International Technology Scanning Program • July 2009

Transportation Research Program Administration in Europe and Asia

ESTABLISHING THE RESEARCH FRAMEWORK • CONDUCT OF RESEARCH • PARTNERSHIP MODELS • INNOVATION DELIVERY

TRPA 2008

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16. Abstract

The Federal Highway Administration, American Association of State Highway and Transportation Officials, and National Cooperative Highway Research Program sponsored a scanning study of Europe and Asia to review transportation research program administration practices. The scan team sought policy initiatives and process improvements to enhance transportation research administration in the United States.

The team found that in the countries it studied, transportation research is directly related to national economic growth and competitiveness, transportation research efforts are promoted, transportation research and development (R&D) is accepted as a valuable contribution to the national good, and addressing intellectual property rights is a common practice that facilitates the delivery of transportation research results.

Team recommendations for U.S. application include building international relationships in transportation research to achieve global goals, developing a nationally coordinated research framework, and strengthening the innovation process by examining international research institutes that link the creation and application of knowledge.

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National Cooperative Highway Research Program

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International Technology Scanning Program

The International Technology Scanning Program, sponsored by FHWA, the American Association of State Highway and Transportation Officials (AASHTO), and the National Cooperative Highway Research Program (NCHRP), evaluates innovative foreign technologies and practices that could significantly benefit U.S. highway transportation systems. This approach allows advanced technology to be adapted and put into practice much more efficiently without spending scarce research funds to re-create advances already developed by other countries.

FHWA and AASHTO, with recommendations from NCHRP, jointly determine priority topics for teams of U.S. experts to study. Teams in the specific areas 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. Scan teams usually include representatives from FHWA, State departments of transportation, local governments, transportation trade and research groups, the private sector, and academia.

After a scan is completed, team members evaluate findings and develop comprehensive reports, including recommendations for further research and pilot projects to verify the value of adapting innovations for U.S. use. Scan reports, as well as the results of pilot programs and research, are circulated throughout the country to State and local transportation officials and the private sector. Since 1990, more than 80 international scans have been organized on topics such as pavements, bridge construction and maintenance, contracting, intermodal transport, organizational management, winter road maintenance, safety, intelligent transportation systems, planning, and policy.

The International Technology Scanning Program has resulted in significant improvements and savings in road program technologies and practices throughout the United States. In some cases, scan studies have facilitated joint research and technology-sharing projects with international counterparts, further conserving resources and advancing the state of the art. Scan studies have also exposed transportation professionals to remarkable advancements and inspired implementation of hundreds of innovations. The result: large savings of research dollars and time, as well as significant improvements in the Nation's transportation system.

Scan reports can be obtained through FHWA free of charge by e-mailing international@dot.gov. Scan reports are also available electronically and can be accessed on the FHWA Office of International Programs Web site at www.international.fhwa.dot.gov..

International Technology Scan Reports

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

Safety

Improving Safety and Mobility for Older Road Users in Australia and Japan (2008)

Halving Roadway Fatalities: A Case Study From Victoria, Australia (2008)

Safety Applications of Intelligent Transportation Systems in Europe and Japan (2006)

Traffic Incident Response Practices in Europe (2006)

Underground Transportation Systems in Europe: Safety, Operations, and Emergency Response (2006)

Roadway Human Factors and Behavioral Safety in Europe (2005)

Traffic Safety Information Systems in Europe and Australia (2004)

Signalized Intersection Safety in Europe (2003)

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European Road Lighting Technologies (2001)

Commercial Vehicle Safety, Technology, and Practice in Europe (2000)

Methods and Procedures to Reduce Motorist Delays in European Work Zones (2000)

Innovative Traffic Control Technology and Practice in Europe (1999)

Road Safety Audits—Final Report and Case Studies (1997)

Speed Management and Enforcement Technology: Europe and Australia (1996)

Safety Management Practices in Japan, Australia, and New Zealand (1995)

Pedestrian and Bicycle Safety in England, Germany, and the Netherlands (1994)

Planning and Environment

Streamlining and Integrating Right-of-Way and Utility Processes With Planning, Environmental, and Design Processes in Australia and Canada (2009)

Active Travel Management: The Next Step in Congestion Management (2007)

Managing Travel Demand: Applying European Perspectives to U.S. Practice (2006)

Risk Assessment and Allocation for Highway Construction Management (2006)

Transportation Asset Management in Australia, Canada, England, and New Zealand (2005)

Transportation Performance Measures in Australia, Canada, Japan, and New Zealand (2004)

European Right-of-Way and Utilities Best Practices (2002)

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National Travel Surveys (1994)

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Transportation Research Program Administration in Europe and Asia (2009)

European Practices in Transportation Workforce Development (2003)

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Emerging Models for Delivering Transportation Programs and Services (1999)

National Travel Surveys (1994)

Acquiring Highway Transportation Information From Abroad (1994)

International Guide to Highway Transportation Information (1994)

International Contract Administration Techniques for Quality Enhancement (1994)

European Intermodal Programs: Planning, Policy, and Technology (1994)

Operations

Freight Mobility and Intermodal Connectivity in China (2008)

Commercial Motor Vehicle Size and Weight Enforcement in Europe (2007)

Active Travel Management: The Next Step in Congestion Management (2007)

Effective Use of Weigh-in-Motion Data: The Netherlands Case Study (2007)

Managing Travel Demand: Applying European Perspectives to U.S. Practice (2006)

Traffic Incident Response Practices in Europe (2006)

Underground Transportation Systems in Europe: Safety, Operations, and Emergency Response (2006)

Superior Materials, Advanced Test Methods, and Specifications in Europe (2004)

Freight Transportation: The Latin American Market (2003)

Meeting 21st Century Challenges of System Performance Through Better Operations (2003)

Traveler Information Systems in Europe (2003)

Freight Transportation: The European Market (2002)

European Road Lighting Technologies (2001)

Methods and Procedures to Reduce Motorist Delays in European Work Zones (2000)

Innovative Traffic Control Technology and Practice in Europe (1999)

European Winter Service Technology (1998)

Traffic Management and Traveler Information Systems (1997)

European Traffic Monitoring (1997)

Highway/Commercial Vehicle Interaction (1996)

Winter Maintenance Technology and Practices—Learning from Abroad (1995)

Advanced Transportation Technology (1994)

Snowbreak Forest Book—Highway Snowstorm Countermeasure Manual (1990)

Infrastructure—General

Public-Private Partnerships for Highway Infrastructure: Capitalizing on International Experience (2009)

Audit Stewardship and Oversight of Large and Innovatively Funded Projects in Europe (2006)

Construction Management Practices in Canada and Europe (2005)

European Practices in Transportation Workforce Development (2003)

All publications are available on the Internet at www.international.fhwa.dot.gov.

Contract Administration: Technology and Practice in Europe (2002)

European Road Lighting Technologies (2001)

Geometric Design Practices for European Roads (2001)

Geotechnical Engineering Practices in Canada and Europe (1999)

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Infrastructure—Pavements

Warm-Mix Asphalt: European Practice (2008)

Long-Life Concrete Pavements in Europe and Canada (2007)

Quiet Pavement Systems in Europe (2005)

Superior Materials, Advanced Test Methods, and Specifications in Europe (2004)

Asphalt Pavement Warranties: Technology and Practice in Europe (2004)

Pavement Preservation Technology in France, South Africa, and Australia (2003)

Recycled Materials in European Highway Environments (1999)

South African Pavement and Other Highway Technologies and Practices (1997)

Highway/Commercial Vehicle Interaction (1996)

European Concrete Highways (1992)

European Asphalt Technology (1990)

Infrastructure—Bridges

Bridge Evaluation Quality Assurance in Europe (2008)

Prefabricated Bridge Elements and Systems in Japan and Europe (2005)

Bridge Preservation and Maintenance in Europe and South Africa (2005)

Performance of Concrete Segmental and Cable-Stayed Bridges in Europe (2001)

Steel Bridge Fabrication Technologies in Europe and Japan (2001)

European Practices for Bridge Scour and Stream Instability Countermeasures (1999)

Advanced Composites in Bridges in Europe and Japan (1997)

Asian Bridge Structures (1997)

Bridge Maintenance Coatings (1997)

Northumberland Strait Crossing Project (1996)

European Bridge Structures (1995)

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Abbreviations and Acronyms

AASHTO	American Association of State Highway and Transportation Officials
CORDIS	Community Research and Development Information Service
DOT	Department of Transportation
DRAST	Department for Research and Scientific and Technical Coordination (France)
DVS	Rijkswaterstaat Transport and Navigation Department (the Netherlands)
EC	European Commission
ECTRI	European Conference of Transport Research Institutes
ERTRAC	European Road Transport Research Advisory Council
ERA-NET	European Research Area–Network, including Road and Transport subthemes
EU	European Union
FEHRL	Forum of European National Highway Research Laboratories
FHWA	Federal Highway Administration
FP7	European Seventh Framework Program
GHD	French National Road Agency, General Highways Department
IBS	Institute of Behavioral Sciences (Japan)
IP	intellectual property
IPR	intellectual property rights
ITPS	Institute for Policy Studies (Japan)
ITS	intelligent transportation systems
INRETS	National Institute for Transport and Safety Research (France)
KICT	Korean Institute of Construction Technology
KICTEP	Korean Institute of Construction and Transportation Technology Evaluation and Planning
KOTI	Korean Transport Institute
KTI	Institute for Transport Sciences (Hungary)
JICE	Japanese Institute of Construction Engineering
LCPC	French Research Laboratory for Public Works
MRI or MIRI	Mitsubishi Research Institute
MLIT	Ministry of Land, Infrastructure, Transport, and Tourism (Japan)
MOU	memorandum of understanding
NCHRP	National Cooperative Highway Research Program
NILIM	National Institute for Land and Infrastructure Management (Japan)
NRA	national research agency
PREDIT	Program of Research, Experimentation, and Innovation in Land Transport (France)
PWRI	Public Works Research Institute (Japan)
RiP	Research-in-Progress
R&D	research and development
RDT	research, development, and technology
SKIA	Strategy, Knowledge, and Innovation Agenda (the Netherlands)
SME	small- to medium-sized enterprise

SRA	Swedish Road Administration
STIP	Scan Team Implementation Plan
SWOV	Institute for Road Safety Research (the Netherlands)
TRB	Transportation Research Board
TRIS	Transportation Research Information Services
TRPA	Transportation Research Program Administration
VINNOVA	Swedish Governmental Agency for Innovation Systems
VTI	Swedish National Road and Transport Research Institute
VTT	Technical Research Center of Finland

Executive Summary

Overview

In April 2008, a team of 11 transportation research, asset, and policy management experts from the United States visited Belgium (European Commission), France, Japan, the Netherlands, South Korea, and Sweden to review and assess transportation research program administration practices. The scan team members sought policy options and initiatives as well as process improvements to enhance the effectiveness of transportation research administrative activities in the United States. The team identified successful practices with potential for application to U.S. surface transportation research programs, particularly in the public sector. In addition, the team realized its presence in the countries visited would provide avenues for developing research partnerships and collaboration opportunities and that this unique experience would promote information sharing and technology transfer with international counterparts. The team also learned that transportation research, quality of life, and national economic competitiveness are inseparable in all of the countries visited, and it gained a greater appreciation of the necessity for robust links between the creation of knowledge via research and the application of knowledge in society. The scan team met with senior research program administrators from national governments and the European Commission, nongovernment national research consortia, institutes, centers of excellence, research foundations, and universities.

This scan is the first solely dedicated to research program management practice. The scan topic originated through discussions among State department of transportation (DOT) research managers committed to improving the effectiveness of research program activities and increasing the stewardship of the resources directed to research. This scan is especially important for the U.S. transportation research community because it addresses program-level activities rather than technical project-based efforts, and it provides concepts that can significantly enhance research program management in the United States.

The Transportation Research Program Administration Scan was conducted through the International Highway Technology Scanning Program, jointly sponsored by FHWA and AASHTO in cooperation with the Transportation Research Board's (TRB) NCHRP, the private sector, and academia.

Areas of Interest

The scan team identified four primary themes that describe its areas of interest. Each theme incorporates an aspect of the research administrative process from early stage, determining the research framework, to late stage, getting the research results into widespread practice. The scan team also developed a series of amplifying questions detailing the information it sought on each theme.

In the context of these four themes, the team focused on how the host countries administer their research programs and projects, including the methods, techniques, and tools they use to accomplish the broad spectrum of administrative functions. The scan team also investigated the roles, responsibilities, and working relationships among research entities in the various countries and within their international domains.

The following are the four primary themes:

1. **Establishing the research framework—**Practices used to determine where to put the emphasis and effort to solve current problems and emerging issues on local, national and federal, and international levels
2. **Partnership models and joint research activities—**Methods of cooperation that enhance technical capacity and increase fiscal and other resources required for research
3. **Conduct of research: performance, quality, and value—**Tools and processes used to measure the

performance, quality, and value of research programs and projects

4. **Delivery: getting research results into widespread practice—**Keys to enhancing the effectiveness of deployment and increasing the use of research results

Findings

Scan team findings are organized by the four primary themes of inquiry.

Establishing the Research Framework

Transportation research is directly related to national economic growth and competitiveness. In every country visited, the prevalent belief was "if you aren't doing transportation R&D, then you won't be globally competitive." The international counterparts appreciated their R&D activities in the context of the entire world. Their perspective on transportation research differed greatly from the U.S. public sector model; the host countries see transportation research as an integral piece of their efforts to maintain or create a more robust national economy.

Strategic and policy-driven frameworks for transportation research are the standard. Transportation research frameworks are developed nationally through a strategic process that is closely tied to national policy goals and objectives. These research frameworks are all-encompassing in that they include broad societal issues, not just transportation.

Exemplary research frameworks are accompanied by well-defined processes to create comprehensive transportation research roadmaps. The scan team identified excellent examples of how expertise in developing research frameworks also affects downstream processes, such as fostering comprehensive roadmaps for determining effective research programs.

The countries had an ability to align the transportation research framework with a common vision. In addition to demonstrating a clear and purposeful approach to establishing strategic frameworks, the countries focus on communicating the framework so that all stakeholders own it. This communication is done through effective and efficient planning and collaboration with industry and academia in building the common vision and accomplishing the research activities. The main drivers are societal goals rather than industrial goals, using transportation to improve the quality of life.

Senior-level individuals frequently emerge as visionaries or champions and play an instrumental role in national program focus and support. In a number of host countries, very senior experts are often regarded as highly credible opinion leaders on the national level. The noteworthy aspect of this high regard is the access these individuals have to national policy formulation and decisionmaking. The availability of accurate and expert transportation R&D knowledge to national leaders is a key factor in the country's support of the necessity for and value of R&D efforts.

National research frameworks had common topics in many of the host countries, and these frameworks are being addressed by cross-ministerial R&D activities. The host countries articulated framework items that are also concerns in the United States (e.g., climate change, aging population and mobility, workforce, aging infrastructure, congestion management, safety, and security). Host countries' research programs look to solve these national priorities in a manner that uses a remarkably broad perspective—incorporating extensive cross-ministerial bodies that include land, infrastructure, energy, environment, culture, and sports, for example.

Partnership Models and Joint Research Activities

In the host countries, transportation research partnerships and joint research efforts are essential, ubiquitous, and actively promoted. The role and use of partnerships and the collaboration of multiple players are integral elements of the research activities in the various countries visited. In many countries officials have a strong sense of "we know we can't do all this separately." With that knowledge, for example, the European Union (EU) international collaboration platform recognizes each country's competitive stance. While each country is an EU member and can benefit by being part of a unified economic entity, each country is also an individual economic entity with unique country priorities.

Host countries' transportation R&D collaboration activities begin substantially further upstream than in the United States. Host countries' research programs incorporated academic and industry participation earlier in the research process than those of the United States. In the host countries there is a continuous flow that

incorporates collaboration throughout the research process—from problem definition (which may include participation in establishing the research framework) through the conduct of the research and the delivery of research products.

Research institutes are an important vehicle for exercising transportation partnerships and collaboration. Without exception, each host country had some form of research institute that is a primary vehicle to either fund and financially manage or foster, house, and accomplish collaborative research efforts. The formation and structure of the research institutes varied from country to country, but each example brought together government, foundations, academia, industry, and other independent organizations that enabled them to respond to the national strategic framework more effectively in collaboration than each organization could on its own.

Academic partners are integral to transportation research performance. In every host country, academic partners in transportation R&D had a more integral and integrated role in research activities than is seen in comparable U.S. research efforts. Countries included the academic expertise for determining framework priorities, creating knowledge, accomplishing research and evaluation, and creating the future workforce.

International research partnership models in transportation are similar to models used in the United States. The scan team found similarities in the partnership models used by its international counterparts. In fact, it was encouraging to see the operation of partnership models in the various international contexts because these similarities showed potential for future partnership and collaborative activities for U.S.-international research efforts. While some aspects of the international partnerships were familiar, others provided learning opportunities for the team. Partnerships used in the countries visited tended to provide multidisciplinary, international research leadership and contribute to framework development, work sharing, and financing in ways not frequently used in the United States.

Conduct of Research: Performance, Quality, and Value

Transportation R&D is accepted as a valuable contribution to the national or societal good. Transportation research programs and their outcomes are seen in the host countries as an important contribution to society. Transportation R&D is especially considered an economic growth generator and an essential element of global competitiveness. The programs reviewed did not have to continually justify expenditures as do most U.S. research programs. In fact, the acceptance of the value of research in the host countries promotes strong research programs, which in turn develops greater value—a virtuous cycle.

International counterparts are funding transportation R&D at significantly high levels. Substantial program funding is committed to transportation research in the host countries. For the most part, the transportation research programs of host countries are significantly more integrated into broad research arenas such as model city, urban regeneration, or climate change impact. R&D funding is generally increasing to match the interest in achieving environmental and economic sustainability and global competitiveness.

Program and project evaluation techniques varied in complexity and effectiveness. For the most part, every research program included some process for evaluating research results. Some programs were more successful than others, and some programs were more risk adverse than others, requiring extensive review to redirect work.

Quantifying the benefits of research results is a continuing challenge for all host countries. As in the United States, the host countries find quantifying benefits of research activities a challenge. The efforts committed to determining the benefits varied, and no country had a completely satisfactory solution. The focus on justifying the program based on the benefits analysis was not a critical concern for any of the countries.

A variety of successful techniques and processes are potential options for consideration in the United States. Some of the items the scan team noted included the role of research institutes in establishing research frameworks, longer term plans with multiyear programming, and closeness of government R&D activities to industry, for example.

Delivery: Getting Research Results Into Widespread Practice

Addressing intellectual property rights is a common practice that facilitates the delivery of transportation research results. The scan team observed decidedly

different perspectives than in the United States on the ownership of intellectual property generated from government-funded transportation research. Intellectual property (IP) development is seen as an opportunity to build a business based on the specific IP, generated fees were used as income sources for R&D, and numbers of patents and licensing opportunities were used as performance metrics.

Development of common platforms among U.S. and international R&D organizations will facilitate research results delivery in all countries. The development of common platforms for a variety of research processes will substantially reduce barriers for R&D collaboration, foster international partnerships, and promote more widespread use of research results.

The number of forums for international sharing of research results is increasing. Venues exist to share and enhance the likelihood of dissemination of research results, and for the global transportation research community those tools and opportunities are growing in capability and capacity.

Scan Team Implementation Plan

The team identified a number of successful transportation research program administration practices in the host countries that can be applied in the United States. These practices are the basis for the Scan Team Implementation Plan (STIP). The STIP describes the six major implementation plan items, discusses each item, and identifies implementation strategies. The timeframe for implementing the STIP items ranges from the time the team returned to the United States through 2011 and beyond.

In addition, findings and best practices obtained from the scan will be widely disseminated throughout the transportation research community through presentations, workshops, reports, articles, and Web-based activities and discussions. Some of the recommendations and implementation strategies can be implemented within the existing transportation research infrastructure. Others may require policy-level studies and international joint activities to realize the desired outcomes and benefits.

The following summary identifies the six STIP items, presents the scan team's rationale for including each item, and highlights major strategies for accomplishing the implementation.

Item 1: Improving International Relationships

Build international relationships and institutionalize cooperation in transportation research to achieve global goals and leverage knowledge and resources.

While the scanning study focused on research program administration, the team realized its presence in other countries would provide avenues for developing new research relationships and potential collaboration opportunities with its international counterparts, particularly on global issues such as climate change and highway safety. Each of the international host organizations visited expressed a desire for expanded collaborative research efforts with the United States. In addition, officials made repeated references to a need for better information sharing and global technology transfer of innovations.

Efforts are already underway to institutionalize cooperation in transportation research between the European community and the United States, as well as between the United States and South Korean researchers—activities in which TRB has been instrumental. A variety of isolated partnerships also exist between agencies, institutes, or companies abroad and in the United States. To foster more of these beneficial international relationships, the scan team presents the following strategies:

- Develop engagement plans—strategies, working processes, and products—to manage collaboration efforts with international research organizations.
- Host a tour of the FHWA Turner-Fairbank Highway Research Center for international researchers and research mangers in January 2009.
- Create a communications package to facilitate international relationships that includes a factsheet with key messages from the scan, presentation materials, and summaries of host agencies' responsibilities and activities. Enable subsequent additions of other international organizations.
- As appropriate, inform international host organizations' members about TRB committee activities and encourage their involvement. Add the names of those visited during the scan to the mailing and newsletter distribution list of the TRB Conduct of Research Committee. Offer them opportunities to write newsletter articles and help develop annual meeting sessions.
- Offer to help develop the scan agenda for the planned

scanning study of the United States by the European Conference of Transport Research Institutes (ECTRI). Share the FHWA–AASHTO process for developing international scanning studies.
- Recommend international collaboration as a theme at a future TRB annual meeting.

Item 2: Developing a Nationally Coordinated Transportation Research Framework

Promote the development and implementation of a nationally coordinated, multimodal transportation research framework.

To remain globally competitive and continue to improve the quality of life for U.S. citizens, it is critical for the Nation to be an active player in the research community. There must be collaboration throughout the Nation to unleash the brilliance of its researchers and identify a national research framework that unites the various sectors of the country behind common research goals or themes.

With this in mind, the scan team believes that a policy study should be undertaken to analyze the current process of many independently run research programs and evaluate the benefits of a nationally focused program in which more research dollars are spent on a few highly critical areas. If the results of the review point to a coordinated national program, the study would recommend a process to develop a coordinated national framework for U.S. transportation research. This framework would be collaboratively developed and flexible enough to address local and regional as well as national issues, and exhibit a broad-based fusion of top-down and bottom-up needs identification. Examples of effective research platforms are available to assist in this effort, including the European Union framework; the Japanese Ministry of Land, Infrastructure, Transport, and Tourism Technology Basic Plan; and South Korean roadmaps. In addition, models such as that used by the National Institutes of Health would be productive benchmark candidates.
The following are implementation strategies for developing a nationally coordinated research framework:

- Create a white paper that identifies the benefits of a nationally coordinated, multimodal transportation research framework. Using the white paper, conduct informal outreach to leaders in a broadly defined transportation community to determine their reception to the concept of a national research framework.
- Propose, advocate, and help staff a policy study that will comprehensively investigate the potential for and benefits of a nationally focused research effort.
- If the policy study recommends proceeding with a national research framework, host a symposium with representatives from all components that impact or are impacted by the transportation community to provide a multidisciplinary approach to transportation research and set a strategic framework.
- Explore the concept of a national research organization that brings together the research community—Federal, State, and local governments; universities; foundations; institutes; and the private sector—to develop a focused research framework that keeps America at the leading edge.

Item 3: Strengthening the Innovation Process

Strengthen the innovation process by examining international research institutes and other models of collaboration to link knowledge creation and knowledge application.

The scan team learned that the host countries use research institutes to bridge the gap between knowledge creation and knowledge application. Institutes often are the venues that bring together the knowledge creation, knowledge management, and knowledge application aspects of R&D and foster transportation partnerships and collaboration that lead to effective innovation.

Without exception, each host country had some form of research institute that is a primary vehicle to either fund and financially manage or foster, house, and accomplish collaborative research efforts. The formation and structure of the research institutes varied from country to country, but each example brought together government, government-funded independent organizations, academia, and industry in a unique manner that enabled them to respond to the national strategic framework more effectively than each organization could on its own. The United States does not have comparable entities to facilitate collaborative research on this level. Some U.S. structures can accomplish portions of the roles of these institutes, but such integration of responsibility in one institutional structure is clearly a non-U.S. model.

The scan team implementation will consist of the following:

- Propose, advocate, and help staff a policy study to

review the structure of Federal transportation research in the United States, including an examination of the research institute model and additional models of collaboration employed in other parts of the world. The study should include a summary documenting characteristics of research institutes in the host countries. Institutes documented in the summary should include, among others, the French Research Laboratory for Public Works (LCPC), the French Carnot Institutes, the Korean Institute of Construction and Transportation Technology Evaluation and Planning (KICTEP), the Swedish Governmental Agency for Innovation Systems (VINNOVA), the Japanese Ministry of Land, Infrastructure, Transport, and Tourism (MLIT), and members of ECTRI.
- If the study concludes that other models of collaboration provide the desired structure to enable the United States to meet its innovation goals, the study should also outline how the structure might best be used in the United States. In addition, the recommendations should address the feasibility of using existing U.S. organizations in the new structure.

Item 4: Exploring Benefits of Intellectual Property Applications in U.S. Transportation Research

Investigate the effects, applications, and potential for intellectual property rights in the United States and abroad.

Among countries visited in the scan, the transportation research community demonstrated a noticeably greater concern for the value and importance of intellectual property than is sometimes evident in the United States. Safeguarding intellectual property was recognized as a critical component of the entire research process to spur innovation, encourage investment in technology development and refinement, and foster commercialization nationally and internationally. Ultimately, intellectual property was seen as a means to bolster national economies by adding companies that hire new employees and sell new products. These perspectives varied from the views and uses of IP in government sector transportation research in the United States.

Differences in intellectual property laws can complicate or frustrate protection and licensing between organizations in different countries. Organizations in nearly every country visited in the scan voiced questions and concerns about international intellectual property rights.

The following are strategies to foster the potential benefits of IP applications in transportation research:

- Collaborate with TRB Committees on the Conduct of Research, Emerging Technology Law, and International Activities to sponsor and present technical sessions on domestic intellectual property law and international intellectual property law at the 2011 TRB Annual Meeting.
- Collaborate with the AASHTO Research Advisory Committee (RAC) Task Forces on Education and Training and on Program Management and Quality and with FHWA to develop an intellectual property short course and manual for transportation research managers.
- Collaborate with FHWA to convene a workshop on international intellectual property law and transportation research at which a multinational panel identifies problems and opportunities related to international intellectual property law and transportation research. Distribute proceedings widely.

Item 5: Exploring Global Use of Research Information

Integrate and enhance accessible databases, Internet forums, portals, or other platforms to coordinate information and knowledge resources at a global level.

Developing common platforms for a variety of research processes would substantially reduce barriers for R&D collaboration and international partnerships and promote more widespread use of research results. Improved awareness of research frameworks, existing collaborations, and intellectual property issues; sharing of research expertise for peer review activities; and widespread information exchange are just a few of the areas that could benefit from the development of linked databases, common access portals, or other platforms among global R&D collaborators.

The scan team believes that such platforms should build on existing initiatives, such as those sponsored by TRB and AASHTO (e.g., Transportation Research Information Services (TRIS), the Research-in-Progress (RiP) database, various AASHTO transportation knowledge

networks efforts, and the TRB Conduct of Research and the AASHTO RAC Task Group on Coordination and Collaboration). In addition, existing international resources including those presented in Sweden and the Netherlands should be integrated. Activities including the U.S. National Science Foundation's model for accepting and cataloging requests for proposals should be benchmarked.

The scan team implementation will consist of the following:

- By consulting existing U.S initiatives, develop a better understanding of the status, capabilities, and capacities of existing and planned information databases, portals, and platforms. Summarize international resources in visited countries. Determine how U.S. and international information sharing and exchange could best be integrated through joint platforms.
- Monitor the ongoing dialog between the TRB Library and international counterparts to determine if a potential model for information exchange with other countries emerges.
- Offer assistance and participate in the "Borderless Access to Information—International Transportation Research Web Resources" workshop scheduled for the 2009 TRB Annual Meeting.
- Provide recommendations on how best to achieve common platforms: connect, incorporate, or coordinate international information resources with those in the United States.
- Develop strategies for improved ability to translate materials in other languages.

Item 6: Improving the Research Evaluation Process

Promote a systematic and consistent practice for continuous research program evaluation and improvement.

The scan team considers the performance, quality, and value of research programs important factors for sustaining credible research programs. In light of this interest, host countries were asked how program quality and value were determined or measured, and how the results were communicated to sponsors and stakeholders.

In each host country visited, the value of funding and conducting research was considered intrinsic to achieving societal and economic goals. That research is valued is a given. As a result, the scan team did not observe much concern about using performance measures or indicators or providing results to bolster program support. However, a number of the host countries presented extensive evaluation schemes at both the programmatic and individual project levels (e.g., Swedish, South Korean, and Japanese schemes used for process and outcome improvement). Based on these examples, there appear to be models and techniques for both program and project evaluation that should be shared with U.S. transportation research administrators and program managers. The countries expressed substantial interest in the Performance Measurement Toolbox created in NCHRP Project 20-63, "Performance Measurement Tool Box and Reporting System for Research Programs and Projects."

The following are strategies to accomplish this implementation item:

- Host a symposium to provide an international exchange of ideas on techniques for program- and project-level evaluations.
- Write articles for *TR News,* the TRB Conduct of Research Committee quarterly newsletter, and other TRB committee publications (e.g., Committee on Performance Measurement).
- Develop a session for the 2009 TRB Annual Meeting on "Research Program and Project Evaluations—An International View." Creating a TRB *Transportation Research Circular* from this session could be useful.
- Develop a presentation outlining the various evaluation techniques discovered during the scan to share with the transportation research community, in particular the TRB Committees on Conduct of Research and Performance Measures, and the AASHTO RAC.

Chapter 1: Introduction

Scan Objectives and Primary Themes

Scan Objectives

There are exemplary international transportation research programs and activities that have mature and successful research administration processes. Recognizing that this rich body of knowledge is available to U.S. research managers, the Transportation Research Program Administration scan team set objectives to examine the management and administrative practices, policies, and experiences of other countries to better understand how they administer their research programs to solve difficult problems, produce more rapid adoption of innovation, and create more value for their research results. The team realized that its presence in the countries visited would also provide avenues for developing research partnerships and collaboration opportunities because this unique circumstance would promote information sharing and technology transfer with international counterparts.

This scan is the first dedicated solely to research program management practice. The scan topic originated through discussions among State DOT research managers committed to improving the effectiveness of research program activities and increasing the stewardship of the resources directed to research. This scan is especially important to the U.S. transportation research community because it addresses program-level activities rather than technical project-based efforts, and it provides concepts that can significantly enhance research program management in the United States. The scan vision was that benefits from learning about and applying other countries' successful administrative practices would not only have an impact on State DOT research programs, but also could cascade to other transportation research activities in academia, the private sector, and other organizations important to transportation research in the United States.

The scan was conducted through the International Highway Technology Scanning Program, jointly sponsored by FHWA and AASHTO in cooperation with TRB's NCHRP, the private sector, and academia.

Four Primary Themes

The scan team identified four primary themes that describe its areas of interest. Each theme incorporates an aspect of the research administrative process from early stage, establishing the research framework, to late stage, getting the research results into widespread practice. The scan team also developed a series of amplifying questions (see Appendix A) detailing the information it sought within each theme.

In the context of these four themes, the team focused on how the host countries administer their research programs and projects—the methods, techniques, and tools used to accomplish the broad spectrum of administrative functions. The scan team also investigated the roles, responsibilities, and working relationships among research entities in the various countries and within their international domains.

The following are the four themes:

1. **Establishing the research framework—** Practices used to determine where to put the emphasis and effort to solve current problems and emerging issues on local, national and federal, and international levels
2. **Partnership models and joint research activities—** Methods of cooperation that enhance technical capacity and increase fiscal and other resources required for research
3. **Conduct of research: performance, quality, and value—**Tools and processes used to measure the performance, quality, and value of research programs and projects
4. **Delivery: getting research results into widespread practice—**Keys to enhancing the effectiveness of deployment and increasing the use of research results

Amplifying Questions

The scan team was particularly interested in how international transportation research programs and projects are managed. Through discussion with international counterparts, the team wanted to better understand the methods and techniques used to accomplish the broad spectrum of administrative responsibilities for research activities. To assist in determining this information, the team developed a list of detailed questions that were submitted to the organizations visited before the team's arrival. The amplifying questions were translated into the language of each country visited to provide clarity and enhance understanding for those who graciously gave their time and expertise to meet with the team.

The amplifying questions were organized into four primary themes reflecting the team's interest. Questions within the four themes address the processes used, motivation for those processes, and successful practices. The team also asked about specific program-level practices and differences between the treatment of program- and project-level activities. The questions enabled the host organizations to structure their presentations on the major themes and guide group discussions. The amplifying questions are in Appendix A.

A glossary was distributed with the amplifying questions to assist the international contacts in understanding terminology that may have uniquely U.S. connotations. The glossary is in Appendix B.

Desk Scan

A review of international programs, called a desk scan, was prepared for the scan team to assist in determining the countries and research programs that would be most productive to visit. The report included information collected by e-mail, personal contacts, and Internet search. The desk scan identified key issues and opportunities and provided a broad summary of the activities and focus of transportation research programs worldwide.(1) From this document and the experiences of the International Technology Scanning Program staff, the scan team determined the most likely candidates for the scanning study. In addition to assisting the team in its decisionmaking, the desk scan is a useful resource that provides an overview of global transportation research program efforts.

Scan Organization

The scan team selected the organizations visited based on the potential to gain administrative management knowledge and apply transportation research program practices to similar contexts in the United States. The team also wanted to make best use of the opportunity to form or better solidify relationships with excellent transportation research programs worldwide. The team met with executive-level research program managers, including country managers of research activities and senior-level technical researchers. Host organizations presented the administrative complexities of their programs and provided the technical context in which the various administrative practices are applied.

The scan team divided its time during the 2-week study by spending 1 week in Europe and 1 week in Asia. In Europe, the team visited the European Commission (EC), EU transportation research stakeholder organizations, France, the Netherlands and Sweden. In Asia, the team met with officials in Japan and South Korea, as well as transportation research stakeholder organizations in both countries. Table 1 details the countries, host organizations, programs, and dates visited. The 2-week scan timeframe limited the number of countries and organizations the team could visit. However, the scan topic was well received by all host countries, and several European organizations scheduled meetings with the scan team during its visit to the European Commission in Brussels, Belgium. Visits to the other host countries also were organized to facilitate meetings with a variety of research organizations in one area or location, minimizing the travel time for the team and maximizing the time it could interact with a significant cross-section of transportation research program officials.

A list of the international contacts who participated in scan team meetings is in Appendix C.

Team Composition

The members of the Transportation Research Program Administration scan included representatives from FHWA field, program, and research offices; four State DOTs (one from each AASHTO region); the private sector, including Ford Motor Company (a large private enterprise) and B. T. Harder, Inc. (a small private enterprise); TRB; and the University of Minnesota. The variety of team member perspectives enabled

Country/Location	Organization/Program	Dates Visited
Sweden	❑ Swedish VINNOVA ❑ Swedish Road Administration (SRA)	April 13–14, 2008
The Netherlands	❑ Rijkswaterstaat Transport and Navigation Department ❑ Institute for Road Safety Research (SWOV) ❑ TNO, Dutch private research contractor	April 15, 2008
European Commission and European Union Transportation Research Stakeholders	❑ EU European Research Area Network (ERA-NET) Transport and Road programs ❑ Forum of European National Highway Research Laboratories (FEHRL) ❑ European Road Transport Research Advisory Council (ERTRAC) ❑ ECTRI, including Hellenistic Institute of Transport, French National Institute for Transport and Safety, Transport Research Center of the Czech Republic, Polytechnic University of Madrid, German Aerospace Center, VTT Technical Research Center of Finland, and KTI Institute for Transport Sciences of Hungary	April 16–17, 2008
France	❑ French National Road Agency, General Highways Department ❑ Department for Research and Scientific and Technical Coordination ❑ National Institute for Transport and Safety Research (INRETS) ❑ French LCPC ❑ Program of Research, Experimentation, and Innovation in Land Transport (PREDIT)	April 18, 2008
Japan	❑ Institute for Transport Policy Studies (ITPS) ❑ Institute of Behavioral Sciences (IBS) ❑ Japan Institute of Construction Engineering (JICE) ❑ MLIT ❑ National Institute for Land and Infrastructure Management (NILIM) ❑ Public Works Research Institute (PWRI) ❑ Mitsubishi Research Institute ❑ University of Tokyo	April 21–23, 2008
South Korea	❑ KICTEP ❑ Korea Transport Institute (KOTI) ❑ Korean Institute of Construction Technology (KICT)	April 24–25, 2008

Table 1. *Host countries, organizations, and programs visited.*

a robust approach to the outcome of the scan that addressed the interests of the government, the private sector, and academia—all necessary parts of U.S. transportation research efforts.

Scan team members are listed below. Contact information and biographic information are in Appendix D.

Debra Elston (FHWA Cochair), Director, Office of Corporate Research and Technology, FHWA Turner-Fairbank Highway Research Center

David Huft (AASHTO Cochair), Research Program Manager and Intelligent Transportation Systems Coordinator, South Dakota DOT

Barbara T. Harder (Report Facilitator), Principal, B. T. Harder, Inc.

Joyce Curtis, Director of Field Services–North, FHWA

Monique R. Evans, Administrator, Office of R&D, Ohio DOT

Christopher W. Jenks, Director, Cooperative Research Programs, TRB

Laurie McGinnis, Associate Director, Center for Transportation Studies, University of Minnesota

Harold R. "Skip" Paul, Director, Louisiana Transportation Research Center, Louisiana Department of Transportation and Development

Glenn Roberts, Chief of Research, Bureau of Materials and Research, New Hampshire DOT

Eric Wingfield, Knowledge Specialist, Information Technology: Strategy and Organizational Development, Ford Motor Company

J. B. "Butch" Wlaschin, Director, Office of Asset Management, FHWA

Chapter 2: Key Findings

One of the most important aspects of the scan team's experience is that we learned what we in the U.S. could do better, and we learned what we should do together globally.

—Debra Elston, Scan Team Cochair

During the early days of the scan, the team approached gathering its findings in a segmented manner—looking at the important information discussed and exchanged organized by country and then by each of the primary themes. As the scan progressed, the significant aspects of the thematic areas emerged, forming a body of information for consideration of its applicability to U.S. research program administrative policies and practices. This chapter discusses the key findings of the team organized by the four primary themes of interest.

Establishing the Research Framework

The transport research agenda is closely related to visions of society development, global competitiveness, citizen and company needs, [and] political government programs.[2]

—Matti Roine, Chief Research Scientist, VTT

Areas of interest within the research framework theme span subthemes such as identification and scope of the research frameworks, addressing consensus, and elements of program portfolios. Issues dealing with national policy and direction as well economic position were also important topics of consideration.

Transportation research is directly related to national economic growth and competitiveness. In every country visited, the prevalent belief was that "if you aren't doing transportation R&D, then you won't be globally competitive." The international counterparts appreciated their R&D activities in the context of the entire world. Their perspective on transportation research differed greatly from the U.S. public sector model; the host countries saw research as an essential piece of their efforts to maintain or create a more robust national economy. Individually as well as collectively through the European Union, European countries clearly saw a role for transportation and infrastructure research activities as a major avenue to achieve a higher global competitive stance. They viewed the outcome of research as an economic stimulus to start new businesses and increase economic growth.

For example, the European Research Area (ERA), a European Commission program, is using knowledge as its basic building block to achieve leadership for Europe (figure 1). This knowledge-based society is created through a strong triangle of research, education, and innovation. These three aspects of science and technology produce sustainable growth and employment. Transportation research is an integral part of ERA and is continually associated with the opportunities and vision for producing economic advantage for Europe.[3]

South Korea and Japan, while expressing the economic competitive stance in different terms (such as "for societal good"), were well aware of the powerful relationship between research outcomes and creating economic value. In fact, creating value and quality of life enhancements in

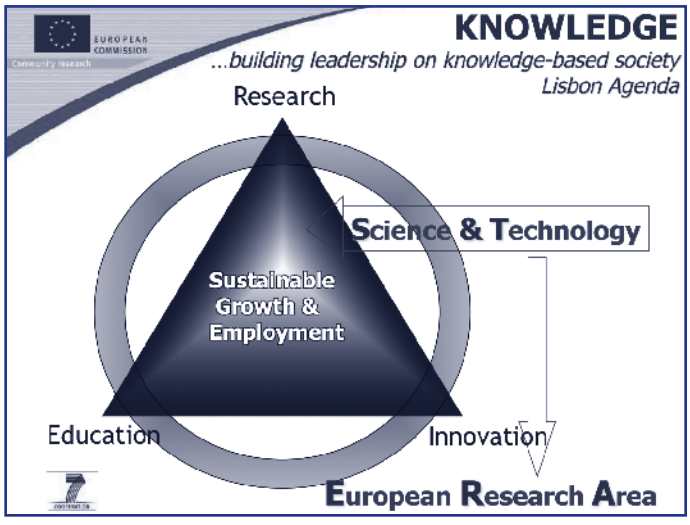

Figure 1. *European Commission research is integral to economic growth, creating knowledge-based leadership.*

both countries was a commonly expressed goal of transportation research. The vision for KICTEP's long-term plan is "contributing to the enhancement of the quality of life in the future society." In figure 3, societal benefit is a core value expressed in terms of sustainable growth, more high-value-added industries, and creation of future growth engines. Similarly, long-term strategic objectives of the KICT include building a safe social infrastructure and using land and resources efficiently.[4]

Moreover, every country visited had recent legislation for research and technology efforts, which addressed more clearly the issue of transportation R&D value and its direct relationship to economic advantage. Certainly, the concept of transportation R&D as a lever to create value for the economy was a dominant concern.

Strategic and policy-driven frameworks for transportation research are the standard. The scan team found that in the countries it visited transportation research frameworks are developed nationally through a strategic process closely tied to national policy goals and objectives. These research frameworks include broad societal issues, and transportation is a primary focus area integrated with other topics to address national concerns. In nearly every country, the effort committed to preparing and using a national research framework was notable. In conjunction with the national perspective, a number of countries, especially in Europe, have well-defined mechanisms to incorporate the country's operational and user needs into the framework.

Figure 2. *The Netherlands DVS integrated Strategy, Knowledge, and Innovation Agenda.*

Comprehensive planning and identification of a European research agenda by the European Commission benefits Sweden, which incorporates and uses as a guide the ERA agenda for determining where it will direct its research resources. The Swedish Road Administration cites three basic principles that link its work to the European research framework[5]:

- European countries share a common view on how roads and road transportation should be developed.
- The problems and challenges Europe confronts are so complex that no player is capable of solving them alone.
- Because the problems and challenges are not unique to Sweden, neither are the solutions.

Particularly exemplary are the activities the Rijkswaterstaat Transport and Navigation Department (DVS) in the Netherlands performs. DVS uses an integrated Strategy, Knowledge, and Innovation Agenda (SKIA), which is used throughout the Dutch Ministry of Transport, Public Works, and Water Management. (See figure 2.) "Given the close connection between knowledge and innovation, and the importance of both for policy, implementation, and supervision, both knowledge and innovation [are] incorporated into one agenda." Both knowledge and innovation are required to "realize the future societal challenges against acceptable costs . . . action is required now in order to be prepared for the future. Therefore: start 'thinking for tomorrow' today."[6] The process for defining a research framework at DVS involves a top-down approach fused with strong bottom-up input. Corporate considerations linked to policy outcomes are incorporated with regional experiences and linked to daily operations. Workshops with a broad reach in the organization are conducted to facilitate the identification of research program portfolios and topics of importance to the field organizations.

Other countries' framework development models included multitiered strategic planning activities. France develops a medium-term plan that includes its strategic priorities for a 4-year period. The example provided to the scan team included five thematic priorities (each having a corresponding research program) in the medium-term plan, each priority having about 10 research areas and each area having three

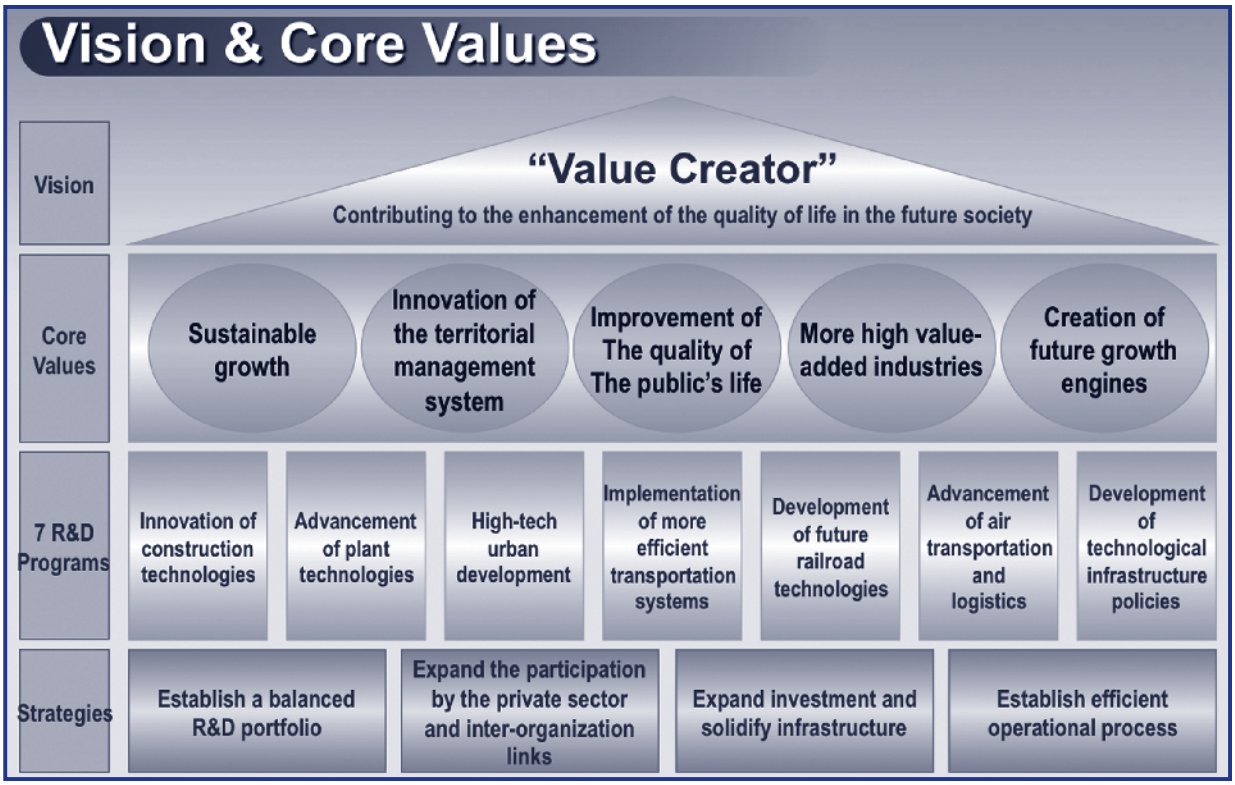

Figure 3. *KICTEP research framework development: long-term plan (innovation roadmap) creating value.*

to four topics yielding 150 to 200 research problems. Top-down strategic orientation is used to accomplish this planning process, but bottom-up origination proposals are received for describing and conducting the research.

The example of a model transportation research framework shown at the KICTEP was a process established through formalized strategic planning. There were some similarities to the French system, such as meshing top-down guidance for long-term strategic direction with bottom-up response for midterm project identification. For KICTEP, planning processes were very well defined.[7] KICTEP's strategic approach includes a long-term planning process (innovation roadmap) leading to its "value creator" vision, as shown in figure 3. The ultimate vision is to seek enhancement of the societal good. To reach this vision, core values are integral. They include comprehensive areas that address providing sustainable, economic, and quality benefits; management excellence; and a focus on future growth. KICTEP uses seven R&D programs to achieve its value contribution. Programs focus on topics such as innovation of construction technologies, implementation of more efficient transportation systems, and development of technological infrastructure policies. These programs are developed by incorporating strategic needs and including continuity with existing projects, ministerial cooperation, technology trends, and private and public sector demands. Furthermore, strategies that allow accomplishment of these programs are establishment of a balanced R&D portfolio, expanded participation by stakeholders, expanded investment in infrastructure, and efficiencies in operation. Elements of this long-term planning process are familiar to U.S. transportation research managers. However, a key to the success of the KICTEP model is the level of commitment to developing a process, assuring that the process serves the organization well and that the process provides integration with the national strategic framework.

The long-term plan or innovation roadmap is one part of the planning process that enables KICTEP to contribute to the national strategic framework. KICTEP assesses the national R&D policy against its construction and transportation R&D policy every 5 years. For its program response, KICTEP develops a long-term plan every 10 years (with periodic assessments during the 10-year timeframe). A midterm plan is developed every 5 years, and action plans and project plans are developed annually. The process is detailed and comprehensive and allows the organization to contribute effectively to national priorities.

Exemplary research frameworks are accompanied by well-defined processes to create comprehensive transportation research roadmaps. The Netherlands and South Korea are excellent examples of how expertise in developing research frameworks affects downstream processes, such as fostering comprehensive roadmaps for determining effective research programs. To show the widespread application of this finding, however, another example from Japan is useful. The Japanese MLIT uses a highly developed process to determine its research framework and projects for research. The outcome of the process is the MLIT Technology Basic Plan (currently for 2008–2012).[8]

MLIT's Technology Basic Plan uses as guidance the Japanese Cabinet-adopted "Long-Term Strategy Guideline," which provides the following society-wide objectives:

- Society in which everyone can stay healthy throughout life
- Safe and secure society
- Society that embraces diversity in life
- Society that contributes to solving global issues
- Society that is open to the world
- A roadmap for technology innovation that promotes strategic R&D and accelerates the transfer of results to society

Further input to the Technology Basic Plan is provided through an Innovation Promotion Outline, also adopted at the national level. Items in the outline that address infrastructure include the following:

- Geographic and spatial information infrastructure
- Infrastructure for connecting people, goods, vehicles, and places with information
- Enhancement of the efficiency of infrastructure development and management and productivity improvement

The Technology Basic Plan is a component of the country's Science and Technology Basic Plan—the national research framework.

The Technology Basic Plan is developed by technology working groups of councils established through law. These working groups seek input by analyzing prior plans and activities; surveying regional organizations, research institutions, private sector organizations, and industry groups; and conducting management of technology and R&D workshops that incorporate perspectives of academic experts and other private sector participants. The output of the working groups is consistent with other government plans, such as those provided for infrastructure development. As with other plans, the Technology Basic Plan receives public comment.

The current Technology Basic Plan identifies eight problems requiring urgent attention:

- Frequent natural disasters
- Traffic accidents and global terrorism
- Rapidly aging infrastructure
- Aging population
- Intensifying international competition
- Possible depletion of resources and energy
- Effects of ecosystem disturbances
- Ongoing global warming

Using these identified problems and societal aims, officials develop R&D priorities that give R&D results back to society, establish a common foundation for innovation, and provide international contribution. The plan continues to detail measures to assure these three priorities are achieved. Additional information about the plan is in this section under the Conduct of Research theme.

All of the research projects that we undertake concern policy issues relevant to actual societal needs.[9]

—Professor Dr. Shigeru Morichi, President, Institute for Transport Policy Studies

The countries had an ability to align the transportation research framework with a common vision. In addition to a clear and purposeful approach to establishing strategic frameworks, the countries demonstrated a notable focus on communicating the frameworks to stakeholders, including the public. For European countries, the strategic framework developed for transportation research at the EU level was fully understood and incorporated as part of the vision and mission for the individual EU countries visited.[10] In Sweden the scan team heard that "there is a common view shared in Europe on how European roads and road transport should be developed, [and] Sweden has adopted the European way ahead for the renewal of roads and road transport."[11]

For KICTEP, the common vision of the national research framework extends deeply into the program portfolio and

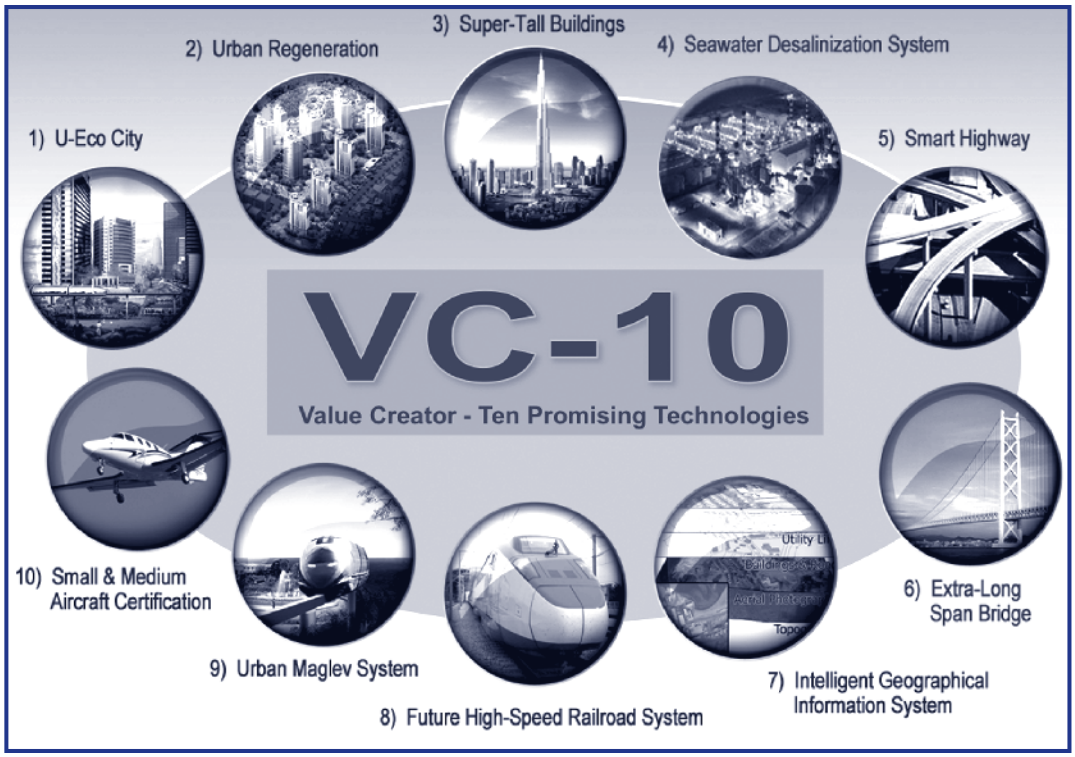

Figure 4. *KICTEP developed 10 promising technologies aligned with common vision.*

project definition aspects of its research planning process (see figure 4). Twenty strategic projects are identified that lead to the development of 10 promising technologies. The process through which these projects and technologies are identified reaches broadly throughout the transportation community, including expert workshops and government council participation. The 10 promising technologies focus on creating value to enhance of the quality of life in the future society.

South Korea and Japan have a unique cultural emphasis on the coordinated society, which helps communicate the framework to support a common vision for research activities.[12] Japan places a great deal of emphasis on responsibility to society, trust, and regard of traditions, which may make it easier to create and accomplish research based on common vision. The Public Research Institute of Japan (PRWI) articulates its research philosophy as follows:

- Research that is responsible to the society of 100 years later
- Research that is evaluated by academic societies and trusted by regional communities
- Research that is rich in enterprising spirit while regarding traditions

All of the host countries give a great deal of attention to assuring the vision is communicated well and owned by all stakeholders. They do it through effective planning and extensive incorporation of industry and academia in building the common vision and accomplishing the research activities. The main drivers are societal rather than industrial goals, using transportation to improve the quality of life.

The issue of common vision also is evident in the way the various modes and elements of the transportation industry are brought together to perform R&D efforts. In the European host countries (France, for example) the vision for transportation research was to solve larger issues—such as reinventing the city, climate change, or creating knowledge for economic advancement—thus bringing autos, trucks, roads, safety, environment, technology, private sector, quasi-public and public sectors, academia, and other areas together to work on the problems at hand. In the Seventh Framework Program (FP7), the European Union's comprehensive research initiative for reaching growth, competitiveness, and employment goals, the research subtheme on sustainable surface transportation includes activities that address environmental concerns, congestion and mobility, safety, and the economy (see box on next page).

EU Seventh Framework Program Research Activities Subtheme: *Sustainable Surface Transport*

- Greening surface transport
- Encouraging modal shift and decongesting transport corridors
- Ensuring sustainable urban mobility
- Improving safety and security
- Strengthening competitiveness

Senior-level individuals frequently emerge as visionaries or champions and play an instrumental role in national program focus and support. In a number of the entities and host countries visited, such as the European Union and Japan, senior experts who have earned a respected place in the transportation community are often regarded as highly credible opinion leaders on a national level. These influential individuals are likely directors of R&D institutes, provide counsel to government and joint research activities through personal contact and various organizations, and possess extensive networks through which they operate. Because of their positions, expertise, and contact with a wide network, these senior-level people also serve as champions for unique research issues, advancing research in a way that attracts financial resources, technical expertise, and political influence. The noteworthy aspect of these individuals is their access to national policy formulation and decisionimaking. The scan team observed that the accurate and expert transportation R&D knowledge these champions provide to national leaders is a key factor in a country's support of the necessity for and value of R&D efforts.

One of the best examples is the role, accomplishments, and valuable contribution made by the president of ITPS in Japan. This highly respected professional works within a broad network that includes academia, government councils, semipublic organizations (foundations), private sector entities, and transportation and policy institutes. His knowledge of the transportation arena is often sought by national policy figures. His expertise and support from the institute and others provide Japan's leaders with reliable, high-quality information that enables them to make effective decisions.

National research frameworks had common topics in many of the host countries, and these frameworks are being addressed by cross-ministerial R&D activities.

It is understandable that many of the European countries had common topics for their national research framework. Considerable effort has been made by the European Union to reach consensus and communicate the common themes to the member countries. The host countries' national frameworks had a remarkable series of topics that were independent of country or location, yet were highly relevant to each country. Problems included in national frameworks tended to be global concerns as well as country concerns. Many issues articulated in Europe were also important to Japan and South Korea:

- Climate change
- Environmental considerations in transportation
- Aging population and mobility
- Workforce capacity
- Aging infrastructure
- Congestion management
- Safety and security

Not only were most of these framework topics brought up in individual country contexts, but solutions to these vitally important national issues were also being addressed by broad resources in the countries. National problems were being solved by incorporating extensive cross-ministerial bodies that include land, infrastructure, energy, environment, culture, and sports, for example. In some countries, the primary ministry that sponsored transportation research incorporated the wider perspective. In France, the LCPC is a state-owned institute under the authority of two ministries, including the Ministry for Ecology, Energy, Sustainable Development, and Spatial Planning. In Japan, the Ministry of Land, Infrastructure, Transport, and Tourism incorporates surface and air transportation as well as land use and other infrastructure topics.

The value of having cross-ministerial or cross-functional organizational structures perform transportation research is that they bring a greater body of resources to finding transportation solutions. Transportation problems include not only facilities and infrastructure, but also energy, ecology, mobility, and land use. The scan team found that many countries address national priorities in such a comprehensive manner.

It was evident that topics of concern in the international transportation research community are also of concern to U.S. researchers. The United States has many opportunities to initiate joint efforts to solve some of these pressing

problems. Furthermore, there are excellent examples of the use of multi- or cross-discipline sponsors and resources for transportation research activities for the United States to consider.

Partnership Models and Joint Research Activities

Understand, Trust, Commit (EU Success Factors)[13]

In the host countries, transportation research partnerships and joint research efforts are essential, ubiquitous, and actively promoted. The role and use of partnerships and the collaboration of multiple players are integral elements of the research activities in the various countries visited. For Europe, the effort of creating a single economic market is a catalyst for fostering joint research. The European FP7 research activities spawned a number of independently formed venues for collaboration, including ERTRAC and ECTRI. Furthermore, there is a strong sense of "we know we can't do all this separately," and organizations such as the FEHRL are actively promoting the attractiveness and effectiveness of stewardship and leveraging of resources for all research processes (program portfolio content to implementation and deployment).

Typical partnership concepts in use in Europe are as follows:

- EU research activities require multicountry participation (at least three).
- The European Union encourages third-country or E12 (newest EU members) participation in research, as well as the participation of countries outside the European Union.
- There is an emphasis on incorporating small- to medium-sized enterprises (SMEs) with a goal to foster the creation of new business opportunities.
- There is high respect for and use of academic expertise.
- In most European host countries and EU research programs, research grant money is distributed according to the size (e.g., large business or SME) and type (e.g., private sector, institute, academia) of partner (see figure 5.)
- The EU international collaboration platform recognizes each country's competitive stance. While each country is an EU member and can benefit by being part of a unified economic entity, it is also an individual economic entity with unique country priorities.
- The European Union views itself as a world partner.

Host countries' transportation R&D collaboration activities begin substantially further upstream than in the United States. Research programs in host countries incorporated academic and industry participation in research activities earlier in the research process than in the United States. In the host countries, collaboration flows throughout the research process—from problem definition (which may include participation in establishing the research framework) through the conduct of the research and the delivery of research products. All programs reviewed had more integration among the various elements of the research process than in the United States. U.S. research activities tend to be divided into discrete elements (e.g., problem definition, researcher selection, conduct of research, technology transfer and implementation, and full deployment). U.S. research administrators are tempted to involve partners only in the later research processes, such as implementation activities or deployment. In the host countries, industry and academia were integral to the problem definition and worked in conjunction with research administration throughout the research effort, accruing numerous benefits to host country programs. For example, in some host countries, the early incorporation of academia provided added potential for the research to develop knowledge as well as provide resources to build workforce capacity for sustainable economies and global

Maximum reimbursement	RTD activities	Demonstration activities	Management of consortium/ other activities
Collaborative project	50 75	50	100
Coordination & support action			100
Network of excellence	50 75		100

non-profit public bodies

academic & research organizations

SMEs

security related research (in certain cases)

© ECTRI

Figure 5. *EU funding levels vary depending on type of R&D partner.*

competition. Likewise, the integration of industry early in the process confirmed that research is a factor in growing national income-generation opportunities. Host countries noted that academia provided knowledge creation and industry provided knowledge application. Encouraging these collaborative activities early in the research process enables a more robust result with a higher likelihood of producing benefits.

Research institutes are an important vehicle for exercising transportation partnerships and collaboration. Without exception, each host country had some form of research institute that is a primary vehicle to either fund and financially manage or foster, house, and accomplish collaborative research efforts. The formation and structure of the research institutes varied from country to country, but each brought together government, quasi-government organizations, foundations, government-funded independent organizations, academia, and industry to more effectively respond to the national strategic framework than each organization could on its own. Institutes often were the venues bringing together the responsibilities for knowledge creation, knowledge management, and knowledge application aspects of R&D. In a number of instances, R&D collaboration is written into law, facilitating industry, university, and government collaboration. The United States does not have comparable unique entities to facilitate collaborative research on this level. Some U.S. structures can accomplish portions of the roles of these institutes, but integration of the various responsibilities in one institutional structure is clearly a non-U.S. model.

An example of the use of institutes is LCPC, which facilitates partnerships with the French National Research Agency, universities, and industry for precompetitive research (research on topics that are not product specific or that have no identified industrial application or capability for commercial exploitation), for research calls by the EU framework program, and for work with FEHRL and other European technology platforms such as ERTRAC (private sector). LCPC promotes research pools of expertise to address research topics, executes memoranda of understanding (MOUs) to accomplish research domestically and internationally, and promotes activities of the Centers for Competitive Capacity, a multipartner R&D effort.

The French commitment to research partnerships extends also to a premier institute structure, the Carnot Institute network. This network includes 13,000 researchers at 33 member institutes, such as the INRETS, located throughout France. The “Carnot” label connotes research partnerships to foster innovation and competitiveness for major economic and social challenges. The Carnot Institute network competencies address seven major themes, one of which is environment, energy, propulsion (including transport), and chemistry. The institute structure is one of the largest European research and technology organization collaborations. The Carnot Institute network and the institute structures in Sweden, Japan, and South Korea, for example, clearly demonstrate the value placed by host countries on this organizational arrangement to accomplish effective transportation R&D.

An important role for research institutes was fostering coordination of research activities and programs. Frequently, the institute structure allowed experts on a topic to come together and provided a forum to advance research efforts, more effectively use resources, and prevent duplication of effort. In addition, research institutes often incorporated private sector organizations that were essential to the research problem design and research conduct and well positioned to put the research results into practice. The Safer Vehicle and Traffic Safety Center in Chalmers, Sweden, is a consortium institution with 22 partners, including the Swedish Road Administration, the University of Gothenburg, vehicle manufacturers, transportation institutes, and other private sector technology organizations. Safer is a joint research unit with a physical location, staff resources, and equipment, but it is not an entity of any of the member organizations. Funding sources are one-third government, one-third university, and one-third private sector. Partners provided a 10-year commitment—2006–2016—to accomplish research.

Institute structures like Safer also focus on innovation. The structural organization of an institute is designed by an agreement that is workable for all parties. Often such flexibility in structure allows greater diversity of partners and provides for a greater level of expertise and resources to solve difficult problems. With commitments for funding stability and long-term research efforts, institutes often were formed to produce innovation or leaps in technology rather than small, incremental steps that may come from isolated research project efforts.

Another example of the usefulness of institutes is the KICT experience with exchange agreements with 37 organizations, including the Republic of Korea Air Force, the Korea

Institute of Industrial Technology, and the Incheon Free Economic Zone. The institute makes its resources available, including opening its laboratories to construction specialists and students, as part of its role as a learning center that combines classroom theory with field-based research.(14)

An example of the central role of institutes in accomplishing research is illustrated in figure 6 from MLIT in Japan.(15) A similar model was used in myriad contexts at host organizations. Each of the three partners of the institute has specific roles and responsibilities. In the MLIT model, universities bring unbiased thought and research capacity, can develop future workforce skills, and are vehicles to promote cooperation; private sector members bring the perspective of economic advantage to the research efforts; and government at various levels sets direction and policy, assists in research results implementation, and provides a link to other necessary government entities. Independent research institutes take the responsibilities of the partners and add their capabilities to conduct research; promote cooperation among the government, industry, and academic partners; and provide an essential third-party perspective for evaluation.

Academic partners are integral to transportation research performance. In every host country, academic partners in transportation R&D had a more integral and integrated role in research activities than seen in comparable U.S. research efforts. In Europe, academics were always incorporated into an innovation group that also could include industry, government, and policy players, whether the structural organization was a research institute or other form of research partnership. The situation was similar in the Japanese research institutes model. Furthermore, the contribution of academic partners in generating and transferring knowledge was seen as a significantly more important outcome of transportation research partnerships than experienced in U.S. public sector transportation research efforts. Figure 7 (see next page) is an illustration from the Technical University of Madrid, an ECTRI member, showing the role of the academic partner in R&D, particularly in interacting with the industrial sector.(16) This university is also a

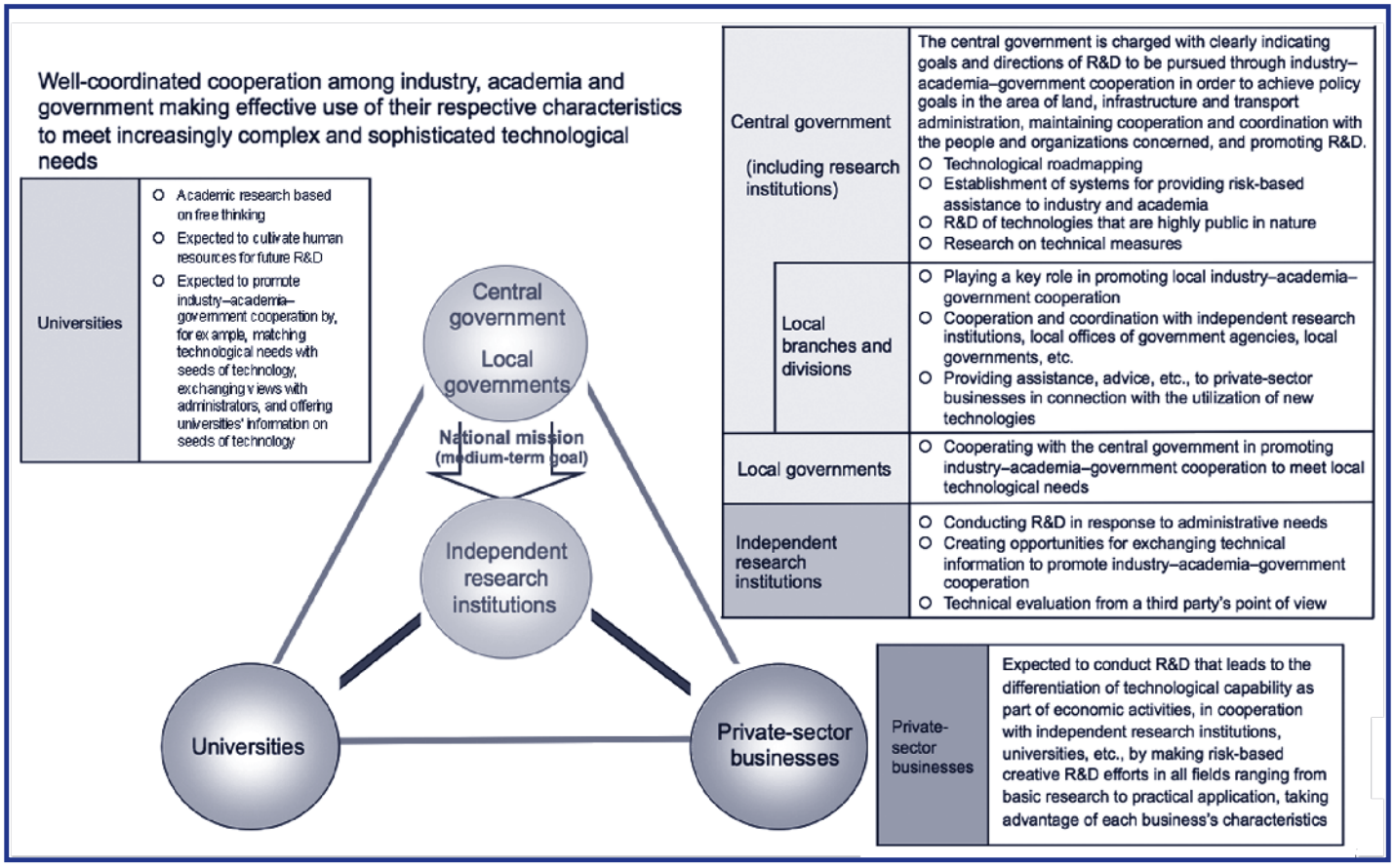

Figure 6. *Institute model: industry-academia-government relationship in R&D at MLIT in Japan.*

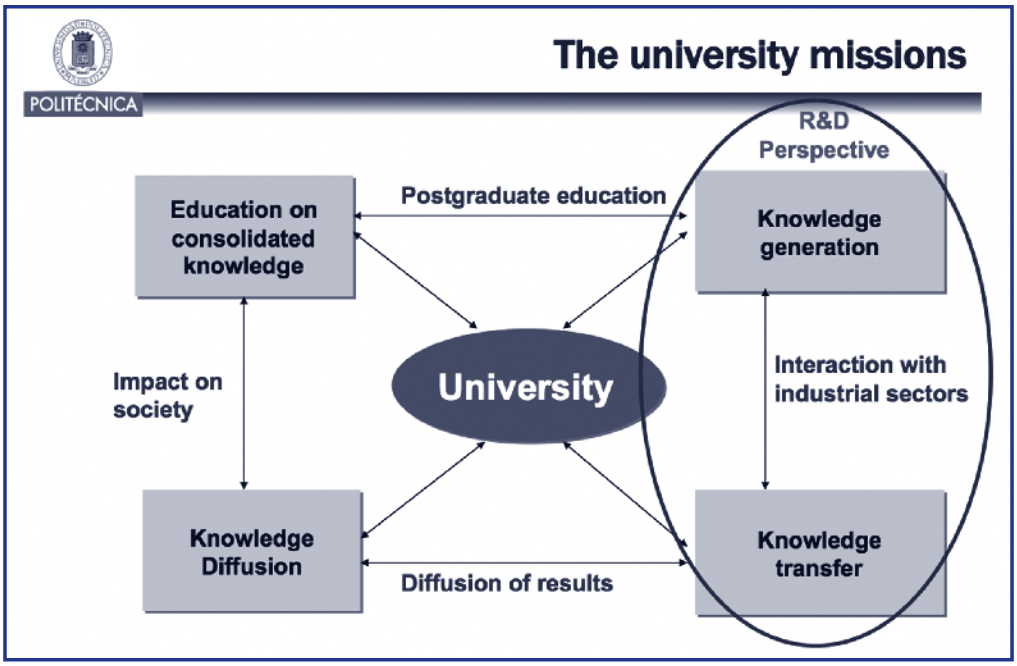

Figure 7. *Technical University of Madrid academic role in R&D.*

participant in EU FP7 activities, which may fund some of the research this figure models. Note the university mission is related to knowledge. Knowledge is developed through R&D and transferred to users for economic advantage. Knowledge is used to build greater knowledge and impact society.

When officials discussed academic expertise during the scan meetings, they mentioned the multiple benefits the academic sector brought to the research effort. Academic partners participated in determining research framework priorities, created knowledge through R&D, provided unbiased third-party assessment and evaluation, helped create the future workforce, and provided advantage for the economy.

International research partnership models in transportation are similar to models used in the United States. The scan team found similarities in the models for partnerships used by its international counterparts. In fact, it was encouraging to see the operation of partnership models in the various international contexts because these similarities showed potential for future partnership and collaborative activities for U.S.-international research efforts. While some aspects of international partnerships were familiar, others provided learning opportunities for the team.

VINNOVA, the Swedish Governmental Agency for Innovation Systems, exhibits a center of excellence model for accomplishing collaborative research.[17] The VINN Centers of Excellence provide a forum for collaboration among the private and public sectors, universities and colleges, research institutes, and other organizations that conduct research. The centers deal with both basic and applied research and work to ensure that new knowledge and technological developments lead to new products, processes, and services. The following are major characteristics of the centers:

- Provide multidisciplinary, international research leadership.
- Create new collaborations among the public sector, business, universities, and other research organizations.
- Contain a market-driven focus.
- Accomplish research programs that are designed, carried out, and funded jointly by the participants.
- Include a geographic focus and use a university or college with a strong research and innovation environment as the organizational center.
- Feature management by a director and board of directors.
- Include long-term partnerships with extensive periodic evaluations.

Many of these characteristics are familiar to U.S. transportation research administrators. However, a few items, such as a focus on international research leadership and

long-term sustainability, may be areas for further investigation for application to U.S. programs.

Four collaboration models identified by the European Research Area Network for Roads (ERA-NET Roads)[18] are another example of successful partnerships. These models address the lowest to highest levels of cooperation:

- The **Common Program** is the lowest level of cooperation:
  - Participants agree to align their national program in a common program.
  - The themes, time schedules, and dissemination are aligned.
  - Projects undertaken in the national program remain national (e.g., funding, procurement, and publishing).
- The **Common Project** involves more cooperation:
  - The national research agencies (NRA) have national programs with common objectives and agree on a common project.
  - Research on a common project is divided into subprojects that contribute to the final goal.
  - Each NRA is responsible for one subproject, including funding and procurement.
  - One subproject includes the lead of the common project to align the results, timing, and final common report.
- The **Common Obligation** (program or project) is also called the "virtual common pot":
  - The NRAs agree on a theme for a common program or project.
  - A project executive board made up of the participating NRAs develops an agreement on all aspects of the study and cooperation.
  - One NRA takes the lead in project governance and procurement.
  - All NRAs make a budget reservation. At the end of the (approved) project or project phase the NRAs pay their share to the lead NRA; they pay on demand.
  - The results of the study are available to all participating NRAs.
- The real **Common Pot** is the highest level of cooperation:
  - The NRAs also agree on a common program or project, a common budget, and on a project or program leader.
  - In contrast to the Common Obligation Model, the whole budget is transferred in advance to the leading NRA.
  - Involved NRAs have equal ownership of the results.

Elements of these models are found in various U.S. R&D activities, but aspects of framework creation, work sharing, and financing continue to present challenges to some. Further investigation of international programs' partnership practices will be beneficial to U.S. transportation research programs.

A typical model of research partnerships found during the scan is Hungary's transport R&D model, shown in figure 8. Like others, the roles of government, industry, and academia are essential. In this model, industry, municipalities, the national office for research and innovation, and international research programs all interface with those performing research, KTI, the Institute of Transport Sciences, universities, consulting organizations, and SMEs in the R&D field. The performance of research focuses on a two-faceted center, transportation policy and R&D policy.

Similarities in partnership models also extended to the types of partners. In many countries, strong partnerships exist with automotive manufacturers. For Sweden, the automotive industry is the top exporter, and in keeping with its focus on maintaining economic competitiveness Sweden has a model partnership program—the Swedish

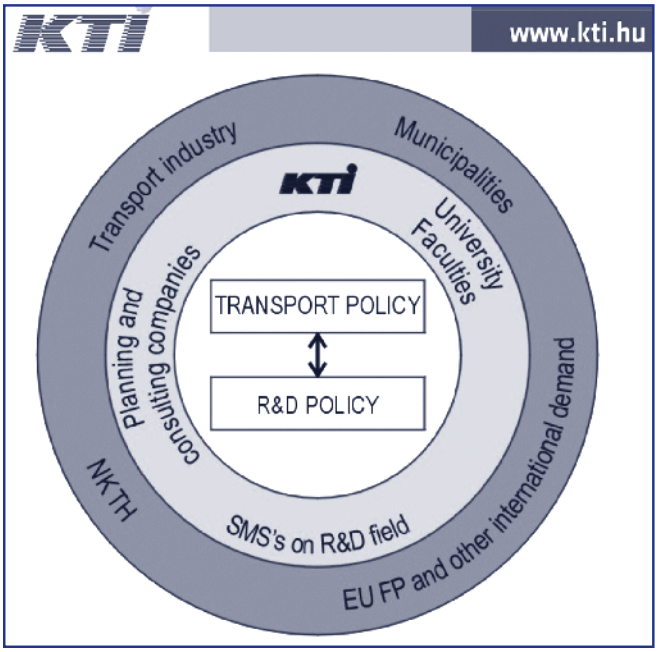

Figure 8. *Transport R&D model in Hungary.*

Automotive Research Program.[19] This program subscribes to the Swedish goal of "Vision Zero" for road fatalities and strictly adheres to European emissions standards. The partnership includes truck manufacturers (Volvo and Scania) as well as premium auto manufacturers (Volvo and SAAB). The research partnership's annual budget is $200 million, a substantial growth since its 1994 inception. The program's administrative organization includes an independent state-appointed chair, the secretariat at VINNOVA, and a cooperative agreement among government agencies and industry. Similar to other research initiatives in Sweden, the program negotiates long-term agreements between government and industry; ensures strong industry involvement for framework development, creating research agendas, and project selection; operates with a small central staff; and fosters continual improvement through program evaluations.

Like Sweden, many countries have active collaborative arrangements with the automotive industry for initiatives in intelligent transportation systems (ITS) and other precompetitive automotive research efforts, such as Japan's government partnership activities with Mitsubishi.

USA partners are very rare up to now; American participation in [European Union] Framework Programs would be very useful.

—Andres Monzon, ECTRI

Conduct of Research: Performance, Quality, and Value

DVS wants to be a leading expert, a smart buyer, and knowledge chain director.[20]

—Rudd Smit, Center for Transport and Navigation, DVS

Transportation R&D is accepted as a valuable contribution to the national or societal good. Transportation research programs and their outcomes are seen in the host countries as an important contribution to society. In fact, R&D activities are directly associated with value creation. That value may be the vision KICTEP expresses in "contributing to the enhancement of the quality of life in the future society" (figure 3), or the French research program focus on megacities and the comfort, quality, and safety of urban areas.[21] Transportation R&D is considered an economic growth generator and an essential element in global competitiveness, both in the context of large established business opportunities and the creation of startup businesses based on innovative research results. Research is also a major contributor to environmental sustainability, a critical issue on the global stage and in every host country the scan team visited. In discussions throughout the scan, transportation R&D was continually credited with providing positive impact.

Because transportation research activities were accepted as a means to achieve value, the programs reviewed did not have to continually justify expenditures, as do most U.S. research programs. In fact, the acceptance of the value of research in the host countries promotes strong research programs, which in turn develops greater value—a virtuous cycle. For example, academic partners, in particular, focus on knowledge creation and understand the contribution this makes to producing societal and economic value. Value is received through research programs that are closely aligned with priority frameworks that address essential problems for the country and society. Value is also an outcome of research collaboration, which provides for more efficient use of resources by using the unique contribution of each member of a partnership. Furthermore, the value of research is considered in the broad context of the quality of life in which benefits from transportation R&D translate into, for example, healthier and safer citizens, a cleaner environment, and sustainable economies.

International counterparts are funding transportation R&D at significantly high levels. Substantial program funding is committed to transportation research in the host countries, and in Europe the EU FP7 adds another large funding source. For the most part the transportation research programs of the host countries are more integrated into broad research arenas such as model city, urban regeneration, or impact of climate change than in the United States. Funding for transportation research in the United States is often directly linked to the specific modal area and is not integrated with larger society or economic goals. Therefore, comparisons between funding levels for transportation R&D in the United States and international programs are not easy. What can be noted, however, is the high level of funding by international programs, funding that is generally increasing to match the interest in achieving environmental and economic sustain-

ability and global competitiveness (e.g., KOTI reported a 60 percent budget increase over the last 3 years).

The following are representative budget figures included in scan meeting presentations:

- The 2008–2012 budget for PREDIT, the French national platform for research and experimentation and innovation support, is €360 million (US$560 million).
- The annual budget for infrastructure research in the Netherlands is €150 million (US$235 million).
- The KICTEP budget for transportation and construction R&D for 2008 is $339 million.

An example of the funds being committed to transportation research is shown in figure 9. This figure highlights the European Union's Seventh Framework Program (2007–2013) transportation R&D budget as a portion of the full research activities: €4.1 billion (US$6.4 billion), or 12.8 percent. The budget includes surface and air transportation R&D activities.

Program and project evaluation techniques varied in complexity and effectiveness. For the most part, every research program included some process for evaluating the results of the conduct of research. Some programs were more successful than others, and some programs were more risk adverse than others, requiring extensive review to redirect work.

VINNOVA and KICTEP provide two examples of well-proven evaluation processes. VINNOVA conducts evaluations at a variety of stages during the research project: a preproject assessment, an evaluation during the conduct of the research (performance monitoring), an assessment at the midterm or at the completion of the research performance, and an impact analysis after implementation.[22] Its "ambitions and work [are] to understand and to increase the impact from efforts in research, innovation and sustainable growth in Sweden."[23] Evaluation of impact is accomplished at four stages during and after the conduct of research, including an impact logic assessment on the proposed research, progress monitoring during the course of the research, an evaluation of the

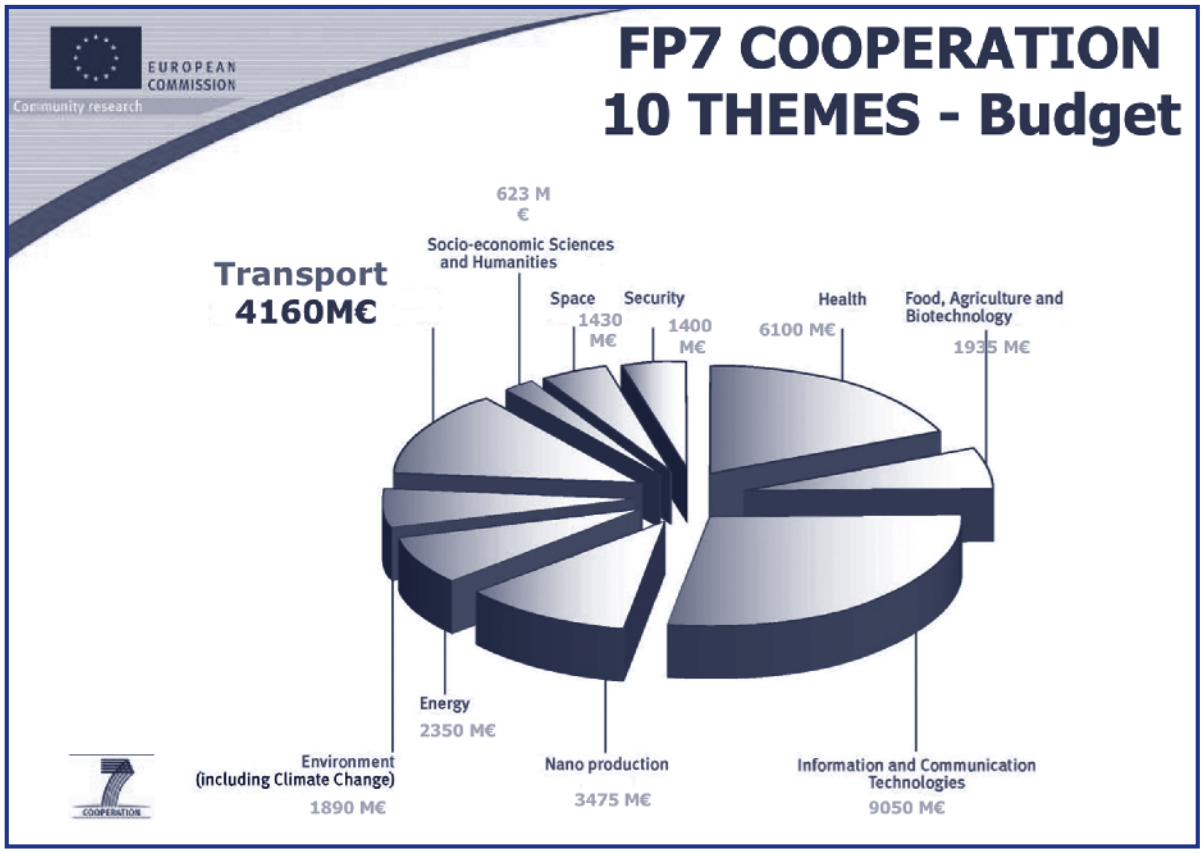

Figure 9. *EU FP7 transport R&D funding.*

research performed, and an impact analysis of the research results in context with other programs and research efforts. Since 2002, VINNOVA has conducted five impact analysis studies that showed a wider and deeper understanding of the R&D studies conducted, demonstrated the use of research results by industry and the public, and provided useful material for policy decision-making, such as the design of the VINN Excellence Center program in 2005.[24] (See figure 10.)

A similar example is shown in the KICTEP model for project management.[25] Project evaluation is an important aspect of the conduct of research. In figure 11 (see next page), KICTEP's concept of whole-cycle project management includes planning and developing performance objectives and evaluation indices, and managing and evaluating the project by these elements. Project scope and budgets are adjusted according to evaluation feedback and after-performance management evaluation tracking. Tracking of implementation results are included as critical to the overall whole-cycle management process.

Additional material provided by KICTEP also shows how integrated evaluation is to the business of research at this organization. The KICTEP evaluation process includes award review, research progress monitoring, interim evaluation, and final evaluation. A unique feature of the KICTEP performance management system is the tracking evaluation for research projects that have been completed for 2 years. The evaluation surveys the outcome application status (or determines the cause of implementation failure). It also analyzes successfully implemented projects, disseminates the successful methodology to other projects, gives incentives to outstanding researchers through awards of new projects for the next 2 years, and provides awards for outstanding researcher efforts.[26]

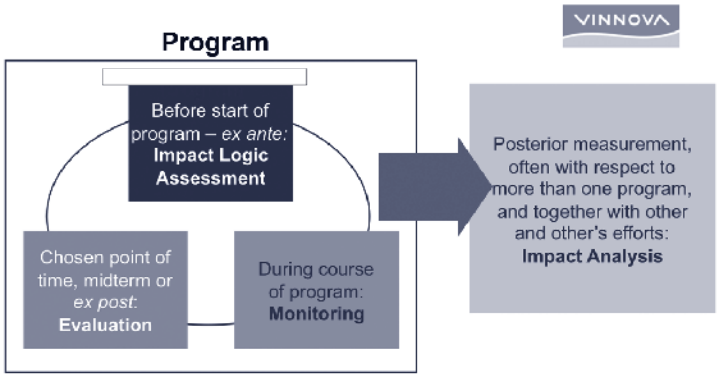

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Figure 10. *VINNOVA assessment, monitoring, evaluation, and impact analysis.*

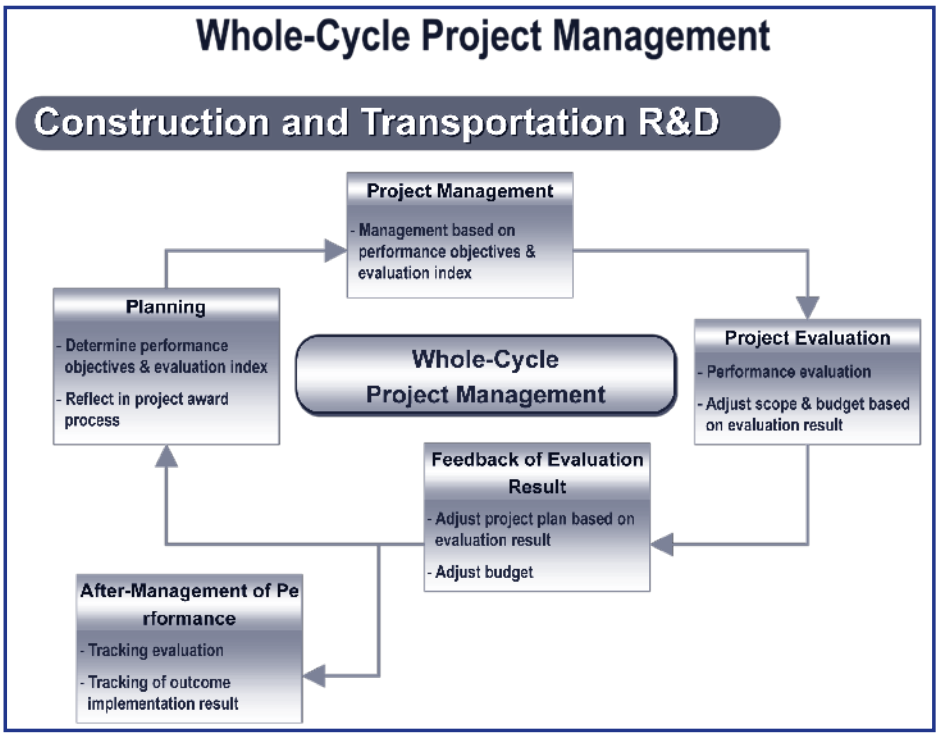

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Figure 11. *KICTEP whole-cycle project management process.*

Evaluation is also an important technique included in Japan's R&D activities. The scan team received the National Guidelines for Evaluating Government-Funded R&D (tentative version, March 29, 2005), produced by the Prime Minister of Japan. This document contains comprehensive descriptions of evaluation processes for R&D. The following are some of the major topics discussed in this document:

- Basic concepts and framework of R&D evaluation
  - Significance of evaluation
  - Responsibilities of evaluating organization, evaluators, and researchers
- Common principles in conducting evaluation

  - Evaluation objectives
  - Selection of evaluators
  - Evaluation methods
  - Use and handling of evaluation results
  - System administration and implementation improvement
- Evaluation of R&D measures, themes, organizations, and researcher performance

The implementation of such evaluation processes is of interest to U.S. research managers, and further interchanges among U.S. and Japanese counterparts could provide mutually beneficial best-practice sharing.

Quantifying the benefits of research results is a continuing challenge for all host countries. As in the United States, the host countries find quantifying benefits of research activities a challenge. The efforts committed to determining the benefits varied, and no country had a completely satisfactory solution. While the information from such benefit analysis is valuable to research programs, the focus on justifying programs based on such analyses was not a critical concern for any of the countries. In fact, the value of research is fully accepted. Cost-benefit analysis in Japan, for example, was not perceived as needed or considered part of the R&D assessment processes. Because the research funding structure is changing in Japan, with organizations such as PWRI moving toward a more competitive funding process, cost-benefit issues may become more important in the future. A number of the host countries considered the United States a leader in quantifying benefits for research results. Several expressed an interest in the United States sharing the research program performance measurement tools developed through NCHRP.[27]

A variety of successful techniques and processes are potential options for consideration in the United States. The following are some of the items the scan team noted:

- In Japan, success measures were determined by the project sponsor, and customer surveys were used to determine whether the research results worked as planned.
- Research institutes and academia play a significant role in determining the specific projects to research. They also provide a broad perspective on what research is needed to fulfill strategic frameworks.
- Host countries developed longer term plans with multiyear programs ranging from 3 to 5 years.
- LCPC in France supports 10 percent of the researcher's time for "blue-sky" research activities (topics selected at the researcher's discretion).
- In some countries, researchers had close contact with industry (e.g., education paid for by industry, research funding contributed by industry). This connection facilitates implementation of research results.
- Because of the government's close association via R&D collaboration with its partners—independent institutes and industry in particular—these partners are sufficiently informed to be effective advocates with legislative bodies. R&D collaborations are a means to incorporate technical expertise into the legislative process.
- All research, basic or applied, has an inherent level of risk for arriving at the anticipated results. In many of the host countries, these risks appeared to be well understood and usually tolerable, and failures were viewed as valuable learning opportunities.

Delivery: Getting Research Results Into Widespread Practice

It is not so complicated to invent a new measure, but it is difficult to get it delivered.

—Fred Wegman, Managing Director, SWOV

Addressing intellectual property rights (IPR) is a common practice that facilitates the delivery of transportation research results. Europe has a decidedly different perspective than the United States on the ownership of intellectual property generated from government-funded transportation research. IPR is addressed before the transportation research is initiated and included in the research partnership contract. In general in Europe, development is seen as an opportunity to build a business based on the specific IP, creating an economic engine for the country. There is no barrier to government-funded organizations seeking patents. In fact, for France's LCPC, the number of patents, along with the results of application, is a performance measure used to evaluate the program.

In conjunction with the intellectual property issue, an important element of Japan's MLIT Technology Basic Plan is dissemination of R&D results by tracking and facilitating

use and evaluating new technologies. The New Technology Information System includes a private sector intellectual property strategy, which fosters the introduction of new technologies into public works projects and promotes R&D in the private sector. Benefits of this process include better data for use in the evaluation information system; a more robust process for promoting use of research results, new technology, or innovation; increased speed in producing evaluation results, which speeds deployment; and strengthened cooperation and information sharing with local governments, which play a large role in dissemination and deployment activities. (See figure 12 on next page.)

Japan's PWRI also tracks and uses as an indication of "practicalization" (application to practice) of its research efforts the number of patents owned and applications for patents and registrations. Fees received through ownership of intellectual property help fund the dissemination of research results. This means the direct financial benefits of the intellectual property are invested in the application of new technologies and innovations.

One item that came up in discussions with European host countries is the need for the United States to "figure out its IP issues." In particular, U.S. methods for addressing IPR for surface transportation do not fit well within the European context. This issue can be a barrier to U.S.–European collaborative activities.

Development of common platforms among U.S. and international R&D organizations will facilitate research results delivery in all countries. The development of common platforms such as linked databases or common access portals for a variety of research processes will substantially reduce barriers for R&D collaboration, foster international partnerships, and promote more widespread use of research results. Topics such as the IPR issues, sharing of research expertise for peer review activities, and development of joint databases for information exchange are just a few of the areas that could benefit from common platforms among global R&D collaborators.

Information management is a prime area for developing common platforms. Sweden's VTI Library and Information Center is already establishing contacts with the TRB Library. Items for cooperation focus on incorporating research reports into the countries' respective information databases through the use of common platforms for information sharing.[28] (See figure 13.) This collaborative effort shows great potential as a model for others to

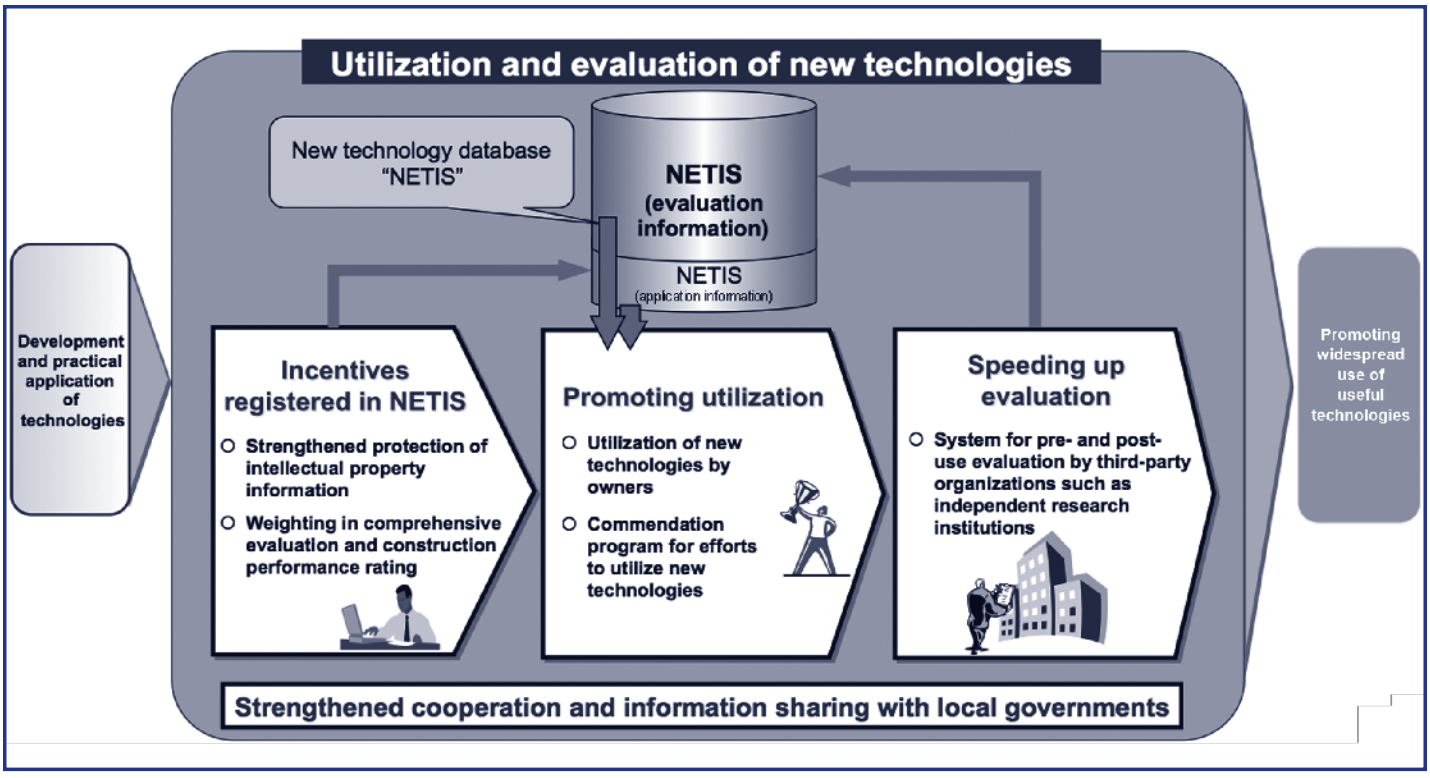

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Figure 12. *MLIT use and evaluation of new technologies.*

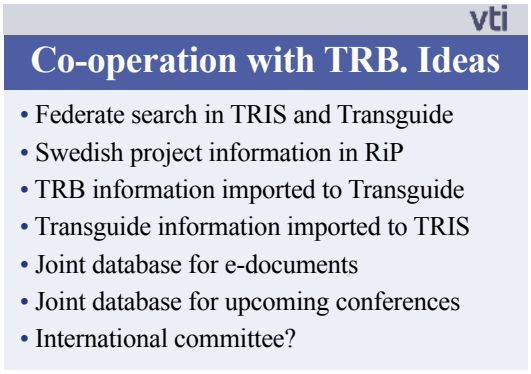

Figure 13. *VTI's ideas to create a common platform for innovation sharing.*

develop more tools and processes to aid in better communication and delivery of research results.

Another example of where common platforms and databases may be beneficial is the Community Research and Development Information Service (CORDIS). The CORDIS Web site for science, research, and development states that it is the official information source on EU FP7 calls for proposals. It offers interactive Web facilities that link researchers, policymakers, managers, and key players in the research field. Its mission is to facilitate participation in European research activities, enhance exploitation of research results with an emphasis on sectors crucial to Europe's competitiveness, and promote dissemination of knowledge fostering innovation for enterprises and the societal acceptance of new technology. Use of CORDIS is free of charge. It makes available to its users briefing material on European innovation and research activities and stakeholders, profiles of partners to facilitate collaboration, research results services, and document library services.[29] Additional investigation of the structure, organization, and use of such a model for U.S. research activities could be helpful for domestic and international collaborative R&D.

The number of forums for international sharing of research results is increasing. ECTRI and many of the host countries identified a variety of venues and forums that exist to increase the use of research results. There were a variety of contexts within industry and the scientific community, through strategic research initiatives and political bodies, in connection with unique research themes and organizations, and based on geographic location.[30] Figure 14 lists some of the forums for sharing new research results used in ECTRI. This list is just one example of the many MOUs, agreements, research

Figure 14. *ECTRI forums for sharing new research results internationally.*

collaborations, joint partnerships, and other vehicles that have allowed diverse international partners to share and benefit from valuable research results.

The scan team observed other examples of this type of activity in South Korea, where research institutes create forums for international sharing using workshops, showcases, and demonstration of research activities. KICT explained in one of its presentations that it had international agreements for exchange and cooperation with 24 organizations and conducted regular joint construction technology seminars with Japanese, Chinese, and Russian counterparts. International cooperation was also a focus for KOTI, which collaborates with a variety of institutes and international organizations, including the East-West Center at the Texas Transportation Institute; INRETS in France; organizations in China, Russia, and Taiwan; and international organizations such as the European Conference of Ministers of Transport and the Organization for Economic Cooperation and Development. International academic forums are additional venues that focus on technology transfer and educational opportunities that enhance the potential for increased implementation or delivery of research results.

During the course of the scan, the team also learned of existing collaborative venues of U.S. academic and

international research organizations. While these research consortia or joint efforts have been developed to create knowledge on specific topics, the associated function of disseminating research results is also a mission of the joint efforts. Most of these U.S.-international activities are only known among those directly associated with the activity or particularly informed about the research topic. Because of these and similar activities, models or networks are already established that could demonstrate methods to build capabilities and capacity for more effective dissemination of research results. More work needs to be done. Opportunities such as this scan and the implementation strategies developed from it can make a difference in the way researchers throughout the world communicate, collaborate, and benefit from the work of their international counterparts.

Chapter 3: Implementation

Scan Team Implementation Plan

The team identified a number of successful transportation research program administration practices in the host countries that can be applied in the United States. This chapter outlines the STIP, including a brief discussion of and implementation strategies for each item. The timeframe for implementing the STIP items ranges from the time the team returned to the United States through 2011 and beyond.

Findings and best practices obtained from the scan will be widely disseminated throughout the transportation research community through presentations, workshops, reports, articles, and Web-based activities and discussions. Some of the recommendations and implementation strategies can be implemented within the existing transportation research infrastructure. Others may require policy-level studies and international joint activities to realize the desired outcomes and benefits.

STIP Items

Item 1: Improving International Relationships

Build international relationships and institutionalize cooperation in transportation research to achieve global goals and leverage knowledge and resources.

Background

While the scan focus was research program administration, the team realized its presence in other countries would provide avenues for developing new research relationships and potential collaboration opportunities with international counterparts, particularly on global issues such as climate change and highway safety. All of the international host organizations expressed a desire for expanded collaborative research efforts with the United States. They also made repeated references to a need for better information sharing and global technology transfer of innovations. Several host countries, for example, expressed interest in the research program performance measures product developed through NCHRP.

Efforts are already underway to institutionalize cooperation in transportation research between the European community and the United States. An MOU signed in 2006 by TRB and its closest European counterpart, ECTRI, has facilitated improved communication and cooperative opportunities abroad and is a model for expanded efforts moving forward.

An MOU signed by TRB and KICTEP in spring 2008 is intended to facilitate information exchange between KICTEP and SHRP2, the second Strategic Highway Research Program. TRB leaders reported that considerable enthusiasm was expressed at the Transport Research Arena Europe 2008 meeting in Ljubljana, Slovenia, for more cooperation and collaboration, and a joint AASHTO–FHWA–TRB meeting was held in July 2008 to discuss institutionalizing such partnerships. The scan team's implementation activities should include monitoring and enhancing these ongoing efforts.

The scan team discovered that a number of other isolated partnerships exist between agencies, institutes, universities, and companies abroad and U.S. counterparts. Projects including researchers from the University of Minnesota, North Carolina State University, and the Texas Transportation Institute were cited. These efforts are not widely known in the U.S. transportation research community and more could be done to publicize such relationships.

Strategies

Scan team implementation will consist of the following:

- Develop engagement plans to manage collaboration efforts with international research organizations. As part of the effort, identify collaboration topics and appropriate international research organizations, establish knowledge of U.S. Department of State framework agreements, develop and document

collaboration work plans to implement actions, and establish a protocol and process to facilitate professional exchange.
- Host a tour of the FHWA Turner-Fairbank Highway Research Center for international researchers and research mangers in January 2009.
- Create a communications package to facilitate international relationships that includes a factsheet with key messages from the scan, a presentation featuring scanning study highlights and lessons learned, and summaries of the international agencies, commissions, institutes, and universities visited during the scan along with contact information. The summary should be readily expandable to eventually include countries not involved in the scan.
- Ask the TRB Conduct of Research Committee to add the names of those visited during the scan to their mailing and newsletter distribution lists. Invite scan team members and foreign hosts to write articles for the committee's newsletter. Assist in developing TRB Annual Meeting sessions related to the scan (e.g., framework development and evaluation) and provide seed funds for targeted presentations by international research administrators.
- Offer to help develop the agenda for the planned ECTRI scanning study of the United States. Share the FHWA–AASHTO process for developing international scanning studies. Advise and help convene groups, bring U.S. people together, and suggest people for visitors to meet.
- Help fit international researchers and administrators to TRB committees. Contact international hosts and inform TRB committee chairs. Identify TRB international membership opportunities. Embellish U.S. representation and involvement with TRB international committees.
- Recommend international collaboration as a theme at a future TRB annual meeting.

Item 2: Developing a Nationally Coordinated Transportation Research Framework

Promote the development and implementation of a nationally coordinated, multimodal transportation research framework.

Background

To remain globally competitive and continue to improve the quality of life for U.S. citizens, it is critical for the Nation to be an active player in the research community. There must be collaboration throughout the Nation to unleash the brilliance of its researchers and identify a national research framework that unites the various sectors of the country behind common research goals or themes.

With this in mind, the scan team believes that a policy study should be done to analyze the current process of many independently run research programs and evaluate the benefits of a nationally focused program in which more research dollars are spent on a few highly critical areas. The study would evaluate the strengths, weaknesses, opportunities, and threats that may evolve from a national program, compared to the value of the current system for determining research products. The policy study would include not just partners in the transportation community, but also bring in expertise from sectors such as the environmental and energy communities to see how transportation might better leverage research funds. As input to this study, a national forum could be conducted to bring together transportation stakeholders from government, academia, and industry to pursue a policy study that looks at the needs, benefits, barriers, and overall process in developing a national research framework.

If the results of the review point to a coordinated national program, the study would recommend a process to develop a coordinated national framework for U.S. transportation research. The framework must be collaborative and not directive, and allow for the continued delivery of research programs focused on more local or regional needs in addition to national needs.

The team observed several examples of effective platforms, including the European Union framework, Japanese MLIT Technology Basic Plan, and South Korean roadmaps. In addition, models such as that used by the National Institutes of Health would be productive benchmark candidates. The team believes that an effective forum to approach the framework development effort will be characterized by a fusion of top-down and bottom-up needs from all parts of the Nation impacted by transportation. Cross-pollination with other sectors will ensure that overall societal and economic goals are articulated and met. Thematic working groups (e.g., environment, energy, quality of life, and asset management) would allow key ideas and perspectives to be collected. Citizen involvement can be obtained through

periodic capture of public input. Finally, the framework-building cycle would include measurable goals, continuous assessment and renewal, and improvements based on the assessments.

Strategies

Implementation will consist of the following:

- Create a white paper that identifies the benefits of a nationally coordinated, multimodal transportation research framework. This would include such topics as the leveraging of resources (both people and dollars), reduced duplication of effort, and the ability to expand potential research topics. Using the white paper, conduct informal outreach to leaders in a broadly defined transportation community to determine their reception to the concept of a national research framework.
- Propose, advocate, and help staff a policy study to do the following:
  - Benchmark and evaluate research efforts, policies, and procedures for identifying and doing research in other sectors, such as pharmaceuticals and health care. Identify what works well and the basic framework of that research, and use it as a potential benchmark for future transportation research.
  - Host a symposium with attendees from a variety of sectors to discuss the pros and cons of a unified national research framework or, as a minimum, a transportation research framework.
  - Research the national framework development processes of the international transportation community, and the barriers and constraints that could limit successful implementation of a national transportation research framework.
  - Host a symposium with representatives from the various components affected by the transportation community. This will provide a multidisciplinary approach to transportation research and set a strategic framework.
  - Explore the concept of a national research organization that brings together the research community—Federal, State, and local governments; universities; foundations; institutes; and the private sector—to develop a transportation research framework that keeps America at the leading edge.

Item 3: Strengthening the Innovation Process

Strengthen the innovation process by examining international research institutes and other models of collaboration to link knowledge creation and knowledge application.

Background

In the United States, a gap frequently exists between the creation and application of knowledge. Sponsors of research, usually government agencies, often attempt to bridge that gap by requiring knowledge creators to identify a process or plan for pushing the knowledge toward application, but too often this is done without the involvement of or connection to industry. The result is that much new knowledge falls short of its full innovation potential because the necessary collaborative structure does not exist to support success.

The scan team learned that the host countries use research institutes to bridge the gap between knowledge creation and knowledge application. Institutes often are the venues that bring together the knowledge creation, knowledge management, and knowledge application aspects of R&D and foster transportation partnerships and collaboration that lead to effective innovation.

Without exception, each host country had some form of research institute that is a primary vehicle to either fund and financially manage or foster, house, and accomplish collaborative research efforts. The formation and structure of the research institutes varied from country to country, but each example brought together government, government-funded independent organizations, academia, and industry to more effectively respond to the national strategic framework in collaboration than each organization could on its own. The United States does not have comparable unique entities to facilitate collaborative research on this level. Some U.S. structures can accomplish portions of the roles of these institutes, but such integration of responsibility in one institutional structure is clearly a non-U.S. model.

Strategies

Implementation will consist of the following:

- Propose, advocate, and help staff a policy study to review the structure of Federal transportation research in the United States, including an examination of the

research institute model and additional models of collaboration employed in other parts of the world. The study should include a summary of the characteristics of research institutes in the host countries, such as the roles of institutes and organizations, funding models, mechanisms to engage industry early and sustain its involvement, administrative structures, and intellectual property standards. Institutes documented in the summary should include, among others, LCPC (France), the Carnot Institutes (France), KICTEP (South Korea), VINNOVA (Sweden), MLIT (Japan), and members of ECTRI (EU).

- If the study concludes that other models of collaboration provide the desired structure to enable the United States to meet its innovation goals, it should include recommendations on how to best use the structure in the United States. The recommendations should combine the best elements of the various research models observed during the scan. In addition, the recommendations should address the feasibility of using existing U.S. organizations in the new structure.

Item 4: Exploring Benefits of Intellectual Property Applications in U.S. Transportation Research

Investigate the effects, applications, and potential for intellectual property rights in the United States and abroad.

Background

The transportation research community is charged with finding solutions to problems. Those solutions often involve new processes and technologies that represent intellectual property with potential economic value.

Among countries visited in the scan, the transportation research community demonstrated a noticeably greater concern for the value and importance of intellectual property than is sometimes evident in the United States. Safeguarding intellectual property was recognized as a critical component of the entire research process to spur innovation, encourage investment for technology development and refinement, and foster commercialization nationally and internationally. Ultimately, intellectual property was seen as a means to bolster national economies by adding companies that hire new employees and sell new products. Successful management of intellectual property was associated with greater trade and foreign global investment.

In the United States, public agencies have traditionally taken the position that they should retain rights to intellectual property derived from their research. While the intent of this policy has been to maintain public ownership of intellectual property, an unintended result has been to impede development. Frequently, Federal agencies have lacked the resources and impetus to commercialize technology or license it to others, and in the absence of intellectual property protection, private concerns have been reluctant to invest in its development. Other public agencies, such as State DOTs, have taken a similar approach with similar results. In contrast, organizations visited during the scan viewed protection and licensing of intellectual property as essential enablers of technology deployment.

Furthermore, many transportation agencies in the United States lack effective policies on employees' rights to intellectual property. For example, any new product or idea that relates to a Federal agency's goals and objectives is owned by the agency because Federal employees are required to assign their intellectual property rights to the government. Undefined policies or policies that preclude employees from sharing intellectual property rights create little incentive for innovation in State and Federal transportation agencies.

A significant barrier to more effective management of intellectual property is the lack of understanding among public transportation agencies of domestic and international intellectual property law. Although the Bayh-Dole Act governs intellectual property developed in federally sponsored research, Federal and State agencies often lack expertise on the fairly complicated and often expensive processes needed to secure and protect intellectual property rights domestically or internationally. Few public transportation agencies have legal staff or retain counsel specializing in intellectual property law.

Finally, differences between intellectual property laws can complicate or frustrate protection and licensing between organizations in different countries. Organizations in nearly every country visited during the scan voiced questions and concerns about international intellectual property rights.

Strategies

- Collaborate with TRB Committees on the Conduct of Research, Emerging Technology Law, and

International Activities to sponsor and present technical sessions on domestic intellectual property law and international intellectual property law at the 2011 TRB Annual Meeting. Each technical session should address the value and importance of intellectual property management, essential elements of law governing intellectual property, and practical considerations of patents and other intellectual property processes.

- Collaborate with the AASHTO RAC Task Forces on Education and Training and on Program Management and Quality and with FHWA to develop an intellectual property short course and manual for transportation research managers. The short course and manual should address the value and importance of intellectual property management, essential elements of law governing intellectual property, and practical considerations of patents and other intellectual property processes.
- Collaborate with FHWA to convene a workshop on international intellectual property law and transportation research at which a multinational panel identifies problems and opportunities related to international intellectual property law and transportation research.

Item 5: Exploring Global Use of Research Information

Integrate and enhance accessible databases, Internet forums, portals, or other platforms to coordinate information and knowledge resources at a global level.

Background

The development of common platforms for a variety of elements in the research cycle would substantially reduce barriers for R&D collaboration and international partnerships and promote more extensive use of research results. Improved awareness of research agendas and existing collaborations, intellectual property issues, sharing of research expertise for peer review activities, and widespread information exchange are just a few of the areas that could benefit from the development of linked databases, common access portals, or other platforms among global R&D collaborators.

The scan team believes that such a platform should build on existing or ongoing initiatives, such as TRIS, the RiP database, transportation knowledge networks discussed in *TRB Special Report 284, Transportation Knowledge Networks,* work being done through NCHRP Project 20-75, "Implementing Transportation Knowledge Networks," and Web tools being implemented through the TRB Conduct of Research and AASHTO RAC Task Group on Coordination and Collaboration. Existing international resources such as those presented in Sweden and the Netherlands should be integrated. Sweden's VTI Library and Information Center, for example, has already established contact with the TRB Library.

Items for cooperation include incorporating research reports into the countries' respective information databases through the use of common platforms for information sharing. In addition, the European Union's CORDIS and in the United States the National Science Foundation's model for accepting and cataloging requests for proposals should be benchmarked.

The team envisions a tool that facilitates all aspects of the research cycle, including needs statements, opportunities for collaboration, available research opportunities, calls for proposals, research in progress, Web discussions, inventories of technical knowledge and human expertise, cataloging capabilities, and model operating processes for use in cooperative R&D agreements. Wiki elements and the ability to translate materials to other languages would remove barriers and enhance more effective collaboration and information sharing.

Strategies

Implementation will consist of the following:

- Consult with appropriate contacts engaged in ongoing information management initiatives in the United States (e.g., TRB Committees on Library and Information Science for Transportation, Technology Transfer, and Conduct of Research; NCHRP Project 20-75 researchers and panel; and AASHTO RAC Task Groups on Coordination and Collaboration and on Transportation Knowledge Networks) to understand the status, capabilities, and capacities of existing and planned information databases, portals, and platforms. Summarize international resources in the countries visited. Determine how U.S. and international information sharing and exchange could best be integrated through joint platforms.

- Monitor the ongoing dialog between the TRB Library and international counterparts such as the VTI Library in Sweden. Evaluate this activity as a potential model for information exchange with other countries. The discussion reportedly includes a federated search and sharing of information between TRIS and Transguide (VTI's information portal), international project information in the RiP database, a joint database for e-documents and upcoming conferences, and a potential international committee for information management.
- Offer assistance to and participate in the "Borderless Access to Information—International Transportation Research Web Resources" workshop scheduled for the 2009 TRB Annual Meeting.
- Provide recommendations on how best to achieve the tool envisioned in the background statement above, and how best to connect, incorporate, or coordinate international information resources with those in the United States.
- Develop strategies for improved ability to translate materials in other languages.

Item 6: Improving the Research Evaluation Process

Promote a systematic and consistent practice for continuous research program evaluation and improvement.

Background

The scan team considered performance, quality, and value of research programs as important factors for sustaining credible research programs. In light of this interest, host countries were asked how program quality and value were determined or measured, and how the results were communicated to sponsors and stakeholders. Were evaluations or performance measures used at both the program and project levels? Were both tangible and intangible benefits considered? Among the U.S. transportation research community it is generally perceived that demonstrating the performance, quality, and value of research programs is essential to maintain or increase limited research funding.

In each host country visited, the value of funding and conducting research was considered intrinsic to achieving societal and economic goals. That research is valued is a given, so there was not as much concern about using performance measures or indicators for program justification. However, several host countries presented extensive evaluation schemes for process and outcome improvements at both the programmatic and individual project levels. There was substantial interest in the Performance Measurement Toolbox created in NCHRP Project 20-63, "Performance Measurement Tool Box and Reporting System for Research Programs and Projects."

Sweden presented a continuous evaluation process that began before the program started with an ex ante logic impact assessment, followed by periodic evaluations during the conduct of research, an ex post evaluation, and a cross-cutting impact analysis study. South Korea has a similar whole-cycle project management process that takes a project from conception through implementation. Japan presented a detailed document issued by the Office of the Prime Minister providing National Guidelines for Evaluating Government-Funded R&D. This document covers evaluations at both the program and project levels. It includes the basic concepts of R&D evaluations, principles for conducting the evaluation, and evaluation criteria and indicators for the programs, research organizations, and individual researchers.

There may be models and techniques for both program and project evaluation that should be shared with U.S. transportation research administrators and program managers. Internal and external audits and reviews, extended post-implementation evaluations, and impact analyses can enable the transportation community to improve on its research investment. The finely detailed evaluation criteria and definitions are well thought through and provide opportunities for systematic and continuous evaluation.

Strategies

- Host a symposium to provide an international exchange of ideas on techniques for program- and project-level evaluations. This could include presentations on NCHRP Project 20-63, "Performance Measurement Tool Box and Reporting System for Research Programs and Projects," which was of particular interest to the host countries. Such a symposium could address the question: "Is there a need for a standardized research program and project evaluation?"
- Write articles for *TR News,* the TRB Conduct of Research Committee quarterly newsletter, and other

TRB committees as appropriate (e.g., Committee on Performance Measurement).

- Develop a session for the 2009 TRB Annual Meeting on "Research Program and Project Evaluations—An International View." After a presentation outlining the scan team findings, presentations on the VINNOVA impact analyses, South Korean project management, Japanese National Evaluation document, and Performance Measurement Toolbox will give attendees an overview of what some countries are doing. Case histories of impact studies, project evaluations, evaluation criteria, evaluation successes, and how the evaluations were communicated, received, and perceived could be presented.
- Develop a presentation outlining the various evaluation techniques discovered during the scan. This could be used as the basis for input to the above strategies. This could be presented to the TRB Committees on Conduct of Research and Performance Measures and the AASHTO RAC.

Appendix A: Amplifying Questions

To facilitate meeting discussions at the host organizations, the team developed a list of detailed questions that were submitted to the organizations visited before the team's arrival. The questions are organized by the four primary themes of the team's interest. Note: as the scan team prepared its report and implementation items, it determined that the phrase "setting the research agenda" was more effectively worded as "establishing or developing the research framework." The amplifying questions reflect the former wording, while the report and implementation discussion use the more recent wording.

1. **Setting the Research Agenda—**Practices used to determine where to put the emphasis and effort to solve current problems and emerging issues on local, national or federal, and international levels

   1.1 Have research programs found ways to identify and actively address consensus research agendas?
      1.1.1 How does your research program identify and establish a strategic research agenda that is supported by all stakeholders? What are the mechanisms used?
      1.1.2 How does your research program identify and prioritize transportation research needs within agencies, localities, and countries and with other countries to address national priorities as well as agency goals and objectives?
      1.1.3 Who participates in forming the research agendas?
      1.1.4 Are there opportunities for top-down and bottom-up contributions to the research agendas? If yes, how is this accomplished?
      1.1.5 What percentage of the overall investment in transportation does research represent? How is this determined?
      1.1.6 Does your research program add intermodal coordination to the research agenda and, if yes, how is this done?
      1.1.7 Do you select the research agenda to include aspects related to other nontransport areas, such as public health, economic development, and global competition? If so, to what extent?
   1.2 How is a portfolio of research projects established to comprise the research program?
   1.3 Does the research program contain projects that address short-term and long-term research needs? If yes, is there a predetermined amount of each type (number of projects or level of funding), and how are these projects identified and prioritized?
   1.4 Does the research program contain projects that address varying levels of risk (e.g., high-risk, low-risk)? If yes, is there a predetermined amount of each type (number of projects or level of funding), and how are these projects identified and prioritized?
   1.5 Does the research program contain projects that address a variety of research topics (e.g., technical topics, policy issues, multimodal, other areas)? If yes, is there a predetermined amount of each type (number of projects or level of funding), and how are these projects identified and prioritized?
   1.6 Does the research program contain projects that address ad hoc or quick-response research activities for meeting emergency or immediate needs? If yes, is there a predetermined amount of each type (number of projects or level of funding), and how are these projects identified and prioritized?
   1.7 Does the research program contain basic and applied research projects? If yes, what is the level of commitment to each type? If no, what is the reason for the current commitment to either basic or applied research activity?
   1.8 What scope does the research program address—national level, state or regional level, local level, or a mix of the three? What is the commitment to each level addressed and why?
   1.9 What is the source of research funding and how are research budgets established and developed for agency programs and for major national research activities?

1.9.1 What trends, if any, have been observed over the last decade on availability of research funding?
1.9.2 What other uses compete for transportation research funding?
1.9.3 What role do performance measures have in establishing funding levels and priorities for research?

1.10 What methods are used to reduce duplication of research effort?

1.11 What processes are used to maximize synergy with other research programs?

2. **Partnerships and Joint Research Activities—** Methods of cooperation that are an effective means to enhance technical capacity and increase fiscal and other resources required for research

2.1 How does your program establish and use partnerships for research within the agencies, localities, and countries; with other countries; and with industry and academia? What kinds of partnerships and examples of joint research activity are most beneficial and why?
2.1.1 Please describe the types of partnerships used and their formation, participants, structure, function, performance, funding, and results. How do partnerships produce value?
2.1.2 Please provide examples of joint research activities, describing their creation, participants, process, and benefits.
2.1.3 Does your agency consider private industry a partner?
2.1.4 How does your government impact the use of partnerships in accomplishing research?

2.2 What opportunities do partnerships or joint research provide?
2.2.1 Does your program maximize or enhance resources through the use of partnerships and joint research activities? If so, how is this done?
2.2.2 Do you find that partnerships and joint research provide for more efficient use of research funds? If yes, how is this accomplished?
2.2.3 What is the level of participation of academic institutions in the research performed by your agency, and do these institutions have a role in fostering education in the transportation arena?
2.2.4 Do partnerships allow enhanced implementation of research results or innovation and deployment activities? If yes, how is this accomplished?

2.3 What barriers are there to forming partnerships and joint research activities? What techniques are used to overcome these barriers?

2.4 How are proprietary issues and intellectual property rights addressed with partners (e.g., industry, consultants, academic institutions, others)?

2.5 How can joint activity and coordination of research between country or multicountry programs and the United States be fostered and increased?

3. **Conduct of Research: Performance, Quality, and Value—**Tools and processes used to measure the performance, quality, and value of research programs and projects

Performance and Quality—Program Level

3.1 How are program quality and value determined and measured and then communicated to stakeholders?

3.2 How are intangible benefits of program value included, such as stronger relationships or increased resources (e.g., funds, staff, facilities)?

3.3 What techniques are used to measure and improve program performance?

3.4 How is innovation measured?

Performance and Quality—Project Level

3.5 Are performance measurements and evaluation efforts applied at the project level? What mechanisms are used? Are tangible and intangible benefits from research measured? (e.g., tangible, such as dollars saved, and intangible, such as workforce development)

3.6 How is quality addressed in the selection of researchers for the conduct of research?

3.7 Who performs the research sponsored by your organization?

3.8 How are time delays, cost overruns, and other challenges in the conduct of research addressed, and how are they mitigated?

3.9 Before research is initiated, what types of literature searches are conducted?

Staffing

3.10 What is the staffing level of your organization?

(If available, please provide an organization chart showing the staffing.)

3.11 What are the roles and responsibilities of the research administrative personnel?

3.12 How is the research administrative and technical staff expertise maintained?

3.13 What resources are available and used to train professionals in both the conduct and administration of research?

Information Management and Access

3.14 How do researchers that perform your agency's research use knowledge management systems and libraries? (Knowledge management comprises a range of practices used by organizations to identify, create, represent, and distribute knowledge.)

3.15 What knowledge management systems and libraries are available to the researchers and how accessible are they?

3.16 What mechanisms are used to make others in the research community aware of your agency's in-progress research projects?

3.17 What mechanisms are used to share results of research within the research community, with other stakeholders, with prospective users, and with the public?

3.18 How can the U.S. research program facilitate or increase access to international research results and also facilitate access to its research results by international programs?

4. **Delivery: Getting Research Results into Widespread Practice—**Keys to enhancing the effectiveness of deployment and increasing the use of research results

Program or Agency Actions

4.1 How does your government impact the administration and implementation (getting results put into practice) of research?

4.2 How does your organization's leadership ensure that research results are integrated into the agency's business practices?

4.3 How is funding provided for implementation or deployment activities, and how is the amount determined?

4.4 Does your agency identify and accept products and methods developed by the private sector or academia and put them into practice? If yes, what are the procedures for accomplishing this?

4.5 How are research results used to formulate effective policy?

4.6 What is your forum for sharing new research results internationally?

Project-Level Actions

4.7 What are the processes or mechanisms used to put beneficial research results into practice so that their deployment produces a change in standard practice?

4.8 Are incentives used to facilitate putting research results into practice and, if so, what are they and how do they work?

4.9 Are innovative contracting procedures an aid to speed or foster getting results into practice? If so, what types of procedures are most beneficial?

4.10 Do specific institutional arrangements contribute to adoption of changed practice? What are some of the most productive arrangements?

4.11 Is there a training component to increase the knowledge of the users of the research results? If yes, what types of training are performed?

4.12 Who participates in getting research results put into practice?

4.13 How is success of implementing a new technology or innovation measured (e.g., the percentage of the affected parties using the innovation, dollars saved, other methods)?

4.14 What challenges do you face in your efforts to get research results put into practice, and how do you define success? What lessons have you learned from unsuccessful efforts?

Appendix B: Glossary

advanced research The study of phenomena relating to high-risk, high-payoff research and innovations to solve critical challenges.

applied research The study of phenomena relating to a specific known need in connection with the functional characteristics of a system; the primary purpose of this kind of research is to answer a question or solve a problem.

basic research The study of phenomena whose specific application has not been identified; the primary purpose of this kind of research is to increase knowledge.

collaboration Working together on a shared problem or project in which all parties have a sense of ownership and are jointly involved in creating the solutions or outcomes; synonymous with partnership.

cooperation Acting together or in compliance or to associate with others for mutual benefit. Unlike collaboration, cooperation does not require shared ownership of the project or joint responsibility for creating outcomes.

coordination Working together harmoniously, typically to bring about a goal or effect.

deployment A five-phase process to gain acceptance and use by stakeholders of a process, product, or regulation. The five phases outlined by the FHWA's Research Development and Technology Program are 1) planning and research, 2) promotion, 3) delivery and reassessment of goal, 4) achievement of goal, communication of accomplishments, and removal from Market-Ready Technology list, and 5) measurement of results and benefits of technology.

development At FHWA, the translation of basic or applied research results into prototype materials, devices, techniques, or procedures for the practical solution of a specific transportation problem.

implementation To put into practical effect. To ensure actual fulfillment. This is similar to deployment and sometimes used synonymously. Deployment is a step toward implementation or full adoption of a product or service.

innovation A new concept, technique, policy, procedure, product, or process that is ready to use and will improve the transportation system by making it safer, building it faster, or helping it perform more effectively.

innovation life cycle The approach illustrating that research and technology development and deployment are not insular activities, but integrated processes that together constitute a system.

knowledge management A process for optimizing the effective application of intellectual capital or communal expertise to achieve organizational objectives. It involves systematically and actively managing (e.g., identifying, storing, organizing, updating, and accessing) and leveraging internal and external information.

knowledge management system An integrated system or framework for managing the processes that create, store, and distribute knowledge or communal expertise throughout an organization.

market-ready technology and innovation A ready-to-use technology or innovation that will improve the transportation system by making it safer, building it faster, or improving how it performs.

outsourcing The delegation of specific operations from internal production to an external entity. Using an entity outside the organization to perform specific tasks that the organization once performed itself.

partnership See collaboration.

policy research Applied research that involves determining the impact of policies on targets. Useful for those responsible for policy interventions. (This can

include research designed to develop effective policy or research to determine the impacts of an existing policy.)

program performance Used to define whether the targets, goals, and objectives for a particular functional area or discipline are being met. For example, for an agency spending money on transportation safety, an assessment of how well the safety program is performing in reducing transportation-related fatalities.

research A systematic, controlled inquiry involving analytical and experimental activities that primarily seeks to increase the understanding of underlying phenomena.

research program performance measurement The ongoing monitoring and reporting of tangible accomplishments of a research program's established goals and objectives. Ideally, performance measures should address the results of the products and services delivered by the program (outcomes). However, performance indicators such as the type or level of program activities conducted (process) and the direct products and services delivered by the program (outputs) may also be used.

resource leveraging A process by which assets of others can be used to move a product or service further along.

strategic research Careful, systematic study to establish facts in a specific field, or research and technological development priorities for the medium to long term. Designed to accomplish a specific measurable outcome on completion. Strategic research often involves input from and coordination with multiple stakeholders.

technology transfer Activities that lead to the adoption of a new technique or product by users. Involves dissemination, demonstration, training, and other activities that lead to eventual deployment.

Appendix C: International Contacts

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Biographical Sketches

Debra Elston (FHWA cochair) serves as the director of the FHWA's Office of Corporate Research, Technology, and Innovation Management. She is also the director of the Research and Technology Program Development and Partnership Team. Elston oversees key strategic initiatives in research and technology, such as the exploratory advanced research program, budget and legislative development, and marketing and communication strategies for FHWA's Research and Technology program. Her collaborative leadership style includes membership on TRB's Conduct of Research Committee and involvement with the European Conference of Transport Research Institutes. Elston presented a paper at the 11th World Conference on Transport Research entitled "Closing the Gap Between Research, Policy, and Practice." Her experience in the transportation field spans more than 27 years, 19 with FHWA. Elston has received numerous awards, including three Secretarial Awards for "Partnering for Excellence."

Dave Huft (AASHTO cochair) is the research program manager and intelligent transportation systems coordinator for the South Dakota Department of Transportation (SDDOT). SDDOT's Office of Research addresses a broad range of research topics in transportation design, construction, operations, maintenance, planning, administration, and market research. Huft has been active in national research activities and is a past chair of the AASHTO Research Advisory Committee (RAC). He is a member of the AASHTO Standing Committee on Research (SCOR) and the AASHTO Technology Implementation Group, and is cochair of the Transportation Research Program Management scan. Huft is a recipient of the AASHTO President's Award for Research and the Alfred E. Johnson Award for Outstanding Achievement.

Barbara T. Harder (report facilitator) is the principal of B. T. Harder, Inc., a consulting firm focusing on transportation research management, technology implementation, transportation policy development and analysis, and program and performance assessment. She assisted FHWA in examining issues of quality, performance, and relevance of research activities. With FHWA she developed program policy and administrative procedures, including the *Expert/Peer Review Handbook* used in the process. In addition, she is part of a team creating an innovation infrastructure for the Pennsylvania Department of Transportation to enable products of research and other innovations to be systematically deployed and institutionalized as standard practice throughout the department. Harder was the lead author for the NCHRP *Synthesis 355: Technology Transfer Successes, Challenges, and Needs.* She also produced a TRB study to determine the tools of strategic value for technology transfer and implementation. In the past several years, Harder has prepared several studies, including a National Strategic Plan for Transportation Information Management for AASHTO (coauthor), NCHRP's *Synthesis 312: Facilitating Research Partnerships in Transportation Research,* and NCHRP's *Synthesis 280: Seven Keys to Building a Robust Research Program* (coauthor). Harder holds a master's in business administration in technology management and a bachelor's degree in mathematics with a concentration in physics. She is cochair of the TRB Committee on the Conduct of Research, a member of the TRB Strategic Management committee, a member of the Women's Transportation

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Joyce Curtis is the director of Field Services-North for FHWA. Curtis leads the 18 Divisions in the northern United States in helping States administer the Federal-aid program. She also is the regional emergency coordinator for a Federal region, overseeing transportation's response to natural and manmade emergencies. As the director of the FHWA Resource Center, Curtis led a multidisciplinary staff of 168 technical and administrative personnel who provide technical and program assistance to FHWA Division offices, State DOTs, metropolitan planning organizations and other partners. Curtis has served on a number of the agency's national task forces and work groups, including the Workforce Planning and Professional Development Task Force and the I-81 Task Force chaired by former Defense Secretary Jack Marsh. Curtis served as assistant division administrator for FHWA's Virginia Division and director of engineering and operations for the former FHWA Regional Office in Baltimore. Curtis graduated from Villanova University with a bachelor's degree in civil engineering. She is the past secretary of the TRB Committee on Urban Transportation Data and Information Systems, and a member of the American Society of Civil Engineers and the Women's Transportation Seminar.

Monique R. Evans is the administrator of the Ohio DOT Office of R&D, where she manages a robust transportation research program of about 100 active projects with a budget of about $9 million. She is responsible for delivering a fair and competitive program that is aligned with departmental strategic initiatives, is fiscally responsible, and produces practical results with a strong emphasis on accountability and implementation. Evans has been employed at the Ohio DOT for 17 years and also has private-sector experience in structural engineering and architectural design. She is a member of several professional organizations, including the Women's Transportation Seminar and the TRB Conduct of Research Committee, for which she chairs the Subcommittee on Strategic Planning. She has been involved in several NCHRP project panels and is a member of the NCHRP's Domestic Scan Program. Evans is also the AASHTO RAC Region 3 vice chair, the RAC Funding Task Group leader, and the AASHTO SCOR/RAC Reauthorization Task Force cochair. She is a certified public manager, a registered professional engineer in Ohio, and a graduate of the University of Cincinnati with a bachelor's degree in civil engineering, specializing in structures.

Christopher W. Jenks serves as director of Cooperative Research Programs for the TRB, a unit of the National Academies in Washington, DC. In this capacity, he is responsible for administering five cooperative research programs with a combined annual budget of about $67 million. Each cooperative research program provides industry-driven, problem-solving applied research to a particular segment of the transportation industry, including State departments of transportation, public transportation operators, airports, and the freight and hazardous materials transportation communities. Research programs administered include the National Cooperative Highway Research Program, Transit Cooperative Research Program, Airport Cooperative Research Program, National Cooperative Freight Research Program, and Hazardous Materials Cooperative Research Program. In the past, Jenks served as an associate director for business planning and development at the Washington Metropolitan Area Transit Authority and chief of transit service planning and operations for the Fairfax County (VA) Department of Transportation in suburban Washington, DC. He also held positions with the Pioneer Valley Planning Commission in western Massachusetts and the Pennsylvania Department of Transportation. He has an engineering degree from Cornell University.

Laurie McGinnis is the associate director of the University of Minnesota Center for Transportation Studies. She provides overall leadership for the center in identifying program opportunities, securing funding, directing programs, guiding program delivery, overseeing center operations, and establishing future directions in transportation research, education, and outreach. Before her work with the university, McGinnis was a project manager and bridge designer at HNTB, where she participated in the design of several bridges for State and local agencies. McGinnis has a bachelor's degree in civil engineering from the University of Wisconsin and master's degrees in public affairs and business administration from the University of Minnesota. She is a registered professional engineer in Minnesota and Wisconsin. Nationally, McGinnis is active in TRB, for which she is the immediate past chair of the Committee on the Conduct of Research and is a member of the Committee on Women's Issues in Transportation. She is also a member of Women's Transportation Seminar and serves on its International Advisory Board.

Harold R. "Skip" Paul has served the Louisiana Department of Transportation and Development for more than 30 years in both the research section and, since 1986, the Louisiana Transportation Research Center (LTRC). He is now the director of LTRC after serving as associate director for research since 1995. Paul has also served as an engineer-in-training, bituminous research engineer, and materials research engineer. As a researcher, he has had more than 40 publications published by TRB, the Association of Asphalt Paving Technologists, and technical publications. Paul has also served TRB in a number of positions and on NCHRP panels, culminating as the Technical Division A chair, responsible for more than 3,500 professionals on more than 200 committees. He was named an associate of the National Academies for his service. Paul is a former board member of the Association of Asphalt Paving Technologists, has participated on many FHWA advisory groups, and now serves on a Federal advisory committee. Paul graduated from Lehigh University with bachelor's degrees in mechanical engineering and English. He is a licensed engineer in Louisiana.

Glenn Roberts is the chief of research for the New Hampshire Department of Transportation (NHDOT). Roberts directs the NHDOT Research Program, supervises product evaluation and qualification activities, and oversees a program of bridge deck condition surveys for existing structures. His research emphasis includes effective and efficient delivery of applied research solutions, implementation, and enhancing and demonstrating the value of research. After joining NHDOT in 1987, Roberts served 5 years as a geotechnical engineer before assuming his present role in research. His prior experience included nearly 6 years in the private sector with United Engineers and Constructors, Inc. working as a structural and field engineer in the nuclear power plant construction industry. Roberts has a bachelor's degree in civil engineering from the University of New Hampshire. He is a licensed professional engineer and septic system designer in New Hampshire and a certified public manager. He serves on several committees of AASHTO, TRB, and the New England Transportation Consortium.

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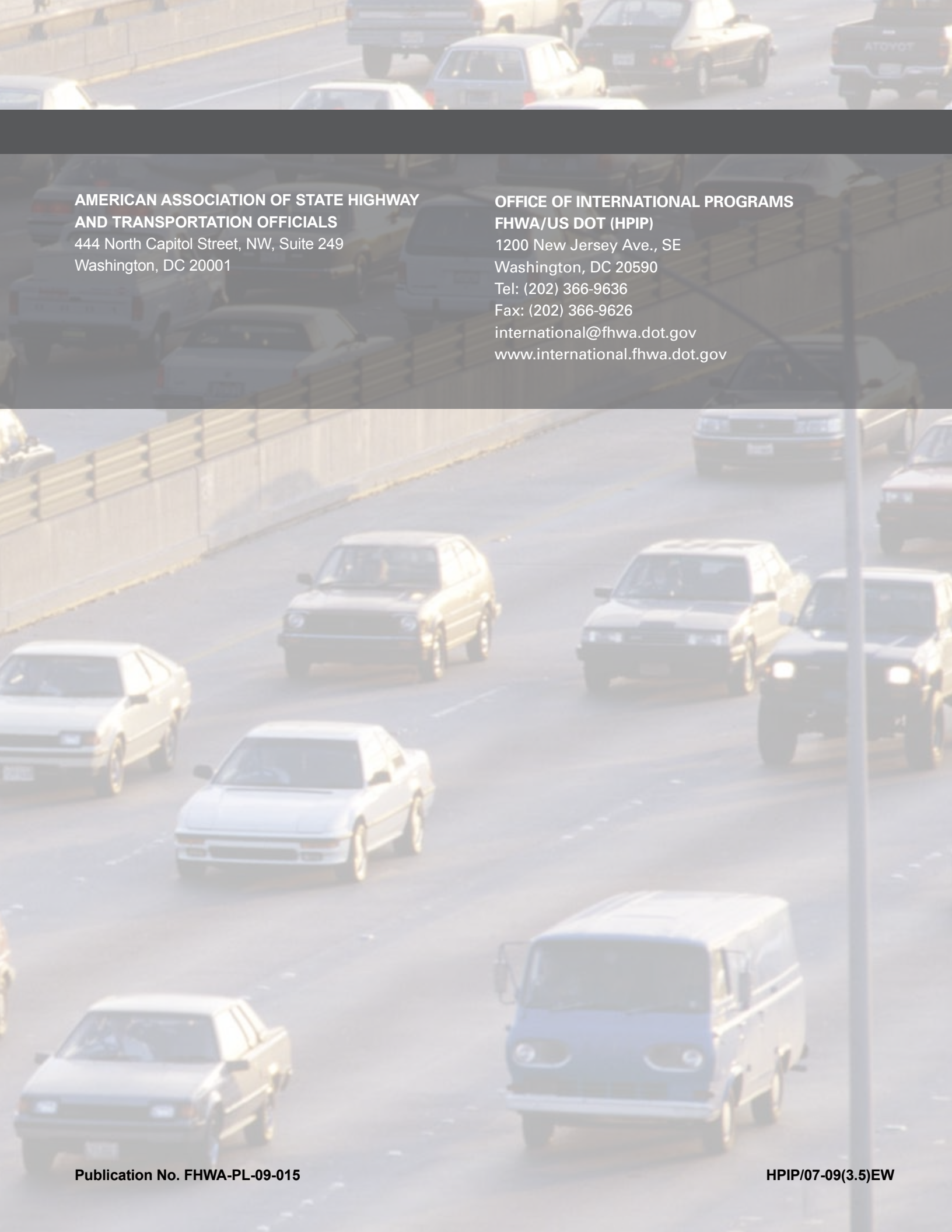

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