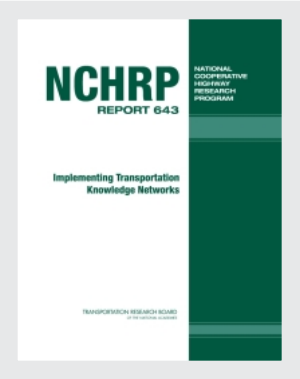

Implementing Transportation Knowledge Networks

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP REPORT 643

Implementing Transportation Knowledge Networks

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Subject Areas
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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

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Frances D. Harrison, Chief Technical Officer of Spy Pond Partners, LLC, served as Principal Investigator and is the primary author of this report. Other members of the research team contributing to this report were Hyun-A Park, President, Spy Pond Partners LLC; Sandy Tucker, Engineering and Applied Sciences Librarian at Texas A&M University Libraries; Arlene Mathison, Information Manager and Librarian at the University of Minnesota Center for Transportation Studies (CTS); Gina Baas, Director, Communications and Outreach at CTS and Robert Johns, Director of CTS. Editorial support was provided by Kate Woodworth at Spy Pond Partners, LLC.

FOREWORD

By Christopher J. Hedges
Staff Officer
Transportation Research Board

This report presents a business plan for the development of Transportation Knowledge Networks in the United States. The project builds on a number of previous TRB activities aimed at improving access to information for transportation professionals. If successfully implemented, a decentralized, managed network of information centers will help link users to the information they need, when they need it. This report will be of interest to all transportation practitioners, managers, and executives who need more effective and efficient ways to navigate the vast pool of information resources available to them.

In 2000, the paper "Access to U.S. Transportation Information Resources," by Jerry Baldwin of Minnesota DOT noted that "a large portion of information resources needed by the nation's transportation policy makers and practitioners cannot be efficiently identified, located and retrieved when needed." There have long been concerns among the transportation library community that information services are inadequate. In recognition of these concerns, the AASHTO Research Advisory Committee requested a small-scale study to determine the scope and content of a national strategic plan for transportation information management. That project, conducted by Barbara Harder and Sandra Tucker in June 2002, compared existing transportation information services with current needs, determined through structured interviews with a wide range of transportation information users. The study found transportation to be lagging behind many public-sector departments in its level of funding for information services.

After reviewing the final report, the AASHTO Standing Committee on Research asked TRB to provide recommendations on how transportation information could best be managed and provided. An expert committee was assembled and appointed by the National Research Council to conduct the study, with funding provided by the National Cooperative Highway Research Program. The study resulted in *TRB Special Report 284: Transportation Knowledge Networks: A Management Strategy for the 21st Century*. The study committee recommended the development of a business plan that would include details of the proposed funding and services of a national network of information service providers called Transportation Knowledge Networks (TKNs). Funding for this follow-on effort was again provided by the NCHRP. Under NCHRP Project 20-75, a research team led by Spy Pond Partners worked under the guidance of the project panel—the result is the business plan outlined in this report.

The product of this research is not an end in itself but a roadmap for achieving a new way of managing transportation information. The research results cannot simply be adopted by any transportation agency; they will require a coordinated, national effort and a stable source of funding. Making recommendations on policy or organizational measures is out-

side the scope of NCHRP projects. It will be up to the transportation community to consider these research results carefully and take the necessary steps to put Transportation Knowledge Networks into practice.

The ways we manage and access information today have changed the way we look at the world. For almost any endeavor we undertake, there are online information sources that show us ways to do it better. The implementation of Transportation Knowledge Networks as recommended in this report could help bring the ways we provide, maintain, and operate our transportation systems into the information age . . . into the 21st Century.

ACRONYMS AND INITIALISMS

AASHTO-IS	AASHTO Financial and Administrative Subcommittee on Information Systems
ACTS	Advisory Council on Transportation Statistics
AgNIC	Agriculture Network Information Center
ARTBA	American Road & Transportation Builders Association
BTS	Bureau of Transportation Statistics
CEO	Chief Executive Officer
CUTC	Council of University Transportation Centers
DOT	Department of Transportation
ETKN	Eastern Transportation Knowledge Network
FACA	Federal Advisory Committee Act
GAO	Government Accountability Office
GSA	Government Services Administration
HEEP	Highway Engineering Exchange Program
LIST	Library and Information Science for Transportation
LTAP	Local Technical Assistance Program
MTKN	Midwest Transportation Knowledge Network
NAC	National Academy of Sciences
NAL	National Agriculture Library
NGO	Nongovernmental Organization
NLM	National Library of Medicine
NLTAPA	National LTAP Association
NN/LM	National Network of Libraries of Medicine
NTL	National Transportation Library
MPO	Metropolitan Planning Organization
OAI	Open Archive Initiative
OCLC	Online Computer Library Center
RAC	AASHTO Research Advisory Committee
RITA	Research and Innovative Technology Administration
RWIS	Road Weather Information System
SCOFA	(AASHTO) Standing Committee on Finance and Administration
SCOH	(AASHTO) Standing Committee on Highways
SCOP	(AASHTO) Standing Committee on Planning
SCoPM	(AASHTO) Standing Committee on Performance Management
TDM	Transportation Demand Management
TKN	Transportation Knowledge Network
TKN-NCB	Transportation Knowledge Network National Coordinating Body
TMIP	Travel Model Improvement Program
TRIS	Transportation Research Information Services
TTAP	Tribal Technical Assistance Program
UTC	University Transportation Center
VMT	Vehicle Miles of Travel
WTKN	Western Transportation Knowledge Network

CONTENTS

SUMMARY

Implementing Transportation Knowledge Networks

Today's transportation professionals are facing an enormous set of challenges as they work to sustain and improve the mobility that is essential to our economic well-being, way of life, and security. Addressing congestion, unacceptably high fatality rates, aging infrastructure, and environmental sustainability in the midst of a worldwide economic crisis will require rapid discovery and adoption of technologies, practices, and methods that work. In this context, a well-functioning infrastructure for sharing and accessing relevant and timely information about current research, best practices, and lessons learned will be a necessity.

In recent years, there has been growing interest across the transportation community to provide a stronger, more coordinated approach to information access and availability for transportation professionals. In 2006, the Transportation Research Board published *Special Report 284: Transportation Knowledge Networks: a Management Strategy for the 21st Century* (also referred to herein as the *TRB Special Report 284* and SR 284). This report laid the foundation for the establishment of Transportation Knowledge Networks or TKNs, which were defined as "decentralized, managed networks linking information providers to users wherever they are located." *TRB Special Report 284* recommended development of a business plan for moving forward with their implementation.

NCHRP Project 20-75 has developed a business plan for implementing TKNs, and has begun the process of conducting the outreach necessary to ensure broad understanding of this plan and its potential benefits. There are three major institutional elements to establishing a sustainable and well-functioning network for information sharing in transportation:

- **Regional TKNs,** which are groups of transportation organizations (for example, state DOTs, MPOs, transit agencies, and engineering firms) that work together to share their information resources and collaborate on information access improvements.
- **A national TKN Coordination Function,** with responsibility for developing a national infrastructure for transportation information sharing and for leading and supporting TKN activities. The Research and Innovative Technology Administration (RITA) of the U.S.DOT was identified in *TRB Special Report 284* as a logical home for this function.
- An **Advisory Board** with senior transportation community representation to provide strategic direction and ensure accountability.

The business plan for TKNs defines ten key products and services to be provided to transportation practitioners by the regional TKNs, with support from the national coordination function. One of the major products to be provided is a national transportation information portal that will serve as a focal point for transportation professionals seeking information. Several services are included in the plan to ensure that this portal is continually refreshed with timely and useful information. Taken as a whole, the ten products and services in the business

plan are designed to achieve (1) a noticeable improvement in information access as perceived by transportation professionals, (2) substantial increases in information sharing among transportation information producers and providers leading to greater efficiencies, (3) preservation of valuable information resources that are at risk due to employee retirements and other factors, and (4) capacity building among transportation information professionals to enhance their effectiveness.

Implementation of the products and services in the business plan will require an estimated $13.5 million annually. A source for this funding will need to be identified.

Outreach activities conducted under this project to communicate the contents of the business plan included individual meetings with senior transportation agency representatives, a focus group with transportation planning practitioners, a briefing and follow-up survey of the AASHTO Standing Committee on Highways (SCOH), and presentations at conferences. A variety of outreach materials were prepared, including an overview flyer, testimonials from members of the transportation community, and narrated slide presentations. Outreach materials included descriptions of hypothetical scenarios for how transportation practitioners would use the transportation information portal to find materials that would help them respond to specific assignments in an efficient manner.

An implementation plan is provided that includes activities that can be pursued prior to availability of additional funds to support the TKN effort as well as a sequence of steps to be followed when and if funding is made available. Immediate activities include continuation of outreach and incremental implementation and tracking of pilot information-sharing initiatives. Some of these activities are already being carried out by the AASHTO Research Advisory Committee TKN Task Force, the National Transportation Library (NTL), members of current regional TKNs, and participants of the Transportation Library Connectivity Pooled Fund Study.

CHAPTER 1

Introduction

Background

Transportation practitioners have an unprecedented level of direct access to a vast pool of information, including standards, statistics, research reports, journal articles, guidebooks, and Web pages. Documents can be obtained in seconds from the comfort of one's office with a few clicks of the mouse. However, despite the explosion of available information on the Internet, substantial gaps exist in our ability to efficiently and reliably find what we need for the task at hand. Part of the problem is related to the sheer volume of information and the challenge of "separating the wheat from the chaff." Despite the existence of good Internet search tools, discovering and accessing needed information takes too long, and the process is "hit or miss."

On the supply side, many useful documents are never made broadly available or are not available on the portion of the World Wide Web that is indexed by search engines. Others are available for a time but never incorporated into a stable, persistent repository. As a result of these gaps, we waste valuable time and miss opportunities to learn from the mistakes and successes of others, to take the straightest line between two points, and to begin where others have left off rather than repeating what has already been done.

Given the current economic picture and demographic trends, effectively capturing and sharing knowledge is more important than ever. A 2003 study (*1*) found that 50 percent of the state transportation agency workforce will be eligible to retire within the next 10 years. Shrinking revenues are forcing many agencies to cut budgets and reduce staff. As transportation agencies face retirement of their most experienced personnel, sharing information across the transportation community and improving ways for less experienced staff to find the information they need to be efficient and effective is becoming increasingly important.

Funding for transportation libraries at the national, state, and regional levels has been shrinking. At the same time, the needs and expectations of information consumers have been changing as a result of the expanded availability of Internet access, rapid improvements in search technology, and an increasingly diverse and differentiated set of information products (RSS feeds, videos, digests, data sets). The transportation research community has long recognized the need for a paradigm shift in the way information is defined, created, captured, synthesized, and delivered. This paradigm shift must involve new products and services, new technology, and new organizational arrangements and partnerships.

Work sponsored by AASHTO and TRB over the past several years has provided some understanding of needs and expectations of transportation information consumers. It has also provided a vision for how to meet these needs efficiently by pooling resources and tapping into available technology. *TRB Special Report 284* (*2*) provides a blueprint for how transportation information is to be efficiently and effectively collected, preserved, and disseminated to researchers, policy makers, and practitioners. The blueprint presents a vision of a group of independent TKNs with membership from state DOTs, universities, local and regional transportation agencies, private sector transportation providers, associations, and the engineering/consulting community. These TKNs are regionally based, with one representing federal agencies. Each TKN works in a coordinated and cooperative fashion to meet the needs of its user community, sharing resources in order to stretch limited dollars and avoid unnecessary duplication of effort. *TRB Special Report 284* envisioned a national coordinating structure located within the U.S.DOT Research and Innovative Technology Administration (RITA) that would build on the current functions of the National Transportation Library (NTL). The TKN National Coordinating Body (TKN-NCB) would provide leadership (policy, guidance, coordination), national infrastructure for information sharing (technology, standards), and support the regional TKNs with seed grants and other assistance. SR 284 recommended an independent advisory body to provide policy direction and oversight to the National Coordinating Body.

The beginnings of this vision are already in place. At the national level, the NTL hosts the Transportation Research Information Services (TRIS) online and underwrites the TLCat union catalog by providing memberships and seed funding for cataloging. TLCat allows for access to the holdings of 42 transportation libraries, including those of 16 state DOTs. The Midwest Transportation Knowledge Network (MTKN) was started in 2001 as a pilot program of the NTL. MTKN is currently an independent nonprofit organization with membership from nine state DOTs, three universities, and three private companies. Eastern and western regional TKNs (the ETKN and WTKN) were formed in 2007 and now collectively have 34 members. The Transportation Library Connectivity Pooled Fund Study (TPF-5[105]), initiated in 2005 by Wisconsin DOT, involves 19 state DOTs, one transit agency (Los Angeles MTA), and two University Transportation Centers (Midwest Regional University Transportation Center and the University of Minnesota Center for Transportation Studies). This pooled fund study is providing member agencies with technical assistance (for cataloging materials into WorldCat/TLCat) and a network for sharing best practices and resources. It is also conducting marketing and outreach to expand participation and to communicate the value of transportation libraries.

In March 2008, the AASHTO Research Advisory Committee (RAC) established a Task Force on Transportation Knowledge Networks. This task force is supporting formation of TKNs, enhancing information exchange in the transportation community, and serving as an advocate for continued improvement to knowledge-sharing tools and practices. Its goal is to "support the rapid and efficient exchange of information resources through development of strategies and the innovative use of technology."

Full implementation of the recommendations of *TRB Special Report 284* will require that the following challenges be addressed:

- Articulate and communicate value to key decision makers who do not have the "transportation information infrastructure" on their radar screens, let alone on their lists of priorities;
- Determine appropriate models of governance and allocation of funds;
- Meet needs of a diverse community: academia and practitioners; federal/state/local/private; multiple modes;
- Forge cooperative relationships across institutions with distinct agendas and priorities and across institutions that, in some cases, compete with one another for funds or contracts;
- Develop collaborative approaches involving institutions that are in very different stages of readiness for collaboration with respect to awareness of the need for and benefits of collaboration, level of understanding of the information resources they hold that might be shared, level of cataloging in place, and nature of existing services to the user community;
- Achieve a balance between contributors to the TKNs and users of the TKNs; and
- Motivate those institutions that have well-established and well-funded information management programs to participate.

Despite these challenges, many opportunities exist that demonstrate value, provided the initiative has the right level of organization, funding, and marketing. The Pooled Fund Study, the MTKN, and the more recent ETKN and WTKN initiatives provide excellent examples of what can be achieved with relatively modest levels of seed money. They demonstrate that grass roots support for knowledge networks is already present. The existing willingness of organizations to pool resources indicates that additional investments to further TKN development will be highly leveraged. Incremental investments in building upon the existing transportation information infrastructure at the national level (TRIS online, TLCat, TRT)—with an appropriate level of effort to ensure awareness and understanding—can also produce a significant "bang for the buck."

Further collaboration and agreements across agencies with respect to tagging and metadata (use of controlled vocabularies) to allow for easier access to both documents and data is another potential big win that could result from TKNs.

Research Objectives

While some steps can be taken within existing resources, elements of the strategy to implement TKNs require a stable source of funding and a national coordination mechanism for identifying, collecting, and preserving information. The authors of *TRB Special Report 284* acknowledged that current funding for RITA and NTL is limited, and new funds will need to be identified in the future to support an enhanced effort. However, much can be done before then to continue to build momentum for this effort and to begin to put the necessary pieces into place.

The objective of NCHRP 20-75 was to develop a business plan for implementing TKNs and to conduct outreach that complements the efforts already begun by the NTL, MTKN, ETKN, WTKN, AASHTO RAC TKN Task Force, and the Pooled Fund Study to build awareness of and support for the TKN concept. The function of the business plan is to articulate the value of making a sustained commitment to investing in the transportation information infrastructure, define implementation steps, and identify resource requirements and sources.

The outreach component of this project was undertaken to ensure that the business plan for TKNs reflects stakeholder

needs and that this plan has the full support of the organizations and individuals who will be instrumental in its successful implementation.

Overview of Research Approach

This research was undertaken in two phases.
Phase I consisted of the following five tasks:

- **Task 1—Transportation Community Outreach.** Elicit input from a variety of stakeholders to shape the content of the business plan.
- **Task 2—Draft Business Plan.** Prepare a business plan for TKNs that describes the business case, defines products and services, and presents an implementation blueprint.
- **Task 3—Products and Strategies Concepts.** Define concepts for products and strategies for improved information access.
- **Task 4—Outreach Plan.** Develop a plan for dissemination of information about the business plan and for obtaining feedback on next steps.
- **Task 5—Interim Report.** Prepare a report summarizing the Phase I work.

Phase II consisted of the following five tasks:

- **Task 6—Products and Strategies.** Develop materials illustrating the products and strategy concepts defined in Task 3, suitable for use in the outreach task.
- **Task 7—Conduct Outreach.** Conduct workshops to build understanding of and support for the business plan.
- **Task 8—Outreach Report and Recommendations.** Summarize the results of the outreach effort and make recommendations for further activities to continue the process.
- **Task 9—Final Report.** Draft a final report summarizing the entire project.
- **Task 10—Presentations.** Present the results of the project at two national meetings.

Report Organization

This report is the deliverable for Task 9; it documents the activities and findings of the research effort.

- Chapter 2 summarizes the initial outreach effort.
- Chapter 3 presents the products and strategies concepts.
- Chapter 4 summarizes the business plan.
- Chapter 5 documents the outreach activities and their findings.
- Chapter 6 is an implementation plan for moving forward with the business plan. It includes some immediate next steps that can be taken to continue outreach as well as steps that should be taken when and if funding for full or partial implementation becomes available.
- Appendix A is the business plan.
- Appendices B and C provide detailed results from the online survey conducted for this project.
- Appendices D and E provide the results of additional surveys, focus groups, and stakeholder meetings.

CHAPTER 2

Initial Outreach Effort

Interviews with Transportation Stakeholders

Scope of Interviews

The research team conducted interviews with stakeholders to understand current perceptions about the need for improvements to transportation information access, to ascertain what types of TKN products and services will be of most value, and to solicit opinions about key barriers to successful TKN implementation and potential funding sources that could be tapped. The following individuals were interviewed:

- Steve Dillingham, Director, U.S.DOT-RITA, Bureau of Transportation Statistics
- John Augustine, Senior Advisor, U.S.DOT-RITA, Office of the Administrator
- Kelly Leone, Deputy Associate Administrator, U.S.DOT-RITA, Office of Research Development and Technology
- Tony Kane, Director of Engineering and Technical Services, AASHTO
- Joe Toole, FHWA Office of Professional and Corporate Development
- Rolf Schmitt, FHWA Office of Operations
- Judy Skeen, Chief Information Officer, Texas DOT
- Nick Mandel, Director of Quality Management, New Mexico DOT
- Gary Allen, Chief of Technology and Innovation, Virginia DOT
- Maureen Hammer, Director, Virginia DOT Knowledge Management Division
- Lance Grenzeback, Senior Vice President, Cambridge Systematics, Inc.
- Hal Kassoff, Senior Vice President, Parsons Brinckerhoff, Inc.
- Burr Stewart, Strategic Planning Manager, Port of Seattle
- John Inglish, General Manager, Utah Transit Authority, Vice Chair of the APTA Research and Technology Committee, and Member, ITS America Executive Committee
- Matt Barrett, Librarian, Los Angeles County Metropolitan Transportation Authority
- Amanda Wilson, Director of the National Transportation Library, U.S.DOT-RITA
- Jerry Baldwin, Library Director, Minnesota DOT
- Ken Winter, Library Director, Librarian, Virginia Transportation Research Council
- Toby Pearlstein, Manager of Information Services, Bain & Co., former librarian for Massachusetts Highway Department and CTPS (Boston MPO staff)
- Lisa Harris, Kansas University LTAP (outgoing NLTAPA president)
- Marie Walsh, Louisiana State University LTAP (current NLTAPA president)

Interviews were also conducted with representatives of library networks in the medical and agricultural fields:

- Melanie Gardner, AgNIC coordinator, National Agriculture Library
- Michelle Malizia, Public Health Outreach Coordinator, National Network of Libraries of Medicine (NN/LM), South Central Region

Key Findings

Findings are summarized below in five groupings: FHWA/AASHTO/DOT Executives, Transit and Port Executives, LTAP Representatives, RITA, Transportation Librarians/Information Professionals, and Non-Transportation Library Networks.

FHWA/AASHTO/DOT Executives. Individuals interviewed within this part of the transportation community articulated the continuing need to support sharing of best practices in the core engineering areas of concern to DOT CEOs, with particular emphasis in emerging areas such as outsourcing and

public/private partnerships or new technologies. TKNs will be of value to this community if they provide an effective, electronic means to locate current information about "who is doing what" in different DOTs. TKNs will be an easier sell if they recognize the distinct subgroups within which information is naturally shared (e.g., geotechnical engineers, statewide planners) and build upon and coordinate with already existing initiatives to share best practices. Such initiatives include FHWA's Communities of Practice, AASHTO's transportation.org Web site, the Center for Environmental Excellence, and the Highway Engineering Exchange Program (HEEP). Interviews also indicated the importance of effective information dissemination. For example, packaging information into tutorials or newsletters will have more impact than simply compiling information resources and making them accessible via search engines.

Transit and Port Executives. Interviews with one transit agency executive and one port executive identified several needs that could be addressed by TKNs:

- Information sharing about current topics of interest, including new vehicle technology, energy efficiency and carbon footprints, labor relations, and asset management;
- Information syntheses to help executives understand what new technologies should be considered for adoption by agencies of their size and characteristics;
- Cross-modal sharing of technology information (the ability to take lessons learned from an application of a given technology in one mode and apply it to another); and
- Services to identify and share information that could be used to demonstrate the value of public transit.

One interviewee noted that the American Public Transportation Association (APTA) already has a structure for capturing and disseminating information on current practice; TKNs should coordinate with this and other existing information-sharing efforts. The port representative suggested that TKNs tap into information resources produced by nongovernmental organizations (NGOs). He also thought that MPOs will be growing in importance as regional information providers and noted that regionally based information-sharing efforts could be supportive of collaborative efforts across agencies to build regional competitiveness. Collaboration would be greatly enhanced via a shared base of information.

LTAP Representatives. The LTAP representatives interviewed cited the need for sharing of training materials, information about funding programs available to local agencies, best practices related to use of available funding, and for providing an integrated view of research activities across academic institutions. They stressed that the needs of local agencies are very different from those of state DOTs: "they are trying to manage transportation systems with very limited resources" and "need answers, not complicated reports." They acknowledged the problems of information overload, fragmentation of information across multiple sources, and duplication of effort across agencies to compile useful information resources. They mentioned several product and service ideas for TKNs that might be of interest, including a central information portal, a searchable collection of training videos, access to information not currently widely available, a consolidated calendar of conferences, provision of directories of organizations providing services to local governments, and tools or services that filter information to cull important information.

The FHWA currently sponsors an information clearinghouse (provided by ARTBA) that includes a searchable resource base for LTAP/TTAP centers. A listserv for LTAP/TTAP centers, T2ALL, allows for informal information exchange. Given these existing services for LTAP/TTAP centers and their market, TKNs will need to demonstrate significant new value to be of interest, particularly if cost is involved for participation.

RITA. NTL staff has indicated general support for the recommendations of TRB SR 284, and the NTL continues in its national leadership and coordination role for TKNs. Efforts have also begun to consolidate U.S.DOT libraries, an important step toward building greater coordination of federal-level transportation information resources. Staff of the Bureau of Transportation Statistics (BTS) and RITA indicated agreement that RITA could be a logical home for the national coordination function recommended in TRB SR 284. However, current resource limitations prevent RITA from taking on new responsibilities. The BTS's core function is to serve as a statistical agency. Accordingly, maintaining and enhancing the popular BTS TransStats Web site (currently getting 19,500 hits per day) is a priority. On the RD&T side, much work remains to organize and catalog information about U.S.DOT-funded research initiatives. This work is viewed as "job one." Even if more resources were made available, RITA would need to weigh the best use of those resources. Investments in knowledge networks would compete against other priorities, such as additional efforts to coordinate research activities across administrations. Thus, the ability of RITA to fully implement the recommendations of TRB SR 284 would likely depend both on obtaining additional resources and on clear statutory direction with respect to activities and resource allocation.

Transportation Librarians/Information Professionals. Transportation librarians interviewed stressed the need for an improved understanding of and appreciation for the value provided by libraries. They believe that strong networks of well-funded libraries are required to move from an "information push mode" to providing information on demand. These

networks should be inclusive and recognize the diversity of information needs within the transportation community. Librarians acknowledge that technology is part of the solution, but indicated that it cannot be a substitute for the services of a skilled library professional. They also see a need for improving information capture at their source, paying more attention to resource preservation, and improving access to for-fee resources (e.g., databases and association standards or guidance documents). These librarians feel that networks can serve many valuable functions, including coordination of collections development, leadership and professional capacity building within the transportation librarian community, increased participation in TLCat, interlibrary loan agreements, and negotiation of favorable group rates for memberships and subscriptions. They value the opportunities provided for face-to-face communication with their peers.

Non-Transportation Library Networks

TRB Special Report 284 summarized the operations, staffing, and budgets of several national libraries (see pp. 37–45.) The networks of the National Agriculture Library (NAL) and the National Library of Medicine (NLM) were selected as models for transportation. The NCHRP 20-75 research team conducted supplemental interviews with a representative of the library networks in place for medicine and agriculture. Network models and scale of operation for these two library networks are very different:

- The Agriculture Network Information Center (AgNIC) is a voluntary partnership with 60 members, primarily universities; the National Network of Libraries of Medicine (NN/LM) has 5,800 members, which includes academic medical libraries, hospitals, pharmaceutical and other special health sciences libraries, and public libraries with consumer health collections.
- AgNIC has a modest, centralized infrastructure. NN/LM is much larger and is organized regionally, with eight competitively awarded contracts for coordination activities within different geographic areas.
- AgNIC is funded primarily through membership fees; NN/LM is funded through the NLM and membership is free. In both cases, members agree to share their information resources.
- Both AgNIC and NN/LM provide Web portals and work with their respective national libraries on shared thesauri and information-sharing standards.

Additional background information on the AgNIC and NN/LM is provided below.

AgNIC began in 1995 as a partnership between four land grant universities and the NAL. AgNIC's focus is "providing electronic access to reliable, evaluated agricultural information enhanced by the application of shared technology and standards." A GSA grant ($250,000) provided funding to set up the initial information infrastructure. By 1996, the AgNIC home page was receiving half a million hits per day. In 1998, a formal governance structure was established that includes a coordinating committee and an executive board. In 2000, a new technical architecture for information sharing was designed and a "one-stop shopping" portal was put in place. Web site hits increased to over 31 million. In 2002, the NAL and AgNIC created the NAL thesaurus, provided as a Web service. Further improvements to the portal and associated Web services were made in 2004. At the 10-year point, the AgNIC membership included 50 universities and agricultural organizations, and sites were getting 125 million hits per day.

AgNIC is supported from membership fees. Three levels of membership are available, with different levels of participation. Sustaining members support one or more selected set of subject areas and maintain Web pages with information on those subjects. For example, the New Mexico State University Library maintains a page on chili peppers. The coordinating committee has representation from all members. It elects an executive board that votes to accept new partners into AgNIC.

AgNIC operates with an annual budget of $430,000. Its staff of three FTEs maintains the Web site, performs coordination and outreach, and works on special projects (e.g., for digitization of documents.) Resources are tight, and AgNIC relies on voluntary efforts of its partners to maintain information resources. A recent survey found that only 5 hours per week are spent updating all of the AgNIC Web sites. The network has, however, provided an effective complement to the NAL's programs, extending its reach and providing a coordinated set of specialized information resources. Coordination on standards has produced a single taxonomy of terms and an approach that enables metadata harvesting from Open Archive Initiative (OAI) compliant repositories of member agencies.

The charge of the NLM is to provide all U.S. health professionals equal access to biomedical information and to improve the public's access to information to enable them to make informed decisions about their health. The Regional Medical Library system came into existence in the mid-1960s to bring NLM services to the local level. NLM contracts with eight major institutions to administer and coordinate NLM services within different geographic regions. These contracts are awarded on a competitive basis. Contracts vary but are sizable. For example, the South/Central region (serving 854 members in five states: Arkansas, Louisiana, New Mexico, Oklahoma, Texas) had a budget of $1.2 million for FY06. The regional libraries provide training and outreach services. Nationwide membership of NN/LM is currently over 5,800. Membership

is free. Full and affiliate memberships are provided. Full members must maintain their own information collections and agree to provide reference and search services and participate in DOCLINE, the NLM's interlibrary loan service. All members must agree to provide updated information on their collections and services for the network registry. Members are eligible to compete for certain funding opportunities. Affiliate members far outnumber full members.

A central server is hosted for the NN/LM's Web site, wiki, and blog by the University of Washington. The NLM hosts DOCLINE from its offices in Bethesda, Maryland.

Web Survey

The purpose of the Web survey was to gather input from transportation researchers, librarians, and practitioners, and to use this input in developing the business plan for TKNs. Requests for responses were e-mailed via the TRB electronic newsletter to AASHTO RAC members, University Transportation Center (UTC) directors, the TranLib Listserv, and the LTAP Listserv. The e-mail request asked recipients to forward the survey to others in their organizations.

Results reflect responses received between July 4, 2007 and September 25, 2007. The study team received a total of 150 responses. Of these, 126 respondents completed the entire survey; the remaining 24 completed a portion of the survey. Responses were distributed as follows:

- 103 (69%) from state DOTs; the remainder from U.S.DOT, universities, local agencies, and consultants.
- 39% from managers/executives; 18% from transportation librarians; remaining 43% from engineers, planners, researchers, other professionals.

Appendix B contains the survey instrument with a summary of responses to non-open-ended questions.

Appendix C contains open-ended responses from the survey. The survey provided a rich source of information on the information resources currently in use and on unmet information needs. Question 8, which asked what tasks respondents would assign to a full-time personal assistant, yielded detailed information that can be used to infer the kinds of TKN products and services that would likely be of value. Question 10, which explicitly asked what improvements to information would be of most value, and question 11, which asked for advice on the business plan, yielded a diverse set of opinions that was extremely helpful in crafting the business plan.

Findings and Conclusions

Key findings from both the interviews and the Web survey are organized around the following three questions:

- Is there a problem related to transportation information access that merits attention and investment of resources?
- What products and/or services could address the problem?
- How should TKN implementation proceed?

Does a Problem Exist that Merits Attention and Investment?

The need for a coordinated approach to information sharing in transportation is well supported by *TRB Special Report 284* and prior investigations of this topic. Interviews conducted for this project and comments on the on-line survey indicated, however, a wide diversity of opinion about the nature of the problem and the priority for taking action. For some, additional investment in information-sharing initiatives is a low priority given extremely tight budgets and difficulties in addressing core business needs. Some opined that transportation professionals don't place a high value on being kept aware of what others have done: engineers derive satisfaction from solving problems by themselves, many workgroups have a "not invented here" syndrome, and the profession is relatively slow moving (in contrast to high tech or medicine), which makes access to the latest information less critical.

In contrast, others feel strongly that transportation is far behind other industries in the information sharing arena. They feel that there has been significant underinvestment in this area that is short sighted and does not make good business sense, particularly in light of the challenges ahead, the need for innovation, and the explosion of available information. One executive commented that without more attention to information capture and sharing, organizations inevitably end up "paying for the same information more than once." Others expressed frustration about the amount of time it takes to find information resources—even within their own organizations. A convenient way to access current information about practice from peers will be of value. Several people interviewed for this project were particularly concerned about the lack of a coordinated approach to preservation of valuable information for both current and future generations of transportation professionals. Several examples were cited of permanent information loss or risk of loss in the near future.

In the middle of these two extremes are practitioners who feel they can find the information they need to get by, but also acknowledge that there is certainly room for improvements in information availability, organization, and access.

The conclusion to be drawn from this diversity of opinion is that some segments of the transportation community are extremely receptive to and supportive of information-sharing initiatives. Librarians and information professionals are perhaps the strongest advocates for improvement given their firsthand and long-standing familiarity with the issues. However, they are not alone. Their concerns are shared by many

managers, researchers, and practitioners. Other segments of the community recognize the problem but are not yet "sold" on the solution. They need to see concrete examples of how information-sharing initiatives will help them cope with information overload, save time or money, or improve their effectiveness. Outreach and education about the nature of the problem and the benefits of proposed solutions are necessary to maximize value from TKN initiatives.

What Products and/or Services Could Address the Problem?

The most frequently cited need was for a central information repository providing a topically organized "one-stop shopping" transportation information source for published documents, data sets, photographs, contacts, and Web sites. Related to this was the desire for improvements to transportation-specific search tools. Another theme in the comments was the need for value-added services to filter, validate, annotate, and package information resources. Practitioners were also interested in mechanisms to support sharing of best practices and lessons learned among peers. Many people commented on a continuing need to capture information beyond nationally sponsored research reports and to increase access to digital documents. Library and information professionals emphasized the importance of cataloging materials so they can be shared across organizations and of preserving materials to ensure their ongoing availability.

As expected, researchers, practitioners, executives, and information professionals offered different perspectives on what is needed to improve information access. These perspectives do not conflict, but rather represent different elements of a complete, coherent information-sharing strategy. Such a strategy involves coordinated, interrelated activities to capture, organize, annotate, filter, catalog, archive, present, and share information resources. Needs expressed by end users of information can and should provide a focus for action in this arena. However, it is important to recognize the many upstream activities that are required to provide the desired result. These activities take place behind the scenes and are often not apparent to end users.

How Should Transportation Knowledge Network Implementation Proceed?

Considerable input was obtained on the question of how TKN implementation should be approached to maximize value and success. Key findings expressed by the survey recipients are:

- The TKN initiative should be crafted as a mixture of technological, organizational, and programmatic elements that collectively achieve the intended results. Overemphasis on the coordination and collaboration element without a visible product or a concrete idea of services to be provided will make it difficult to gain strong support.
- There is clear support for action at the national level but less clarity of understanding (particularly outside of the library community) about why a regional approach is being pursued. This suggests the need for emphasis on national-level actions as well as clear communication about the role envisioned for the regional TKNs.
- Several people suggested a focus (at least initially) on new technologies, innovation, and emerging issues or "hot topics," rather than a broad-based effort, in the interest of addressing the most pressing need for information sharing.
- While many, particularly in the library community, feel a need to increase the level of investment in libraries and information sharing, others feel that there should not be a major new initiative, particularly given today's tight funding climate. To strike a balance between these viewpoints, it will be important to emphasize that the intent is to improve efficiencies by providing a much-needed boost and coordination mechanism for already-existing information-sharing efforts.
- TKNs need to have elements of centralized and decentralized approaches. Many people seem to be looking for a national transportation "one-stop information shop." However, many organizations view themselves as the primary source for information within a particular area and do not want to relinquish this role. In addition, transportation organizations are looking for solutions to their own internal information-sharing challenges. Therefore, crafting a modular approach to information-sharing tools, providing components that can be plugged in to a national portal but also made available to individual organizations would be an appropriate strategy. An example of this approach is the state DOT search engine developed with the Google custom search engine, which can be easily incorporated into any Web site. The Online Computer Library Center (OCLC) Open WorldCat search box is another example.
- Accountability is critical for this effort. Objectives and performance measures must be clearly defined and mechanisms for continuing evaluation and improvement should be established. One suggestion was to establish a TKN "brand" that appears on all Web pages associated with TKNs in order to provide wide recognition of what is being offered.

CHAPTER 3

TKN Products and Strategies

Overview

This chapter presents products and strategies for improved information access. These products and strategies provide concrete examples to the stakeholder community of the potential value and benefit provided by implementation of TKNs.

Objectives

Based on the feedback received in the initial outreach phase of the project and subsequent input from the project panel, the following objectives were established for TKN products and strategies:

- Provide a "one-stop shopping" portal for transportation information as a focal point, building on existing resources and the vision established by *TRB Special Report 284*.
- Emphasize the collaborative arrangements and processes that will need to be in place to share information across organizations.
- Incorporate support for peer-to-peer sharing of current practices and best practices.
- Address the need for improved vertical search tools (i.e., domain-specific search capabilities) for information of interest to transportation practitioners, providing access to a broader pool of digital information resources than is currently available.
- Support the need for consistent cataloging and preservation of information resources.

The research statement suggested that TKN products and strategies build from the "vision of a user-focused transportation information system" that was described on page 51 of *TRB Special Report 284* (*1*) and focus on ways to deliver information to specific types of end users when they need it and in a usable form. This vision is reproduced below:

Envision state department of transportation employees working at their desks on time-sensitive projects or projects with long timescales:

- They identify a need for information and, because of good marketing in the agency, they know where to turn. They open their Internet or intranet browser to the library page or information portal and choose the service they desire, such as literature review, facts on file (common questions from across the country that are stored for easy retrieval), or reference requests.
- They find a front-end application that asks them how they want to search for information—geographically, topically, by title or author, or by other formats. This interface is visually engaging and easy to use. With a click, they are taken to that search tool, or this information is all on the first page.
- They type in their search phrase or point and click to icons and retrieve the desired information. The databases and systems that are being searched are noted while the search is under way ("now searching BIOSIS . . .").
- They can clarify whether they want information in narrative form, tabular, or geospatial data, or all of these. To help refine the search, questions that librarians typically ask users are programmed into the system.
- Once they come up with a list that reflects the information they are seeking, they can check boxes to say "I want to save this information" and create a customized list stored under their e-mail address or account.
- They can then retrieve the documents and data on the list with highlights pointing to the specific text relevant to their search. Because the documents and data are tagged, they are able to find specifically what they are seeking. The behind-the-scenes effort to obtain, catalog, index, tag, and store the information is not obvious.
- They are able to pull quotes from the documents, with prompts helping them understand copyright laws and appropriate uses and references.

- If a document is not available electronically, they are offered a menu for delivery: interlibrary loan (because of the Transportation Libraries Catalog or First Search, the location of the closest borrowing institution is known); electronic document delivery (from where and how much); purchase of paper copies (from where, how much, and how fast); or whatever the correct terminology is for the suite of options. In this vision, they will not have to pay $800 for a full document if they want only a paragraph from it.
- When the site includes data references, they can easily understand the data platform and relevant uses.
- The results are provided to them in good English without cryptic abbreviations.
- Ideally, the system is somewhat fun or at least easy to use, and they understand the sources they are searching, how far those sources will take them, and when they will need to seek additional information.

Product and Service Components

Building on the framework established in *TRB Special Report 284,* the study team developed an expanded vision of the components of a transportation information infrastructure. This vision is illustrated below in Figure 1.

Key elements (reading Figure 1 from top to bottom) are the following:

- A *portal* serving as a national focal point for transportation information, providing access to the core information resources. These resources will be physically distributed. The portal will draw upon multiple information repositories and improve discovery and access to existing disseminated information. It will allow TKN member organizations to subscribe to information feeds or receive e-mail notifications when information changes. The boxes at the top of Figure 1 are features that will be provided on the portal, allowing users to browse or search the information resources.
- A network of transportation information providers and practitioners (represented by the shaded boxes in the middle of Figure 1) who share their information resources and participate in shaping the content and services provided by the portal.
- An evolving set of distributed *information resources and tools* for accessing these resources. Information resources will include GIS data sets, training materials, image files, and documents. Tools will include search engines and query capabilities.
- Knowledge services and protocols for acquiring, cataloging, digitizing, archiving, and sharing information resources.
- Standards that facilitate information sharing, including a thesaurus or taxonomy of terms, glossaries, metadata standards, data exchange standards, and crosswalks that allow for translation across different formats.

TKN Product and Service Descriptions

The Transportation Information Portal

A mock-up of the home page of the Transportation Information Portal is shown in Figure 2.

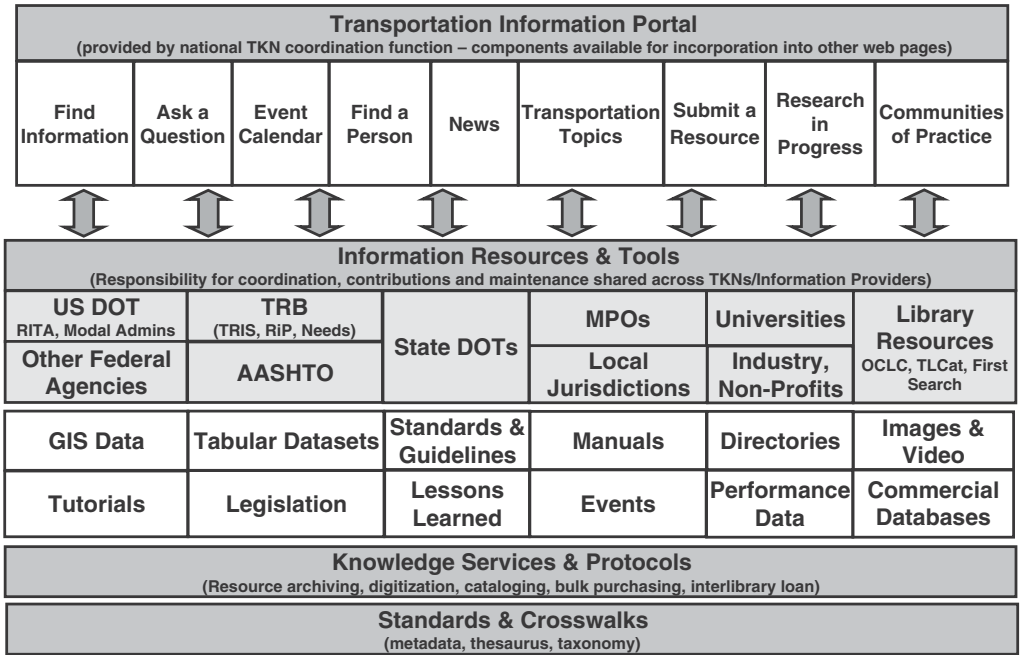

Figure 1. Transportation information infrastructure vision.

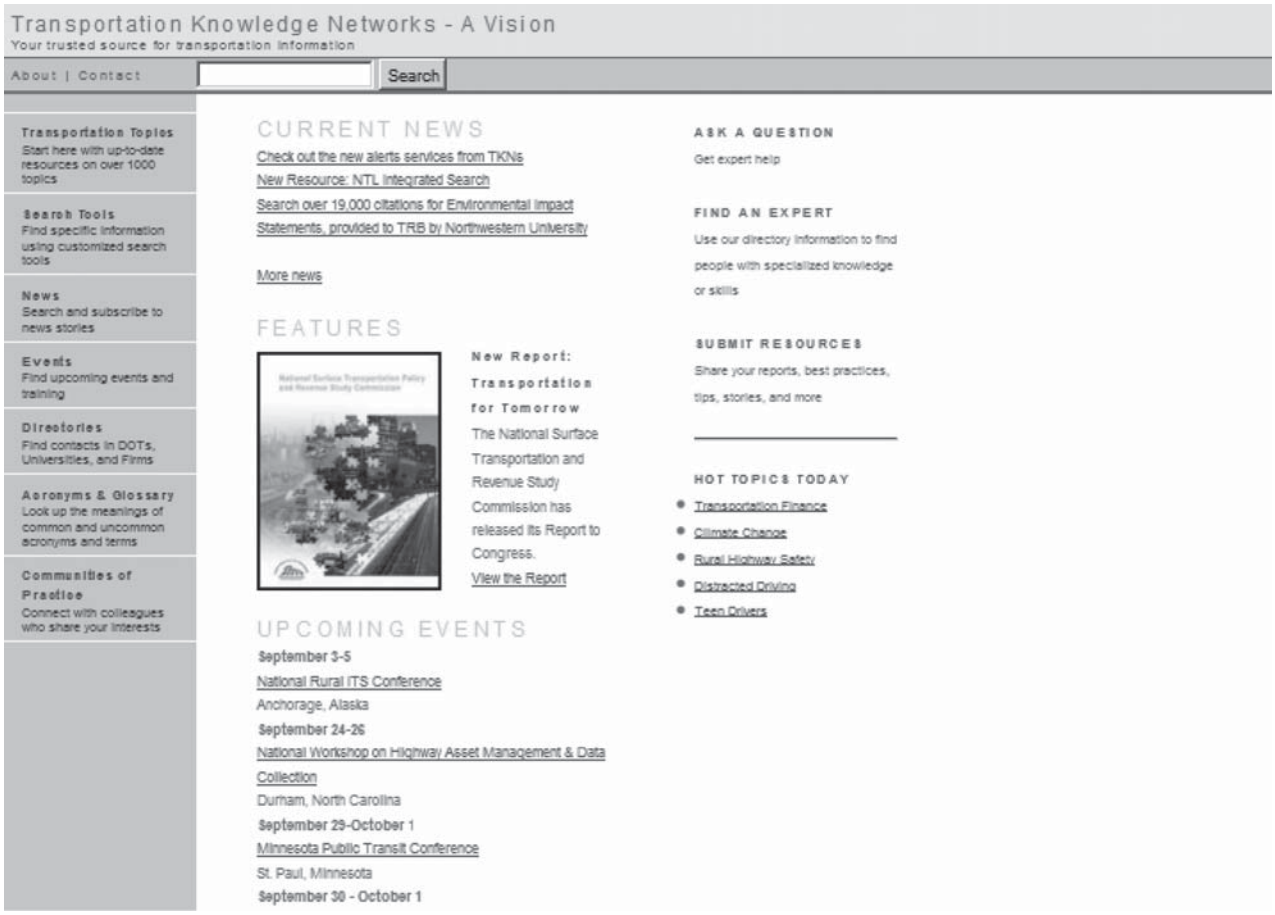

Figure 2. Transportation information portal mock-up.

Key features of the portal include the following:

Find Information—A page that allows users to identify information resources relevant to their questions. This page will provide access to different information sources, including agency survey results, library catalogs, data sets, and legislation. It will include a search capability showing different sources of transportation information, illustrating access to the resources shown in published literature, data sets, legislation, lessons learned, etc. It will also include an option to request a literature review on a particular topic area.

The portal, as planned, makes use of federated search technology in order to connect users to authoritative information sites and to simultaneously search live content based on specified criteria. Federated search technology provides better quality results than a general search engine because it targets specific sites (that may not be linked to other Web content) and performs translations from search criteria provided by the user to those required by the target site(s). Examples of Web sites using federated search include Amazon.com, Science.gov, mednar.com, medlineplus.gov/, and usa.gov. The Virginia DOT Research Library has implemented a pilot of this technology called OneSearch (*3*).

Research and literature review services will be offered via discussion forum, e-mail, phone, or messaging. Tremendous benefits can be realized by offering services of skilled, specialized transportation information professionals for conducting literature reviews, building annotated bibliographies on particular topic areas, or simply tracking down answers to specific information requests. Wide availability of these services to the transportation community will save time and provide better information for both research and practice. Individual requests could be distributed to specific designated specialists (among the TKN membership) by subtopic. Over time, additional efficiencies will be realized as multiple requests on the same topic are received.

Ask a Question—Page where users submit a question to be answered by the network of transportation information professionals within the TKNs. The user may choose to chat online with the scheduled information professional or to submit a question by e-mail. If appropriate, the user may then be connected with appropriate communities of practice, which are part of the TKN.

Event Calendar—Consolidated calendar of events relevant to transportation professionals. The TKN-NCB and

each TKN maintain a contact with professional organizations and arrange for sharing of events calendars.

Find a Person—Directory (or set of distributed directories) of transportation professionals organized by function. The intent of this page is to answer questions such as "Who is the traffic engineer for city x," or "Who can I talk to in state Y about experience with public-private partnerships?" Contact information is updated annually by regional TKNs that identify individuals in key roles within their member organizations. The TKN-NCB coordinates the establishment of which standard roles are to be included and sets the structure for the contact information.

News—Page with links to current news stories and clipping files of relevance to transportation professionals. This page draws upon subscriptions to news services such as LexisNexis, ProQuest, and Dow Jones Factiva.

Transportation Topics—Page provides quick access to a filtered set of information resources organized by topical areas within transportation (e.g., highway safety, asset management, congestion pricing). National topic leaders will be identified to provide content.

Submit a Resource—Page provides an easy way to submit an electronic document or data set for inclusion in one or more designated information repositories. Core databases include TRIS Online, the NTL's Digital Catalog, TKN identified repositories, and TRB's Research in Progress. Each TKN member submits resources, following the indexing guidelines established by the TKN-NCB and TKNs. Outreach and training will be provided to enable and encourage transportation organizations not able to build their own repositories (or that have limited capacity) to contribute resources.

Research in Progress—Access to the TRB Research in Progress site; links to other sites with updates on active transportation-related research.

Communities of Practice—List of active communities of practice that incorporates the current FHWA set in addition to a broader set for other TKN market segments. Designated TKN topic leaders maintain the list of communities of practice.

Information Resources and Tools

The portal will draw upon a pool of information resources including those that currently exist (such as TRIS, TLCat, OCLC, and the TRB Research in Progress), as well as additional resources that are gathered over time to fill priority gaps in practitioner needs. A distributed model will be used, with emphasis on helping people find needed resources wherever they are stored. However, in order to meet the demand for additional digital resources, part of the TKN effort will involve expanding and enhancing the NTL's existing digital repository. To minimize duplication and provide opportunities for wider sharing of information resources across organizations, seed funding to support transportation libraries to catalog collections into OCLC will also be provided.

Part of the value added by the TKN initiative is to gather information from member organizations based on common standards. Simple examples include building a consolidated event calendar or creating a contacts database based on a common set of functions across agencies (as opposed to agency job titles). Other examples are assembly of strategic highway safety plans from all of the states and display of location-based information from multiple states (e.g., infrastructure condition, traffic, crashes). TKNs have already begun such activities albeit at a limited scale by contributing state climate change information to augment the national climate change information available through climate.dot.gov.

Collaborative approaches will also be explored for improving member organization access to fee-based information resources, such as professional journals, scientific literature, and standards documents. Negotiation of group subscription rates at a national level will reduce access costs to these resources for individual TKN members. Where licensing for direct access to such resources for employees of multiple organizations cannot be negotiated, a subsidized interlibrary loan service can be explored, using the "Loansome Doc" service of the National Library of Medicine as a possible model.

Services, Standards, and Protocols for Information Sharing

Information-sharing services, standards, and protocols are critical elements of the TKN initiative. These include implementation of technologies that enable data sharing, development of model programmatic initiatives such as interlibrary loan or data-sharing agreements, collection management strategies to avoid unnecessary duplication, and supporting services for digitizing, indexing, and cataloging information resources so they can be shared.

Ideally, one outcome of the network will be that information producers begin to build in standard ways of providing and disseminating their information. For example, a research project to perform a multi-state synthesis of current practice could be scoped to produce as one of its deliverables a set of tagged results in a format that could be easily integrated into the portal. This approach dramatically increases the value provided through these research programs by making the information produced more easily accessible and integrated with related resources.

Use of common standards is an underpinning of the success of information-sharing efforts. The library community has decades of experience with data standards (e.g., MARC, Dublin Core). Standards are continuing to evolve for sharing information resources over the World Wide Web. The transportation community has a thesaurus of transportation research terms (the TRT) that was initially released in 2001 and that has been steadily improved since then. The TRT provides standardized terminology for indexing information resources in the TRIS database as well as in government and university transportation library collections and Web pages. It currently contains roughly 10,000 terms and is maintained with part-time staff and voluntary assistance. In contrast, the NAL thesaurus contains over 68,500 terms and is maintained by a staff of seven indexers (*4*). The Medical Subject Headings (MeSH) thesaurus contains over 160,000 entry terms. The Unified Medical Language System® (UMLS) includes a "Metathesaurus" that incorporates MeSH and several other vocabularies and a "Semantic Network" that includes 135 semantic types and 54 relationships across the types. The semantic types are assigned to concepts in the Metathesaurus. MeSH and the UMLS are used for indexing, cataloging, search, and natural language processing applications in medicine and related fields. This improves the ability to find information relevant to the searcher's need.

The resources provided to the TKN initiative will allow for continued expansion and improvement of the TRT to fill existing gaps in terminology and allow the TRT to evolve into a more useful and widely used resource.

Example Scenarios

Four scenarios were developed to illustrate and communicate the value of the TKN products and services. Each of these scenarios illustrates a situation in which a transportation practitioner is seeking information. In today's situation—namely, without active and coordinated TKNs and a central portal for transportation information—these searches likely take considerably more time and yield less useful outcomes. Standard Internet searches won't yield the most valuable information resources for the task at hand. Practitioners waste time recreating material (presentations, training manuals) that others have already produced.

In the scenarios presented below, the efficiency of users' searches is enabled through coordination and collaboration activities that are taking place "behind the scenes" to provide the information being sought in a convenient and timely manner. The scenarios assume that the national TKN coordination function develops and maintains the transportation information portal. With input from TKN members and guidance from the national TKN steering committee, priority topic areas are reviewed and revised each year. Teams of topic leaders are enlisted in each of the priority areas. These teams work with information specialists from the national or regional TKNs to craft the initial set of information resources for inclusion in the portal (FAQ, list of resources, contact people) and to review these for currency on a quarterly basis. The information management specialist ensures that each relevant resource is archived (if needed) and properly cataloged and tagged.

Scenario 1: VMT-Based User Fees

Situation: A state DOT policy analyst receives an urgent request from his commissioner to prepare a legislative briefing on the implications of mileage-based user fees. The briefing must be completed within 24 hours.

TKN Value Provided: The analyst goes to the national transportation portal, selects the "Transportation Finance" topic under "Transportation Topics," and then clicks on "synthesis documents." The first link on the list is a briefing paper done for the National Surface Transportation Policy and Revenue Study Commission. This paper includes a summary of advantages and obstacles, technological approaches, a review of recent experience, revenue implications and key policy issues. It also includes comments from the blue ribbon panel that are indicative of the kinds of questions that the policy analyst should anticipate. This gives the policy analyst a "big picture" view of the topic.

The second link on the list is a reference to an FHWA-funded "National Evaluation of a Mileage-Based Road User Charge," a $16.5 million effort including field tests of technology and user acceptability in six locations (Austin, TX; Baltimore, MD; Boise, ID; Eastern Iowa; the Research Triangle Region of North Carolina; and San Diego). The policy analyst notes that one of these locations is in his home state and makes a note to obtain further information on this initiative for inclusion in the briefing.

The policy analyst then finds that there is a Transportation Finance Community of Practice Web site referenced in the portal. He goes to this site and sees that a colleague in another state has posted a presentation prepared in response to a similar request. The policy analyst is able to adapt material from this presentation for his briefing, saving considerable time.

Scenario 2: Winter Storm After Action Report

Scenario: A winter storm brings traffic to a standstill on a 20-mile section of an Interstate highway. Motorists are stranded for hours. Following this incident, the state DOT Secretary requests a review of how to avoid this situation in the future, along with a list of action items for immediate implementation. His chief of operations asks her assistant to produce

a briefing on what went wrong and what steps should be taken to avoid the situation in the future.

TKN Value Provided: The assistant uses the transportation information portal to identify colleagues at other agencies to interview, seek alternative solutions for road weather information systems (RWIS) capabilities, and identify available resource materials for conducting drills. The portal contains a news subscription service, and a search of major newspapers brings up several stories of similar incidents in major metropolitan areas. The researcher looks for more information and finds several news clippings, press releases, and a consultant's report analyzing the agency's response and making recommendations to avoid that situation in the future. She reads the key findings, which include the need for pre-event incident response training, lack of policies and procedures for chemical additive stockpiles, and inoperable RWIS sites. She and the chief of operations get on the phone with their own RWIS person and find that they, too, have an issue with reliability of sensors. They use the "Find a Person" feature to locate the right contact person at appropriate states, and call the contacts to see how they responded to the recommendations, get a copy of the training materials, and ask how they are addressing the RWIS issue. The assistant then adapts the training materials (only minor changes needed) and uses the "Submit Resources" feature to post the adapted training materials to the portal. She also goes to the "Community of Practice" area, finds the NTIMC traffic incident management community of practice, and adds a comment pointing others to the consultant report and the training materials that were posted.

Scenario 3: Public–Private Partnerships

Scenario: A state-level joint legislative subcommittee is appointed to study use of competitive bidding practices for public-private partnerships (PPP) in the United States and internationally and to recommend changes in the state's existing legislation to encourage more competition. Legislative staff is charged with preparing a scope for this study and identifying national experts to provide assistance.

TKN Value Provided: Legislative staff use the transportation information portal and quickly find the FHWA PPP Web site, which includes a state-by-state analysis of legislation. They use the portal's clipping service to review articles about competitive bidding practices in Canada, Australia, India, and China. The staffers use the directory to locate relevant contacts in several states to learn more about their procurement practices. They also contact those involved in several projects in Canada. Three of the people contacted are willing to testify before the committee.

Scenario 4: Safety Improvement Prioritization Methods

Scenario: A county traffic engineer with 40 years of experience retires, taking with him an encyclopedic knowledge of the road system and its "hotspots," an intuitive feel for how to make best use of available safety dollars, and a strong personal network of contacts in neighboring jurisdictions and other agencies. His replacement, a young engineer, is looking to implement a data-driven approach to identifying and prioritizing safety improvements.

TKN Value Provided: The young engineer goes to the transportation information portal to look for models and resources. He identifies a program description and simple software application for prioritizing countermeasures from a similar rural county, which he is able to adapt for his needs.

CHAPTER 4

Business Plan Summary

Overview

The business plan for implementing Transportation Knowledge Networks (TKNs) includes an executive summary and three substantive sections:

- **The Context for TKNs**—describes why TKNs are needed.
- **The TKN Concept**—presents history of the TKN concept; defines the purpose and functions of TKNs, proposes a framework for measuring success of future investments in TKNs; defines the market, products, and services to be provided; and describes the stewardship model to be utilized for delivering these products and services.
- **Costs and Funding**—provides a breakdown of annual funding needs by function.

Each major section is summarized below. The full business plan is attached in Appendix A to this report.

Context for Transportation Knowledge Networks

The business case for TKNs is grounded in the need for innovation and rapid development of solutions to critical changes in transportation, including inadequate funding, increasing inflation, congestion, deteriorating infrastructure, unacceptable highway fatality rates, and heightened risks of natural disasters and terrorist attacks that necessitate stronger emergency response and evacuation systems. Moreover, these issues must be addressed in an increasingly constrained and dynamic environment of economic crisis, climate change, and concerns about dependence on fossil fuels. Ability to meet these challenges depends on expeditious discovery and implementation of new technologies, programs, and methods. Rapid dissemination of research findings, technology developments, lessons learned, and actionable information is needed to ensure the necessary pace of innovation and change.

Transportation lags behind health (and other fields) in providing a well-supported information infrastructure to ensure that any level of research investment is providing maximum value, and in ensuring that beneficial innovations occurring within individual organizations (outside of research and development efforts) are expeditiously documented and disseminated to others. An improved information infrastructure addresses the ubiquitous problem of information overload, providing a means to speed discovery of accurate and relevant information. It also provides an ongoing mechanism to capture essential information not currently available within library catalogs or via Internet searches. The current wave of baby boomer retirements and an increasingly fluid workforce make improvements to knowledge capture and dissemination especially urgent.

Transportation Knowledge Network Concept

Purpose

The business plan describes the purpose of TKNs and the potential payoff from investments in transportation information sharing. TKNs are intended to improve peer-to-peer information sharing about successful practices; provide more efficient access to information resources including data sets, documents, and multi-media objects; and enable more efficient and effective conduct of research. They will help improve efficiency by making it easier for both researchers and practitioners to build upon and re-use existing work. Studies from IDC and Outsell are cited that document monetary savings from information services. The IDC and Outsell findings attribute these savings to (1) reducing the amount of time needed to locate information and (2) using information discovered to avoid or reduce costs that would otherwise have been incurred without the information.

Examples of how information services produced clear payoffs are also provided from the 1998 FHWA report on the

value of information services, *TR News,* and the Library Connectivity Pooled Fund Study.

Performance Framework

The performance framework in the business plan consists of a mission statement, goals, and performance measures for TKNs. The mission statement is:

> Support and sustain a network of transportation information providers . . . to collaborate and leverage collective resources . . . so that they can provide transportation professionals with timely and convenient access to relevant information . . . that enables faster progress toward meeting critical transportation challenges.

Goals are:

- Achievement of a noticeable improvement in information access as perceived by transportation professionals;
- Greater collaboration across transportation information producers and providers that leads to improved resource sharing;
- Preservation of valuable transportation resources that are at risk due to retirements, employee turnover, agency moves, and other factors; and
- Capacity building within the transportation information provider community.

Recommended performance measures cover four categories:

- End user market penetration and benefits—user awareness of TKN services, user-reported benefits from TKN services, changes in access time, and cost for a standard "basket" of information goods.
- Information provider involvement and benefits—TKN membership levels and reported benefits from members.
- Shared information resources—percentage of unique transportation library holdings that can be discovered via available search tools; percentage of active and completed research projects that can be discovered; adoption of standards and practices for interoperability of transportation information.
- Product and service accomplishment vs. targets—achievement of specific targeted products and services.

Market

The business plan identifies the *potential* market for TKNs to include a broad set of public and private sector organizations involved in funding, planning, and providing transportation in all modes and in R&D that supports improved transportation practice. It suggests that the TKN initiative begin with a focus within a limited market and subsequently expand to include additional markets once initial infrastructure is built and success is demonstrated. The initial market segment should be one where clear and significant benefits of investment can be demonstrated, where resources can be secured, and where there is already some level of awareness of and support for the TKN concept. Based on these criteria, possible target organizations are FHWA, state DOTs, UTCs, MPOs, LTAP/TTAP Centers; and professional associations that represent or serve members of these organizations. Target customers or end users for TKNs are senior technical and management staff within DOTs and directors of UTCs, MPOs, and LTAP/TTAP Centers.

Products and Services

The business plan identifies ten key functions for TKNs that enable the national network of transportation information providers to achieve the mission and realize the vision of the strategic transportation information infrastructure. These include print and digital transportation information repositories, a national portal including specific information modules and a federated search capability, development and maintenance of standards to facilitate information sharing and discovery, outreach and coordination to transportation information providers, and end user outreach and education. See Chapter 3 of this report for a description of the TKN products and services that were included in the business plan.

Stewardship Model

The stewardship model for TKNs includes three elements: a national coordination function, regional TKNs, and an advisory board. In developing the stewardship model, the research team took the recommendations of *TRB Special Report 284* as "givens"—that is, we began with this three-tiered structure.

National Coordination Function. The research team examined several options for where the TKN-NCB (TKN National Coordinating Body) might be housed. Among those options, the NTL already has established relationships with the transportation library community and is playing a key leadership role in assisting with regional TKN formation and implementation of the digital repository. Similar national coordination functions for the fields of agriculture and medicine are being served by the NAL and the National Library of Medicine. If the NTL were to become the TKN-NCB, then it could also serve as the federal TKN, working to improve coordination and information sharing within U.S.DOT and with other federal agencies. In order for the NTL to be successful in this coordination role, the business plan concludes that the TKN-NCB would require a stable source of dedicated funding for the TKN coordination functions. Specific staff functions are defined (which could be provided by in-house or contractor resources), including management and coordi-

nation, information architecture, standards and cataloging, collection management, information systems management, and user services.

Regional TKNs. The outreach conducted for the business plan found that the need for regional TKNs was not broadly understood or accepted. There were questions about why a regional approach was required given today's technology for information sharing and whether this approach might create unnecessary layers of coordination and bureaucracy. The arguments for retaining the regional TKNs are compelling, however. Regional TKNs ensure substantive stakeholder involvement in TKN service provision. They provide a greater level of strength and stability to the network by offering opportunities for leadership development and innovation within the transportation information provider community. This makes the network more resilient, which reduces its vulnerability to departures of key individuals. Regional networks also allow for leverage of existing interagency relationships and regional gatherings and more focused outreach activities than are possible at the national level.

The business plan acknowledges that three regional TKNs are up and running, providing an initial foundation for the network. Current TKNs operate under an informal model in which there is no membership fee, leadership is rotated among the membership, and each member is asked to commit to some level of information sharing but active participation is voluntary. The business plan suggests that the regional TKNs may evolve toward more formal models involving formation of nonprofit associations and development of specific service offerings to members. It allows for a range of organizational models to be followed, depending on the needs, goals, and resources of the members. Membership in a TKN could entitle an organization to apply for grants from the national coordination function to develop information products and provide services. These grants could be made for outreach and delivery of specific products and services that have a national benefit. They could be awarded in response to specific proposals for development of products or services (e.g., to digitize a collection and make it available to the entire transportation community) rather than on a formula basis. The national coordination function would need to develop criteria in its solicitation package that reinforce collaborative efforts across TKN members who use these funds.

TKN Advisory Board. With respect to the advisory board, TRB SR 284 recommended a governance body for TKNs be created by modifying the Advisory Council on Transportation Statistics (ACTS) to broaden its membership, focus, and reporting functions. A RITA representative suggested that instead of modifying the legislatively mandated charter for the ACTS, an independent stakeholders' council could be established with representation from AASHTO membership, academia, and other national libraries. The business plan outlines the advantages of a separate advisory board rather than altering responsibilities of the ACTS.

The primary role of the advisory board would be to ensure that the national coordination function uses broad stakeholder input as it allocates available resources and makes decisions on specific product and service offerings. The business plan describes an advisory board with up to 13 members, including representatives from a broad cross section of stakeholders, which could include AASHTO, TRB, a state DOT library, a university transportation library, a UTC, a transportation engineering or consulting firm, an LTAP/TTAP Center, the Special Libraries Association–Transportation Division, and a representative of the NAL (to provide an external perspective and lessons learned from similar undertakings). The plan suggests that the board meet quarterly, and that it produce an annual or biennial assessment of TKN performance.

Chapter 6 of this report (Implementation Plan) outlines two approaches that might be considered for formation of this advisory board: It could be established by the U.S.DOT following provisions of the Federal Advisory Committee Act (FACA), or it could be established by a non-governmental organization such as the National Academy of Sciences (following requirements under section 15 of FACA.)

Costs and Funding

The total estimated average annual funding needs (over a 5-year period) to implement TKNs is $13.5 million. The business plan provides estimates of how these costs break down by the ten TKN products and services, but notes that the actual allocation of a given budget across functions could vary considerably. The estimated breakdown is:

- $7.9 million for providing content that will be accessible via the central portal from both national sources and collaborative efforts of federal, state, and local knowledge network participants.
- $3.1 million for the technical and administrative infrastructure, including standards coordination and thesaurus maintenance.
- $1.5 million for outreach and education.
- $1 million for research and literature review services.

While the national coordination function should work with the advisory board to determine the best allocation of available resources, rules of thumb based on the analysis conducted for development of the TKN business plan are:

- Half of the funds ($6–7 million) would be for grants to regional TKN members for development of content, providing research and literature review services, coordination and outreach to information providers, and end user out-

reach and education. The national coordination function would consult with the advisory board and establish policies for eligible activities and program priorities each year. Based on these priorities, the board would develop a solicitation package. TKN members respond to this package and grants would be awarded competitively based on the merits of the submittals.

- The remaining funds would be for the National Coordination Body. Funds would be split (in roughly equal parts) for staffing (combination of contracted and in-house resources), purchase of access to commercial information sources and services, and direct costs (including hardware, software licenses, storage fees, shipping, travel, and specialized services).

CHAPTER 5

Summary of Transportation Knowledge Network Outreach Activities

Overview

The ability to move forward with the vision for TKNs depends on establishment of a broad base of support within the target market segments. The outreach strategies implemented in this project began the process of building this support.

A central element of the outreach strategy was to identify and enlist a network of key champions who understand the vision and the benefits to be gained from TKNs and who are in a position to advocate for TKN implementation. This network of key champions could include representatives of the target markets to be served: U.S.DOT Administrations, state DOTs, MPOs, universities, and LTAP/TTAP Centers. It could also include RITA and NTL representatives who would play a leadership role in TKN effort. The focus of the outreach activities has been state DOT leadership and planners and the leadership of the UTCs.

Members of the transportation library and research communities bring a greater degree of support for enhanced information services and greater familiarity with the TKN concept than others within the target market organizations. Those in senior management positions need to be educated about what TKNs are, what services they will provide, and how these services will benefit their organizations. Therefore, the focus of the outreach activities was on education about TKNs outside of the library and research communities.

Key outreach activities included the following:

- A communications toolkit was developed that includes presentations and briefing materials for use by those involved in outreach activities.
- The content of the business plan was publicized on a project Web page and key audiences were notified about the materials through targeted e-mail lists.
- Briefings about the TKN initiative were provided at selected transportation conferences and meetings including the TRB annual meeting, the AASHTO spring meeting, and the CUTC annual meeting.
- One-on-one briefings were conducted with senior transportation managers who are in a position to champion the TKN initiative.
- A focus group was held to obtain detailed feedback on the TKN portal concept.

Outreach Activities and Deliverables

Specific actions and deliverables undertaken are summarized below. Detailed outreach materials are provided as appendices to this report.

Action Step 1—Develop Communications Toolkit

Objectives: Develop materials for team and panel members to use with key stakeholders. Publicize the project and the communications toolkit within the transportation community.

Deliverables:

- Web site for the NCHRP 20-75 project, including FAQs, related links, the draft business plan, and the outreach materials (presentations, one-pager, audio testimonials).
- Project Overview. This overview was originally developed for the January 2008 TRB annual meeting, and was subsequently refined for use at the AASHTO SCOH meeting in May 2008, and for individual interviews and focus groups in July and August 2008. A shorter version was developed for use following completion of the project.
- Mock-up of the home page of a one-stop shopping portal Web site.
- Overview presentation of the TKN business plan.
- Two narrated slideshows illustrating how TKNs could help in two information-seeking scenarios, one on incident response and the other on mileage-based user fees.
- Audio testimonials from four leaders in the transportation community and an associate professor at the School of

Information Studies at Syracuse University about their perspective on the need for TKNs.

Action Step 2—Outreach at Professional Meetings

Objectives: Create awareness of and support for the business plan among key stakeholders.

Deliverables:

- Informal briefings on the project at the AASHTO Information Systems meeting and the AASHTO Standing Committee on Quality meeting.
- Briefing at the LIST Committee meeting at the summer TRB meeting.
- Presentation about the TKN business plan at a Transportation Library Connectivity Pooled Fund Study annual meeting.
- A one-page overview of the business plan distributed at several meetings during TRB week.
- Materials prepared for a project briefing at the AASHTO spring meeting of the SCOH.
- A brief (four question) follow-up survey of AASHTO SCOH was conducted to obtain feedback on the TKN concept. Twenty-eight responses were received. Full results are included in Appendix D. Key findings were as follows:
  - 86% of respondents felt that a transportation knowledge network/information portal will add value for transportation agencies; remaining respondents answered "don't know" to this question.
  - The three most compelling arguments (of nine options provided) for TKNs were (1) providing one-stop shopping to make searching for transportation information easier, (2) creating opportunities to reuse/adapt analysis tools and reports developed at peer agencies, and (3) improving ability to keep up with what peer agencies are doing.
  - The least compelling arguments were (1) current investment in transportation information services is very low compared to other fields and (2) the need and ability to capture institutional knowledge before employees leave or retire.
- Presentation was delivered at a CUTC meeting.

Action Step 3—Hold a Focus Group for a Specific Target Market

Objectives: Walk through the portal concept with a group of transportation professionals to find out what features and content they would find most valuable and educate them on the efforts under way to develop a portal and services.

Deliverables:

- A focus group was conducted via conference call and the Internet. The purpose of the call was to gather reactions to (1) elements of the business plan, (2) tools that could be developed to assist in the search for information, and (3) the process for procuring and maintaining information resources. The invitation was sent initially to about twenty members of the AASHTO Standing Committee on Planning (SCOP). Three states responded, and members of the research team followed up with others to obtain representation from five states. Planning representatives from Alaska, Idaho, Michigan, Oregon, and Virginia DOTs participated in the focus group.

  Generally, the participants liked the idea of TKNs and an information portal, provided the resources were available to develop and maintain them. All emphasized the need for sharing of information with peers and the importance of the portal being comprehensive and up to date. Topic areas of interest included revenue generation, privatization, climate change, reauthorization, and multimodal tradeoffs. One participant suggested that having multiple individuals involved in leading topics would provide a balanced and diverse set of perspectives. Some discussion arose regarding the regional TKN model. Participants understood that this could be an effective way of building on existing connections across transportation organizations, but they raised question about whether three regions would be sufficient. Participants also pointed out a need for incentives and simple processes for information sharing, indicating that everyone knows it is the right thing to do, but that it is difficult to make time for it.
- See Appendix E for the full summary report.

Action Step 4—Individual Meetings with Key Stakeholders

Objective: Facilitate a common vision and ownership of the business plan among identified key stakeholders.

Deliverables:

- Talking points and specific questions about the political, financial, and marketing challenges.
- Individual briefings between research team members and representatives from the following agencies: KDOT, PennDOT, Mn/DOT, CalTrans, and the University of Texas Center for Transportation Research.

CHAPTER 6

Implementation Plan

In some respects, implementation of Transportation Knowledge Networks is already under way, albeit at a relatively modest level of activity. As additional resources become available, implementation can be stepped up to the level necessary to make a noticeable improvement in information access as perceived by transportation professionals. Steps 1–4 below could be undertaken immediately by existing bodies such as the NTL, the current regional TKNs, the AASHTO RAC TKN Task Force, and the Library Connectivity Pooled Fund Study project to continue to make progress in building knowledge networks and communicating their purpose and potential value to the user community. When and if additional funding becomes available for TKNs, steps 5–8 outline the activities needed to initiate and sustain delivery of the products and services outlined in the business plan.

Step 1: Refine and Expand the Communications Toolkit

Communication materials developed for this project should be made available as resources for continuing outreach efforts. These materials include the audio testimonials, the one-page overview of the business plan, the narrated presentations, and the Web portal mock-up. These materials can be expanded (as resources permit) to add testimonials, case studies, and more detailed fact sheets on different components of the business plan.

Future communication activities should refine key messages based on what was learned from the outreach phase of this project. The outreach activities indicate recognition of the need for improved information sharing and access and general support for the concept of TKNs. The most compelling arguments for investment in TKNs, defined as those that resonated most with the stakeholders interviewed by the research team, were:

- Providing critical information in time-sensitive situations such as weather emergencies or economic crises;
- Providing efficiencies and preventing duplication of effort by sharing information that addresses needs that are common across transportation agencies;
- Addressing the loss of institutional knowledge related to turnover of highly experienced employees;
- Supporting innovation and high-priority program areas—helping organizations learn from each others' successes in order to improve performance in areas such as transportation safety, emergency preparedness, and organizational efficiency; and
- Filling gaps in current information availability by allowing easy sharing of a broader set of resources, including consultant studies, data, software tools, and current contact information.

However, given the extremely tight funding situation and multiple competing needs among existing programs, building a stronger and broader base of support will require extensive communication about TKN products and services and the value they provide. Key questions and concerns raised were:

- This initiative may be perceived as adding one more information source to the already large pool of sources. How will this be different?
- What mechanisms will be used to provide comprehensive and unbiased information on the portal and to keep it from getting stale?
- What incentives could be provided to people to get them to share information, which takes time and effort and does not benefit them directly?
- The initiative is very broad and should be more narrowly focused on particular sub-communities, topic areas, and types of information.
- Greater specificity behind the estimates of funding requirements is needed.

Based on these comments, future outreach activities for TKNs should emphasize that the purpose of this initiative is to

strengthen the infrastructure for information sharing and make existing information more findable. Rather than "adding one more information source," the TKN coordinating function will tap into existing information sources, making them more easily accessible to those outside of the particular communities for which they were developed and reducing duplication of effort. TKN members will identify and leverage topically based information-sharing initiatives within various communities.

Future outreach activities should cite examples of existing information clearinghouses that are currently providing significant value within communities of interest. They can point out how the national TKN portal will support and strengthen these existing clearinghouses, serving as a "clearinghouse of clearinghouses." Examples of existing clearinghouses include:

- The Transportation and Climate Change Clearinghouse (*6*)—a one-stop source for information on "greenhouse gas (GHG) inventories, analytic methods and tools, GHG-reduction strategies, potential impacts of climate change on transportation infrastructure, and approaches for integrating climate change considerations into transportation decision making." This national site was updated under NCHRP Project 25-25, and the regional TKNs augmented the information by collating state resources to add to the site. The site is being maintained by the U.S.DOT and NTL.
- The National Work Zone Safety Information Clearinghouse (*7*)—a clearinghouse of information on work zones, including work zone fatality data, expert contacts, regulations, research, standards and practices, and training courses.
- The AASHTO Innovative Finance for Surface Transportation Clearinghouse (*8*)—containing information on innovative financing practices, organized topically and by project. This site was originally developed through an NCHRP project and is currently being maintained by AASHTO with support from FHWA.
- The AASHTO Center for Environmental Excellence (*9*)—a one-stop shop providing access to resources for "transportation professionals seeking technical assistance, training, information exchange, partnership-building opportunities, and quick and easy access to environmental tools." The Center is supported by AASHTO and FHWA and is guided by an advisory board of state DOT and FHWA representatives.
- The Travel Model Improvement Program (TMIP) Clearinghouse (*10*)—a clearinghouse of information in support of the TMIP's mission to "advance the state of the practice of travel modeling and planning analysis." The TMIP Web site includes topically organized links to information resources. Each topic has an advisory panel. The TMIP includes an e-mail list of modeling community members to push information of interest and facilitate peer exchange. The Web site is sponsored by FHWA and maintained by a contractor.
- The MRUTC Maintenance Quality Assurance Resource Site (*11*)—contains a collection of manuals, presentations and training documents on application of maintenance level-of-service approaches in different states.

Outreach materials can also document similar initiatives in order to provide concrete examples of what a transportation information portal might look like. One such example is the European Union Transport Research Knowledge Center (*12*). With funding from the European Commission's Directorate General for Energy and Transport, a consortium of organizations collects standardized information about research projects and programs and makes this information accessible in a Web portal. Researchers can submit information about projects, events, or links on their own. Information resources are searchable by sector, geography, mode, policy objective, and tool type. Individuals and organizations are encouraged to become part of the "Transportation Research Knowledge Community" and participate by sharing their information resources and providing input on user information needs. While this example is focused on research projects, it does show how an organized effort to identify, qualify, and categorize information resources across multiple topic areas can be structured.

Success of the TKN initiative depends on funding to support professionals who will drive the information-sharing activities at national and regional levels and who will ensure that information on the portal is refreshed continually for different topic areas. Reliance on purely voluntary information-sharing efforts or efforts that do not incorporate appropriate performance competencies will have limited effectiveness. Funding is needed to ensure an active and sustained level of coordination and networking.

Step 2: Continue Outreach

Continuing outreach activities will sustain momentum achieved to date and raise broader awareness of the value that can be provided from a well-supported, sustainable TKN function. Outreach could be carried out by all stakeholder organizations, including AASHTO and TRB committees with knowledge and interest such as the AASHTO RAC TKN Task Force, the Transportation Library Connectivity Pooled Fund Study, members of the existing regional TKNs, the TRB Committee on Library and Information Science for Transportation (LIST), and the TRB Data Section. A single coordinator can be designated for continuing outreach activities to maintain consistency and avoid duplication. A standard outreach activity summary sheet can be developed so that a record of each meeting can be maintained and shared among those involved in outreach.

The research team recommends using a combination of the techniques employed within this project, including one-on-one sessions with key influential decision makers, briefings at

AASHTO committee meetings (ideally finding a trusted committee member to deliver the briefing), briefings at professional meetings, and focus groups with practitioners. In addition, each state DOT librarian and/or research director should brief senior management on the TKN initiative and its potential benefits.

Step 3: Use the Directory Project to Build Awareness of TKNs

Use the continuation of NCHRP Project 20-75—Directory of Transportation Libraries and Information Centers—to extend the breadth and depth of the existing TKN networks and to create broader awareness of the TKN initiative. The directory will include transportation libraries, information centers and data offices in U.S.DOT, state DOTs, transit agencies, MPOs, universities, professional associations, and private firms. As part of this initiative, summaries of the TKN business plan, with links to the outreach materials prepared as part of the NCHRP 20-75 Project, can be distributed.

Step 4: Implement Pilot TKN Products and Services and Measure Results

Prior to availability of new funding, continue to use existing resources (e.g., NTL staff, Transportation Library Connectivity Pooled Fund Study, volunteer efforts of TKN members) to implement practical, achievable initiatives that improve information access through collaborative effort. Examples include the National Transportation Library TKN Resource Sharing Network Project; Northwestern University's free document delivery service for TKN members; the Eastern TKN's digital collaborative project, in which each member organization is digitizing and making available five key information resources for inclusion in the NTL's digital repository, with a live link from TRIS; and augmenting existing clearinghouses with additional information such as climate.dot.gov.

The research team suggests tracking services implemented and results achieved at a national level. Information on implemented programs should be part of a knowledge base, providing a set of models that can be drawn upon in the future. Information on program use and effectiveness can be maintained to strengthen TKN outreach materials and to provide input for future investment decisions.

Step 5: Create TKN Advisory Board

Once funding becomes available, TRB SR 284 recommended creating an advisory board for the TKNs. The advisory board would meet regularly and provide a channel for stakeholder input and advice on how to make best use of available funds. It would provide periodic assessments of performance and effectiveness for the national TKN coordination function. At the first meeting each year, members could review and comment on the national coordination function's strategic plan (including target activities and resource allocations.) Targets and reported progress could be evaluated at other meetings. The advisory board might also be charged with conducting an annual or biennial independent assessment of TKN performance. Initial membership of the advisory board might include key stakeholders such as the following:

- Three to four representatives, selected from the following AASHTO committees: Standing Committee on Research (SCOR), Standing Committee on Highways (SCOH), Standing Committee on Planning (SCOP), Standing Committee on Performance Management (SCoPM); and the Standing Committee on Finance and Administration Subcommittee on Information Systems (AASHTO IS);
- One MPO executive director;
- One member of the National LTAP Association (NLTAPA) executive committee;
- One member of the Special Libraries Association Transportation Division executive board
- One engineering/consulting firm representative;
- One University Transportation Center director;
- One university transportation library director;
- One state DOT library director;
- One Transportation Research Board representative; and
- One representative from the National Agriculture Library or other non-transportation organization (able to provide an external perspective and lessons learned from a similar undertaking).

The advisory board could have flexibility to be reconstituted, for example, to include more multimodal (transit, air) representation. Members could serve staggered 3-year terms to provide continuity.

The advisory group could be established by the U.S.DOT, the National Academy of Sciences, AASHTO, another relevant industry association, or some combination thereof.

Once established, the TKN advisory board could provide input to the allocation of initial year resources and establishment of priorities for information product and service development. Subsequent quarterly meetings could focus on review of accomplishments and performance and provision of feedback from the stakeholder community. The advisory board could also be responsible for an independent assessment of TKN performance, to be conducted annually or biennially.

Step 6: Develop a Detailed Program Plan and Budget

The TKN National Coordinating Body would designate a TKN program manager charged with the responsibility for developing a detailed program plan and budget that matches

with available funding. The program plan should include the following ten products and services, consistent with the business plan. Specific activities are listed in Table 1 for each of the products/services that can be used as a starting point for budgeting.

Ideally, the plan would also include a performance measurement element based on the goals, objectives, and performance measures listed in the TKN business plan. A methodology for evaluating each product and service component should be established, and a staff (or contractor) resource should be devoted to data collection, monitoring, assessment, reporting, and recommendations for future adjustment based on results.

The elements listed in the table were used to develop the estimated need for $13.5 million annually to provide this package of products and services. See Chapter 4, Business Plan Summary for further information on how these funds break down by product and service category, and by expenditure type (grants, staffing, access to commercially available information content and direct costs).

Step 7: Program Start-up Activities

Once the program plan and budget are developed and approved, the TKN-NCB could proceed with the following start-up activities:

- Developing and formalizing the staffing plan and job descriptions,
- Hiring staff and contractors,
- Developing policies, procedures and guidelines,
- Developing a communication plan,
- Developing the initial solicitation package for TKN grants,
- Developing a contract for requirements, design and development of the portal,
- Developing management controls to ensure that activities are properly sequenced and coordinated and that planned versus actual progress is closely monitored, and
- Developing performance tracking templates and reporting systems

Step 8: Initial Implementation

Following approval of the program plan and a 6- to 9-month ramp-up period, the TKN-NCB would be in a position to move forward with initial activities in most of the ten product and service areas. Contracts with regional TKN members would be in place as well. Initial activities to be undertaken at the national and regional TKN levels would be scheduled to culminate in the launch of the new portal. This would involve coordinated development of information modules to be included in the portal, as well as development of communications materials describing all product and service offerings.

After the initial launch of the portal, a regular schedule of rollouts of new material could be established, with accompanying communications targeted to appropriate segments of the end user community.

Table 1. Products and services providing a starting point for TKN budgeting.

Product or Service	Description	Program Plan Elements
1. National Digital Repository – including documents and data	Expansion of the current NTL Digital Repository.	Develop policies and procedures for digital collection development and management. Evaluate and implement hardware/software/telecom infrastructure changes to accommodate new content and backups. Implement and monitor digital preservation services (Meta-Archive + LOCKSS). Evaluate and fill staffing needs (system manager, catalogers, digital preservation specialist).
2. National Print Repository	Physical preservation of nationally significant transportation information resources.	Develop policies and procedures for collection development and management. Investigate and arrange for off-site storage and document shipping services. Evaluate and fill staffing needs (curator/archivist, digitize on-demand service fulfillment).
3. National Transportation Portal with Federated Search	Actively moderated and managed portal providing one-stop shopping access to information.	Develop specific requirements. Evaluate technical architecture and software options for the portal and federated search feature. Plan for hardware/software needs. Design and develop portal. Evaluate and fill staffing needs (portal manager/webmaster).
4. Information Modules	Pursue targeted projects at the national and regional levels to collect and digitize information resources in areas of historical or strategic significance.	Conduct outreach and establish initial priority areas. Develop TKN grant program guidelines (covering components 4, 5, 7, 8, 9, and 10). Investigate and negotiate access to commercial information resources (databases, journals, news feeds, standards). Investigate and arrange for access to publicly available information resources (e.g., data clearinghouses). Evaluate and fill staffing needs: planning and coordination, grant administration.
5. Research/ Literature Review Services	Research and literature review services and search assistance via the national portal discussion forum, e-mail, phone, or messaging.	Develop service description and evaluation criteria. Develop outreach materials. Implement pilot program. Evaluate pilot program. Expand program to include TKN member participation via grants (pending results of evaluation). Evaluate and fill staffing needs (reference librarian, transportation data specialist).
6. Standards Coordination and Thesaurus	Provide technical leadership for widespread adoption of standards for information sharing (including data standards) within the transportation community. Maintain and expand existing thesaurus of transportation terms.	Develop 3–5 year work plan including thesaurus maintenance and expansion; data standards stewardship; liaison, coordination and outreach; communications; special projects. Evaluate adequacy of current software tools and changes in technology. Upgrade if needed. Evaluate and fill staffing needs (thesaurus team, data architect, outreach/coordination).
7. Targeted Collection and Digitization Efforts	Pursue targeted projects at the national and regional levels to collect and digitize information resources in areas of historical or strategic significance.	Conduct outreach and establish initial priority areas. Evaluate and fill staffing needs (planning and coordination, grant administration in conjunction with element 4).
8. Information Provider Outreach, Coordination, and Communication	Identify and develop leaders within the transportation information provider community; support coordination and synergistic activities across the provider community so efficiencies can be realized.	Develop standard outreach materials. Coordinate with regional TKNs. Evaluate and fill staffing needs (planning and coordination, grant administration in conjunction with element 4).
9. Library Connectivity Support and Advocacy	Provide technical support and advocacy for transportation libraries to enable sharing of resources and expertise, and coordination of collections development.	Sponsor annual meeting and quarterly/monthly webinars. Maintain/update transportation librarian toolkit. Negotiate/coordinate with OCLC. Coordinate with regional TKNs. Evaluate and fill staffing needs (planning and coordination, grant administration in conjunction with element 4).
10. User Outreach and Education	Provide outreach and education on accessing transportation information and information services geared both to managers and executives of transportation organizations and to end users of transportation information resources.	Develop standard training materials. Coordinate with regional TKNs. Plan and budget for travel/conference fees. Evaluate and fill staffing needs (outreach specialist, grant administration in conjunction with element 4).

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APPENDIX A

Transportation Knowledge Networks: A Business Plan

CONTENTS

Executive Summary

The Vision

Imagine a future where . . .

Lessons learned from any transportation organization are readily available to others facing similar challenges.

No transportation organization pays to reinvent the wheel—it is easy to find out what has been done before.

It takes minutes, not hours or days to find current, relevant, and accurate information about any transportation-related topic.

A wealth of convenient information is at your fingertips—a consolidated calendar of transportation-related conferences, a directory of software products currently in use at transportation agencies, up-to-date contact information for your counterparts in peer agencies.

A secure national archive is in place to hold important documents and data sets for transportation professionals of today . . . and tomorrow.

This vision can become a reality if a critical mass of transportation leaders from the public and private sectors see its value and work together to make it happen. This business plan describes the opportunity, the strategy, and the value proposition for moving transportation information access into the 21st century. It shows how following established models from the medical and agricultural fields can provide a method for information sharing among transportation professionals that combines the best features of centralized and decentralized approaches. It also dispels the myth that good information access will happen on its own, without any deliberate and coordinated action on the part of the transportation community.

This business plan was motivated by a sense of urgency. There are overwhelming challenges to be addressed in transportation over the coming decade. Access to high-quality, relevant information on demand is critical to our ability to address these challenges. Our increasingly "born digital" workforce is expecting a well-functioning information infrastructure to fuel the significant level of future innovation and agility that will be needed to keep our transportation systems functioning safely, efficiently, and effectively.

Over the past five years, there has been growing interest across the transportation community to provide a stronger, more coordinated approach to information access and availability for transportation professionals. Studies have been conducted. Models from other fields have been researched. A blue ribbon panel has developed and endorsed the approach. Grass roots efforts to make it happen are well under way. Now it is time to put sufficient resources behind it, move forward, and realize the benefits.

The Opportunity

Current technology allows us to find and download information resources held by organizations around the world. Libraries are linking their collections into global catalogs. Universities are implementing digital repositories to provide timely access and long-term preservation for research data and scholarly works. Numerous organizations have blogs, wikis, and content management systems that allow users to easily post or publish their own content. Desktop search tools serve up content in a quick and easy way.

This technology comes with the blessing of an unprecedented level of information access from our desktops—and the curse of information overload. Based on a national survey conducted for this business plan, transportation professionals are experiencing information overload in spades and crave a "one-stop shopping" source of information. Most don't want to become experts in how to navigate the myriad Web sites and data sources that are available. Many are concerned about trying to find a "needle in a haystack" using an Internet search for specialized information, and about the quality and completeness of the information they may find. Person-to-person communication is still the primary means of getting an answer to a question. This technique will always be used, but it clearly has

limitations given the amount of information that is out there—even for a very specialized topic area.

The transportation community has the opportunity to work collectively to harness the power of current technology to dramatically improve our ability to find the information we need, when we need it. A collaborative effort makes sense given our common information needs and the enormous value that can be derived from convenient access to consistently organized information from experts and peers.

Given current changes in the transportation workforce, including the loss of many career professionals due to retirements, transportation organizations are seeking ways to better preserve and provide access to their institutional knowledge and to help get new employees up to speed as quickly as possible. In addition, many organizations increasingly rely on contracted services or partnerships for maintenance, operation, and management—and need to develop new mechanisms for sharing information with their partners.

Each transportation organization is now working on an individual basis to manage its own information resources—including plans, policies, procedures, performance data, consultant studies, photographs, maps, traffic counts, crash data, and facility inspection reports. Even though the information content is similar across organizations, there are, for the most part, no common ways of tagging, organizing, or structuring this information. A strategically focused, collective effort to facilitate information sharing across organizations could offer tremendous support and added value to these internal efforts. It could provide tools, standards, and processes for organizing, archiving, and accessing information resources, without the need for duplicative investments on the part of individual organizations. It could open up new avenues for agencies to learn from their peers without waiting months or years for a case study or synthesis report to be published. In transportation, we have only scratched the surface of what can be achieved in the information-sharing arena, and we don't realize what we are missing. Transportation is well behind other fields that have invested in a common information infrastructure to meet their specialized needs.

The Strategy

A strategy has been developed to make meaningful, measurable progress over the next five years. The first, critical step is to set up sustainable institutional structures for information sharing in transportation. This involves the following three components:

- **Establish Regional Transportation Knowledge Networks (TKNs)**—groups of transportation organizations (for example, state DOTs, MPOs, Transit Agencies, and engineering firms) that work together to share their information resources and collaborate on information access improvements.
- **Establish a TKN National Coordinating Body (NCB)**—responsible for developing national infrastructure for transportation information sharing, and for leading and supporting TKN activities. As outlined in *TRB Special Report 284,* the TKN-NCB could serve as a national TKN, working with federal agencies such as the Bureau of Transportation Statistics (BTS), U.S.DOT modal administrations, as well as other federal agencies such as the Environmental Protection Agency and the Department of Energy. This TKN-NCB would require stable, dedicated funding to successfully carry out these responsibilities.
- **Establish an Advisory Board with senior transportation community representation** to provide strategic direction and ensure accountability.

Once these institutional structures are established and funding is secured, specific information products and services can be developed and rolled out. The TKNs will identify needs and opportunities for information sharing among their member agencies. The advisory board will provide direction for allocation of resources among competing needs. The TKN-NCB will provide technical leadership and manage product and service development. The TKN members will implement information sharing initiatives, making use of the products and services developed.

This strategy was designed to provide a robust and sustainable infrastructure for information sharing in transportation. TKNs ensure responsiveness to user needs through substantive and broad participation throughout the transportation community. The TKN-NCB's national TKN coordination function provides a focal point for action, minimizes duplication of effort, and maximizes synergies and collaboration among participants. The advisory board provides independent oversight for the effort to ensure that progress is being made and resources are being well spent.

The Target Market and Projected Benefits

TKNs are envisioned to extend to the entire transportation community but the first target groups are state DOTs, FHWA, University Transportation Centers (UTCs), Metropolitan Planning Organizations (MPOs), LTAP/TTAP Centers, and professional associations that serve these markets.

If this strategy is implemented, then transportation professionals will see a noticeable improvement in their level of access to relevant, current information when they need it. Transportation organizations will be able to draw upon a rich knowledge base from their peer agencies and will be better equipped to manage their own information resources. Agencies will be

able to easily showcase their successful programs or practices, enabling others to quickly learn about these successes and apply lessons learned to their own initiatives. The end results will be improved performance, improved efficiencies, and avoidance of unnecessary costs for studies that have already been done, or for building software already available off-the-shelf. Current transportation libraries and information management units will benefit from networking, resource sharing, and capacity-building opportunities. Those organizations unable to provide these functions internally will be able to tap into shared information services.

The Costs and Funding Model

Required funding for the TKN initiative is $13.5 million annually over a five-year period. This level of funding is roughly half of the National Library of Agriculture's budget, and less than 4 percent of the National Library of Medicine's.[1] The funding would flow to the TKN-NCB, which would contract for services as needed to develop and/or provide information products and services. Roughly 50 percent of the available funds would be made available to support activities of the TKNs and/or their members for outreach and delivery of specific products and services that have a national benefit.

[1]Figures are for 2005 budgets, as reported in *TRB Special Report 284.*

The Value Proposition

This business plan responds to the need for an improved, coordinated approach to information sharing among transportation professionals using 21st century technologies and organizational models for collaboration and partnerships. Investments in a national TKN will yield benefits that far exceed their costs and are an essential component of a much broader nationwide strategy that will be needed to address the significant challenges that transportation professionals will be tackling in the years to come. TKNs will enable rapid delivery of reliable information to transportation professionals when they need it, enabling them to carry out the mission-critical goals of their organizations, and remain on the cutting edge of new research and technologies.

The Context

Unprecedented Challenges in Transportation

Transportation organizations are currently faced with an extraordinary set of challenges as they work to sustain and improve the mobility that is essential to our economic well-being, way of life, and security. We are experiencing high levels of congestion across all modes of transportation, which are expected to get much worse based on current population projections and trends in international trade. We continue to have unacceptably high fatality levels on our nation's highways—over 42,000 people died on the road in 2006. We face a mammoth infrastructure crisis with increasing risks of structural failures, facility closures, and traveler delays as the gap between preservation and replacement needs and available resources widens. There are serious and growing concerns about our vulnerability to both natural disasters and terrorist attacks, and our ability to rapidly marshal and deploy the resources needed for large-scale emergency evacuations. The transportation sector is a major consumer of petroleum-based fuel (accounting for over 66 percent of U.S. consumption) and a contributor to greenhouse gas emissions (accounting for over one-third of energy-based CO_2 emissions). Major shifts in technology and travel behavior will be required to address growing concerns about dependence on fossil fuels, air pollution, and climate change. Our ability to address these issues is severely constrained by the nation's economic crisis, the shrinking resource pool for transportation, underinvestment in R&D, and challenged institutional capacity to adjust to new roles and ways of doing business.

Need for Innovation

Our success in meeting these seemingly insurmountable challenges will depend on our collective ability to expediently discover and implement new technologies, programs, and methods. "Business as usual" will be a recipe for failure. The pace of change must be accelerated in order to prevent severe consequences.

The 2005 TRB summary of "Critical Issues in Transportation" pointed out that while transportation and health care account for similar proportions of U.S. GDP, federal investment in health care research is more than ten times greater than its investment in transportation research. Additional, well-focused research investments are clearly needed. It is also clear that transportation is lagging behind health (and other fields) in providing a well-supported "information infrastructure" to ensure that any level of research investment is providing maximum value, and that beneficial innovations occurring within individual organizations (outside of R&D efforts) are expeditiously documented and disseminated to others.

Suboptimal State of Information Access

Problems with information access are by no means unique to transportation, though as mentioned above, other fields are much further ahead in addressing these problems. We are faced with an explosion of information from multiple, disjointed sources, and we lack the time and tools to comb through all of the sources, identify what is relevant to our current task, and track down what we need. Despite the existence of good Internet search tools, it takes too long to discover and access needed information, and the process is "hit or miss." Some of us have librarians or other skilled information professionals available to assist us; but many of us either don't have access to such professionals or don't have the time or inclination to use them. We waste time wading through pages of irrelevant or untrustworthy hits to find the few possibilities worth investigating. Even when a search identifies relevant resources, lack of free and immediate access to these resources presents a barrier to obtaining them. Much of the information we need is not available on the Internet for general discovery; much is not captured and reliably preserved at

all. An enormous amount of information is on the Internet, but is part of the so-called "deep web" or "invisible web" that cannot be found by search engines. Many times we require information about current practice at peer agencies, but are stymied because it is hard to discover "who is doing what" and we find that most documents of value are behind agency firewalls. Most of us rely on experienced experts within our organizations for guidance. However, this important resource is drying up with retirements of our most senior people and an increasingly fluid workforce.

The impact of this suboptimal state of affairs is that we proceed without the information that could help us do a better job, we do not take the straightest line between two points, we are inefficient, and we repeat work that has already been done because earlier work hasn't been preserved or is too difficult to find.

Transportation Knowledge Networks Concept

Background

In 2005, the AASHTO Standing Committee on Research (SCOR) asked TRB to develop a 21st century strategy for transportation information management. The TRB study committee, a distinguished group of transportation research and information management leaders, envisioned a transition from "centralized and managed physical collections" to a decentralized approach in which information services are provided to users wherever they reside. This was to be achieved through a three-pronged strategy involving (a) a decentralized set of information provider networks (TKNs) in each region of the country, (b) a well-funded and strategically focused national coordination function within U.S.DOT to provide leadership for information sharing, and (c) a governance body to provide strategic direction and ensure accountability. One TKN, the Midwest Transportation Knowledge Network (MTKN), was established in 2001 and provided a model that guided the study committee's recommendations.

The committee published its recommendations in *TRB Special Report 284: Transportation Knowledge Networks: a Management Strategy for the 21st Century*. It recommended that a business plan be developed for moving forward with implementation of TKNs.

Since *TRB Special Report 284* was published, two additional TKNs—the Western TKN (WTKN) and the Eastern TKN (ETKN)—have formed in anticipation of full implementation of the committee's recommendations. Collectively, the three TKNs have members from over half of the 50 states. To date, TKNs have primarily involved transportation libraries at state DOTs, MPOs, and transit agencies, but they are open to participation from other information providers—including data offices, GIS clearinghouses, research units, and engineering/consulting organizations. Current TKNs rely on voluntary contributions of time and resources by member organizations. These voluntary initiatives are making incremental progress, but have very limited resources at their disposal. The NTL has been very supportive of TKN formation. An FHWA Pooled Fund Study involving many of the member organizations participating in the three TKNs has been providing consultant resources in support of TKN formation and transportation library connectivity.

With a strong and unified national commitment to coordinate and support existing and future TKNs, the vision described above can be realized. Without such commitment, progress will be slow and is unlikely to reach the critical mass needed to make a real difference.

Approach

The strategy for managing transportation information in the 21st century has a strong technology component. However, technology is only one piece of the puzzle. Any organization that has set up a document management system, a knowledge base, a discussion forum, or a wiki knows that "if you build it, they will come" is typically not a recipe for success. It is also true, but perhaps not as well known, that our ability to easily find what we need using common Internet search tools depends on work done behind the scenes to make information resources available and findable, as well as the level of skill and perseverance of the user. The bottom line is that most useful information-sharing initiatives rely on continuous effort to identify and encourage quality content contributions, to organize and tag this content so that it is easy to retrieve, and to assist users in finding what they need. Underlying the TRB study committee's recommendations—and a premise of this business plan—is that meaningful progress in the transportation information-sharing arena will require a strong and coordinated network of information providers equipped to meet the varied needs of information consumers throughout the transportation sector.

That is where the concept of a "Transportation Knowledge Network" (TKN) comes in. Based on successful models from the health and agriculture fields, TKNs are voluntary

associations of transportation organizations that agree to work together to improve information access to their employees and partners. This collaboration focuses on opening the information resources within each organization for use by others, but it also includes resource sharing, joint purchasing of for-fee information resources, agreement on standards and technologies that facilitate information sharing, and information exchange on best practices. TKNs involve institutional arrangements for resource sharing and coordination and leverage available technological solutions that provide end users with targeted, "on demand" information access at their desktops.

The TRB study committee envisioned that TKNs will be on the front lines, well positioned to understand and meet the specific needs of different user communities. The committee recommended that TKNs be established in every region of the United States, and at the federal level to link information providers to users wherever they may be. A geographic focus for TKNs was recommended as the initial model. However, the committee also left open the possibility that TKNs could in the future be focused on particular modal or topical areas.

Are TKNs Synonymous with Transportation Library Networks?

TKNs encompass library networks but are broader, involving a wider set of information providers. Library networks have long been in existence—formed for purposes of sharing collections through integrated library systems and inter-library loan programs, group purchasing for subscriptions, professional development for staff, and advocacy. The functions of a TKN suggested in *TRB Special Report 284* are consistent with these standard library network functions.

While *TRB Special Report 284* acknowledged the central role of libraries in knowledge networks, it indicated that other information providers should be involved. For example, on page 54, the report states:

> Over time, the coverage of regional TKNs could be broadened in several ways. They could be extended to include other data providers, such as transit agencies, metropolitan planning organizations, local governments, and consultants. In addition, network information content coverage could be broadened to capture statistical and geospatial data, as well as more traditional narrative information sources (e.g., books, reports, journal articles).

This business plan adopts this broader definition of knowledge networks, assuming that they include traditional and expanded library services as well as technology that enables other individuals and organizational units to contribute and access information directly.

The use of the term "knowledge networks" rather than "library networks" emphasizes the notion that libraries are evolving from our image of places providing access to physical collections to become broader access points for a wide range of information resources—both physical and digital. Current information technologies for metadata harvesting and federated searching enable integration of information from the user perspective without the need for a centralized approach to information storage.

Use of the term "knowledge networks" also underscores the importance of having a network of transportation organizations actively participating in the endeavor of making information more useable. As shown in Figure 1, raw "data" resources (e.g., articles, CAD drawings, photos, data sets) require addition of metadata (e.g., tags, index terms, geographic locations) to make them findable outside of the unit in which they were created, and additional intelligence (e.g., synthesis, interpretation, certification) to make them useful for a particular task at hand. This last step requires application of specialized expertise within subject areas and a means of agreeing on common terminology and semantics within a particular community of research/practice.

Core expertise provided by libraries—discovering, identifying, classifying, organizing and preserving intellectual content,

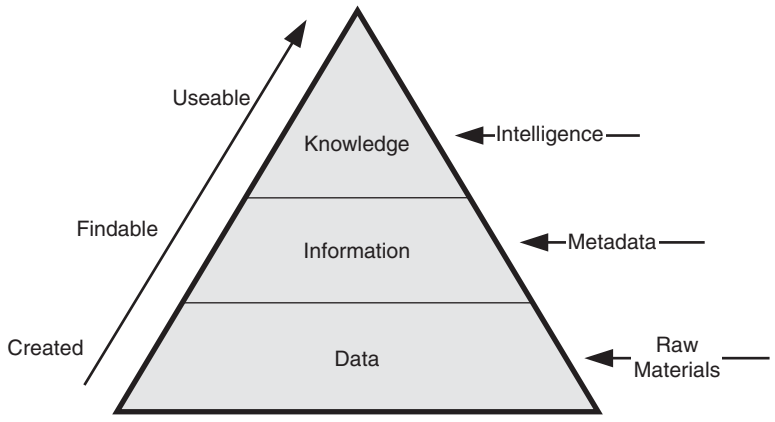

Figure 1. TKN role in sharing information and data.

and working with users to clarify their needs and locate relevant resources—is crucial in our information-based economy. Current library science professionals bring a rich set of skills to the table and are increasingly technology savvy. Special libraries bring an in-depth understanding of particular topic areas and an ability to work closely with other information providers and with user communities to improve both the ability to find and use information. Well-supported transportation libraries with strong established partnerships throughout the transportation community will be key drivers of successful TKNs.

Purpose

A strong information infrastructure for transportation is essential for maximizing value from R&D investment and making real progress in meeting the challenges noted above. Initiatives in domains including medicine, law, agriculture, and the physical sciences have provided researchers and practitioners in these fields with ready access to the information they need. Similar effort is needed in the transportation field. A strong information infrastructure supports:

- Peer-to-peer sharing of information, which is becoming increasingly important as organizations struggle to cope with loss of institutional knowledge due to retirements and increasing staff turnover rates;
- Discovery of benchmarking information, that enables agencies to compare their performance to peers and learn about successful practices;
- Faster access to information resources, including geospatial data sets, photographs, CAD drawings, plans, and environmental impact statements;
- Faster progress in meeting challenges by enabling practitioners to discover and use relevant information when they are in a position to take action; and
- More efficient and effective conduct of research—by ensuring that new studies build upon rather than duplicate prior work, providing easy access to relevant information, and helping transportation professionals target their work to areas of greatest need and opportunity for impact.

TKNs can be viewed as the backbone of a transportation information infrastructure. They can provide the connections and the protocols for information produced at any given node to flow to other nodes. TKNs piggyback on existing networks—both human and electronic. They build on the following:

- Widespread access to high-speed Internet connections among transportation professionals;
- Existing repositories of information (print and electronic; documents and data) maintained by transportation libraries; research centers; public agencies; and private and nonprofit organizations;
- Existing library networks—dominated by the Online Computer Library Center (OCLC) that provides WorldCat—a global library catalog with one billion holdings; and
- Existing professional organizations and associations that produce and disseminate transportation information.

Investments are already being made to develop and maintain information repositories and Web sites on particular topics within the transportation domain. TKNs don't duplicate these existing efforts. Rather, they increase the value of existing information resources by bringing them to a broader audience, making them more findable, and connecting them to related resources.

As the next generation of "born digital" transportation professionals takes its place, with high expectations for easy access to information from the desktop, a well-functioning information infrastructure will be viewed as an obvious and essential part of doing business—not a luxury.

Value of Information Services

According to a 2005 study by IDC, "it has become obvious that tasks related to creating, organizing, finding, and analyzing information have become significant time sinks." The study found that employees engaged in information work (in government, healthcare, financial services, and manufacturing) spend about 18 hours a week—almost half time—searching and gathering information for document preparation. The same study also found that on average 6.5 hours per week are wasted on unsuccessful searches and recreating content that already existed. This translates into a waste of $10,000 per year per employee. Today's modern libraries provide services that eliminate some of this wasted time. A 2007 survey of library users by Outsell, Inc. found that government users reported savings of 12.2 hours on average for each interaction with the library.

The last comprehensive study on the value of information services within the transportation field was conducted in 1998 by the FHWA. This study documented numerous examples of high returns from library services—including a case from New York State DOT in which an annual savings of $9 million in life-cycle costs were attributed to a literature review that revealed a new concrete mix for use on bridge decks.

A 2004 TR Update article on the value of transportation information relates the following example:

> In 1994 one of the Pennsylvania Transportation Institute's research associates came to the author with a question. She needed to know what types of snow plows were available because her research group needed to either find one in the literature or start a series of designs and tests to get one that could clear large amounts of snow and throw it far enough off the road in one pass. They

were very interested in the height and the angle of the plow. A search of the literature found some articles that seemed to answer her questions. However, the most useful article was in Finnish and not translated. The article was obtained, and she was able to find all the details she needed from the charts and the pictures. It saved her 'reinventing' something that had already been done very well and had been tested. The value, a great deal of time and effort. The value was never computed in terms of money but her group did not have to duplicate research, wasting time and money.

The Library Connectivity Pooled Fund Study has been collecting more recent "success stories" that demonstrate the value of transportation libraries:

- The Minnesota DOT transportation library located data needed by an engineer on the BTU energy content of various fuels—the engineer had searched for 2 hours; the librarian found what was needed in 2 minutes.
- The Wisconsin DOT transportation library located a NHTSA-related study about the demerit point/administrative license withdrawal system used by other states and provided it to the general counsel's office within 15 minutes of receiving the request. This saved the agency from going forward with a proposed $50,000 procurement to study this same topic.
- The Kansas DOT (KDOT) transportation library located a 1949 paper on a test that KDOT had been doing since the 1930s to predict alkali-silica reaction in cement-aggregate mixtures. The information in the paper, as well as the accompanying discussion comments, helped to answer the questions. The requestor felt that additional tests would not be necessary because the information the librarian sent to him resolved his questions. Valuable KDOT staff time was saved, as the test takes 1 year to complete.

Mission, Goals, and Objectives

Mission

The following mission statement is proposed for TKNs:

> Support and sustain a network of transportation information providers . . .
> to collaborate and leverage collective resources . . .
> so that they can provide transportation professionals . . .
> with timely and convenient access to relevant information . . .
> that enables faster progress . . .
> toward meeting critical transportation challenges.

The TKN effort should be judged to be successful if it accomplishes a *noticeable* improvement in access to usable information (a.k.a. knowledge) and is able to do this by effectively leveraging available resources. Thus, progress and performance of the effort should be evaluated based on whether transportation professionals perceive impact and value, as well as the extent to which it creates a strong, well-functioning network of information providers.

Goals

The proposed goals of the TKN initiative are:

Goal 1—Better Information Access for Transportation Professionals

Achieve a noticeable improvement in information access as perceived by transportation professionals. This improvement should be felt both by members of larger organizations that have their own libraries as well as by those affiliated with smaller organizations that cannot justify "providing an internal library and information services." Improvements in information access to be achieved include the following:

- Easier discovery of pertinent information on key topics of interest;
- Greater availability of full text digital documents accessible from the desktop; and
- Greater accessibility of existing national, state-level, and regional data sets of interest.

Goal 2—Increased Collaboration among Transportation Information Producers and Providers

Achieve greater collaboration across transportation information producers and providers that results in the following:

- Use of consistent standards and technologies that facilitate information sharing and make possible a more seamless information discovery and access experience for users; and
- Improved awareness among providers of the information resources available within each organization so that opportunities for resource sharing can be identified and so that organizations are able to build their collections in a complementary manner.

Goal 3—Preservation of Valuable Transportation Information Resources

Provide and facilitate use of national print and digital repositories for preservation of valuable information resources that are at risk due to retirements, employee turnover, agency

moves, and other factors. Use best practices for digital preservation to ensure that materials remain accessible as older file formats cease to be supported by available software.

Goal 4—Capacity Building within the Transportation Information Professional Community

Increase and further develop a proficient transportation information professional community that enables each information provider to provide better service to their customers.

Performance Measures

The following list of candidate performance measures is aligned with these goals. These can be used at the national level or by individual federal or regional TKNs. These measures can be tailored to specific targeted market segments and focus areas that are established in an annual strategic planning process at the national or region level.

End User Market Penetration and Benefits

- Changes in user awareness and use of available information services and tools (including the national repositories), ascertained from surveys;
- Percentage of users reporting benefits to research or practice from use of information services or tools, ascertained from surveys;
- User-reported time savings from use of information services or tools, ascertained from surveys; and
- Changes in information accessibility—measured based on access time and cost for a standard "basket" of information goods.

Information Provider Involvement and Benefits

- Percentage of transportation information providers that are members of a TKN;
- Percentage of TKN members reporting that belonging to a TKN significantly improved their customer services and ability to share resources;
- Increased professional development of staff involved in TKNs; and
- Increase in the relative value institutions assign to TKN membership in comparison with costs of membership.

Shared Information Resources

- Percentage of unique holdings of transportation libraries that can be found in standard search engines and nationally available transportation specific search tools;
- Percentage of current research projects in progress that can be found in standard search engines and nationally available transportation-specific search tools;
- Percentage of completed research efforts that can be found in standard search engines and nationally available transportation-specific search tools (abstracts and full text); and
- Adoption of standards and practices for interoperability of transportation information.

Product and Service Accomplishment vs. Target

- Percentage achievement of target new products and services (targets to be established through annual strategic planning process); and
- Percentage achievement of target new collections

Market

Broad Market for TKNs

TKNs are intended to benefit the transportation community at large: public and private sector organizations involved in funding, planning, and providing transportation in all modes, and in R&D that supports improved transportation practice. Organization types could include:

- U.S.DOT Modal Administrations (FAA, FHWA, FMCSA, FRA, FTA, MARAD, NHTSA, PHMSA, RITA, SLSDC) and Research Centers (Volpe Center, TFHRC, TTRC, Hughes Center, National Transit Institute, NADS, U.S. Merchant Marine Academy);
- State DOTs;
- LTAP/TTAP Centers;
- City and County Public Works Agencies;
- Public Transit Agencies;
- Railroads;
- Trucking Companies;
- Shippers;
- Logistics Firms;
- Airlines;
- Air and Sea Ports;
- Pipeline Owners;
- MPOs;
- Private Engineering/Consulting Firms;
- Professional Associations
- Universities and Associated Transportation Research Centers/Centers of Excellence

Within these organizations, practitioner types who would use and benefit from TKNs include:

- Executives and their staffs,
- Managers,

- Engineers,
- Planners,
- Analysts,
- Researchers,
- Librarians/Information Professionals,
- HR Professionals, and
- IT Professionals.

This is a very large and heterogeneous market. It would require an enormous effort to address its diverse set of needs and conduct meaningful outreach in a comprehensive manner. Rather than attempting this, it would be better to define different segments for targeting of TKN products and services and establish priorities with respect to which market segments should be targeted initially versus in later phases of TKN evolution.

Market segments could be defined a number of ways—by organization type, mode, geographic scope (national/state/regional/local), function (planning, design, construction, maintenance, operations, research), goal (safety, mobility, environment, infrastructure), or some combination of these. Market segments could be prioritized based on degree of need for improved information access, level of likely benefits from investments in information sharing, or ability to pay for information-sharing products and services.

TKN products and services can be initially geared to one or two well-defined market segments, but designed so they can be easily expanded to include additional markets—once initial infrastructure was built and success is demonstrated. The initial market segment should be one where clear and significant benefits of investment could be demonstrated, where resources could be secured, and where there is already some level of awareness of and support for the TKN concept.

Based on these criteria, initial target markets for TKN products and services are state DOTs, FHWA, UTCs, MPOs, LTAP/TTAP Centers; and professional associations that serve these markets. If TKNs are viewed as a business, then the target customers are those individuals who make buying decisions. Target customers are senior technical and management staff within DOTs, and directors of UTCs, MPOs, and LTAP/TTAP Centers. This is a manageable group to which outreach efforts may be targeted.

Products and Services

The TKNs' function is to continually improve and support the "transportation information infrastructure." A vision for this infrastructure is shown in Figure 2.

Key elements are:

- A *portal* serving as a national focal point for transportation information, providing access to the core information resources. Ideally, this portal is designed to allow for each component to be sharable so that other organizations can incorporate selected components into their respective Web sites. It should also be designed to ensure that credit is properly given to organizations that share their information through the portal.
- A *network of organizations* that actively share their information resources.

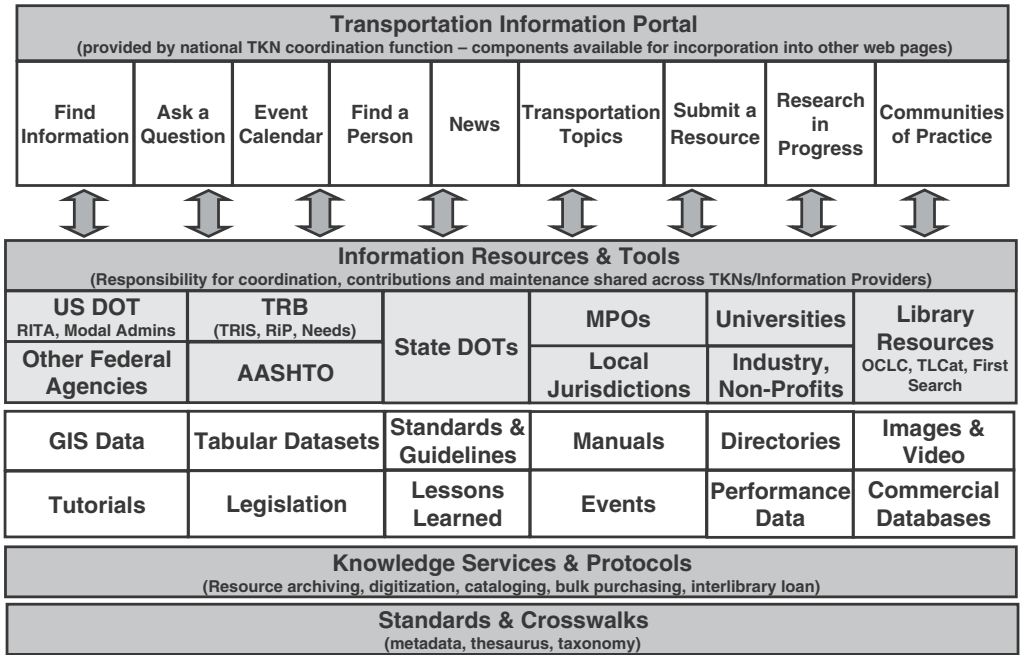

Figure 2. Transportation information infrastructure vision.

- An evolving collection of *information resources and tools* for accessing these resources, including bibliographic databases, document repositories, library catalogs, journals, datasets, shared calendars, directories, etc.
- *Services and protocols* for assisting information providers with processes of collecting, cataloging, indexing, digitizing, and archiving information resources; for integrating various external information resources; and for sharing resources with others.
- *Standards* that facilitate information sharing, including a thesaurus or taxonomy of terms, glossaries, metadata standards, data exchange standards, and crosswalks that allow for translation across different formats. National leadership to coordinate these activities is essential.

Pieces of this infrastructure exist, built and maintained by the National Transportation Library, the Bureau of Transportation Statistics, TRB, and transportation libraries in universities and state DOTs. Information resources that are of general interest to the transportation community are also scattered across hundreds of Web sites maintained by multiple administrations and offices within U.S.DOT, AASHTO, and other associations, state DOTs, MPOs, and universities. Skilled transportation librarians and researchers have learned to navigate the current set of available resources. However, for the uninitiated, the lack of connectivity and integration across sources makes it confusing and difficult to find things. Improvements are being made, but progress has been slow due to limited resources. With some incremental investment, leadership, and coordination to get transportation information stakeholders "rowing in the same direction," dramatic improvements to information access are possible.

The TKN Ten

Ten key functions have been identified that will enable the national network of transportation information providers to achieve its mission and realize the vision of the transportation information infrastructure described above. Table 1 lists these functions and indicates their alignment with the four TKN goals.

1. National Digital Repository

Continue to build the current NTL digital repository, expanding outreach and training to enable and encourage transportation organizations unable to build their own repositories (or who have limited capacity) to contribute resources. Provide online tools that allow individual researchers, practitioners,

Table 1. Functions and alignment with TKN goals.

	Goals			
	Access	*Collaboration*	*Preservation*	*Capacity Building*
1. National Digital Repository—including documents and data	X	X	X	
2. National Print Repository	X	X	X	
3. National Transportation Portal with Federated Search	X	X		
4. Information Modules	X	X	X	
5. Research/Literature Review Services	X	X		
6. Standards Coordination + Thesaurus	X	X		
7. Targeted Collection and Digitization Efforts	X	X	X	
8. Information Provider Outreach, Coordination, and Communication	X	X	X	X
9. Library Connectivity Support and Advocacy	X	X	X	X
10. User Outreach and Education	X	X		

research offices, or libraries to upload digital materials to the repository. Develop materials that describe the current capabilities of the repository and use these materials to engage TKN members in a discussion of what new capabilities are desired. As a result of these discussions, develop a strategic plan for extending the capabilities of the repository, including providing seamless access to a distributed set of digital information collections, and maintaining 24/7 access to information for transportation professionals from multiple computers (home and office). Collections should accommodate a wide variety of information resources, including data sets, CAD drawings, photographs, videos, and training materials. Specifically address both preservation and access capabilities, including access controls and providing for planned redundancy via mirrored sites. Periodically assess the technology platform to ensure that it best meets the needs.

2. National Print Repository

Provide resources needed to develop a national archive for print materials. This archive would include existing print collections within U.S.DOT and would provide secure storage for "last copies" of transportation information resources of national significance. This would provide a home for selected collections from library closings and professional papers of retiring practitioners.

Provide cataloging, interlibrary loan, and digitize-on-demand services to enable access to the print collection.

3. National Transportation Portal with Federated Search

Design and develop a national transportation portal hosted by the TKN-NCB that provides a single point of access to materials from a variety of sources, including but not limited to TRIS online, the NTL digital repository, the BTS statistical datasets and tools, TRB/NCHRP publications, TRB Research in Progress and Research Needs databases, OCLC WorldCat and TLCat (the WorldCat transportation subset), peer-reviewed transportation journals, the Communities of Practice sites provided by FHWA and other organizations, and other Web resources. Provide and continually improve federated search tools that allow users to find materials across all of these sources that are relevant to a particular topic area or question. Include modules for peer-to-peer information sharing and for users to obtain "real-time" syntheses of current practice for particular topic areas.

4. Information Modules

Provide a series of "information modules" for inclusion on the National Transportation Portal, but also made available for inclusion on other TKN member Web sites. These would include a guide to current legislation of interest to transportation practitioners, a directory of experts by transportation topic area, a guide to practitioners in state DOTs and MPOs by role and topic area, a consolidated calendar of transportation-related conferences and workshops (offered by TRB, AASHTO, HEEP, ASCE, etc.), descriptions of current practice for specific topic areas across multiple agencies, a collection of online tutorials or training materials, state- or locally developed manuals or guidelines (e.g., for access management, corridor planning, roadside maintenance), data standards, GIS data sets, benchmarks, and performance data.

This item would also include access to fee-based information resources, including professional journals, scientific literature, and standards documents. Negotiation of group subscription rates at a national level would reduce access costs to these resources for individual TKN members. Where licensing for direct access to such resources for employees of multiple organizations cannot be negotiated, a subsidized interlibrary loan service would be explored using the "Loansome Doc" service of the National Library of Medicine as a possible model.

The national coordination function would work with regional TKNs to identify priorities and encourage development of these information modules, establish basic standards that would allow these to be searched and shared, as well as standard services (such as RSS feeds or email notifications when information changes). One promising avenue to be explored is for NCHRP, UTC, and U.S.DOT research initiatives to be structured to produce new information modules or update existing ones. For example, a research project to perform a multi-state synthesis of current practice could be scoped to produce as one of its deliverables a set of tagged results in a format that could be easily integrated into the portal. This approach could dramatically increase the value provided through these research programs by making the information produced more easily accessible and integrated with related resources.

5. Research/Literature Review Services

Offer research and literature review services to the transportation community (on the national portal; provided via discussion forum, email, phone, or messaging). There are tremendous benefits to be gained through offering services of skilled, specialized transportation information professionals for conducting literature reviews, building annotated bibliographies on particular topic areas, or simply tracking down answers to specific information requests. Availability of these services widely throughout the transportation community would save time and provide better information for both research and practice. Individual requests could be "farmed out" to specific designated specialists (among the TKN membership) by subtopic. Over time, additional efficiencies

would be realized as multiple requests on the same topic were received.

6. Standards Coordination and Thesaurus

Provide technical leadership for widespread adoption of standards for information sharing within the transportation community. Use of common standards is an underpinning of the success of information-sharing efforts. The library community has decades of experience with data standards (e.g., MARC, Dublin Core). Standards are continuing to evolve for sharing information resources over the World Wide Web. In the transportation community, a thesaurus of transportation research terms (the TRT) was initially released in 2001 and has been steadily improved since then. There is a need to take the TRT to the next level and encourage more widespread use of standard terms for indexing and tagging of information resources. There is also a continuing need within the transportation community to agree on standard metadata for describing both documents and datasets. The national coordination function is the logical place for leadership in this area.

7. Targeted Collection and Digitization Efforts

Pursue targeted projects at the national and regional levels to collect and digitize information resources in areas of historical or strategic significance. One of the key strengths offered by TKNs is that they can offer a strategic approach to collection, digitization, and preservation of information. It is not economically feasible or desirable to capture and preserve every piece of transportation-related information that is produced. However, there are some types of information resources that are of particular importance at a national, regional, local, or organization level. Having information producers and providers at the same table allows for development of coherent strategies about what types of investments in information collection and preservation are worthwhile. Definition and execution of targeted collection and digitization projects will provide clear end results and accountability for investments made. Examples of targeted collection projects include assembly of strategic highway safety plans from all of the states, display of key household survey results from all United States metropolitan areas, or preservation of the professional papers of key recently retired leaders in the transportation field.

8. Information Provider Outreach, Coordination, and Communication

Provide mechanisms for transportation information providers to function as a network. The success of the TKN concept depends on having strong nodes and strong links. The nodes are the information providers; the links are the communication channels and personal relationships across the information providers. There needs to be a continuing function to identify and develop leaders within the transportation information provider community; to encourage participation; to support communication by providing opportunities to meet in person, via telephone or video conference, and online forums; and to coordinate activities so synergies can be achieved and efficiencies realized. This function includes involvement of a wide range of information providers including transportation libraries, state DOT, UTC and MPO website maintainers, and special centers such as the AASHTO Center for Environmental Excellence, and the ARTBA/FHWA National Work Zone Safety Clearinghouse.

9. Library Connectivity Support and Advocacy

Provide technical support and advocacy for transportation libraries. This function is related to the general "Information Provider Coordination and Communication" function, but is specifically geared to transportation libraries, which are at the core of basic TKN functions. Many operate on a shoestring, with a solo librarian; some have no professional library staff. Strengthening the existing libraries, enabling them to share their holdings through OCLC and TLCat, supporting them in negotiation of favorable group rates for subscriptions, and helping them to provide improved service for their customers is an essential component of TKNs. This function currently is partially being carried out through the Transportation Library Connectivity Pooled Fund Study.

10. User Outreach and Education

Provide outreach and education geared both to managers and executives of transportation organizations and to end users of transportation information resources. Many executives and end users are not familiar with the information resources that currently exist. This results in underuse of transportation information resources and lack of support for continued improvements to these resources. The objectives of the outreach efforts would be to (1) build widespread understanding of what is available, (2) provide information and training that practitioners require to make productive use of existing resources, (3) provide managers and executives of transportation organizations with an understanding of how their organizations could use and benefit from the resources that exist, and (4) allow for continuing feedback from transportation information users about the types of improvements they would like to see.

Tangible Results

Implementing "the TKN Ten" will allow the transportation community to realize the vision for a user-focused

transportation information system, as articulated within *TRB Special Report 284:*

> Envision state department of transportation employees working at their desks on time-sensitive projects or projects with long time scales:
>
> - They identify a need for information and, because of good marketing in the agency, they know where to turn.
> - They open their Internet or intranet browser to the library page or information portal and choose the service they desire, such as literature review, facts on file (common questions from across the country that are stored for easy retrieval), or reference requests.
> - They find a front-end application that asks them how they want to search for information—geographically, topically, by title or author, or by other formats. This interface is visually engaging and easy to use. With a click, they are taken to that search tool, or this information is all on the first page.
> - They type in their search phrase or point and click to icons and retrieve the desired information. The databases and systems that are being searched are noted while the search is under way ("now searching BIOSIS . . .").
> - They can clarify whether they want information in narrative form, tabular or geospatial data, or all of these. To help refine the search, questions that librarians typically ask users are programmed into the system.
> - Once they come up with a list that reflects the information they are seeking, they can check boxes to say "I want to save this information" and create a customized list stored under their e-mail address or account.
> - They can then retrieve the documents and data on the list, with highlights pointing to the specific text relevant to their search. Because the documents and data are tagged, they are able to find specifically what they are seeking. The behind-the-scenes effort to obtain, catalogue, index, tag, and store the information is not obvious.
> - They are able to pull quotes from the documents, with prompts helping them understand copyright laws and appropriate uses and references.
> - If a document is not available electronically, they are offered a menu for delivery: interlibrary loan (because of the Transportation Libraries Catalog or First Search, the location of the closest borrowing institution is known); electronic document delivery (from where and how much); purchase of paper copies (from where, how much, and how fast); or whatever the correct terminology is for the suite of options. In this vision, they will not have to pay $800 for a full document if they want only a paragraph from it.
> - When the site includes data references, they can easily understand the data platform and relevant uses.
> - The results are provided to them in good English without cryptic abbreviations.
> - Ideally, the system is somewhat fun or at least easy to use, and they understand the sources they are searching, how far those sources will take them, and when they will need to seek additional information.

Stewardship Model

National Coordination Function

The crux of the TKN concept is to have a centralized National Coordination Body that acts to leverage and enable synergistic actions on the part of a large number of other organizations. The MTKN is an example of this at the regional level—seed funding from the NTL and the resources of a full-time leader enabled a group of libraries from nine state DOTs, three universities, and one private firm to achieve significant benefits from their membership. Despite having no additional funding or resources since 2003, the MTKN has grown to include fifteen organizations, with the addition of another private engineering firm and a regional planning commission. The current Transportation Library Connectivity Pooled Fund Study and the efforts of the NTL are showing that relatively modest investments in coordination and assistance can go a long way toward enabling collective progress toward a common goal. With help from the Pooled Fund Study and the NTL, new Western and Eastern TKNs have formed, bringing the total number of TKN members to forty-nine. These efforts are indicative of the strong grass roots interest and commitment within the transportation community to move forward with information-sharing initiatives, even with the currently available limited resources.

Development of a central national portal that provides access to transportation information resources is an essential activity that will provide a valuable resource for practitioners. It will provide a concrete and highly visible means of showing progress and benefits as TKN activities expand. It will take national leadership, commitment of resources, and coordinated effort on the part of multiple organizations to develop and sustain the vision of a "one-stop shop" for transportation information.

TRB Special Report 284 recommended that the national coordination function be within RITA, but it did not specify where within RITA this function should be placed.

Similar national coordination functions for the fields of agriculture and medicine are being served by the National Agriculture Library and the National Library of Medicine. The NTL has established relationships with the transportation library community, and is playing a key leadership role in assisting with regional TKN formation and implementation of the digital repository.

The following types of functions would be provided by the National Coordinating Body:

Management and Coordination

- Strategic planning and budgeting,
- Technical leadership with respect to collections, cataloging, indexing, and archiving,
- Staff direction,
- Development and administration of grants to TKN members for service provision,
- Coordination of library connectivity activities and support to TKNs,
- Coordination within U.S.DOT and between U.S.DOT and other federal agency information providers with respect to integration of information resources, and
- Performance monitoring—evaluating performance, developing lessons learned and recommendations for improvement, and communication to the advisory board.

Information Architecture

- Architecture of approach to information integration,
- Technical design and development of the digital repository and national portal,
- Provide information technology expertise to ensure use of best practices,
- Leadership in development and adoption of data standards throughout the transportation community, potentially including TransXML, and
- Work to ensure coordination and integration with ITS data standards efforts.

Standards and Cataloging

- Continued development and maintenance of the TRT, including ongoing coordination and processing of input from the transportation community and
- Cataloging and indexing.

Collection Management

- Manage and coordinate development and maintenance of the digital and print repositories.

Information Systems Management

- Manage the national transportation information portal, including regular updates and integration of new information modules as they are developed—includes webmaster and database administration roles.

User Services

- Direct providing of reference and literature review services to users and
- Develop educational and outreach materials.

Advisory Board

An independent Stakeholders Council would be established with representation from AASHTO membership, academia, and other national libraries. Given the initial market focus on state DOTs, UTCs, MPOs, and LTAP/TTAP centers, the following candidates for the advisory board could be considered:

- Three to four representatives selected from the following AASHTO committees: Standing Committee on Research (SCOR), Standing Committee on Highways (SCOH), Standing Committee on Planning (SCOP), Standing Committee on Performance Management (SCoPM); Standing Committee on Finance and Administration Subcommittee on Information Systems (AASHTO IS);
- One MPO executive director;
- One member of the National LTAP Association (NLTAPA) executive committee;
- One member of the Special Libraries Association Transportation Division executive board;
- One engineering/consulting firm representative;
- One University Transportation Center director;
- One university transportation library director;
- One state DOT library director;
- One Transportation Research Board representative; and
- One representative from the National Agriculture Library or other non-transportation organization (able to provide an external perspective and lessons learned from a similar undertaking).

The advisory board should have flexibility to be reconstituted, for example, to include more multimodal (transit, air) representation. Members should serve staggered 3-year terms in order to provide continuity.

The advisory group could be established by the U.S.DOT, the National Academy of Sciences, AASHTO, another relevant industry association, or some combination thereof.

Once established, the TKN advisory board would provide input to the allocation of initial year resources and establishment of priorities for information product and service development. Subsequent quarterly meetings would focus on review of accomplishments and performance and providing feedback from the stakeholder community. The advisory board would also be responsible for conducting an independent assessment of TKN performance, conducted annually or biennially.

Regional TKNs

One of the key findings of the input phase to develop this business plan was that the need for regional TKNs is not broadly understood or accepted. Some people feel that regional TKNs are not needed given today's technology for information sharing (and overnight delivery services). They feel that sticking to a national network would provide what is needed and wish to avoid adding unnecessary layers of coordination and bureaucracy.

However, participants in the existing Midwest TKN point out that having regional TKNs provides a greater level of strength and stability to the national network than would otherwise exist. Regional TKNs provide opportunities for leadership development within the transportation information provider community that reduces its vulnerability to departures of key individuals. Regional networks also allow for more focused outreach activities than would be possible at the national level and provide opportunities for face-to-face communication at already-existing regional gatherings of transportation professionals.

As noted earlier, three Regional TKNs are already up and running and provide an excellent starting point. As these TKNs evolve and others are formed, a range of organizational models can be considered, depending on the needs, goals, and resources of the members. The following models provide two variations that illustrate the range of possibilities:

Variation I—Informal. A loose association of transportation information providers meets annually and has bimonthly conference calls. Responsibility for leadership is rotated among the membership. The TKN's primary function is to share information and identify opportunities for individual member organizations to share resources or collaborate on specific projects. There is no membership fee, but each member is asked to commit to some level of information sharing, including providing a listing of their information resources in a National TKN directory. Two levels of membership could be established—one for organizations with significant collections to share, and another for organizations that have more limited information resources to offer. Individual TKN members apply for available grants (from the national coordination function or other sources) on behalf of the TKN for specific projects.

Variation II—Formal. A nonprofit association that has meetings and conference calls and provides a specific set of services to its members. The TKN services are provided by either full- or part-time staff, consultant services, or a combination. These services are funded through a combination of annual membership dues and fees. The TKN may offer certain premium services for an additional fee. The TKN may also identify grant opportunities and prepare grant applications to fund projects of interest to the membership.

Regardless of how TKNs are organized, TKN-NCB could provide each regional TKN with a Web site for collaboration and maintain contact with designated TKN representatives to provide information about and obtain feedback on national information-sharing initiatives.

Costs and Funding

The estimated average annual funding needs (over a 5-year period) for different TKN functions are displayed in Table 2. These costs would need to be "front loaded" to accommodate start-up activities and technology investments. Note that these are rough estimates to relate specific activities to line item budgets. Actual allocation of a given budget across functions could vary considerably.

This breakdown of needs is consistent with the high end of the recommendations of *TRB Special Report 284.* The total investment would be $13.5 million annually. Functions 1, 2, 3, and 6 would be performed by the national coordination function. Functions 4, 5, and 7–10 (marked with asterisks) would be performed by the regional TKNs in partnership with the National Coordinating Body. Therefore, the amounts shown for this latter set of activities (marked with asterisks) include grants for TKN members. It is envisioned that these grants would be made in response to specific proposals to develop products or services (e.g., to digitize a collection and make it available to the entire transportation community) rather than on a formula basis. For estimation purposes, it was assumed below that roughly 50 percent of the total would be for TKN member activities, including outreach and delivery of specific products and services that have a national benefit.

Table 2. TKN funding needs by function—average annual investment over 5 years.

Function	Investment
1. National Digital Repository—including documents & data	$800,000
2. National Print Repository	$500,000
3. National Transportation Portal with Federated Search	$1,000,000
4. Information Modules*	$3,400,000
5. Research/Literature Review Services* (could be partially self-supporting through fees for service for non-TKN members)	$1,000,000
6. Standards Coordination + Thesaurus	$800,000
7. Targeted Collection & Digitization Efforts*	$4,500,000
8. Information Provider Outreach, Coordination and Communication*	$500,000
9. Library Connectivity Support and Advocacy*	$500,000
10. User Outreach & Education*	$500,000
TOTAL	**$13,500,000**

APPENDIX B

Initial Web Survey—Questionnaire and Results

Improving Access to Transportation Information - Request for Input

1. Which of the following best describes your organization:			
		Response Percent	Response Count
US DOT		9.3%	14
State DOT		**69.3%**	104
City or County Transportation Agency		0.7%	1
Local or Regional Planning Agency		0.7%	1
Transportation Service Provider		0.7%	1
Academic Institution		11.3%	17
Consulting/Engineering Firm		2.0%	3
Professional Association		1.3%	2
Other (please specify)		4.7%	7
	answered question		**150**
	skipped question		**0**

2. Which of the following best describes you:			
		Response Percent	Response Count
Librarian		18.0%	27
Engineer		22.7%	34
Planner		6.0%	9
Manager/Executive		**38.7%**	58
Other (please specify)		14.7%	22
	answered question		**150**
	skipped question		**0**

3. What are the primary information sources that you use to help your customers keep up with the latest developments in their area(s) of expertise, or want to know how others have approached a problem or topic area?		
	Response Percent	Response Count
Source 1	**100.0%**	26
Source 2	96.2%	25
Source 3	88.5%	23
Source 4	61.5%	16
answered question		**26**
skipped question		**1**

4. When your customers are looking for transportation-related data sets (national, state, or local), what sources do you most frequently use?		
	Response Percent	Response Count
Source 1	**100.0%**	22
Source 2	81.8%	18
Source 3	81.8%	18
Source 4	63.6%	14
answered question		**22**
skipped question		**5**

5. What kinds of transportation-related information do your customers seek that you find most difficult or time consuming to provide? Please be specific.	
	Response Count
	23
answered question	**23**
skipped question	**4**

6. How do you keep up with the latest developments in your area(s) of expertise, or find out how others have approached a problem or topic area? (Please check all sources that you use regularly.)

	Response Percent	Response Count
Meetings and Conferences	**92.6%**	113
Discussions with colleagues	91.8%	112
Internet - General Search Engines (like Google or Yahoo)	82.0%	100
Internet - Specific Web Sites	70.5%	86
Print magazines/journals	73.8%	90
Online magazines/journals	45.1%	55
Blogs/wikis/email discussion lists	19.7%	24
Email newsletters or bulletins	70.5%	86
RSS feeds on my home page	1.6%	2
Local library catalog	14.8%	18
Library staff	31.2%	38
TRIS online	36.9%	45
TLCat	5.7%	7
WorldCat	5.7%	7
	answered question	**122**
	skipped question	**0**

7. When you are looking for transportation-related data sets (national, state, or local), what sources do you most frequently use?

	Response Percent	Response Count
Source 1	**100.0%**	101
Source 2	88.1%	89
Source 3	71.3%	72
Source 4	41.6%	42
	answered question	**101**
	skipped question	**0**

8. If you had a full time personal assistant whose job was to provide you with the information you need to be effective, name three tasks you would have given them in the last month.			
		Response Percent	**Response Count**
Task 1		**100.0%**	87
Task 2		94.3%	82
Task 3		80.5%	70
	answered question		**87**
	skipped question		**0**

9. You have just been awarded a $10,000,000 grant to improve the ability of transportation researchers and practitioners to find the information they need when they need it. How would you prioritize the following candidates for use of these funds?						
	High	Medium	Low	Don't know	**Rating Average**	**Response Count**
Getting agreement on standards for transportation information sharing - both documents and data	**36.3% (45)**	33.9% (42)	25.8% (32)	4.0% (5)	1.98	124
Establishing a national transportation information archive to preserve and provide stable access to both print and electronic documents	**53.2% (67)**	31.7% (40)	13.5% (17)	1.6% (2)	1.63	126
Building a better national transportation information web site	**45.2% (57)**	38.9% (49)	14.3% (18)	1.6% (2)	1.72	126
Improving transportation-specific search tools	**46.4% (58)**	34.4% (43)	18.4% (23)	0.8% (1)	1.74	125
Building a collaboration or social networking web site for transportation practitioners	29.6% (37)	**36.0% (45)**	32.0% (40)	2.4% (3)	2.07	125
Setting up subscription services that inform practitioners about specific topics of interest on a weekly or monthly basis	25.6% (32)	**43.2% (54)**	28.0% (35)	3.2% (4)	2.09	125
Providing seed funding for transportation organizations to establish better in-house library services	21.4% (27)	34.1% (43)	**37.3% (47)**	7.1% (9)	2.30	126

Providing grants to transportation libraries to allow them to loan and deliver documents to outside organizations	17.5% (22)	26.2% (33)	**51.6% (65)**	4.8% (6)	2.44	126
Digitizing paper documents to enable electronic access	**39.7% (50)**	31.7% (40)	26.2% (33)	2.4% (3)	1.91	126
Expanding training for transportation practitioners on available tools and information sources	37.0% (47)	**44.1% (56)**	18.1% (23)	0.8% (1)	1.83	127
Developing a marketing campaign to build awareness of the need for each organization to commit resources for information sharing	28.0% (35)	35.2% (44)	**36.0% (45)**	0.8% (1)	2.10	125
Establishing a national coordinating function to improve collaboration across existing information sharing, technical assistance and knowledge management efforts	**52.4% (65)**	31.5% (39)	13.7% (17)	2.4% (3)	1.66	124
				answered question		**128**
				skipped question		**0**

10. What improvements in transportation information access would be of greatest value to you?	
	Response Count
	109
answered question	**109**
skipped question	**0**

11. Please use the space below to provide any other comments that you would like to see considered in the business plan for implementing Transportation Knowledge Networks. Thank you for your input!	
	Response Count
	58
answered question	**58**
skipped question	**0**

APPENDIX C

Initial Web Survey Results—Open-Ended Responses

Initial Web Survey Results—Open-Ended Response

Open-ended responses to the web survey are listed below. See Appendix B for the full survey instrument.

Similar responses were grouped into single line items with a number in parentheses following the response to indicate how many respondents provided this answer. Responses for questions 8, 10, and 11 were grouped into categories to facilitate analysis of the results.

Question 3. (for Librarians) – What are the primary information sources that you use to help your customers keep up with the latest developments in their area(s) of expertise, or want to know how others have approached a problem or topic area? <List up to four sources>

- DOT and TRB Search Tools (TRIS/TRIS Integrated Search, RIP, NTL (8)
- DOT or FHWA websites (2)
- TRB publications/TRR (3)
- TRB Transportation Research E-Newsletter (2)
- library catalog (3)
- WorldCat
- University Consortium of lib catalogs, databases and electronic journals
- AASHTO updates and journal
- Web of Science
- Acqweb
- Hard copy or electronic journals or conference proceedings (5)
- Federal Register
- Proprietary databases – Factiva, DIALOG (6)
- Planning project, and construction documents (2)
- Technical, research reports, annual reports (3)
- National and local news articles
- Google Transportation Meta Search
- Publication announcements from DOTs, etc.
- Expertise & knowledge of individual agency staff member (2)
- Web search. Online resources (2)
- Listservs, blogs (3)
- E-newsletters from professional organizations & vendors (for standards & specifications)
- Web-based news, alert services, press releases
- PUSH generated library links—to RSS Feed, Library Tips (biweekly) New Book Link
- Blurbs and e-mails from established vendors

Question 4. (For Librarians) - When your customers are looking for transportation-related data sets (national, state, or local), what sources do you most frequently use? <List up to four sources>

- Union catalogs, local or library catalog/OCLC/Worldcat (6)
- TRIS/TLCat (4)
- NTL online/NTL Catalog (3)
- BTS/Transtats (7)
- FHWA, USDOT, FAA (2)
- FHWA Highway Statistics (3)
- National Transportation Statistics (2)
- FedStats
- National Transit Database
- US Census
- National Highway Traffic Safety Administration's National Center for Statistics and Analysis publications
- Engineering Index
- TRANSPORT, DIALOG, Other transportation databases (3)
- Other Transportation Library resources—bibliographies or webliographies
- TRB/TRR online (2)
- TRB/Research in Progress
- Internet/web search/websites (4)
- Content databases on Internet
- Listservs (2)
- Federal Resources online

- Local Crash Facts
- ASTM pubs
- ASCE journals
- USA.gov
- State demographic center
- Internal agency resources (databases, reports, raw data) (4)
- GIS applications
- Personal contacts, expertise & knowledge of a staff member (2)

Question 5. (For Librarians) What kinds of transportation-related information do your customers seek that you find most difficult or time consuming to provide?

- Gray literature, unpublished information, foreign publications. Obtaining materials referenced in publications that can't be verified or have no holdings in OCLC. Historical information to explain the reasoning behind why a test method (for example) was changed at a given time.
- A specific historical question, often environmental, that involves construction plans and maps.
- Freight data - specific costs to move a specific commodity from origin to destination. Cost of pollution from passenger vehicles, trucks, public transit. Information regarding specific details of construction of given highway or segment of highway, and costs associated with freeway construction in general.
- Current statistics because most are 1-2 years old, if not older.
- It isn't the information that they seek, but the time constraints that causes difficulty.
- Any kind of search where the patron doesn't really know how to use information sources or what she is looking for and doesn't know how to comb through a result list; this addresses a lack of training in staying current in a field. There is a minor education department at this DOT but it doesn't offer credit and is used only for upgrade in supervisory levels. Although there is acknowledgment of the importance of training, it usually concerns new software being introduced to the DOT. I see a very large need for critical thinking and problem solving courses or workshops. I know I need to be part of training of this type in new information sources available to transportation, but we are understaffed to do this in a solo library. I think that there would be a huge benefit to employee exchange among transportation organizations to learn best practices. Benefits for long-term employment here encourage mediocrity and risk-averse thinking; there is a very little risk-taking and most DOTs move slowly and carefully. I would like to see acknowledgment of true life-long learning in critical thinking, not just new software.
- State-specific Commodity-specific
- Public marine transportation info. It is almost always faster to contact a similar agency than look for papers/research
- Standards and statistics from other countries
- Both the most current and historical research on transportation related topics including engineering, planning, design, construction, and current research in progress
- Statistical information
- Standards that cost a lot of money, and books from private companies like ASTM, AISC, NEC, and so on. . . .
- Detailed airline statistics, personal travel data, comprehensive source of state regulations/laws
- Commodity flow point to point data
- Particular views of data sets
- Legislative/funding information, at state and local level
- Legislative requests
- Research that is multidisciplinary and not specifically related to transportation engineering, for example, transportation economics, or recently . . . looking for food miles and transportation costs,
- 1) As a state DOT, I get many requests to acquire internal data from other DOTs on various topics. This can be very difficult to do. 2) Historical statistical data, especially in the motor vehicle arena (such as registrations, etc.) to try and answer specific questions about patterns of vehicle ownership (for example, was there an increase in young female drivers for the time period of 1955-1965, etc.) 3) Internal information from other state and federal government agencies, such as budget data. 4) Transportation history questions can be time-consuming, especially when they involve something like what kind of pavement was used on a certain segment of road in 1945, etc.? Related to this are questions about traffic accidents in years past (i.e., who investigated, what were the outcomes, etc.). Basically, these are archival and institutional memory-type questions, and our coverage of such information is spotty, at best (which includes both our state DOT and state historical society)
- Searches for known, but ill-described publications from USDOT and state DOTs, especially those without library services (i.e., "a couple years back FHWA or somebody did a study on maintenance vehicle visibility"). Searches for what other state DOTs are currently doing on any given topic (i.e., electronic signatures, utility permit management, innovative finance, etc.)
- Evolving and emerging "best practices" information, typically, what are other state DOTs doing in one technical area or another. Often defies utility of typical transportation info sources because the literature has not yet been published, and when it is, it is grey lit and not well disseminated, collected and cataloged.
- Statistics—data on other transit agency staffing and operations—older EISs and planning documents, especially when the name of the project changes over time

Question 7. (Non-Librarians) – When you are looking for transportation-related data sets (national, state, or local), what sources do you most frequently use? <List up to four sources>

- US DOT
- FHWA/FHWA website (15)
- FHWA HMPS (2)
- FHWA NBI
- FHWA Truck Weight Study
- FHWA Highway Statistics (3)
- FHWA Resource Center
- FHWA Safety webpage
- FHWA Traffic Volume Trends
- FHWA (State Division Office)
- FHWA staff
- FTA National Transit Database, Reporting Summaries (5)
- BTS (11)
- JPO's Lessons Learned Database
- Volpe Center Library
- NPTS/NHTS (2)
- LTPP (2)
- NHTSA/Fatality Analysis Reporting System (FARS) (3)
- US Census – CTPP, PUMS, American Community Survey (6)
- Transearch, CFS, VIUS [freight data]
- Federal agency web pages
- TRB/TRR/NCHRP (22)
- RIP Database (5)
- TRIS Online (26)
- National Transportation Library (4)
- State DOT Search Engine (2)
- AASHTO
- WorldCat (2)
- Agency Library/Library Staff (20)
- UC Davis Pavement Research Center
- California TASAS
- Lit search
- Eurostat
- LTAP Clearinghouse/LTAP Center websites (2)
- AASHTO, Committee Surveys (7)
- APWA
- APTA (2)
- NACTO
- IMSA
- NCSL
- IHS
- ATSI
- PTI
- Publications/magazines/journals (9)
- Textbooks
- Agency internal data—e.g., truck counts, traffic counts, collision, inventory, transit, GIS library, data marts (17)
- State DOT research (3)
- MPO
- Traconet
- Port-generated info
- Economic Development sites
- WestStart
- University-generated info
- Engineering Drawings
- Crash Records Database/Crash Reports (3)
- Reports by local agencies
- Pooled fund studies
- On-line community of practice (ex. FHWA Highway Community Exchange)
- State DOTs/State DOT web pages (4)
- University website (2)
- MadCat (university catalog)
- General web research/Internet (33)
- Internet-specific sites (14)
- Google alerts
- Several key state and Federal data archives
- E-Mail Newsletters/Discussion Lists
- E-mail (2)
- Meetings and Conferences (2)
- Discussions with colleagues, contacts, peers(23)
- Other ferry organizations
- Contact Local University/Professors, UTC Faculty (3)
- University of Missouri Extension

Question 8. (Non-Librarians) If you had a full time personal assistant whose job was to provide you with the information you need to be effective, name three tasks you would have given them in the last month.

[Responses have been organized by type of task and topic area]

Filter, Synthesize and Disseminate Information

- Collect reading / developments in general trans. Issues and use this information to identify projects/issues of concern to our DOT
- Provide News About Transportation Decisions/Trends
- Prepare a weekly e-mail with abstracts of 3-5 key reports/articles, with links to full reports/further information, for circulation to an internal distribution list
- Search for national info - scan and sort for utility
- Evaluate regional info for utility
- Review and summarize articles of interest from journals/newsletters (print, online, e-mail)
- Summarize recent reports
- Review Community of Practice website at FHWA for interesting items
- Gather/provide executive summaries of new research reports/analyses from reliable sources, on topics relevant to

our agency's operations and planning (both transit and highway)
- Review incoming e-mail newsletters, etc. for distribution to DOT employees
- Condense latest information
- Read germane journals/reports articles and summarize for me
- Research and prepare fact sheets/summaries for upcoming meetings and events.
- Monitor print publications
- Newly published relevant literature
- Update or monitor communities of practice
- Prepare short synthesis reports on specific topics
- Browse latest research and write brief report
- New Product Scan
- Stay abreast of all new technologies in the field of transportation and research

Research and Analysis, Literature Reviews (General)

- Find Reference Information
- Research specific topics and options and collate results
- Market trends
- Strategic plan research and development
- Proposal research and development
- Research data needs
- Contact respective research organizations for input on their results
- Literature searches (10)
- Literature search to ensure research proposed is not duplicated
- Literature searches for inquiry requests
- Review/Search TRIS (2)
- Internet searches (4)
- Prepare summary of search
- Scan web for related info
- Verify TRIS search with Google
- Search for latest research in areas I have projects
- Most current information on a subject
- Search for projects/research in progress
- Research best practices (2)
- Identify Performance Benchmarks in certain areas
- Case studies

Research and Analysis, Literature Review (Specific Topics)

- Research modal trends in U.S. - China trade
- Research Info - future transportation funding
- Research recent land sales
- Search for latest developments in Automated Speed Enforcement
- Safety (3)
- Work zone safety
- Ramps design
- Cable anchoring systems
- Synthesis on orthotropic bridge deck overlays
- Types of accelerated construction methods that work
- Maintenance management
- DOT Maintenance Contracting
- Coordination of Transportation Services
- Develop a matrix of performance measures
- Derivation of travel time from speed detectors
- Earthquake Incident Preparedness
- Intelligent Transportation
- Quality of Transit Initiatives
- Find the latest Research on fish passage
- Find the latest Research on creating wetlands habitat
- Recent articles on congestion pricing
- Search for latest developments in converting HOV to HOT lanes
- National investments in ITS
- Number of traffic signals in the US
- Effective Road Safety Enforcement
- Researching best practices for snow AVL operations
- Compile latest traveler information resources
- Compile latest congestion related resources
- Pull all relevant research related to multimodal transportation issues
- Recent articles on land use-infrastructure "concurrency"
- I needed to know a lot of background information on billboards
- Literature review for forward deflection structural condition index
- Driver Behavior
- Find body of research on Bioengineering
- Research dynamic cone penetrometer applications and actual state specifications
- Find me information about TSP2

Research and Analysis, Literature Reviews - Information Technology/Applications

- Researching IT Asset Management Systems
- IT system research for software server configuration for particular application
- Research digital signature in our state
- Researching Online Work Order management systems
- Compare and contrast various document mgmt systems in use
- Gather info. on creation of web-based databases
- Finding and implementing a search system for the company's reports
- Provide information about technology
- Identify elements of a prototype project office for document management

Research and Analysis, Literature Reviews – Financial Info

- State-by-state comparison of highway construction $
- Identify best practice for revenue projections
- Prepare spending projections based on spending history for our unit
- Track all financial expenditures by BTS

Research and Analysis, Literature Reviews - Equipment Information

- Find online manuals for our test equipment
- Price equipment
- Contact equipment suppliers

Research and Analysis, Literature Reviews - Workforce Issues

- Comparison of Pay Scales for Engineers for surrounding states
- Succession planning data
- Ways to recruit engineers from schools
- Research position classification comparisons between agencies/states
- Training opportunities for staff in range of topics in transportation planning

Data Collection & Analysis - General

- Analyze & Report on Internal Data (2)
- Exploratory data analysis
- Merge many data points into simple presentation
- Collect data from wherever needed
- Compile data into a database
- Collate survey results
- Extract Data from Datamart and provide me a spreadsheet of current data
- Data for research efforts

Data Collection & Analysis – Specific Topics

- Collect traffic data from work zones
- Research border crossing trends
- Search through construction records for information on specific state projects
- Truck traffic on selected highways
- Crash data
- Climate data for selected sites
- Keep current on all economic data stats
- Cost data
- Gather transportation emissions data
- Develop national and international ferry-related data base
- Use NTD to examine trends in several specific factors affecting transit productivity
- Hot Mix Asphalt density in relation to performance
- Build asset inventories - locate specific features
- Request and assemble detailed daily ridership data from vanpool operators
- Write VB code necessary to analyze traffic temporal data from class counts and TMC
- What is the history of pavement distress on test projects before and after construction
- Use PUMS data of the Consumer Expenditure Survey to examine relationships between household transportation expenditures and vehicle ownership and other households
- Develop our travel trends report for my review
- Prepare reports that compare 3 previous forecast series from the same vendor

Collect, Catalog and Archive Information Resources

- Inventory Data Sources
- Find descriptive information on transportation datasets
- Research internal data files and resources
- Download new reports to CD/DVD to add to library collection
- Catalog info

Specifications and Practices from Peer Agencies

- Query other DOT specifications
- Call other states on specific issues for past practice
- Review of best practices used in information/report dissemination
- Call state agency staff
- Call 5 state DOTs and ask them how they update their highway inventory
- Find me information on how frequently each state DOT collects pavement condition data

Legislative/Regulatory/Legal

- Track legislative requirements
- Track legislative proposals that impact transportation funding, particularly BTS
- Translation of Federal Regulations
- Outline SAFETEA-LU statewide planning requirements
- Legal questions

Identify Expertise

- Develop and maintain a list of key organizations and individuals conducting transportation (transit and highway) research/analysis, including contact information and links to websites

- Identify researchers on certain topics
- Develop/maintain contacts of peers for our technical area in other DOTs

Compile and Organize Information

- Organize paper/e-mails into subject files
- Organize existing files
- Clean and file my office stacks that are unfiled from meetings
- Organizing shelves with reports and other reference material
- Create desktop shortcuts for all reports
- Compile data into a report
- Compile results of survey into information sheets for Upper Management
- Create a contracts and agreements database
- Create databases for information that is internal to the organization so that it can be better utilized
- Document and summarize processes
- Database input of reports/newsletters/tech briefs rec'd
- Download financial data from the agency's accounting system

Funding Opportunities

- Collect information on research funding sources from other than transportation agencies
- Funding Opportunities
- Review and search for other grant opportunities
- Search for possible request for proposals and reports that relate to interested research of our organization
- Upcoming requests for proposals

Project Tracking and Evaluation

- Status of all SPR Research Projects
- Current Research projects underway
- Determine the BCR of our recently completed research projects.

Summarize and Communicate

- Manage dissemination of publication from my center
- Provide synopses of our organization's research reports
- Prepare summary report
- Disseminate information to users
- Provide information to others
- News for specific website such as fuel cell
- Collate department websites and information resources into an information portal

Question 10. What improvements in transportation information access would be of greatest value to you?

One-Stop Shopping/Web Site/Search Tools

- Establishing a comprehensive Internet site that houses all the information with good search tools.
- A national transportation website that indexes sources of transportation information by categories and sub categories.
- A national, web-based clearinghouse of reports, data, and other information from reliable sources (official, refereed, etc.), supplemented by a listserv function broken down by topic areas (not geography). This would help ensure that useful research and information reach a wide audience of interested practitioners and researchers, and also facilitate proactive research efforts by organizations with limited staff.
- National clearinghouse for data/information
- More single-stop shopping like BTS provides via National Transportation Library
- That narrative, tabular and geospatial data, photographs are all retrievable through one portal.
- Combining all the information access into one website. There are so many researchers doing research on the same topics. With having one main website, it would be easier to keep track.
- An excellent national transportation information portal that would point to all types of information, not just websites or electronic documents.
- A quick "google-like" search tool for transportation-related searches
- Make searching the TRB and AASHTO websites user friendly. To find something on TRB I go to Google; it's much faster and much more accurate.
- Having a centralized resource center to search for and retrieve information (one stop shopping).
- Transportation-specific search tools.
- Comprehensive search engine
- Better on-line search tools relating to transportation.
- Expanded keyword search capability
- Improved search engines
- Central resource for international, national, state and local information.
- On-line transportation-related search engines that are connected nationally.
- Search engine that provides decent summaries
- To be able to electronically search and access all transportation-related documents produced by public agencies at the local, state, and federal government levels
- Easy to use, standard, Search Strategy with simple How to Use instructions. State Content Clearly, Description & Management upfront. Marketing format choices help
- Easier searching - data gathered and organized in sets or topics - newest info first - links to related topics or articles in browser
- OPAC access to grey lit Centralized web portals for regional or topical access to sources (well designed and maintained)

- Some national website that would simply have links to a multitude of research links. This website would simply be a site that those interested could go to to find a link. The reason for this is now I save a website on my "favorites" list that now I have so many favorites that it can be difficult to search.
- Better coordination. A one-stop-shop of information would be best.
- Consolidating all transportation information into a one-stop shopping resource, a la OCLC WorldCat. Currently there are lots of overlapping resources whose missions and purposes seem similar, resulting in confusion for the researcher.
- Publicize the availability of TRIS and insist that it be used by all transportation research organizations or do away with TRIS in favor of one, single comprehensive repository for all transportation research done or in progress. Access should be provided to a title/topic, a synopsis and a total, searchable document with an automatic link to the document at the original research source/organization.

Value-Added Services to Filter, Organize and Integrate Information

- Prioritizing available information. Outdated and unsubstantiated information is of little value yet is listed on most search sites along side the latest available research and industry best practices.
- The biggest problem we face is information assessment. Available information varies dramatically in quality. In addition, the transportation literature is enormous, and relatively easy to access, but the sheer volume makes effective assimilation of information impractical. We need more and better peer review and assessment of transportation information, especially for information available on the Internet.
- Scanning and sorting and evaluating information so I receive useful information, not reams of it
- Develop more targeted information for each sector. There is so much information, it's an overload.
- Develop specific topic area clearinghouses
- Expand and centralize access to blurbs and short syntheses of information about transportation topics. Currently, TRB, WI, AZ and VA are creating this type of content but it would be very useful to have more with access to all and with keyword searching from one website.
- A comprehensive listing of citations for programs that are known by certain brief names, i.e., Section IX, 401(f).
- The e-mail subscription services such as the TRB Transportation Research E-Newsletter have been very useful in trying to keep up with information as it comes in.
- Listing of sources, web page links
- Comprehensive directories and glossaries
- The ability to access a common group of functionalities across public rail transportation

Transportation Data Dissemination

- Development of a tool at the federal level that all states would use for collecting, reporting and analyzing data.
- More tailored data sets that can be linked. I do not want or need to wade through everything within transportation but would like to share some central information from a more localized set of information
- Identification of data needed to make decisions and available data - to identify the gaps in data needed and systematic approach/plan to fill gaps.
- A data search engine similar to Google that reviews all transportation data sources, including international, Federal, state, and university data bases.
- Data clearhouse concepts for: - safety, traffic operations, maintenance, etc.
- Make local, state, and national time series data accessible with query tools.
- More data accessible on-line, more coordination of data between jurisdictions. More GIS data
- Central information source with staffing to assist in locating info
- Better and more current data on highway crashes, causation, purpose of trip, etc.
- A well-designed database with good data-mining tools.
- Improved data on transportation costs and benefits
- Access to archived traffic data from prior research activities
- When data is available, make it software independent, i.e. comma delimited with appropriate documentation.

Best Practice and Support for Peer to Peer Knowledge Sharing

- Topic-specific searches of best practices and people to contact with experience in a particular subject.
- The social networking sites (especially for DOT contacts in specific technical areas) would be most useful.
- Collaboration and sharing of knowledge.
- An active social networking site where my questions would be answered in a timely fashion; where I could go to keep my finger on the pulse of what is happening in state DOTs.
- Building national site to include knowledge sharing among transit's front line staff/blue collar workers
- Building a collaboration or social networking web site for transportation practitioners- as posted in question above. But, in considering the above there are already a number of similar networks that I don't use now. Unsure of what is needed.

Information Capture, Cataloging and Archiving

- Funding to support a 5-10 year collaborative effort in acquisitions, cataloging, access and digital preservation. TRISNet

for the 21st century - an effective means for every state DOT, FHWA, research centers, etc. to disseminate copies of their research reports to interested parties. National transportation archive for long-term access and preservation for print and digital documents
- Having an improved ability to search transportation references would have the greatest value. However, I don't think the issue is as much that search tools need improvement as it is that there is a lack of resources to digitize documents, tag their metadata, and encourage agencies to share their library resources.
- If every organization would catalog their own publications into a library catalog (OCLC preferred). Standard language would be used to organize all types of information resources (complete with synonyms for a user friendly face). Federal transportation libraries would stabilize and actually collect USDOT publications so that they are findable within the transportation community long term. Topical access tools are improved (made more robust, more easily findable)
- Knowing that state and federal (and university, where affiliated) digital documents will be permanently archived and retrievable at no cost. Many of us have limited physical space. I'd like to see regional coordination on collections for certain categories of documents - not everyone needs to keep superseded AASHTO administrative manuals (for example) - perhaps certain libraries could agree to hold specific collections of infrequently used titles. More participants in OCLC group LSTR for no-cost resource sharing. Getting local holdings into TRIS. In our state, we have state DOT reports that aren't in TRIS. If a searcher uses TRIS and not TLCat, they may miss a number of older reports.
- Improved uploading of research results
- Improving the information pipeline doesn't mean a lot if there is nothing useful being produced to put in it. Those with the time and motivation to produce informational documents are rarely those who are actually developing innovations or doing the work. Those who are doing the work seldom have the time to document their knowledge or hard-earned learnings. Internships ought to be developed whereby students could work with practitioners and have the time to document their knowledge. Then the pipeline could be filled with useful product.
- Creating the transportation equivalent system to the NLM Medline database. Currently, TRIS does not cover the breadth and depth of the transportation field that Medline covers in medicine. Also the quality of records in the Medline is far superior to TRIS. Medline has very few duplicate or incomplete data records whereas TRIS has so many that it's almost funny. TRIS should be expanded to include not only gov't supported research, but transportation related articles and materials from a broad range of commercial publishers as well.
- Establishing a national transportation information archive to preserve and provide stable access to both print and electronic documents
- An easy system for agencies to provide their information. The value of TKN is limited to the information provided.
- Electronic access to documents - at no charge. Information changes rapidly so digitizing all old documents would not be a very effective use of funds.
- Transportation Archive Access to that data
- Better bibliographic description and control of transportation literature
- Long term preservation of digital and print resources. Seed money to improve networking and cooperative planning.
- Knowing where to search for information and having information cataloged for easy search

Digitizing & Links to Electronic Documents

- Our patrons want more on-line access to reference materials, so digitizing projects would be the greatest value.
- Digitized/web documents
- Greater digitization of documents
- It has to exist digitally for you to access it
- Requiring state and federal transportation agencies to digitize all current and historic collections, archiving them and making them available in Google for posterity.
- I am seeing more and more full online documents that can be downloaded free of charge. This is really helpful and saves a great deal of time. Improved search capability of state info would be helpful too. Many are in TRIS with links. Don't know if it is possible to have a separate search robot check all state sites in a search.
- Simply put, having access to information easily and quickly. Electronic documents are a must.
- 1) I believe there is a great amount of grey literature that would be valuable to the transportation community. A campaign to convince them that the reports in their files are valuable might help make this information more readily available. 2) I believe that the community needs more in-depth indexing of its literature: something more detailed than item level description (for books and reports) and that would bring material on the same subject together more effectively than Google.
- Access to existing research that doesn't exist in sharable, electronic format.

Coordination & Standards for Information Sharing

- An information sharing technical and human infrastructure.
- National coordination with a working method to ensure timely input of information.

- Sharing of electronic documents policies, procedures, business plans, manuals, guidance documents, etc.
- Each state DOT should have up-to-date websites. AASHTO or TRB should provide service to state DOT's for sharing information.
- Greater integration among state DOTs and USDOT
- I strongly believe information exists but needs to be standardized.
- Standardization
- Getting agreement on standards for transportation information sharing

Building Awareness of Existing Information Sources (Including Librarians)

- Improved awareness of currently available tools & resources.
- As a solo librarian, everything I do must be geared toward enabling my patrons to find or know how to use information themselves. This would include tutorials on using databases or the OPAC using new technology like screencasting; or continually updated powerpoints that are publicly available describing new library resources. We are dependent on networks and the assistance of other libraries who have already created bibliographies. DOT patrons are independent and don't want to attend classes; anything that we can give them that helps them help themselves is what they want, although they are no different in this regard than college students or users of other digital libraries. I would like to offer a type of electronic reserves for the management classes but the education department here is not aware of e-reserves.
- Convince people that professionals (i.e., librarians) can find more than I can on my own

Funding and Support for Library Services and Networks

- A national transportation library that is funded commensurate with the transportation industry's contribution to the nation's economy
- Providing better in-house services to practitioners (with financial support.)
- Helping other transportation libraries help themselves and each other. If each was willing to collect, catalog, and provide collective access to nothing more than their own holdings (i.e., those originating from their state, mode, or area of expertise), then collectively the whole would be far greater than the sum of its parts. As it stands these libraries, relative to their peers in even the least developed sectors, are in an appalling state of arrested development. This is not about technology or about standards. Those got figured out decades ago. It is also not about "marketing the value" or building a better bookmark. It is about doing the job the way our peers do it . . . There is a vast amount of transportation research information that would be of great value if brought under bibliographic control. It is not hard to do, but due to its specialized nature, if we don't do it nobody will. Unfortunately there are not enough transportation libraries. Of those, not enough have staff with the competencies required to do modern librarianship right. Most barely have a staff at all . . . and typically they are paraprofessionals or people with barely any library background. Most of these libraries barely have a budget, facilities, or resources at all to speak of . . . all the more reason why a non-biased (non-pooled fund) national coordinating body could dramatically advance the state of the practice by getting these small shops to work together to defray costs and expand their collective access to information and research. Other sectors figured this out long ago. The time for platitudes and excuses has come to an end. This is about smart business. What is stopping transportation?
- Money for cooperation (which will lead to development of standards, cooperative projects to produce better in-house and regional library services, and other improvements)—preserving historic materials—one place to locate books, data, and article research Of course, many of our problems stem directly from lack of funding. Appropriate funding would enable myself (as a solo DOT Library) to secure subscriptions to the expensive, but peer-reviewed transportation research (journal articles, etc.) that my customers demand. Related to this is access to statistical data, especially demographic via database subscriptions. Funding would also help digitize documents and ultimately create better access to them for transportation customers. Also, being able to gather information from other state DOTs on a more consistent basis would be very helpful. I get many requests that start with the phrase "What are other DOTs doing in such and such area?" In our own organization, we need a better effort to access our own data that is not necessarily in a traditional published (library) format. Specifically, archival materials such as correspondence, draft reports, speeches, presentations, photographs, and the knowledge from key, but recently retired employees too often slips through the cracks and is gone forever. We need to do a better job of capturing this nontraditional type of information dissemination.
- Establishing national collection development plans that are collaborative, with funding for international materials and journals. Selecting and using standards for preservation of physical and digital collections. Subsidies for services—interlibrary loans, training for library staff information users. Preservation of existing collections, physical and digital. Mechanism and funding for collecting and preserving materials, including realia. Establish a "flagship" library that sets direction and guidance for the US transportation community.

- Expanding the identification, cataloging and preservation of transportation information resources at point of production. Providing within each transportation organization at least one staff member with knowledge of transportation information production, distribution, and description with the resources needed to share information about the resources with a national network and provide access on an as-needed basis.
- We currently are fortunate enough to have a very good transportation library in California and excellent resources available through the university catalog MELVYL. If there were more resources available to enhance the services provided by these organizations it would increase their value.

Free/Low Cost Access to Information

- Free access to journals and other published sources of information
- Access to things I cannot afford
- Affordable electronic sources and licensing of same to allow direct end-user access

Other

- Let the UTC National Centers be the catalyst for providing these services for information access.
- TRB is on the right track but they need more funding to provide comprehensive services. One central source would be the most economical method but making membership affordable would likely be a problem.
- Latest technology information availability
- Integrating administrative support organizations with the project management efforts.
- I wouldn't be surprised if a carefully prepared survey revealed that the most helpful information would be a better knowledge of what's going on in our own organizations.
- Networking with others—and not just via the Internet or e-mail
- Our librarian has moved us forward, and as we use her so much, access is less of an issue to me
- An assistant to monitor and report on developments
- Improving communication between various research groups.
- More translations of European research reports.
- International Research Documents Translation to English and available from a national service
- A more user friendly Manual on Uniform Traffic Control Devices
- Ferry information is currently not included - we need this to learn best practices - we need international and national ferry information on all aspects of ferry transportation.
- The focus seems to be on libraries. Transportation includes information beyond libraries, such as data, records, etc. These groups need help as well. While we need a strong and well funded NTL, we also need to expand the thought that information is under the sole purview of libraries. So, 1. Build and strong NTL that is well funded. 2. Expand definitions and make sure the scope of this project, TKNs, etc. extends beyond libraries.
- Transportation Information has to be EZ to look-up and EZ to understand even for a 6 year old. I know that is not so EZ to do.
- Readily available information via Internet
- Improved access via Internet.

Question 11. Please use the space below to provide any other comments that you would like to see considered in the business plan for implementing Transportation Knowledge Networks.

Comments about TKN Organization, Products and Services

- Would like for the NTL to provide leadership in helping establish regional TKNs and perhaps providing some seed money for initial meetings.
- Careful consideration needs to be given to the organizational structure of the oversight committees. Ideally one-, two-, or three-tier organizational structure with representatives from the primary user communities can be established so everyone works together for the common good without excessive duplication of effort.
- A user advisory board(s) should be established to make sure needs continue to be met.
- Build on the existing network of transportation libraries and the services that these provide.
- Continue efforts in connecting all transported related libraries electronically thru the web.
- Have up to date contact information about research in progress
- Knowledge Network should go beyond libraries and include other stakeholder of information.
- It is easy to give away money to start libraries and websites, but can not be sustained unless there is continued support from respective agency top managers. Involving right persons in the plan would be the first and important step. Consider having some transportation managers with technical background and an MBA.
- Targeting top state government transportation managers to convey how important in-house library services and transportation knowledge networks are to staff in performing their work. Many state DOT libraries have been closed because of the misconception by top management that all information is "easily" accessed through the web.
- I would like to see some flexibility in membership rules - there is no one size fits all for transportation libraries. Many

of the membership rules being proposed are not going to work for us.
- Recognition that participation by already overwhelmed librarians (many of whom are solo practitioners) requires support at a high level to allow attendance at meetings, time to devote to TKN efforts, etc. Support that is both financial and organizational, at local and higher levels.
- Points of access to any national transportation information resources network need to be distributed to be as close to the practitioner as possible. Availability of these points of access need to be marketed as broadly as possible. Practitioners need to know efforts are being made to provide local access to a nationwide network that can deliver what is needed when it is needed. "Think globally, ask locally?"
- Make participants in a national network accountable for results. Drop the regional focus. This country needs to get transportation information figured out . . . and that's far more important than the egos in the Midwest. Encourage the most proficient transportation libraries to act as "big brothers" and "big sisters" to other libraries, especially in regards to setting policy, best practices, and training. Use OCLC . . . and leverage that investment by using it fully (cataloging, training, resource sharing, colab collect dev., digital ref.). Negotiate discounted group rates with OCLC and other vendors. Find a way to provide clear leadership. With the MTKN, the pooled fund, the NTL . . . it's all just too confusing. Why does transportation make something that is essentially easy and turn it so difficult? We're making things way more difficult than they need to be . . .
- Centralizing rather than regionalizing to produce one stop shopping. We look nationwide for resources.
- Strengthen the National Transportation Library's role as networking leader, collection collaboration leader, data quality leader.
- I hope this plan enables libraries to play a more central role in the distribution of transportation information, particularly from the federal level.
- Personally, I think such all-too-common tasks in efforts like this such as "creating a marketing campaign" or "having a kick-off conference" represent a total waste of money. Most transportation professionals know the places they need to go for information; the problem is, many times the information is incomplete or otherwise unavailable. Spend your dollars on the data itself — not on "fluff".
- I do not like to see funds used on bureaucratic standardizing (pdfs are fine) and training. The web is simple to search and a national level page with lists of other links would be useful if it were easily searchable.
- Sponsoring travel opportunities for in-person social networking—many public agencies find it difficult whether budgetary or politically to travel to some of the best training/learning/sharing opportunities
- The option from Question #9 "Developing a marketing campaign to build awareness of the need for each organization to commit resources for information sharing" is very important. Getting organizations to commit resources will ensure long term support and a better payoff from these activities. The options to provide seed funding or grants with a limited time duration run a high risk of leaving users high and dry if no agency picks the service up for the long term.
- Training, education and marketing of the tools available and value of TKN is needed.
- 1) The plan needs to retain the "origination credit" for the organization that created the research while making that research available as broadly as possible; i.e., a click on the document or pages printed should be automatically credited to the research originating organization to show the use/interest in the subject to guide further research. 2) Inquiries regarding the research should be automatically routed to the research originator to answer. 3) The service should be free to avoid any hesitancy by potential users. 4) Numeric trends toward the use of topics solicited by inquirers should be available to all users to assist with research needs assessments. 5) Apparent plagiarism should be tactfully identified to both the offender and offendee. Etc.
- Emphasis on the need for trained library and information professionals as key to connecting people with the information they need. Importance of accurate and complete cataloging of materials as key to access to collections. Necessity of quality search tools as key to retrieval of information. Again, a consolidated one-stop shopping source for transportation info and materials, a la WorldCat.
- Basically, as a state DOT librarian, I would like to impress the point that information requests are often atypical of a traditional academic or public library. Our customers are looking for information, and do not really care whether it comes from a published research report, a piece of correspondence, from a spreadsheet on someone's hard drive, on the back of a photograph, or from an expert's personal notes. Librarians need more support in becoming more than a traditional library. They need to be established as a central information hub, for all types of information requests. The library in a state DOT needs the support to be the first place an information seeker goes to, instead of being the last resort. This support can be through a visible location in the building, ample space for their resources, as well as support to subscribe to key electronic resources. The librarian/library as well needs to make better connections within their own building, to key raw information resources, besides the usual collecting of library materials. In addition, the librarian should make external connections if possible to local historical society where DOT records are kept, as well as academic partnerships that could become mutually beneficial. Thank you.

- To document results may wish to establish contest showing value derived form Networks.
- Reasonable fees to OCLC, and support to encourage my DOT to buy us into OCLC.
- It needs to be flexible allowing multiple small depositories that are close to customers and communication across depositories.
- Internet forums can be a great way to query one's colleagues quickly. To work, such forums need to be specialized enough but not too much and supported with features such as reference reports.
- On your website, the initial paragraph talks about "access and share" and although I have not read all the documents, there is no mention of acquisition, housing and preservation of information . . . not everything is digital nor will it be for a while . . . so we still need to think about these issues.

Comments about Barriers to be Overcome

- It seems like some states have great ideas that work but other states either do not know about them or seem hesitant to use other ideas. We keep re-inventing the wheel which hinders the progress in the transportation field, therefore our infrastructures is decades behind. Look at bridge maintenance on the interstate system as a good example. We inspect them all the time but for some reason they do not get the maintenance attention they need and it is an aging system.
- The largest impediment that I see is the lack of awareness of how to learn throughout life. I would like to see requirements for continual learning, like the kind that teachers must go through in order to stay certified to teach, or that health care workers must take in order to stay licensed. The problem is twofold; there is already a lot of information on transportation, it's just that it's not harvested in an efficient way yet, like the NIH does for medical libraries, and two, there is no mechanism developed yet that enables or forces state DOT workers to take advantage of this knowledge in a systematic way.
- The problem has been framed as primarily a lack of access to data. I'm not sure that is the right way to look at the situation. You might ask why it is that transportation agencies so often prefer to re-invent the wheel rather than looking around to see what is available first. I think you will discover that lack of access to data usually isn't the obstacle to good decisions and workable plans. Agencies often have more difficulty defining the problems they are trying to solve, establishing objectives, and being open to a wide range of alternatives. And because public agencies very often go into a project or planning process with a "solution" already firmly in mind they have much less incentive to look around at how others have tackled similar problems. Even when public agencies approach a problem with an open mind they often don't know what questions to ask. If you don't know what you are looking for it doesn't matter how much information is (or isn't) already available. It is fine to talk about "data driven" decisions, but at many public agencies decisions are driven as much by policies and politics as they are by data. As the old saying goes, you can lead a donkey to water but you can't make him drink. So it goes with public sector transportation decision making. Greater access to information could be helpful, but I wouldn't expect that to dramatically change either the decision making process or the outcome.
- Stable funding source would be the key to success. Not too many of these available.
- There are more important issues that need to be addressed than libraries. When the legislature won't provide sufficient positions to do needed design, etc. enhancing library services is the least of my worries.

Comments about Information Access Needs

- As much focus needs to be paid to the capturing of the latest best practices that are developing and not yet documented in research as the latest NCHRP reports.
- (1) It would be more useful to organize information by topic area (e.g., mode, technology type, key issue) rather than by geographic area. (2) It would also be helpful to include sources from outside the U.S.
- Dedicated resources to address data/information collection/availability. The current approach is to rely on existing resources to do this work whenever it can be squeezed in. Those resources usually have higher priority issues to deal with.
- Find a way to link international, Federal, state, and university databases to allow searches of all sources from one search engine.
- One critical element of such networks is that they need all electronic search and access. Electronic search and access for published materials are well established through university libraries across the nation. However, electronic search and access for un-published documents, particularly those from various government agencies at all levels, is not well established. The key is to have a system in which all such documents would be provided electronically through the Internet or a particular database.
- Develop a search engine like Google which can comb the world's transportation libraries, and which will let us know research in progress as well as completed studies.
- The key here is to make the information easily accessible from anywhere. Practitioners want information instantly. If not available, they will simply move on with the work and assume no information is available.

- Need to consider how data is used in relation to format it is provided. GIS data is essential

Comments about Specific Information Needs to be Addressed

- I would like to see more information for Landscape Architects. Bio engineering, mitigation creation, fish passage, etc.
- Best practices for information management, GIS, SOA, Open Source.
- Better use of web training or other methods to disseminate research results.
- Free documents from TRB and AASHTO, more electronic access to more things, more links to outsiders views of what transportation is and does

Other

- As transportation seems to be a follower in this area compared to other disciplines, it would make sense to emulate what other areas that are leaders in information sharing have done (e.g., biotech?), and in the plan address how their experience can be leveraged for the transportation community.
- Enterprise Content/Document Management; structures to support improvements in technical advances; scalability
- Need to think differently than the past. What new technology will come into use. I would like information to put on my I-Pod or e-reader. What "toys" will we have in the future?
- Define the problem . . . identifies the information need. . . . identifies the data to be collected. . . .does this exist and then where does this exist or does it need to be purchased. . . . information and knowledge are problem driven . . . people want to know where do I get it, how do I interpret it and can I use if for what i want . . .
- Evaluation of how other industries around the world are dealing with the same problem.
- Ability to map transportation research products to the national roadmaps for pavement, bridge, safety, etc. There is a lot of research going on that the Feds don't know about and a lot of national vision not being communicated to researchers.
- Promote a culture of measurement wherever possible.
- This is a much needed effort!

APPENDIX D

Follow-up Survey to AASHTO SCOH Members

Transportation Knowledge Networks Presentation at AASHTO SCOH - Feedback		
Do you think that a transportation knowledge network/information portal would add value for transportation agencies?		
Answer Options	**Response Percent**	**Response Count**
Yes	85.7%	24
No	0.0%	0
Don't Know	14.3%	4
If you answered No or Don't Know, please explain:		4
answered question		28
skipped question		0

Number	Response Date	If you answered No or Don't Know, please explain:
1	05/13/2008 12:23:00	Not sure if people will really use it. staff is so busy now that unless they have a person on staff that is aware of the portal, then could go unused.
2	05/23/2008 18:11:00	There are so many sites with info on them. How will one determine what is important? I.E., the site includes the report from the commission wich is on other sites. Will this site only have info you can find here?
3	05/28/2008 17:00:00	Did not hear the presentation at AASHTO meeting, not sure what the niche or approach is vs existing sites - although from questions below...
4	05/29/2008 12:07:00	Most of this information is already easily available through simple internet searches. The info is valuable, but a new portal may not be needed.

Transportation Knowledge Networks Presentation at AASHTO SCOH - Feedback		
Which arguments for transportation knowledge networks did you find to be compelling (check all that apply)?		
Answer Options	**Response Percent**	**Response Count**
One stop shopping capability would make searching for transportation information easier and more efficient	78.6%	22
Opportunities to reuse/adapt analysis tools and reports developed at peer agencies	75.0%	21
Improved ability to keep up with what peer agencies are doing	71.4%	20
Providing new services for the next generation "born digital" workforce in transportation	42.9%	12
Improved ability to get new staff and consultants up to speed	46.4%	13
All agencies will benefit from a national investment in information sharing	75.0%	21
Current investment in transportation information services is very low relative to other fields	14.3%	4
The need and ability to capture institutional knowledge before employees leave or retire.	32.1%	9
The opportunity to deliver clear and concise information about transportation issues to the public.	50.0%	14
Other (please specify)		0
answered question		28
skipped question		0

Transportation Knowledge Networks Presentation at AASHTO SCOH - Feedback		
If a national transportation information portal were created, what types of content would be useful for the scope of responsibilities you manage?		
Answer Options	**Response Percent**	**Response Count**
Industry Standards and Guidelines	60.7%	17
Current Policies and Procedures	82.1%	23
Data sources	50.0%	14
Directory of transportation professionals across the nation	60.7%	17
Research reports	75.0%	21
State of the practice/Lessons Learned resources	89.3%	25
Key transportation facts (gas tax by state, which states are using variable pricing...)	96.4%	27
Event data (national and regional meetings and conferences)	35.7%	10
Other (please specify)		1
answered question		28
skipped question		0

Number	Response Date	Other (please specify)
1	05/10/2008 11:26:00	There should be a blog for recent retirees. One of their issues to adjust is that they have a career of knowledge to share but unless they consult they have no voice or venue to mentor and advise.

Transportation Knowledge Networks Presentation at AASHTO SCOH - Feedback	
What additional advice or feedback do you have regarding the draft information portal?	
Answer Options	**Response Count**
	11
answered question	11
skipped question	17

Number	Response Date	Response Text
1	05/10/2008 11:26:00	Good idea.
2	05/11/2008 00:31:00	none
3	05/13/2008 12:23:00	The challenge is trying to collect this information with no additional work required by the transportation agencies. the portal needs to access data that is already accessable which also means that the data is not in any one format but rather a wide range of formats that make consolidating it very difficult.
4	05/14/2008 14:34:00	This is a complex question with lots of opportunities to have the process mis-directed in its construction. It will need careful observations.
5	05/21/2008 14:59:00	Keep it concise, quick look capability for data needs, updated regularly with data relevant to DOTs especially on funding and legislation.
6	05/23/2008 18:04:00	The sooner the better.
7	05/23/2008 18:48:00	Some AASHTO Technical Committee members might be able to use something like this to upload large files of draft publications or documents for review and coments by other committee members.
8	05/23/2008 21:51:00	The colors used are hard to see in some areas.
9	05/28/2008 15:55:00	Although the Department agrees that a transportation knowledge network/information portal would be valuable, we would not commit to share in the cost at this time.
10	05/28/2008 19:10:00	none
11	06/05/2008 16:53:00	National Transportation Information portal is vital. Would meet a tremendous need and be very valuable to DOT's across the country.

APPENDIX E

Focus Group Summary

Overview

A focus group was held on Wednesday, August 27, 2008, from 1:00-2:00 p.m. CDT. It was conducted via conference call and the Internet. Its purpose was to gather reactions and ideas to elements of the business plan, to the tools that could be developed to assist in the search for information, and to the process for procuring and maintaining information resources. The session was facilitated by Gina Baas of the University of Minnesota and Frances Harrison, and Hyun-A Park of Spy Pond Partners.

Generally, the participants liked the idea of TKNs and an information portal, provided the resources were available to develop and maintain them as described in the slides. Some specific suggestions from the participants include:

- May want to consider the public television/public radio model of funding using advertising for contributing funds to maintain the information portal.
- Rather than having a single topic leader to maintain topical information, have a team of individuals to provide a more balanced and diverse view.
- All emphasized importance of the portal being comprehensive and up-to-date; it's critical for the business plan to address how that would happen.
- In terms of organizations' willingness and ability to share their own information, it would help to have an automated process of sharing; it's the "right" thing to do, but needs to be easy, automated. Perhaps incentives need to be put into place to ensure that needed information is shared.
- One participant suggested that the regional transportation knowledge networks could provide a good model for building information by taking advantage of connections with local and regional MPOs, agencies, etc. However, three regions are probably not enough.

A recording of the focus group is available online: https://umconnect.umn.edu/p17878894/ (Length: 1 hour, 2 minutes).

Attendees

The invitation was initially sent to about twenty members of the AASHTO Standing Committee on Planning (SCOP). Three states responded, and members of the research team followed up with others to obtain representation from five states. Participants were:

- Alaska DOT: Jack Stickel, Transportation Data Services Manager, Division of Program Development (Planning Division), jack.stickel@alaska.gov
- Idaho DOT: Inez Hopkins, Roadway Data, Research, Librarian inez.hopkins@itd.idaho.gov
- Michigan DOT: Debra Alfonso, Manager of Intermodal Services Section, Department of Planning, alfonsod@michigan.gov
- Oregon DOT: Robert Maestre, Long-Range Planning Manager, Robert.A.MAESTRE@odot.state.or.us
- Virginia DOT: Ben Mannell, Assistant State Transportation Planner, Ben.Mannell@VDOT.Virginia.gov

Summary of Presentation and Discussion

The focus group began with introductions by members of the research team and the participants, followed by a couple of ice-breaker questions.

Question #1 was: What is your greatest challenge in managing the information and resources needed to do your job?

Responses included:

- "There's too much [information]."
- Staff spend too much time searching the Web.
- Need for meet information needs related to staff turnover, including business process documentation and training materials.
- TRB Synthesis reports have been helpful in getting going on new project areas.

Question #2 was: How does your organization manage and disseminate its own information and products?

Responses were:

- Virginia: VDOT manages internal information through departmental policy memoranda; internal Web site; information memoranda; and team sites for specific projects, such as Bicycle and Pedestrian, Operations, Transportation Demand Management team sites. Also, monthly videoconferences held with regional offices to share information. VDOT has a KM Center that they use fairly regularly. In terms of external information, many VDOT staff members participate on TRB panels, resulting in the sharing of best practices.
- Idaho submits reports to TRB (for TRIS online) and OCLC; state library depository system.
- Alaska has elements of what VDOT and IDOT have, but wants to be further along. Alaska DOT is in the process of developing a comprehensive data business plan, including knowledge management elements.
- Oregon: Uses an Intranet, department-wide newsletters, and division-wide newsletters, member of WTKN: dedicated transportation knowledge librarian within State Library. One problem is that the regional offices need information from MPOs.
- Michigan – disseminate policies and memos well; internal newsletters. Challenges include keeping the flow of information going between, and managing historical information (anything that isn't the latest version).

Then, a scenario was presented to the group: "You have ½ day to prepare testimony for your commissioner on this topic of the implications of mileage-based user fees for your state. What would you do in this situation?"

- Oregon: Call Jim Whitty, get a mini-team together at the beginning, do a Web search: mileage-based user fees, with "implications or consequences or legislation," Make phone calls, cut and paste.
- Idaho: Would use the State DOT search engine, TRB's TRIS Online, and the National Transportation Library's catalog.
- Virginia: Also, get a handle on VMT in your state: TTP, Growth in VMT, TDM Models: impacts on average commute lengths.
- Oregon: Also, think of how to search related fields: air quality, climate change, trucking, the politics of the issue.

The TKN vision and portal concept was presented, showing how the portal might be used to address the scenario, and explaining the "behind the scenes" work needed to populate the information in the portal.

Initial reactions from the group were:

- Oregon DOT: Experts are really key to making this work. He recommended the book: "Wikinomics: How Mass Collaboration Changes Everything", by Don Tapscott and Anthony D. Williams. This book shows how innovation spreads by being broadcast to a larger panel.
- "Where's the advertising sidebar to support it?" Should at least consider public television/public radio model of funding/advertising. Will be fairly expensive to keep up, probably $2-5 million per year. Professional and transportation-related advertising may be a reasonable way to support it.

Responses to Structured Questions

1. Which aspects of this would provide value to your organization?
   - Alaska: specific application at another state DOT, such as 511, road weather, transportation data, typically buried in a department's Web site. Would be great to have the pre-work done, with the links provided by subject.
   - Michigan: needs assurance that it would be a comprehensive source; what kind of incentives can be put in place to ensure that needed information is shared?
   - Virginia: Portal idea a good one. How would it ensure that it stays current and comprehensive?
   - Oregon: Would be better to have national "topic teams" instead of "topic leaders" – this would ensure that you get a balanced perspective and would provide greater credibility.
   - Virginia: One search engine accessing multiple sources of info.
2. How would you use the portal if it were in place? Are there particular topic areas or types of information that you'd be most interested in seeing?
   - Revenue generation
   - Privatization
   - Climate change
   - Devolution of responsibility of management of the roadway network
   - Transportation and Health
   - Reauthorization and the potential for performance measures and eligibility for federal
   - Multimodal tradeoffs
3. Would your organization be willing to share information such as presentations or consultant studies that could be of value to others?
   - Michigan: Biggest challenge is time constraints – information would need to be organized and that takes time

- Virginia: would like one point of contact to funnel information to portal (most likely the VDOT Knowledge Management Center)
- Oregon: if process was easy & automated
- Virginia: suggested a pilot program to share – illustrate the benefits of knowledge exchange, show tangible results

4. What questions do you have about how this would work?
   - Michigan: needs assurance that it would be a comprehensive source; what kind of incentives can be put in place to ensure that needed information is shared?
   - Virginia: Portal idea a good one. How would we ensure that it stays current and comprehensive?

Final comments were:

- Michigan: suggested the idea of regional knowledge networks as a feasible model, taking advantage of connections with local and regional MPOs, agencies, etc.
- Alaska: Important for the business plan to take into account the ongoing maintenance and updating

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation