This report provides a compilation of the executive summaries in CEDR's Final Reports published under CEDR's Second Strategic Plan. These reports were published in the period 2010-2014. All reports are available in English and French.

With contributions from the following CEDR task groups:

<table>
<thead>
<tr>
<th>Task group</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Costs for maintenance and operation</td>
</tr>
<tr>
<td>2</td>
<td>Networks-Data-Performance Indicators</td>
</tr>
<tr>
<td>7</td>
<td>Wildlife and traffic</td>
</tr>
<tr>
<td>10</td>
<td>Forgiving and self explaining roads</td>
</tr>
<tr>
<td>11</td>
<td>Comparison of Congestion Policies of NRAs</td>
</tr>
<tr>
<td>12</td>
<td>Traffic Management to reduce congestion</td>
</tr>
<tr>
<td>13</td>
<td>Incident &amp; Emergency Management</td>
</tr>
<tr>
<td>14</td>
<td>NRA’s roles in ITS, Easyway, eSafety</td>
</tr>
<tr>
<td>15</td>
<td>Customer orientation of NRAs (ERUS)</td>
</tr>
<tr>
<td>16</td>
<td>Adapting to climate change</td>
</tr>
<tr>
<td>17</td>
<td>Mitigating climate change</td>
</tr>
</tbody>
</table>

Edited and published by: CEDR’s Secretariat

This compilation report is for information purposes only.

Disclosure:
This document expresses solely the current view of CEDR. Readers should not regard these views as a statement of the official position of CEDR’s Member States.
Table of contents

Report on BEXPRAC benchmarking of expenditures and practices of maintenance and operation (2010) ........................................................................................................................... 4

Trans-European road network, TEN-T (Roads): 2011 performance report ......................... 7

Mobility for humans and wildlife – cost-effective ways forward (2012) ............................... 9

Forgiving roadsides design guide (2013) .............................................................................. 11

Comparison of the congestion policies of national road authorities (2012) ....................... 13

Traffic management to reduce congestion (2013) ................................................................. 15

Best practice in European traffic incident management (2012) .......................................... 18

National Road Authorities’ roles in ITS (2014)................................................................... 21

Journey towards customer orientation (2013) .................................................................. 23

Adaptation to climate change (2013) .................................................................................. 26

Mitigating climate change (2014) ...................................................................................... 29

All CEDR reports presented in this document are available for download at the CEDR website: http://www.cedr.fr/home/index.php?id=5
Report on BEXPRAC benchmarking of expenditures and practices of maintenance and operation (2010)

Executive Summary

The national road authorities (NRAs) of 13 European countries launched the BEXPRAC survey (Benchmarking of expenditures and practices of maintenance and operation) in an effort to benchmark the performance of their maintenance and operation (M&O) policies within the framework of the Conference of European Directors of Roads (CEDR). The benchmark was to be completed by sharing figures and best practices. The timeframe was fixed in such a way that the results and the final reports would be delivered in early 2010 at the latest.

This is the first time a survey like BEXPRAC has ever been undertaken by NRAs at international level; some CEDR member states were highly sceptical about the project and decided not to participate.

The participating NRAs sought to:

- obtain references in order to better justify budget allowances;
- ascertain maintainable levels of service and prioritise rules within a given budget;
- obtain references in order to define performance targets;
- improve performance levels by sharing best practices.
To achieve these goals, the participating countries set up a working group for the BEXPRAC project (WG BEXPRAC). A consultant was hired for two main data collection and analysis modules.

1 The macroscopic or macro module with a top-down approach, which sought to:
   • compare the overall costs of operation and maintenance in the participating NRAs;
   • explain some of the differences by comparing the distinctive profiles of the networks and the overall levels of service provided.

2 The microscopic or micro module with a bottom-up approach, which sought to:
   • compare actual performance levels on a limited range of small-scale subsets in some of the countries;
   • identify the best field practices in road maintenance and operation on the basis of the same observations.

Both modules complemented each other. The macro module provided a comprehensive and structured reference framework; the micro module provided clarification and explanations for differences observed at macro level thanks to a fine-tuned comparison of practices. The results will help each NRA to draw up its own policy and strategy and perhaps facilitate future budget negotiations.

The biggest difficulties encountered were missing or incomplete data in some countries, major differences in the expense allocation rules among the task blocks, and the physical allocation of expenses to a stretch of the road network. Nevertheless, CEDR now has at its disposal a significant international database of road M&O expenses, as well as a set of common definitions for the main task blocks and templates to facilitate any future updates.

Even at this very early stage of international benchmarking, it was possible to draw up a model for the expenses related to the main driving factors; the results of the model range from -30% to +40%. It is worth noting that without a model, the expenses per km of highway vary much more significantly, namely from 1 to 20.

The participating countries listed what they defined as their best practice and, in so doing, provided references and clues to other CEDR members.

WG BEXPRAC made proposals on how best to bring forward the results of the project after its completion. It was felt that it would be of little interest to launch a similar survey in the short term because of the existing major differences in accounting and expense allocation practices in the different European countries. More accurate results could only be obtained after intense international harmonisation efforts.

The mutual understanding and the knowledge of the problems acquired by the WG members, as well as the large amount of data collected, should now be taken forward within the framework of CEDR's SP2 strategic task 3 on asset management entitled 'Long-term investments in road infrastructure'. This would guarantee value for money. Furthermore, the results gained through the asset management programmes, which include the life cycle aspect of different kinds of assets, would help explain some of the M&O expenses more accurately.
Even though task 3 on asset management has been postponed for a while, WG BEXPRAC recommends periodically updating the macro module data collected within the framework of BEXPRAC. This exercise would not be very expensive and would provide valuable information on the evolution of expenses for the maintenance and operation of the networks.

Despite all the difficulties encountered, the BEXPRAC project overcame the widespread scepticism mentioned above and delivered results which met nearly all the objectives set for this project.
Executive Summary

This is the second biennial CEDR report on the performance of the trans-European road network, TEN-T (Roads). It shows the state of the art of the TEN-T (Roads) network on 1 January 2011. The 2011 TEN-T (Roads) performance report builds on the previous report to show that it is possible to produce comparable information on the performance of the TEN-T (Roads) network within the majority of CEDR member states.

The 2009 report covered 17 countries and 61% of the TEN-T (Roads) network and a limited number of performance indicators. The 2011 report includes data from 20 countries and covers nearly 78,000 km or 83% of the TEN-T (Roads) network. This network represents the most important roads in Europe. More than two billion vehicle kilometres are driven on this network every day. The number of performance indicators has also increased since the 2009 report.

Discussions with other CEDR groups have continued in order to establish the need for additional performance indicators and the associated base data that can be defined and collected from the CEDR countries.
The following performance indicators are included in the second CEDR performance report:

<table>
<thead>
<tr>
<th>Structure of the network</th>
<th>Performance of the network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Type</td>
<td>Average Traffic Flow</td>
</tr>
<tr>
<td>Number of Lanes</td>
<td>Traffic Density</td>
</tr>
<tr>
<td>Length of Bridges</td>
<td>Proportion of Heavy Goods Vehicles</td>
</tr>
<tr>
<td>Length of Tunnels</td>
<td>Heavy Goods Vehicles Traffic Flow</td>
</tr>
<tr>
<td>Road Environment</td>
<td>Fatal Accident Rate</td>
</tr>
<tr>
<td>ITS and PPP Schemes</td>
<td>Performance of ITS Sections</td>
</tr>
</tbody>
</table>

Definitions of the performance indicators are given in section 7, Appendix 2: BASE DATA DEFINITIONS. Data collected on the extent of tolled sections of the TEN-T (Roads) network have not been included in the report due to a lack of common definitions. It is expected that these issues will be addressed in the next performance report in 2013.

It should be noted that at present, the data for Belgium only covers TEN-T roads in the Walloon region, and the UK data only covers TEN-T roads in England.

As this is the second biennial performance report, and many countries are either participating in the report for the first time or are correcting errors in the data from the previous report, it is not yet possible to thoroughly examine changes or identify trends in the performance of the network. The intention is that this will be possible in future as the process and underpinning data definitions become more stable, and the report seeks to consolidate rather than introduce new indicators.

However, the performance reporting framework will enable member states to provide consistent data about network performance that could enable meaningful comparison of information and benchmarking between member states of CEDR. The work on the 2009 and 2011 performance reports has shown that it is possible to produce a performance report of TEN-T (Roads) within the CEDR member states with a common location referencing system as well as with common data definitions throughout Europe.
Executive Summary

This report, *Mobility for humans and wildlife – cost-effective ways forward* is the outcome of the work of Project Group (PG) Wildlife and Traffic.

The group has worked with two main strategies to identify solutions in order to reduce the impact of infrastructure on biodiversity:

1. Use of the COST 341 Handbook *Wildlife and traffic – A European handbook for identifying conflicts and designing solutions*.
2. Strategic, institutional aspects: best practice in the EU regarding road networks and wildlife.

Based on the analysis of the use of the COST 341 Handbook released in 2003, the PG concludes that the handbook is a good tool for the countries concerned. In order to ensure the usefulness of the handbook, not only now but also in the future, it is necessary to revise it regularly and extend it with new subjects. Furthermore, there is often a need for the European guidelines given in the COST 341 Handbook to be adapted to national conditions.
From the analysis of the strategic, institutional aspects, it seems clear that certain countries have more success in avoiding/reducing ecological fragmentation than others. It has also been noted that national institutional arrangements can explain a great deal of the differences between the countries. The PG concludes that institutional arrangements are of vital importance to some countries' success in reducing ecological fragmentation in a cost-effective manner. Also of importance are the established procedures for interaction within public administrations, especially between the national road administrations (NRAs) and the environmental protection agencies. Over the years, these have led to increased understanding and mutual acceptance. Countries where institutional issues do not seem to be a problem have road administrations that have engaged with or employed ecologists for years and consider ecological connectivity as part of their responsibilities.

Three ways forward are presented. These are:
- the do-nothing scenario (‘business as usual’);
- taking action at national level;
- taking action at national and European level.

The result of the analysis of the three ways forward is that it will be more cost-effective if CEDR assists the NRAs in adapting to a more successful integration of road networks and wildlife than if each country does this alone. The PG therefore recommends the third way forward, i.e. taking action at national and European level. The key factors are coordination, cooperation, and the sharing of knowledge and experience from countries with different natural and political conditions but successful implementation.

The PG has recommended that CEDR help the member states adapt towards a more cost-effective and sustainable way of integrating wildlife and road networks. This can be done by a) facilitating actions at national level in the member states and b) taking the initiative for actions at European level.

The most relevant recommendations from the PG are that CEDR take the initiative to:

A. promote the updating of the COST 341 Handbook;
B. start a research programme for cost-effective mitigation measures. This could be based on EU financing or as part of ERA-NET ROAD;
C. support a European exchange of knowledge through existing international networks;
D. recommend CEDR members to consider actions at national level that lead to success when it comes to cooperation with other stakeholders and spatial planning authorities, as well as cooperation within the NRA as described in this report and in the report from Gifford. The NRAs can choose from the list of factors leading to success, according to the challenges and situation in their country. CEDR could also arrange a seminar for employees from the member states on factors leading to success to avoid continued increased costs due to project delays, reputational damage, and damage to wildlife;
E. deal with environmental items as performance indicators according to the indicators identified by CEDR's PG Performance Indicators; and
F. share knowledge about public private partnerships (PPP) (and other ways of contracting) regarding mitigating measures.
Forgiving roadsides design guide (2013)

Executive Summary
Analyses of fatal road accidents in the European Union show that 45% are single-vehicle accidents. These accidents are primarily classified as run-off-road accidents, where the vehicle leaves the road and enters the roadside.

A roadside is called unforgiving if hazardous objects such as trees are placed at an inappropriate distance from the road so that the risk of severe accidents is increased. The purpose of the ‘forgiving roadside’ concept is to avoid crashes of errant vehicles with potential hazards or to minimise crash consequences.

CEDR has identified the design of forgiving roads as one of the top priorities in its Strategic Plan 2009–2013. For this reason, a specific team dealing with forgiving roadsides was established within CEDR's Technical Group Road Safety (TGRS).

In recent years, several projects have been conducted with a view to producing guidelines to design forgiving roadsides worldwide, and several national standards have been produced. However, different approaches are often proposed. The final results of trans-national research projects, aimed at identifying harmonised solutions, are often extremely scientific but not practical and result in a lack of applicability.
Based on the results of a detailed state of the art review and a study on the evaluation tools related to roadside features and an additional literature review, this activity produced a practical guide that can be applied in practice in road safety design projects thanks to interaction with road administrations and operators (through the webinars that have been organised and through the synergy with the CEDR TG Road Safety). The different interventions proposed are linked to the potential effectiveness estimated and defined in the effectiveness study and in other relevant literature in order to allow the user to perform a cost-effectiveness evaluation before planning a specific treatment.

One issue has been the harmonisation of different existing standards or the identification of underlying reasons for different existing solutions for the same treatments in order to allow the user to select the optimum treatment and to properly assess its effectiveness.

The roadside features for which the Forgiving roadsides design guide has been developed are:

- barrier terminals,
- shoulder rumble strips,
- forgiving support structures for road equipment, and
- shoulder width.

Each feature is analysed in a separate section of the guide providing:

- an introduction,
- design criteria,
- assessment of effectiveness,
- case studies/examples, and
- key references.

This Forgiving roadsides design guide is a harmonised collection of best practice treatments to make roadsides forgiving. CEDR TG Road Safety recommends this guide to all practitioners working in road safety.

As a complement to the core part of the guide providing guidance to the designers, Annex A provides a comprehensive overview of the state of the art in the field of forgiving roadsides and a detailed description of studies conducted as part of this project in order to evaluate the effectiveness of different roadside safety treatments.
Executive Summary

Road networks in CEDR member states are becoming increasingly congested. Various policies have been introduced to mitigate this negative trend. The goal of task group 11 is to provide a better understanding of how NRAs reduce congestion, taking into account the policies adopted by governments. This report is the result of this work. The added value of this report is that it allows NRAs to present the work they are doing in reducing congestion and mitigating its negative effects both to the broader public and to those in charge of policy.

The main conclusions of the report are as follows:

- The high-level goals and the interventions of the countries that participated in the study are similar.

- There are differences in the relationship between goals and interventions. There is a 'grey area' between the goals and interventions in most countries. In some countries, there appears to be little or almost no direct relationship between goals and interventions.

- The relationship between goals and interventions can be improved by developing adequate performance indicators to bridge the gap. By monitoring effects, NRAs can determine if and to what level interventions contribute to the delivery of their goals and targets and in turn if the decision-making cycle is complete.
• It is important to use indicators that are measurable and, preferably, can be quantified; in this way they can reflect performance.

The following aspects were recognised as being the main causes of congestion: recurrent congestion (traffic demand), incidents and accidents, road works, major planned events, and severe weather. With regard to the roles of NRAs, in most countries they are responsible for maintenance, the gathering of traffic data, and traffic management. Policy interventions in all countries are quite similar and can be divided into four categories: physical expansion of capacity, better management of capacity, pricing mechanisms, and information systems.

Developing a strategy to reduce congestion, starting implementation, managing operation, and conducting evaluation are all complex processes that involves a large number of different parties. NRAs should be aware of the various roles they play within these processes.

Because of their position and the external environment in which they operate, NRAs run certain risks. For example, society’s goals may not be realistic; the NRA may be responsible for aspects that it cannot influence; or because the organisation’s goals have changed over time while the organisation itself hasn’t.

Task group 11 recommends the following to NRAs:

• Analyse the risks run by the NRA, taking into account the NRA’s position in the policy process and their responsibilities.

• Elaborate on the indicators, bridging the gap between goals and interventions.

• Take traffic management measures into account as a smart way of accommodating mobility with fewer costs and less environmental impact. In addition to the construction of (new) roads and spatial planning, this is an important area.

• Increase the focus on monitoring to determine the status of the indicators and to further understand the effects of interventions.
Traffic management to reduce congestion (2013)

Executive Summary

Congestion on the European road network has increased significantly over the past decade. This is the result of an increase in car ownership and car use in most European countries. It should be noted that investment in new roads is not growing at the same rate. Furthermore, there is a delayed decision-making process on (new) road infrastructure because, among other things, of tighter European legislation on the environment.

In western European countries, increasing road capacity is often problematic. This is particularly true in the case of conurbations where there is little space for new roads to be constructed and because of the high costs involved. Furthermore, in these areas, the quality of the environment is a bigger issue.

This is one of the main reasons why many European countries have decided to shift from the construction of new roads to the improved utilisation of existing roads and the influencing of traffic demand. One of the most effective ways of achieving this change in policy is the deployment of traffic management.
NRAs are increasingly working with all kinds of traffic management measures. Consequently, there is a growing need to exchange knowledge on the measures taken and on the evaluation of the effects these measures have on traffic safety and on throughput, as well as on the society, the economy, and the environment.

A lot of work has already been done on traffic management. Within NRAs, there is a great interest in lowering the cost of the procurement of ITS components and services. Sharing know-how and experience within CEDR is a main target of this task.

This task acts as a platform where all this material is condensed so that it can be used at the appropriate levels of CEDR and their NRAs. The goal is to condense, summarise, and structure existing knowledge so that it becomes digestible for CEDR’s GB and EB members.

**Main conclusions**

- Traffic management is a relatively new part of most national traffic and transport policies. Some highly populated countries with dense motorway networks and high congestion levels have made a shift in policy from reflexive road extension to a concept of better utilisation of the existing network that includes traffic management. Other European countries have not yet encountered such problems and are not at the same level of deployment of traffic management measures. Besides this, some countries have more urgent traffic problems than congestion and give priority to weather-related problems such as snow and ice. This means that there are significant differences in the amount and type of measures in the field of traffic management and control.

- In this final report, task group 12 sets out a traffic management strategy: in eight steps, we move from high-level goals to measures and control scenarios. Traffic management needs a problem-oriented approach rather than a solution-based interpretation. The eight-step process described in chapter 4.2 can help traffic engineers to find and establish the right measures and to implement the most effective control scenarios.

- Traffic management should be addressed network-wide in order to avoid adverse effects such as spillback that lead to gridlock somewhere else in the network. The eight-step process can also help to optimise network performance here.

- In an appendix to this report, task group 12 provides 11 fact sheets that present traffic management facts about (among other things) costs and benefits. Although the costs and benefits of traffic management are very important, they are also a problematic topic. Making decisions on the basis of factual evidence is the best way to ensure effective policy. The problem is that good information on costs and benefits is scarce; it is particularly difficult to find information that is relevant for specific situations. CEDR task group 12 has made a great effort to gather as much relevant information as possible.
Traffic management is not necessarily the only instrument that should be used to ease traffic congestion. Measures that affect traffic demand can be effective as well. The four-stage approach mentioned in chapter 4.1 can help to find the most cost-effective solutions to counter the defined congestion problems in the road transport system.

Main recommendations

With regard to the decision-making process:
- Further work on the facts of traffic management is necessary; sound information on costs (for investment and maintenance), benefits, benefit-cost ratios, and the effects of traffic management are necessary for evidence-based decision making.
- Since key cost figures are difficult to define, a project-specific analysis of costs is recommended for any traffic management measure in advance of deployment.
- Traffic management should be considered in conjunction with the construction of new roads. New road investments can be combined with investments in utilisation measures.

With regard to the deployment of measures:
- The durability of measures is a factor; at some locations the effect of a measure (such as hard shoulder running) will be temporary. Because traffic demand is likely to increase, one should plan what to do next after a few years. The same goes for adding capacity by constructing new roads. When assessing the effects of a measure, the temporary character of effects should be checked.

With regard to the operation of measures:
- Staff are needed to run and maintain traffic management measures. Staff costs need to be included in the decision-making process.
- Systems may not work in extreme weather conditions. Traffic management (ITS) systems are more vulnerable than concrete roads.
- It should be taken into account that maintenance costs for traffic management (ITS) are higher per kilometre than maintenance costs for roads (but not in all cases).
- Task group 12 proposes to use the decomposition methodology defined in the main report for future research into the cost of traffic management. The methodology should be fine-tuned to enable the gathering of information from different European countries.
Executive Summary

E.1 Traffic incidents not only cause danger to and loss of life (around 40,000 people are killed on the EU's roads every year), they also cause congestion and generate economic costs. Across Europe, road incidents account for 10–25% of congestion. One objective of the EC's ITS Action Plan and Directive is to reduce congestion and increase safety and efficiency. CEDR's specific remit is to optimise the use of the capacity of the road system. Incident management is one way of both doing this and contributing to the EC's objectives. Non-injury accidents are also estimated to cause considerable congestion: 30% in the Netherlands and up to 60% in the USA, where average traffic density is lower. CEDR's SP2 task group 13 (Incident and Emergency Management) aims to define and promote best practice in European incident management and to provide tools for the practice and development of incident management across the countries of Europe, taking account of their various conditions and resources.

E.2 The focus of the task is on the strategic road networks within the remit of NRAs, ranging from critical points such as tunnels to the entire Trans-European Road Network (TERN). Its approach is to set out a framework within which NRAs can set and develop their capability. Much of this is derived from NRAs' experience with established TIM practices and national guidelines. However, a guiding principle is to allow for differences between NRAs' overall remits and national needs and resources, while pointing out where harmonisation would be beneficial.
E.3 A protocol for cooperation between CEDR and EasyWay has been agreed. One consideration is to coordinate with EasyWay while avoiding unnecessary duplication. However, since NRAs will be the ones implementing any recommendations or directives concerned with incident management, part of the coordination work is to ensure that NRAs are happy with the results.

E.4 This document is the final report deliverable from CEDR SP2 task group 13 (Incident and Emergency Management) in Thematic Domain Operation. It is supported by an earlier interim report analysing a web-based survey on traffic incident management in CEDR member states. The strategy for task 13 was developed by the preceding SP1 task group O5 (Traffic Incident Management).

E.5 The first part of the report is as a conventional task report. It outlines the motivation, composition, strategy, methodology, and results of the task, as well as issues ‘for decision’. This is followed by appendices devoted to best practice at operational, tactical, and strategic levels. Appendix A is a framework guide that summarises the essential components and factors in TIM including the cycle of phases which make up the critical timeline. Appendix B addresses wider concepts for effective TIM including international best practice. Appendix C highlights both the role of TIM in relation to the EC’s ITS Action Plan and the EasyWay project and paths for development of TIM capability. Appendix D contains definitions and references.

E.6 In addition, a portable A5-sized aide-mémoire for NRAs and responders has been produced. This aide-mémoire lists appropriate actions in the different phases of incident management and contains useful mnemonics and definitions, while allowing for different levels of TIM implementation.

E.7 Apart from safety issues, congestion is a major consequence of incidents. In the survey, six countries reported that they see TIM as a way of reducing congestion, while only two reported that they did not see TIM as a way of reducing congestion following non-injury incidents.

E.8 Effective TIM can reduce both safety and non-safety related costs by:
- reducing response and clearance times as well as total management time by making improvements that focus on the most critical or longest components of the response timeline;
- reducing the risk of secondary incidents;
- ensuring the safety of incident responders;
- maximising the use of available responses.

E.9 Incident prevention is a natural companion of incident management. Just as incidents arise from combinations of factors, so successful incident prevention may depend on a combination of measures: analysis and intelligence, driver information and education, and physical measures.

E.10 In many countries, incident management is not only led by but also mainly implemented by the police. The police’s primary responsibility tends to be public safety and criminal investigation; rapid clearance and the minimisation of congestion tend to be reduced priorities. Because of their legal status, any modification of the role of the police may involve delicate negotiations with them and other responders who are affected.

E.11 The NRAs of seven countries surveyed have either already taken over roles from the police or would like to. Taking over roles from the police e.g. by setting up a dedicated traffic
officer service with limited legal powers involves a substantial investment in staff, equipment, and training, and consequently involves significant risk. It is most appropriate in those cases where the target network is well defined and carries high traffic volumes, and where monitoring and control are already well developed. However, it could also be a way forward in those cases where the development of traffic and incident management would mean undesirable extra responsibilities for the police. An intermediate approach might be to set up civilian patrols to monitor road and traffic conditions and report anomalies. This is an area where much may be gained from the exchange of experience between countries. It is hoped that TISPOL could become involved in mapping out development paths.

E.12 Recognising the benefits and potential of incident management identified by this task group and described in the results of its work, it is recommended that national road administrations:

1) collect appropriate data from their own business and key stakeholders and work with national policymakers to identify the operational and economic opportunities of incident management;

2) utilise and adapt the outputs of this task and work with operational partners to:
   a) maximise the value of existing national incident management capability and
   b) develop national incident management capability;

3) establish methods of monitoring their incident management performance and benefits realisation;

4) set up through CEDR an annual European forum on incident management at which members could share and review incident management best practice across Europe (it is proposed that the first forum should coincide with TRA 2012).
National Road Authorities' roles in ITS (2014)

Executive Summary

This report outlines the main achievements and conclusions of task group 14 (Roles and responsibilities of NRAs in ITS) during CEDR’s Strategic Plan 2 (SP2) 2009–2013.

The group has reached all of its objectives, including having a CEDR representative in the ITS Advisory Group for the EC, steering the work of key iMobility working groups as co-chairs, and establishing close cooperation with the major European ITS deployment action EasyWay. Furthermore, the group cooperated with the Traveller Information Services Association (TISA), achieving tangible results, and initiated the large-scale deployment of cooperative systems in the Amsterdam Group together with the other road authorities/operators and vehicle manufacturers.

Intelligent Transport Systems (ITS) have continued to develop very quickly such that CEDR has had to be dynamic in adapting its work plan to respond quickly to new demands. Key changes related to the EU adoption of the ITS Directive in 2010, the expansion of the safety-oriented eSafety Forum into the iMobility Forum for safe, smart, and clean road mobility, and the forceful entry of big multi-national private companies into the ITS domain. All of this requires a speedy yet considered response from NRAs.
This report provides CEDR and NRAs with a strategic assessment and recommendations in the following areas:

- EU ITS Action Plan and EC ITS Directive
- EasyWay and follow-up project(s)
- iMobility
- priority services and data quality
- cooperative systems
- research guidance

In essence, the recommendations underscore the need for NRAs to be proactive in relation to key developments such as the ITS Directive, iMobility, and connected vehicles. At different levels, NRAs need to establish and maintain a structure of communication and cooperation with the EC and important stakeholders and projects driving the research, development, and deployment of ITS. The issue of optimum data and information quality is a topic of specific importance for NRAs.

In addition, CEDR identifies a number of important ITS deployment issues such as standardisation, open data, and market developments, which will require CEDR and NRA attention in the near future.

The experience of the task group clearly shows that when it comes to activities within dynamic and turbulent domains—such as ITS today—CEDR would benefit from a dynamic and flexible task organisation to ensure that each urgent issue is tackled by the best experts.
Journey towards customer orientation (2013)

Executive Summary

Customers the users of the road network should be the main reason why road administrations exist. Roads and the associated infrastructure are not provided for their own sake; their primary purpose is to enable people to travel in order to meet their everyday needs and to enable businesses to transport products.

The definition of customer orientation is 'the way of thinking and acting where the activities of an organisation are focused on providing benefits for its customers'. For a road authority to be customer orientated, it needs to show that it is developing and improving its activities and services by looking at them through the eyes of its customers. This is also at the core of road planning, construction, and improvement; knowing and understanding customer needs helps the organisation to do the right things in the right way; for example establishing a reasonable service level, prioritising tasks, and making improvements.

There is a general trend towards more customer-focused national road administrations (NRAs). Many NRAs are systematically working towards having a better understanding of their customers in order to deliver services that meet their customers' needs. There are several reasons for this. The public sector in European countries is changing and becoming more customer-focused. Customers' expectations and requirements regarding services delivered by the public sector including road services are rising while budgets are being reduced.
How then does customer orientation help tackle these developments in society?

Firstly, discussing ideas and proposals for improvement with customers helps to manage their expectations and demands and should ensure that the best solution is identified. An open dialogue with customers at a sufficiently early stage in the planning process often helps and speeds up the process at a later stage as there may be less complaints and conflicts. At its best, dialogue helps all parties to understand each other and should lead to better solutions than would have been identified without the dialogue.

Secondly, customer orientation helps organisations to allocate resources, which are often scarce, in the most efficient way. For example, there is evidence that the level of customer satisfaction for winter maintenance has stayed the same even though less money has been spent on maintenance and traffic volumes have increased. This has been achieved by prioritising the right tasks and choosing the right service levels by taking account of customer orientation.

There are three areas that organisations have to develop in order to achieve continual improvement in customer orientation. One is to make strategic-level decisions, the second is to listen to and communicate with customers, and the third is to develop their products, services, and processes accordingly. Due to the different political and structural organisation of the national road administrations, there is no one right solution or uniform model for customer orientation. Each country has to analyse its own situation, define its own strategies for customer orientation, and take measures accordingly; in other words, they must make their own journey and find their own way.

Nevertheless, based on our experience, we do make some recommendations for those authorities that are at the beginning of their journey and for those whose challenge is to develop their degree of customer orientation.

Recommendations:

Awakening: how to start

1. Top-level decisions are needed. Make sure that the key decision-makers and top management are involved. Make top management the figurehead for the change.
2. A lot of discussion is needed during this phase: clarify within your organisation why the change is needed, what benefits will be gained, and what it means in practice. Use early adopters as ambassadors.
3. Benchmarking with other countries, organisations, and private companies will help you to define what customer orientation means to your organisation.
4. Be prepared to make time for a discussion about the definition of 'the customer'. It can be a big change for an organisation to consider an end-user as the customer instead of, for example, politicians or ministers. Sometimes the word 'customer' can be irritating. Using other concepts (e.g. user, passenger, citizen) might make it easier to accept.
5. Make sure research processes are systematic, so that people can learn to rely on them. Plan, for example, prepare timetables, and decide how the results are to be utilised.
6. Remember that feedback differs from group to group. This explains the difference in results from feedback and surveys. It is important to consider all channels for customer feedback; do not rely on one source of feedback.
7. Make sure that the communication is relevant. Customers will ask: 'What's in it for me?' Try to explain in an understandable way the reasons for decisions: why is the NRA (not) doing something.
Getting it to work: make customer orientation part of 'business as usual':

1. Make sure that customer needs are one of the driving forces for business and strategic planning: introduce targets for customer satisfaction and bonuses if customer goals are reached.
2. If you are using contractors, do not forget to motivate them and their sub-contractors to work for the end-users.
3. Create systematic ways and learning programmes that involve all your staff. Do not forget middle management.
4. Include customer orientation in day-to-day working processes. Quite often you won't need separate or new customer processes; it's more a question of how decisions are made during the process and what information these decisions are based on.
5. Having an action plan for improving customer satisfaction that is agreed by both technical and customer service staff is a good way to integrate customer thinking into everyday actions.
6. Combine different sources of customer data: customer opinions that have been collected in the course of surveys and through complaints, correspondence, and direct contact with customers should all be used to inform decision-making.
7. When a customer suggests a solution, try to understand his/her needs and the issues behind them. At the end of the day, the solution to the problem might be quite different, but the customer's concerns and needs will still be met.
8. Customer segmentation is a useful tool for understanding different customers' needs and ensuring that needs are recognised. Be prepared to make time to carry out customer segmentation, especially for decision-making. It is a strategic choice.

It is good to remember that even though road administrations are responsible for a part of the journey, the customers' experience is based on how smooth and safe the whole journey is. That means that close co-operation with stakeholders is needed.
Adaptation to climate change (2013)

Executive Summary

The climate in Europe will change during the twenty-first century. Model predictions indicate that the mean annual temperature will rise by between 1 and 5.5°C. While annual precipitation is likely to increase in the north and decrease in the south, the intensity of daily precipitation and the probability of extreme precipitation intensities may increase in all regions. Mean annual wind speeds are expected to increase in the northern regions as well, while possibly decreasing in the Mediterranean regions. Extreme wind speeds may increase in western and central Europe and in the North Sea area. As a consequence of climate change, the sea level in some areas is likely to rise by up to 0.9 m by the end of the century.

Climate change will modify actual risk levels and therefore challenge design guidelines and procedures for the operation and maintenance of the road infrastructure. There will be an increase in unusual climatic events, with significant impacts on infrastructure, operations, and the economy as a whole. For road owners, adaptation to climate change should be included in current and future procedures covering all aspects of road planning, design, maintenance, and operation.

The goals of this report are to:

- show the consequences of climate change for infrastructure; and
- propose actions for adapting the road network to climate change.

ENGLISH

FRANÇAIS
The working group conducted two surveys among its member states: an overview of risks related to climate change for each country (Appendix 1) and an overview of on-going work related to adaptation to climate change at national level and road administration level (Appendix 2). In addition, examples of on-going adaptation work and good practice relevant to adaptation to climate change were collected (Appendix 3).

Climate change, as described by the projections from global and regional models, will bring about a number of challenges for the road network in Europe. In most cases, these will be the same challenges as today, but on a larger scale, occurring more frequently and at other locations than expected. In addition, more unusual weather combinations may be experienced, e.g. winter floods. In some cases, climate change may be beneficial for road owners, e.g. in places where less snow can be expected.

Chapter 1 summarises the main effects of climate change on the road network as follows:

- more flooding and erosion: a challenge for drainage systems and erosion protection and for the design and maintenance of culverts and bridges;
- landslides and avalanches: occurring more frequently, at new locations and with a higher share of ‘wet’ landslide types, such as slush avalanches and debris flow;
- droughts and high summer temperatures may pose problems for asphalt surfacing, due to softening, but also for run-off conditions, due to lower permeability. Risk of wildfires may also increase in the southernmost regions;
- deterioration of roads and pavements: as expressed by service life and rutting, mostly in cases where drainage is insufficient;
- effects of sea-level rise on coastal stability and importance of ensuring sufficient elevation for roads, quays, and bridges, as well as entrance levels for sub-sea tunnels;
- heavy snowfall in mountain areas of northern Europe causing trouble for winter maintenance and operation under difficult conditions; and
- the need for better risk management and efficient procedures for initiating remedial actions after a weather-related event occurs, due to the fact that existing protective measures may not be sufficient and that the planning of remedial measures requires time.

All these effects can be recognised in all phases of road management: planning, design, construction, maintenance, and operation.

Chapter 2 indicates some possible routes towards adaptation to climate change. The measures are divided into working procedures from planning to operation.

Adaptation to climate change should begin during the planning of a road project by choosing an alignment (including elevation) where the road is not too exposed to risk from landslides, floods, etc. A good overall plan for management of run-off water should be prepared during this phase of work.

Climate change will require the adaptation of design guidelines in order to ensure sufficient drainage capacity and erosion protection, define adequate quality requirements for road construction materials, manage landslide risks, and implement measures to ensure protection of the environment. Construction contracts that consider climate change are important in order to avoid some of the problems that could occur during maintenance and operation.

Maintenance and operation of the existing road network is where most of the adaptation work needs to be done. This includes risk assessment, by identifying vulnerable assets and potential risks, and risk management related to weather-related events, including both preventive measures and emergency plans. Taking care of maintenance backlogs is an important part of
adaptation to climate change and is also beneficial for other reasons. In mountain areas and in northern countries, it is necessary to prepare for harsher winter conditions. Traffic management under difficult weather conditions needs attention, including communication of risks, re-routing, and the use of good monitoring systems for traffic control. Contracts for maintenance and operation need to be revised to ensure that adequate account is taken of climate conditions.

At the same time, it is important to keep developing the knowledge base for adaptation. This is achieved by supporting research on climate change and its effects on infrastructure, by improving the monitoring, mapping, and documentation of weather-related events on the road network, by better education on climate change, and by raising awareness about the importance of adaptation.

Chapter 3 describes some principles for making decisions concerning alternative adaptation measures and for prioritising them.

Adaptation to climate change should begin in the planning phase of a road project and should infiltrate all other working procedures. For existing infrastructure, adaptation measures should be considered as part of planned maintenance or repairs. The measures should be chosen to ensure that adequate safety is achieved during the (remaining) service life of the structure. Postponing action is advisable only if it is followed up by monitoring of the condition of the structure and of the development of the relevant climate factors. In some cases, accepting damage and the costs of repairs may be the best solution. Risk analysis and cost-benefit analysis for possible adaptation measures are recommended as a basis for decision-making.

However, defining the acceptable risk level is a difficult task. It is also difficult to define the standard or 'normal' climate applicable to the service life of a structure or for the duration of a maintenance contract. This underlines the need for good contact with experts in meteorology and hydrology and for good contracts for maintenance and operation.

This report can be read in several ways:

If you are mostly interested in how climate parameters affect the road network and what can be done, concentrate on the following chapters:

- 1.5, where the current situation as reported by the NRAs is described; and
- 1.6, where an overview of all the most important effects and remedial measures are given.

If you are mostly interested in how climate change affects a certain working operation, from planning to operation and maintenance, concentrate on:

- 1.9, for a short overview of the effects of climate change; and
- 2.3, for a more detailed description of effects and measures.

If you are interested in ideas for the development of the NRAs’ top-level strategic approach to adaptation to climate change, focus on:

- 2.2, for ideas on what to include in the adaptation strategy; and
- 3 and 4, for a discussion of uncertainty and decision-making.

For an overview of good examples of on-going adaptation work or good practice relevant to adaptation to climate change, see Appendix 3.
Executive Summary

The mitigation of climate change is by definition any action that seeks to decrease the intensity of radioactive forcing in order to reduce the potential effects of global warming. Mitigation of climate change is distinguished from adaptation to global warming, which means acting to tolerate the effects of global warming.

International cooperation and measures

For a number of years, the European Union (EU) has been committed to tackling climate change both internally and internationally and has placed it high on the EU agenda, as reflected in European climate change policy. The 2011 EU White Paper on the Future of Transport outlines very ambitious long-term goals. A Transport 2050 roadmap has been drawn up, setting goals for different types of travel: within cities, between cities, and long distance.

Policies, targets, and research

Very few of the participating countries have a separate strategy for reducing energy use and GHG emissions in the road sector. Most countries incorporate the road sector into their overall strategy for the transport sector. All countries that responded to the survey have a national policy for mitigating climate change. Most, but not all, NRAs have a wider role in addition to their core mission of building and maintaining the national road network.
Trends and indicators for energy use and GHG emissions

The transport sector's share of GHG emissions has increased from 14% in 1990 to 20% in 2010 in the EU-27. Road transport accounts for the largest share of GHG emissions in the transport sector, with a peak in GHG emissions for some of the 12 countries participating in the Project Group on Climate Change (CEDR-12) in 2000 and 2005.

Energy efficiency increased during the 1990s; accordingly, GHG emissions and total energy use per unit of gross domestic product decreased during the decade. From 1995 to 2011, CO₂ emissions from new passenger cars were reduced by 27% within the EU-27, from 186 g/km to 136 g/km.

The potential for GHG reduction in the road transport sector

In order to meet climate objectives, an 80% reduction in GHG emissions from road transport in the EU by 2030 (with 2004 as the baseline) might be needed. Actions are needed in three different areas: development and use of more energy-efficient vehicles, replacement of fossil fuels with renewable fuels and electricity, and measures to decrease VKT (vehicle kilometres travelled). Measures to decrease VKT include sustainable urban planning, improved public transport and facilities for cycling and walking, more efficient transport of goods, increased fuel taxes, stricter parking policies, and vehicle charges (congestion charging as well as road pricing per km or restrictions on vehicles).

Sweden's experience indicates that reductions in GHG in line with the 2°C climate target are possible for the road transport sector. The crucial element is the production of biofuel. Sufficient production of second- and third-generation biofuels is required, and this production must be sustainable.

Long-term planning is often not in line with GHG objectives

Transport system planning usually relies on predictions based on current trends. This method of planning the expansion and extension of a road system is called 'predict and provide': the road system is developed in accordance with existing trends and prognoses for traffic growth. However, the climate objectives and other needs point in a different direction.

As a basis for transport planning, the desirable future which meets political objectives must be defined first; then planners must work backwards to identify the tools and measures needed to connect the future to the present. The method is called 'back-casting'.

In rural areas, cars will continue to be the main mode of transport. It is important to design measures that do not compromise the viability of these areas. The considerable change in trend according to car use will initially involve higher costs for vehicles, fuels, and infrastructure. In the longer term, beyond 2030, costs relating to this scenario could be lower compared with a scenario based on current developments. These conclusions are also supported by a recent report by the International Energy Agency (IEA). Their conclusion, based on a scenario for the transport system that contributes to the fulfilment of the 2°C target, is that the reduction in costs yielded by fewer vehicles and less infrastructure with reduced energy use more than compensates for early investments in technology compared with existing developments.

Traffic management can influence GHG emissions

Traffic management and ITS measures can be used to achieve better traffic flow and to reduce the emission of contaminants, in this case GHG. In urban areas, this can be done by optimising traffic lights. For highway networks, different types of measures are available. In most cases, when traffic flow is improved and travel time reduced, the volume of traffic also increases. The induced traffic could slightly reduce the environmental benefits of the traffic flow improvement.
One demand management method is congestion charging, also called congestion tax or congestion pricing. The main objective of this scheme is to reduce congestion, thereby reducing travel times and improving reliability for individual and public transport users. Large-scale congestion charging systems are in place in Singapore, London, Stockholm, and Milan. In London, traffic has been reduced by 237 million vehicle km and GHG emissions by 120,000 t.

**Energy-efficient road infrastructure.**

Energy use is not limited to the vehicles using the infrastructure. Infrastructure construction, maintenance, and operation also require energy. To minimise energy use, it is important to consider the life cycle of the infrastructure, including the energy consumed by the vehicles that utilise it. This methodology, which is based on Life Cycle Assessment (LCA), aggregates the emissions generated by the extraction of raw materials, the processing of these materials, construction of the infrastructure, and its use. GHG emissions should be taken into account at the earliest stage of planning, while there are still alternative solutions that may vary significantly with respect to greenhouse gas emissions.

**Cooperation with other partners**

NRAs must cooperate with other partners (research institutions, construction companies, municipalities, and agencies for technical standards and guidelines) in their efforts to mitigate climate change. Even though they may not have a direct influence on certain processes, the NRAs can play an important catalysing role by seeking contact with potential partners and encouraging and supporting these partners' own activities to reduce GHG emissions.