but rather cover selected good examples of INM best practice from countries that participated in the survey. More countries and more case studies need to be involved in the follow-up phase of the work (in AP2017–2019), with more NRAs getting involved and more dissemination of new case studies and knowledge exchange.

3 Approach

According to CEDR's SP 3, the goals for TG N6 were summed up in 5 action points, as illustrated in Figure 2.

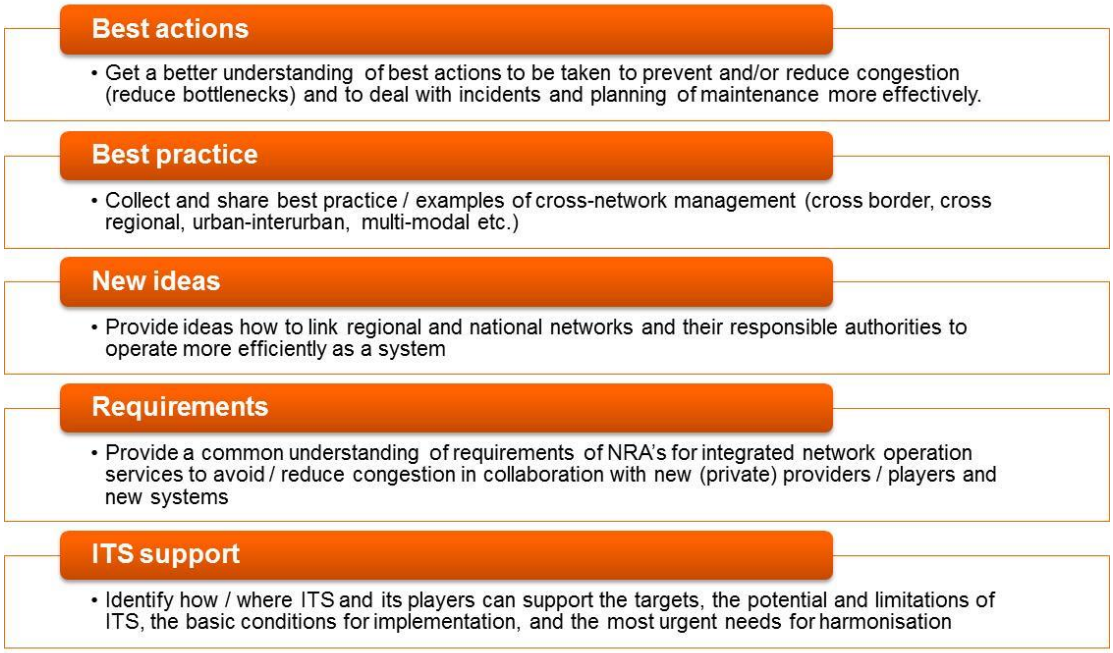


Figure 2: Goals for TG N6 in SP3

First of all, it was necessary to have a common definition of integrated network management and to determine what kind of traffic management and information measures could be integrated within and across transport networks. Naturally, there is no clear point where single network management ends and integrated network management begins; the transition is more fluid, with complexity increasing with performance (see
Figure 3).

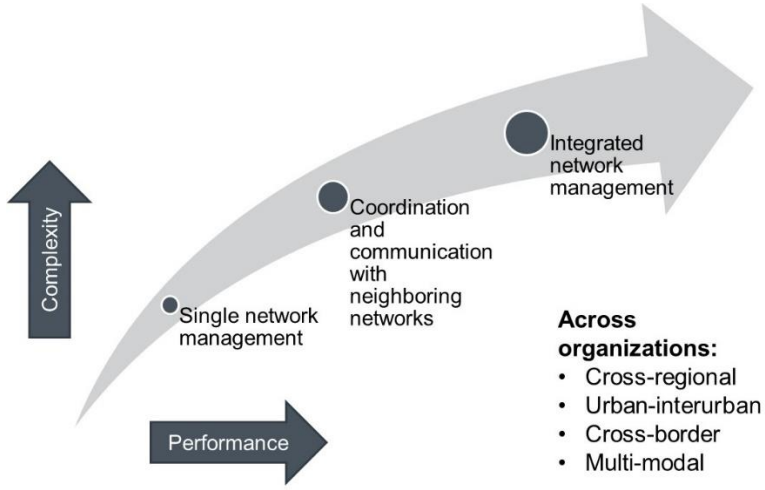


Figure 3: Moving towards integrated network management

After finding a common definition of integrated network management (INM) and of harmonised network operation services, there was a need to establish a process that would allow the group to make recommendations on how NRAs could deploy INM.

TG N6 came to the conclusion that the best starting point was to use a pre-defined structure to analyse successful implemented examples of INM. On the basis of best practice, NRAs' needs and requirements as well as the necessary frameworks and basic conditions for INM were defined. The final step was to make a recommendation to NRAs that would enable and promote the successful implementation of INM. Using this process and in accordance with the expected outcomes, four pillars or main tasks were identified for TG N6 (see
Figure 4).

Figure 4: The main tasks for TG N6 in SP3

The first step was to send a questionnaire to the five countries represented in TG N6 in order to identify a common definition and framework for INM. In addition, case studies from the members of TG N6 were collected and analysed in order to find a clear structure for describing examples and making it possible to identify needs, requirements, and INM framework conditions. This was followed up by an extensive survey where 15 out of 26 CEDR countries provided a total of 25 case studies reflecting a variety of operating conditions.

The questionnaire and the template used to collect INM case studies can be found in Annex A.

4 Definition of and framework for INM

Based on initial discussions within N6 and a set of case studies, which was then followed up and validated by the INM experience and case studies provided in the survey, a common definition of INM and an INM framework were developed.

4.1 Definition of INM

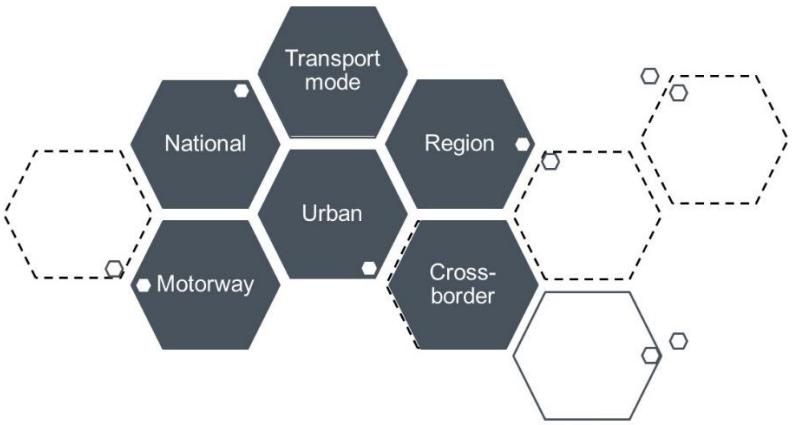
INM can be defined as

> 'a traffic management approach that includes both traffic management and traffic information measures integrated and managed within a transport network.'

TG N6 thinks that this common definition will help NRAs that are interested in taking first or next steps in this area.

This definition covers the following parameters:

- a network managed as a system with compatible objectives among partners;
- integrated management across motorways, arterial roads, urban roads, public transport modes, and/or parking systems;
- cooperation between multiple actors, including public-private partnerships;
- the integration of traffic management and information measures and applications within a unified network strategy;
- the integration of roadside, pre-trip (home/offices/mobile), and mobile (in car/public transport) measures;
- pro-active and harmonised operations.



As seen in Figure 5, INM can be considered the link between transport flows and networks across one or several 'blocks' that include:

- transport mode: auto vehicle/public transit/regional train
- urban: motorway/urban network interface
- region: across various neighbouring regions
- national: across all sectors and regions at country level

- cross-border: international coordination between countries
- stakeholders: across various stakeholders including motorway operators, service providers, enforcement agencies, public transport operators, urban authorities, national organisations, etc.

INM means coordinating and linking traffic management and information measures across modes, networks, regions, borders, and/or authorities.

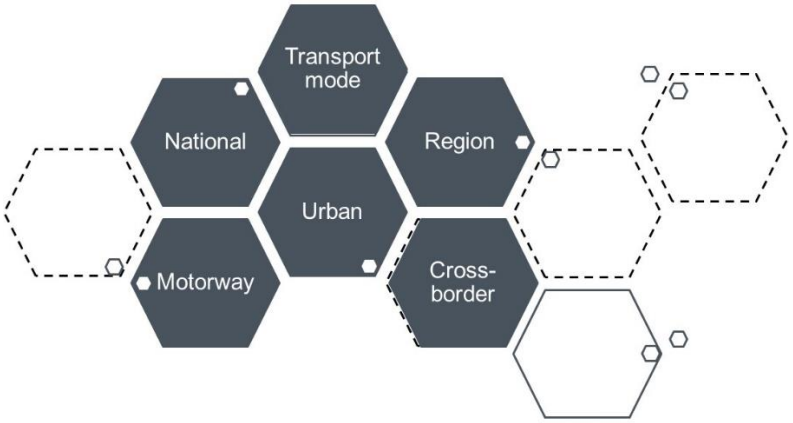


Figure 5: Various dimensions of integrated traffic management

4.2 Framework for INM

TG N6 proposed the following elements to set up the proposed INM framework used in the questionnaire to allow stakeholder needs to be assessed and case studies to be reported:

- problems tackled and/or objectives to be reached
- network deployment scale (urban, motorway, multi-modal)
- scope and level of integration
- scope of deployment (national, motorway, transport mode, region, urban, cross-border)
- level (single network, communication/information exchange, integrated network management)
- strategies: traffic information, traffic management or combined
- measures: traveller Information, traffic control, road-side/centre
- stakeholders involved and regulatory/cooperation frameworks, if any
- current level of deployment: study, under development, initial testing and deployment, full deployment and operation
- description of service(s): coverage, date of implementation, technical equipment packages
- impacts/assessment: experiences, benefits and benchmarking of outputs and outcomes, when available
- future expansions and developments
- recommendations for transferability

In terms of INM measures, three levels were identified for deployment:

1) institutional integration: coordination and collaboration across agencies and transport modes;
2) operational integration: joint operational strategies to manage and balance total capacity and

demand across a whole network;
3) technical integration: sharing and distributing information and system operations to support analysis and immediate response.

These points provided the framework for TG N6's European survey on INM and its collection of case studies describing the successful use/implementation of INM. All NRAs that responded to the survey accepted the above definition and framework for INM. Most INM case studies reported having several dimensions of the framework but not all dimensions were reported in a single INM deployment.

5 N6 Activities

TG N6 started its work with a kick-off meeting in Vienna in September 2013. Since September 2013, several steps were taken towards arriving at a Europe-wide view on INM. Based on first case studies provided by each member of TG N6, an initial definition of INM and a framework structure for further analysis were elaborated. A first draft questionnaire was developed and tested using case studies provided by TG N6 members. Based on the outcome of this work, the questionnaire was improved. The questionnaire was finalised and was distributed to CEDR members between June and November 2015. A first analysis of the survey results was discussed at the last TG N6 meeting in Ljubljana in June 2016. A detailed, finalised analysis of survey results is included in this report.

In addition, TGs N6 and N7 (ITS for NRAs) coordinated their activities and reporting. One NRA was represented in both groups. They also held joint meetings to exchange knowledge and output. The first joint N6/N7 meeting was held in Copenhagen on 16 September 2015; the second in Vienna on 24 February 2016. The joint meetings were organised as workshops to discuss how traffic management will evolve in the next 5–10 years and to identify case studies in various CEDR countries that relate various traffic management measures to European ITS Actions and innovative measures.

Figure 6: TG N6's working schedule and activities until the end of 2016

6 CEDR's INM survey

In accordance with the framework developed for INM, a questionnaire was developed to get an overview of the objectives, needs, and requirements of European NRAs regarding INM and to provide guidance for effective INM on the basis of the best-practice case studies provided.

As a first step, an internal survey of TG N6 member NRAs was conducted to test the questionnaire and to gather initial views on INM and best-practice case studies from each of the five NRAs represented in the task group.

Following testing and validation of the initial questionnaire and an assessment of results, the questionnaire was distributed to a larger group of CEDR NRAs in order to get a more complete overview of needs, requirements, and best practice for INM at European level. The questionnaire used can be found in Annex A.

The Europe-wide survey of CEDR members started on 10 June 2015 and ended in November of the same year.

The main objectives of the survey were:

- to get a CEDR-wide overview of the current thinking on integrated network management and best practice in this area;
- to collect enough concrete material to contribute to TG N6's recommendations to CEDR;
- to create a basis for possible next steps.

In accordance with the design of the questionnaire, results of the survey were divided into two areas:

- general survey results detailing common definitions of INM and the requirements and needs of each NRA in this area;
- specific case studies detailing best practice in INM deployment (planned or in place) in each road authority that responded to the survey. In order to ensure consistent assessment across the survey, case studies were reported in accordance with the framework developed by TG N6.

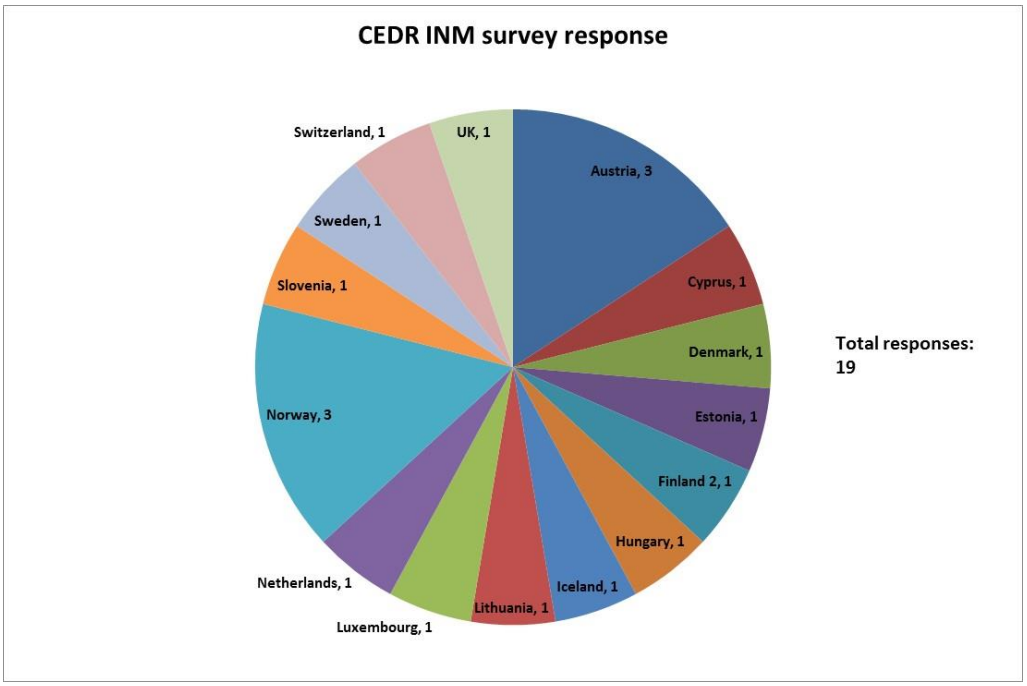


Figure 7: Response to CEDR's INM survey

Of the 26 road authorities that were contacted, 19 responses were received from 15 countries. Major countries such as France, Germany, Spain, and Italy, and many central and eastern European countries did not respond.

Since TG N6 thinks it is important to involve more countries in this important area of work, the group recommends inviting the major countries mentioned above to join the working group Traffic and Network Management and/or provide the group with relevant case studies during AP2017–2019.

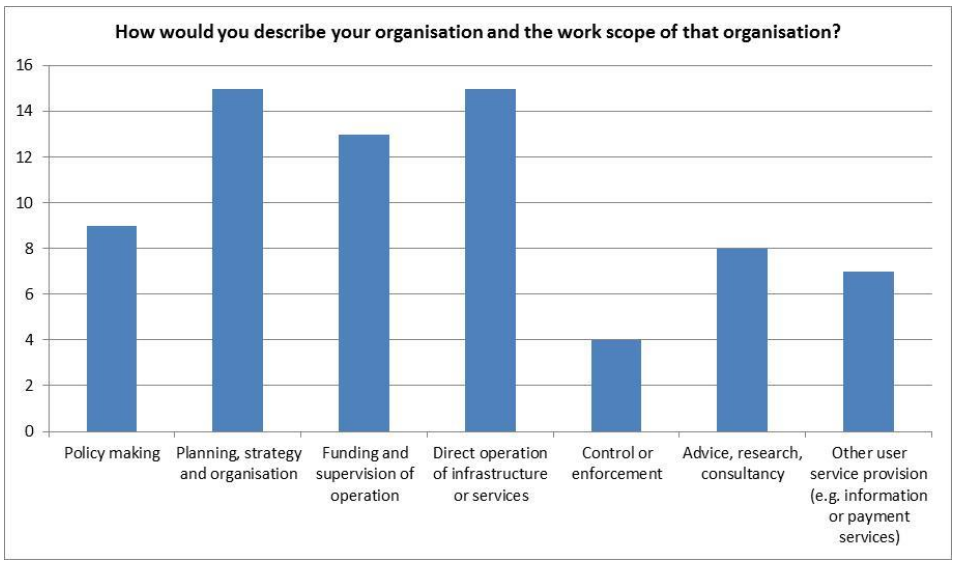


Figure 8: The role and scope of road authorities that responded to the survey

Road authorities, with direct responsibility for planning and direct operation of road infrastructure, provided the majority of responses.

6.1 Overall survey results

This section outlines the key issues addressed in the survey and the overall results and conclusions of the survey.

6.1.2 Definition of INM

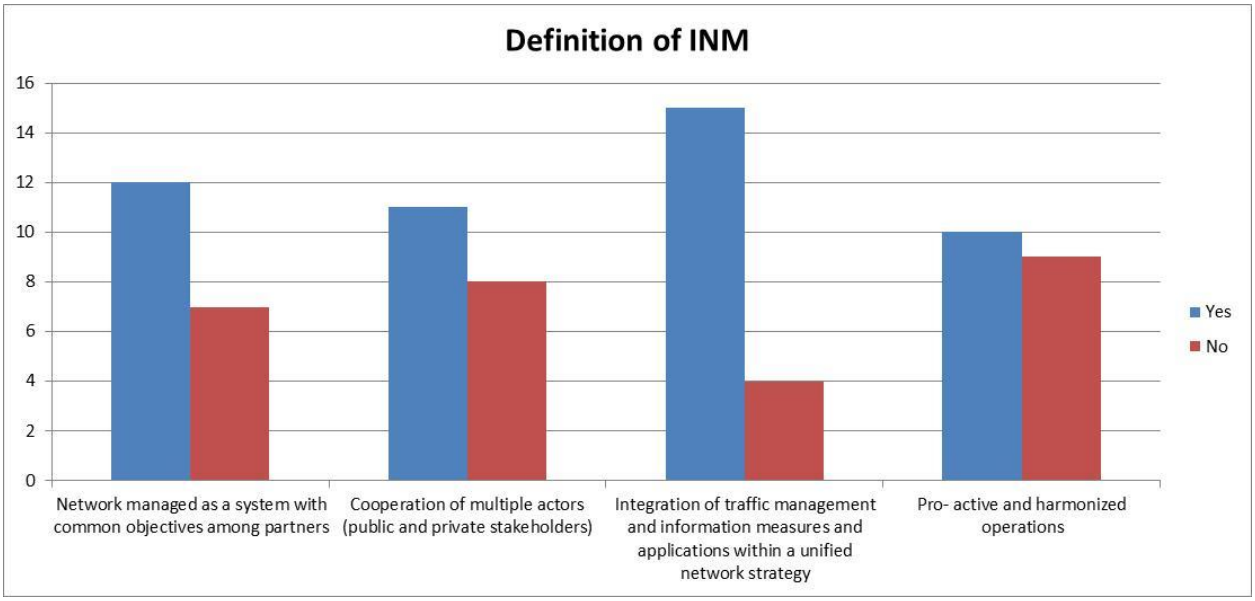


Figure 9: Opinions on the definition of integrated network management (INM)

Most road authorities that responded to the survey were of the opinion that the most important features of INM were the integration of traffic management and traffic information measures within a unified network strategy followed closely by the management of the network as a system with common objectives among partners. The second most popular feature of INM was cooperation of multiple actors and stakeholders. There was slightly less consensus among respondents that pro-active and harmonised operations are a definitive characteristic of INM.

Based on these responses, INM can be defined as 'a traffic management approach that includes both traffic management and traffic information measures integrated and managed within a common transport network'.

TG N6 is confident that this common definition will help road authorities that are interested in taking initial or next steps in this area.

6.1.2 Scope of INM

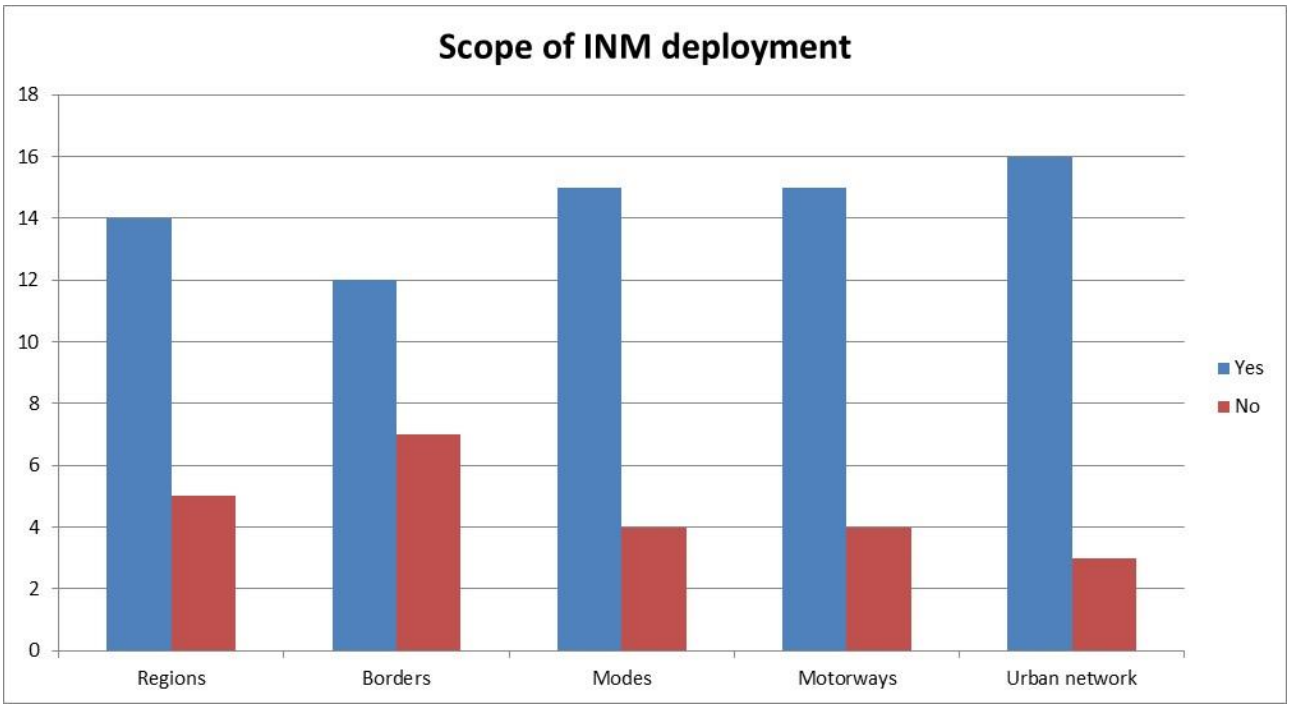


Figure 10: The scope of INM deployment in the road authorities that responded to the survey

Most road authorities that responded to the survey were of the opinion that the scope of INM covered integration across urban networks, regions, motorways, and/or modes. Surprisingly, there was relatively little consensus about cross-border integration (around 60% of road authorities that responded to the survey considered cross-border integration to be a vital feature). This might be due to the scope of NRAs that deal mainly with a national road network and that have no significant coordinated network management across borders (e.g. Iceland, Cyprus, UK, Finland, and Norway).

Based on these responses, it can be concluded that an integrated network management approach encompassing measures across modes/networks is a MUST focus for most road authorities.

All NRAs are of the opinion that urban networks are part of the scope of INM. However, the case studies received reflect the implementation of few integrated urban/interurban measures. There is a need to work more on this and on a compatible level of TM measures (consistent TM framework). The same conclusion can be derived for integration across modes, with few case studies demonstrating full integration of measures across modes.

TG N6 considers this an interesting conclusion that needs further and specific attention in the next phase to derive measures and case studies that illustrate high integration across networks and/or modes. In addition, there is a need in AP2017–2019 to include more case studies with cross-border elements to depict ways of integrating measures across borders in terms of TM strategies, data exchange, and the coordinated deployment of travel information/traffic control measures. For example, one or more cross-border corridor projects could be analysed in AP 2017–2019.

6.1.3 Level of INM deployment

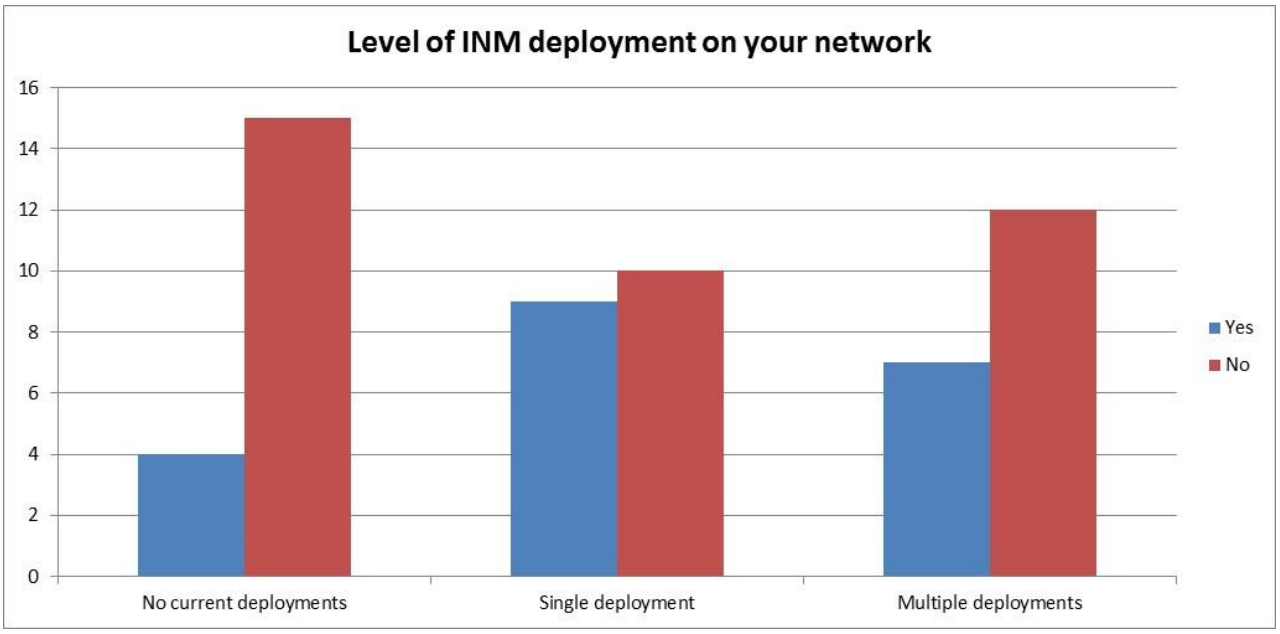


Figure 11: Level of INM deployment in road authorities that responded to the survey

Around nine of the road authorities that responded to the survey reported the single deployment of INM. Only seven of the road authorities that responded to the survey reported multiple deployments of INM, with the rest reporting no current deployment. This shows that the level of INM deployment is not as widespread across CEDR as conventional network management measures.

One problem was that major European countries such as Germany, Italy, Spain, and France, which all have considerable experience of INM, did not respond to the survey. Consequently, the result for 'level of deployment' may not provide an accurate overview/mean value for all of CEDR, instead providing a good insight into the situation in smaller countries.

Because of the importance of INM for other developments such as automated driving, TG N6 feels that it is important that CEDR continues to focus on INM implementation and gets not only the bigger countries like Germany, England, France, and Italy involved but also more eastern and southern European countries.

On that basis, there is a need to expand into more compilation of best-practice INM deployments through wider participation and account for smart mobility measures as part of integrated measures with the need to continue and expand into more INM case studies in AP2017–2019.

6.1.4 Partners for the successful delivery of INM

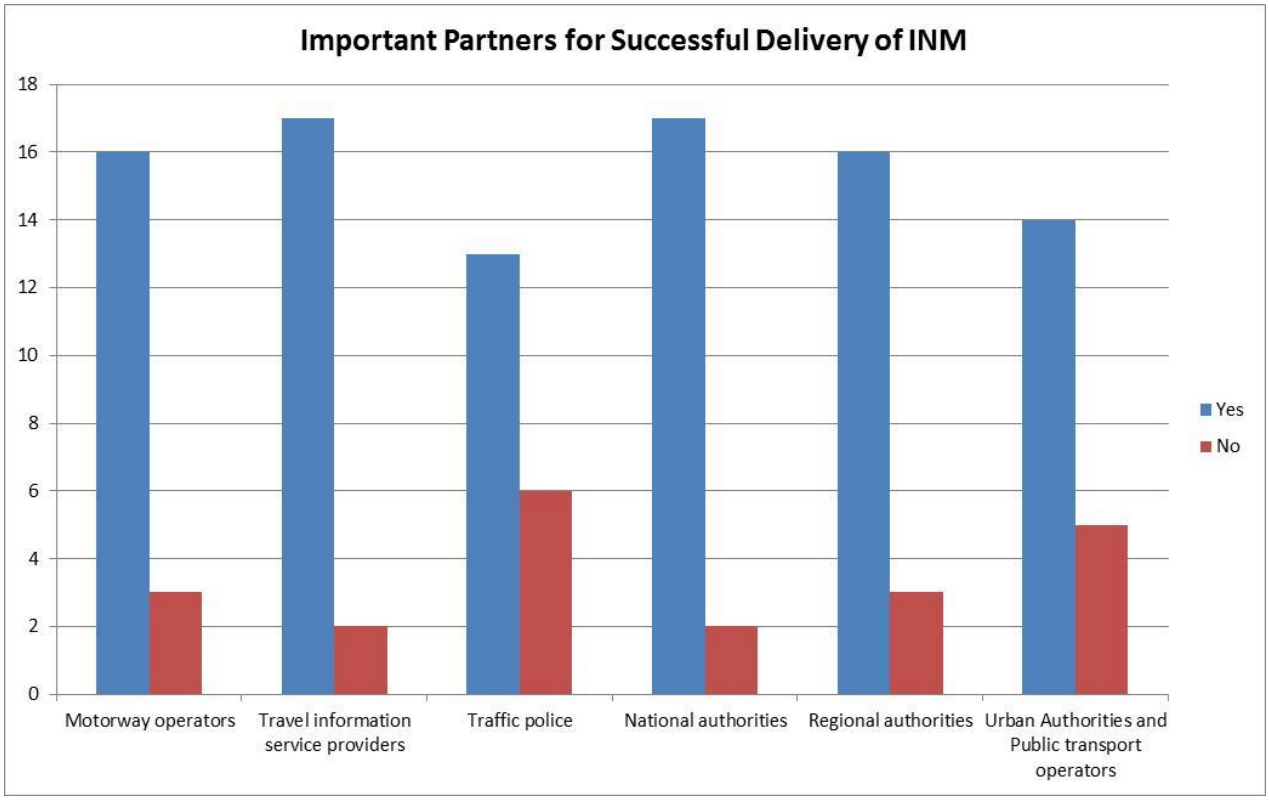


Figure 12: Partners for the successful delivery of INM

The key partners in INM were identified on the basis of priorities. As expected, the road authorities that responded to the survey considered motorway operators, service providers, and national/regional authorities the most important partners for the successful delivery of INM measures. These were followed by regional authorities. Surprisingly, only 14 of the road authorities that responded to the survey considered urban authorities and public transport operators important, despite the emphasis on the urban/motorway interface and public transport in several European countries. Thirteen of the road authorities that responded to the survey saw the traffic police as enforcement actors with no involvement in the deployment and operation of INM measures, except where the traffic police is part of the traffic management team at regional and national level.

TG N6 also considers this to be an interesting response that requires further attention since the involvement of all public and private partners is crucial if INM is to be taken forward.

INM requires a number of partners. The role of NRAs is to take the initiative and bring more partners to the table. Some case studies show ways of involving more partners as service providers and public transport (PT) operators. Failure to do so will have negative impacts on effective TM. Aspects of the organisational challenges and different political goals within INM deployment are barriers to ensuring successful INM.

6.1.5 Key objectives behind INM deployment

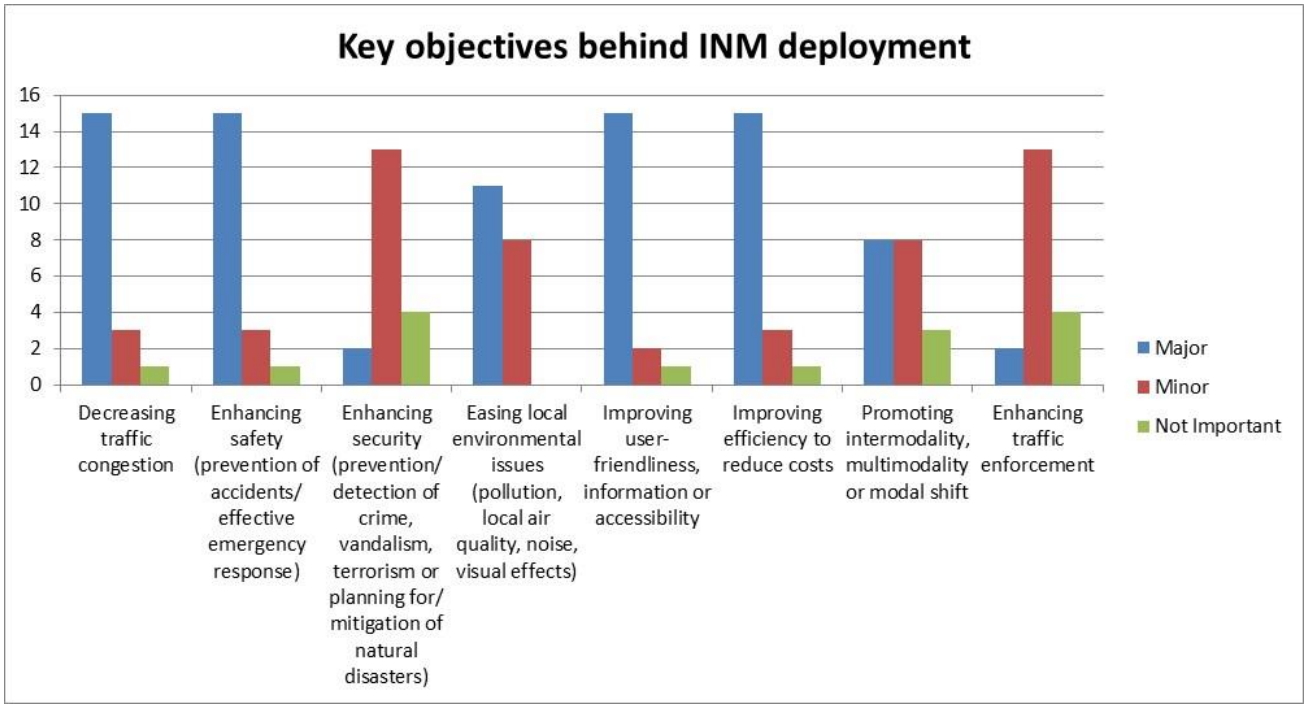


Figure 13: Key objectives behind INM deployment

Most NRAs considered improving accessibility, decreasing traffic congestion, and enhancing safety and improving efficiency as the top objectives for deploying INM measures. More than 60 per cent of road authorities that responded to the survey considered easing local environment issues to be a major objective. Promoting inter-/multi-modality was seen as a major objective behind INM deployment by only slightly more than 40 per cent of road authorities that responded to the survey, indicating that multi-modal measures are largely being deployed at a more local level. More than 80 per cent of road authorities that responded to the survey saw enhancing traffic enforcement and enhancing security as minor and/or not important objectives when deploying INM measures.

In the view of TG N6, this underlines the potential of INM to contribute to the most important policy goals that have been set in the area of transportation and mobility. Growing congestion in the coming years requires a global network approach rather than single elements and more deployment in INM due to its positive impacts. More focus on the network approach will probably also support and facilitate better and more transparent tests and deployment of C-ITS and automation in the coming years.

6.1.6 Tools used to deploy traffic management

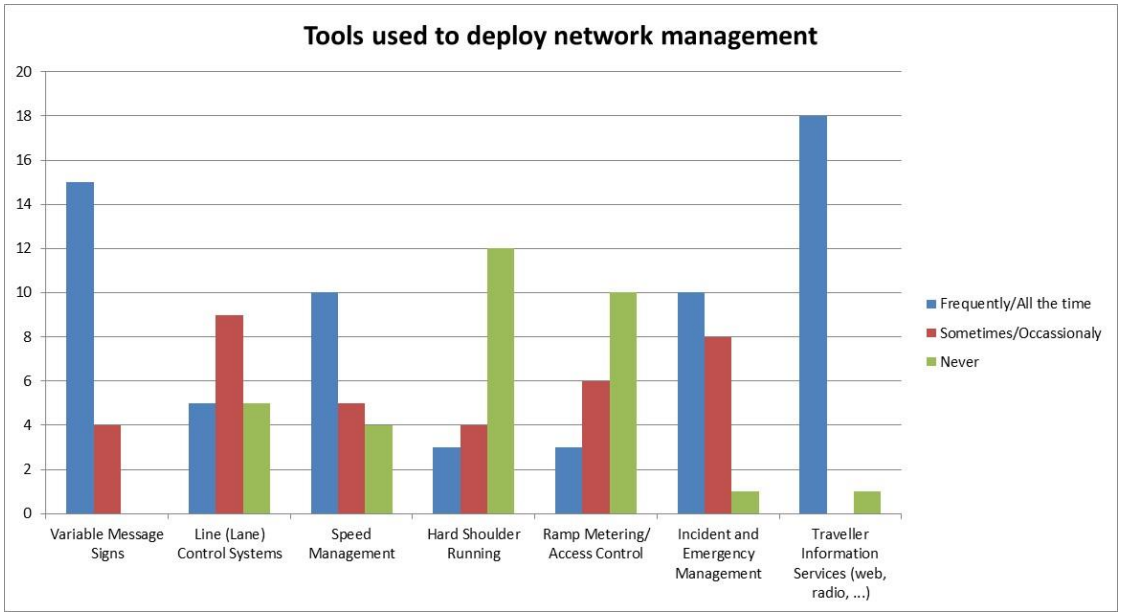


Figure 14: Tools used by road authorities that responded to the survey for traffic management

Traveller information services, followed closely by variable message signs, were the most frequently used tools in integrated network management (they are used by approximately 80 per cent of road authorities that responded to the survey). Slightly more than 50 per cent of road authorities that responded to the survey reported that they use incident/emergency management and speed management frequently. More than 50% of road authorities that responded to the survey said that they sometimes use line control systems, with hard shoulder running and ramp metering not being used by more than 60 per cent of road authorities that responded to the survey. Only 40 per cent of road authorities that responded to the survey use ramp metering and access control as traffic management measures in their networks.

In the medium to long-terms, new smart mobility measures can be seen as ways of complementing or even replacing traditional ITS measures in providing INM.

This survey covers a limited number of countries. There is a need to expand the survey to include more and bigger countries and more case studies to get a wider scope of measures.

Traveller information services (public and private) are necessary for INM, but there is a need to ensure consistent content and dissemination platforms. Data completeness and information quality is a key element for the successful deployment and operation of INM schemes. Service level agreements (SLAs) on operational level could be a solution for consistent delivery of services and information.

TG N6 is convinced that concrete INM examples that have proven to be effective are the best way to share knowledge with other CEDR members and help them move forward. Especially countries with little experience with INM and either none or only a few INM deployments could benefit from that and take a big leap forward, while more experienced countries could get new inspiration and maybe, where relevant, take the initiative to start cross-border projects.

6.1.7 INM case studies provided

In total, 25 case studies were provided, with several road authorities providing multiple case studies.

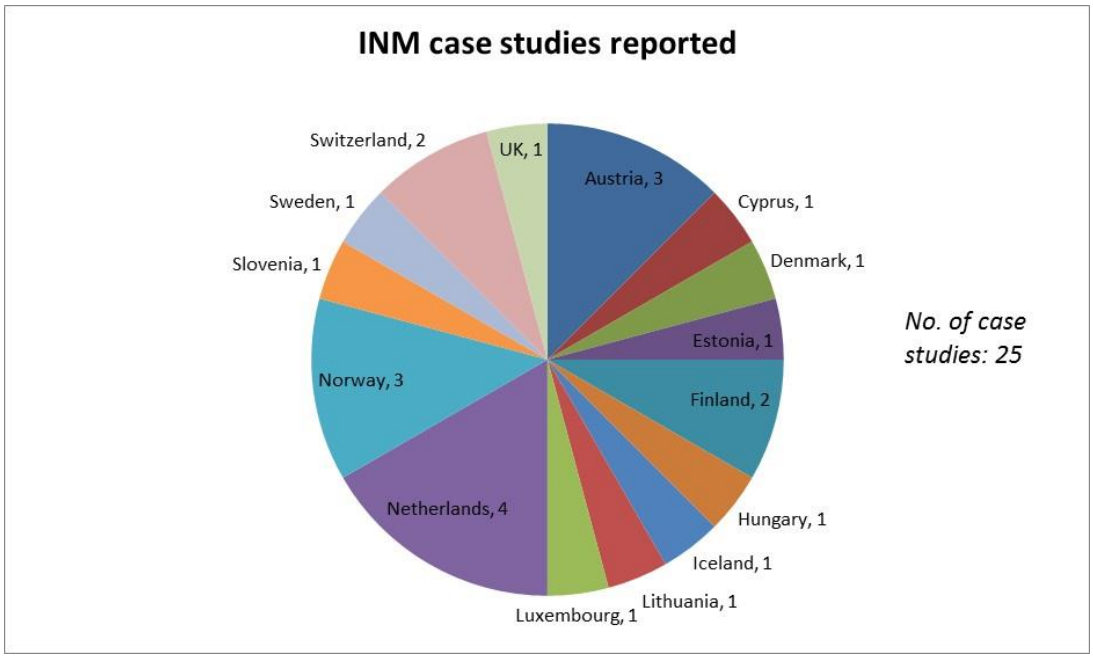


Figure 15: INM case studies reported in the CEDR survey

6.1.8 INM case studies: problems tackled

In the case studies provided, the following problems were the reason for/motivation behind the implementation and operation of INM (with ranking of the reported reasons):

1 Capacity and congestion problems
2 Environmental problems
3 Lack of information and common data
4 Incidents
5 Non-integrated traffic management/information solutions
6 Limited possibility for infrastructure expansion
7 High costs

This is very much in line with the key objectives of INM deployment reported in the general part of the survey, where road authorities said they considered capacity and congestion problems to be a high priority for INM (see
Figure 13).

6.1.9 Features of the INM case studies provided

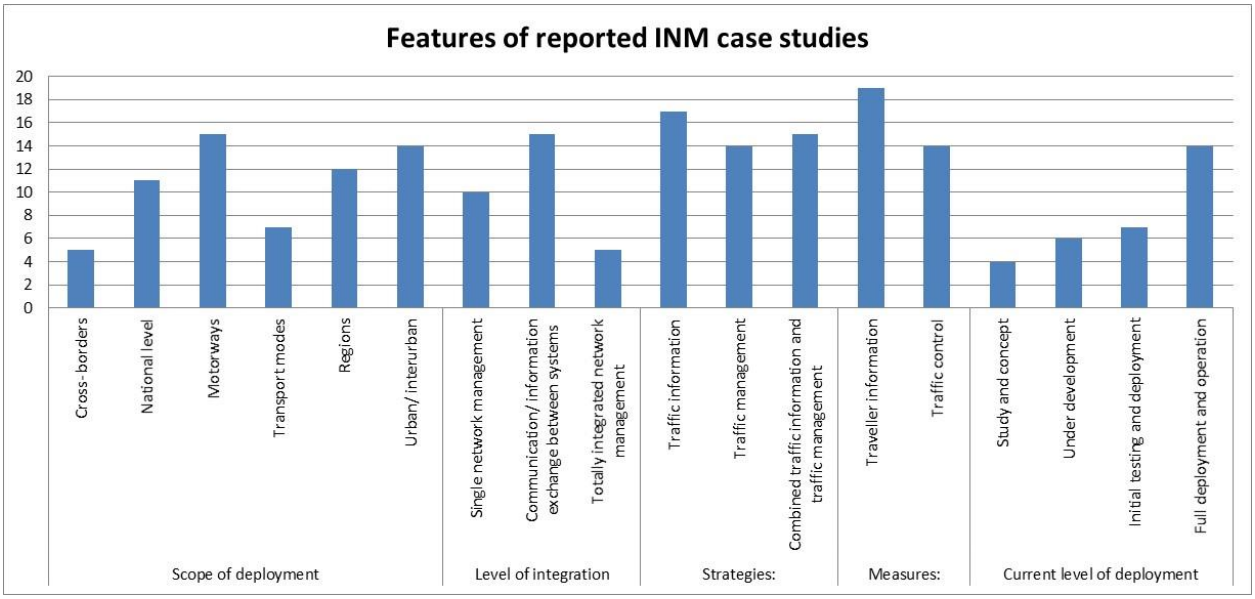


Figure 16: Features of case studies provided as part of the CEDR INM survey

Most case studies provided by road authorities featured deployment covering both regional and motorway networks, with the majority either having traveller information services on their own or combined with traffic management services. The majority of case studies featured the exchange of information across entities as a minimum level of integration, although five case studies were reported as being totally integrated. Most INM deployments reported (14 case studies) were reported as being in full deployment and operation. Seven INM case studies were reported as being under initial testing.

6.1.10 INM case studies: success factors for INM deployment and operation

Based on the case studies provided, the following factors can be considered key to the success of the implementation and operation of INM:

- NRAs' coordination/leadership role: NRAs must bring stakeholders together and enable close cooperation, which is very important
- Focus on common goals and targets (including shared benefits): the network as a whole and not the scope of a single infrastructure should be considered
- Flexibility of NRAs and operators
- The communication of benefits: measured/proven improvements should be promoted and communicated. To this end, assessment is important
- Willingness to cooperate, between bodies with different responsibilities and across borders (regional, national and international cooperation between stakeholders, providers, NRAs, operators)
- Common service level agreements and quality criteria
- A step-by-step approach, early testing phases
- User orientation (user-oriented solutions): user satisfaction, benefits for the user
- Shared benefits and shared, minimised costs

6.1.11 Availability of assessment results for case studies

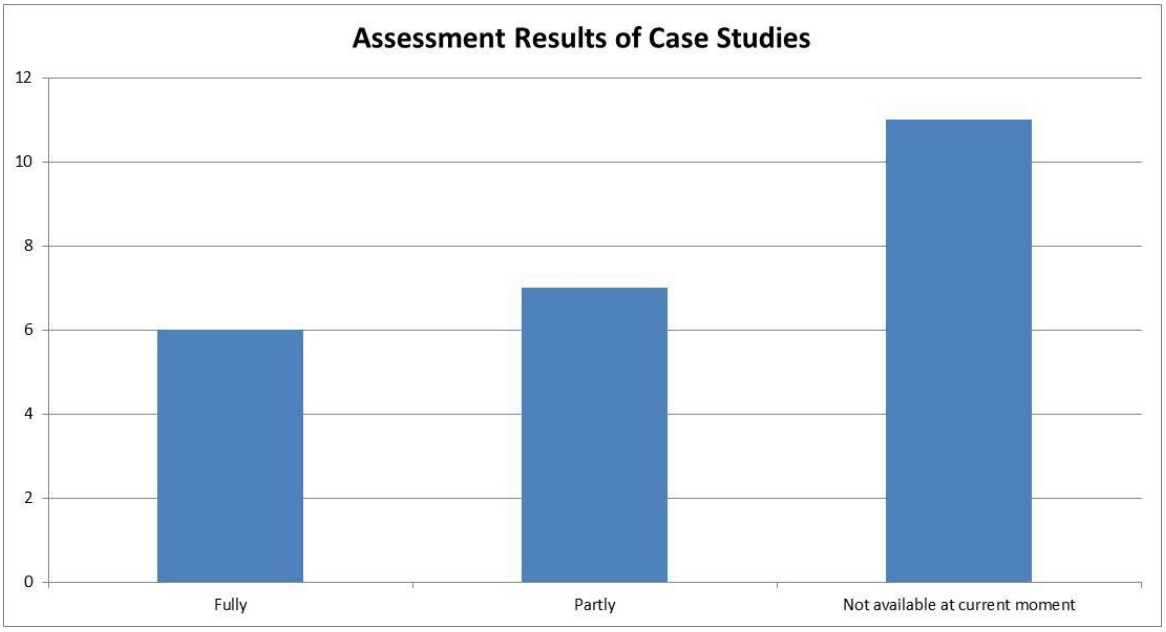


Figure 17: Availability of assessment results for the case studies provided

No assessment results were available for the majority of the 11 case studies. Full assessment results were available for only six case studies.

In order to deduce the benefits/impacts of INM, many more case studies with concrete examples are needed. Assessment (i.e. identifying the impacts of particular measures or packages of measures) is a difficult exercise. All stakeholders agree that more work is needed to identify impacts and report them in a consistent manner.

The conclusions based on the survey responses show that no one yet knows exactly where NRAs in general are going with INM. However, instead of being a disadvantage, this is actually an advantage since it gives every CEDR member the chance to join the Traffic Management Group in AP2017–2019. This would enable participating CEDR members to assess and search for the best ways to implement INM so that it contributes the most to the goals set and to the other developments that NRAs are dealing with in the mobility arena. The proposed CEDR working group on Performance Indicators in AP2017–2019 can provide the framework for consistent reporting of impacts.

For information on the INM case studies received, see Annex C.

For further details on key case studies, please contact TG N6 or visit to the CEDR website, where some key outlines of some case studies will be published.

7 ITS interface to traffic management and INM

Most integrated network management strategies and measures are highly influenced by ITS deployment on the road networks. Both traditional and new ITS deployment needs to be integrated across various dimensions in order to achieve maximum effectiveness on road networks. CEDR's TG N7 adopted a more strategic approach, focusing on the field of ITS, while TG N6 focused on operational and tactical traffic management measures. ITS topics and issues are highly relevant to the work of TG N6. This is why the two groups agreed to cooperate on several issues in order to share information and enhance the results of the work being carried out.

TGs N6 and N7 coordinated their activities and reporting (one NRA was represented in both groups) and held joint meetings to exchange knowledge and output. The first joint N6/N7 meeting took place in Copenhagen on 16 September 2015; the second in Vienna on 24 February 2016. Some of the main topics and activities are mentioned below.

7.1 Workshop about new directions for traffic management

The purpose of the workshop was to discuss how traffic management (TM) will evolve in the next 5-10 year horizon. Participants were divided into three transversal groups. Some of the overall findings and conclusions are given below.

- Challenges relating to increased congestion will continue and the focus will remain on improving traffic flow and traffic safety. This calls, among other things, for a continuing network approach from NRAs and also places high demands on the direction of new developments in automation and C-ITS.
- More stakeholders are getting involved in traffic management. These stakeholders have different objectives, needs, and priorities. Stakeholders should aim to work together and have a common strategy.
- NRAs and traffic management centres are expected to face many challenges in the transition phase from a low to a high degree of automation. Different penetration rates can be expected from country to country.
- Who does traffic management and who is responsible for it? NRAs will continue to operate roadside traffic management deployment but the role of the private sector and cooperation with the private sector in data generation and traveller information will increase. Harmonisation is required for route guidance and navigation services between both road-side and in-car services.
- The trend is towards more—and increasingly more advanced—equipment in vehicles and at the same time less traditional ITS roadside equipment.
- Everything is becoming more data oriented and connected, which emphasises the need for systematic data collection and exchange, data cleaning, and effective big data analysis.
- There is a need to look into the legal framework and possible harmonisation of national regulations.

  Several discussions took place on how to continue work on traffic management at CEDR level. It was proposed that TG N6, as CEDR's operational traffic management-oriented group, would continue working on a more practical operational level of traffic management measures deployment with a network approach. It was also proposed that TG N7, which focuses more on the future, would continue working at the strategic level with focus on C-ITS and

automation.

One of the conclusions was that many NRAs are in the process of moving from single road management towards integrated network management and cooperation with other networks and stakeholders. That will, on the one hand, enhance overall performance. On the other, it will also add complexity. That complexity will increase even more in the coming years, when congestion is expected to get worse and new developments in areas such as C-ITS and automation will be introduced and will exist alongside more traditional traffic management measures and ITS.

7.2 Matrix with traffic management measures and ITS

The two groups worked together to develop a matrix that linked 10 selected classic types of traffic management measures on one side to European ITS Actions as reflected in the European ITS Action Plan Directive and to other innovative measures as C-ITS and automated driving on the other. Answers from Austria (AT), Switzerland (CH), Denmark (DK), Finland (FI), Greece (GR), the Netherlands (NL), Sweden (SWE), and the United Kingdom (UK) were collected and used to populate the matrix below.

Traffic Management measures	Intelligent Transport Systems - ITS						
	Priority a *Multimodal Travel Info and Route Planner*	**Priority b** *Real Time Traffic Info*	**Priority c** *Safety Related Traffic Info*	**Priority d** *eCall*	**Priority e** *Secure Truck Parking Information*	**Cooperative ITS** *C-ITS*	**Automated Driving** *AD*
Capacity management (e,g, ramp metering, hard shoulder running, dynamic lane management etc.)	NL	Most countries active	CH, DK, NL			CH, UK	AT, CH, SWE
Roadworks management	CH		Most countries active			Most countries active	Most countries active
Incident management	CH, FI		All countries active	Most countries active		All countries active	
Lane control	CH		Most countries active			AT, CH, NL	
Variable speed limits	CH					AT, CH, GR, NL	
Alternative route management	CH, NL					AT, CH, FI, GR	
Roadside information	CH, NL				CH	Most countries active	
Truck parking information	CH		CH		Most countries active	AT, CH, NL, UK	AT, CH, NL, SWE
Management of abnormal transports		AT, FI	FI			CH	AT, CH, FI, SWE
Winter maintenance supporting systems		All countries active	Most countries active			Most countries active	AT, CH, FI, SWE
Other, please specify:							
DK	National travel planner (www.rejseplan.dk)						Legal aspects Truck platooning
FI		Incident warnings TM renewal T-LOIK				Incident warnings NordicWay	Incident warnings AURORA
NL		CHARM					
SWE		Internal deployment project				Big Data Analysis BADA	
UK		METHOD CEDR				Control Office System PCP Anaconda CEDR Cobra CEDR	Dragon CITE

Figure 18: Matrix of traffic management measures relating to European ITS Actions,

C-ITS, and automation summarising answers from eight countries

The purpose of this exercise was twofold: firstly, to identify the areas where ITS can support traditional TM measures through reporting case studies that accommodated both. To this end, members of TGs N6 and N7 identified relevant case studies. Secondly, to provide overviews and highlight the areas where countries are active in various ITS and traffic management areas and where it could be relevant to exchange knowledge and coordinate activities.

Most of the countries presented their individual matrices containing case studies incorporating both ITS and traffic management measures. The resulting matrix summarising the results was developed. Some of the overall findings and conclusions were:

- N7 has a more strategic approach with a special focus on the ITS area, while N6 focuses on traditional traffic management measures. The matrix shows that there is a need for more cooperation and coordination between these groups and disciplines, especially regarding roadworks management, incident management, lane control, variable speed limits, alternative route management, roadside information, and winter maintenance supporting systems in relation to the ITS Directives Priority actions (b) and (c), C-ITS, and automation.
- It is very important to provide road users with good-quality services. ITS priority actions should help NRAs improve in this area. However, there are still differences in national policies in NRAs delivering key traffic management and traffic information services.
- The goal is to have pan-European interoperable traffic management services. Therefore, standardisation issues are relevant. Some examples are:
  - Road data warehouse is using TISA recommendations as guidance, e.g. the standard is there but not obligatory.
  - Safety messages are standardised to the access point. However, how the automotive industry should standardise messages to users has not been defined.
  - OEMs indicate that everything in the future will be processed and stored in the cloud.
- The quality of data is an issue (the quality needs to be agreed at a high-decision making level in the organisation). Data quality was the most difficult aspect in ITS priority action (c).
- Automation is going to influence all traffic management topics in the future. It will probably be a big challenge—also an economic challenge—for all NRAs to handle this well. Road users and political stakeholders will expect NRAs to continuously provide or ensure consistent traffic information and guidance in the transition period towards a higher level of automation, while NRAs will, at the same time, have to downgrade/adjust and in time phase out more traditional traffic management measures.
- It is important that CEDR task groups and working groups provide recommendations and guidance to NRAs in these areas through the Governing Board to help them solve challenges with mobility, congestion, and safety.

7.3 Recommendations regarding future work in AP2017–2019

In the course of joint discussions about future work on traffic management, ITS, automation and C-ITS in AP2017–2019, it became evident that it would be difficult to merge the two task groups without downgrading important areas. The suggestion is, therefore, to maintain a distinction between operation and strategy in the coming CEDR Action Plan 2017–2019, while also maintaining close cooperation between the two groups. This will ensure complementarity at strategic, technological, and operational levels. This could be a starting point for the identification of

further case studies and more concrete projects and a basis for future workshops dealing with special traffic management measures.

8 Conclusions and recommendations

The following conclusions and recommendations are based on the objectives and findings of TG N6 and the knowledge acquired from the CEDR INM survey. Key conclusions and recommendations can be taken up and expanded upon in AP2017–2019.

The amount of available data for traffic management is increasing rapidly, as is the number of different operating systems. As a consequence, the analysis and exchange of data, strategies, and measures between different systems are important factors for comprehensive, co-operational network-wide management.

In order to support and promote integrated network management (INM) with a view to ensuring optimum handling of traffic problems in the future, TG N6 makes the following recommendations:

- **Close cooperation is a key necessity**
  Smart mobility requires connected networks. When considered from this perspective, integrated network management can be seen as key to making our roads more efficient, transport safer and cleaner, and to provide road users with a better level of service. Positive basic conditions and frameworks need to be created to ensure that all partners with different responsibilities are willing to cooperate. It is therefore important that ALL CEDR members keep working on integrated network management and cooperate closely with each other so that they can deal with any impacts that may arise and in order to ensure that they are adequately prepared for new scenarios (e.g. cooperative systems and automated driving). This N6 report is meant to support CEDR members who are and/or who want to become active in INM.

- **A clear definition and consistent framework and a roadmap for INM are helpful**
  Integrated network management is a new and broad term. Using one definition of INM ('a traffic management approach that includes both traffic management and traffic information measures integrated and managed within a transport network') and a framework for deployment can help NRAs deploy and operate INM successfully. It is important to communicate the definition and framework within CEDR and start working with them actively. In addition, for those countries that are willing to adopt integrated network management, a step-by-step approach, including early testing phases, is useful for the smart deployment of INM with reasonable cost-benefit effects. Each participating CEDR member should outline a road map for planning and deploying integrated traffic management measures in line with overall transportation/traffic management strategies at national and urban levels.

- **A platform for knowledge exchange based on case studies is highly beneficial**
  A full-scale integrated network management approach is a relatively new part of most national traffic and transport policies. It can, therefore, be very helpful and cost-effective to provide a platform for knowledge exchange based on a rich knowledge base of traffic management case studies across CEDR members. In some cases, INM sounds difficult. However, at an operational level, it can meet requirements and solve critical problems at network level. Countries with little experience of INM can benefit hugely from a knowledge transfer based on best practice and relevant case studies. Consistent assessment results across case studies is quite helpful for knowledge transfer and needs to be enhanced in future phases.

- **Strengthening public-private cooperation for INM**
  In most cases, integrated network management requires cooperation between public and private partners. Different road authorities and stakeholders can have different—and sometimes conflicting—traffic policy goals, which can complicate efforts to find the optimum solution. Furthermore, private partners and service providers may play a bigger role and influence traffic management in a direct or indirect way. If NRAs/operators want to keep playing a strong, active role in the future, they need to be flexible to handle interaction with other key stakeholders such as suppliers, service providers, and the automotive industry and also to handle innovative measures such as cooperative systems and automated driving. A clear understanding of the proper mix and deployment time scales between conventional and innovative measures needs to be outlined, together with identification of relevant case studies, to enable a smooth transition. This calls for further strengthening of public-private cooperation, not only at strategic but also at tactical and operational levels. Public-private cooperation requires sound business cases. INM can be seen as a tool for the better utilisation of funds.

- **INM requires complete, high-quality data**
  Data completeness and quality are key aspects of the successful deployment and operation of INM schemes. Supplementary data sources such as crowd sourcing and floating car data (FCD) together with traditional data sources coupled with data quality schemes are necessary to ensure adequate quality of information. Use of supplementary data requires the opening up of cooperation with what are mostly private service providers. As a follow-up, a national database and consistent standards need to be set-up in each member country to allow for data integration and consistent exchange of data between national access points at cross-border levels.

- **Consistent delivery of services needs to be ensured**
  With more traffic information measures taken up by private players, service level agreements (SLAs) need to be integrated at operational level to ensure consistent delivery of services within agreements between NRAs and service providers. Case studies incorporating such SLAs should be investigated in order to come up with the right mix of traffic service quality related to level and scope of utilisation with the reduction of conflicting priorities among public and private players.

Regarding all developments on information and automation level, traffic management will continue to be the tool for handling traffic in the future and maintaining an active role for NRAs. A specific task group for traffic management can capitalise on the CEDR structure for bringing about different projects and programmes across European countries and across public and private partners in the right way and according to sound business models. Within AP2017–2019, such a framework can serve as a cooperation and knowledge exchange platform for the collection and dissemination of best-practice case studies through participation of more European countries in the working group beyond the six NRAs represented in the current task group N6.

9 Proposed follow-up for the working group traffic and network management in AP2017–2019

9.1 Outlook

In recent years, CEDR member countries have experienced increasing traffic volumes and more traffic problems in the form of increasing congestion and the higher impact of incidents on traffic flow.

The trend is very clear, especially on motorways, and there is no immediate prospect of any major changes in that development.

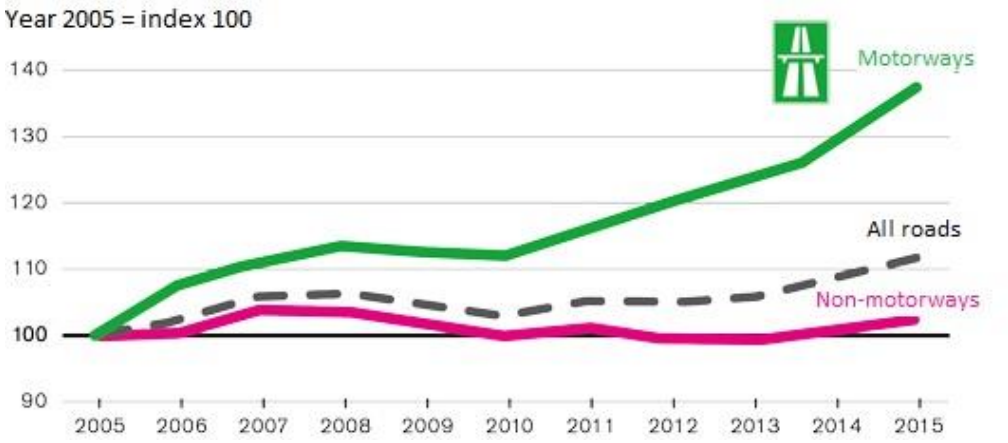


Figure 19: Development in traffic volumes on the road network in Denmark.

There are no indications that developments in the fields of C-ITS and automation in the coming five years will have a significant positive impact on the increasing traffic problems in CEDR countries. On the contrary, the early implementation of these new technologies may generate even more challenges for NRAs and others in their efforts to keep traffic flowing and road users happy using traditional traffic management measures.

There is, therefore, a need for NRAs to keep focused on three areas in the coming years:

- Continuation of traditional traffic management (e.g. traffic control, incident management, route monitoring, provision of (data for) pre-trip and on-road information) on motorways and other vital parts of the road network.
- Preparations for C-ITS and automation should feature close dialogue and cooperation with stakeholders in these areas. The focus should be on making the relevant adjustments to traditional traffic management in time and supporting developments in C-ITS and automation by providing input (for example, in connection with the evaluation of trials and the development of equipment and automated vehicles) and assessing the results and their consequences.
- Increasing cooperation with other stakeholders in traffic management partly to strengthen INM and partly to improve the relations with these stakeholders in the light of the coming challenges with C-ITS and automation.

In all three areas, it would be of value for NRAs/CEDR countries to exchange and discuss experiences, partly to learn from each other and partly to get closer to a more harmonised approach that will benefit all NRAs. This needs a continuation of the work on INM and a setup of transversal cooperation with stakeholders in C-ITS and automation through the workshops and continued cooperation with TG N7.

9.2 Proposed Traffic and Network Management working group in AP2017–2019

Sharing know-how and experience within CEDR is a main target of the proposed working group Traffic and Network Management in AP2017–2019. The Traffic and Network Management working group will act as a platform that condenses all the material to be used at the appropriate levels of CEDR and NRAs. The overall objective of the proposed working group Traffic and Network Management is to condense, structure, and transfer experience, knowledge, and useful information about traffic management measures on European road networks (regional, national, and cross-border) to CEDR EB/GB, but also among experts and people within CEDR countries dealing with traffic and transportation (NRAs, operators, municipalities, police, etc.).

The work will be done by a network of national and international experts from NRAs and road operators. Working group members will provide expertise in the field of traffic management in general and at national level. Based on the knowledge and expertise of the work undertaken at national level, the group will concentrate on a few selected, pre-defined measures/services and go into more detail.

On each of the selected topics, the proposed working group will collect best practice examples of deployment and operation and discuss and share existing knowledge/experience. Workshops will be held to promote this exchange.

Based on the examples already mentioned above, interesting/important pre-defined measures/services could among other things include:

- mobile traffic management systems and their integrated use,
- linking local measures as incident management to integrated Traffic Management & Information Services,
- intelligent construction site management,
- hard shoulder running,
- traffic management centres (operational aspects and supporting systems),
- organising (big) data, and
- initial experience of using C-ITS for information and, if available, traffic management. Regarding C-ITS, the proposed Traffic and Network Management working group could, in cooperation with the working Group on Automated Driving, help build a bridge between national and local authorities.

The core of the WG's strategy in AP2017–2019 will be to organise workshops on specific topics and/or concrete case studies to discuss key factors and lessons learned. Sharing this knowledge can help countries that are already working with those traffic management measures to further improve their operations and can help those countries that also have ideas or are already willing to implement those measures. The results of these workshops will be summarised in fact sheets on specific topics. These fact sheets will highlight available knowledge/experience.

The topics will be defined each year, according to requirements. The working group will therefore investigate focus areas among the TG members and via CEDR EB. As an added value, in each workshop session of the Traffic and Network Management working group, there will be opportunities to exchange experience in all fields of traffic and integrated network management between different countries with different responsibilities of NRAs and other fields of TM and ITS.

The Traffic and Network Management working group will get in contact and interact with other CEDR activities, other organisations, institutions, and stakeholders (e.g. EasyWay continuation) to discuss their point of view and coordinate working content and targets in order to avoid redundancy and ensure progress.

10 Annexes

ANNEX A: Questionnaire

CEDR European NRA Questionnaire on Integrated Network Management (INM)

Introduction

Many NRAs are in the process of moving from single road management towards integrated network management covering different modes, regions, borders and networks. According to CEDR Strategic Plan 2013-2017, the objectives of the CEDR N6 Task Group on Harmonised Network Operation Services are to:

- Provide a common definition and understanding of integrated network management (INM) and the requirements of NRA's for integrated network operation services to avoid / reduce congestion in collaboration with new (private) partners / players and innovative systems
- Collect and share best practice / examples of cross-network management (cross border, cross regional, urban-interurban, multi-modal etc.)
- Provide ideas how to link regional and (inter)national networks and their responsible authorities to operate more efficiently as a system
- Provide concrete recommendations for NRA's for the further development of integrated network management services.

The survey will be used to get an overview of objectives, needs and requirements of NRAs in Europe regarding INM and provide guidance for effective INM on the basis of best-practice.

On that basis, we would like to ask your opinion on a range of issues.

The questionnaire is structured into 2 parts: first part on a general basis with the second part for specific case studies in your network. The average time for filling in the questionnaire will take less than 10 minutes.

For any questions, please contact the following **CEDR N6 Task Group members**:

- Christian Ebner, ASFINAG Service GmbH, Tel.: +43 50108 17610; Email: christian.ebner@asfinag.at
- Michael Schneider, ASFINAG Service GmbH, Tel.: +43 50108 17625; Email: michael.schneider@asfinag.at

Please fill in this questionnaire by the end of July 2015.

--- Part 1---

a) Information about you and your organisation

Question 1: How would you describe your organisation and the work scope of that organisation? (*Check any that apply*).

Policy Making	☐
Planning, Strategy and Organisation	☐
Funding and Supervision of Operation	☐
Direct operation of infrastructure or services	☐
Control or enforcement	☐
Advice, research, consultancy	☐
Other user service provision (e. g. information or payment services)	☐
Other role (please specify)	☐

If 'other' is ticked in the above table, please describe here: ……

Question 2: What is your level of professional experience (in years) of dealing with:

- Transport in general (transport / infrastructure engineering, operations, economics, policy, etc.)?
  ……. years
- Road network traffic management?
  ..... years

Question 3: What is your position in your organisation? Please describe briefly your role
.....

b) Definition and Scope of Integrated Network Management (INM)

Check any that apply

Question 4: Do you agree with the definition for INM as

- ☐ Network managed as a system with common objectives among partners
- ☐ Cooperation of multiple actors (public and private stakeholders)
- ☐ Integration of traffic management and information measures and applications within a unified network strategy
- ☐ Pro-active and harmonized operations

If not, please provide your view regarding definition of INM

- ☐ ……..

Question 5: Scope of INM covers integration across

- ☐ Regions
- ☐ Borders
- ☐ Modes
- ☐ Motorways
- ☐ Urban network

Would you include other areas to be covered by INM?

- ☐ ……..

Question 6: What is the level of deployment of INM in your network?

- ☐ 0: No current deployments
- ☐ 1: Single deployment
- ☐ 2: Multiple deployments

Question 7: What important partners need to be involved for successful delivery of INM?

- ☐ Motorway operators
- ☐ Travel information service providers
- ☐ Traffic police
- ☐ National authorities
- ☐ Regional authorities
- ☐ Urban authorities
- ☐ Public transport operators
- ☐ Other e.g., research institutes, industry, etc., (please specify):
  ……

Question 8: In your organisation, how important are the following objectives in implementing or planning to implement Integrated Traffic Management solutions in your network?

Not Important	Minor	Major	
☐	☐	☐	Decreasing traffic congestion
☐	☐	☐	Enhancing safety (prevention of accidents / effective emergency response)
☐	☐	☐	Enhancing security (prevention / detection of crime, vandalism, terrorism or planning for / mitigation of natural disasters)
☐	☐	☐	Easing local environmental issues (pollution, local air quality, noise, visual effects)
☐	☐	☐	Improving user-friendliness, information or accessibility
☐	☐	☐	Improving efficiency to reduce costs
☐	☐	☐	Promoting intermodality, multimodality or modal shift
☐	☐	☐	Enhancing traffic enforcement

Are there other objectives, please specify:……..

Question 9: What tools do you use to deploy traffic management measures in your network?

Never	Sometimes / Occasionally	Frequently / All the time	
☐	☐	☐	Variable Message Signs
☐	☐	☐	Line (Lane) Control Systems
☐	☐	☐	Speed Management
☐	☐	☐	Hard Shoulder Running
☐	☐	☐	Ramp Metering/Access Control
☐	☐	☐	Incident and Emergency Management
☐	☐	☐	Traveller Information Services (web, radio, …)

Are there other tools, please specify:……..

Further remarks or suggestions:……..

--- Part 2---

Case Studies for Integrated Network Management (INM)

Please provide details on case studies that represent INM by your organisation and fill out the following questions for each case study. Please provide some additional material such as figures, maps, reports, presentations, etc. to illustrate your reported INM deployment (you have the possibility to upload files as a last step in the questionnaire for each case study). At the end of the first case study you will be asked to either finish the questionnaire or to start further case studies.

INM Case Studies Reporting Template

- Country/Region Implemented:
- Problems tackled
- Objectives to be reached
- Network deployment scale (urban, motorway, multi-modal)
  Check any that apply
- Scope of deployment across:
  - cross-borders
  - national level
  - motorways
  - transport modes
  - regions
  - urban/interurban

- Level of integration
  - single network management
  - communication/information exchange between systems
  - totally integrated network management

- Strategies:
  - traffic information,
  - traffic management
  - combined traffic information and traffic management

- Measures:
  - Traveller Information,
  - Traffic control

- Stakeholders involved and regulatory/cooperation frameworks, if any
- Current Level of Deployment:
  - Study and concept
  - under development,
  - initial testing and deployment,
  - full deployment and operation

- Description of service(s):
  - Coverage: …….
  - Date of implementation: …….
  - Technical equipment packages: ……

- Impacts/Assessment: Experiences, benefits and benchmarking of outputs and outcomes, when available …….

- Key Factors and Lessons learned:
  - Problems encountered: ……..
  - Solutions made: ……
  - Success factors: ……..
- Future expansions and developments
- Recommendations for transferability
- Further remarks or suggestions
- Please provide some additional material such as figures, maps, reports, presentations, etc. to illustrate your reported INM deployment:
  Please upload at most one file:

  Upload files
- Contact person (email, contact details)

Your name: _____

Title: _____

Organisation: _____

Address: _____

City + postcode: _____ Country: _____

E-mail: _____ Telephone number: (+ ____) _____

Many thanks for your help!

ANNEX B: INM Deployment Survey Results by Country

	How would you describe your organisation and the work scope of that organisation									What is your level of professional experience (in years) of dealing with:		is your position in your organi	Do you agree with the definition for INM as					Scope of INM covers integration across						What is the level of deployment of INM in your			What important partners need to be involved for successful delivery of INM							In your organisation, how important are the following objectives in implementing or planning to implement Integrated Traffic Management solutions in your network								What tools do you use to deploy traffic management measures in your network								
country	Policy making	Planning, strategy and organisation	Funding and supervision of operation	Direct operation of infrastructure or services	Control or enforcement	Advice, research, consultancy	Other user service provision (e.g. information or payment services)	Other role	If "other" is ticked in the above table, please describe here:	Transport in general (transport/ infrastructure engineering, operations, economics, policy, etc)	Road network traffic management	Please describe briefly your role:	Network managed as a system with common objectives among partners	Cooperation of multiple actors (public and private stakeholders)	Integration of traffic management and information measures and applications within a unified network strategy	Pro- active and harmonized operations	Other	Regions	Borders	Modes	Motorways	Urban network	Other	No current deployments	Single deployment	Multiple deployments	Motorway operators	Travel information service providers	Traffic police	National authorities	Regional authorities	Urban Authorities and Public transport operators	Other	Decreasing traffic congestion	Enhancing safety (prevention of accidents, effective emergency response)	Enhancing security (prevention/ detection of crime, sabotage, terrorism or planning for/ mitigation of natural disasters)	Easing local environmental issues (pollution, local air quality, noise, visual effects)	Improving user- friendliness, information or accessibility	Improving efficiency to reduce costs	Promoting intermodality, multimodality or modal shift	Enhancing traffic enforcement	Are there other objectives, please specify:	Variable Message Signs	Line (Lane) Control Systems	Speed Management	Hard Shoulder Running	Ramp Metering/ Access Control	Incident and Emergency Management	Traveller Information Services (web, radio, ...)	Are there other tools, please specify:
Norway	Yes	Yes	Yes	No	Yes	Yes	Yes	No		27	27	Project Owner and Project Manager on large projects	No	No	Yes	No		Yes	Yes	Yes	Yes	Yes		No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes		Minor	Major	Minor	Major	Minor	Major	Major	Minor		Frequently/ All the time	Sometimes/ Occasionally	Sometimes/ Occasionally	Never	Sometimes/ Occasionally	Sometimes/ Occasionally	Frequently/ All the time	
Finland	Yes	Yes	Yes	Yes	No	No	Yes	No		40	20	Principal Advisor on ITS	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	rescue authorities	Major	Major	Minor	Major	Major	Major	Major	Minor		Frequently/ All the time	Sometimes/ Occasionally	Frequently/ All the time	Never	Never	Frequently/ All the time	Frequently/ All the time	
Norway	Yes	Yes	Yes	No	No	No	Yes	No		25	10	Head of Section ITS	No	No	Yes	No		No	No	Yes	No	Yes		Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes		Major	Major	Minor	Major	Major	Major	Major	Minor	Reducing climate footprints from transport	Frequently/ All the time	Sometimes/ Occasionally	Never	Never	Sometimes/ Occasionally	Sometimes/ Occasionally	Frequently/ All the time	
Norway	Yes	Yes	Yes	No	No	No	Yes	No		43	30	Head of traffic management section at head office	No	No	Yes	No		No	No	Yes	No	Yes		Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes		Major	Major	Minor	Major	Major	Major	Major	Minor	Reducing climate footprint from transport	Frequently/ All the time	Sometimes/ Occasionally	Never	Never	Sometimes/ Occasionally	Sometimes/ Occasionally	Frequently/ All the time	
Iceland	Yes	Yes	Yes	Yes	No	Yes	No	No		43		Deputy Director General	Yes	Yes	No	Yes		Yes	No	Yes	Yes	Yes		Yes	No	No	No	Yes	No	Yes	Yes	Yes		Not Important	Major	Minor	Major	Major	Major	Minor	Minor		Sometimes/ Occasionally	Never	Sometimes/ Occasionally	Never	Never	Never	Frequently/ All the time	
Austria	No	No	No	No	No	Yes	No	No		8	3	Senior Engineer, Thematic Coordinator	No	No	Yes	No		No	No	No	Yes	Yes		No	Yes	No	Yes	No	Yes	No	Yes	No		Minor	Not Important	Not Important	Major	Not Important	Not Important	Not Important	Not Important	REDUCTIONS OF TRAFFIC EMISSIONS SPECIFICALLY CO2 and BLACK CARBON	Frequently/ All the time	Never	Never	Never	Never	Sometimes/ Occasionally	Never	DYNAMIC TRAFFIC LIGHT STRATEGY ADAPTATION
Hungary	No	No	No	Yes	No	No	No	No		5		CEO	Yes	No	No	Yes		Yes	No	No	Yes	Yes		Yes	No	No	Yes	Yes	No	Yes	Yes	No		Major	Major	Minor	Minor	Major	Major	Minor	Minor		Frequently/ All the time	Sometimes/ Occasionally	Sometimes/ Occasionally	Sometimes/ Occasionally	Never	Sometimes/ Occasionally	Frequently/ All the time	
Estonia	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Clental services via e-channels and transport registry.	23	10	Deputy Director general on Construction; Acting Director General - organisational management.	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes		No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes		Major	Major	Major	Major	Major	Major	Major	Major		Sometimes/ Occasionally	Sometimes/ Occasionally	Frequently/ All the time	Sometimes/ Occasionally	Sometimes/ Occasionally	Sometimes/ Occasionally	Frequently/ All the time	
Cyprus	No	Yes	No	Yes	No	No	No	No		15		Executive/Transport Engineer	No	No	Yes	No		Yes	Yes	Yes	Yes	Yes		No	No	Yes	Yes	Yes	Yes	Yes	No	Yes		Major	Major	Major	Major	Major	Major	Major	Major		Sometimes/ Occasionally	Never	Never	Never	Never	Sometimes/ Occasionally	Frequently/ All the time	
Luxembourg	No	Yes	Yes	Yes	No	No	No	No			5	Head of the Highway Department for the NRA	No	No	Yes	Yes		No	No	No	Yes	No		No	Yes	No	Yes	Yes	Yes	Yes	No	No		Major	Major	Not Important	Minor	Major	Minor	Minor	Minor		Frequently/ All the time	Sometimes/ Occasionally	Sometimes/ Occasionally	Never	Never	Frequently/ All the time	Frequently/ All the time	
Lithuania	No	Yes	Yes	Yes	No	No	No	No	Road administration	25	25	Long term planning division	No	No	Yes	No		Yes	No	Yes	No	No		No	No	Yes	No	No	No	Yes	Yes	No		Minor	Major	Minor	Minor	Minor	Major	Minor	Minor		Sometimes/ Occasionally	Never	Frequently/ All the time	Never	Never	Sometimes/ Occasionally	Frequently/ All the time	https://www.eismoinfo.lt/en
Slovenia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		12	2	head of department for traffic management on the motorways	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes		No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes		Major	Major	Minor	Minor	Major	Minor	Minor	Minor		Frequently/ All the time	Never	Sometimes/ Occasionally	Never	Never	Frequently/ All the time	Frequently/ All the time	
Switzerland	No	Yes	Yes	Yes	No	Yes	No	No		30	10	Project Leader traffic management for motorways	Yes	Yes	Yes	Yes		No	Yes	Yes	Yes	Yes		No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes		Major	Major	Minor	Major	Major	Major	Not Important	Not Important		Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	
Austria	No	No	No	Yes	No	No	No	No		3	1	Project- and Program Manager in Traffic Information	Yes	Yes	No	No		Yes	Yes	Yes	No	No		No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes		Major	Major	Minor	Major	Major	Major	Major	Minor		Frequently/ All the time	Sometimes/ Occasionally	Frequently/ All the time	Sometimes/ Occasionally	Never	Frequently/ All the time	Frequently/ All the time	
Sweden	Yes	Yes	Yes	Yes	No	No	No	No		18	18	Operations manager, Traffic Management	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes		No	No	Yes	No	Yes	No	Yes	No	Yes	Cities / municipalities	Major	Major	Minor	Major	Major	Major	Major	Minor		Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Never	Sometimes/ Occasionally	Frequently/ All the time	Frequently/ All the time	
UK	No	No	No	Yes	No	No	No	No		12	8	Project Sponsor for the Collaborative Traffic Management Programme of works	Yes	Yes	Yes	Yes		Yes	Yes	No	Yes	Yes		No	No	Yes	Yes	Yes	No	No	Yes	No		Major	Minor	Minor	Minor	Major	Minor	Not Important	Minor		Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	
Austria	No	Yes	No	Yes	Yes	No	No	No		12	5	Expert on strategic traffic management and information	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Major	Minor	Not Important	Minor	Majo	Major	Minor	Minor		Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Never	Sometimes/ Occasionally	Frequently/ All the time	Frequently/ All the time	traffic lights for tunnel control
Denmark	Yes	Yes	Yes	Yes	No	Yes	Yes	No		21	5	Project Manager	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes		No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes		Major	Major	Minor	Minor	Major	Major	Minor	Not Important		Frequently/ All the time	Sometimes/ Occasionally	Frequently/ All the time	Sometimes/ Occasionally	Never	Frequently/ All the time	Frequently/ All the time	
Netherlands	Yes	Yes	Yes	Yes	No	Yes	No	No		27	2	Senior advisor	Yes	Yes	No	No		Yes	Yes	Yes	Yes	Yes		No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	PARTNERS TO BE INVOLVED DEPEND ON THE TYPE OF INM (E.G. IS IT CROSS BORDER ON MOTORWAYS, OR IS IT IN AN URBAN ENVIRONMENT?).	Major	Minor	Not Important	Minor	Major	Major	Minor	Not Important		Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Frequently/ All the time	Tidal Flow, Traffic Lights

ANNEX C: INM Case Studies Reported

C1: Case Studies: General

country		Country/ Region implemented	Problems tackled:	Objectives to be reached:	Network deployment scale (urban, motorway, multi- modal)
Norway		Norway	Congestion, environment		urban
Finland		Finland	Unintegrated and low-usability/availablity control tools	Proactive coordinated traffic management for improved safety and efficiency	national multimodal
Finland		Finland	Uncordinated and inefficient incident management	Improved safety, efficiency and network operation via better coordination of stakeholder actions	All
Norway		NorwayOslo Region	Incidents, congestions	Traffic effeiciency/safety	Motorway/urban
Norway		Norway	Incidents, congestion	Safety, efficiency	Urban motorways
Iceland					
Austria	Project Carbotraf	Graz, Styria, Austria	Reduction of traffic emissions by traveller routing information to select a low-emission "eco" route	reductions of total traffic emissions , improvement of local urban air quality at 2 major urban/interurban routes	urban - motorway
Hungary					
Estonia		Estonia/Latvia	Planning of Funding before design works	Cross-boarder benefits	Cross-regional
Cyprus					
Luxembourg					
Lithuania		Lithuania			national roads, multi-modal
Slovenia		slovenia	no info about rerouting	informing the users SLO-Italy	motorway
Switzerland		Switzerland "Truckinfo.ch"	Protection Alpine Region from negative effects of HGV through trafic	Capacity restrictions for HGV	multi-modal (railway alp-transit for HGV)
Switzerland		Switzerland "Dynamic Routing parking facilities Basel"	Parking gudance at Basel	Best access for exhibitors and visitors	urban, motorway, multi-modal, intermodal
Switzerland		Dynamic routing Lugano „Infoviabilità	High traffic volume and specific geographical situation of Lugano need stabilization of traffic flow in case of overloading or incidents (on primary distributors), tunnel closing and great events in downtown of Lugano	Optimizing traffic control, parking guidance and roadside routing	Urban, motorway, multi-modal
Austria	Traffic Information Austria	Austria	variety of services (diversity), regional/not integrated coverage,various databases,mono modality, quality	Hormonization of Traffic Information, Intermodal End User Services	multi-modal
Sweden		Stockholm	Congestion, incidents	Decreased travel time, better safety	Motorways and streets in metropolitan area
UK		UK - M25/South East	Congestion hot spots	Smoother Traffic, less queues	Motorway to nearby urban network
Austria	Traffic Control System Salzburg	Conurbation of Salzburg	Regarding the region of Salzburg, two straight-lined motorways (T-form) have to handle local, transit and holiday traffic. There is no beltway and no high-ranking ring-road, the density of junctions / exits along the straight-lined motorway is very high. Furthermore the City of Salzburg has some traffic restrictions depending on the weather situation, for events and shopping centres there are special concepts for the parking areas available. In order to solve / improve the traffic problems on the motorway it is necessary to consider city traffic restrictions and concepts.	During the planning phase of the new Line Control System on the motorways in Salzburg there was a consideration of how ITS on the motorway could support / improve traffic management & information for the whole network (not motorway only). The decision was to construct & deploy several vms info screens additionally to the LCS in order to display relevant traffic information for motorways, city of Salzburg, Exhibition centre, stadion, shopping centre, designer outlet centre	Urban and motorway: Smart traffic and parking management (based on information using road side telematics infrastructure)
Denmark	Strategic traffic management in East Jutland / Aarhus area	Denmark, East Jutland / Aarhus area	Reducing negative effects from congestion, Need for better use of the infrastructure and the transport system, Need for more coordination regarding road works, traffic information and incidents	Road authorities and the police representing the major road network in the Østjylland area signed a framework agreement defining issues of common interest regarding traffic management in 2009. The main goals are better use of the infrastructure and the transport system by better information for road users, reduction of congestion, better traffic safety, coordination of road works across road authorities, better handling of incidents and events in cooperation with the police and road authorities.	Motorway and urban. Covering an area about 70 x 100 km with more than 800.000 inhabitants. The biggest cities are Aarhus (260.000 inhabitants), Randers (61.000) and Horsens (56.000). Østjyske Motorway (E45): AADT up to 72.000 veh/day.
Netherlands	Cooperative ITS Corridor	Netherlands, Germany and Austria along the corridor from Rotterdam via Frankfurt to Vienna	Main problems to be tackled are incidents associated with work zones and retrieving probe vehicle data from vehicles. This in the context of deploying first C-ITS services on an international scale to improve safety and efficiency with a minimal impact on the environment	o solving the "chicken-egg" problem between road operators and OEMs where both are reluctant to invest in C-ITS without knowing if the other stakeholder is also committed. o standardized and interoperable deployment of the C-ITS services Road Works Warning (RWW) and Probe Vehicle Data (PVD) in three countries o achieve effective coordination and collaboration among road authorities, the automotive sector and other providers of C-ITS o serve as starting point for extended deployment, both in terms of regions/countries and functionality (more services)	predominantly on motorways and concerning both heavy and light vehicles.
Netherlands	Incident Management in The Netherlands	The Netherlands	IM entails the consultation of all parties and bodies involved in traffic flow on the principal road network to create support and agreement (voluntarily) to accelerate the clearing of the road following an accident or incident whereby each party participates on the basis of its own role and responsibility.	Incident Management aims to limit the societal costs (costs of traffic jams) due to incidents on roads by making (task) agreements with all those involved so that the length of time needed to clear the accident is minimised, taking account of help for casualties and proper investigation in relation to determining party responsible for causing the accident.	Incident Management on the principal road network (mainly motorways).
Netherlands	National Datawarehouse for Traffic Information	The Netherlands	The main purpose of NDW is to organise easy access to traffic data and the shared use of this data by road authorities en private service providers. Road authorities use this data for conducting optimal traffic management. Private service providers use this data for providing traffic information services to road users. Both resulting in less congestion, lower emissions of CO2 and other pollutants and improved safety. NDW was established at the end of 2007. At present, 24 public authorities have joined this alliance. Together, they are generating many terabytes of data collected from thousands of kilometres of national, provincial and municipal roads.	o Less congestion, lower emissions and improved safety By better real-time traffic information for road users both pre- and on trip. By efficient and effective traffic- and networkmanagement on a local, regional and nation wide scale By better planning and evaluation of traffic policy o Appropriate and effective actions during incidents and crisis situations on or near roads o Open data providing traffic data as 'open data' easy accessible and without conditions contributing to innovation and governmental transparency o Efficiency By providing a shared data portal By operating as a shared service organization for data purchase, maintenance, quality services and standardization	NDW collects traffic data on all motorways, main rural roads and main city roads in the Netherlands
Netherlands	Practical Trial Amsterdam	Amsterdam	The main problems tackled are the traffic problems (delays) on the motorways around Amsterdam, on the main roads in to the city and on the main roads of the Province of North-Holland. Main purpose of the project is to gain insight and practical experiences in development and application of Integrated Network Management. This includes the cooperation of several road authorities as well as the cooperation with private industries en universities. The results are intended as basis for nationwide applications.	o Testing the possibilities to contribute to the policy objectives of the national and regional authorities by applying coordinated network-wide traffic management in the region of Amsterdam. This is realised by: Ξ Applying in a coordinated way the traffic management measures of the motorways and rural and city roads. Ξ Providing actual traffic information to road users (in-car). o Gaining insight and experiences with coordinated network-wide traffic management and the way road users adapt their behaviour by a combined use of road side equipment and dynamic navigation systems and/or other in-car information means. o Conclude on the applicability of the approach in other situations/regions; also on the basis of gained insights in applicability; cost-effectiveness; efficiency; user-acceptance and the cooperation between road authorities. Expected results of the project are: o A technical stable, operational PPA traffic management concept o Positive effects on the traffic (less delays) o Positive perspective for further applications outside the region (positive cost-benefit) o Positive effects on the cooperation between public, private and knowledge organisations. More concrete this means gaining insight and experience in: o The working and effects of Coordinated Network-wide Traffic Management and In-car. o The behaviour and acceptance of road users o Possible applications outside the region in The Netherlands or abroad	PPA involves the motorways, main rural roads and main city roads in the region of Amsterdam and surrounding. The results are intended as examples for application in the whole of The Netherlands.

C2: Case Studies Statistics

		INM Case Studies	Scope of deployment across						Level of integration			Strategies:			Measures:		Current level of deployment			
country		**Country/ Region implemented**	**Cross- borders**	**National level**	**Motorways**	**Transport modes**	**Regions**	**Urban/ interurban**	**Single network management**	**Communication/ information exchange between systems**	**Totally integrated network management**	**Traffic information**	**Traffic management**	**Combined traffic information and traffic management**	**Traveller information**	**Traffic control**	**Study and concept**	**Under development**	**Initial testing and deployment**	**Full deployment and operation**
Norway		Norway	No	Yes	No	No	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	No	No
Finland		Finland	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Finland		Finland	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	No	Yes
Norway		NorwayOslo Region	No	No	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	No	No	No	Yes
Norway		Norway	No	No	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes
Iceland			No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Austria	Project Carbotraf	Graz, Styria, Austria	No	No	Yes	No	No	Yes	No	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes	No
Hungary			No	Yes	No	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No	Yes	No	No
Estonia		Estonia/Latvia	Yes	Yes	No	No	Yes	No	Yes	Yes	No	Yes	No	No	Yes	No	No	No	No	Yes
Cyprus			No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Luxembourg			No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Lithuania		Lithuania	No	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Slovenia		slovenia	Yes	No	No	No	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	Yes
Switzerland		Switzerland "Truckinfo.ch"	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes
Switzerland		Switzerland "Dynamic Routing parking facilities Basel"	Yes	No	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes
witzerland		Dynamic routing Lugano „Infoviabilità	No	No	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No
Austria	Traffic Information Austria	Austria	No	Yes	Yes	Yes	No	No	No	Yes	No	Yes	No	No	Yes	No	No	No	No	Yes
Sweden		Stockholm	No	No	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes
UK		UK - M25/South East	No	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Austria	Traffic Control System Salzburg	Conurbation of Salzburg	No	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Denmark	Strategic traffic management in East Jutland / Aarhus area	Denmark, East Jutland / Aarhus area	No	No	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	Yes	No	Yes
Netherlands	Cooperative ITS Corridor	Rotterdam via Frankfurt to Vienna	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	No	No	Yes	No	Yes	Yes	Yes	No
Netherlands	Incident Management in The Netherlands	The Netherlands	No	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes
Netherlands	National Datawarehouse for Traffic Information	The Netherlands	No	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	No	No	No	No	Yes
Netherlands	Practical Trial Amsterdam	Amsterdam	No	No	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No

C3: Case Studies Services Description

		INM Case Studies	Description of service(s)		
country		**Country/ Region implemented**	**Coverage:**	**Date of implementation:**	**Technical equipment packages:**
Norway		Norway			
Finland		Finland	Comprehensive over all networks	31 August 2015 and gradual extension until end 2018	All levels of technology, incl. highly modern top layer of IT and automation; the nucleus is the T-LOIK integrated technical and user interface IT system
Finland		Finland	The whole network	2010	Not really technology, more instituional cooperation
Norway		NorwayOslo Region	Urban area	Developed early 1990's	Varaible Message Signs, Cameras, Lane Controls, rescue services, Traffic control centre
Norway		Norway	The Oslo Area	Developed extensively since early 1990's	Traffic surveillance, lane Control, VMS, travel time in real tinme, traffic information services, resque services
Iceland					
Austria	Project Carbotraf	Graz, Styria, Austria	two motorway exits into the city of Graz, two major urban corridors in the city of Graz	Nov. 2014 - Feb. 2015	-roadside: 1x mobile VMS, 4x bluetooth journey time measurement, (every junction in urban network)x traffic flow measurement from traffic light induction loops, 2x roadside and 1x background air quality measurement units, 3x traffic average speed and vehicle acceleration sensors -ICT: offline traffic micro simulation for "emission scenario database" as a basis for traffic operator decision support, 2x web-based user interfaces at urban traffic control and motorway traffic management centres
Hungary					
Estonia		Estonia/Latvia	Eliminationg the infrastructure barriers on all-round development of border areas. reconstruction of Estonian latvian boarder roads (Estonia)Karksi-Nuia-Lilli-(Latvia) Rujena, Konija and seda river (Latvia) http://www.mnt.ee/index.php?id=13058	09.04.2010-08.01.2012	ERDF 85% 2715568,61 EUR, total budget 3194786,60 EUR
Cyprus					
Luxembourg					
Lithuania		Lithuania	National roads, urban roads, multi-modal	2011-09-30; 2015-07-20	
Slovenia		slovenia	Kozina (SLO) - Palmanova (I)	2008	Improve cooperation in traffic monitoring Operational cooperation in traffic management Safeguard continuity in tactical traffic management Levels of quality of travel information services Assessment and evaluation of results
Switzerland		Switzerland "truckinfo.ch"	Information for national motorways and adjacent countries	2002	Internet service with real timeinformation and guidance for HGV
Switzerland		Switzerland "Dynamic Routing parking facilities Basel"	Dynamic parking routing on 2 Motorway exits	2008	Variable message signs, prismatic variable signs, road side equipment for parking guidance and mobile equipment (orange arrows)
Switzerland		Dynamic routing Lugano „Infoviabilità	Lugano region	2012	Traffic detection, variable message signs (LED), prismatic variable signs, dynamic route panels, traffic control devices, system integration urban and motorway and tunnel management
Austria	Traffic Information Austria	Austria	national, Multi modal door to door routing and additional traffic Information (parking and park+ride possibilities, short term parking areas, public Transport timetables, POIs,...)	December 2013; since then a variety of end user Services went public	(?) COTS Hardware+Network, Virtualized; individual Software Solutions, partially relying on Standard Software (i.e. Geoserver); specified Interfaces (some following Standards, others individual)
Sweden		Stockholm	Metropolitan area of Stockholm, motorways and main street network	Don't remember exactly, somewhere between 2000 and 2003.	
UK		UK - M25/South East			
Austria	Traffic Control System Salzburg	Conurbation of Salzburg	Routing Service for all Austria (all roads, railroad network), Traffic messages for all Austria, real time Travel Information service (traffic situation - LoS) for motorways, national roads, urban roads in Vienna and Graz, national roads in federal provinces Lower Austria and Upper Austria	March 2015	LCS, VMS
Denmark	Strategic traffic management in East Jutland / Aarhus area	Denmark, East Jutland / Aarhus area	Coverage: Major roads in the area across road authorities, public transport, bikes and ferries	2010-2015	Webpage and app
Netherlands	Cooperative ITS Corridor	Netherlands, Germany and Austria along the corridor from Rotterdam via Frankfurt to Vienna	The two C-ITS services to be deployed by 2016 are Road Works Warning (RWW) and Probe Vehicle Data (PVD) and the coverage is along the complete corridor.		In the Cooperative ITS Corridor two C-ITS services based on wireless exchange of information via WiFi 802.11p will be deployed. There is also an added functionality of exchanging information via long range telecommunications
Netherlands	Incident Management in The Netherlands	The Netherlands	Following the Plan of Action to implement the recommendations contained in the report 'Low congestion traffic control' (Ministry of Transport, Public Works and Water Management, 1995) four pilot projects were carried out in 1996 and 1997 to prepare for nationwide implementation, which laid the foundation for the introduction of the current national regulations.	1997	National car regulations In the Netherlands all cars must be third-party insured at least. This third-party insurance also covers recompense for primary emergency salvage following an accident. Salvage assistance is also a private matter that the insurers have incorporated within the emergency centres, which take care of the deployment of salvage companies and settlement of costs. The emergency centres are represented in the Association for Incident Management Nederland (SIMN), which tenders regional permits for the salvage companies every three years. This association is also responsible for the execution and quality of the primary salvage and regional distribution as well as for the organisation of the central emergency room. National truck regulations In the Netherlands most trucks are not insured for emergency salvage, hence the repeated incidents that occur on the Dutch principal road network whereby one or more trucks fully or partly block the road. Studies have shown that the centrally coordinated deployment of material and personnel along with a direct approach from the owners/holders of the trucks involved in incidents on the principal road network can significantly accelerate the process of clearing the incident and limit traffic-jam costs. This has resulted in the foundation of Stimva, the incident management association for trucks. For example, the breakdown of a truck due to a broken axle or flat tyre attracts the attention of the other traffic and quickly leads to a traffic jam. The vehicle's repair often requires an additional lane to be closed off for safety reasons. Stimva, a partnership between the Association of Insurers, the TLN, EVO and KNV industry associations and Rijkswaterstaat, has declared its willingness to take responsibility for setting up and operating a central emergency room for truck salvage on the principal road network and for the deployment of IM experts. The salvage companies deployed for heavy salvage by Rijkswaterstaat are contracted on the basis of industry requirements and criteria. Rijkswaterstaat dictates the pricing for this work, sending a specification of the selected heavy salvage companies to the CMV along with agreed fees. The CMV coordinates the deployment and settles the costs with the vehicle owners. Right of retention applies to heavy salvage. For both the car and truck regulations nationwide central emergency rooms have been established. These emergency rooms receive notifications from the respective police emergency rooms or highways authorities and immediately deploy a contracted salvage company. For the truck regulation an IM expert is also deployed at the same time and regional traffic centres are informed of this action.
Netherlands	National Datawarehouse for Traffic Information	The Netherlands	nation wide scale	Since 2008 and ongoing	Services: o real-time traffic data covering flow, speed and travel time o status data covering traffic reports on incidents, accidents, congestion, planned and real-time road works, opening and closure of bridges and rush hour lanes o Historical data
Netherlands	Practical Trial Amsterdam	Amsterdam	With PPA this is the region of Amsterdam and surrounding. The results are aimed to be applicable nationwide (and abroad).	The PPA trials last until the end of 2017. First phase is almost finalised, second phase last until April 2016, third phase until end of 2017.	PPA uses: Ramp metering system, Traffic light control systems, loop detectors, advanced (newly developed) algorithms for coordinated traffic management, in-car systems, advanced central systems of the private partners to provide traffic services, Floating Car Data.

C4: Key factors and lessons learned

		INM Case Studies	Key factors and lessons learned:		
country		**Country/ Region implemented**	**Problems encountered:**	**Solutions made:**	**Success factors:**
Norway		Norway			
Finland		Finland	High costs of maintaining and developing silo systems and black box systems, low usability and availability of them	Full integration and agile approach on development	NRA strong insight and leadership, ability to make agile decision
Finland		Finland	Rigid institutional boundaries	national cooperation model, instructions, common incident management drills, working at common premises with all major stakeholders	Awareness of considerable mutual benefits despite the minimal costs
Norway		NorwayOslo Region	Non particular	Non particular	
Norway		Norway			
Iceland					
Austria	Project Carbotraf	Graz, Styria, Austria	-Driver compliance rate to VMS routing advice a-priory unknown. assessment of results indicate a low compliance rate to eco-route advice of 2% -offline traffic micro simulation approach for "emission scenario database" is too complex for use in active traffic management	built-in flexibility of system to reconfigure to the observed traveller compliance rate user interface adaptable to the needed of urban and motorway traffic management centres	Close cooperation and communication with all stakeholders, frequent meetings, workshops
Hungary					
Estonia		Estonia/Latvia	No larger problems occurred.	Joint cooperation planning phase has high importance for future implementations.	Joint funding from EU funds.
Cyprus					
Luxembourg					
Lithuania		Lithuania	Legislation problems, information exchange between institutions	standard solutions for data exchange used (datexII)	
Slovenia		slovenia	the was no unique info for the drivers whic are driving between Ljubljana and Palmanova	coordinated VMS signs; coordinated informations; coordinated TMP	more flowing traffic
Switzerland		Switzerland "truckinfo.ch"	Protection of the Alpine region from negative effects of HGV through traffic. Constitu-tional article accepted by the electorate and cantons on 20.2.1994.	Rerouting HGV and guidance to free parking facilities by traffic information, variable message displays and traffic regulation installations	adequate parking facilities, intenational information exchange
Switzerland		Switzerland "Dynamic Routing parking facilities Basel"	Basel is high frequented city for trade fairs. Traffic volume increase important on road network, which has spatial restrictions.	Traveller Information (on road and via radio), dynamic parking guidance, manual traffic control (police) as support, bus shuttle from and to additional temporary places,	close cooperation and communication with all stakeholders
Switzerland		Dynamic routing Lugano „Infoviabilità	High traffic volume and specific geographical situation of Lugano need stabilization of traffic flow in case of overloading or incidents (on primary distributors), tunnel closing and great events in downtown of Lugano	Congestion warning, dynamic route guiding with VMS on motorway and urban streets, program modification by traffic lights on urban streets, event information in combination with traffic information and routing proposals (f. e. park and ride)	
Austria	Traffic Information Austria	Austria	* large Project, lots of stakeholders; varying interests * technical challenges * strategic challenges	* open and frequent communication (frequent steering comittees) * Definition of common Goals and Vision	* bringing together all relevant infrastructure and traffic Information providers * common Goal, early testing phases * Promotion and Support by federal ministry * individuals
Sweden		Stockholm			
UK		UK - M25/South East	Political disagreements, lack of system-to-system compatability	Memoranda of understanding, changes to common technical specifications	Recuctions in customer complaints, measured improvements in jounrey times.
Austria	Traffic Control System Salzburg	Conurbation of Salzburg	different wishes between partners, financing (invest for deployment), operation (who is responsible for waht, who has to pay costs for operation and maintenance, who can order which scenarios	sharing of investment costs for deployment, common development and coordination of an operating concept, operation: TMC of motorway operator, police is allowed to order control scenarios (including urban roads), other parnter can order information scenarios, maintenance: responsible is motorway operator	concentration of common optimum instead of local optimum, shared benefit (not money, but info), shared costs
Denmark	Strategic traffic management in East Jutland / Aarhus area	Denmark, East Jutland / Aarhus area	The partners have different approaches, varying degrees of traffic problems and various possibilities for financing of new initiatives, Lack of funding for "normal" data collection and implementation of ITS systems with e.g. VMS.	A framework agreement that ensures both development and fair financing of common solutions and solutions that only some of the partners want, Web and app based solutions reduce the costs for development and maintenance and is easier to adapt to changes in the road users needs.	Solutions that are useful for road users, Better coordination of activities among the partners and cost effective common solutions.
Netherlands	Cooperative ITS Corridor	Netherlands, Germany and Austria along the corridor from Rotterdam via Frankfurt to Vienna	The Cooperative ITS Corridor project is still in an early phase; it is too early to identify already the lessons learned.		
Netherlands	Incident Management in The Netherlands	The Netherlands	1. Different arrangements for incident management at different levels. 2. Lack of balance between the need for investigation, ensuring the safety of the incident location and the need to get traffic running again. 3. Not enough qualified road authority officials: people from the road authorities were not taken seriously by officials from the police, the fire brigade and the ambulance services.	1. Organize traffic management on a national level with the different partners: road authorities (national, regional and local), emergency services, insurance companies etc. and make national traffic management arrangements, rules and regulations. 2. Investment in number and quality of road inspectors: road authorities ears and eyes on the road and well trained to play an important role at the incident scene.	1. Measuring, showing and communicating the progress: for example road inspectors are now taking over police tasks because road users trust them and are happy with the service. 2. Reserving sufficient budget for incident management: of course this must be based on showing concrete results!
Netherlands	National Datawarehouse for Traffic Information	The Netherlands	1. Cooperation of different road authorities e.g.different levels of involvement of the partners, value for money, long term engagement 2. Requirement of standardization and uniformity of the data 3. Difficult to develop profitable traffic information services for private sector	Solutions made for 1: 1. Offer flexibility by creating 'packages' that meet the different needs of the partners e.g. the option to join NDW only for data on roadwork at lower costs; 2. a framework agreement for data procurement that enables customized tenders plus the option for partners to make their own arrangements for collecting the data; 3. a financial contribution for the organization and systems based on the services required (packages) and the number of inhabitants instead of volume of data in the database (excluding the costs for data procurement) Solutions made for 2: 1. Invest in support and involvement of the stakeholders (working groups, bilateral contacts, facts about necessity) 2. Make things easy: give support by implementation, make toolboxes etc.. 3. Allow different quality levels of data and invest in making these differences visible for the recipients of data Solutions made for 3: 1. Make the data available as open data, so there are no costs involved for the private parties	1. Create flexibility and give room to different needs of different road authorities 2. Invest in support and involvement of the stakeholders when changes have to be made in their processes or organization for the higher goal of (inter)national cooperation and standardization.
Netherlands	Practical Trial Amsterdam	Amsterdam	⊏ Cooperation between different road authorities at strategic, tactical and operational level. ⊏ From academic ideas to practical trials on the road and in the car. The private ITS suppliers involved had difficulties to understand and implement the conceptual ideas from the academic world. ⊏ The existing traffic management systems where not performing / operational as expected. ⊏ The traffic flows are much more divers than expected. There was a lack of insight in where the main traffic streams where (origin-destination information). It is crucial to know this in an integrated network approach.	⊏ Strong and continuous involvement of the different public and private partners at all levels (working groups, development activities, project team, steering group) plus many bilateral contacts. ⊏ The academic world has been involved in detail in cooperation with the ITS suppliers in designing, testing and evaluating the results. With a continuous feedback for corrections en improvements. ⊏ Operating the existing traffic management systems at the existing Service level agreements is the responsibility of the different partners. In Phase 1 these unexpected problems where encountered during test phase (much too late). In later phases this is the first priority: first a correct operational basis of existing systems and only applying new developments. ⊏ Experience in phase 1 showed the large diversity in traffic streams. In phase 2 PPA will try to get a better insight in these streams by off-line (and possibly on-line) analysis of Floating Car Data.	⊏ Informing each other about the goals and objectives of ach of the partners and respecting this. Treating each other as equal partners. ⊏ Sticking to a hard deadline. The opening of a new tunnel was such a hard deadline, after opening the evaluation would have been useless. This strongly helped to get the system in phase 1 up and running in time. ⊏ Ensure that the basis is ok, not only on paper, but really measure the quality and bring it up to the agreed Service Level Agreement. ⊏ Not yet known, but the use of FCD might give here sufficient insights.

C5: Impacts and Key Assessments

		INM Case Studies	Stakeholders				
country		**Country/ Region implemented**	**Stakeholders involved and regulatory/ cooperation frameworks, if any:**	**Impacts/ Assessment: Experiences, benefits and benchmarking of outputs and outcomes, when available:**	**Future expansions and developments:**	**Recommendations for transferability:**	**Further remarks or suggestions:**
Norway		Norway					
Finland		Finland	road authorities (national and urban), rescue (112, fire brigade), police, public transport operators, maintenance	Not yet available	Continuous agile developments enabled and expected	Full preparedness for sharing tool, information, results etc	
Finland		Finland	NRA, Police, 112, fire brigade, maintenance contractors, towing companies, cities and municapalities	Much quicker reactions in incident manegement, faster information chain, better situational awareness - all leading to improved safety and efficiency	Continuous development, special targets/locations such as tunnels, searching for low hanging fruit	Fully transferable	
Norway		NorwayOslo Region	Local authorities Traffic management centres	It's an ongoing process based on experience.	Short term traffic prognosis/prediction	Open data	
Norway		Norway	Local, regional and national authorities, Traffic management centers. Public transport administrations	No comprehensive evaluation is performed	Enhanced traffic monitoring, short term traffic prognosis/prediction, better decision Control systems		
Iceland							No case studies available in this field.
Austria	Project Carbotraf	Graz, Styria, Austria	+Regional air quality department of styrian government +Urban traffic authorities +Local traffic police +motorway operator/authority	effective network wide emission reduction of max. 3% during peak traffic hours. effective max.local emission reduction (at junctions) 10%. (based on modelled emissions from measured impact on traffic)	use of simpler (real-time capable) models as a basis for active traffic management (traffic macro simulation instead of micro simulation) -further investigations on road-side air quality and the dependence on traffic-state likely	implementation of open standards and interfaces highly recommended, in the case of this project UTMC was used.	guidelines for VMS design of "eco" - routing messages is missing
Hungary							
Estonia		Estonia/Latvia	Cross-boarder national authorities, local municipalities under Est-Lat cooperation project	European cross-boarder cooperation for implementing safer road network.			
Cyprus							
Luxembourg							
Lithuania		Lithuania			VMS, average speed control, traffic enforcement system		
Slovenia		slovenia		ex ante avaluation	the same DATEX protokol (DATEX I and II)		
Switzerland		Switzerland "truckinfo.ch"	FEDRO, Cantons, HUPAC	Good experiences for many years concerning operation and acceptance	Co-operation with neighbouring countries is under consideration	Truckinfo-application has transferability generally. System can work nationalwide or international.	Input to "truckinfo" requested frrom neighbouring countries
Switzerland		Switzerland "Dynamic Routing parking facilities Basel"	Canton Basel Stadt, police, MCH Messe Basel, Basler Verkehrs-Betriebe	Good experiences for many years concerning operation and acceptance	not planned	functally transferable	none
Switzerland		Dynamic routing Lugano „Infoviabilità	Local authority Lugano, canton Tessin, police, public transport agency		integration in TM-CH		
Austria	Traffic Information Austria	Austria		* full functional end user Services; intermodal door-to-door Routing Service for all of Austria * powerful backend: various Options to plug new frontends (Apps, Web Applications,...) * about 17 end user Services (Apps, Web Applications) and the number is growing * more than 2 mio Routing requests per month and the number is growing	* further stabilizing * cross-border Areas * even higher density of traffic Information * even higher density of realtime Information (public Transport, LOS on road Network) * functional enhancements		
Sweden		Stockholm	City of Stockholm, Swedish Transport Administration		Development of a short term traffic prediction tool.	Don't underestimate the time and efforts to come to an agreement with other parties.	
UK		UK - M25/South East	Highways England, Surrey County Council, Transport for London,Kent County Council, Hertfordhsire County Council		Wider South East of England network		
Austria	Traffic Control System Salzburg	Conurbation of Salzburg	motorway operator, municipality of Salzburg, traffic police, event companies, privat companies	not available at the moment	none	not availabel at the moment	
Denmark	Strategic traffic management in East Jutland / Aarhus area	Denmark, East Jutland / Aarhus area	Danish Road Directorate (DRD), Østjyllands Police, 10 municipalities and 2 public transport companies. The public transport companies only provide input to the web page and don't participate in the working or steering group.	The Østjylland traffic information app was launched in April 2014 and has been downloaded 7.290 times, The Østjylland traffic information web site has an average of 10.100 unique users every month with a peak in winter months about 22.800, The winter app that covers the whole of Denmark was launched in October 2013 and has been downloaded 80.200 times, The total annual cost for operation and minor adjustments of the web page and app is approx. 30-35,000 €, The involved partners experience that road users get a better service, and that it has become easier to coordinate different activities	In 2015 DRD is working on a tender regarding acquisition of GPS-based real time traffic. The data will be used to obtain a better knowledge of the traffic situation and of extraordinary congestion. It is expected to give road users better traffic information, improve incident management and hence improve traffic flow. The level of ITS-implementation regarding VMS in the area is very low. There has also been carried out studies regarding more data collection and different ways of providing real time information on the motorways, and the major roads towards/in Randers and Aarhus. Further actions have to be decided and funded	Coordination of road works between NRA and other road authorities, Development of apps providing road users with real time traffic information as an alternative or supplement to information on VMS. The development and maintenance of apps can be coordinated nationwide, Better coordination regarding handling of incidents and big events, Initially strategic consensus among the involved partners on a high level.	There are also similar activities in 3 other areas in Denmark with variations in level of traffic and ITS-implementation (e.g. variable speed signs, queue warning, travel times and HSR trial) and the number and kind of involved partners. The 3 other web portals can be seen here: http://www.vejdirektoratet.dk/da/trafik/regional%20trafik/sider/default.aspx
Netherlands	Cooperative ITS Corridor	Netherlands, Germany and Austria along the corridor from Rotterdam via Frankfurt to Vienna	Core stakeholders are the three national Ministries of transportation (Netherlands, Germany and Austria), the BAST, Hessen Mobil, ASFINAG and Rijkswaterstaat.	Not available yet	Cooperation with other countries and regions is anticipated	The Cooperative ITS Corridor aims at a close cooperation with national and international stakeholders in order to exchange as much as possible existing knowledge and experiences. Results, when available, will also be disseminated at (inter)national conferences.	
Netherlands	Incident Management in The Netherlands	The Netherlands	Organisationally, Incident Management is a special phenomenon since it is not one organisation alone that shapes IM; cooperation among different organisations is essential. The organisations involved in Incident Management are both public – the police (including the national police force (KLPD) and regional police, Rijkswaterstaat, the fire services, ambulance services, the public prosecutor – and private – the insurers association, transport companies, Transport and Logistics Nederland (TLN), the KNV and EVO transport associations, salvage industry associations, damage experts, emergency centre services and breakdown services (ANWB/Bovag/VACO).	In 2002 Berenschot undertook a study of the effects of IM on the principal road network, concluding that IM significantly reduces societal costs caused by traffic jams (some 15 minutes' gain in time per incident involving cars and approx. 60-90 minutes in incidents involving trucks) resulting in an estimated 25% less in the costs of traffic jams caused by accidents (around €150 million p/a). This report now provides the basis for an examination of further IM improvements to reduce these societal costs even further. In 2003 Berenschot took a snapshot. This revealed that the results were still being gained and even bettered while snapshots from 2006 and 2008 showed that accidents were being dealt with in an even shorter time. In 2008 the joint partners expressed a desire to reduce incident duration by a further 25% by 2015 through better cooperation and measures.	Package 21 (Incident Management) of the Mobility initiative is currently being undertaken by the Ministry of Infrastructure and the Environment. This package contains measures like Stand-by Salvage at Hotspots during rush hour, improving incident-related information, improving multidisciplinary cooperation, sharing real-time information among partners, accelerating technical investigation by the police and nationwide roll-out of the motorbike mobile highways inspector.	Much knowledge and experience is available in The Netherlands, also in English and the Dutch authorities are more than willing to support and cooperate internationally.	
Netherlands	National Datawarehouse for Traffic Information	The Netherlands	The initiator of the NDW is the Ministry of Infrastructure and Environment together with 18 local and regional road authorities. Meanwhile the alliance has expanded to 24 road authorities including the national road authority, all provincial road authorities and the major cities in the Netherlands All partners contribute to the cooperation both in a financial and a governmental way. Private service providers are very welcome to use the NDW-data. They can chose between using the 'open data portal'(free of use and without conditions) or using the NDW production portal for which terms of use are applicable. NDW-data is being used by more than 50 private service providers.	NDW was evaluated in 2013 and based on that the decision was made to continue NDW in all its objectives	The main objectives for 2015 are o providing traffic data service as stated in t he NDW partner agreement o exploration of combining NDW with NDOV/GOVI. NDOV/GOVI provide real-time public transport information in the Netherlands o improvement of quality of data o Improvement of quality of services o intensify the use of data (more users, more applications, more traffic information service etc) o unlock big data applications, stimulation of research o improvement of the use of the open data portal	NDW is a unique alliance in Europe. Via different international opportunities NDW provides information on establishing and the benefits of this cooperation between governments and private service providers. Trough collaboration within EIP NDW contributes to establishing international standards for dataexchange, quality measurement and assessment methods. NDW maintains close contacts with the German Mobility Data Marketplace for future developments.	
Netherlands	Practical Trial Amsterdam	Amsterdam	The initiator is the Ministry of Infrastructure and Environment. Road authorities involved are: o Rijkswaterstaat o Gemeente Amsterdam o Provincie Noord-Holland o Stadsregio Amsterdam o Gemeente Zaanstad They operate in close cooperation and each carries the costs of their own expenses. Other parties involved (mainly on a contractual basis from PPA): o Universities (Delft, Eindhoven, Amsterdam) o ITS suppliers (Technolution, Vialis, IT&T, Fileradar, Ziut, VID, ARS, TNO, Siemens, TomTom) o Consultants (Arcadis, Twijnstra-Gudde, Arane, MARCEL). o At European level (ERTICO, CEDR, USA (via TRB) and China)	Evaluation is on-going and the results not yet available. First positive results are: o Increased cooperation between road authorities involved o Positive effects of the approach of coordinated traffic management measures o Experience in the acceptance of road users wrt. PPA o Insights in improvements of the PPA concepts o Insight in the possibilities of private organisations wrt. PPA o Several sub-systems ready for operational deployment	PPA approaches the end of the first phase. It is planned to continue with phase 2 and 3 until the end of 2017. Covering larger parts of the Amsterdam region and aiming at a closer integration/cooperation of public and private organisations. The results are aimed to form the basis for nationwide deployment of coordinated network-wide traffic management.	PPA aims at a close cooperation with national and international stakeholders. First to collect and use as much as possible existing knowledge and experiences and secondly to disseminate the PPA results as wide as possible. Sub-systems of PPA have been transferred already to operational deployment. Further results are aimed to be used national and abroad.	

Ref: CEDR report 2017/01 - Reducing congestion with integrated network management (INM)

ISBN: 979-10-93321-23-3

Conference of European Directors of Roads
Avenue d'Auderghem 22-28
1040 Brussels, Belgium

e-mail : information@cedr.eu
Tel. : + 32 (0) 2 771 2478