CEDR
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Directors of Roads

Subgroup **Telematics**

The Move of the European Road Administrations

towards Network Operations

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This report has been compiled by the Subgroup Telematics, being one the Subgroups of the Conference of European Directors of Roads (CEDR).

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Abstract

National Road Administrations are having to expand their traditional role of maintaining and improving the road network by taking on an additional responsibility for network management, to ensure that the best use is made of their existing infrastructure. In the USA this expansion of the road authorities' role has been called the "Big Shift", later replaced by the term "Network Operations".
The Subgroup Telematics of CEDR have undertaken a study of the changes happening within Western Europe and the USA and have identified the potential benefits and common experiences of the early "shifters". This report summarises those experiences and benefits and presents the key messages and recommendations derived from those early examples, in order that other Road Authorities can benefit from the lessons learnt.

Table of Contents

Executive Summary

What is the 'Big Shift'?

In February 2001 CEDR established the Subgroup Telematics to provide strategic recommendations to its members concerning deployment of Intelligent Transport Services. The Subgroup Telematics has defined five domains, covering the 'Big Shift', Interoperability, ITS and Enforcement, Human Machine Interfaces and e-Safety. This report covers the 'Big Shift', which the Subgroup has defined as "the change in emphasis within NRAs *(National Road Administrations)* from road building and maintenance to include network operations, and the consequent change in organisation and processes required to deliver high quality network services". Note that ITS (*Intelligent Transport Systems*) could be a "tool" to assist in this change of role rather than being the origin, driver or a prerequisite for the change.

The term 'Big Shift' was originally used in the USA to describe similar changes taking place there. In the USA it has now been replaced by the term "Network Operations". Also this report title has been changed to "Network Operations" to reflect CEDR's similar emphasis as in the USA. However, the term 'Big Shift' has been retained in this reports to provide continuity within the Subgroup Telematics.

Why is it happening?

National Road Administrations are primarily responsible for maintaining and improving traffic flow and safety on their road networks. They have traditionally met these responsibilities through the construction of new roads, widening or improvement of existing roads and through the maintenance of their existing infrastructure to an appropriate standard, including minimising the impact of adverse weather, etc. Any other tasks undertaken by NRAs have been secondary to these main tasks and perceived as being of less importance.

In recent years the environment in which NRAs are operating has been changing. Traffic flows continue to grow at rates that cannot be matched by capacity increases from construction, leading to worsening congestion and unpredictable, unreliable journey times. Construction costs are increasing, and are examined more critically as the economic situation reduces available budgets. Increased environmental awareness places new restrictions on, and further increases the cost of, the NRAs work, in some cases stopping it altogether. NRAs are expected to deal with events (for example a World Expo or the Olympic Games) or 'external' decisions such as the extension of a major airport, often in very short timescales.

Road administrations have often initially introduced ITS to solve single problems such as safety or congestion black-spots, but later it has become clear that the problems are not just local and need a network approach. In addition, the NRAs' roads are increasingly affected by others who produce

roadside and in-vehicle equipment, including the automotive industry who have developed ITS and safety systems in cars, etc., and who may want to take the lead in ITS applications. Finally, more and more user-oriented 'services' are being delivered by private industry, possibly with aims conflicting with the responsibilities of the NRAs.

These developments are taking place in the various European countries, as well as in other developed countries, at different speeds depending on local circumstances, policy, organisation, level of implementation and expertise.

In this situation NRAs have to adapt in order to keep fulfilling their major tasks of maintaining and improving traffic flow and safety. Although maintaining the road quality and building new roads is still important, it is not sufficient anymore, as NRAs have to ensure that they first make the best use of their existing infrastructure. As a result the NRAs role is changing, becoming more complex as the focus is not only on the infrastructure but on the road user as well, to include network management and operations. This is the process that has been called the 'Big Shift'.

The Telematics Subgroup has reviewed five "case studies" to determine what motivated the early adopting NRAs, what benefits can be expected from the inclusion of the role of network operator and to make recommendations to NRAs that are in the early stages of the 'Big Shift' to enable them to learn from the experience of others. The five case studies were the ring roads around the cities of Utrecht and Alkmaar, the Netherlands, the Highways Agency's NTCC (National Traffic Control Centre), England (and the early stages of the Agency's move to a new Traffic Manager role), traffic management within the Hessen region, traffic management for the Hannover World Expo 2000, Germany and the 'Big Shift' at the FHWA, USA.

What are the Benefits?

Provided road administrations are well prepared, the Big Shift will not only bring challenges and changes, but also offer them opportunities to improve and expand their role. In practice, this could also happen the other way around - as a consequence of deciding to enlarge their role, NRAs will have to change their attitude. The principle benefit for NRAs will be that they are able to deliver their main tasks of improving traffic flow and safety more effectively and efficiently. Experience from the case studies confirms that in addition NRAs can expect:

- to be more cost effective and therefore to provide better 'value for money'. ITS could play an additional role as it may be less expensive than conventional construction and can deliver similar (or greater) benefits within shorter timescales. The additional knowledge of the network available to an operator or traffic manager ensures that conventional investment is targeted at the most deserving areas.

- to be better prepared for unexpected or unusual situations, such as major incidents, special events, political changes or extreme weather conditions. The development of partnerships and

the detailed planning required at strategic, tactical and operational levels means that a network operator is able to respond faster and more effectively.

- to improve their customer service. All 'customers' of NRAs, including road users, all other travellers, the general public and their political or financial 'masters' can expect to benefit from the reduced congestion, improved journeys and safety or from the improved information available to a network operator.

- to enhance their reputation. By offering improved services NRAs will be able to enhance their reputation, both with the public and with politicians, and even internally within its own organisation. A good reputation can be a great help when competing for scarce funds.

What should we do?

At this time the Subgroup Telematics does not consider that it can provide detailed recommendations for new structures and changes to existing organisations. Each organisation is unique, will have its own vision, must work within its own political and institutional boundaries, is at a different stage of the 'Big Shift' and moving at a different pace. The report points out where change may be required and what needs to be achieved in order that NRAs are better prepared to respond when the shift happens and to seize any opportunity that occurs.

There should be significant gains from exchanging mutual experiences with similar organisations in CEDR. The objectives of the 'Big Shift' report are to create awareness within NRAs on the future changes, to convince NRAs of the need for, and benefits from, taking action to operate the network more efficiently, to make the use of ITS more effective and to assist NRAs in getting the best from the new possibilities by providing recommendations, tools and contacts to assist them in their local situation.

Analysis of the experiences from the case studies has identified many lessons that have been learnt and many recommendations and 'tips' for future 'Big Shifters'. The Subgroup Telematics have distilled these down to six key messages, with more detailed information given against each in the main report. The six are:

- **Services rather than Systems** – travellers and the wider community are the ultimate 'customers' of the road network. NRAs must work continuously with all their customers to identify (changing) demand and deliver appropriate and seamless services. Users appreciate services, not systems nor equipment.

- **Multiple Stakeholders and Partnerships** – in a network operator role NRAs have to deal with a variety of stakeholders from the public and private sectors. Appropriate partnering arrangements will be required which recognise their different aims, ambitions and motivation.

- **New Roles and Different Skills** – the expansion of responsibilities to include road network operations requires a change of roles, attitude and approach to liability by the NRAs. These changes involve new challenges and opportunities and will require different skills and methods of working (24/7).

- **Strategic, Tactical and Operational Planning** – when developing and implementing service operations it is important to take account of strategic and policy objectives to meet public and Government aspirations. NRAs must seek to optimise and co-ordinate at strategic, tactical and operational levels.

- **Changing Perspective on Funding and Finance** – service implementation opens up opportunities for new, multiple sources of funding, and ensures that the whole life cycle costs of the service are taken into account, not just initial capital costs.

- **Data and Information Management** – the availability of high quality traffic and management information (not just data) is essential for the success of network operators. Information and data can be major assets and must follow international standards.

Concluding remarks

The move from infrastructure provider and maintainer to network operator is coming for all Road Administrations. European NRAs are at different stages of this expanding role, some have already started the 'shift', others are about to start and for some it is still in the future. There could be significant benefits for everyone in learning from the experience of early 'shifters'. Later 'shifters' may enrich the key messages with their new experiences.

This report reflects the current experience of the Subgroup Telematics in the 'Big Shift'. It will need to be extended and kept up-to-date as further examples of the inclusion of the role of network operator are identified, in other words to become a 'living' document. The Subgroup recommends that interactive communication should be maintained to continue the exchange of experiences and recommendations between NRAs.

1. The Need for a Big Shift

1.1 NRAs roles and responsibilities change: Big Shift

Historically National Road Administrations' (NRAs) responsibilities have involved two main tasks:

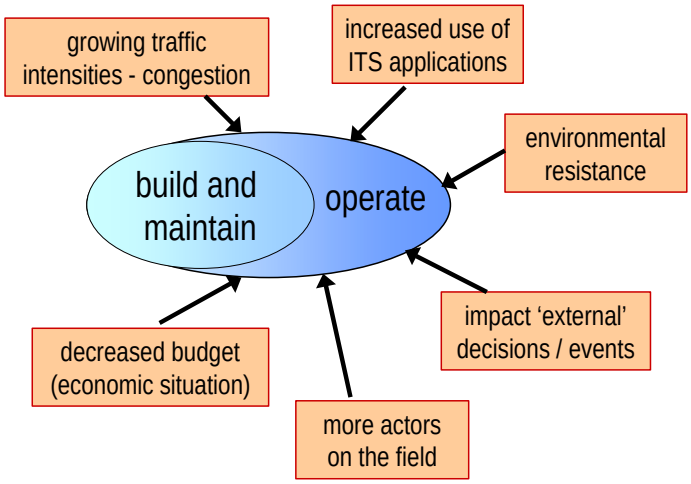
- To improve and optimise the traffic flow quality
- To improve and optimise the traffic safety

Traditionally this has involved building new road infrastructure and maintaining existing roads to an appropriate standard. All other tasks and roles of the organisation have been secondary to these main tasks and have been of less importance.

However, the situation in which NRAs are functioning has been changing over recent years. Traffic flows tend to grow faster than road capacity, leading to increasing congestion. Road administrations are increasingly making use of ITS services. Investment decisions are considered more critically as the economic environment decreases the available budgets. More actors come into play, such as private partners who produce roadside equipment, the automotive industry that develops safety systems in cars, etc. NRAs have to deal with 'external' decisions and events, for example the World Expo or the Olympic Games, or decisions such as the extension of a major airport. And finally in several situations public resistance on environmental issues hampers the undisturbed progress of NRAs' work.

All these developments take place in the various Western European countries at a different pace and influenced by various local circumstances relating to policy, organisation, implementation and level of expertise.

In this situation the role of the NRA is changing, although still fulfilling its major tasks regarding traffic flow and safety. Maintaining the road quality and adding capacity by building new roads is reaching the limits of affordability, practicability and political acceptability.



A new approach is required, in which optimisation of the use of the existing infrastructure and providing better services to the road users is the primary objective. The NRAs role therefore becomes more complex, focusing not only on the infrastructure, but paying attention to the needs of the customer as well. As a result the NRAs responsibilities are changing to include network management and operations. The figure illustrates the process as described here.

We call this process the "Big Shift"[1]. The Subgroup Telematics has defined the Big Shift as follows.

Big Shift: the change in emphasis within National Road Authorities from road building and maintenance to include road network operations and the consequent change in organisation and process required to deliver high quality network services.

These developments result in a **challenge** for all NRAs to prepare for the upcoming situation and to build an effective organisation, which will achieve high quality "service oriented network operation". At the same time road administrations must be aware of the industry's drive to take the lead in the development of ITS applications. In addition, more and more user-oriented 'services' are being delivered by private industry, possibly conflicting with the responsibilities of the NRAs.

The preparation for these developments will require both organisational changes and the development of specific ITS knowledge and skills within the various National Road Administrations. This document aims to assist in this.

The "Road Network Operations Handbook", as published in 2003 by the World Road Association PIARC, strongly supports this story. This Handbook gives a comprehensive and useful overview of what needs to be understood by 'operations', the tasks and services that are part of it and the ITS solutions that can support it. In Appendix B some parts of this PIARC Handbook have been reproduced for illustration purposes.

Within their traditional role NRAs already execute several activities which are about or closely related to road operations. In the Big Shift the major change is the shift of focus to specifically include (network) operations, sometimes to the extent that it becomes the most important objective. In other words, the move towards network operations adds new features and tasks, and moreover a new attitude to the traditional tasks of the NRAs.

[1] the terminology has been originally used in the United States of America, where the FHWA is going through a similar process, for which they used the name Big Shift (see also Appendix B)

1.2 Implementation of Intelligent Transport Services

The abbreviation ITS is used traditionally for Intelligent Transport *Systems*. *H*owever, within the Big Shift a more user oriented service approach is preferred and for this reason we refer to *Services* instead of systems.

Intelligent Transport Services (ITS) is synonymous with the concept of providing smarter, smoother, shorter and safer integrated services across all modes of transportation, rather than the 'traditional' situation where systems are deployed to solve single problems. Despite the fact that ITS can deliver cost-effective solutions, some ITS projects have proven the opposite. Often due to poor project management the expected benefits could not be demonstrated and the projects turned out to be expensive failures.
ITS incorporates the latest technological developments into typical transportation operations to improve traffic flow, enhance road safety and offer additional information to motorists. Road users then can determine their preferred mode, route choice or time to travel. ITS offer benefits to law enforcement agencies through the enhancement of monitoring capabilities and the use of additional, real-time information, improving the response time of emergency services.

Other typical examples of ITS applications include the ability to monitor public transport operations on a route-by-route or on an individual operator basis, to implement tolling without the need to stop the passing vehicles, to monitor traffic flows and introduce alternative route strategies to improve traffic conditions and to implement flexible road pricing strategies for different types of vehicles. In short, ITS enables the road authorities to perform essential road network management services.

The stage of implementation of Intelligent Transport Services varies from country to country and even from region to region within (Western) Europe. Ultimately, improving international traffic flow throughout Europe will require a consistent network between countries and good cooperation to optimise not only the local or the individual country's situation, but also the overall flow between regions. Only then a seamless service on the Trans European Road Network (TERN) and beyond will become reality.

1.3 CEDR initiative

The CEDR[2] established the Subgroup Telematics in February 2001 to provide strategic recommendations to CEDR members concerning deployment of Intelligent Transport Services in the following five domains:

[2] CEDR: Conference of European Directors of Roads (formerly known as WERD/DERD - Western European Road Directors / Deputy European Road Directors)

- Big Shift
- Interoperability
- ITS and Enforcement
- Human Machine Interface
- e-Safety

This report covers the Big Shift domain.

1.4 Big Shift domain objectives

At some time all NRAs will be confronted, to a greater or lesser degree, with the development of network operations, including ITS services, as explained earlier in this chapter. The increasing use of ITS and the changing role from network provision towards network operation requires NRAs to look critically at their own organisation. This emerging situation requires NRAs to be(come) customer oriented. As customer demands tend to change over time, it requires the organisation to be flexible. This report identifies that roles will (have to) change and indicates objectives that will be affected in the future. The road administrations should prepare for this.

Each organisation is unique and each NRA will have his own vision for network operations that suits the local situation and must work within individual political and institutional boundaries. The present development of the "operator" role and ITS deployment will vary from NRA to NRA. They themselves are best placed to identify any plan for change. There could however be significant gains from exchanging mutual experiences with similar organisations in the Western European context.

At this time the Subgroup Telematics does not consider that it can provide detailed recommendations for new structures and changes to existing organisations. The Subgroup considers that the report points to where change is required and what needs to be achieved.

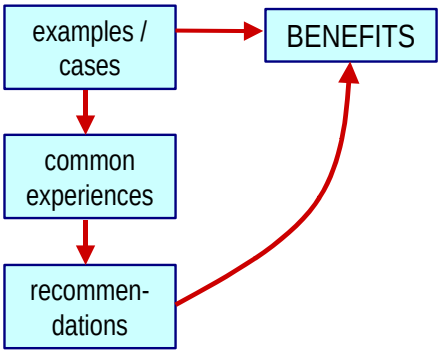
The main objectives of the Subgroup Telematics for this "Big Shift" report are:

- To explain that the Big Shift has already taken place, or is taking place, at some NRAs
- To create awareness within NRAs on the future change
- To convince NRAs of the need for and benefits from taking action to:
    - Operate the network more efficiently
    - Make the use of ITS more effective
- To assist NRAs in the new possibilities by providing recommendations, tools and contacts to assist NRAs in their local situation

2. Benefits for the NRAs

Provided road administrations are well prepared, the Big Shift will not only bring challenges and changes, but also offer them opportunities to improve and expand their role. The principle benefit for NRAs will be that they are able to deliver their main tasks of improving traffic flow and safety more effectively and efficiently. Experience from the case studies confirms that in addition NRAs can expect other benefits, as explained here.

The benefits as listed in this chapter are not imaginary. The learning experiences from 'early shifters' proved the existence and occurrence of these benefits. In the study and analysis of several cases, as presented in Appendix A, common experiences were derived for broader purposes. From these common experiences recommendations were extracted which are presented in the next chapter. This completes the 'circle of verification', by providing recommendations we offer **proven benefits** to the NRAs.



2.1 To be more cost-effective

NRAs have to be more cost-effective and therefore provide better 'value for money'. ITS tends to be less expensive than conventional construction, but can deliver similar (or even greater) benefits within shorter timescales, if implemented correctly. The additional knowledge of the network made available to an operator or traffic manager ensures that conventional investment is targeted at the most deserving areas.

Increased cost-effectiveness can also be seen from other perspectives:

- Using ITS and focussing on traffic and network operations can assist in making better use of existing infrastructure and thus optimising the use of the available infrastructure.
- ITS solutions are in general cheaper for similar increases in traffic flow quality than extension of road infrastructure by adding additional lanes or building complete new roads.
- By exchanging ideas and experiences between NRAs and learning from other administrations costs for feasibility studies, assessment studies, etc. can possibly be reduced. Reinventing the wheel and making (unnecessary) mistakes can be prevented.

- The focus on network operations focuses more on prevention of congestion, which in turn reduces economic costs (losses).

2.2 Better prepared for unexpected situations

NRAs will be better prepared for unexpected or unusual situations, such as major incidents, special events, political changes or extreme weather conditions. The development of partnerships and the detailed planning required at strategic, tactical and operational levels means that a network operator is able to respond faster and more effectively. For example:

- Having predefined scenarios (traffic measures, procedures) on how to handle certain incidents or events can reduce the time in which NRAs can (re)act to those situations and to other unexpected situations.
- Focussing on traffic operations forces NRAs to be better organised, to be pre-aligned with (possible) partners, to have good communications with them, have existing agreements with them and to have built trust with them.
- Having the links in place for straightforward communication enables NRAs to make the right decisions when unexpected situations occur.
- ITS provides NRAs with tools to take (effective) measures at short notice that were not possible at all using the traditional tools of road building and maintenance.

2.3 Improved customer service

NRAs will be able to improve their customer service, with many having already committed themselves to this objective. All ‘customers’ of NRAs, not only the road users, but also all other travellers, the general public and their political or financial ‘masters’ can expect to benefit from the reduced congestion, improved journeys and safety or from the improved information available to a network operator.
As the focus is on traffic operations the final ‘delivery’ of the NRAs is closer to the ‘need’ of their market. Providing the road infrastructure and maintaining it in good condition in fact only facilitates the deeper need, the operation of the traffic.

2.4 Enhanced reputation

By offering improved services, but also as a result of the other benefits as mentioned in this chapter, NRAs will be able to enhance their reputation, both with the public and with politicians, and even internally within its own organisation. NRAs become a more reliable partner, for all existing and potential partners. A good reputation with the public, politicians, financiers and partners can be a great help when competing for scarce funds.

3. Key Messages for Road Network Operations

In this chapter recommendations are presented to support National Road Administrations in undertaking their main responsibilities and optimise their road network operations. Six 'categories' of recommendations with additional detailed 'tips' have been identified, which are regarded as giving important or useful messages for NRAs. The recommendations are based upon 'common experiences' as analysed from a selection of case studies.

The six key messages as detailed further are:

- Services rather than systems
- Multiple stakeholders and partnerships
- New roles and different skills
- Strategic, tactical and operational planning
- Changed perspective on funding and financing
- Data and information management

3.1 Services rather than Systems

Travellers and the wider community are the ultimate 'customers' of the road network. NRAs must work continuously with all their customers to identify (changing) demand and deliver appropriate and seamless services. Users appreciate services, not systems nor equipment.

Illustration from case study Traffic Management in the Hessen Region (Germany)

In the Hessen Region, around the City of Frankfurt, traffic problems occur on a regular basis, often leading to severe blockages on adjacent roads, as the traffic network is very dense. In such circumstances many road users can be confronted with the consequences of a 'single' traffic problem elsewhere. Realising this situation, the relevant road (and public transport) administrations have sought cooperation in order to manage the traffic as best as possible, using ITS applications, such as traffic information, in an effective way. In this approach the road user, being the ultimate customer, has been taken as the basis for which the traffic management measures have been selected and applied.

Recommendations:

- The service requirements of the end user, the road **user of ITS applications** must be central: they are the ultimate customer. The identification and definition of the network operations and ITS services should be oriented towards these users.

- The provision of intelligent transport systems alone does not always result in the solution to traffic problems, some ITS projects have failed to deliver the expected benefits. Systems are just a part of the services and it is **Intelligent Transport Services** that generate road user benefits and appreciation.

- Note that traffic situations, traffic demand and customer requirements tend to **change over time**, leading to the need to adjust the services provided.

- For users, network operations and intelligent transport services are not fundamentally constrained by any borders, either spatial or between services. Provision of a **seamless service** to users and optimum network performance requires cooperation with neighbouring road administrations and other key actors.

3.2 Multiple Stakeholders and Partnerships

In a network operator role NRAs have to deal with a variety of stakeholders from the public and private sectors. Appropriate partnering arrangements will be required which recognise their different aims, ambitions and motivation.

Illustration from case study Hannover World Expo 2000 (Germany)

The facilitation of traffic to and from an event such as the World Expo is a critical success factor for the event. The organisation of the Hannover World Expo 2000 therefore decided to set up a specific organisation (MOVE GMbH) to manage the traffic during the opening weeks of the Expo. This organisation had the challenge to get all stakeholders and road managers on board: local, regional and national road administrations, public transport operators, etc.
All traffic data was transferred to MOVE, which was the only actor from the private sector in this respect. The road network was treated as one common integrated network, disregarding individual preferences. All administrations 'handed over' power (for the time being) to the overall traffic manager. At the final end of the event it was concluded that this integrated approach, in which the management of all transportation systems was regarded central, was one of the main success factors to keep the traffic moving during the entire period of the World Expo 2000. Unfortunately, at the conclusion of the event the need for co-operation disappeared and the MOVE organisation has been disbanded.

Recommendations:

- **Partnering** is important in developing and operating services and network operations. Understand and identify stakeholders involved and note how they are organised. **Allow for time** to build trust and reach consensus with all parties involved.

- Where different authorities or operators are involved in the provision of transport services it is needed:
  - To have a **shared appreciation** of the problem;
  - To have a **shared belief** in cooperation between the partners;
  - To **understand** respective responsibilities and ways of working.

- A good **business case** stimulates success. Look for opportunities, including additional stakeholders.

- Arrange for **mutual agreements** between partners in implementation and operation processes (cross competences, 'sharing the pain'). Where private sector organisations are involved more formal agreements are required, but keep flexibility.

- Be conscious of the **role of the industry**, being a strong and potentially 'leading' partner in the development and implementation of ITS applications.

- Flexibility can be facilitated via the creation of an **independent, separate 'body'**, often being a third party, which in turn can increase the chance to get a (real) common strategy implemented and the overall priorities set.

- **Public support** is often essential to obtain and to sustain successful implementation of ITS services. Incorporate 'public support' in the organisation preferably throughout a public relations plan.

3.3 New Roles and Different Skills

The move towards road network operations requires a change of roles, attitude and approach to liability by the NRAs. These changes involve new challenges and opportunities and will require different skills and methods of working (24 hours / 7 days).

Illustration from case study Highways Agency's Traffic Manager Role (England)

Originally formed to maintain and improve England's strategic road network, the Highways Agency (HA) was given the additional task of managing the network in the late '90s. Although plans were

developed for the new role within the HA's Ten Year Transport Plan, progress towards implementation was slow. In January 2003 severe snowfall brought much of the road network to a standstill in the South-East of England ("White Friday"). This provided the impetus for a much more rapid re-alignment of roles and responsibilities with the Police and the early introduction of Regional Control Centres. As part of this' shift' ,much of the responsibility (and thus roles and tasks) for traffic on the strategic network was handed over from the Police to the Agency. In April 2004 the first HA Traffic Officers started patrolling the motorways and working alongside the Police in the Control Centre for the Midland motorways. In the coming years the completion of the HA's "Big Shift" is planned, ultimately leading to a situation in which the HA will have moved to a 24/7 operation, responsible for the operation of their road network.

Recommendations:

- ITS services extend **beyond the conventional competences** of the NRAs; attention is needed for (re)training of staff on skills, a focus on service oriented attitude, etceteras.
- **Liability is an issue** to take into account by NRAs when offering ITS services; each traffic management measure, such as a redirection of traffic, could include legal liability consequences for NRAs.
- **Flexibility in the organisation** is required because the changing demand of the road users over time, which can lead to adjustments in the (ITS) services to be provided.
- Getting the **right people** on board, with capable persons and assignments on tactical positions, can increase the chance on successful ITS implementation.
- Note that in the change towards road network operations the role of the **traffic police is changing** as well. Coordination and communication with them is required, also to remain supportive to each other. Related to the (new) role of traffic operations learning experiences from the police could be beneficial.
- In the change towards operations **working hours become 24/7** (24 hours a day, 7 days a week) in stead of 8/5 (8 hours a day, 5 days a week). This obviously also has its impact on planning and management.

3.4 Strategic, Tactical and Operational Planning

When developing and implementing service operations it is important to take account of strategic and policy objectives to meet public and Government aspirations. NRAs must seek to optimise and co-ordinate at strategic, tactical and operational levels.

Illustration from case study Ring Roads of the Cities of Alkmaar and Utrecht (the Netherlands)

In the Netherlands the Cities of Alkmaar and Utrecht were confronted with similar problems: congestion on the ring road, but facing a situation in which different authorities are responsible for different parts of that ring road. It was recognised that a common approach should be most feasible and effective to solve the traffic problem. In both cases a top-down approach was used, intended to solve the problem finally on the operational level, on the street. This approach turned out to be very effective, starting by defining a common vision, translate this into a common network strategy and network requirements and coming down towards operational measures. The interactions between all road administrations involved became through this step-by-step process visible and understandable.

Recommendations:

- In the process leading towards the implementation of network operations three levels should be distinguished: **the strategic, the tactical and the operational level** (see also Appendix A). All levels need to be covered. Check at each level the agreements and reflect them with the objectives of the next higher level.

- Preferably the implementation **process** should be **followed top-down**: starting from the strategic level, through the tactical level towards the operational level. At the same time iterations in this process should be allowed for. In case the process starts on the operational or tactical level seek agreement or confirmation from the higher level to prevent possible later hick-ups caused by missing support from that level.

- Strategic objectives for the road network must reflect an **overall, integrated transport policy**.

- Common **strategic objectives** need to be formulated for the total road network, which subsequently need to be **translated** into qualitative requirements for road network performance.

- **Solutions conceived at the operational level** (can) assist in clarifying objectives at the policy/political level, which in turn helps to optimise the framework for the operational level.

- Particular **events can function as stimulation** for the implementation of network operations (political will, additional funding). However, it is wise to ensure similarly a long-term structure and a sustainable service to prevent losing momentum after the event.

- Responsibility for tasks should be delegated to the **best capable partner** in doing so (standardisation, implementation). A change in the designation of a responsible partner may conflict with existing agreements, but can improve effectiveness.

- **Predefining scenarios** (including procedures) for network operations is a way to optimise efficiency and effectiveness in respond to arising (traffic) problems. It makes quick response and implementation of measures possible.

- **Political awareness** of problems and support is needed, as well as agreement on and commitment to the objectives. Putting (special) legislation in place can enable necessary power, budgets and operation.

- Intelligent Transport Services may be affected, more than other domains, by **non-transport related circumstances** (government policies, industrial strategies, technological developments), which may have a great impact.

- Think ahead: **being better prepared** for unexpected and unusual situations (events, incidents) can assist in being optimal geared to customer services at all times.

3.5 Changing Perspective on Funding and Financing

Service implementation opens up opportunities for new, multiple sources of funding, and ensures that the whole life cycle costs of the service are taken into account, not just initial capital costs.

Illustration from case study NTCC – National Traffic Control Centre (England)

In the early 90s congestion became an increasing problem on England's strategic road network. Research identified the potential for significant reduced congestion benefits from the management of traffic by means of rerouting, especially in the event of incidents. Pilot schemes in Kent and around Birmingham confirmed the benefits were achievable. Based on this experience the Highways Agency developed the concept of expanding the pilot systems to provide a national network of strategic diversion signs to be controlled from a National Traffic Control Centre. In order to implement the NTCC within the shortest possible time, the concept of using a Public Private Partnership (PPP) was developed, with capital funding and the systems and services provided by the private sector and the HA paying for the service over a defined time period. The NTCC contract was competitively tendered, a contract awarded and the NTCC has recently started operation.

Recommendations:

- ITS services may be appropriate for **Public Private Partnerships (PPP) and alternative financing**. It is however important to consider carefully how and where to involve the private sector.

- The relatively **short life cycle of ITS system components**, the time span and extent of the maintenance and the ongoing developments in ITS services need to be considered when contracting network operations.

- **Life cycle costs** include maintenance costs and capital costs as well as operational costs. These maintenance and operational costs can be substantially higher than the capital costs. Take this into account while setting up a business case. Note that total costs for well managed ITS related investments are generally still substantially lower than total costs for 'traditional' infrastructure measures.

- It is advised already in the design phase of ITS applications to take maintenance costs and costs for disposal of electronic equipment into account as part of the total life cycle costs.

3.6 Data and Information Management

The availability of high quality traffic and management information (not just data) is essential for the success of network operators. Information and data can be major assets and must follow international standards.

Illustration from case study Traffic Management for the Hannover World Expo 2000 (Germany)

The City of Hannover in Germany was confronted with a major challenge to organise the traffic management during the World Expo 2000. Normal traffic needed to proceed and good accessibility was required for all visitors. One centre was set-up, leaded by a specific company, which was made responsibility for the complete traffic management in the region. It was identified immediately that traffic data should play a vital role in this process. Therefore a model was set up, in which all relevant parties, both individual and public transport companies, brought together their traffic data. This data was brought onto one level and translated into recommendations and information, for the use of tactical control plans and future prognostics. All parties that provided data got enriched data in return, which they could use for their own purposes, but not for distribution. Besides that, clear arrangements were made about the use of data (content and outlook).

Recommendations:

- **Issues relating to data** descriptions, ownership, quality, availability (including cost) and liability need to be considered when the information is collected from or used by others to provide additional services.

- The transition of **raw data into information** is vital to create added value for the end user.

- **Data protection and privacy** are issues to take care of thoroughly, as these issues could become potential failure factors.

- **Traffic data are regarded as the asset** in relation to ITS services. Reliable and actual data play a major role in ITS services. Data is critical for several (NRA) tasks, such as controlling traffic.

- Data description, ownership, quality, liability, availability, charging, sharing and dissemination all need attention in **information management**. One format and adoption of international standards and harmonisation should be supported.

- Data management should be reflected in a **defined policy and strategy**, for instance via an information management plan, to ensure its full support and importance.

- Information management involves also **management information**; in order to be always optimal geared to provide customer services. Performance reporting should become common use.

Concluding remarks

The primary audience of this report are the Directors of the National Road Administrations, as represented in the CEDR. The focus in this document relates to the responsibilities of the NRAs, i.e. **road transport on national, major roads.** However, the interoperability with other modes, such as rail transport, should also be considered and as NRAs are involved in a complete transport service, many issues as discussed in this report are also applicable to urban roads and cross border road connections.

The expansion of their role from infrastructure provider and maintainer to include network operator is coming for all Road Administrations. European NRAs are at different stages of this move, some have already started the ‘shift’, others are about to start and for some it is still in the future. There could be significant benefits for everyone in learning from the experience of early ‘shifters’. Later ‘shifters’ may enrich the key messages with their new experiences.

This report reflects the current experience of the Subgroup Telematics in the Big Shift, it will need to be extended and kept up-to-date, in other words it becomes a **‘living’ document**. The currently

formulated recommendations therefore should possibly be reviewed as implementation experience becomes available.

The Subgroup recommends that interactive communication and feedback from the experiences of the individual NRAs should be used regularly to update the information and recommendations. This will optimise support to NRAs in the challenging but changing world of network operations using ITS.

Appendix A: Methodology Used

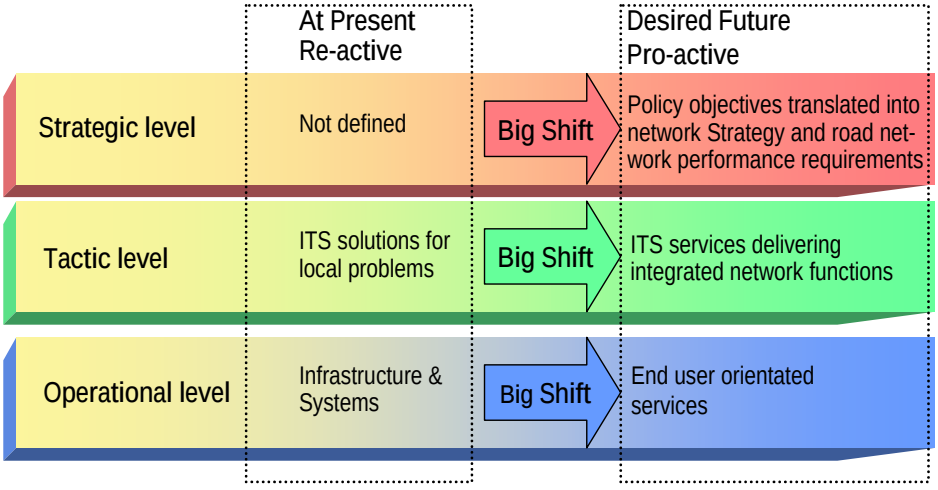
1. Approach

The Subgroup Telematics has gone through a structured process in order to list the conclusions and recommendations as revealed in this document. Based on a work plan the Subgroup has carried out the following activities:

- Desk-research, internal discussions and external interviews to identify **scope** and **status** of ITS deployment
- Development of a structured **framework model** to help the analysis of ITS deployment and identify the processes of change within road administrations. In section 2 this framework model is elaborated on.
- Testing and refinement of the framework through analysis of practical **cases**. In section 3 the cases are mentioned and briefly explained.
- Identification of most relevant and useful recommendations, based on **best practices**, in the form of "common experiences".
- Preparation of a report containing **messages** and **recommendations** to NRAs, together with ideas for additional support activities covering communications and methods for future exchange of ideas and best practice.

2. Framework model

The Subgroup Telematics developed a 'framework model' in which the Big Shift process is divided into three hierarchical levels: the strategic level, the tactical level and the operational level. This framework is tested in various practical cases as discussed later in this report. Experience has shown that this framework is useful in the analysis of transition processes and also contributes to structure these processes. It therefore offers the NRAs a framework for the "Big Shift" towards network operator. Having this model in mind also helps to provide a consistent basis for analysis and



recommendations. The figure shown here presents this 'three-layer' model, which has been used in analysing the cases.

On the **strategic level** policy goals are translated into road network performance requirements. The policy goals are usually well defined, in qualitative terms, considering the desired economic development, and land use and environmental planning. Rarely are these goals translated into specific road network performance requirements. This however should be done since the road network performance is directly related to and influences economic performance and mobility.

On the **tactical level** the road network performance requirements are translated into network functions of the roads and routes within the network. Network functions are for example functions for primary routes, feeder routes, rerouting etc. These functions, together with their service level attributes, help to achieve the overall network performance (it specifies which link of the network is primarily for flow, where buffer capacity is, which link is suitable for rerouting, etc). Furthermore services such as traffic information, traffic management or incident management are defined at this level, which enable the network functionality to be achieved to a certain quality.

On the **operational level** the systems, procedures, protocols and other organisational requirements to achieve the desired services are relevant. Technology is only a small part of the operational level. Yet in current daily practice a strong focus on systems and technical aspects rather than organisational and process frameworks exists.

Within this approach two lines can be distinguished:

- Process: coverage of all three administrative levels on the way towards the implementation of ITS: start by having a strategic agreement, a policy where it fits in, then define the tactical level and only then the translation into detailed operational aspects.
- Content: coverage of the various content topics on all levels as defined, focused on the network operation tasks.

3. Case studies

Case studies have been examined to verify, test and refine the framework model, but even more to derive 'common experiences' of Big Shift situations.

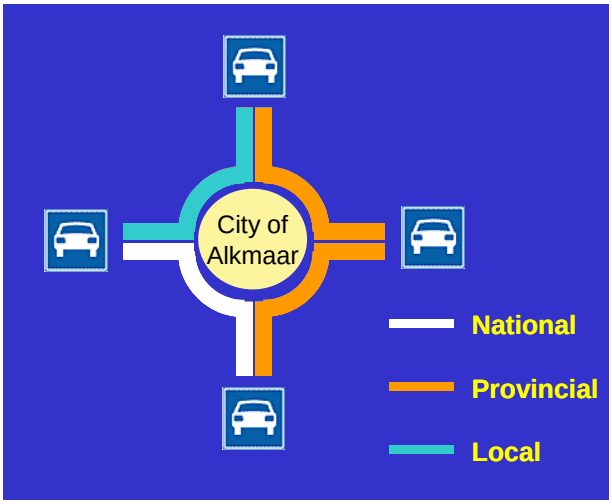
The following cases have been analysed:

a) The Netherlands: Ring Roads for City of Utrecht and Alkmaar
b) United Kingdom: National Traffic Control Centre (NTCC) of England and Role Change of Highways Agency
c) Germany: Traffic Management in Hessen Region
d) Germany: Traffic Management for Hannover World Expo 2000
e) USA: Big Shift from the Federal Highways Agency (FWHA)

a) Ring Roads for City of Utrecht and Alkmaar (the Netherlands)

The Case

The Cities of Utrecht and Alkmaar are both middle-sized cities in the Netherlands. Both cities are dealing with severe congestion on their trunk roads. The trunk road network around the cities belongs to several road authorities: the National Road Authority ("Rijkswaterstaat"), the Province and the Municipality. These roads can fulfil complementary functions within the regional view, such as for rerouting or buffering in case of severe congestion problems. However, each road authority has its own responsibility and therefore focuses primarily on its own roads, in order to optimise these. Looking to the complete set of roads from a (regional) network point of view is of secondary importance.



The initiative was taken to search for cooperation between the three road authorities. The central question was how the road authorities could come to a situation in which the existing road capacity and the complementarities of the road network will be used optimally. The process followed was corresponding the three-layer model as explained in the previous section:

- Defining one common vision on the regional road network; taking into account the individual policy objectives
- Set up management strategies
- Defining management tactics
- Determining operational measures

The following scheme shows the main results in change of strategy, based on this approach.

National Road Authority:
- traffic flow on the trunk road network (through traffic) has absolute priority;
- trunk road network is not for local traffic but primarily for through traffic;
- problems on municipal road should not have repercussions on the trunk road network.

Province:
- the road network should facilitate spatially located functions and developments;
- spatial planning should consider infrastructure capacity.

Municipality:
- parallel structures alongside trunk roads are for local and regional traffic;
- keep traffic as long as possible on the higher category of roads.

Big Shift

The common vision:
- there is one regional road network;
- this network should facilitate local, regional and through traffic adequately and safely;
- a common focus on most efficient use of the regional road network capacity;
- therefore exchange of traffic between each others networks will be facilitated, even when this calls for specific measures in maintenance or lay out of roads;
- traffic management in co-operation;
- a shared responsibility to solve bottlenecks;
- common ideas for completing the city's ring road.

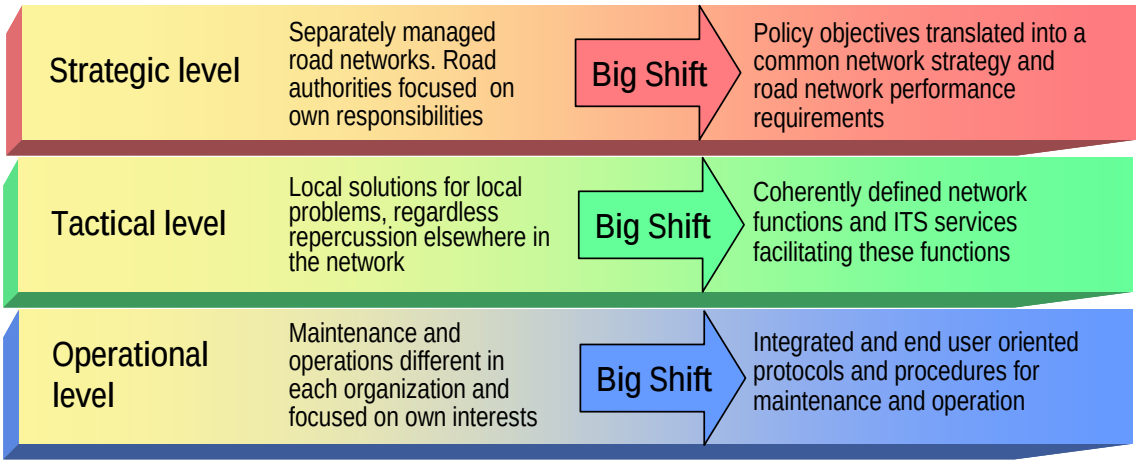
The essence of the Big Shift is that the three road authorities have adopted a service-oriented attitude towards the road user. A common sense of urgency has grown that cooperation is necessary to be able to provide the road users an adequate service level. Hence the authorities look beyond their separate responsibilities. Actually the different interests and responsibilities are combined in common objectives with regard to the functionalities of the regional road network.

In this case the common policy objectives are translated into qualitative requirements for the road network performance. These requirements are partly translated into network functions (tactical level). Specific links in the network have been appointed which can serve for rerouting or buffering. Other links have been established, which have a primary function for through traffic and are vital for the Ring Road around the city.

In the case for the City of Utrecht the primary objective was to define a common vision, as a framework for further cooperation. Interpretation of the strategy towards the tactical level (network functions and facilitating services) and the operational level (concrete measures) has not been made. Subsequently, practical organizational changes have not been taken in the stage of studying this case.

Consequently, those changes have been detailed on the tactical level, towards common network functions being geographically localized and services being identified in order to facilitate these functions. On the operational level practical agreements and contracts for operations and maintenance were developed, containing tuned protocols and procedures.

In the case for the City of Alkmaar the strategic, tactical and operational level were all covered. The need to solve the congestion problems was urgent, however possibilities on the short term to enhance road capacity were very limited. The scheme below shows the changes on the different levels.



Learning Experiences

On strategic level:
- Shared sense of urgency that cooperation is necessary to provide road users adequate service level
- Common objectives formulated with regard to functionalities of regional road network
- Translation objectives into qualitative requirements for road network performance

On tactical level:
- Road network requirements partly translated into network functions, including assigning each road on primary function
- Specific services identified to facilitate the road function (Alkmaar)

On operational level:
- Change in attitude within organizations involved due to common vision and joint responsibility for road network performance
- Practical agreements and contracts for operations and maintenance developed; authority with best competences assigned to perform tasks for entire regional network (Alkmaar)
- Contracts made with service providers to perform sub tasks in responsibility of task assigned partner (Alkmaar)

Related to the process:
- Basically top-down approach followed (common vision - management strategies - management tactics - operational measures); seemed most efficient
- Existing tool "Architecture for Traffic Management" assisted in going through process (Alkmaar)
- Tendency in process to concentrate on measures and systems (too fast), therefore in fact iterative process

b) National Traffic Control Centre and Traffic Manager Role Highways Agency (England)

The Case

Originally formed to maintain and improve England's strategic road network, in the late '90s the Highways Agency (HA) was given the additional task of managing the network as part of the Government's New Deal for Transport. Research in the early '90s had identified the potential for significant reduced congestion benefits from the management of traffic on the strategic motorway network, especially in the event of incidents. In the mid '90s, pilot strategic diversion schemes in Kent (the road corridor between London and the Channel Tunnel and Channel ports) as part of the EC Pleiades project, and around Birmingham (MDIS – Midlands Driver Information System) confirmed the benefits were achievable. To support its additional role of managing the network the HA developed the concept of expanding the Kent and MDIS systems to provide a national network of strategic diversion signs to be controlled from a National Traffic Control Centre (NTCC). The NTCC

would also be responsible for providing a central source of traffic data for the HA's network, for interfacing with the Scottish (NADICS) and Welsh (M4ntais) traffic control centres and for setting up partnerships with the Local Authorities who were responsible for the non-HA road network and with the Police who managed incidents and traffic on the HA's network from 33 Police Control Offices.

In order to implement the NTCC within the shortest possible time, the concept of using a Public Private Partnership (PPP) was developed, with capital funding and the systems provided by the private sector and the HA paying for the service over a long time period (10 years). The NTCC contract was competitively tendered and a contract awarded in March 2001 to Traffic Information services (TiS). The NTCC is already operating from a new control centre near the M5 in the West Midlands.

In October 2000, as part of its input to the Government's Ten Year Plan for Transport, the HA announced that within the 10 years it would develop systems to allow it to manage traffic (ATM – Active Traffic Management) from 6 regional control centres. In addition it announced a review of the roles and responsibilities of the Police and HA staff, to determine who was best placed to deliver traffic management services to drivers. The results of that review were available in January 2003, when snowfall brought the road network to a standstill in the South-East of England ("White Friday"). This provided the impetus for a much more rapid re-alignment of roles and responsibilities with the Police and the early introduction of HA Regional Control Centres to replace the more numerous Police Control Offices.

In April 2004 the first HA Traffic Officers started patrolling the motorways and working alongside the Police in the Control Office for the motorways around Birmingham. The HA's role will expand over the coming months until by 2006 HA Traffic Officers will be patrolling all of the English motorway network, the Regional Control Centres will be established and will be manned by HA staff and the HA will have moved to a 24/7 operation, responsible for the operation of their road network.

Learning experiences

On strategic level:

- Whenever a need for driver services is identified it is useful to check at the strategic level for the impact on or need to develop a network strategy.
- Consider the impact of DBFO (Design, Build, Finance, Operate) road contracts on network wide operations à try to ensure flexibility.
- Consider pro's and cons of conventional and PFI (Private Finance Initiative) procurement or PPP (Public Private Partnerships).

On tactical level:

- Note the importance of Partnering in developing services.
- Partnering also create risks; for instance by losing flexibility for the duration of a concession period (contract), in case developments asks for adjustments, or by forced split of tasks for interdependent tasks (e.g. investments in hardware and maintenance by another party)
- Detailed development at the tactic level reflects directly into service type specifications for the operational level.
- Task distribution between road authority and police becomes more of an issue in relation to the role of 'network operator'.

On operational level:

- Note the amount of development involved in ITS services throughout their life and the importance of allowing for this in contracts
- Identify clearly the road authority role and the possible roles that may be undertaken by others
- Align regionalized "infrastructure provision & maintenance" organization with network wide operational objectives
- Note the requirement for more formal agreements where private sector organizations are involved.
- Note the short life cycles of ICT components when contracting operations

Related to the process:

- 'Opportunity', being for example an event or a major incident, is needed or accelerates the implementation of the move towards network operations
- Recognize the existence of the three levels and how they relate to each other
- Set "break points" for each level, to reflect agreements to the next higher level, before going down to another level: check the results in each level against the initial objectives before proceeding.
- The operational role must be embedded on the strategic (and political) level
- Note the importance of service related specifications as they can help to link directly the outcomes with the policy/strategy objectives
- Recognize that robust business cases will be required and the criteria and priorities can vary between public and private organizations.

c) Traffic Management in Hessen Region (Germany)

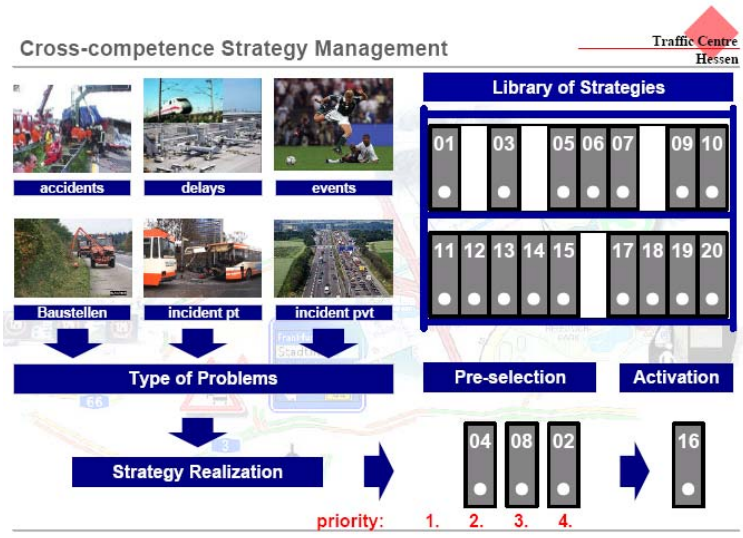
The Case

The Frankfurt-Rhein region, located formally in the Hessen Region in Germany, is one of areas in Europe with the most traffic movements. Both the road infrastructure and the public transport infrastructure is extensive in size, but also intensive in its use. Incidents, such as accidents or local congestion problems, special events and road works are critical issues to disorder the entire traffic flow in the region.

The “Hessisches Landesamt” (road director for both national and regional roads in the region) has initiated an integrated traffic management program for the region, by searching cooperation with all relevant parties: local road authorities, public transport authorities, airport authorities, etceteras. The objective was to improve communication and cooperation, in order use the available transport network(s) as efficient as possible. This has resulted in a program called “Cross Competence Strategy Management” system, which is supported by an operational regional traffic management centre. Part of these developments is also the creation of a specific organisation, a public authority company (called IVM Region Rhein-Main GmbH), which should be responsible for the management of the regional traffic management program.

Cross Competence Strategy Manager system

This system, also referred to as the “intermodal strategy manager (ISM)” is the basis for the regional traffic management. In conjunction with all parties traffic management strategies were identified, how to handle, in terms of both procedures and measures, in case of problem situations. Scenarios have been developed for identified potential problems. These scenarios, in which always a set of measures is included, are stored in a ‘library’, including criteria for activation, the stakeholders to be involved and the procedures to follow. Implementation of these predefined scenarios takes by tailor-made software, being the “ISM”. No specific consultation and discussions with other parties is required anymore. After activation of a scenario an evaluation is part of the program standard.



IVM Region Rhein-Main GmbH

The intention in Hessen was to create a specific organisation, a public authority company, called IVM Region Rhein-Main GmbH, which is responsible for the management of the regional traffic management program. At the moment of doing this case study the creation of this company was in full progress. The IVM Company is aimed to take also the lead in the prioritising of various funding streams. Special is the 'intermodal' character of the organisation, as it manages both the road network and the public transport network.

Learning Experiences

On strategic level:

- A common strategy involving all administrative levels to approach traffic problems (congestion)
- Agreement on the determination of strategic road infrastructure
- An independent, separate body proposed to get common strategy and overall priorities implemented (IVM GmbH is responsible for coordination of traffic management services)
- The 'client' of ITS applications must be central: the end user, the road user
- ITS applications make PPP constructions more applicable. However, deliberate selections where to involve private or public parties is important.
- Development of common perception and awareness needs attention
- Marketing of the overall mobility supply (and used concepts) needs attention

On tactical level:

- A predefinition of sets of measures / services is recommended
- An evaluation process which set of ITS services to choose, based on fixed procedures, involving all administrative levels (asking for approval), needs to be in place
- Integrated services: different levels of road (urban, regional, national) but also different modes of transport (intermodality)

On operational level:

- Procedures arranged beforehand in case a (traffic) problem arises
- Implementation and standardization based on best capable partner
- Mutual contracts between partners for implementation process
- Subcontracting of joint activities for cooperation partners
- Let operational bodies with best capabilities and insight do the job, delegate responsibilities when possible

Related to the process:

- Start at the right level when seeking for cooperation (often top-down, but not in every situation)
- Reserve time to reach consensus with all parties involved
- Start 'small' with new plans (e.g. IVM), concentrate on main goal first, better to add-on after establishment

- General success factors:
  - have the right momentum
  - have the people who are convinced
  - have the people who can convey the message to others, including decision makers

d) Traffic Management for Hannover World Expo 2000 (Germany)

The Case

The World Expo in the year 2000 took place in the City of Hannover, Germany. 2002. Such an event attracts enormous attention and many visitors. Subsequently the traffic situation is a critical issue for the Expo to become successful. In preparation to the Expo a full-scope traffic management organisation and plan has been prepared. The challenge was given to install and organise a traffic management system that took care of the 'normal' traffic to be carried on without additional problems, the major through traffic on the freeways should continue to function fluently and the City should be a good 'host' by providing good accessibility. The intention was also to provide a platform for the future, for áfter the Expo lifetime. Preparations for the traffic management centre started in 1994/1995.

Special legislation has been put in place to enable the power and responsibility issues around traffic management for the Expo. In this law it has been stated amongst others that the specifically for this purpose installed company MOVE got final responsibility for traffic management in the region. This meant that MOVE was responsible for the traffic management for all roads in the region (the German state Niedersaksen): both freeways, regional roads ánd the urban road network, and besides got influence on the public transport and setting priorities. A quite unique concept, in which political commitment and public support were included and being regarded as important success factors.

Important element in the traffic management set-up was related to the traffic data. A model was set up, bringing all relevant parties together; the "cooperative traffic management". In this body áll relevant data were brought together from both individual and public transport companies (rail, road, taxi, regional bus companies, road authorities, etc.). This data was brought onto one level and translated into recommendations and information (for the use of tactical control plans and future prognostics).

Ultimately, one (physical) central office has been set up, including a traffic control centre, from where the daily operation of the traffic took place.

In practice the preparation and coordination between parties appeared to function so well that the emergency scenarios, which were in place, never needed to be implemented during all 5 months of the Expo opening.

MOVE Company

The MOVE Company, a juridical based entity, was a Public Private Partnership (PPP); 51% of the shares belonged to the public authority (named Communal Association), private partners owned the rest. The 'income' for the private partners was the "right of use" of the concept and the company.
In fact the event of the World Expo empowered the actors to cooperate and establish MOVE. Its temporary character worked as a pressure-cooker, leading to commitment and action by all parties involved. Throughout the Expo MOVE operated successfully, but MOVE ceased operation at the end of Expo, due to financial and political reasons. Today, several organisations are discussing the 'revival' of an organisation similar to MOVE.

Learning Experiences

On strategic level:

- Strategy and priorities set beforehand, at the start of the 'project'
- Independent body installed (MOVE GmbH)
- Coverage by (special) law, to enable power and responsibility and provide clarity
- Think through PPP constructions well; where to involve private or public parties and have a good business case is important for success.

On tactical level:

- Independent body was given power to determine most applicable ITS services in case of (traffic) problems, covering the entire road and rail network (!)
- Good cooperation between partners and good preparation can even prevent need for use of worst-case (emergency) scenarios

On operational level:

- Arrangements on data collection, dissemination and distribution, including procedures
- In return on data delivery partners got 'enriched' data back

Related to the process:

- Public support is essentially to obtain and to keep (bottom-up); incorporate 'public support' in the organization if possible
- Inclusion of urban roads makes the process more complex and more difficult to reach consensus (pressure tool via special law)
- Assign tactical and capable persons in right positions (Hannover: former head of police)
- Success in this case was due to:
    - public support built-in the organization
    - event character: pressure-cooker and more political commitment

f) Big Shift at the FHWA (USA)

The Case

Within the Federal Highways Agency (FHWA) of the United States of America the Big Shift as an issue is alive since many years. In fact the origin of the expression 'Big Shift' was within the organisation of the FHWA, from which the Subgroup Telematics 'borrowed' it. A visit was paid to the FHWA in order to exchange experiences and ideas. The main reflections of the FHWA case are presented here.

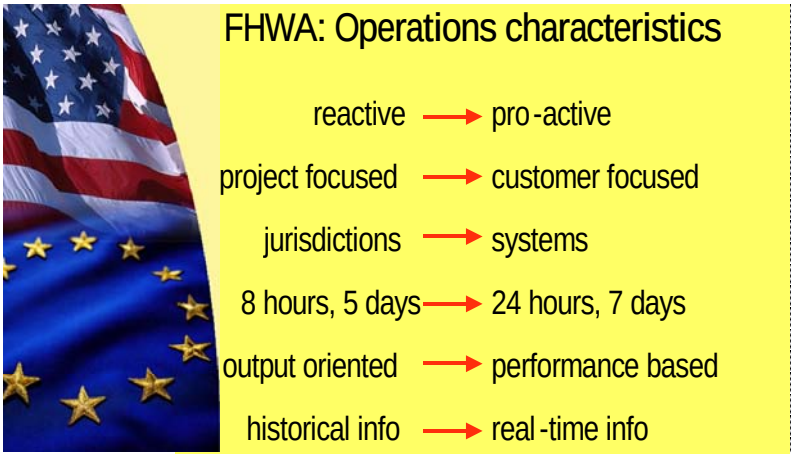
The FHWA launched the concept of the Big Shift in 1999 by starting a "National Dialogue on Transportation Operations". Consciousness was present that, facing the congestion problems in the country, a new approach was needed, intended to support 21st Century Operations using 21st Century Technologies. The main issues in this National Dialogue on Operations were related to:

- Customer focus
- Interagency coordination and cooperation
- Cultural changes
- Policies and practices that support operations
- Commitment at all levels
- Performance-based decision-making
- Interoperability

Subsequently the FHWA tried to get the message across in their own organisation and get it implemented, within the State DOTs (Department of Transports), AASHTO (the American Association of State Highway and Transportation Officials) and other related institutes (ITE, TRB, APTA, ITSA). AASHTO went through an institutional change, however this process struggled within the DOTs, although an increasing recognition of their 'operational' mission was occurring in these organisations.

Based on this delayed implementation a new push was launched from the FHWA; called the "National Coalition for Advancing Transportation Operations". The name Big Shift was left behind, the newest key word is "Operations", as the broad impression is that this triggers the DOTs more. This "National Coalition" intends to make the move from 'dialogue' to 'action' and get day-to-day operations more institutionalised on a broader scale.

The major elements of the FHWA point of view are reflected in the next overview.



Learning Experiences

Being mainly related to the process:

- Think in and find opportunities to get the Big Shift operations started
- To get the message across and achieve cultural changes is a long and difficult process
- Create recognition within politics
- Bringing the Big Shift message again and again in the only way
- Higher appreciation from managers with business or utility background than from road building
- Make the Big Shift through the planning process; from capital investment to lifecycle costs
- Focus on performance indicators because they are the driver for operations
- Future mobility demands can not realised without a Big Shift and integrated operations

Appendix B: Extract from PIARC "Road Network Operations Handbook"

To illustrate the contents of the PIARC Handbook on Road Operations herewith the table of contents and a part of Chapter 1 is presented.

Table of contents

Part of Chapter 1

Historically, road authorities responded to increasing demand by adding capacity, building new roads or expanding the existing ones. With the high costs and constraints on building conventional infrastructure, maximising the effectiveness of existing systems, including capitalising on new technologies such as Intelligent Transport Systems (ITS), has become, for many authorities, a new focus. Given demographic trends and the growing demand for improved system performance, road authorities are changing the way they plan and operate their transport systems and are focusing more intensely on road network operations.

More importantly, the transportation world has become increasingly user-driven. Users/customers are concerned with mobility and accessibility. They want transportation choices and real-time information in order to make informed decisions. Improved travel-time and congestion relief are desired. Greater reliability of the transportation system and the minimisation of unpredictable delays, greater safety and security are also high on the list of user expectations.

Operating the network is thus much more than keeping the system running. It is about optimising the system performance. The mission shift toward user responsiveness implies a clear and definite goal to improving the transportation system performance. In order to understand how successful we are in achieving our goal, we need to adopt performance measures that will evaluate the efficiency and effectiveness of our road network operations activities.

The current Handbook is structured in six chapters:

- Road Network Operations – Introduction
- Road Network Operations – (Challenges, Fields and Missions)
- Road Network Operations - Tasks and Measures
- ITS Solutions
- Institutional and Organisational Aspects of Road Network Operations
- Performance Indicators for Road Network Operations

Further, throughout this Handbook, five main fields have been identified in relation to road network operations and chapters 2 through 4 have been organised correspondingly:

- Network monitoring;
- Maintaining road serviceability and safety;
- Traffic control;
- Travel aid and user information;
- Demand management.

1.2 ROAD NETWORK OPERATIONS – CHALLENGES, FIELDS AND MISSIONS

"Road network operations" can be defined as "maintaining optimal conditions on the road network in relation to supply and demand". **Supply** is based on a hierarchy of service levels that determines the methods, organisational structures and resources needed to support strategies for road network operations, maintenance and incident response. **Demand** reflects the needs of the various customers and stakeholders (road network operators and users) and their operational objectives. The objectives of the network operator include:

- Improving safety on the road network;
- Optimising traffic flow on arterial and freeway networks;
- Reducing congestion within and between cities;
- Co-ordinating agency traffic/transit operations;
- Managing incidents, reducing delays and adverse effects of incidents, weather, roadwork, special events, emergencies and disaster situations;
- Effectively managing maintenance and construction work to minimise the impact on safety and congestion;
- Informing travellers with timely and accurate information;
- Improving the interfaces between modes of transport for passengers and freight;
- Eliminating bottlenecks due to inadequate road geometry;
- Providing reliable and convenient public transport services.

The operations refocus is also consistent with the mission of developing sustainable transport, providing for the mobility needs of the user while avoiding critical negative environmental impacts. More and more, transportation professionals and officials will be called upon to implement strategies that support sustainability providing the basic access needs of individuals and societies in balance with human and ecosystem health and, with equity within and between generations.

Chapter 2 presents the challenges of the operations focus and looks into network operators' missions and the related services that are delivered.

1.3 ROAD NETWORK OPERATIONS TASKS AND MEASURES

Before defining the tasks, measures and services that the network operator will undertake to achieve his missions, it is essential that he establish a comprehensive operations programme that specifies the objectives of the programme, sets the strategies to be implemented and identifies the issues that need to be resolved. This programme will contribute to identifying the required resources, technical, financial and human.

The technical solutions that will put the strategies into a concrete form then appear as tasks and measures for the network operator.

In Chapter 3, these tasks and measures are detailed in terms of their objectives, their technical and organisational characteristics and their constraints.

1.4 ROAD NETWORK OPERATIONS AND ITS SOLUTIONS

The last few decades have witnessed an increased use of information technology and communications in all sectors of the economy. Transportation has also benefited from this progress, through the provision of improved services for users. The use of road networks is greater than ever and the increase both in travel and changes in transport mode underscore the need to improve the management and operation of existing road networks.

Intelligent Transportation Systems (ITS) draw upon and integrate advanced information processing, telecommunications and electronics technology. ITS result in safer and more efficient transportation systems for both travellers and freight be it in urban centres or rural areas. ITS also provide useful information in real time to motorists and commercial operators as well as road network operators.

ITS applications have been grouped into families of services (…). While ITS provide important technologies to support transport operations, ITS and operations are not identical concepts. There are operational issues which have little or no relation to the technologies of ITS. Inversely, some ITS components relate more to planning than to operation.

(…)

The use of Intelligent Transport Systems (ITS) makes it possible either to devise new strategies for network operations or to improve existing strategies. ITS also provide a greater quantity and diversity of information, thus allowing users (motorists, commercial operators and public transport customers) to make informed travel decisions based on such factors as traffic conditions, road maintenance or construction work that potentially impact their travel time, and weather conditions that affect the road

network and safety. This information is becoming increasingly available through traditional media like radio and television and, more recently, online over Internet dedicated tools.

At the dawn of a real revolution in telecommunications spawned by wireless communications, real-time information is becoming increasingly available for all categories of users. Such information enables users to change trip plans en route based on the various conditions and disturbances on the road network. The same information allows road network operators to offer better service and to minimise certain safety-related risks.

These information systems also have the potential of bringing together modes of transportation that favour inter-modal schemes both for freight and passengers. Smartcards are one noteworthy means by which users can access seamless transportation networks. Such systems primarily benefit users but also generate valuable data that road network operators can draw upon to adapt services to real needs.

These new tools can assist in demand management and make it possible to influence the distribution of users between the various networks in order to improve traffic flow and achieve greater efficiency for the benefit of all.

The use of ITS for road network operations makes it possible to acquire a better knowledge of the road network and to implement every available means to optimise road network operations and services available to customers.

The current Handbook will indicate ITS tools that can be used in operating the network. However, each road authority will need to develop their own ITS strategies in line with their specific context, environment, policies and priorities. A much more detailed discussion on the full spectrum of ITS considerations can be found in PIARC's ITS Handbook 2000. The ITS Handbook covers all aspects of ITS from benefits of their implementation, to how to get started, as well as institutional issues and special considerations for countries in transition.

Chapter 4 looks into ITS tools that can optimise road network operations. Services, solutions (measures) and implementation issues will be discussed for each of the previously identified fields, from network monitoring to demand management.

Appendix C: Overview documents on ITS Costs and Benefits

This appendix lists overview documents describing the impacts, costs and benefits of ITS applications. A large number of ITS evaluations have resulted in even more documents on solitary pilots and applications in different countries. Below only the documents are mentioned that include an overview of multiple ITS applications.

In French and English

PIARC ITS Handbook 2000
Compiled by PIARC's Committee on Intelligent Transport, this documents provides a full review of operational tests and deployment of Intelligent Transportation Systems (ITS) in various countries around the world including evaluation results (costs, benefits) and lessons learned from today's pioneers of tomorrow's ITS.
Reference: PIARC ITS Handbook 2000. Publication: ISBN: 1-58053-103-2
Weblink: http://www.piarc.org/exec/publication.htm?objectId=151
An updated version is expected to be published at the end of 2004.

In English

Viking Status and overview of evaluations
Report with an overview of Evaluations of a wide range of ITS applications (roadside and in-car) in Finland, Denmark, Sweden, Norway and Northern Germany. Brief content descriptions in English.
Viking website: http://www.viking.ten-t.com/VikingExtern/Index.htm
Reference: Euro-Regional Project VIKING –MIP (2004), Viking Status and overview of evaluations, Version 0.95 (April 2004)

Intelligent Transportation Systems, Benefits and Costs, 2003 Update (DoT, USA)
This comprehensive report is a continuation of a series of reports (1999, 2001) providing a synthesis of the information collected by the United States Department of Transportation's ITS Joint Program Office on the impact and benefits that ITS projects have on the operation of the surface transportation network.
Reference: http://www.mitretek.org/its/benecost/BC_Update_2003/index.html

Available ITS Benefits and Unit Costs Database Related Documents (DoT, USA)
Overview website with listing, brief description and links to a variety of costs/benefits documents. The ITS Benefits and Unit Costs Database is a regularly updated repository of such information.
Reference: http://www.benefitcost.its.dot.gov/ITS/benecost.nsf/ByLink/DBDocs

The International Benefits Evaluation and Costs (IBEC) Working Group: An ITS Resource
IBEC is a working group for the ITS community, set up to exchange information and techniques used to evaluate the costs and benefits of Intelligent Transportation Systems & Services throughout the world. IBEC website: www.ibec-its.org
Reference: IBEC Working Group (2003), The International Benefits Evaluation and Costs (IBEC) Working Group: An ITS Resource, Paper 2866

Economic Impacts of Intelligent Transportation Systems
Compared with traditional transportation infrastructure, ITS technologies have different life cycles, cost structures, and a number of interrelated elements. This book addresses these concerns and proposes new economic assessment techniques as well as modifications to existing ones.
Weblink: http://www.elsevier.com/wps/find/bookdescription.cws_home/703230/description
Reference: Elsevier (2003), Economic Impacts of Intelligent Transportation Systems 8 (Innovations and Case Studies), ISBN: 0762309784

In other languages

Cost Effectiveness of Traffic Management Measures (the Netherlands)
Costs-benefits analysis report of 8 ITS and traffic management measures in the Netherlands 1995-2000.
Reference: Ministerie van Verkeer en Waterstaat, AVV (Maart 2003). (in Dutch, no English summary). Kosteneffectiviteit benuttingsmaatregelen.

Impacts of ITS applications (Sweden)
This report contains the compilation of the updated knowledge of impacts for 20 different ITS applications.
Reference: Vägverket (2003). (in Swedish, no English summary) ITS Effektsamband. Uppdatering av Effektsamband 2000 med avseende på ITS. Publication 2003:193

Summary of ITS impacts (Finland)
Study of the benefits and costs of 10 ITS applications in Finnish conditions
Reference: FITS (2004). (in Finnish, no English Summary). Eräiden joukko- ja tieliikenteen telematiikkasovellusten kannattavuus Suomen oloissa. Publication: ISBN 951-723-896-7, FITS-julkaisuja, Helsinki 2004

Help from telematics (Finland)
Finnish brochure for decision makers describing the function and benefits/costs for 20 different ITS services/systems
Reference: Apua telematiikasta 20 ratkaisua liikenteen ongelmiin (in Finnish, no English Summary), 2004

Appendix D: Glossary

Big Shift

The change in emphasis within NRAs from road building and maintenance to include road network operations and the consequent change in organisation and process required to deliver high quality network services

CEDR

Conference of European Directors of Roads (in French: Conférence Européenne des Directeurs des Routes), formerly known as WERD/DERD). The secretariat is settled in the building La Grande Arche, La Défense, Paris

FHWA

Federal HighWay Administration (USA), founder of the term ‘Big Shift’

ITS

See Intelligent Transport Systems and Intelligent Transport Services

Intelligent Transport Services

The abbreviation ITS is used traditionally for Intelligent Transport Systems. However, within the Big Shift a more user oriented service approach is preferred and for this reason we refer to Services instead of systems in this report.

Intelligent Transport Systems

ITS incorporates the latest technological developments in typical transportation operations to improve efficiencies of traffic flow, enhance road safety and offer additional information to motorists.

Network Operations

The integrated approach of maximising the effectiveness of existing systems, including capitalising on new technologies such as Intelligent Transport Systems

NRA

National Road Administration, the members of CEDR

PIARC / AIPCR

World Road Association / Association Mondiale de la Route, issuer of the Road Network Operations Handbook

Road Network Operations Handbook

"Historically, road authorities responded to increasing demand by adding capacity, building new roads or expanding the existing ones. With the high costs and constraints on building conventional infrastructure, maximising the effectiveness of existing systems, including capitalising on new technologies such as Intelligent Transport Systems (ITS), has become, for many authorities, a new focus. This handbook focuses on the soft engineering approaches and tools available to the network operator to improve network operations."

Subgroup Telematics

The CEDR established the Subgroup Telematics in February 2001 to provide strategic recommendations to CEDR members concerning the deployment of Intelligent Transport Services on the following five domains: Big Shift, Interoperability, ITS and Enforcement, Human Machine Interface, e-Safety

WERD/DERD

Western European Road Directors / Deputy European Road Directors, presently known as CEDR