NETWORK OPERATIONS

Friday 24 October 2003 (8.30 – 12.00 a.m.)

Session Agenda & Introductory Report

22.16.E

SESSION AGENDA

1. Activity Report

Ms. Sandra SULTANA (C16 Chairperson/CANADA-QUEBEC)

2. A Balanced Network Strategy: The Western Australia case

Mr. Bob PETERS (C16 member/AUSTRALIA)

2. ITS in Transitional Countries

a) Applying Intelligent transportation systems in developing and transitional countries

Dr. Toshiyuki YOKOTA (The World Bank/JAPAN)

b) The feasibility of ITS as a tool for improved Network

Mr. Alex van NIEKERK (C16 member/SOUTH AFRICA)

3. Road Pricing: Demand management through road pricing: London and Trondheim case studies

Mr. David CLOWES (C16 member/UK)
Mr. Torre HOVEN (C16 member/NORWAY)

4. Traveler Information

a) The benefits of traffic forecast and travel time estimation for drivers and network operators

Mr. Martial CHEVREUIL (ISIS Group EGIS/FRANCE)

b) Traveler information services in Europe

Mr. Yvon LOYAERTS (C16 member/FRANCE)

5. The Swiss distance related heavy vehicle fee

Dr. Matthias RAPP (C16 member/SWITZERLAND)

6. Future Actions

Mr. Jim WRIGHT (C16 English-speaking Secretary/USA)

7. Closure

Mr. John MILES (Session Chairman, C16 member/UK)

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ABSTRACT

While the last C16 cycle emphasized Intelligent Transportation Systems, the current cycle of the PIARC C16 Technical Committee emphasized Network Operations. The transition between the two topics was fluid because of the relationships between Intelligent Transportation Systems and Network Operations. Network Operations is the objective or strategy and Intelligent Transportation Systems is one of the tools to deliver this strategy.

A primary emphasis of the last four years has been the preparation of a NETWORK OPERATIONS HANDBOOK. The Handbook discusses theory, operations activities, institutional considerations and performance indicators. The Handbook is available at the XXIInd World Road Congress.

C16 will hold a session on Friday, 24th October at 8:30 AM to present aspects of Network Operations from around the world and to facilitate discussions about Network Operations theory, practice and future considerations. To assist participants understand and prepare for the session an **Introductory Report** was prepared. The report explains the concept of Network Operations, demonstrates where and how it is being applied, briefly discusses benefits and how to launch a Network Operations program. The report discusses selected issues and makes recommendations on future directions for these issues. A short section on Network Operations and Countries in Transitions is included. And finally a set of draft conclusions is presented for policy leaders, transportation professionals and international organizations.

EXECUTIVE SUMMARY

Historically, transportation agencies 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, maximizing the effectiveness of existing systems, including capitalizing on new technologies such as Intelligent Transport Systems (ITS), has become, for many agencies, a new focus. Given demographic trends and the growing demand for improved system performance, transportation agencies are changing the way they plan and operate their transport systems and are focusing more intensely on network operations.

More importantly, the transportation world has become increasingly customer-driven. 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 minimization of unpredictable delays, greater safety and security are also high on the list of customer expectations.

Operating the network is thus much more than keeping the system running. It is about optimizing the system performance. The mission shift toward customer 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 operations activities.

Network Operations in developing countries may take the same philosophical approach as in more developed countries. In actual implementation, however, special approaches may be required because of institutional maturity and resource availability. Some thoughtful consideration of the opportunities available and local needs and resources will ultimately determine the proper Network Operations strategy.

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INTRODUCTION

The C16 session will present Network Operations experiences from around the world. Key issues will be addressed that road administrators encounter when developing and implementing Network Operations. Particular experiences will address issues of freight, Intelligent Transportation Systems, road pricing, travel information, future travel time estimations and network operations in transition countries.

Case studies will be used to demonstrate specific aspects of network operations and conclusion drawn from each experience. Specific presentations include:

- Network Operations Committee - Activities Report
  During the 2000-2003 period, the committee on Network Operations has produced a Network Operations Manual that assembles fundamental information on the objectives and missions of the network operator and on measures and performance criteria that will ensure efficiency. The seven chapters of the Manual will be discussed.

- A Balanced Network Operations Strategy – The Western Australia Case

  In Western Australia, the network operator must have a strategy that takes into account very distinct road environments from large urban areas with typical urban transport problems to agricultural regions with medium levels of traffic and including a large remote area producing mineral exports with a need for reliable low cost road freight transport. These environments need ITS (Intelligent Transport Systems), innovative and flexible heavy vehicle management, appropriate road rules, traffic management, information and education, community and stakeholder involvement, signing, policing, clever improvements, and to meet the needs of pedestrians, cyclist, disabled needs and much more.

- The Feasibility of ITS as a Tool for Improved Network Operations for Freeways in South Africa
  Severe congestion is experienced on South African freeways in urban areas. The feasibility of ITS applications versus other options such as capacity improvements and new infrastructure to improve traffic congestion must be determined. The South African user needs must be defined as well as their interest for and their reaction to advanced ITS technologies.

- Demand Management through Road Pricing – Case study in London and Trondheim

  Demand management measures are increasingly being deployed to reduce traffic growth and improve mobility particularly in city centres where congestion, traffic accidents and air pollution are everyday problems the network operators must deal with. Two possible cases of demand management through road pricing will be presented: the London congestion charging scheme and the Trondheim Toll Ring System.

- The Swiss Distance Related Heavy Vehicle Fee – A Novel Approach to Area-Wide Road Charging
  Since the beginning of 2001 an electronic fee collection system for kilometre charging for heavy vehicles in Switzerland is in operation. The fee is collected with the help of sophisticated on-board units that make use of a variety of technologies. The main goal of the fee is to internalize the external costs of freight transport. By this "true costs" approach, rail transport is made more competitive and an incentive for modal shift towards the rail is created, while at the same time, the revenue helps finance the large Swiss transalpine railway projects. The extent to which the goals of this measure have been met will be discussed.

- Traveller Information Services in Europe
  Traveller information services are increasingly being deployed throughout the world whether to provide real-time information or predictive information. These services are integrated in a comprehensible policy for network operations that is focussed on traffic management and user services. The discussion will explore, in the European context, the role of road operators in the delivery of traveller information as well as their interactions with private sector service providers.

- The benefits of traffic forecast and travel time estimation for drivers and network operators
  Different tools are now available to provide traffic predictions and travel time on complex road network. These tools allow network operators to implement traffic control strategies better suited to cope with the rapidly evolving traffic situation as well as to provide drivers with accurate travel time information. Some of the tools in operation will be discussed particularly focussing on observed drivers' behavioural changes to the implementation of theses tools.

- Applying Intelligent Transportation Systems in developing and transitional countries

  The transportation situation in developing countries and countries in transition can be complicated as the need for new facilities is balanced with the need to operate the current system. Often the facilities are extremely overcrowded and there can be a broad range of vehicles operating on the system. Careful planning of resource allocations and the effective use of ITS may alleviate selected problems and improve the operational efficiency of the network. Selected case studies will demonstrate actions and the results of these actions.

- Network Operations Committee – Future Actions
  In closing, future actions and themes to be undertaken by the Committee on Network Operations will be discussed.

This Introductory Report is provided to assist all delegates better understand what is occurring in network operations and prepare them for actively participating in the C16 session discussion period.

The material in this report came from a variety of sources. A primary source is the Network Operations Handbook, which is available at this World Congress. Additional sources include various papers and presentations made at C16 meetings and other locations around the world.

Throughout the world transportation systems are feeling the strain of increased demands for personal mobility and for movement of products. As populations and economies grow transportation needs grow. At the same time there is a global realization that transportation is adding to environmental problems such as global warming. Political leaders and transportation professionals find themselves in continuous need of new tools to provide sustainable transport. Network Operations is one of these strategies.

THE CONCEPT OF NETWORK OPERATIONS

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

- improving safety on the road system;
- optimizing traffic flow on arterial and freeway networks ;
- reducing congestion within and between cities;
- coordinating agency traffic/transit operations;

- managing incidents, reducing delays and adverse effects of incidents, weather, work zones, special events, emergencies and disaster situations;

- effectively managing maintenance and construction work to minimize 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 geometrics;
- 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 customer 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.

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 transportation 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 networks.

NETWORK OPERATIONS - THE BIG SHIFT

Until recently road authorities' main goal was building and maintaining a road network. The "Big Shift" is the transition from this traditional approach to an operation function that includes a policy oriented towards the user. For road network operations two developments or shifts are relevant. Together these shifts can be referred to as a big shift, because they refer to the change of emphasis from road construction to road network operations, which is a much wider spectrum.

Firstly, there is the shift from building roads as such to the optimization of the use of existing roads or road networks. It can generally be realized by better traffic management, from re-active traffic influencing at point level (like traffic regulation at crossroads) to pro-active traffic influencing at network level (like traffic regulation to better guide economic relevant traffic streams to vital economic centres during rush hours). Major organizational changes are needed in order to make this shift.

Secondly, there is a shift from road network optimization (like traffic management) to the support of road network users (like support for traffic participation) which is viewed in two ways. The Outside-in view emphasis is on the services needed by road users. In the Inside-out view emphasis is on the operations needed to deliver the services. From his point of view a road user "participates in traffic", while a traffic manager from his point of view is involved in "traffic management". Good traffic management may lead to a better optimization of the road network, from the point of view of the traffic manager. However, this does not yet imply that traffic management is primarily directed at road user support. This again is another shift in approach.

There is another shift possible namely the shift from an emphasis on road network user support to transport user support, in which road network services delivered to road users are seen as part of the transport services delivered to transport users in a broader sense. A transport user in that sense can partly be a road user.

The “Big Shift” can be defined at the strategic, tactical and operational levels:

- **strategy**: this is the level where policy objectives are translated into road network performance requirements in qualitative terms of traffic flow, traffic safety, convenience, etc. The strategy will be derived in “missions”.

- **tactics**: this is the level where road network performance requirements are translated into road network “functions” with a certain quality. Furthermore “services” are defined on this level, which indicate the road network functionality to be performed at a certain quality level.

- **operation**: at this level we are confronted with organizational requirements, procedures and protocols and with the implementation of tools and strategies in order to meet the user needs.

The relationship between the three levels may be illustrated as follows.

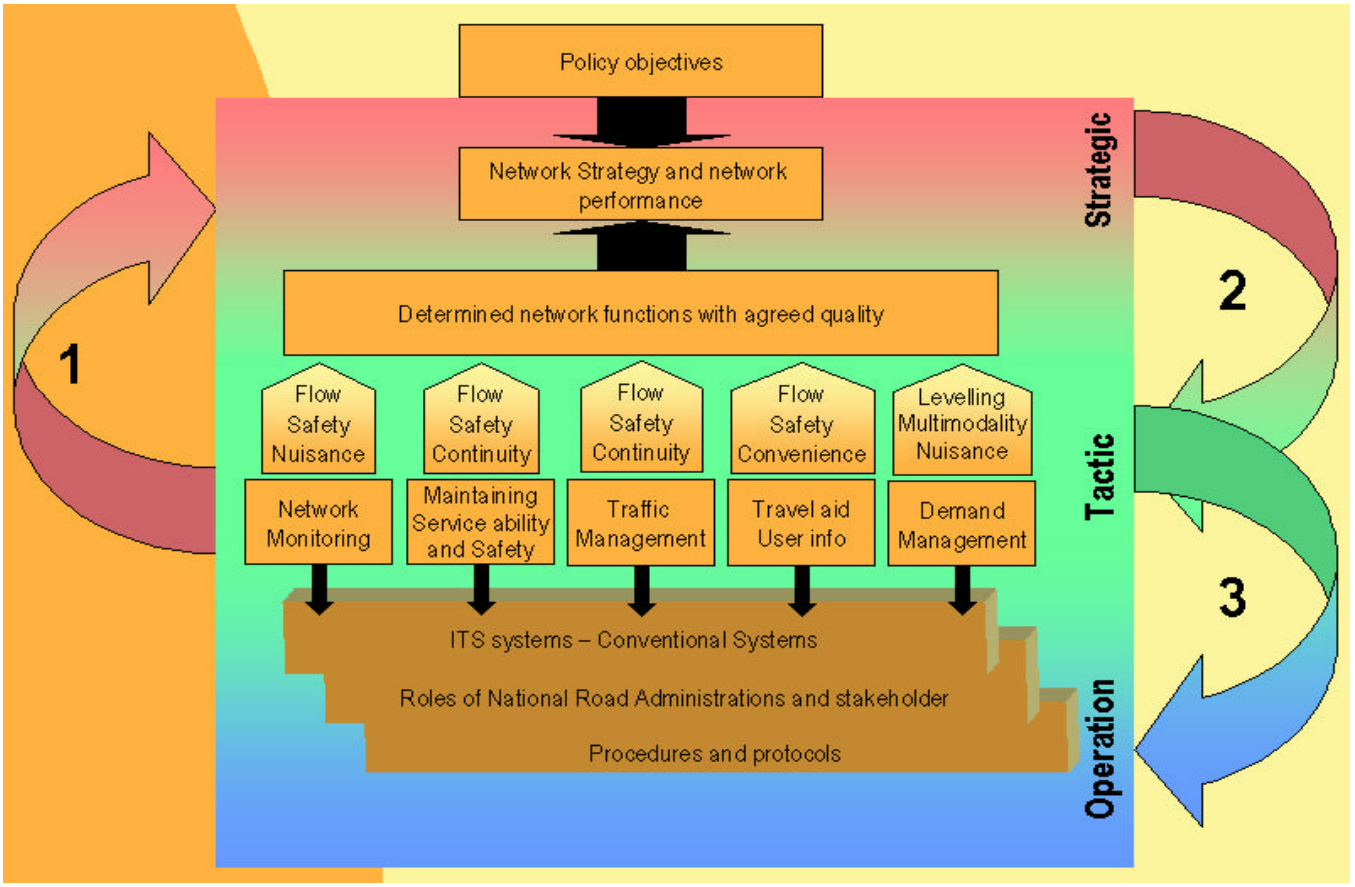

Figure 1 - The Big Shift

Intelligent Transport Systems (ITS) are present in each level although more specifically in the tactical and operational levels. Although they are not the only tools available to realise the “Big Shift” their development in recent years and their important potential give them a major role within new road network operation policy and more conventional services such as signing, emergency operations, attendant services to the road, etc.

NETWORK OPERATIONS: TASKS AND MEASURES

The network operator must perform a number of programmed technical or organizational tasks and measures specific to the following fields:

1. *network monitoring;*
2. *maintaining viability and safety;*
3. *traffic control;*
4. *travel aid and user information;*
5. *demand management.*

1. *Network Monitoring*
   Road network operators must have quick access to quantitative and qualitative data on the road and its operations, equipment and environment, to manage and maintain the road network as effectively as possible. The data used to operate the road are gathered manually or automatically; these can be used in real time or non-real time. Data can be gathered through roadside equipment, surveillance patrols, aerial observations and from users.

2. *Maintaining viability and safety*
   Incidents such as crashes and broken down vehicles as well as impassable/unsafe road conditions are estimated to cause up to 60% of annual roadway congestion. The traffic congestion that results from these incidents can lead to additional crashes and cause delayed response to emergency situations. Improved viability and safety of the road and road user can be achieved through:

   - effective emergency,
   - weather related services and winter service,
   - management of planned interventions,
   - enforcement,
   - weight Enforcement.

3. *Traffic control*
   Traffic control is one of the major objectives for the network operator. Improved and effective traffic control can be achieved through:

   - the **identification of periods at risk** by determining in advance when the risk of disruption is high in order to set in motion plans to avoid disruptions during these periods ;
   - **traffic forecasts**: The operator must forecast as accurately as possible, especially during known high-risk periods, the anticipated traffic in the network, to prepare to manage the consequences by adapting as much as possible;

- the **development of traffic management plans** to define and formalise, in non-real time decision-making and functional activities; organization of communications focused on the user; and coordinated traffic management and road information measures;
- the **production of procedures manuals** to define the operating actions of all road partners and guide their implementation to avoid dysfunctions in the handling of events due to organizational shortcomings;

- the **optimization of road use** by adapting the operation of traffic signal lights, regulating lane assignment, regulating speed to increase the capacity of an arterial and improve safety;

- **spreading traffic over time and space** in order to better balance traffic flow over the network including measures such as advisory diversion operations, traffic regulation, closing access, controlling access;

- **adapting road infrastructure and stationary equipment** such as **infrastructure improvements** to restore capacity consistent with that on the rest of the route by making temporary, low-cost improvements to geometry to cope with peak traffic flows or solve chronic dysfunctions.

4. *Travel aid and user information*
   Road information cuts across the entire field of operations and entails several facets such as the gathering of information from partners and user information on current traffic conditions. To be able to inform partners and drivers effectively, road network operators must:

   - establish information systems,
   - develop information exchanged by partners,
   - develop information sent to users.

5. *Demand Management*
   The increase of traffic is closely related to a region's economic prosperity. However, the problems of traffic jams have become a serious social issue throughout the world. Furthermore, the construction and improvement of road themselves would invite further economic development, leading to more automobiles on the network, which may exceed the added capacity and worsen the situation. Therefore, there must be a way to control demand itself, rather than forever playing catch-up to traffic demand. Possible actions that can be implemented or promoted by network operators include:

   - **information provision** before the trip or during the trip can allow road users to make individual judgment to take another route.

   - **road pricing** - Traffic congestion is clearly a case of imbalance between supply and demand. Controlling it through pricing is therefore a natural solution to reduce the demand for a road section.
   - **ramp metering** is a method to restrict the entry of vehicles through a certain on-ramp.

- **entry restriction** is a common method to close off a zone and limit the entrance to that zone based on the vehicle occupancy or the license plate of the vehicle.

- other methods of demand management, which may not directly involve the network operator such as the promotion of park-and-ride, ride share schemes, modal transfer incentives and promotion of public transport, etc. Subsidies for these programs may also be helpful.

INTELLIGENT TRANSPORTATION SYSTEMS - A TOOL FOR IMPROVED NETWORK OPERATIONS

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 network operators.

ITS applications have been grouped into families of services, one such grouping being shown in table 1. While ITS provide important technologies to support transportation 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.

Table 1 – User Services Provided by ITS

USER INFORMATION
Traveller information (en route or pre-trip)
Route guidance and navigation
Ride matching and reservations
Traveller services and reservations
TRAFFIC MANAGEMENT
Traffic control
Incident management
Travel demand management
Environmental conditions monitoring
Operations and maintenance
Automated dynamic enforcement
Non-vehicular road user safety
Multi-modal junction control and safety
PUBLIC TRANSPORT
Public transport management
En-route transit information
Demand responsive transport
Public travel security
ELECTRONIC PAYMENT
Electronic payment services

COMMERCIAL VEHICLE OPERATIONS
Electronic clearance
Automated roadside safety inspections
On-board safety monitoring
Administrative processes
Commercial fleet management
Inter-modal freight management
EMERGENCY MANAGEMENT
Emergency notification and personal security
Hazardous material incident response
Emergency vehicle management
Disaster response and management
ADVANCED VEHICLE CONTROLS AND SAFETY SYSTEMS
Collision avoidance (on board vehicles)
Collision avoidance (infrastructure)
Sensor-based driving safety enhancements
Safety
Pre-crash restraint deployment
Automated highway system (AHS)
DATA WAREHOUSING SERVICES
Weather and environmental data management
Archived data management

The use of intelligent transportation 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 transit customers – to make enlightened 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 system and safety. This information is becoming increasingly available through traditional media like radio and television and, more recently, online over the Internet.

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 transportation network. The same information allows transportation network operators to offer better service and to minimize 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 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 network operations makes it possible to acquire a better knowledge of the network and to implement every available means to optimize network operations and services available to customers.

INSTITUTIONAL AND ORGANIZATIONAL ASPECTS

Network operations can be characterized by the involvement of many partners in the delivery of services. Different agencies are involved in network operations depending on the network hierarchy (expressways, highways, urban roadways, etc.), transport mode (roadways, public transport, railways, etc.) or the type of service (safety, information, etc.). Effective network operations require functional, organizational, and inter-jurisdictional coordination, cooperation, integration and interoperability within a geographic region.

The logical outcome of the shared responsibility for network operations is the need to establish partnerships. In their organizational, financial and legal aspects, partnerships are often beset with particularly challenging issues. Some of the reasons institutional issues arise are included in Table 2 below.

Table 2 - Summary of Potential Causes of Institutional Issues

Reason	Explanation	Comments
Concern with autonomy	Coordination implies a loss of individual organization autonomy	
Different missions	Different organizations have different missions	The missions may be complementary but each organization brings a different mindset to the table which may cause institutional difficulties
Differences in resources	Budgets vary by jurisdiction and agency which may lead to differences in the capability of partners to perform equally	
Technology	Different organizations adopt different technological approaches which lead to difficulties in making technical systems interface properly.	
Information	The operations mission depends on information	Sharing of information is a very sensitive issue. Also integrating information may present technical difficulties.

It is thus not only necessary to analyze the particular needs, operational constraints and priorities of each party involved but it is also essential to define a clear division of roles and responsibilities among various partners, be they from the public or private sectors. Through this approach, various options for the functional, logical and physical architecture can be drawn up and formalized as the institutional framework.

PERFORMANCE ASSESSMENT

To improve performance for the benefit of users, it is critical to implement processes that enable the assessment of operations. Performance assessment methods must be both reliable and credible and must serve as a means of changing how things are done. It is thus advantageous to establish specific performance indicators, methods of cost-benefit analysis, as well as structured and quantified quality plans. Some of the major reasons for adopting performance include:

- accountability: performance measurement provides a means of determining whether resources are being allocated to the priority needs;
- efficiency: performance measurement focuses actions and resources on organizational outputs and the process of delivery;
- effectiveness: performance measurement provides a link between ultimate outcomes of policy decisions and the more immediate actions of transportation agencies. It provides a means to evaluate how well we are achieving our goals;

- communications: performance measurement provides better information to customers and stakeholders on progress being made toward desired goals and objectives;
- progress: performance measurement allows periodic refinement of programs and service delivery.

Performance management must become an ongoing activity for network operators. The use of performance measurement information will help set agreed-upon performance goals, allocate and prioritize resources, inform operators to either confirm or change current policy or program directions to meet those goals, and finally, report on the success of meeting the goals set.

CONSIDERATIONS FOR FUTURE DIRECTIONS

Over the last four years, the C16 Technical Committee has focused its attention on Network Operations, which has been briefly summarized above. The previous four years of C16 work were focused on Intelligent Transportation Systems, which was articulated in the ITS Handbook. The upcoming four years for C16 will need to continue this evolution of thinking and consider additional topics for its efforts. To establish some foundation for these activities several topic areas have been summarized. Each topic includes considerations for future C16 efforts.

Intermodality

Convenient interfaces between various modes of transportation can assist in more efficient travel as well as more travel options. For example, Euro-Rail has a web site that can provide schedules, ticketing and connection information. Travelers throughout the world can easily access this site and make all train arrangements.

In the freight area, containers, packages and mail can be tracked throughout their route. This attribute allows for known delivery times and provides a degree of customer satisfaction.

Consideration for Future Directions – Inter-modality needs to have substantial definition developed for a variety of inter-modal interfaces.

Data Acquisition and Management

As intelligent transportation systems installations grow there are continued demands for faster and more efficient data acquisition and management. For example, in traffic management there are trends toward the integration of several traffic management centers within a region. As regions deploy more data gathering equipment for traffic control, enforcement, incident management, homeland security and other services there will be more resources required for data fusion and management.

The ITS America Ten Year program Plan calls for an Integrated National Transportation Information system to be developed and deployed over the next ten years.

In several European communities there is growing support for road pricing schemes that will require very accurate and timely financial transaction capabilities.

Considerations for Future Directions –This topic will mature throughout the next few years and it should be a consideration in the next C16 cycle.

Road Pricing

Congestion is a formidable and growing world wide issue. The traditional tools to manage or stay ahead of the problem have been to build more capacity in the roadway or in transit facilities. Another strategy is to introduce more sophisticated traffic control and management strategies.

In order to guarantee sustainable development and a high quality transport service, road authorities need to look for new methods for financing and regulating traffic. A strategy that is now getting more attention is the idea of road pricing. Road pricing can take the form of toll facilities or the form of access control. Both of these strategies have political and technical issues to deal with if they are to become reality.

Considerations for Future Directions – An inventory of existing road pricing projects regarding the technology (how), the philosophy and policies (why) and the price-setting mechanisms used could be undertaken. The next C16 cycle could develop a series of white papers on best practices for international road pricing.

Sustainable development

Sustainable development in transportation is part of the larger discussion of sustainable development in society. In some respects, sustainable transportation trades off free mobility with environmental quality, fiscal constraints, safety and other human concerns. The vision for sustainable transportation is still being considered and debated.

Considerations for Future Directions – The next C16 cycle could consider conducting a seminar on sustainable development practices

Evaluation Methodologies

All measures in the field of network operations and traffic control aim at improvements in various areas such as: efficiency of transport and traffic, safety, environmental compatibility and mobility. To justify a measure in terms of costs and benefits, adequate evaluation methodologies are needed. Basically, there are two groups of methods: the cost-benefit analyses which evaluate all effects in monetary units, and the utility analyses which give relative weights to the various effects in a more or less socially accepted consensus due to the fact that there are no market prices of all effects.

Considerations for Future Directions - One task for the next years should be to discuss these problems and derive better-accepted recommendations for the evaluation procedure comprising the calculation process and the interpretation of model assumptions and results as well.

Performance Measures

The operational performance of a road network must be considered from the perspective of both the customers of the network (the road users and the wider community) and the owners and operators of the networks.

It is vital that performance measures employed be simple to use; they must be easy to obtain, accurate and reliable; and it is preferable that the data to be used is already available. The main aim is to quantify changes in performance in relation both to the inputs and the outputs. This should be tracked year on year:

- to determine if performance is improving or reducing
- to benchmark against performance targets
- to benchmark against other networks.

We must recognize that all performance indicators are likely to need significant interpretation and must be set up with great care.

Each operator will need to assess how he or she wishes to make use of the statistics generated by these measurements. Apart from the clear demonstration of the success or failure of the enterprise and the changes that take place year by year, the measures can be used as a positive management tool to improve services and cost effectiveness.

Considerations for Future Directions - Many countries have been using performance indicators for some time. It would be useful to look in more depth which indicators have proved successful and which have not. It would also be useful to find out how countries have used the data from performance indicators within their management systems to assist them in improving their service delivery to the customer and to improve the effectiveness of their operations.

Road Network Operations and Transport Integration

Road network operations are part of the transport system in a broader sense. Especially in more advanced transport systems the need emerges to manage transport in an integral way. Several issues are addressed in this context, such as sustainable mobility and the transport chain management. Strongly related to these global issues are integrated information, demand management and slot management.

In order to do this a basic transport model is needed to properly position transport and road network operations.

Considerations for Future Directions – It would be useful to develop a basic transport model to position road network operations within this broader concept and to identify ways of better integrating transportation operations as a whole.
The model would be based on case studies and developments as they have taken place and take place in several parts of the world.

Road Operations Development Model

Throughout recent years, the concept of road operations has evolved. Road operations at the network level is one of the latest stages in this development.

An interesting question is to determine how countries in transition can accelerate the development of road operations, building on the knowledge and progress achieved by developed countries.

To address this issue, it could be helpful to have a development model for road operations, which is based on real developments and best practices throughout the world. This model would be a primary means of understanding the major functions of road network operations and of setting performance measures.

Considerations for Future Directions - A road operations development model that would be based on real developments as they have taken place and take place in several parts of the world.

Homeland Security

Homeland security has become a significant issue in nations of all sizes. Both domestic and international terrorism can have a significant impact on a nation's economy and quality of life. Citizens expect their governments, including their transport departments, to prevent attacks where possible, and to be prepared to recover when attacked.

Much about transportation's role in defending the homeland requires attention in order for transportation assets to be protected from attack, and for transportation agencies to be able to carry out the responsibilities in responding to and recovering from attacks. Since many of the processes and much of the technology related to terrorism and disaster management are not part of either the training or the experience of transportation professionals, they need assistance in order to be properly prepared.

Considerations for Future Directions - Of immediate value would be activities such as documenting and sharing the lessons learned by nations that have experienced threats to their homeland security, and the practices, technologies, and other resources that they have found helpful in maintaining readiness.

Travel Information

Over the last few years transportation agencies have been moving towards a customer service model for updating their business practices. The overall theme of this business model is operations. The operational concept covers multiple services including travel information.

In some of the transition countries travel information is also a fundamental service required for public transport and roadway events. In transition countries this service is of a very fundamental nature. Here the service is often driven by the costs of making the products available to the practitioners.

The roadway travel information systems in Asia, America and Europe provide congestion information, incident information, weather information, location of reports and in some cases travel times. For public transport, schedule information, delays and fares are typical.

In America a three-digit phone number (511) has been made available exclusively for travel information. The Federal Communications Commission (FCC) has provided the number exclusively to the state Departments of transportation.

Considerations for Future Directions - There are a variety of issues surrounding development, deployment and operations of travel information systems. Some examples of these issues include: what does the customer want, what delivery mechanisms are appropriate, how to financially sustain a growing service and what transportation impacts result from providing the service.

Network Operations in Transitional Countries

Transportation in developing and transitional countries can be complicated because of a variety of factors. For example there is a need to operate a network that is often extremely overcrowded. At the same time there is a need to make new investments for infrastructure construction and upgrading of existing infrastructure. These tradeoffs require careful planning and allocation of the resources.

New tools are being used that can have a beneficial impact such as Intelligent Transportation Systems (ITS) or methods of funding and building new infrastructure such as public-private partnerships (PPP) to Build Operate Transfer (BOT) and Build Operate Own (BOO). Of course there are other types of concession schemes available also. These new tools and methods, while effective, require a significant amount of sophistication in human resources and institutional foundation that may not be available.

Considerations for Future Directions - The relative implementation costs of ITS for transitional countries may be much higher than in economically advanced countries to increase road capacity, due to the currencies in which most of the hardware and software for ITS needs to be purchased. The benefits vs. the costs of implementing ITS in transitional countries must be evaluated against more conventional methods such as infrastructure expansion or value engineering improvements to determine the appropriateness of ITS for countries in transition.

Considerations for Future Directions - There are a number of aspects regarding PPP that need to be evaluated. PPP, especially in urban areas, effectively increase the number of network operators in an already complex environment of different road authorities. If the PPP is serviced through income from tolls, conflict may arise between the effective management of a total network by a single network operator, or the optimization of revenue or traffic flow for the PPP project by the PPP operator.

Automatic Enforcement

Traffic rules enforcement has been considered for a long time as the task of the Police and only the Police (except for some aspects such as weight enforcement and freight transport regulation). However, today with the shift of activities from road building and maintenance to road operation, road operators are confronted to the fact that the benefits of the measures they implement depend heavily on user compliance to these measures. Thus, enforcement becomes a key issue for the success of traffic management measures such as speed control, access control or pricing policies.

In addition, new technologies can offer new facilities for enforcement without impeding traffic flow: automatic enforcement is feasible as it has been already demonstrated in several countries.

Considerations for Future Directions - This activity should then start with the identification of automatic enforcement systems in place or in development in the world (technologies, conditions of use, evaluation,…). Legal aspects will be also investigated. The objective is to end with some recommendations for road operators on the conditions for implementing enforcement.

Automated highway (consequences for operation)

The automotive industry continues to advance automated highway systems technology. Some examples include: distance keeping systems (already on the market), intelligent speed adaptation (or limitation, ...), platooning (could be introduced starting with two vehicles…), use of accurate road data in navigation maps for improving safety. Even if at a first stage, we can imagine that these new features will not revolutionise traffic operation, they could yet progressively modify the traffic flow behaviour.

Considerations for Future Directions - This activity should start with the identification of the key systems to be considered (in relation with their probability and delay of market introduction), and identification of the modifications they can introduce on the road operator side. These modifications can be in terms of new advantages that can be drawn from the systems (e.g.: ability for the operator to send direct “speed instructions” in conformity with a speed control system) or on the contrary new constraints (e.g.: how to organise the updating of accurate road data used in safety system, what are the possible liability issues?).

User surveys – Marketing – Communications

Road network operations might be characterized by a clearly expressed willingness to improve the service to the user, the different techniques, methods and fields being only tools to reach the fixed target.

In that framework, the essence itself of the relationship between the driver (the user) and the road operator (the service provider) must be clearly (re)defined as the mutual perception of the expectations, projects, etc.

So it sounds important to take care in the future of the perception that the users might have of a realistic and efficient evolution of the new tools brought to their disposal, beyond the reactions created by slogans or publicity. In the same way, the whole range of services related to network operations should be properly perceived by the driver as, reciprocally, the latter's real needs should be taken into account by the operator. That might be done through a whole range of marketing actions but also through user surveys, the definition of satisfaction indicators, etc. Improvement of operations strategies may result from the good use of all those techniques.

Considerations for Future Directions - In the next work cycle the different aspects, interpretations and consequences that this communication policy might cover should be considered in order to improve its use and, consequently, the road network operations policies.

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DRAFT CONCLUSIONS

Relief for transportation congestion is becoming more of an issue throughout the world. The rising congestion is present on most modes and is directly affecting the economies of many nations. Recently the transportation community has been discussing a new strategy to alleviate some of the growing congestion. This strategy is called Network Operations and under this approach the attention shifts from an institutional focus to a customer focus. Under a network operations approach the outputs and performance issues deal more directly with customer requirements. Consequently, policy leaders, transportation professionals and international organizations need to pay attention to Network Operations concepts as a new influence on their thinking and their actions.

A. For policy leaders

- A major transition needs to occur from a public works mentality to a mobility service mentality. A transition of this magnitude will require leadership and constituency building from governmental and private transportation organisations. Policy leaders must provide this leadership.

- Network Operations needs to be defined and institutionalized in agencies' policies, in their processes and in their programs.
- The new focus will require a customer performance point of view rather then just a facilities performance point of view.
- Establishment of performance measures for multiple modes and for interdependent agencies will be required. This action necessitates inter-agency collaboration and cooperation.

B. For transportation professionals

- Transportation professionals will be the ones implementing the policies, operating the systems and actually measuring the performance. Therefore, the organizations' plans, programs and staffing needs to reflect network operations concepts.
- A continuous learning process will be required as the transition takes place from public works to network operations.
- Mechanisms to establish measurable customer expectations and to actually measure customer satisfaction will have to be developed and refined.

- Academic institutions will be required to modify transportation curriculums to include Network Operations concepts, practices and tools.

C. For international organizations

- Information sharing on Network Operations concepts, best practices, benefits and funding sources should become a high priority.

- Introducing Network Operations modules into international conferences would be valuable in spreading the experiences of many countries.

- Publication of handbooks in several languages could facilitate a better understanding of the concepts and the potential benefits of Network Operations.
- Web sites and routine publications could carry experiences, best practices and identify locations where successful Network Operations actions are underway.

- International scanning tours would be of a great assistance.