INTERNATIONAL TECHNOLOGY EXCHANGE PROGRAM

AUGUST 2003

Meeting 21st Century Challenges of System Performance Through Better Operations

U.S. Department of Transportation
Federal Highway Administration

NOTICE

The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official policy of the Department of Transportation.

The metric units reported are those used in common practice by the persons interviewed. They have not been converted to pure SI units because in some cases, the level of precision implied would have been changed.

The United States Government does not endorse products or manufacturers. Trademarks or manufacturers' names appear herein only because they are considered essential to the document.

The publication of this document was sponsored by the U.S. Federal Highway Administration under contract number DTFH61-99-C00005, awarded to American Trade Initiatives, Inc. Any opinions, options, findings, conclusions, or recommendations expressed herein are those of the authors and do not necessarily reflect those of the U.S. Government, the authors' parent institutions, or American Trade Initiatives, Inc.

This report does not constitute a standard, specification, or regulation.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-PL-03-012		

4. Title and Subtitle	5. Report Date
Meeting 21st Century Challenges of System Performance Through Better Operations	August 2003
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Jeff Lindley, Tom Warne, Andrea d'Amato, John Fisher, Cheri Heramb, Adele McCormick, Melisa Ridenour, Gerry Smith, Joe Stapleton, David Zavattero	

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
American Trade Initiatives P.O. Box 8228 Alexandria, VA 22306-8228	
	11. Contract or Grant No. DTFH61-99-C-0005

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Office of International Programs Office of Policy Federal Highway Administration U.S. Department of Transportation American Association of State Highway and Transportation Officials	
	14. Sponsoring Agency Code

15. Supplementary Notes

FHWA COTR: Hana Maier, Office of International Programs

16. Abstract

Meeting the nation's mobility needs in the 21st century requires moving from a construction-based focus to an emphasis on system operations across all transportation modes. The Federal Highway Administration, American Association of State Highway and Transportation Officials, and National Cooperative Highway Research Program sponsored a scanning study of Germany, France, England, and the Netherlands to investigate current and planned strategies for sustaining good system performance and operational practices in those countries.

The U.S. delegation observed that reducing congestion and integrating transportation systems and services are national commitments in each country, and that funding for these activities is higher than in the United States. Governments base both strategic investment and tactical operations decisions on the priorities of safety and customer service.

The scanning team's recommendations for U.S. application include making a long-term national commitment to reducing congestion and integrating surface transportation systems and services. The team also recommends actions that can be taken at State and local levels, including focusing on safety and customer service, balancing passenger and freight operations, and contracting for management and operations activities.

17. Key Words	18. Distribution Statement
Traffic management, mobility, transportation system integration, intermodal coordination, intelligent transportation systems, privatization	No restrictions. This document is available to the public from the: Office of International Programs, FHWA-HPIP, Room 3325, U.S. Dept. of Transportation, Washington, DC 20590 *international@fhwa.dot.gov* *www.international.fhwa.dot.gov*

19. Security Classify. (of this report)	20. Security Classify. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	53	Free

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Meeting 21st Century Challenges of System Performance Through Better Operations

PREPARED BY THE INTERNATIONAL SCANNING STUDY TEAM

Jeff Lindley
FHWA
Team Leader

Tom Warne
Utah DOT
Team Leader

Andrea d'Amato
City of Boston DOT

Matt Edelman
TRANSCOM

John Fisher
City of Los Angeles DOT

Cheri Heramb
City of Chicago DOT

Adele McCormick
Report Facilitator

Melisa Ridenour
FHWA

Gerry Smith
Washington State DOT

Joe Stapleton
Georgia DOT

David Zavattero
Illinois DOT

and

American Trade Initiatives, Inc.

LGB & Associates, Inc.

for the

Federal Highway Administration
U.S. Department of Transportation

American Association of State Highway and Transportation Officials

National Cooperative Highway Research Program
(Panel 20-36)
of the Transportation Research Board

August 2003

Acknowledgements

A large number of people contributed to the success of the 21st Century Operations scanning study. Above all, the team would like to thank the members of the host delegations who so willingly gave their time, resources, and hospitality to make us welcome and provide us with a wealth of valuable information on transportation operations practices in their countries. Although too numerous to name here, the individuals the team met with are listed in Appendix C. In addition to the people listed in the appendix, the team would like to thank all of the people in the host countries who worked on logistical aspects behind the scenes. We appreciate their valuable contribution to the success of this trip. Special thanks go also to the superb interpreters who allowed the team members to focus their attention on the content of each presentation with such ease.

The team would like to express their gratitude to the staff of American Trade Initiatives, Inc., (ATI) for their phenomenal efforts, without which this trip would not have been possible. ATI, contracting to the Federal Highway Administration (FHWA), handled all logistical aspects of the study, and the staff's guidance was invaluable. In particular, the team would like to recognize the following:

- Joe Conn for his expert guidance and assistance in organizing the trip.
- John O'Neill for his leadership and guidance as our escort during the study. It would not have been possible to accomplish all we did without him.
- Alexandra Doumani for her unfailing assistance and expertise with travel arrangements and disbursement of funds.
- Betty Dillon for her assistance in preparing this report for publication.

Finally, this trip would not have been possible without the support and funding of the FHWA Office of International Programs. The team would especially like to thank Donald Symmes and Hana Maier for sponsoring the trip and allowing the team to learn firsthand how the European countries they visited are meeting the 21st century challenges of system performance through better operations.

FHWA International Technology Exchange Programs

The Federal Highway Administration's (FHWA) international programs focus on meeting the growing demands of its partners at the Federal, State, and local levels for access to information on state-of-the-art technology and the best practices used worldwide. While FHWA is considered a world leader in highway transportation, the domestic highway community is interested in advanced technologies being developed by other countries, as well as innovative organizational and financing techniques used by the FHWA's international counterparts.

The International Technology Scanning Program accesses and evaluates foreign technologies and innovations that could significantly benefit U.S. highway transportation systems. Access to foreign innovations is strengthened by U.S. participation on the technical committees of international highway organizations and through bilateral technical exchange agreements with selected nations. The program is undertaken cooperatively with the American Association of State Highway and Transportation Officials and its Select Committee on International Activities, and the Transportation Research Board's National Cooperative Highway Research Program (Panel 20-36), the private sector, and academia.

FHWA and its partners jointly determine priority topic areas. Teams of specialists in the specific areas of expertise being investigated are formed and sent to countries where significant advances and innovations have been made in technology, management practices, organizational structure, program delivery, and financing. Teams usually include Federal and State highway officials, private sector and industry association representatives, and members of the academic community.

FHWA has organized more than 50 of these reviews and disseminated results nationwide. Topics have encompassed pavements, bridge construction and maintenance, contracting, intermodal transport, organizational management, winter road maintenance, safety, intelligent transportation systems, planning, and policy. Findings are recommended for follow-up with further research and pilot or demonstration projects to verify adaptability to the United States. Information about the scan findings and results of pilot programs are then disseminated nationally to State and local highway and transportation officials and the private sector for implementation.

This program has resulted in significant improvements and savings in road program technologies and practices throughout the United States, particularly in the areas of structures, pavements, safety, and winter road maintenance. Joint research and technology-sharing projects have also been launched with international counterparts, further conserving resources and advancing the state of the art.

For a complete list of International Technology Scanning topics and to order free copies of the reports, please see page iv.

Website: www.international.fhwa.dot.gov
E-Mail: international@fhwa.dot.gov

FHWA International Technology Exchange Reports

International Technology Scanning Program: Bringing Global Innovations to U.S. Highways

INFRASTRUCTURE

Geotechnical Engineering Practices in Canada and Europe

Geotechnology—Soil Nailing

International Contract Administration Techniques for Quality Enhancement—CATQUEST

Contract Administration: Technology and Practice in Europe

PAVEMENTS

European Asphalt Technology

European Concrete Technology

South African Pavement Technology

Highway/Commercial Vehicle Interaction

Recycled Materials in European Highway Environments

Pavement Preservation Technology in France, South Africa, and Australia

BRIDGES

European Bridge Structures

Asian Bridge Structures

Bridge Maintenance Coatings

European Practices for Bridge Scour and Stream Instability Countermeasures

Advanced Composites in Bridges in Europe and Japan

Steel Bridge Fabrication Technologies in Europe and Japan

Performance of Concrete Segmental and Cable-Stayed Bridges in Europe

PLANNING AND ENVIRONMENT

European Intermodal Programs: Planning, Policy, and Technology

National Travel Surveys

Recycled Materials in European Highway Environments

Geometric Design Practices for European Roads

Sustainable Transportation Practices in Europe

Wildlife Habitat Connectivity Across European Highways

European Right-of-Way and Utilities Best Practices

SAFETY

Pedestrian and Bicycle Safety in England, Germany, and the Netherlands

Speed Management and Enforcement Technology: Europe and Australia

Safety Management Practices in Japan, Australia, and New Zealand

Road Safety Audits—Final Report

Road Safety Audits—Case Studies

Innovative Traffic Control Technology and Practice in Europe

Commercial Vehicle Safety Technology and Practice in Europe

Methods and Procedures to Reduce Motorist Delays in European Work Zones

Managing and Organizing Comprehensive Highway Safety in Europe

OPERATIONS

Advanced Transportation Technology

European Traffic Monitoring

Traffic Management and Traveler Information Systems

European Winter Service Technology

Snowbreak Forest Book—Highway Snowstorm Countermeasure Manual (translated from Japanese)

European Road Lighting Technologies

Freight Transportation: The European Market

Freight Transportation: the Latin American Market

Meeting 21st Century Challenges of System Performance Through Better Operations

POLICY AND INFORMATION

Emerging Models for Delivering Transportation Programs and Services

Acquiring Highway Transportation Information from Abroad—Handbook

Acquiring Highway Transportation Information from Abroad—Final Report

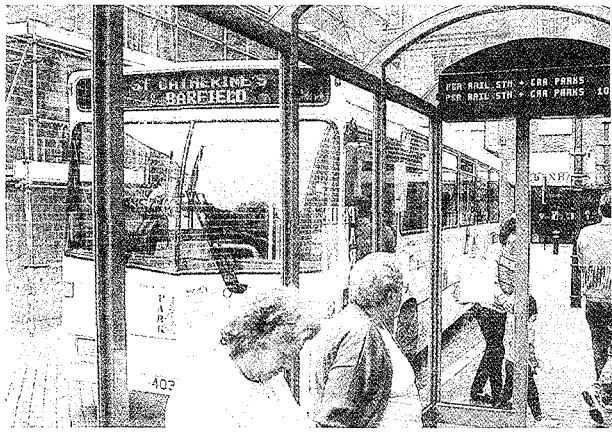
International Guide to Transportation Information

European Best Practices in Transportation Workforce Development

All publications are available at ***www.international.fhwa.dot.gov***

Contents

p. 6



p. 20

p. 27

CONTENTS

p. 28

p. 36

Executive Summary

Surface transportation systems developed in the United States during the last century are reaching their capacity, especially in metropolitan areas. Traffic congestion is increasing as we run out of capacity to put more cars and trucks on the roads. Because our transportation modes have been developed and operated as unique systems, intermodal coordination, both for passengers and freight, is in its infancy in most areas.

As our surface transportation systems reach capacity, a new element is being added to our nation's infrastructure. A network of telecommunication systems, complemented by wireless and satellite systems, now links our nation.

The solutions for meeting our nation's mobility requirements in the 21st century need to go beyond building more and wider roads. Our focus must shift from car- and truck-moving capacity to people- and freight-moving capacity. Our transportation system will still be based on rail and roads, but we can maximize these elements with the integration of communication systems, technology advances, and computing power.

In March 2001, the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) jointly sponsored an international scanning study to investigate the historical and contemporary context for transportation operations in four European countries. The team also focused on the policies and strategies planned for the future to sustain good system performance and operational practices in these countries. The U.S. delegation's goal is for the lessons learned from this scan to help U.S. transportation agencies evolve from a culture based primarily on construction to one that also emphasizes system operations across all modes, and balances that with facility expansion.

The U.S. delegation included members representing AASHTO; FHWA; State departments of transportation (DOTs) in Georgia, Illinois, Utah, and Washington; transportation departments of the cities of Boston, Chicago, and Los Angeles; and TRANSCOM, a regional transportation operations coordinating committee including traffic and transit agencies in the New York/New Jersey/Connecticut metropolitan area. Team members are listed in Appendix A.

The team met with transportation officials in Bonn and Frankfurt, Germany; Delft, Netherlands; Paris, France; and London and Winchester, England. The host officials provided a wealth of information on their strategies for meeting the 21st century challenges of system performance through better operations.

Team meetings were held at the beginning, midpoint, and end of the two-week study to share observations and discuss those practices identified as having value for potential implementation in the United States.

The host countries are experiencing many of the same economic, cultural, and transportation trends as the United States. With growing economies, populations, and employment, urban areas are expanding beyond their traditional boundaries. Auto ownership and use are growing and leisure trips make up a larger portion of travel. Truck traffic is increasing and the average trip is longer.

Europeans share similar values, which are reflected in the planning goals for their transport systems. Their highest priority is safety. They consider affordable transportation to be a key to healthy economies. They are committed to minimizing transportation's negative environmental effects by reducing emissions, noise, and visual intrusion. Mobility is considered fun and a contributor to a higher overall quality of life.

Transportation officials share a customer focus. Both strategic investment and tactical operations decisions are driven by safety and customer preference.

While there are many commonalities between the United States and Europe, different technologies and operating practices have been developed to meet local needs. This scanning study was an opportunity to view new solutions and to evaluate their potential benefits to the United States.

The findings and observations contained in this report are grouped into the following chapters: Policy, Relationship Integration, Resources, and Methods. Each chapter contains findings and observations that team members believe have significance and/or potential implementation value in the United States. The findings, observations, and recommendations are those of the scanning team and not of FHWA.

Policy

In planning strategic investment, governments at all levels seek to optimize the use of existing facilities through better operations and extend their useful life by preventive maintenance to avoid the cost and disruption of major reconstruction. Although they acknowledge that they cannot build their way out of congestion, the countries the team visited are undertaking new construction to fill service gaps. What they build is deliberate and focused on an integrated plan. Building is done for specific purposes and is complementary to what is already in place.

The strong federal government creates a different culture in Europe for how various levels of government interrelate. Recent delegation in several countries has clarified the transportation management roles of various government levels. As in the United States, all levels of government undertake improvements for safety, maintenance, and expansion of the existing system.

When competing for transportation funding in London, the need for infrastructure rehabilitation is at odds with new projects that offer more visible improvements.

Many initiatives focused on safety, including national research programs that evaluate changes in practice and their effect on safety. Intelligent transportation systems (ITS) are widely used to provide data to evaluate both the performance and safety of transportation systems. ITS techniques are used to maximize the capacity of existing roads without deviating from safety standards. The use of surveillance cameras for traffic speed enforcement has significantly reduced accident rates, as has the use of variable message signs to convey information on traffic onditions, weather, and lane closures, and to set variable speed limits for traffic lanes.

Across the European Union, the emphasis is on privatizing transportation—including bus and maintenance services and the operation and ownership of rail lines—but true privatization does not exist. Private transport services are strictly regulated and appear to be heavily subsidized by the government to assure that services are available for citizens whether or not user fees can cover their cost. The government provides the principal source of funds for operating and maintaining both public and private transport. Supplemental funding is provided by transit fares and highway tolls where available. Private sector contracts are focused on customer service, including qualitative and quantitative performance measures.

Governments strive for a better balance of transportation service integration and to maximize the utility of the system without compromising safety. In all of the countries visited, transportation infrastructure is generally shared for both passenger and freight movement.

Intermodal transfers should be easy, seamless, and transparent to the user, regardless of mode or jurisdiction. The universal transit pass, good for all transit modes in a region, is popular and convenient.

Throughout Europe the focus is on customer service. Every country visited emphasized ascertaining what the customer wants and developing strategies to deliver products and services accordingly. In some cases, contract renewals depend on customer satisfaction.

Relationship Integration

The U.S. delegation did not discover any quick solutions for integrating transportation systems and information. In the United States, we try to combine traffic management functions in one place. The delegation discovered that in Europe, interagency cooperation can be more important than providing a common physical location.

Although highway and transit systems are rarely integrated, the mayor of London and French mobility authorities strive for integration, and highway and transit information is successfully integrated in Hampshire County in the United Kingdom. In other places, new systems have been built without including integration across modes.

Examples of positive integration within modes include extensive integration of all highway-planning functions in the Netherlands and multiagency operational integration in France. Agencies share real-time information and cooperate in

managing traffic during incidents, both among multiple regions and within individual regions.

Resources

Reducing congestion and integrating transportation systems and services are consistent national commitments manifested in different ways in each country. Management and operations are givens, not afterthoughts, and overall funding levels for these activities are higher than in the United States. Management and operations research and development activities are also well funded and closely related to public sector implementation plans. Each country has a strong national government presence in funding of management and operations activities in large urban areas and in the national transportation system.

The level of contracting for management, operations, and public transportation services is higher than in the United States, and greater focus is put on quality and customer service as selection criteria. Contracting for services creates incentives for making improvements that can reduce subsidies and enhance service.

Asset management is recognized as critical to effective management and operations of the transportation system. It is recognized that resources to perform asset management activities need to be identified and protected.

Methods

The European countries have developed a variety of traffic management strategies of interest to the U.S. delegation:

- Standardized software applications.
- Cameras and video for transit monitoring and enforcement.
- Security cameras at high-volume transit stops.
- Onboard devices for bus headway balancing.
- Use of ITS in all transportation-related functions.
- Exclusive lanes for buses and trucks.
- Integration of bicycle facilities into roadway and transit design.
- Use of the hard shoulder as a lane during incidents and to relieve congestion.
- Use of circumferential transit lines to complement radial lines.
- Use of roadway scheduling for utilities and contractors to encourage timely completion of roadwork.
- Arterial management by licensed agencies.
- Efforts to overcome jurisdictional barriers for traffic management.
- Full acknowledgment of taxis as an integral part of the transit system.
- Performance-based incentives for maintenance and utility work to minimize traffic disruptions.
- Toll and fare strategies that include standardized toll collection technology and the use of multioperator transit cards.

Team members found several information strategies interesting:

- Consumers prefer that a single authority provide pretrip information for all modes and service providers and that this information be available through a variety of media, including phone, Internet, and printed maps.
- The public has a higher level of confidence in the reliability of traveler information received from a public agency than that distributed by a private company. Distribution of real-time traveler information by privately owned subscription services has not been profitable.
- When delays occur, travelers want specific information on the length of delay and alternate travel routes. This information is conveyed through real-time congestion information on the Internet, cell phones, global positioning satellite (GPS) technology on fleet vehicles such as taxis, and the use of activated blank-out and variable message signs to convey real-time traffic information, including travel time, travel delay, and length of queue. (Note that GPS is for vehicle positioning only and a different satellite service is needed for communications with a vehicle.)
- Information is relayed through accessible devices, including tactile devices for the blind.

Recommendations

The European countries visited are experiencing many of the same economic, cultural, and transportation trends as the United States. Agencies responsible for transportation services also face similar challenges. In general, the policy, institutional, integration, resource, and technical strategies being pursued in Europe to address these challenges are similar to those being

used, or at least experimented with, by forward-thinking transportation agencies in the United States. Though a few of the team's recommendations call for action at the national level, most are intended for tailored use by individual transportation agencies, metropolitan areas, or States as they decide how to meet the mobility challenges of the 21st century.

Long-Term National Commitment to Reducing Congestion and Integrating Transportation Systems and Services

Make a consistent, long-term national commitment to reduce congestion and integrate surface transportation systems and services. Increase overall funding for management and operations activities at the Federal, State, and local levels. Increase funding for transportation management and operations research and closely align research activities with public sector implementation plans.

Federal Funding for Management and Operations Activities

Provide dedicated Federal funding for management and operations activities in large metropolitan areas and on the National Highway System.

Safety and Customer Service

Focus on safety and customer service as primary objectives for transportation system management and operations activities. Communicate improvements through the media as feedback to the customer.

Seamless and Transparent Modal and Jurisdictional Transportation System Integration

Continue to strive for the goal of seamless and transparent modal and jurisdictional transportation system integration, including one-stop shopping for traveler information accessed by a variety of media, such as phone, Internet, and printed maps, and single-fare media for transit, tolls, parking, etc. European countries struggle with the same integration issues that we have in the United States, but modal and jurisdictional integration remains a critical goal. The team viewed several models that may make good case studies for application in the United States:

- Frankfurt, Germany—Regional transit authority's integration of activities of more than 150 operators.
- Transport for London—Modal integration in a large-city setting.
- France—Establishment of regional mobility authorities.
- Hampshire County, United Kingdom—Integration of highway and transit information.
- The Netherlands—Integration of highway functions.

Multijurisdictional Organizations

Encourage formation of multijurisdictional organizations (including multistate and multicountry) to focus on transportation system management and operations issues. These include incident management, traveler information, truck operations, and multiagency construction coordination.

Strategic Investments in the Surface Transportation System

Focus on strategic investments in the surface transportation system that include optimizing the use of existing facilities, preserving existing facilities through preventive maintenance and rehabilitation, and making major investments in new capacity to close gaps and provide additional services where needed. Use customer-service-based metrics to drive strategic and tactical decisions. Effective asset management is critical to making this happen.

Balanced Passenger and Freight Operations

Continue to focus on balancing passenger and freight operations and enhancing intermodal operations without compromising safety. The focus in Europe is primarily on the rail aspects of this issue, since existing rail facilities are heavily used for freight, commuter, and intercity purposes. The United States faces this issue more acutely in truck freight movement, although rail congestion is also becoming an issue in some key corridors.

Contracting for Management and Operations Activities and Public Transportation Services

Continue to contract for management and operations activities and public transportation services where feasible. Base award criteria and performance measures on customer service and quality. Contract out services in a way that creates incentives for making improvements that will reduce public costs and enhance service. Develop training targeted to the public agency personnel charged with making this happen.

Privatization and Toll and Debt Financing

Continue to use privatization and toll and debt financing for transportation infrastructure and operations where appropriate, but recognize their limitations. Most examples of privatized activities and services the

team observed in Europe remain heavily subsidized and regulated by the public sector.

Selling Traveler Information for Profit

The jury is still out on the viability of selling traveler information for profit. Europe has few success stories, but the United States should continue to encourage and experiment in this arena. Public agencies should make a basic level of traveler information available free to the public. This level may vary from area to area. Encourage development of fee-based, value-added information services in cooperation with the private sector.

Test, Demonstrate, or Deploy Technologies and Strategies

Based on experiences in Europe, test, demonstrate, or deploy the following technologies and strategies on a more widespread basis (not listed in priority order):

Transportation Management Strategies

- Variable speed limits based on real-time traffic and weather conditions.
- Use of video for enforcement and security purposes. Reductions in accidents, environmental effects, and traffic violations in Europe have been significant.
- Reserved lanes for transit vehicles and trucks.
- Use of shoulders as travel lanes during incidents and by buses during peak travel periods. European countries also use this strategy on a time-of-day basis to manage vehicle traffic, but this has been largely abandoned in the United States because of safety concerns. No such concerns were reported in Europe because monitoring systems are used.
- Coordinated scheduling and use of performance-based incentives for maintenance and utility work to minimize traffic disruptions.
- Standardized electronic toll collection technology.
- Multioperator smart cards.
- Integration of taxi services into public transit systems.
- Integration of bicycle facilities into roadway and transit design.
- Use of onboard systems on transit buses for headway balancing. Use of transit priority measures to enhance schedule reliability and customer service.
- Standardized software applications.

Traveler Information Strategies

- Use of dynamic message signs on both freeways and major arterials to convey real-time traffic information, such as travel times, travel delays, lengths of queues, alternate routes, lane closures, weather conditions, and parking availability.
- Provision of pretrip traveler information via the Internet.
- Certification of traveler information providers.
- Use of vehicle location technology (GPS) as travel time data probes on fleet vehicles, including taxis.

Implementation Strategies

The U.S. delegation will share its findings and promote the recommendations to constituencies through distribution of this report, published articles, and presentations at meetings and conferences. The team will develop specific implementation plans for any recommendations on which it determines it would like to offer direct assistance to gain experience in the United States.

Further implementation strategies include the following:

- Facilitate action on the recommendations contained in this report. The goal is to find a home and champion in an AASHTO subcommittee for each recommendation to ensure that it receives adequate review and actual application and implementation.
- Publish the final report on the AASHTO and FHWA Web sites.
- Provide announcement of the availability of the final report to the following electronic distribution lists:
  - Appropriate Transportation Research Board (TRB) committees and subcommittees
  - Local Technical Assistance Program list server

Figure 1. Scanning team members and their Hampshire County Council hosts meet at the Hampshire County Council Traffic Control Center in Winchester, United Kingdom.

  - ITS America
  - AASHTO Subcommittees on Advanced Transport Systems, Traffic Engineering, Design, Operations, and Maintenance
  - ITS Cooperative Deployment Network
  - Institute of Transportation Engineers and Traffic Engineering Councils
  - AASHTO Standing Committees on Highways, Planning, and Public Transportation
- Distribute the final report to the following:
  - FHWA
  - TRB
  - Federal Transit Administration
  - State DOTs
  - Metropolitan planning organizations
  - ITS America
  - ITE
  - Transit operating agencies
  - European venues as determined by the FHWA Office of International Programs
- Prepare articles to be published in *Better Roads, Public Roads, ITE Journal, and APTA Passenger Transport.*
- Develop presentations for use by the team at workshops, conferences, special presentations, etc., at the national, State, local, and association levels. This will facilitate customized presentations based on the audience. One large presentation is envisioned with components that can be deleted, depending on the audience and time allotted. Provide this presentation electronically and on diskette.
- Make presentations at the following national venues:
  - 2001 AASHTO Meeting
  - 2002 TRB Meeting
  - ITE
  - ITS America—ATMS Committee
  - National Committee on Uniform Traffic Control Devices
  - National Association of City Transportation Officials
  - American Society of Civil Engineers
  - AASHTO Standing Committees on Highways, Planning, and Public Transportation
  - AASHTO Subcommittees on Advanced Transport Systems, Traffic Engineering, Design, Operations, and Maintenance
  - American Public Transportation Association
  - International Bridge and Turnpike Association
- Make presentations at regional and State meetings. These meetings will include section/chapter meetings and other professional organization meetings.
- Send research recommendations and problem statements to the appropriate AASHTO committees and the National Cooperative Highway Research Program to encourage additional research activity.

Introduction

Surface transportation systems developed in the United States during the last century are reaching their capacity, especially in metropolitan areas. Traffic congestion is increasing as we run out of capacity to put more cars and trucks on the roads. Because our transportation modes have been developed and operated as unique systems, intermodal coordination, both for passengers and freight, is in its infancy in most areas.

As our surface transportation systems reach capacity, a new element is being added to our nation's infrastructure. A network of telecommunication systems, complemented by wireless and satellite systems, now links our nation.

The solutions for meeting our nation's mobility needs in the 21st century need to go beyond building more and wider roads. Our focus needs to shift from car- and truck-moving capacity to people- and freight-moving capacity. Our transportation system will still be based on rail and roads, but we can maximize these elements with the integration of communication systems, technology advances, and computing power.

The International Technology Scanning Program study on Meeting 21st Century Challenges of System Performance Through Better Operations (a.k.a. 21st Century Operations) was jointly sponsored by the U.S. Department of Transportation's Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO).

The objective of this scanning study was to investigate the historical and contemporary context for transportation operations in each country visited. In addition, the team wished to focus on the policies and strategies planned for the future to sustain good system performance and operational practices in these countries. The U.S. delegation's goal is for the lessons learned from this scan to help U.S. transportation agencies evolve from a culture based primarily on construction to one that also emphasizes system operations across all modes, and balances that with facility expansion.

Germany, the Netherlands, France, and England were identified as countries where systems operations issues would relate to issues in the United States and where solutions to intermodal and capacity challenges could be beneficial when solving similar challenges with our own transportation systems.

The U.S. delegation included representatives of AASHTO; FHWA; the Georgia, Illinois, Utah, and Washington departments of transportation (DOTs); the transportation departments of the cities of Boston, Chicago, and Los Angeles; and TRANSCOM, a regional transportation operations coordinating committee including traffic and transit agencies in the New York/New Jersey/Connecticut metropolitan area.

This report describes the team's findings and observations and includes its recommendations for potential adoption of European systems operations techniques and best practices that will enhance the ability of Federal, State, and local agencies to find solutions to intermodal and capacity challenges with their transportation systems.

Scanning Study Planning

A Joint AASHTO-FHWA International Technology Scanning Program was established in 1998. This program includes joint proposal and selection of topics to be studied and also joint responsibility for implementation in the United States of useful techniques and practices identified during scanning studies. Twelve studies are conducted under this program every two years. Two co-chairs head each scanning team, one from AASHTO and one from FHWA. The co-chairs recruit other members of the team, which typically includes representatives of FHWA, State DOTs, industry associations, the private sector, and academia.

Once FHWA and AASHTO identify the need for a scanning study and a team is formed, an organizational meeting is held to address key aspects of the trip and develop amplifying questions. The amplifying questions are submitted to the host countries to give them an indication of the basis and scope of information desired by the team. The amplifying questions for this study are included in Appendix B. An FHWA contractor, American Trade Initiatives, Inc. (ATI), guided the organizational meeting and the team's activities throughout the scanning study.

Team Members

The team members for the 21st Century Operations

scanning study represented FHWA, State and city DOTs, and a regional transportation operations coordinating committee. Jeff Lindley, representing FHWA, and Tom Warne, representing AASHTO and the Utah DOT, served as co-chairs. Other members from State DOTs included Gerry Smith of Washington, Joe Stapleton of Georgia and David Zavattero of Illinois. Members from city DOTs included Andrea d'Amato of Boston, John Fisher of Los Angeles, and Cheri Heramb of Chicago. Matt Edelman represented TRANSCOM, a regional transportation operations coordinating committee including traffic and transit agencies in the New York/New Jersey/Connecticut metropolitan area. Melisa Ridenour represented FHWA. Appendix A contains information on the team members.

Meetings

The team held four meetings, listed in Table 1, at various stages during study development and travel. The first organizational meeting in Washington, D.C., gave team members an opportunity to meet each other and set the focus for the study. The team discussed focus areas in system operations processes in the United States and developed amplifying questions to forward to the host countries.

The second team meeting was held in Bonn, Germany, on the day before the first day of presentations by the team's German hosts. This meeting provided an opportunity for the team to review the study objectives and the host countries' agendas.

The third team meeting was held halfway through the study in Paris, France. This was a pivotal meeting at which the team discussed the first week's findings and observations and set the course for the second week.

The final meeting was held in London, England, on the last day of the study, after the final day of presentations by the team's British hosts. Team members used this meeting to combine their findings and observations from the trip and develop recommendations for implementation.

Amplifying Questions

The team developed amplifying questions to give the European hosts an understanding of the scope of information it desired. Questions were divided into 10 major headings:

1. Background organizational processes.
2. Institutional coordination and partnerships for improved operations.
3. Integration of systems for improved operations.
4. Performance measures for operations.
5. Urban-rural balance for operations applications.
6. Customer service aspects.
7. Planning for operational improvements.
8. Innovative techniques and technologies.
9. Funding and budgeting for operations, including policies and legislation, revenue sources, and revenue generation.
10. Incident and events management for emergencies, accidents, and special events such as marathons, concerts, parades, visiting heads of state, etc.

Each topic included several specific questions intended to provide the team with an understanding of the host country's systems operations practices and techniques. The amplifying questions are listed in Appendix B.

Itinerary

The 21st Century Operations scanning study took place in March 2001. The team met with highway personnel in Bonn and Frankfurt, Germany; Delft, Netherlands; Paris, France; and London and Winchester, England.

LOCATION	DATE	PURPOSE
Washington, D.C.	Sept. 12, 2000 (six months before trip)	Set study focus and develop amplifying questions
Bonn, Germany	March 4, 2001 (start of study)	Review team objectives and host country agendas
Paris, France	March 11, 2001 (mid-study)	Discuss findings and review objectives
London, England	March 17, 2001 (final day of study)	Identify key findings and develop recommendations for implementation

Table 1. 21st Century Operations Team Meetings

Although the team traveled to and from Europe by air, the remainder of travel between cities and countries was by rail. This allowed the team to experience systems operations first hand in those countries.

The team met with representatives of the national ministries of transport and highways agencies in each country. They also met with representatives of the Rhein-Main-Verkehrs Verbund GmbH and the Verkehrsgesellschaft traffic control center in Frankfurt, Germany; the Delft Test Center in Delft, Netherlands; the Traffic Control Center in Utrecht, Netherlands; the Traffic Control Center in Arcueil, Paris, France; Railtrack in London, England; the Hampshire County Council in Winchester, England; and the University of Southampton in Hampshire, England. Table 2 lists the host countries and cities visited.

Host Delegations

The team met with representatives from the Bundesministerium fur Verkehr, Bau- und Wohnungswesen (Federal Ministry of Transport, Building and Housing), the Rhein-Main-Verkehrs Verbund GmbH, and the Verkehrsgesellschaft in Germany; the Ministerie van Verkeer en Waterstaat, Rijkswaterstaat (Ministry of Transport, Public Works, and Water Management), the Delft Test Center, and the traffic control center in Utrecht, Netherlands; the French Ministère de l'Equipement, des Transports et du Logement (Ministry of Public Works, Transports and Housing), and the Arcueil traffic control center in Paris, in France; and Railtrack, the Highways Agency (an executive agency of the Department for Transport) and Valuation Office, the Hampshire County Council, and the University of Southampton in England.

Appendix C lists members of the host nations' delegations. These officials provided the team with a wealth of information on their strategies for meeting the 21st century challenges of system performance through better operations. The team was grateful for the incredible amount of time and energy expended by the host delegations to make their visit to each country informative and rewarding.

The various languages of the host delegations posed few barriers to communication. Most of the meetings were conducted in English. The German delegation provided interpreters to translate their presentations, and also conversed in English during less-formal discussions. The ability to communicate with such ease, both formally and informally, allowed the team to come away with a great deal of information about and insight into the systems operations practices of these European countries.

Report Organization

During its meetings in each host country, the team identified many interesting technologies and operating practices that may be of value for implementation in the United States. The following chapters present these findings in the categories of Policy, Relationship Integration, Resources, and Methods. The chapters include findings and observations the team believes may have value for implementation in the United States. Specific recommendations and implementation strategies are included in the final chapter of the report.

DATES	COUNTRIES	CITIES
March 5-6, 2001	Germany	Bonn Frankfurt
March 8-9, 2001	The Netherlands	The Hague Delft Driebergen Utrecht
March 12-13, 2001	France	Paris
March 14-16, 2001	England	London Winchester

Note: This table shows only the dates the team members met with host country delegations. It does not include travel days and team meetings.

Table 2. Cities and Countries Visited.

CHAPTER 2

Policy

The 21st Century Operations study team members found that the host countries are experiencing many of the same economic, cultural, and transportation trends as the United States. Growing economies, populations, and employment are causing urban areas to expand, car ownership to increase, leisure trips to make up a larger portion of travel, and truck traffic to grow. Each of the host countries is developing innovative technologies and operating practices to accommodate the growth of local transportation needs, improve accessibility, and improve safety and quality of life. Transportation officials share a customer focus. Strategic investment and tactical operations decisions are driven by safety and customer preference.

Strategic Investment

Optimizing Existing Facilities

Governments at all levels seek to optimize the use of existing facilities through better operations. Because of restrictions to infrastructure expansion in many areas, they cannot build their way out of congestion. Instead, they must find ways to provide better service. Although the countries visited are undertaking new construction to fill service gaps, they seek to extend the useful life of existing facilities by preventive maintenance to avoid the cost and disruption of major reconstruction. All of the countries have environmental concerns and goals for how their society should be structured. They strive to balance the things they want to preserve, such as green spaces and neighborhoods, with the needs of the highway system. All of the transportation agencies integrate environmental issues into their planning. As in the United States, all levels of government are working to improve safety, maintenance, and expansion of the existing system, in that order.

The *National Traffic and Transport Plan for the Netherlands 2001-2020* includes a policy shift from previous plans:

FROM	TO
Reduction of mobility	Mobility as fun
Focus on shift to public transport	Public transport as just another mode
Government responsibility	Shared responsibility
Mobility as basic good	Mobility has its price
Focus on building more roads	Focus on smart roads and cars

Transport 2010, The 10 Year Plan developed by the Department of the Environment, Transport and the Regions in London, has similar goals, including less congestion, better integration, effective maintenance, safer travel, better information, quieter roads, delivering in partnership, and smarter roads by making the best use of new technology.[1]

The French Ministry of Public Works, Transport, and Housing is also committed to making new infrastructure investments only after optimizing the use of the country's current infrastructure or to fill service gaps.

A project to fill service gaps is under way in the Ile-de-France area, the largest urban region in Europe. The Ile-de-France is centered on Paris and extends about 30 kilometers (km) in every direction. One-third of the population of France lives and works in this region. As it developed, radial routes were built for both highways and transit. The 33-km Paris Boulevard Périphérique is the original urban ring road circling Paris, within an average radius of 5 km from the capital's historic center. As suburban areas have grown and trips between suburban areas have increased, so has the need for orbital routes allowing people to avoid going into the city to go back out to where they work.

To fill this service gap, the 78-km A-86 Motorway, also called the Périphérique d'Ile-de-France, located an average 5 km beyond the Boulevard Périphérique, is under construction and scheduled for completion in 2006. This road includes two tunnels reserved for personal vehicles. The 7.5-km West Tunnel provides an underground link from Rueil-Malmaison, west of Paris, to the A-12 highway and is reserved for vehicles under 2 meters high. The 10-km East Tunnel links to Pont Colbert.

A third ring road, the Francilienne, 25 to 30 km from the capital, links five new towns in the eastern part of the region, but is not yet built in the west. These orbital roads will significantly increase suburban accessibility by highways. Orbital routes are needed for public transport also, but are not yet under way.

Transportation Management

Recent delegation in several countries has clarified the transportation management roles of various

government levels. An example is the Dutch Kennisplatform (Knowledge Platform) VERDI, which involves better use of existing roads through dynamic traffic management, a cautious approach to building new roads, and decentralization of traffic and transport tasks to counties, urban districts, and municipalities. It supports the process of decentralization by disseminating knowledge from the central government to local authorities, supporting the exchange of knowledge between local authorities, and putting knowledge research issues of local authorities on the governmental agenda.

Although the German constitution says the federal government is the owner of the federal trunk roads and has the responsibility to build, construct, and maintain them, the Laender (states), have the authority to act on behalf of the national government. The Federal Trunk Road Act is the basis for planning and maintaining federal trunk roads. The federal government allocates funds and makes alignment decisions. All roads that are not federal trunk roads fall under full responsibility of the Laender for planning, building, and maintenance.

The Highways Agency in England is responsible for operating, maintaining, and improving the strategic road network on behalf of the Secretary of State for Transport (with other roads being the responsibility of local highway authorities). The agency contributes to regional transport plans and multimodal studies (led by the government's regional offices) to determine transportation requirements and how they can best be met.

In England, strategically important improvements to the trunk road network will in the future be planned through the regional planning guidance system, via eight regional planning bodies, to ensure integration across all forms of transport and with land use planning. In addition, about a third of the trunk road network was the subject of multimodal studies led by eight government offices (whose boundaries are aligned to the eight planning bodies) to ensure that the most pressing trunk road problems were considered in a multimodal manner.

While this regional approach ensures that any emerging trunk road schemes reflect regional priorities, the Highways Agency works in partnership with the regional planning bodies and the government offices to ensure that a national strategic view of

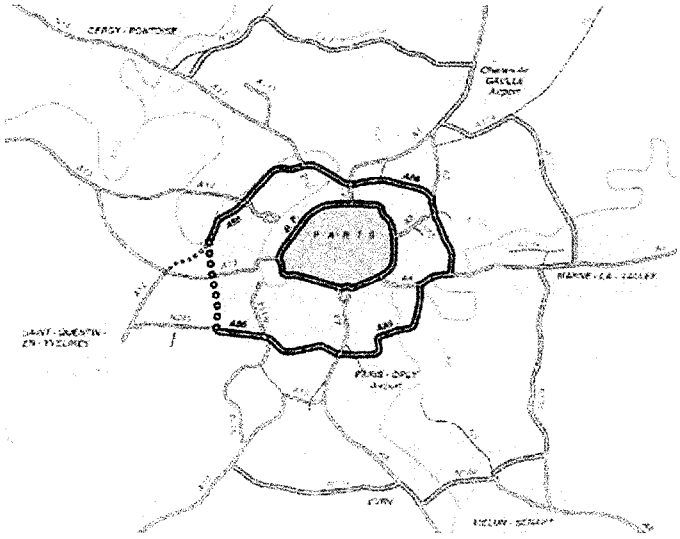


Figure 2. The road development plan of Ile-de-France is designed to fill service gaps in an area where a third of France's population lives.

the network forms part of the basis on which ministers make decisions. When the decision to construct or improve a section of trunk road has been taken, the scheme enters the "Targetted Programme of Improvements" and is progressed by the Highways Agency.

The Highways Agency is moving toward a leaner headquarters in London with most staff based in its other offices throughout the country. Wales and Scotland are responsible for their own strategic roadway networks, although they receive significant funding from the central government.

In its *2030 Vision*, the Highways Agency has considered the implications of several future transport scenarios and is developing its delivery strategies around projected needs and expectations.

Future transport systems are expected to offer the following:

- Faster, more reliable, and more predictable journeys.
- Increased levels of safety.
- Better integration of pubic transport systems.
- Lower vehicle emission and noise levels.
- Less visual intrusion from transport links.

- More leisure travel and less commuter travel and shopping trips.

This could be accomplished by the following:

- Controlled operation—Vehicle control is transferred from the driver to an infrastructure-linked control system.
- Optimized operation—Safety, environmental impact, and operational efficiency of the network is optimized by the control system.
- Managed access—Full electronic road charging with provision for vehicle paths is booked in advance.
- Multimodal integration—Full integration between modes of transport creates seamless journeys.
- Smart operations—Infrastructure maintenance operations are scheduled with a minimum of disruption and down time.
- Smart car—Vehicle condition is continuously monitored by onboard diagnostics and advance warning of problems is given to a central control system.

The Highways Agency recognizes that to bring about any of these changes will require a partnership approach with its many stakeholders. It recognizes that patience and realism are necessary, and that little can be accomplished overnight.

A few short sections of motorway in London are under the jurisdiction of the Highways Agency, but London's roads are now included in Transport for London, which is directly accountable to the mayor of London. Transport for London includes all transport modes in London, not just roads. The mayor's budget for Transport for London gets 10 percent of its funding from residents and the rest from the central government and fares.

In France, the national government has a program assistance contract with 22 regions throughout the country. The regions include major cities and their transportation departments. The national government has a directorate in each region to coordinate the contract with all levels and manage funding, and supplies partial funding to realize the contract.

In all of the countries visited, funding and transportation strategies are handed down from the national government. State and local agencies can choose their own methods, but they are ultimately responsible for carrying out the national plan.

The strong national governments in Europe affect how the various levels of government interrelate. This has assisted in the voluntary acceptance of the European Union standards and guidance, which influence many transportation decisions. The European Union focuses on the national level, but is also working to integrate national plans on a European level. To facilitate a seamless trans-European network, main rail lines in each country need to connect to the rail network, and highways must connect to the road network.

Intelligent Transportation Systems

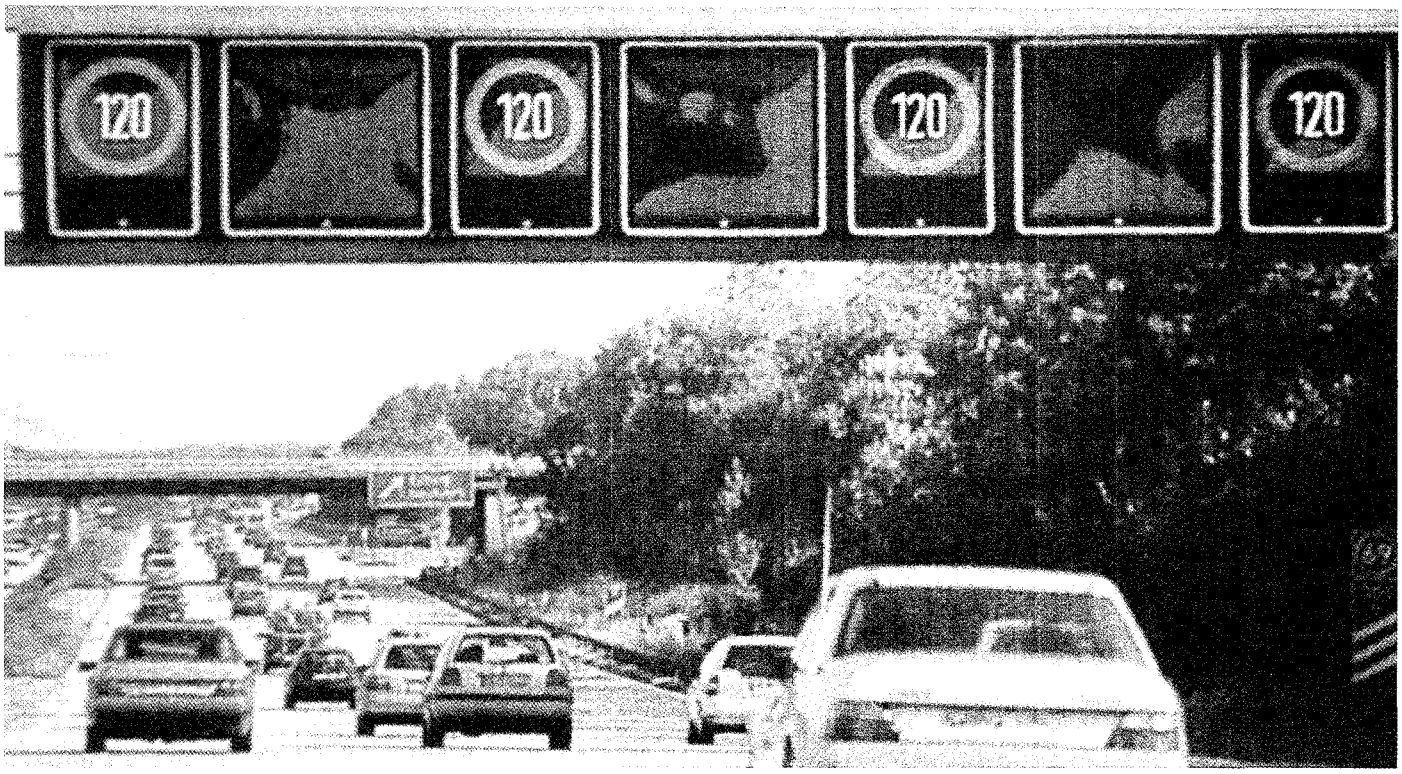
Intelligent transportation system (ITS) strategies are widely used throughout the European countries. Feedback from ITS systems provides data that can be used to evaluate and modify conditions to enhance the performance and safety of the transportation system. Motorway control systems and traffic monitoring allow traffic control centers to evaluate and modify roadways to ease congestion, reduce accident rates, facilitate prompt incident response, and provide accurate traveler information.

The Netherlands and France in particular have a national commitment to ongoing research that pushes the state of the art. Benefits are seen in standardization of gantries (overhead sign structures), ITS equipment, etc. Unfortunately, this commitment to ongoing research falls by the wayside in the United States when budgets get tight.

Safety

All of the countries have road management initiatives focused on safety, and they have set ambitious goals for reducing accidents and fatalities. National research programs evaluate changes in practice and their effect on safety. The focus on safety begins with highway design and continues through operations and maintenance. The European Union plays an important role in road safety by establishing technical standards for vehicles. It has also set up a number of working groups to develop strategies for further measures to improve safety.

Highway agencies use intelligent transportation techniques to reduce risks over the entire highway



network. The use of variable speed signs coupled with surveillance cameras for enforcement has produced significant reductions in traffic accidents in several countries, with the added benefit of increasing highway capacity. In England, the Highways Agency has found that some ITS strategies have raised personal privacy issues involving the identification of drivers and vehicles on its network. Measures have been put in place to address them.

Figure 3. Variable speed signs have helped reduce traffic accidents in Europe. (Courtesy *Weniger Stau - Mehr Mobilität,* Bundesministerium für Verkehr, Bau- und Wohnungswesen)

The overall aim of variable message/speed signs is to steady the traffic flow. They are used to convey information on traffic conditions, weather, and lane closures, as well as variable speed limits.

Surveillance cameras installed along highways are also used to detect incidents and allow quick emergency response. The Netherlands uses section control technology in some areas, which uses surveillance cameras located on highway gantries to photograph vehicles at several points. The cameras are triggered as cars pass over detectors in the pavement. A fine is levied if a car drives too fast over a considerable distance. The system is fully automated from capturing the pictures to charging the fine and allows structured, rather than random, enforcement.

Figure 4. Autoroute-Info 107.7 FM, Europe's largest motorway information system, broadcasts 24 hours a day. (Courtesy *Road Management and Safety in France*)

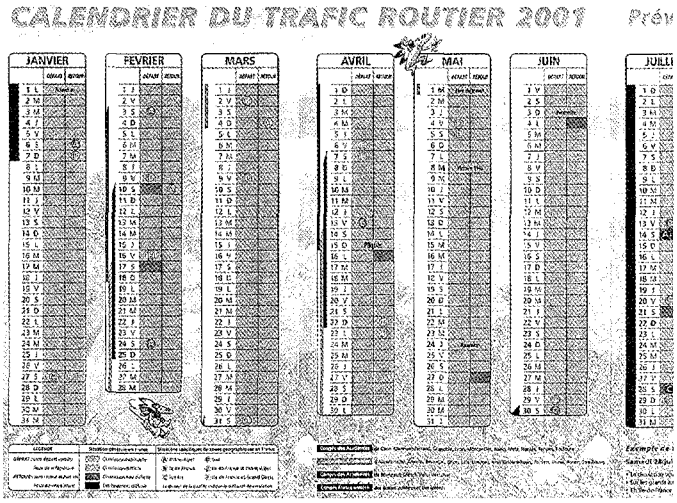


Figure 5. Bison Fute's calendar forecasts traffic patterns based on the holiday schedule of French companies.

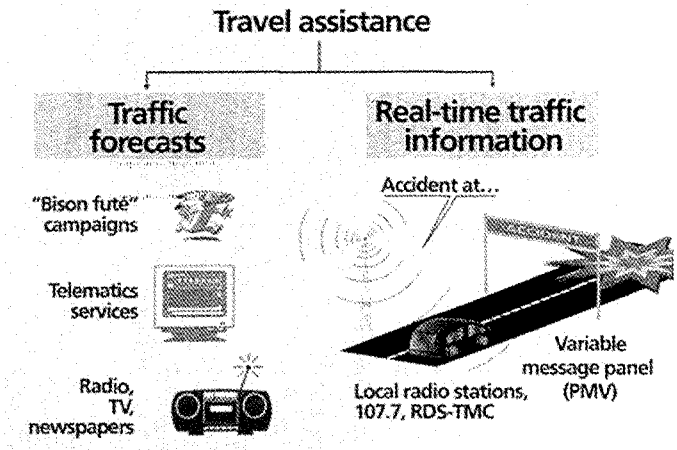


Figure 6. France has created a variety of tools for better travel assistance. (Courtesy *Road Management and Safety in France*)

A pilot program in Tilburg, Netherlands, is testing intelligent speed adjustment. This uses an automatic speed limiter that allows the speed of the car to be controlled remotely. Traffic flows and speed can be adjusted for congestion, incidents, or bad weather without serious enforcement problems. It has been tested successfully on 25 cars, and expansion of the pilot is being considered. It is part of a European initiative led by Sweden.

Traveler information contributes to effective road management, better traffic flow, and greater safety by cutting congestion and influencing modal split. Traveler information is provided in a number of ways, including traffic forecasts on the Internet and in the news media, and real-time traffic information on variable message signs and on traffic news radio stations. In addition, actual information is automatically broadcast via the digital RDS-TMC channel, used by most car radios and navigation computers.

Autoroute-Info 107.7 FM is a traffic news radio station operated by motorway concessionaires. It is Europe's largest motorway information system, broadcasting 24 hours a day on over 3,000 kilometers of motorway. It is expected to cover the entire privately operated trans-European highway network in the next four to five years.

France's Bison Fute advertising campaign was created in 1976 in response to gridlock experienced on holiday routes to Spain the year before. Bison Fute publishes a yearly calendar that classifies each day according to traffic forecasts (green, orange, red, or black), offers route maps showing detours to avoid congested roads, and provides a variety of information leaflets and media kits. Each year, Bison Fute surveys the holiday schedules of several thousand French companies to forecast traffic patterns.

Road management strategies in all of the countries visited are aimed at guaranteeing the ability to travel from one place to another in a predictable time while ensuring safety and comfort for both passengers and goods.

Privatization

The European countries the scanning team visited put emphasis on privatizing transportation services, from bus and maintenance services to operation and ownership of rail lines. None of the countries, however, has pure privatization. Private transport services are strictly regulated and in many cases are heavily subsidized by the government to ensure their availability whether or not user fees can cover their full cost. In general, the government is the principal source of funds for operating and maintaining both public and private transport. This is supplemented by transit fares and, where available, highway tolls. The national governments set performance and design standards and the private companies must meet these standards. The private companies are told what they have to accomplish, but not the method to accomplish it. Private sector

contracts must focus on customer service, including qualitative and quantitative performance measures. Public/private partnerships have proven to be effective.

Private companies provide most public transport services in the United Kingdom. The national government and local authorities provide subsidies to these companies. Although much of the local authority funding actually originates from the national government, some local authorities contribute additional funding from local taxes.

The process of rail privatization in Britain began in the early 1990s. Rail investment had been low for years, rail traffic was down, and British Rail was unpopular. In 1994, the rail system was still in state ownership, but operations were privatized. Railtrack, the infrastructure supplier, was separated from operations and was intended to remain in the public sector, but Railtrack was also privatized in 1996.

The rail system now includes about 100 separate private sector companies, including passenger operators, freight operators, rolling stock companies, maintenance contractors, and Railtrack. Railtrack owns the infrastructure and sells access to passenger and freight train operators. It is highly regulated to ensure it does not abuse its monopoly position and to stimulate a competitive environment. The Office of the Rail Regulator was created under the Railways Act of 1993 to act as an economic regulator of Railtrack. It issues and enforces licenses held by train, station, depot, and network operators. Regulation ensures that Railtrack manages the railway efficiently and fairly and sets access charges at a level to cover costs and provide a reasonable return for its shareholders.

The principles of rail privatization in the United Kingdom include the following:

- Long-term reduction in government subsidy to rail.
- Access to private capital and investments.
- Protection of existing passenger services.
- Control of fare increases.
- Improvement in train punctuality and reliability.
- More dynamic, customer-focused private sector management.
- Opportunity to promote open access and competition.

Since privatization, rail passenger traffic has increased unexpectedly. Between 1994 and 1999, passenger travel increased by 26 percent and freight traffic increased by 34 percent. The increase in passenger traffic stemmed from several factors, including economic growth and higher disposable incomes. Privatized rail companies developed initiatives to encourage higher ridership, and worsening traffic conditions on the roads made commuting by rail more attractive.

The increase in passenger and freight traffic combined with a lengthy period of under-investment in the rail system and short-term contracts put severe pressure on Britain's railways. The new government, which took office in May 1997, recognized that the country needed a well-laid-out, safe, efficient rail system with the capacity to handle a significant modal shift to rail.

In 1998, the government issued a white paper, *A New Deal for Transport: Better for Everyone* that emphasized public transport, a modal shift from road to rail, and integration of rail with other forms of transport. The Strategic Rail Authority (SRA) was formed to provide the framework for the private sector to deliver a safe, efficient, and growing railway system. Although modernizing a system initially set up in the 19th century to fit 21st century needs is a daunting task, the SRA's strategies are under way to develop a safer, better, and bigger railway system. Investments are being focused on new infrastructure and rolling stock, while keeping in mind the needs of both operators and customers and making the best use of new technology.

In Germany, although the vehicles for rail and bus transit systems are privately owned, the government owns the rail lines. The government subsidizes private transit operators, who must use their vehicles exclusively for public transit. The overall political aim is to promote mass transit by subsidizing infrastructure and improving services to make mass transit safer and more attractive to the public.

Germany has become a major transit country in Europe since German reunification, the rapprochement between Eastern and Western Europe, and the realization of the European Union. To reduce the impact of necessary budget consolidation on

transport infrastructure investments, the Federal Ministry of Transport, Building, and Housing has allowed private funding of federal trunk roads.

The first step toward including the private sector in Germany's transportation infrastructure investments was the private sector prefinancing model, under which 12 pilot projects were approved. The costs of these prefinanced projects will be recovered by means of appropriations paid in 15 annual installments once the projects are opened to traffic. Because of existing commitments and the burden on future budgets, however, projects with private sector prefinancing will not be pursued further.

German transport officials believe the operator model will allow more private sector involvement than private sector prefinancing. For sustained involvement, private sector investors must have the ability to recover their costs. Design and construction, maintenance, operations, and financing of trunk road projects can be transferred to private sector investors by allowing the use of tolls. The Private Sector Funding of Trunk Road Construction Act was created in 1994 to cover private sector financing of bridges, tunnels, and mountain passes along federal motorways and federal highways, including motorway-like federal highways (dual carriageways). The act is limited to these types of construction as a result of European Union legislation under which a toll may not be levied on a section of road that already has a time-related road user charge. Germany and several other European countries have levied time-related charges for use of the motorways on trucks with a maximum permissible weight of over 12 metric tons.

A commission proposal would extend private sector funding to include all federal trunk road construction and maintenance projects. The Private Sector Funding of Trunk Road Construction Act must be extended, however, to allow further privatization of federal trunk roads beyond the current operator model. This will not be possible until the changeover from a time-related charge to a distance-related charge for large trucks takes effect in 2003.

Construction, maintenance, operation, and funding are the responsibility of private sector companies. They are given the right to charge tolls, which are based on costs for construction, maintenance, operation, and further improvement of the section of road involved. The Federal Ministry of Transport, Building, and Housing issues toll regulations with the consensus of the state affected.

Transportation Service Integration

Many European countries and regions within countries are working to develop intermodal transfers that are easy, seamless, and transparent to the user, regardless of transportation mode or jurisdiction. Although the operators retain some level of independence, the customer sees a unified system. Transportation service is focused on customers: What do they need and how do we market it to them? While the motivation for transit use in the United States is environmental, this is not the key issue in Europe, where they use transit for mobility and their marketing strategies reflect this.

In the United States, it is often difficult to persuade riders to use the bus rather than other transit options because buses are seen as having second-class ridership. In Europe, buses are as attractive as other transit options, such as light rail, because they are high quality, convenient, and safe.

The U.S. delegation was intrigued by the idea in the Netherlands that "transit is just another mode." Transit is a system with a high level of service within the broader transport system that includes a variety of viable modes, including bicycles.

The European countries have found that the universal transit pass, good for all transit modes in a region, is popular and convenient for users. Integrated ticket systems make public transport more attractive. These travel tickets are good on both regional and local transport.

The Rhein-Main-Verkehrsverbund GmbH (RMV), a limited liability company that provides mobility for the Frankfurt/Rhein-Main region in Germany, wants an integrated transport management system that includes more than subways, buses, trams, and trains. The RMV integrated ticket also includes taxis. In the evenings when demand is insufficient for buses, taxis may be used at a reduced fare. Taxi companies receive compensation from RMV based on the number of RMV riders who use their services. Although not yet universally available, RMV is working to integrate planes into the system by allowing plane tickets to serve as public transport tickets as well.

The price of the integrated ticket depends on the number of fare zones involved, passenger age, and time of travel. RMV, for example, offers single tickets, short-hop tickets, daily travel tickets, daily group travel tickets, and weekly, monthly, or annual season tickets. It also offers special tickets for hotel guests (two-day unlimited bus and train travel within the Frankfurt fare zone, including the airport), and for tourists wishing to explore Frankfurt (similar to the hotel card, but it includes discounts on admissions to various Frankfurt attractions). Another special fare is the job ticket used exclusively to commute to and from work. As more job tickets are sold, more parking areas can be eliminated in the central city areas. In addition, a movement to implement car sharing among residents of the community is being explored.

In the Ile-de-France region around Paris, more than 500,000 people under age 25 have travel cards that are good for all forms of transport. They must use them in a particular area during the week, but there are no restrictions on weekend travel.

The Travelcard in London can be used on buses, underground (subway), light rail, and national rail. Officials are working to develop a smart card with a stored fare for use on buses, trains, and undergrounds. Initially, it will just replace the travel card, but eventually officials hope to use it for other transport modes as well.

Smart cards are an intriguing possibility in most countries and regions. Interoperability issues need to be worked out, but some areas in southern France use smart cards already. Currently they are usable only within a given area. Interoperability from city to city is still in the future. Cards are used mainly for transit and include parking in some areas. Officials are working on the possibility of adding other services, such as an electronic purse for purchasing merchandise, swimming pool passes, library cards, etc. To do this, the cards will need different applications to keep banking and transport activities separate because it is not possible to use common money in the card for transport and for buying other things.

In all of the countries visited, transportation infrastructure is generally shared by both passenger and freight movement. The various governments are working to achieve a better balance and to maximize the utility of the system without compromising safety.

In France, where road freight movement is increasing and railway freight is decreasing, officials would like to develop greater freight transportation by train. Currently, 80 percent of freight is carried on the roads and only 20 percent by rail. Cross-country highways carry a high volume of truck traffic, and trucks may make up as much as 50 percent of the traffic volume on the highways between France and Italy. In high-density areas, the roads are not sufficient to handle the heavy traffic. Rail also presents challenges. The railway infrastructure is used mainly for passenger trains, and they do not have the infrastructure to designate rails exclusively for freight as in the United States. Although officials are working to have some rail lines reserved for freight, it may be 10 to 20 years before they have a freight corridor from Benelux south. Meanwhile, freight and passenger trains share the tracks. Another concern when using rail for freight is the differences in railways from country to country. When a train travels from France to Germany, it must change engines and electrical elements, which can cause long delays.

In the United Kingdom, passenger rail traffic is generally given priority over freight, especially on the busiest lines. Freight has a loud political voice, but its market share is much lower. The heaviest freight uses 25-ton axles, but most of the railway is not equipped to run 25-ton axles regularly. Current loadings on masonry structures are about 10 times what they were when the structures were built. This heavy loading causes significant damage to masonry structures. Rebuilding the structures is expensive, especially when the freight traffic causing the damage is only about 5 percent of Railtrack's business.

Several countries have highway lanes devoted to trucks. This allows trucks to bypass traffic congestion. The Netherlands allows buses to use the truck lanes, but trucks cannot use bus-only lanes.

Freight versus passenger rail and vehicle traffic remains an issue that each country must work to balance effectively and appropriately.

CHAPTER 3

Relationship Integration

The U.S. delegation did not discover any quick solutions for integrating transportation systems and information. Although many regions have successful integration within transportation modes, highway and transit information is rarely integrated and new transportation systems are being built without including integration. Often integration is lacking because the agencies responsible for various transportation systems have policies that differ. This was seen in the Paris metropolitan area, which has differing policies on capital projects for the region's circumferential highway and transit links. Many areas, though, including the Paris metropolitan area, are working toward successful integration across modes.

Integration Across Modes

Although integration across modes is as rare in Europe as it is in the United States, the U.S. delegation found several examples of positive integration. The French mobility authorities and the mayor of London are striving for integration and are developing strategies toward that end. The Hampshire County Council in the United Kingdom has developed a local transportation plan in response to the government's white paper, *A New Deal for Transport: Better for Everyone*, that lays out strategies to successfully integrate highway and transit information.

In France, infrastructure planning for passengers and freight is done at the national level. Urban planning requires mobility plans for cities with populations over 100,000, with the objective of reducing car traffic in French cities. In addition, coordination plans are developed regionally.

A recent innovation is the development of mobility authorities to organize transport for system mobility. The administrative organization of France is comprised of three levels of public authority. The largest of these authorities are the 26 regions. Regional councils administer them and are responsible for economic development, and rail and road regional transport services. The next level of authority includes the 100 departments administered by a general council. The departments are responsible for social assistance, roads, and non-urban public transport and school transport. Finally, 37,000 communes are administered by municipal councils. The commune manages the largest part of the public services that are essential to the community's daily activities, including roads and transport. Each of the communes has the opportunity to decide if it will join a mobility authority. The mobility authorities, although not in charge of highway policy, are responsible for transit and urban road network traffic management within their individual communities. Although they have a relationship with the highways, the highways are an intercity transport mode and are under state authority.

The mayor of London has significant powers within London and is responsible for Transport for London. The mayor's transport strategy is an integrated package of measures to improve public transport, enhance the environment, and foster London's economic development. Transport for London implements the transport strategy for surface services, including strategic highways, buses, trams, boats, taxis and minicabs, and light rail. The underground, or subway, was expected to become part of Transport for London in 2001. Transport for London is not responsible for the national rail network, which was privatized under the previous government administration and has private infrastructure.

Research shows that traffic congestion is the number one transport issue in the central London area. One of Transport for London's priorities is to institute congestion charging in the center of London once public transport in that area is capable of

handling the resulting increase in riders. The intention is to change the culture in central London by relieving congestion. It is hoped that the daily fee to travel in or through central London will encourage people to choose other forms of travel whenever possible. Congestion charging is expected to reduce congestion, reduce through traffic, encourage use of public transport, benefit businesses by moving goods and people more efficiently, and create a better environment for pedestrians and bicyclists. Revenues generated by congestion charging will be invested in Transport for London for at least 10 years. More information on Transport for London can be found **www.tfl.gov.uk/tfl/**.

The Hampshire County Council is recognized by the national government as a center of excellence for regional integrated transport planning. The Hampshire County Council, in partnership with district councils, local organizations, and citizens, has developed a Hampshire Local Transport Plan for 2001-2006. Local transport plans (LTPs) such as this one allow local authorities to plan future improvements by providing long-term, secure funding arrangements. The Hampshire County Council LTP identifies strategies to link all modes of transport into a fully integrated system. Cars, road safety, public transport, cyclists and pedestrians, ports and airports, and freight are all included in the LTP. The county is looking at sustainable solutions as well as new capacity because officials realize they cannot just build their way out of their transportation problems. The Hampshire County Council's LTP can be found at **www.hants.gov.uk/environment/ltp**.

The main performance target for Hampshire County is to reduce traffic growth across the county by 50 percent by 2020. Other Hampshire County Council (HCC) and national targets include the following:

- Increase use of public transport by 25 percent by 2020 (HCC).
- Increase walking by 25 percent by 2020 (HCC).
- Reduce serious and fatal road accidents by 40 percent of the average 1995-1998 level by 2010 (national).
- Contribute to the national target of quadrupling bicycle trips by 2012 (national).
- Encourage development of green commuter plans for major businesses and schools (HCC).
- Reduce levels of main air pollutants to meet national targets for air quality (national).

The transport strategy includes looking after the network to make it safe, make the best use of it, and widen travel choices by establishing a good balance between modes.

The council got a head start on the plan with a community involvement program that included proper and meaningful dialogue with citizens and a soft policy approach to necessary lifestyle, attitude, and behavioral changes. Rather than having large public hearings, the council meets with smaller groups at the groups' invitation, a strategy that has worked well.

Since most transport is privatized, the Hampshire Economic Partnership was set up so the transport companies can work together to ensure that their policies and programs do not conflict. They work to make public transport a quality system, using such technologies as closed-circuit television (CCTV), telephone, Internet, and smart cards, so that people will eventually want to switch to it even though now they would not consider it. Using local, national, and private funding, they want to introduce a mass transit system that is state of the art and fully integrated.

In some areas, road space has been reallocated to foot traffic. They have found that trade and foot traffic have increased and cars and public transit work better even with the narrower roadway.

Hampshire County's 500 schools are an important part of the transportation picture. When the schools are on holidays, the current traffic and transit systems work. Transport plans have been requested from each of the schools to factor them into the system.

Technology is integral to the transportation structure. A small consortium led by the Hampshire County Council founded ROMANSE (Road Management System for Europe) in 1992. This project was developed to pilot ITS and establish a model for transport management systems across Europe.

The aims of the ROMANSE project are to influence travel behavior, increase use of public transport, maximize the efficiency of the transport system, improve

environmental conditions, and provide improved transport information to planners and decision makers. By using advanced telematics, the project intends to provide accurate, timely, and accessible information to travelers before, during, and after their trips. With this information, people can make informed choices about their route, the timing of their trip, and the best method of transport.

The core of ROMANSE is the Strategic Information System, a fully integrated traffic and travel database referenced by location. This system can be accessed in real time and used to make traffic management decisions. The system provides layers of information that can be selected separately for information on parking availability, traffic control equipment, CCTV cameras, variable message signs, public transport information, and other travel information.

ROMANSE has also developed three telematic applications for public transport. The STOPWATCH system uses variable message signs to provide real-time information on bus services at bus stops.

"Talking" bus stops provide audible information that replicates the information displayed on the STOPWATCH signs to visually impaired riders. A handheld trigger activates the "Talking" STOPWATCH, which provides audible announcements on approaching buses, route numbers, destinations, and minutes till arrival. The Bus Departure Information System use information display units to display arrival and departure times on a screen. These units have been installed in public areas, parking lots, and transport interchanges in the Southampton city center to display live traffic and travel information.

ROMANSE developed TRIPlanners to provide public and private transport information for trip planning. These are installed in public locations such as shopping centers, libraries, and railway stations. Each self-contained unit includes a touch screen, computer, and printer. After trip information is entered, the unit calculates the optimum trip using one or more transport modes. It presents other trip options and provides a printout of calculated routes.

Figure 7. STOPWATCH signs provide real-time information at bus stops in Southampton and Winchester, United Kingdom. (Courtesy *ROMANSE II* Executive Summary)

ROMANSE variable message signs have been installed to provide route guidance, transport information, and car parking information. Trailer-mounted mobile signs have been developed for use during major roadwork, special events, and major accidents or incidents.

The ROMANSE project has successfully integrated a number of diverse systems to provide a fully operational travel and traffic information system aimed at reducing traffic growth and congestion problems in urban areas. More information on ROMANSE is available at **www.romanse.org.uk**.

Integration Within Modes

Although solutions to integration of highway and transit information are not common, many European regions have successful integration within transportation modes.

The Netherlands has extensive integration of all highway-planning functions. Being a small country, federal and state transportation authorities are the same, which makes this simpler. To provide an efficient transportation system, cooperation in providing services is a primary objective. It is important to know at what level to make decisions and at what level to carry them out.

Recent delegation in several countries has clarified the transportation management roles of various governmental levels. Formal agreements to accomplish this are more common than in the United States. Germany and the Netherlands have recently delegated authority to lower levels.

In the Netherlands, Kennisplatform VERDI (knowledge platform VERDI) performs as a marketplace for traffic and transportation knowledge to and from the traffic institutions of the provinces and municipalities. This platform is the result of the VERDI agreement, in which the Association of Netherlands Provinces, the Association of Netherlands Municipalities, the Ministry of Transport, Public Works and Water Management, and the Ministry of Interior and Kingdom Relations arranged for the decentralization of responsibilities for and financing of traffic and transportation.

In the past, the federal government was responsible for many transportation tasks that have now been delegated to regional and municipal authorities. Kennisplatform VERDI supports the process of decentralization by disseminating knowledge from the central government to the local authorities, supporting exchange of knowledge between local authorities, and putting knowledge research issues of the local authorities on the governmental agenda.

The main problem the platform addresses is the relationship between motorways and connected national and urban roads in dynamic traffic management. Questions to be solved concern how to optimize use of motorways and other roads at the network level, and how to create the best conditions for cooperation between different authorities.

In the Netherlands, the U.S. delegation noted that traffic authorities seem to understand what their roles are and do their part without crossing boundaries. They get involved only when something affects their facility's ability to move traffic.

The German federal government no longer cofinances public transport. The law now gives responsibility and financial means to the states. The states have created regional transit authorities with responsibility for mass transit (road and rail traffic). The main task of these authorities is to organize all types of mass transit into an integrated system that will result in better conditions for the customer. The transit authorities are private legal entities, which allows them a degree of flexibility.

The U.S. delegation met with officials from the Rhein-Main-Verkehrsverbund GmbH in Frankfurt and the Verkehrsverbund Rhein-Sieg GmbH in Köln. Both of these regional transit authorities have similar goals of using one ticket to cover all modes of transportation, providing comprehensive traveler information to the customer, and planning efficient mass transit operations for all of the cities in their regions.

The U.S. delegation found that European agencies share real-time information and cooperate in managing traffic during incidents among and within regions. The DATEX model in many countries provides data across national lines for major incidents. All the European ministries of transport have signed a memorandum of understanding setting DATEX as the standard for traffic information communications and have asked all traffic management centers, including local centers, to have at least an interface to DATEX.

CHAPTER 4

Resources

Reducing congestion and integrating transportation systems and services are consistent national commitments manifested in different ways in each country. Management and operations are givens, not afterthoughts, and overall funding levels for these activities are higher than in the United States. Management and operations research and development activities are also well funded and closely related to public sector implementation plans. Each country has a strong national government presence in funding of management and operations activities in large urban areas and in the national transportation system.

The level of contracting for management, operations, and public transportation services is higher than in the United States, and the focus on quality and customer service as selection criteria is greater. Contracting for services creates incentives for making improvements that can reduce subsidies and enhance service.

Asset management is recognized as critical to effective management and operations of the transportation system. It is recognized that resources to perform asset management activities need to be identified and protected.

Operations and Maintenance

The present German federal government attaches special importance to maintaining and upgrading the existing infrastructure to guarantee full operability of the trunk road network both for industry and the public. Operating and maintaining federal trunk roads are federal government responsibilities, while the Laender carry their own administrative costs. The federal government also provides a small amount of financing for federal trunk road feeder roads and roads crossing cities. These voluntary contributions are given only when there is federal interest in the project and the project cannot be done without federal contributions. The federal government can also help finance grade separation projects because they contribute to road safety.

Germany's federal trunk roads are financed from a percentage of the country's mineral oil revenue. Although this revenue was originally earmarked just for roads, it is now divided among other types of transportation expenses also. No direct link exists between an increase in gas tax revenue and road construction.

Of the 10.8 billion DM budgeted for federal trunk roads in 2001, 3.6 billion DM was earmarked for maintenance and 1.7 billion DM for operations. Expenditures for operations are expected to remain about the same even though the length of roads will increase, but maintenance expenditures will increase because the road network is aging as well as getting longer. Maintenance funds before 2000 were allocated according to the length of the road network. Since 2000, funds have been allocated according to a key that takes road length, traffic, and age into account.

The British government's white paper on the future of transport, *A New Deal for Transport: Better for Everyone*, recognizes that traffic growth is the major factor in the national traffic debate and that the country cannot build its way out of congestion. The white paper and related roads review, *A New Deal for Trunk Roads in England*, moved the role of the Highways Agency from road builder and maintainer to network operator. It provided a new strategic aim: To contribute to sustainable development by maintaining, operating, and improving the trunk road network in support of the government's integrated transport and land use policies.[2]

Three investment areas identified by the white paper are maintenance, operations, and improvements. Giving priority to maintenance and developing the network operator role are the top two objectives. The strategic plan focuses on maximizing the efficiency of maintenance by keeping the network in a safe condition, while at the same time minimizing whole life costs, disruption to the traveling public, and environmental effects. The focus on

operations has been expanded to include influencing and controlling how the network is used. It emphasizes the importance of meeting customer needs, assisting integration, and increasing the role of public transport.[3]

Local transportation agencies in Europe depend on national funding. In the United States, local governments often depend on State funding rather than Federal, although this varies somewhat from State to State.

German reunification exhausted financial resources for transportation projects, so in 1992 Germany began using private sector funds to develop roadways. Twenty-seven projects totaling 4.8 billion DM are being financed this way. The federal government will buy back the projects over 15 years. Since this type of financing burdens the federal government with an annual payment, it will not be used on future projects.

In France, 33 percent of the financing of public transport comes from employers with 10 or more employees. Another 30 percent comes from passenger revenue.

In the Netherlands and France in particular, funding does not appear to be a major constraint and in fact appears to be one of the least concerns.

Asset Management

Europeans recognize asset management as critical to effective management and operation of the transportation system. In London, the U.S. delegation met with representatives of Railtrack, the railway infrastructure supplier. They emphasized the importance of having a thorough knowledge of the system's assets and managing them responsibly. Their asset-management vision includes prioritizing a list of assets, establishing whole-life asset management regimes, and providing best practice work management processes.

CHAPTER 5

Methods

The European countries have developed a variety of traffic management and traveler information strategies that the U.S. delegation found interesting. Some that they found particularly notable are listed below (with no implied priority).

Standardized Software Applications

The U.S. delegation found that each country is attempting to move to a standardized platform for software and architecture so software does not need to be rewritten regularly. ITS software applications are standardized in each country, and are used throughout the country with the same basic functionality.

Cameras and Video for Transit Monitoring and Enforcement

Cameras and video equipment are used in a variety of situations throughout Europe for transit monitoring and traffic enforcement. Video surveillance is used for transit monitoring, both for rider safety and prevention of vandalism of the rolling stock. Camera enforcement is used to keep bus lanes clear, and for speed and tailgating enforcement. Cameras are also used for incident detection and observation of congestion during peak hours.

By 2002, all London bus lanes were expected to be equipped with cameras for traffic enforcement of cars driving in the bus lanes. When the U.S. delegation visited in 2001, camera enforcement already covered more than half of London's 610 bus lanes. Fines for driving in bus lanes will eventually be raised to £60.

The Netherlands uses cameras in conjunction with license plate recognition software for speed enforcement. This can also be used for tracking and tracing stolen cars. An electronic image of the vehicle is taken at several points within a section control area. A driver is fined only if the vehicle's speed is excessive over a considerable distance. The system is fully automated from capturing the picture to charging the fine, which is the responsibility of the car owner even if the car has been loaned to someone else.

Motorists in the Netherlands consider this a more fair system than a radar trap, which takes only an instant shot. They do not seem particularly concerned about privacy issues with this system. The initial image is used for image recognition and comparison. The license plate is scrutinized only if there is a violation. Police do not look at the driver because they are concerned only about the car owner. Identification is certified by a police officer, which is no different than a police officer actually seeing the license plate. Images are never used unless there is a court challenge. They are kept until the fine is paid and then destroyed.

Although operated by the police, the infrastructure (gantries and cameras) belongs to the Ministry of Transport. This guarantees a standardized format and equipment. The system is certified for enforcement issues and is checked at regular intervals. A detector embedded in the pavement detects a vehicle and then the picture is taken. The pictures are sent on for license plate recognition only if there is a violation. The license plate recognition software can read plates from the Netherlands and Belgium, while others have to be hand identified. The Netherlands has prosecution agreements with Germany and Belgium. Foreign drivers commit a large percentage of the violations because they believe they will not be prosecuted.

License plate recognition is also used in France to produce travel times on arterials for traveler information. In this case, it is used for information gathering only, not for enforcement.

The Netherlands' National Police Agency uses a video control system for tailgating enforcement. Tailgating is both the number-one cause of accidents and the number-one annoyance on the road. Enforcement is based on time and distance.

Cameras and video are also used throughout Europe for red light and variable speed limit enforcement, as well as for weigh in motion.

Although camera and video monitoring improve enforcement and safety, privacy issues must be addressed. Methods to ensure privacy include destruction of images and photographing only the backs of cars for license plate recognition.

Security Cameras at Transit Stops

Video surveillance is used at some high-volume transit stops in Frankfurt, Germany, for observation and security purposes. Surveillance areas will be extended to

include meeting points so people will feel more secure when waiting in these areas. Eventually, the railway wants to install cameras inside passenger cars to fight vandalism.

Video surveillance is used on board transit vehicles in some areas. In 1998, numerous incidents in the Ile-de-France region led to development of a new program to reinforce security and combat attacks. Each transit bus in the region is now equipped with four cameras connected to a digital video recorder. These cameras are monitored at the RATP (Paris Rapid Transit Authority) Security Command Post and at bus centers. Images from the cameras are compressed and saved on an extractable hard disk. This configuration allows eight hours of recording at a rate of four images per second per camera. Once the capacity of the disk is reached, older images are destroyed and the disk is rerecorded. If an alarm is activated, the video surveillance system protects the recorded time segment for 15 minutes before and after activation. This information can then be transferred to a dedicated fixed reader station and selected segments can be printed or transferred to a video tape recorder.

Onboard Devices for Bus Headway Balancing

England is involved in bus priority studies for the European Commission, Hampshire, Southampton, and London. These studies are being done to facilitate bus priority at traffic signals, use ITS to improve bus operations, and develop the potential for strong bus priority.

The ultimate goal is to achieve green lights for buses most of the time. Just having a bus lane does not ensure bus regularity. The aim is to give high priority to particular buses when bus headways (time or distance between buses) are too large. The bus priority system includes an automatic vehicle location center to ascertain where buses are on their route. An algorithm is developed on how much priority each bus needs.

Information goes to and from the bus through radio polling and by beacon to a light pole. An opaque window with a transmitter/receiver is attached to the side of the bus. Every time the bus crosses a beacon, it receives information and transmits back. The actual bus location is compared to where it should be to determine how late it is. This drives countdown information displayed on variable message signs at bus stops, giving passengers an assessment of when the bus will arrive. It also gives the operators a visual display of the buses on the road, showing them as red if they are late or green if they are on time. Drivers receive information on the buses ahead and behind to balance the headway.

This information can also be fed to traffic signals. Beacons on the traffic signal arms will receive information and give priority to buses as appropriate. Some signal controllers are capable of this already, and new ones will be able to do this.

Several ITS applications are being studied for advanced urban transit centers in England, including bus priority, automatic vehicle location, automatic ticketing, camera enforcement of bus lanes, variable message signs, and integrated applications.

When more priority is given to buses, cars and other vehicles may be at a disadvantage. The objective is to develop a large enough modal advantage for buses that people will switch from driving their own cars to riding the bus.

When working with bus scheduling and headway regularity in England, researchers use the FLOWSIM program for car simulation behavior modeling. This program is unique in its use of fuzzy logic. Car simulation behavior modeling uses a vehicle with different drivers to develop fuzzy logic for car-following and lane-changing behavior. The result is very close to a real situation. To develop headway regularity for high-frequency services, the algorithm must be based on vehicle location. The system must know where all buses are to compare the actual headway of a bus to what it should be and, according to that ratio, give it

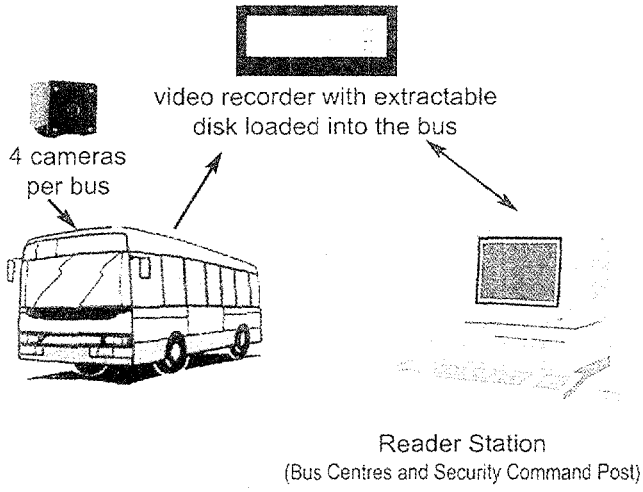


Figure 8. Transit buses in the Il-de-France region are equipped with surveillance cameras to reinforce security.

higher priority over buses downstream. Basically, this system gives priority to all buses. The method of locating the vehicle and the timing accuracy is essential for priority. The trend in Europe is to move to using GPS for determining locations. France is using GPS to track both buses and maintenance vehicles.

This is a flexible tool. It is possible to increase the priority on one route and reduce it on a crossing route, but if two buses are coming on opposite arms it is not possible to help them both. Because bus companies are assessed on quality of service on a route-specific basis, headway regularization is also done on a route-specific basis. In some cases, it may be better to regularize headway on a combined basis.

London uses CCTV for bus lane enforcement. Operators watch the bus lane and can use the encrypted information for enforcement.

ITS Use in Transportation-Related Functions

ITS use is expanding rapidly throughout Europe as countries strive to create modern, less polluting, and more efficient transportation systems. They have found that building more and bigger roads is not a long-term solution to increased traffic and congestion. The rapid development of telecommunication techniques—including satellites, fiber-optic networks, digital transmissions, and smaller and smaller microprocessors—has opened a realm of possibilities for the transport industry. New systems are expected to provide more reliable journey times, improved safety, and controlled traffic flow. Road networks are being built with sophisticated monitoring systems enabling quick incident response, efficient traffic management, and accurate traveler information. Onboard traveler information helps drivers plan their routes and, in some cases, their transportation mode as well.

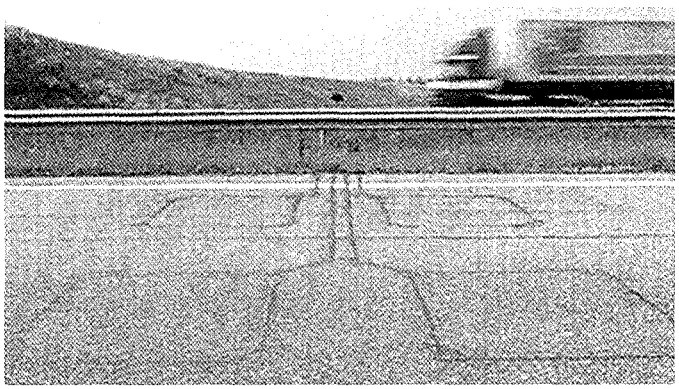


Figure 9. Detection loops in the road surface yield data for use in traffic congestion monitoring and incident response. (Courtesy *Policy Document on Traveller Information,* The Netherlands)

Although all of the countries use ITS, France appears to be advancing its use more rapidly than the others. France has developed ACTIF, a national system architecture for deployment of ITS. This project, scheduled for completion in September 2001, is funded by the French Ministry of Transport and the European Commission, and covers all modes of transport.

All of the countries visited are installing induction loops in the pavement of their major highways. Data from these loops is monitored at collection centers and supplies up-to-date, reliable information for variable speed and messages signs, traveler information systems, route guidance systems, congestion monitoring, and incident response.

Variable message signs are used to warn drivers of incidents or events and give them route recommendations, advice, or information on travel times or length of queue. In cities, they also may be used for dynamic management of parking lots by letting drivers know where spaces are available. Many public transport systems use variable message signs in stations and bus shelters to provide dynamic information on schedules, routes and wait times.

Variable message signs are credible to drivers because they offer dynamic information. In the United States we tend to use warning signs, but often by the time a driver gets to the problem area the problem no longer exists, so motorists tend to pay little attention to the signs. Variable message or activated traffic control signs would offer more accurate and timely information.

The Europeans have responded to the need for multilingual signage and announcements by using pictograms on their variable message signs. Although perhaps not as pronounced a need in the United States as in Europe, multilingual signage is a concern that needs to be addressed. Thought should be given to using graphics versus text messages and incorporating international signage. One strategy is to use a pictogram to identify the problem and text to indicate what action should be taken.

Variable speed signs are used in Germany, the Netherlands, and France to steady the flow of traffic during peak periods. They increase safety by slowing traffic to avoid sudden braking and rear-end collisions. England has introduced variable speed signs on part of the London Orbital Motorway, the M25, and will

extend their use further. Increased capacity rather than safety is considered the greatest benefit of the system.

In France, the Netherlands, and England, variable message signs are being used both on arterials and motorways for traffic information. In Paris, the signs are installed at one-kilometer intervals on the ring road and at entries and junctions on the motorway. This is an efficient system that gives drivers real-time traffic information so they can decide which road to take. In interviews with 10,000 people, 35 percent responded that they had used this traffic information. Others were reluctant to try an unfamiliar route. The objective is not to divert everyone, only regular drivers who are responsible for 70 percent of all trips.

Other ITS systems used in Europe include control signaling systems, highway monitoring, ramp metering, floating car data using GPS and mobile phones, and smart lanes, which allow use of the hard shoulder or narrower lanes during peak travel times.

In some countries, car manufacturers are installing onboard alarm systems to allow motorists to request help, breakdown assistance, and other information. The press of a button relays a signal to a control center identifying the vehicle and its location using GPS positions. The driver is then contacted by cellular phone and the appropriate help or information is provided.

Electronic passes (smart cards) are in use for public transport in some areas, including a number of cities in France. These are an improvement over magnetic strip tickets because they do not have to be swiped or fed into a reader. The cards can be loaded for a variety of services, including season tickets, one-way tickets, and tickets including a variety of transport modes. The public transport systems in France are working with banks to develop an electronic wallet that can be used to pay for travel or other purchases. The cards are now city-specific, but eventually they may be linked to travel cards to become a multifaceted electronic pass.

In France, Télépéage is an electronic tolling system that uses a short-range ground-vehicle communication application. This system uses a tag placed on the vehicle's windshield and a road beacon placed on one or more reserved lanes that allow drivers to pass through without stopping.

Automatic tolling systems like Télépéage allow both a wide range of payment methods and a variety of pricing levels based on type of vehicle and journey times.

In response to customers wishing to use this system without having to worry about the large number of highway operators, French motorway companies are working with manufacturers to design a single multi-company pay tag and to develop an interconnected system run by the various operators. The dedicated short-range communication toll payment link was designed to accommodate other applications, such as measuring travel time between road beacons. This will provide travel information for both operators and roadway users.

One aim of Télépéage is to provide interoperability in other countries, especially Spain and Italy. Not all European countries have toll motorways, but many are considering them.

The Netherlands is testing intelligent speed adjustment, which controls the speed of a car remotely. Traffic flows and speed can be adjusted to improve

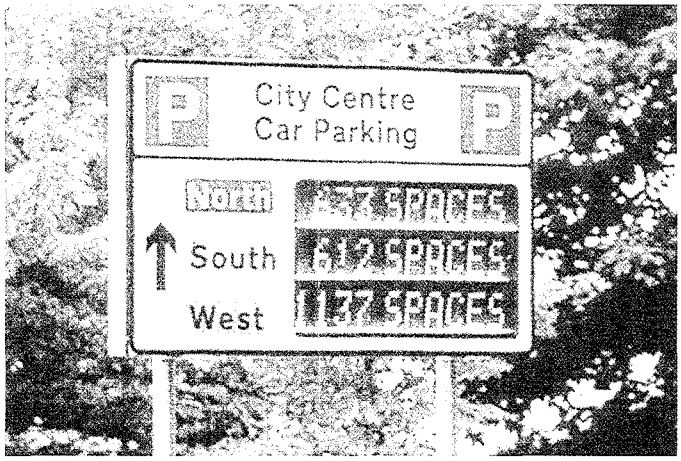


Figure 10. Variable message signs in parking lots tell drivers where empty spaces are located. (Courtesy ROMANSE II Executive Summary)

Figure 11. Drivers who use France's Télépéage electronic tolling system can pass through tollbooths without stopping. (Courtesy Association Des Sociétés Francaises D'Autoroutes)

safety when highways are congested or during bad weather. Intelligent speed adjustment is also an option to slow down cars in residential areas.

Exclusive Bus and Truck Lanes

Some European countries have exclusive lanes for buses and trucks and are moving to make these corridors smart roadways. Special truck lanes are available in the Netherlands in areas where trucks are an important part of the economy. Fifty percent of cross-border trucking in Europe is done by Dutch truck drivers.

Figure 12. The Netherlands' pro-bicycle policy includes combining cycle and train travel.

Figure 13. The Dutch government encourages construction of bicycle facilities in urban areas, such as bicycle parking at the train station in Den Hague.

Figure 14. Dutch cities like Den Hague accommodate bicycles physically into their transportation systems.

Buses may use the truck lanes in some areas to bypass queues, but trucks are not allowed in bus lanes. In some areas taxis may use bus lanes, although this causes some conflicts when too many taxis use the lanes. Officials are considering letting motorcycles use bus lanes, but bicyclists who use them now do not want motorcycles there. The Netherlands has bypasses on some ramp meters for buses and trucks, but not for other high-occupancy vehicles.

The Netherlands also has designated lanes for high-impact volume use. They can alternate this lane for even wear of the roadway, but that requires installation of variable message signs every 1,500 meters.

Integration of Bicycle Facilities into Roadway and Transit Design

Bicycle use is prevalent throughout Europe. In the Netherlands, 30 percent of travel in the cities is by bicycle or walking. The U.S. delegation was impressed by the number of bicycles on the road and parked at the railway stations.

The National Traffic and Transport Plan for the Netherlands 2001-2020: From 'A to Better' includes the following bicycle policy for mobility management: Quality in cycle facilities to be improved, in particular bike-garaging and through-routes. This will boost cycling as an efficient, environment-friendly alternative for short journeys—and in combination with public transportation.

The plan also recognizes the advantage of a pro-bicycle policy for better air quality in urban areas. The plan includes bicycles as an important part of a cohesive public transportation network.

For bicycles to compete with car use in the Netherlands, safe bicycle facilities must be available, including infrastructure and parking near railway stations and public transport stops. The National Traffic and Transport Plan allows decentralized governmental bodies to use regional mobility funds for bicycle facilities in designated areas.

The U.S. delegation noted that Dutch cities accommodate bicycles physically into their systems as well. Curbs are not placed as restrictions, only to channel water, and high curbs are rare in both the Netherlands and Germany. Since many passengers in the Netherlands commute to

and from transit facilities by bicycle, interchange facilities often have vandal-proof lockers for bicycle storage and banks of standard bicycle racks. In some areas, buses carry bikes on special racks or platforms.

Using Hard Shoulders for Incident and Congestion Management

Several European countries use—or intend to use—hard shoulders as lanes for incident management and clearance during peak congestion periods, and as dedicated vehicle lanes. They have found that with the right monitoring and control systems, use of hard shoulders can improve traffic flow. This ITS-dependent strategy is used in conjunction with variable message signs, cameras, and video enforcement.

In Germany, efforts are under way to use hard shoulders (built to the same standard as traffic lanes) as traffic lanes to increase safety and capacity, especially at peak hours and during school holidays when congestion increases in southern Germany. According to the Federal Ministry of Transport, temporary use of the hard shoulder as a lane to increase capacity and reduce congestion does not significantly reduce safety. Police increase patrols to keep hard shoulders free of obstacles. They tried using cameras to be sure lanes remained clear, but found they were not reliable enough.

A variable message sign over the hard shoulder shows a green arrow when it can be used as a travel lane and a red X when it cannot. A fixed sign on the side of the road also indicates when the shoulder can be used. Officials have found that it is best to use the hard shoulder as a lane only between two junctions. If it is extended further, drivers become confused.

A problem with using the hard shoulder is that crossing a solid line is a traffic offense. Road traffic regulations need to be revised so that in areas where these lanes are used, it is permissible for road users to cross the lines.

In the Netherlands, where they also use the hard shoulder during rush hour for an extra lane, they are testing dynamic road markings at a site near Rotterdam. These markings, which change to indicate whether the lane is opened or closed, require a considerable amount of system equipment. Initially tube lighting was buried in the road, but now fiber optics are applied to the roadway surface.

The Netherlands initially built high-occupancy vehicle lanes to address congestion issues, but the public outcry against them was significant. Opening the hard shoulder to traffic during peak traffic hours was much more acceptable. Every facility with four or more lanes also has a hard shoulder on the left side and they are used during rush hour as lanes. The original high-occupancy vehicle lanes have been converted to reversible lanes during rush hours.

England includes part-time use of the hard shoulder as a lane in its Active Traffic Management (ATM) pilot project. The Highways Agency is conducting this pro-ject as part of the government's 10-year transport plan, Transport 2010. Hard shoulders will be used for incident management and clearance, during peak congestion periods, and as dedicated vehicle lanes. ATM components forming part of the trial include mandatory signals on lightweight gantries every 500 meters on all lanes (including the hard shoulder), increased monitoring using more closely spaced detection loops and CCTV, access control, and emergency pullouts every 500 meters.

The United States has discounted the use of hard shoulders as lanes for safety reasons, but this strategy might be useful in areas where it is difficult to obtain waivers for lane widths. The European countries using the hard shoulder as a lane are positive about its benefits for use as a temporary measure for congestion.

Use of Circumferential Transit Lines to Complement Radial Lines

The Ile-de-France region, centered on Paris, is the largest urban region in Europe, harboring one-third of the total population of France. The public transport system is adequate in the city, where the population is stable. The suburbs are growing quickly, however, and trips between suburban areas are increasing. Current transit routes are mostly radial, so getting from one suburban area to another involves traveling into Paris and out again. The highway system also has a radial design, but circumferential highways are now being added. Public transport is considering adding an orbital route about 25 kilometers from the center of Paris to make transit between suburban areas more efficient. Unfortunately, coordination between the circumferential highway and transit routes is not apparent.

Roadway Scheduling for Utilities and Contractors

The U.S. delegation was interested in the concept of space allocation booking as a future ITS element. This concept involves contractors and utilities booking space on the system for installations and repair work. In some areas, where the motorway may

eventually be significantly over capacity, this concept could extend to motorway users also.

To avoid traveler inconvenience and congestion issues, roadway work in the United States is often performed at night. The U.S. delegation learned that Germany, however, discourages night work because of noise impacts and lower quality of work.

Integrating Taxis Into Transit Systems

In London, officials are trying to integrate the bus and cab industries, which are now competitive. In some areas of Europe, taxis are already incorporated into the transit system. Some transit authorities in Germany include taxi use on transit passes.

Pavement Design Life Cycle

Germany has developed a catalog of pavement standards based on a 30-year life and 7-year overlay. The Germans use a pragmatic approach to pavement design and leave out the exotics. The commonality of standards is good for competition and makes pavement projects easier to bid.

Car Sharing

Car sharing is available in some areas where parking is unavailable. Frankfurt, Germany, has a pool of vehicles located around the city. Cars are unlocked and operated with a smart card. This transit option had been available for only six months when the U.S. delegation visited and was not used much yet. Under a carpool model in Wiesbaden, Germany, the carpool company cooperates with the transport company to allow a special price to annual ticket holders of the transport company. Use is increasing. The Netherlands and France are also looking at car-sharing options.

Teleworking

Teleworking is one measure being encouraged to meet the challenge of mobility management in the Netherlands. The department of transport is trying this with some of its employees to see how it works. The main objective is for employees to travel to work during off-peak hours, so the number of hours of teleworking is not as important as altering the commute time.

Teleworking is catching on, but it is not for everyone and cannot be used at every level. The arrangement generally does not work for young families with small children because they do not have the space to work at home without interference from family members. For teleworking to be successful, the employer and employee need to agree on the amount of time to be worked outside the office, and appropriate equipment and support must to be provided. The department of transport believes the expense of setting up the equipment is justified by the benefits. Some employers have set up remote offices, but this is new and no reports are available yet on how it is working.

The department of transport in the Netherlands is also trying low-profile teleworking. This allows parents to take their children to school and pick them up, then work in the evening. In this case, the department provides the computer to use at home, but the employee must pay for the computer. Generally, employees are able to give back a few days of vacation to buy a computer.

Toll and Fare Strategies

Toll and fare strategies include standardized toll collection technology and use of multioperator transit cards.

Multioperator Transit Cards

The European countries are working to provide integrated transport tickets that are easy to get, offer value for the money, and offer flexibility for use on a variety of transport modes.

One of the best examples in England is the London Travelcard, which includes unlimited prepaid travel within specified zones on bus, rail, underground (subway), and Docklands Light Railway services throughout the capital. London Transport estimates that introduction of the Travelcard has increased bus passenger travel by one-fifth and underground use by one-third. Although rail operators in England are required to offer through ticketing for all rail journeys, bus operators are not under the same obligation. The white paper *A New Deal for Transport: Better for Everyone* encourages the positive action taken by some bus companies to accept other operators' tickets or participate in area ticketing programs. Operators introducing initiatives for rail-bus tickets are also encouraged.

In the Frankfurt/Rhein-Main region of Germany, the Rhein-Main-Verkehrsverbund GmbH (RMV) is working to integrate planes into the ticketing system by allowing a plane ticket to serve as a public transport ticket. In addition to rail, tram, buses, and subways, the RMV transit ticket also covers a portion of taxi fees in the evenings when the number of travelers is insufficient to justify a bus route. The taxi company receives compensation from RMV based on the number of RMV riders. On interconnecting services in Hanover and Stuttgart, evening passengers can ask their tram driver to radio ahead to have a taxi meet them at their

destination. The cost is included in the tram fare as a flat-rate add-on.

The Netherlands offers "strippen kaart" tickets to allow passengers to make a number of journeys in different Dutch cities using any type of public transport paying per length of each trip.

In France, over half a million young people under age 25 have transit cards good for all forms of transport. These are restricted to use in a particular area during the week, but restrictions are lifted on weekends. For the past 10 years, students in the Netherlands have received travel cards that are restricted to travel either on weekdays or weekends, but not both.

Several countries are exploring the possibility of using smart cards for transit. In 1997, France had about 30,000 smart cards in use in four cities, and they expect 7 million to be in use by 2003. These electronic passes are non-contact cards that do not have to be swiped or fed through a reader, thus speeding up processing at peak hours. The cards are used now for bus and transit, but the French are working to load them with a variety of ticketing strategies, including different types of season tickets, one-way tickets, tickets for a variety of transport modes, or stocks of tickets. They would like to expand their use to include parking, swimming pools, libraries, etc. Ultimately, the passes will also include an electronic wallet to pay for travel and purchases.

Toll Strategies

In Germany, private sector operators are given the right to charge tolls based on costs of construction, maintenance, operation, and improvement of the road section involved. The Federal Ministry of Transport, Building, and Housing issues toll regulations with the consensus of the Laender (states). The Private Sector Funding of Trunk Road Construction Act was created in 1994 to cover private sector financing of bridges, tunnels, and mountain passes along federal motorways and federal highways, including motorway-like federal highways (dual carriageways). The act is limited to these types of construction as a result of European Union legislation under which a toll may not be levied on a section of road that already has a time-related road user charge. Germany and several other European countries levy time-related charges for use of motorways on trucks with a maximum permissible weight of more than 12 metric tons. Germany will eventually change to distance-related charges and will then have the ability to charge highway tolls.

In the Netherlands, where tolls and congestion pricing are unpopular, officials are looking at vehicle/kilometer distance pricing as an alternative. The idea is to reduce the tax on cars and increase the tax on mileage, which is a revenue-neutral exchange. The technology is available for distance pricing and is being used successfully in Denmark in the form of a black box that monitors how far and where the car is driven. This pricing scheme was set to be implemented in the Netherlands in 2002. Although officials believe it is a good political goal, they are not entirely convinced of its practicality.

England develops some major highway projects using private financing for designing, building, financing, and operating (DBFO) the projects. This allows them to deliver major projects and provide maintenance for large route lengths or area networks. Initial DBFO contracts have a 30-year duration and are paid using shadow tolls based on traffic volumes. For subsequent DBFOs, payment mechanisms have been developed that increase the focus on lane availability and level of service.

Of the 9,000 kilometers of highway in the French network, more than 7,200 kilometers were being financed by tolls in January 2000. Concession contracts

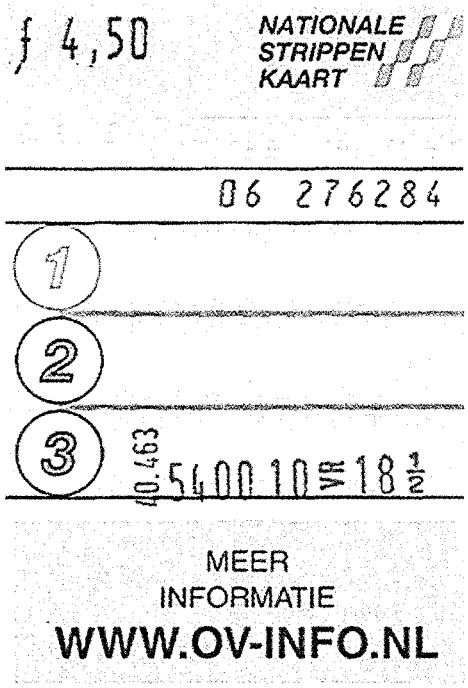


Figure 15. With strippen kaart transit tickets, travelers in the Netherlands use any form of public transport and pay for the length of the trip.

are granted for construction and operation of highways in France. To pay for financing, building, maintaining, and operating its own network, the concessionaire obtains long-term loans that are reimbursed by tolls, which represent about 97 percent of its resources. Tolls are a way to finance highway extensions, interregional links, maintenance on existing roadway sections, implementation of infrastructures and equipment, service areas, rest areas, and traveler assistance and information. The French believe tolls are a fair way to finance the highway network. Financing these endeavors through the national budget would increase the annual income tax for everyone, which would be unfair to the people who never use the highway. Highway users provide a direct contribution to highway financing through toll rates appropriate to the category of vehicle they drive. Roads under urban area responsibility in France are not tolled. Only long-distance roads of national interest carry tolls.

The U.S. delegation was interested in congestion pricing, but none of the countries visited uses true congestion pricing. Transport for London intends to institute a congestion-charging scheme to change the transport culture in central London. Revenues will be kept for transport purposes, although this is not considered a moneymaking venture. Once road space is freed up, officials will take out lanes so traffic speeds do not increase significantly. Excess lanes will become bus lanes, walking areas, etc. Freight movers welcome the idea, if the charge is set at a manageable level, because they will be able to move around the area more easily. Before congestion charging can take effect, Transport for London needs to ensure that the public transport system can handle the extra passengers.

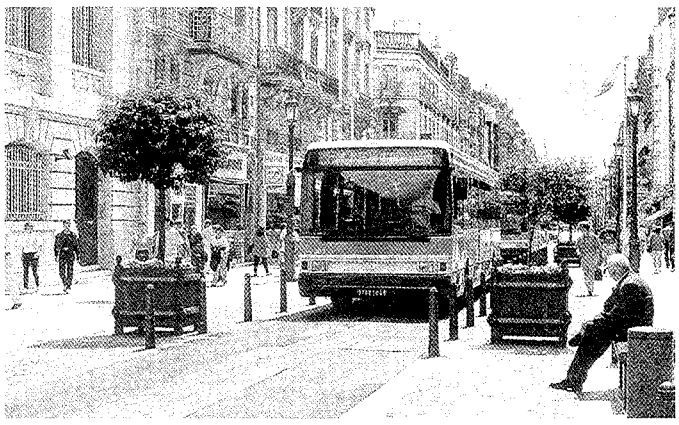


Figure 16. A dedicated bus right-of-way for buses in Orlèans, France, contributes to smoother bus flows. (Courtesy *Urban Transport Equipment*)

Traffic Information

The European countries visited use a variety of information gathering techniques for traveler information. In some countries, private sector companies install detection devices on the highway system. In Germany, clients of these private companies are fleet operators for whom time is the important factor, while public information focuses on safety.

The U.S. delegation found the use of road guards in the Netherlands intriguing. These are drivers who have a contract with the traffic information center to call in if they come upon an incident while driving between home and work.

Traditionally, the British government did not collect and supply traffic information, so private suppliers filled the gap. Traffic Master is a private company that collects and distributes data in the United Kingdom and Germany. The company works with car manufacturers to implement data collection systems in cars. The cost of this service can be incorporated into the price of the car rather than collected through a monthly subscription fee. The Highways Agency is developing the Traffic Control Centre, an ambitious telematics project aimed at providing free, real-time information on England's network of motorways and trunk roads to road users. The Traffic Control Centre is being procured by the Highways Agency as a private finance initiative as part of the government's public-private partnership policy.

In France, traveler information is focused on giving travel time rather than travel delay as a means of communicating a uniform measure of impact. Authorities use fleet vehicles to determine travel times, and have equipped 3,000 taxis with GPS equipment to report travel times to radio stations. France has also developed onboard car systems so drivers can receive traffic information in any language. At the time of the scanning study, this system had been developed but not deployed. Real-time information is also available on the Internet.

In England, although many people have Internet access, they prefer to use the phone for traveler information. The Internet is useful for supplying traveler information to the media, but not to the general road user.

In most countries, people are not willing to pay for traveler information and it is available for free. Some countries tried subscriber traveler information, but it was not well received.

- Use of hard shoulders as travel lanes during incidents and by buses during peak travel periods. European countries also use this strategy on a time-of-day basis to manage vehicle traffic, but this has been largely abandoned in the United States because of safety concerns.
- Coordinated scheduling and use of performance-based incentives for maintenance and utility work to minimize traffic disruptions.
- Standardized electronic toll collection technology.
- Multioperator smart cards.
- Integration of taxi services into public transit systems.
- Integration of bicycle facilities into roadway and transit design.
- Use of onboard systems on transit buses for headway balancing. Use of transit priority measures to enhance schedule reliability and customer service.
- Standardized software applications.

Traveler Information Strategies

- Use of dynamic message signs on both freeways and major arterials to convey real-time traffic information, such as travel times, travel delays, lengths of queues, alternate routes, lane closures, weather conditions, and parking availability.
- Provision of pretrip traveler information via the Internet.
- Certification of traveler information providers.
- Use of vehicle location technology (GPS) as travel time data probes on fleet vehicles, including taxis.

Implementation Strategies

The U.S. delegation will share its findings and promote the recommendations to constituencies through distribution of this report in electronic and printed form, published articles, and presentations at meetings and conferences. The team will develop specific implementation plans for any recommendations on which it determines it would like to offer direct assistance to gain experience in the United States.

Further implementation strategies include the following:

- Facilitate action on the recommendations contained in this report. The goal is to find a home and champion in an AASHTO subcommittee for each recommendation to ensure that it receives adequate review and actual application and implementation.
- Publish the final report on the AASHTO and FHWA Web sites.
- Provide announcement of the availability of the final report to the following electronic distribution lists:
  - Appropriate Transportation Research Board (TRB) committees and subcommittees
  - Local Technical Assistance Program list server
  - ITS America
  - AASHTO Subcommittees on Advanced Transport Systems, Traffic Engineering, Design, Operations, and Maintenance
  - ITS Cooperative Deployment Network
  - Institute of Transportation Engineers and Traffic Engineering Councils
  - AASHTO Standing Committees on Highways, Planning, and Public Transportation
- Distribute the final report to the following:
  - FHWA
  - TRB
  - Federal Transit Administration
  - State DOTs
  - Metropolitan planning organizations
  - ITS America
  - ITE
  - Transit operating agencies
  - European venues as determined by FHWA's Office of International Programs

- Prepare articles to be published in *Better Roads, Public Roads, ITE Journal,* and *APTA Passenger Transport.*
- Develop presentations for use by the team at workshops, conferences, special presentations, etc., at the national, State, local, and association levels. This will facilitate customized presentations based on the audience. One large presentation is envisioned with components that can be deleted, depending on the audience and allotted time. Provide this presentation electronically and on diskette.
- Make presentations at the following national venues:

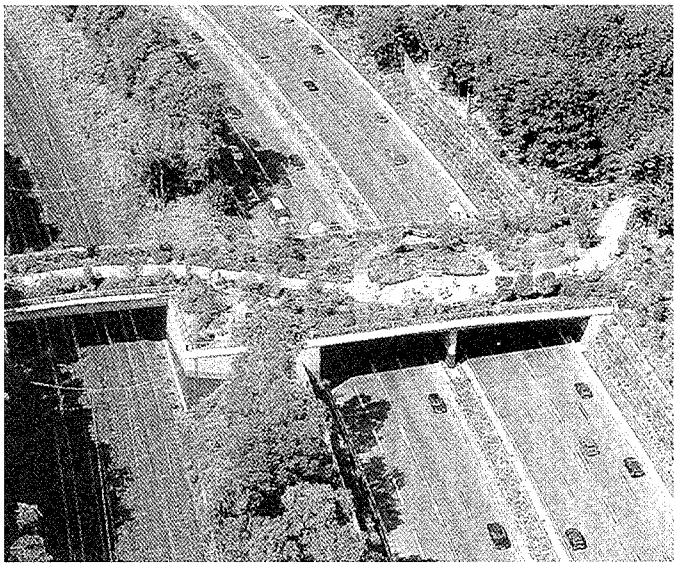


Figure 17. Cars travel under the Duisburger Zoo motorway overpass near Köln, Germany. (Courtesy Strassenbaubericht 1999, Bundesministerium für Verkehr, Bau- und Wohnungswesen)

  - 2001 AASHTO Meeting
  - 2002 TRB Meeting
  - ITE
  - ITS America—ATMS Committee
  - National Committee on Uniform Traffic Control Devices
  - National Association of City Transportation Officials
  - American Society of Civil Engineers
  - AASHTO Standing Committees on Highways, Planning, and Public Transportation
  - AASHTO Subcommittees on Advanced Transport Systems, Traffic Engineering, Design, Operations, and Maintenance
  - American Public Transportation Association
  - International Bridge and Turnpike Association
- Make presentations at regional and State meetings. These meetings will include section/chapter meetings and other professional organization meetings.
- Send research recommendations and problem statements to the appropriate AASHTO committees and to NCHRP to encourage additional research activity.

Team Members and Affiliations

Thomas R. Warne (Co-Chair)
Executive Director
Utah Department of Transportation
Calvin Rampton Complex
4501 South 2700 West, Box 141245
Salt Lake City, UT 94114-1245
Phone: (801) 965-4027
Fax: (801) 965-4338
E-Mail: *twarne@tomwarne.com*

Jeffrey A. Lindley (Co-Chair)
Director, Office of Travel Management
Federal Highway Administration
Room 3401
400 7th Street SW
Washington, DC 20590
Phone: (202) 366-1285
Fax: (202) 366-3302
E-Mail: *jeffery.lindley@fhwa.dot.gov*

Andrea d'Amato
Chief of Environmental Services
Commissioner of Transportation
Office of the Mayor
Boston City Hall, Room 721
Boston, MA 02201
Phone: (617) 635-3075
Fax: (617) 635-4295
E-Mail: *Andrea.d'Amato@ci.boston.ma.us*

Matthew Edelman
TRANSCOM
Newport Financial Center
111 Pavonia Avenue, Suite 605
Jersey City, NJ 07310-1755
Phone: (201) 963-4033
Fax: (201) 964-8376
E-Mail: *edelman@xcm.org*

John E. Fisher
Assistant General Manager
Office of Transportation Operations
Department of Transportation
Mail Stop 725
221 N Figueroa Street, Suite 500
Los Angeles, CA 90012
Phone: (213) 580-1189
Fax: (213) 580-1188
E-Mail: *jfisher@dot.lacity.org*

Cheri Heramb
Deputy CommissionerDepartment of Transportation
Bureau of Administration & Planning
Room 600
30 North LaSalle Street
Chicago, IL 60602-2570
Phone: (312) 744-5697
Fax: (312) 744-4399
E-Mail: *cheramb@ci.chi.il.us*

Adele McCormick (Report Facilitator)
Technical Writer
4017 Libby Road NE
Olympia, WA 98506
Phone: (360) 943-4708
Fax: (360) 459-3705
E-Mail: *McAdele@aol.com*

Melisa L. Ridenour
Division Administrator
US Department of Transportation
Federal Highway Administration
Rhode Island Division
380 Westminster Mall, Room 547
Providence, RI 02903
Phone: (401) 528-4544
Fax: (401) 528-4542
E-Mail: *melisa.ridenour@fhwa.dot.gov*

Gerald E. Smith
Deputy Secretary for Operations
Washington State Department of Transportation
PO Box 47316
Olympia, WA 98506-7316
Phone: (360) 705-7032
Fax: (360) 705-6800
E-Mail: *gsmith@skillings.com*

Lawson P. "Joe" Stapleton, Jr.
Administrator, Infrastructure
Division of Information Technology
Georgia Department of Transportation
No. 2 Capitol Square
Atlanta, GA 30354
Phone: (404) 656-5034
Fax: (404) 651-7183
E-Mail: *Joe.Stapleton@dot.state.ga.us*

David A. Zavattero
ITS Program Manager
Illinois Department of Transportation
Office of Planning & Programming
120 West Center Court
Schaumburg, IL 60195
Phone: (847) 705-4800
Fax: (847) 705-4803
E-Mail: *zavatteroda@nt.dot.state.il.us*

TEAM MEMBER BIOGRAPHIES

THE FOLLOWING BIOGRAPHIES WERE WRITTEN BEFORE THE 21ST CENTURY OPERATIONS SCANNING STUDY TO PROVIDE INFORMATION ABOUT THE TEAM MEMBERS TO THE HOST DELEGATIONS.

Thomas R. Warne (Co-Chair) is Executive Director of the Utah Department of Transportation (UDOT). Warne directs the activities of UDOT, including the planning, design, construction, and operation of the State's 6,000-mile road system. He is responsible for the $1.59 billion I-15 reconstruction project in Salt Lake City that has been built in four years using the design-build approach. Warne has spent more than 20 years in the transportation arena, working with transit, aviation, rail, communications, and highway systems. As a practitioner, he has intimate knowledge of these individual systems and their interrelationships. Warne holds a bachelor's degree in civil engineering from Brigham Young University and a master's degree in civil engineering from Arizona State University. He is a professional engineer in Arizona and Utah. He is president of the American Association of State Highway and Transportation Officials and serves as a member of the Transportation Research Board Executive Committee.

Jeffrey A. Lindley (Co-Chair) is Director of the Office of Travel Management in the Operations Core Business Unit of the U.S. Federal Highway Administration (FHWA) in Washington, D.C. His office is responsible for FHWA policies and programs related to Intelligent Transportation Systems (ITS) deployment and transportation management. Earlier, Lindley served as FHWA California Division Administrator, Deputy Director of the ITS Joint Program Office, and in other management and staff positions in the area of transportation operations in Washington, D.C., San Francisco, California, and McLean, Virginia. He has previous transportation engineering experience in the private sector and with the U.S. Air Force. Lindley holds a bachelor's degree in civil engineering from Virginia Polytechnic Institute and State University and a master's degree in transportation engineering from the University of Maryland. He is a registered professional engineer in Virginia, a member and past chair of the Transportation Research Board's Committee on Freeway Operations, and chair of the ITS Council of the Institute of Transportation Engineers.

Andrea d' Amato is Chief of Environmental Services and Commissioner of Transportation for the City of Boston. As Chief of Environmental Services, d'Amato oversees several city agencies, including the Environment Department, Inspectional Services Department, Transportation Department, Water and Sewer Commission, recycling program of the Public Works Department, Open Space Planning at the Parks and Recreation Department, and the Sustainable Boston Program. As Commissioner of Transportation, d'Amato oversees a staff of 500 and a yearly budget of $25 million. She is vice president of the National Association of City Transportation Officials and is slated to serve as president in July 2001. She holds a double master's degree in Urban and Regional Planning and Economic Geography. She serves as a member of the board of directors for both the Massachusetts Bay Transit Authority Advisory Board and the Intelligent Transportation Systems of America, Massachusetts Chapter, and is a member of the American Institute of Certified Planners.

Matthew Edelman is Executive Director of TRANSCOM (the Transportation Operations Coordinating Committee), based in Jersey City, New Jersey. Edelman directs a coalition of the 16 major traffic and transit agencies in the New York/New Jersey/Connecticut metropolitan area. TRANSCOM applies a cooperative model for the regional management of the transportation system across a large number of jurisdictions. All of the coalition's responsibilities in regional incident management and construction coordination and multiagency implementation of intelligent transportation systems have resulted from cooperative agreements among the agencies. Before joining TRANSCOM, Edelman was manager of the Freight Planning Division of the Port Authority of New York and New Jersey. He received a bachelor's degree from Wesleyan University and a master's degree in civil engineering from the Massachusetts Institute of Technology. He is a member of the Coordinating Council of ITS America, and a member of the board of directors of each of the three State chapters of ITS America in his region. He is former chairman of the I-95 Corridor Coalition Steering Committee.

John E. Fisher is the Assistant General Manager of the Los Angeles Department of Transportation (LADOT), in charge of transportation operations. He manages a staff of 425 whose responsibilities include investigations to improve traffic circulation and safety, designs for traffic signals and channelization, traffic signal timing, and maintenance of traffic control devices. He has concentrated on developing LADOT's Neighborhood Traffic Management Program, expanding the Pedestrian Safety Program, and expanding the Advanced Traffic Management System, known as ATSAC (Automated Traffic Surveillance and Control). He has been with LADOT for 27 years. He has a bachelor's degree in civil engineering and a master's degree in public administration from California State University at Long Beach. He is registered as a civil engineer and traffic engineer in of California, and is a certified professional traffic operations engineer. He is a member of the National Committee on Uniform Traffic Control Devices, the California Traffic Control Devices Committee, and the Institute of Transportation Engineers.

Adele McCormick is a technical writer for the Washington State Department of Transportation (WSDOT) in Olympia, Washington. She is responsible for writing and editing reports, manuals, and studies developed by the Olympia Service Center Design Office and other WSDOT offices and teams. She is Web master for several WSDOT Web pages covering roadside and site development, design-build, real estate acquisition, and real estate asset management. McCormick has served as technical writer for numerous WSDOT value engineering studies and process improvement teams. She recently completed two comprehensive process improvement efforts covering real estate acquisition and real estate asset management. She has a bachelor's degree in speech from Washington State University.

Gerald E. Smith is Deputy Secretary for Operations for the Washington State Department of Transportation (WSDOT) in Olympia, Washington. Smith directs and provides policy interpretation for the daily operations of the department, which includes environmental, design, and all construction, maintenance and operations activities. Earlier, he served as the Southwest Region Administrator for the Washington State Department of Transportation. He also served as Engineering Superintendent for Washington State Ferries and Operations Engineer (construction and maintenance) in WSDOT's Northwest Region. Smith has a bachelor's degree in civil engineering from Washington State University. He is a licensed professional engineer in Washington. He serves on several technical committees for the American Association of State Highway and Transportation Officials and is a member to the Washington State University College of Engineering and Architecture Advisory Board.

Cheri Heramb is Deputy Commissioner of the Chicago Department of Transportation. Biographical data was not available at the time this report was printed.

Melisa L. Ridenour is the Division Administrator for the Rhode Island Division of the Federal Highway Administration. Biographical data was not available at the time this report was printed.

Lawson P. "Joe" Stapleton, Jr., is the Administrator for Infrastructure of the Division of Information Technology of the Georgia Department of Transportation. Biographical data was not available at the time this report was printed.

David A. Zavattero is ITS Program Manager for the Illinois Department of Transportation. Biographical data was not available at the time this report was printed.

Amplifying Questions

SEVERAL MONTHS BEFORE THE SCANNING STUDY, U.S. DELEGATION MEMBERS DEVELOPED THE FOLLOWING LIST OF TOPICS AND QUESTIONS. THESE AMPLIFYING QUESTIONS WERE SUBMITTED TO THE HOST COUNTRIES TO GIVE THEM AN INDICATION OF THE BASIS AND SCOPE OF INFORMATION DESIRED BY THE TEAM. THE HOST COUNTRIES USED THESE QUESTIONS AS A GUIDE FOR DEVELOPING THEIR PRESENTATIONS.

Definition of Operations

Operations include all maintenance and day-to-day management actions necessary for proper functioning of the transportation network, including its intermodal connections.

1. Background organizational processes.

1.1. Please provide an historical perspective on the development of your transportation network and the evolution of your current policies on system operations.

1.2. Who owns and operates the various modal elements of the transportation system?

1.3. Please provide information on how travel is distributed between modes, different types of facilities (motorways versus city streets), and urban versus rural roadways.

1.4. Is there a formal or informal institutional structure that links the transportation modes? What is the extent and means of coordination between modes?

1.5. Please describe your funding sources and budgeting levels for operations. Does your agency have responsibility for both capital improvements and operations? How is funding allocated for both?

1.6. How are policy decisions that impact operations mandated and/or coordinated within your agency as well as among different agencies? What did it take to achieve this?

1.7. What management level makes the critical day-to-day operations decisions?

1.8. How do environmental concerns affect transportation decision making for both operations and capital improvements?

2. Institutional coordination and partnerships for improved operations.

2.1. Please describe the level of coordination and the relationships between institutions and jurisdictions for the following:

2.1.1. Standards for roadway design and traffic control devices.

2.1.2. Incident response and clearing.

2.1.3. Traffic management centers and emergency services such as fire, police, and medical.

2.1.4. Systems to control traffic.

2.1.5. Congestion management strategies.

2.1.6. Public transport operations.

2.1.7. Equipment sharing.

2.1.8. Management of delivery and service

vehicle operations.

2.1.9. Operational approaches during periods of severe weather.

2.1.10. Construction management techniques.

2.1.11. Management of private sector passenger transportation (buses, taxis, etc.).

2.1.12. Systems to disseminate real-time information to travelers.

2.2. To what extent are operations integrated between international, national, regional, and local jurisdictions? Who has the responsibility for roadways?

2.3. Please describe any public-private partnerships you have in place for operations such as safety rest areas and maintenance.

2.4. How are operational problems communicated to roadway designers or traffic management staff? How are the problems reconciled?

2.5. What role does organized labor play in the implementation of new technologies and the adoption of operational strategies related to public transportation?

3. Integration of systems for improved operations.

3.1. How does systems integration affect your agency's efforts to improve operations? What efforts does your agency make to share information or share control of systems owned by other agencies and jurisdictions?

3.2. What traffic engineering and traffic management techniques are emphasized to improve system performance? Are transit and traffic engineering functions under the same or separate organizations and how do they coordinate?

3.3. Describe the system for fare payment transfers between public transportation modes. How is the fare collected?

3.4. What security measures do you have in place to make light rail and bus systems safe for riders, including children, 24 hours a day?

4. Performance measures for operations.

4.1. What systematic process or methodology do you use to determine the success of an operational improvement?

4.2. What quantitative and qualitative performance measures do you use to evaluate the operations of your system? Have these measures been effective?

4.3. What tools and technologies are used to gather operational transportation data? How is this data shared within your agency and with other agencies and jurisdictions?

4.4. How are data management systems coordinated and shared among agencies and levels of government?

5. Urban-rural balance for operations applications.

5.1. Are there separate design standards for urban versus rural roads and bridges? How are these established? How is their operational effectiveness determined?

5.2. How is funding allocated between rural and urban areas?

5.3. What rural operations applications are used by your agency, such as for fog, wind, and storm emergencies?

5.4. What is the level of Intelligent Transportation System deployment in rural and urban settings?

6. Customer service aspects.

6.1. What mechanisms are in place to accept, evaluate, and integrate customer input. How is customer satisfaction measured?

6.2. What legal liability issues do you face relating to roadway design, operations, maintenance, and Intelligent Transportation Systems?

6.3. How do you currently use traveler information to help satisfy customer expectations? What

impact does this have on operations?

7. Planning for operational improvements.

7.1. What kind of strategic planning is done to implement operational improvements?

7.2. How do you involve the public in the planning and implementation of transportation systems?

7.3. How are roadway improvements prioritized?

7.4. What life-cycle issues need to be considered when an operational improvement is planned and implemented (for example, staffing, training and recruitment, equipment, etc.)?

7.5. Are environmental controls and requirements being maintained, increased, or reduced?

7.6. How is the movement of freight and goods compared to the movement of people when making system operations decisions?

7.7. How much research is being devoted to operations and how is it translated into actual practices? Who does the research (private sector, public sector, etc.)?

8. Innovative techniques and technologies.

8.1. What innovative techniques and technologies are you using to improve operations? (For example, electronic tolling, congestion pricing, video cameras for traffic enforcement.) How effective are they? How are they funded?

8.2. What demand management techniques are used and how do they affect operations?

9. Funding and budgeting for operations, including policies and legislation, revenue sources, and revenue generation.

9.1. What national or regional policies and legislation exist relating to operations?

9.2. What transportation-related taxation policies support operations?

9.3. How is funding for transportation improvements, including operations, prioritized?

9.4. Have you achieved a stable funding source for your operations? If so, how have you achieved it?

9.5. Are you exploring any new and/or innovative funding sources for operations?

10. Incident and events management for emergencies, accidents, and special events such as marathons, concerts, parades, visiting heads of state, etc.

10.1. How do you budget for costs and resource demands associated with emergencies and special events?

10.2. Are you using any new and/or innovative operational procedures and planning for such events?

10.3. Please describe your traffic management features during reconstruction, repairs, special events, and traffic incidents.

Host Country Contacts

THE LIST BELOW INCLUDES THE NAMES OF THE INDIVIDUALS THE TEAM MET WITH DURING THE SCANNING STUDY. THE TEAM MEMBERS WISH TO EXPRESS THEIR SINCERE GRATITUDE TO THESE INDIVIDUALS FOR THEIR TIME, HOSPITALITY, AND THE VALUABLE INFORMATION THEY PROVIDED. THE LISTS ARE PRESENTED IN ALPHABETICAL ORDER.

Germany

Bundesministerium für Verkehr, Bau-und Vohnungswesen (Federal Ministry of Transport, Building and Housing)
Holger Figge
Dieter Gluck
Armin Keppel
Christian Springe
Dieter Steinfels
Frank Süsser
Stefan Zirngibl

Federal Highway Research Institute
Fritz Bolte

Rhein-Main-Verkehrsverbund GmbH
Jörg Lunkenheimer

Stadwerke Verkehrsgesellschaft Frankfurt am Main mbH
Alois Rautschka

The Netherlands

Ministerie van Verkeer en Waterstaat (Ministry of Transport, Public Works, and Water Management)
Job Klijnhout
Willem Jan Knibbe
René Korevaar
Hans Kramer
Frans Middelham
Jan Slager
Iris Casteren van Cattenburch
Leo van den Berg
Pieter J. van der Veen
Frank van Erkel
Jan A. van Selm
G. A. van Toorenburg
Marcel Westerman

Kennisplatform VERDI
A. (Bram) van Luipen

TIC
R. Korevaar
Jan Malenstein

Politie
J. Malenstein

France

Ministère de l'Equipement, des Transports et du Logement (Ministry of Public Works, Transport and Housing)
Yolande Daniel
Jean-Pierre Grégoire
Jean-Francois Janin
Olivier Paul-Dubois-Taine
Yves Robichon
Patrick Vidal

STIF (Syndicat des Transports D'Ile-de-France)
Stephane Lecler

RATP
Alain Caire
Alain Chesnoy
Claude Janet

Diréction Regionale de l'Equipement Ile-de-France
Valèrie Moutal

Association des Sociètès Francaises d'Autoroutes
Malika Seddi

Cofiroute
Lauriane Chappe
Dominique Ratouis

Autoroutes du Sud de la France
Claude Bidaud

England

Railtrack
Fiona Bulmer
Ian Cloughton
Alan Dray

Highways Agency
Emile Al-Uzaizi
Ian H. Beck
Eric Belfield
Peter Bevis
Steve Brown
Richard Eastman
Brian Harbord
Alan Hobbs
Tim Matthews
Richard Thorndike
John Robinson
Steve Rowsell

Transport for London
Peter Heather
Richard Smith
Jon Willis

Hampshire County Council
Tony Brown
Tony Ciaburro
Councillor Dudley A. Keep
Ken Laughlin
David Tarrant
Councillor M. J. Woodall FRICS

TRG Transportation Research Group, University of Southampton
Tom Cherrett
Granville Fisher
Richard Hall
Nick Hounsell
Glenn Lyons
Mike McDonald
Andy Richards
Jianping Wu

References

A New Deal for Transport: Better for Everyone. Department of the Environment, Transport and the Regions. Presented to Parliament by the Deputy Prime Minister and Secretary of State for the Environment, Transport and the Regions, and the Secretaries of State for Scotland, Wales and Northern Ireland by Command of Her Majesty. July 1998.

A Strategic Agenda. Sir Alastair Morton, Chairman, Strategic Rail Authority. March 2001.

Bison Fute 2001 Calendrier du Trafic Routier. Securite Routiere.

Intelligent Transport; France Know-how. Ministry of Public Works, Transport and Housing and Center for Studies on Urban Planning, Transport, Utilities and Public Constructions.

National Traffic and Transport Plan for the Netherlands 2001-2020: 'From A to Better,' Summary of Proposed Policy. Ministry of Transport, Public Works and Water Management. January 2001.

Policy Document on Traveller Information. Ministry of Transport, Public Works and Water Management, Directorate-General for Transport of Passengers, Mobility and Competition. The Netherlands.

Road Management and Safety in France. Securite Routiere. December 1999.

ROMANSE II (ROad MANagement System for Europe) Executive Summary. Hampshire County Council and Southampton City Council. Winchester and Southampton, UK.

The A86 West Underground Link-Up; Smooth driving below ground for a better quality of life above. L'A96 A L'oust, Cofiroute.

The Highways Agency Family of Strategic Plans. Highways Agency: London. 2000.

Transport 2010, The 10-Year Plan. Department of the Environment, Transport and the Regions: London. July 2000.

Urban Public Transport in France, Institutional Organization. Land Transport Administration, Ministere de l'Equipement, des Transports et du Logement. December 1997.

Urban Transportation Equipment, A Review of French Manufacturers' Products. Ministry of Public Works, Transportation and Housing. June 2000.

Video-surveillance, Cameras on board in the buses. Information Systems and Telecommunications Department, RATP/SIT. May 2000.

Weniger Stau - Mehr Mobilität. Bundesministerium für Verkehr, Bau- und Whonungswesen. September 1999.

Web Sites

Bison Fute
http://www.bison-fute.equipement.gouv.fr

Cofiroute - Direction des Activites Internationales
http://www.cofiroute.fr/Uk/home.cfm

Hampshire County Council Local Transportation Plan
http://www.hants.gov.uk/environment/ltp

Highways Agency
http://www.highways.gov.uk/

ROMANSE
http://www.romanse.org.uk

Transport for London
http://www.tfl.gov.uk/tfl/

Endnotes

1. In May 2002, the department became the Department for Transport with responsibility for most of its former non-transport functions transferred to the Office of the Deputy Prime Minister.

2. In April 2003, the Highways Agency's Aim and Objectives were simplified:

Aim: Safe roads, Reliable Journeys, Informed Travellers

Objectives:

1. To deliver a high quality service to all our customers by:
   - Improving road safety;
   - Making journeys more reliable through better network management and information; and
   - Respecting the environment.
2. To ensure more effective delivery through better working relationships.
3. To implement best practices and innovative solutions to improve service now and in the future.
4. To be a good employer.
5. To be an efficient agency with effective business processes and resource management system.

3. An increased network operator role is now envisioned for the Highways Agency in which it will work in closer partnership with the police. The agency's aim is to assume responsibility for a range of supporting and ancillary tasks associated with effective road management and traffic flow such as setting message signs, answering emergency roadside telephones, providing accurate information to the media, and dealing with the traffic consequences of incidents. The intention is to improve traffic managment while enabling the police to focus on managing incidents and dealing with road traffic violations.

Office of International Programs
FHWA/US DOT (HPIP)
400 Seventh Street, SW
Washington, DC 20590

Tel: 202/366-9636
Fax: 202/366-9626

international@fhwa.dot.gov
www.international.fhwa.dot.gov

Publication No. FHWA-PL-03-012
HPIP/8-03(5M)EW