PB99-148967

U.S.Department of Transportation
Federal Highway Administration

Value of Information and Information Services

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October 1998

Publication No. FHWA-SA-99-038

REPRODUCED BY: NTIS
U.S. Department of Commerce
National Technical Information Service
Springfield, Virginia 22161

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Abstract

This report describes and, where possible, quantifies the value of information and information services for transportation agencies. It evaluates the various means of accessing information and looks at the important role of the information professional. In 1994, the Transportation Research Board Committee A5001 on the Conduct of Research addressed the need to improve recognition of the value of information, information services, and information professionals. As a result, the Federal Highway Administration initiated a project overseen by a panel of technical experts to 1) determine the value of information and information services and 2) identify strategies for promoting information programs (included in this report as an appendix).

This report documents how information services help transportation agencies operate more efficiently and effectively. Based on an extensive literature search and interviews with public- and private-sector experts, it shows that the value of information can be measured in terms of: 1) reduced costs of agency research, technology development, and operations; 2) quicker implementation of innovations and time savings, and 3) more effective decision making at all levels of the agency. The support of top management is also an indicator of the value information and information services hold within an organization.

This report documents that information services are of significant value to transportation agencies. It also identifies a number of areas where existing programs and resources need to be strengthened. Recommendations for the Federal Highway Administration and its partners include:

- Taking the lead in building consensus on information issues and developing a national transportation information policy,

- Developing a national marketing action plan to raise awareness of the value of information, educate management on the need for information services, and promote information programs in transportation agencies, and

- Developing a comprehensive inventory of all transportation information resources and programs available nationwide.

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Background

Transportation professionals rely on accurate, timely, and easily accessible information to make good decisions. In 1991, the Intermodal Surface Transportation Efficiency Act (ISTEA) gave transportation agencies great flexibility to develop and plan their transportation programs, yet created broad new requirements for information collection and dissemination. Today, in addition to providing safe and efficient transportation, agencies must address a full range of issues to better serve their customers. Transportation professionals rely on a steady stream of information to keep up with a technology base that is continually evolving and changing, and the movement toward decentralization creates a need for information at many different levels of an agency. Finally, as transportation becomes integral to meeting our broader societal goals—such as ensuring environmental quality and providing mobility for a diverse population—agencies' needs for information become even greater.

The *Strategic Plan 1997–2002* of the U.S. Department of Transportation (DOT) recognizes the importance of quality information for making sound transportation decisions. Within the Department, the plan "recognizes that the collection and dissemination of data and information, and the creation and sharing of knowledge about the Nation's transportation sector, are crucial to ... success in an age of growth, increasing complexity, and decentralization." The *Strategic Plan* emphasizes that

> DOT has an essential role in improving the quality of decisions affecting the transportation sector through the provision of better information to both the public and private sectors. Broad dissemination of information will become an essential departmental mission in years to come.

In support of this mission, this report describes and, where possible, quantifies the value of information for transportation agencies. It assesses the various means of accessing information and looks at the important role of the information professional. In 1994, the Transportation Research Board (TRB) Committee A5001 on the Conduct of Research addressed the need to improve recognition of the value of information, information services, and information professionals. As a result, the Federal Highway Administration (FHWA) initiated a project overseen by a technical panel of transportation professionals and TRB committee members. This report represents the first phase of this project, which has two overall goals: 1) determine the value of information and information services and 2) identify strategies for promoting information programs (addressed in this report in Appendix C). The ultimate objective is to assist transportation agencies in making optimum use of effective and efficient information programs in the delivery of quality transportation services.

Introduction

The Growth of Information

ISTEA, devolution of authority, and technological innovation have increased the need for quality information among transportation professionals and decision makers.

Transportation agencies require timely and accurate information on a vast array of transportation issues, including intelligent transportation systems, intermodal systems, planning, mobility, land use, and safety. In its 1997 *Strategic Highway Safety Plan*, the American Association of State Highway and Transportation Officials (AASHTO) identified good information as "one of the underpinnings of a sound traffic safety enterprise" and called for the development of a safety information clearinghouse and a model safety information system.

Technologies such as the Internet have made certain kinds of information far easier to obtain, leading some agencies to downsize or eliminate their transportation libraries or reduce other information programs. But the increased volume of information makes information integration, analysis, and management even more critical. As stated in the AASHTO *Strategic Highway Safety Plan*, "The most accurately compiled set of data is meaningless if users are unable to work with it."

Information and Information Resources

Information can be considered as data (both factual and numeric) that is organized and imbued with meaning or as intelligence resulting from the assembly, analysis, or summary of data into a meaningful form (McGee, 1993; Walker, 1993). Examples include research results, technology evaluations, and new methodologies. The value of information is determined by its importance to the decision maker or to the outcome of the decision being made.

Transportation professionals require information that is not only accurate, timely, and relevant, but also presented and interpreted in a meaningful way. Among the primary sources of transportation information are books, technical reports, journals, data sets, directories, and the expertise of colleagues. These primary sources may be accessed through numerous secondary sources, ranging from library catalogs and databases to help lines, such as that provided by the Bureau of Transportation Statistics (BTS), and the World Wide Web. The section on "Information and Information Access" details the various means of accessing information and the role of the information professional.

How Decision Makers Value Information

Accurate, timely, and relevant information saves transportation agencies both time and money through increased efficiency, improved productivity, and rapid deployment of innovations. For example, access to research results allows agencies to benefit from the experiences of others and avoids costly duplication of effort. While the benefits are substantial, they are difficult to quantify and the value of information goes unrecognized. An extensive literature review and interviews with State DOTs, private companies, and transportation libraries reveal that access to information yields both time and cost savings by improving decision making, expediting solutions, and avoiding unnecessary research. The benefits of information and information services are summarized below. For a more detailed discussion of the literature review and interviews conducted for this report, see Appendices A and B.

Good Information Reduces Costs

Reducing costs is a primary concern for transportation agencies. A number of studies and experts consulted for this report cited the following cost savings resulting from access to information:

- New York State DOT (NYDOT) estimates life-cycle cost savings of nearly $9 million per year resulting from a new concrete mix for bridge decks that was developed as the result of a literature search. The new mix was implemented by NYDOT in less than a year.

- Illinois DOT saved approximately $300,000 through access to research at Louisiana State University on heat-strengthening of steel bridges.

- For New York, an innovative horizontal drain system discovered at a TRB conference not only solved a landslide problem, but also yielded net savings of more than $2.5 million over conventional stabilization treatments.

- In the private sector, Texas Instruments calculated a 515 percent return on its investment in library services.

- A subsidiary of another major U.S. manufacturer found that the information produced by a series of literature searches performed by its corporate library was worth about $400,000—and cost the company just $17,000.

- According to Griffiths and King (1993), firms without libraries spend 2 to 4 times more to acquire information than those with in-house libraries. Obtaining information through the use of alternative sources costs 2.3 times as much as acquiring the same information through an in-house library.

- Table 1 shows benefit-cost ratios for in-house information services range from 16 to 1 (Georgia Technical Institute) to 3 to 1 (Paccar, Inc.).

Table 1. Benefit-Cost Ratios for Information Services

Georgia Technical Institute	16 to 1
Exxon[1]	11 to 1
Minnesota DOT	9-10 to 1
NASA[2]	7.6 to 1
Paccar, Inc.	3 to 1

Information Saves Time

Quality information saves time in numerous ways—by avoiding duplicative efforts, stopping unproductive activities, modifying design approaches, or correcting bad information:

- Griffiths and King surveyed more than 27,000 professionals over an 11-year period on their use of information. Table 2 shows the percentage of journal articles, books, and internal reports to which the survey respondents attributed time savings.

Table 2. Information Sources and Time Savings

Information Source	**% Yielding Time Savings**
Journal articles	26 percent
Books	42 percent
Internal reports	50 percent

- For North Carolina DOT, knowing what other States have done, and how these methods or results fit into its own research plan, is an invaluable time-saver. Experts there report that the time gap between initiation of a research project and its inclusion in an information database can be costly to other research efforts; they urge a concentrated effort to expedite the reporting of research in progress.

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[1] See Koenig, 1992.
[2] *Ibid.*

- An in-house librarian at Paccar, Inc., joined a task force to reduce the turnaround time for findings from a vehicle test track. The test results, with digitized photographs, were made available on the corporate Intranet within 1 to 6 days instead of the usual 1 to 6 months. The speedier access to the test track data significantly reduced the engineering design cycle.

- Another corporate library reduced from 10 days to just 1 day the process of computing cost and labor rates for proposals by developing an on-line, in-house capability to perform functions formerly provided by an outside contractor.

- Parsons-Brinckerhoff saves time for managers and staff with its knowledge sharing network. This network has been successful in building the corporate knowledge base and in filling short-term vacancies for specialized personnel.

Information Improves Decision Making

Within the highly decentralized transportation community, knowing what other organizations have done or how they have confronted similar challenges is invaluable when making technical or policy decisions:

- Marshall's 1993 survey of banking managers documents the value of information in the decision-making process. Eighty-four percent of the 299 managers surveyed felt that the information provided by their company's information service contributed to better decisions. More than half said that the information led them to handle some aspect of an assignment differently. In cases where a decision involved a financial transaction, 74 percent estimated the value of the decision at more than $1 million.

- Respondents to Griffiths and King's survey measured the impact of information on work quality. Table 3 shows (from 1=low to 7=high) how respondents rated the quality of their work both with and without specific types of information.

Table 3. Information and Quality of Work (Scale of 1 to 7)

	Journals	Books	Internal Reports
With Information	5.82	5.68	5.78
Without Information	4.04	3.57	3.52

Information Yields Customer Satisfaction

Although many organizations cannot quantify the value of information or information services, the perceived value among users is high. Users discuss value in terms of whether, and to what extent, the information provided meets their expectations and needs. For example:

- Texas Instruments' library in Houston reported that 81 percent of the users sampled felt that the library's services had a positive impact on their jobs.

- Virginia's Transportation Research Council yielded an overall rating from its customers of 4 on a 1-to-5 scale.

- In Matarazzo and Prusak's 1995 survey, 75 percent of senior managers thought that their libraries contributed to their organization's strategic goals by providing valuable information. Information obtained from electronic databases and reference services were most valued.

Information and Information Access

As mentioned above, transportation professionals make use of numerous primary sources of information. Secondary sources provide access to this information and often convey or imply ownership. Another category, tertiary sources, provides access to the secondary sources. An example is Engineering Index's fee-based "EI Village," which provides on-line access to information resources required by engineers. Table 4 shows some of the principal primary and secondary sources of transportation information.

Table 4. Primary and Secondary Sources of Transportation Information

Primary Sources	Secondary Sources
• Internal and external reports	• Library catalogs
• Books	• Union lists of holdings
• Articles in periodicals and journals	• Bibliographic databases
• Conference proceedings	• Colleagues
• Laws and regulations	• Indexes built by the World Wide Web
• Directories, almanacs, encyclopedias	• Clearinghouses
• Newspapers	• Help lines
• Data sets	• Syntheses
• Laboratory notebooks	
• Best practices	
• Expertise	
• Research-in-progress descriptions	
• Policies and procedures	

Accessing Transportation Information

For transportation professionals, secondary sources are key to finding quality information in a timely, efficient manner. In this regard, these professionals rely heavily on information specialists, who are uniquely trained in creating and using these resources. Information professionals have designed some of the most successful secondary sources, ranging from clearinghouses to Web sites. While secondary sources are of critical importance, they possess some serious shortcomings, necessitating an information professional's expertise. Table 5 summarizes the most frequently used secondary sources of transportation information and their most critical gaps.

Table 5. Secondary Information Sources and Their Gaps

Source	Summary	Gaps
Clearinghouses and Help Lines	Clearinghouses provide subject-specific information, *e.g.*, those at Northwestern University's Infrastructure Technology Institute and North Carolina State University's Center for Transportation and the Environment. Help lines, such as BTS's Statistical Information Line, provide information on a wide range of topics and research.	• Comprehensiveness: can only provide access to information of which they are aware. • Web-based clearinghouses are emerging. They are limited in that their scope, coverage, and linkages are incomplete.
Colleagues	Personal contacts are among the most common means of obtaining transportation-related information.	• Information is not comprehensive and may be biased. • Mid-level managers and technical staff have fewer opportunities to interact with colleagues than do top managers. • No comprehensive directory of expertise is available.
Databases	Provide access to citations by searching bibliographic records. TRIS (Transportation Research Information Services) and IRRD (International Road Research Database) are the most well-known transportation examples. Others used in transportation are COMPENDEX, ABI-INFORM, Trade & Industry Index, and Predicasts. TRIS also provides access to research in progress, syntheses, and best practices (see below).	• Timeliness: there are large time gaps between publication of materials and their inclusion in a database. • Many materials never reach databases. • Can be cumbersome to search. • For TRIS, mandate to send in research-in-progress summaries is not enforced; erodes confidence in the information's quality and comprehensiveness. • TRIS reporting needs to be simplified. Require specialized training to use effectively.
Library Catalogs	Record, describe, and index the resources of a collection. Usually classify information and assign subject headings.	• Lack of coordination and links between library catalogs means duplication of holdings and inefficiency in searching. • Do not include unpublished materials.
Syntheses	Concise reports written for an identified audience. The National Cooperative Highway Research Program (NCHRP), for example, synthesizes the knowledge available on a subject through reports on various practices.	• NCHRP funds only 12 projects a year. • Is an 18-24 month turnaround time for publication and no feedback mechanism.
Union Lists of Holdings	A complete record of holdings for a given group of libraries or for a certain type of materials. In any format, these lists assist with identifying a lending source for an information request. The Transportation Division of the Special Libraries Association publishes a union list of transportation serials.	• Lack comprehensiveness. • Escalating subscription costs adversely impact information service budgets.
WWW-Built Indexes and Search Engines	Serving millions of users a day, search engines construct indexes and find information on the WWW. They send out "messengers" to every site they can identify and then download and examine these pages to extract indexing information.	• Indexing lacks standardization. • Information is rarely classified, *i.e.*, a report vs. a bibliographic entry or an advertisement. • Search engines recognize text only; cannot index password-protected information. • Requires specialized training of both information professionals and end users.

The Role of the Information Professional

Information specialists have the qualifications and expertise needed to create, access, and evaluate secondary information sources. In this role, these specialists provide quality, filtered information to transportation professionals based on their specific requirements.

The value of information professionals to organizations is well documented. For example, Matarazzo and Prusak (1995) determined that senior managers most value information specialists' communication skills, abilities to respond quickly to information requests, and in-depth knowledge of both information sources and their organizations.

Going beyond this study, the Special Libraries Association in 1996 published its report, *Competencies for Special Librarians of the 21st Century*. The report identified a number of professional skills crucial for the highly qualified, well-trained information specialist. These skills and competencies are listed in Table 6.

Table 6. Professional Competencies for Information Specialists in the 21st Century

Has expert knowledge of information resources
Has specialized subject knowledge
Develops and manages convenient, accessible, and cost-effective services
Assesses information needs and designs services to meet these needs
Uses appropriate information technology
Uses appropriate business and management approaches
Develops specialized information products
Evaluates the outcomes of information use
Continually improves information services
Is an effective member of the management team

As this list indicates, the qualified information professional continually upgrades his or her skills, assesses the organization's information needs and programs, and provides training and support to information users.

One area in which information professionals may be particularly valuable to users is in navigating the myriad new information products and services. For example, information specialists are uniquely qualified to assess the quality and relevance of information generated through on-line searches. In this role, information specialists assist transportation professionals in using the World Wide Web and other resources by helping them to make the most efficient use of agencies' assets and minimize the time spent looking for information.

Summary and Conclusions

This report documents how information and information services help transportation agencies to operate more efficiently and effectively. As determined from an extensive search of the literature and interviews with public- and private-sector experts, the value of information can be measured in terms of the following:

- Reduced costs of agency research, technology development, and operations,
- Quicker implementation of innovations,
- Increased time savings,
- More effective decision making at all levels of the agency, and
- Support from top management for information services.

Although information services are valuable to transportation agencies, there are a number of areas where existing information programs and secondary sources should be improved. Specific areas for immediate improvement include:

- Reducing gaps in the time between publication of research and its inclusion in reference databases,
- Reducing the inefficiencies of searching the World Wide Web and retrieving on-line information,
- Simplifying the process of, and providing incentives for, contributing research-in-progress summaries to TRIS and other secondary sources,
- Providing adequate training to both information specialists and users, and
- Assessing information professionals' skills and competencies to ensure that they meet their organizations' evolving requirements.

Information is an investment. Transportation agencies that value information must be prepared to invest adequately in information services. Griffiths and King concluded that information programs cost between $400 and $1,000 per professional a year (in 1993 dollars). They proposed a guideline of one full-time information specialist for every 50 to 75 professionals in an organization. As new information products become available, an effective information program will require targeted funding in key areas. For example, on-line services put tremendous amounts of information within reach of transportation professionals. If transportation agencies wish to make the most of these valuable services, they must invest not only in the services themselves, but also in adequate training for information specialists and other staff.

Recommendations

The technical panel strongly supports immediate action on the improvements outlined in the conclusion. In addition, the panel offers the following recommendations:

- Consistent with the efforts of BTS and the National Transportation Library, FHWA and its partners should take the lead in building consensus on information issues and developing a national transportation information policy.

- With the assistance of its partners and the technical panel, FHWA should develop a national marketing action plan to raise awareness of the value of information, educate management on the need for information services, and promote information programs in transportation agencies.

- FHWA and the technical panel should develop a comprehensive inventory of all transportation information resources and programs available nationwide.

Quality information is valuable to transportation agencies. While agencies recognize this value, there is a need for consensus on information issues. A national transportation information policy with a strategic marketing effort to promote information programs and ensure that they receive adequate resources is needed. An inventory of all transportation information resources available nationwide should be part of this effort. A comprehensive approach to managing our transportation information resources is crucial to addressing both today's transportation challenges and the emerging challenges of the next century.

Appendix A
Literature Review

As discussed above, preparation of this report involved an extensive search of the published literature on the value of information and information services. The sources consulted included ERIC (Educational Resources Information) and LISA (Library and Information Science Abstracts). Several CD-ROM sources were also consulted: TRANSPORT, Compendex-Plus (Engineering Index), NTIS (National Technical Information Service), Computer-Select, ABI-Inform-Select, and MOVE (from the Society of Automotive Engineers). A summary of the results of this literature search follows.

The Value of Information and Information Services

IMPORTANCE OF DEMONSTRATING THE VALUE OF INFORMATION SERVICES

The report of a task force of the Special Libraries Association (Matarazzo, *et al.*, 1987), stressed that information professionals must be prepared to prove the value of their services through one or more of the following approaches: 1) measuring time saved; 2) determining actual monetary savings or gains; or 3) providing qualitative, anecdotal evidence of value. Employing these approaches, the task force cited a number of case studies demonstrating the value of information professionals to their organizations. For example, the Georgia Technical Institute installed a campus-wide on-line library system in 1986 and reduced the costs of its literature searches by $1.2 million a year. Another case study was the library at the Houston division of Texas Instruments. In a survey conducted by the library, users' responses indicated that the library saved the company $268,800 a year and increased users' job proficiency by a value of $523,000 a year. From an annual investment in the library of $186,000 a year, Texas Instruments netted $959,000 in benefits—a 515 percent rate of return.

In a separate report, Bernard Basch (1990), a member of the Special Libraries Association task force, pointed out that corporate information services compete for funds with a variety of other departments. Thus, information professionals need to gather qualitative evidence of their services' seemingly intangible benefits. It is also extremely important that they know the key decision makers in their organizations, Basch added, and become thoroughly familiar with the business of the organization and its competitors. To build customer loyalty, information professionals must continually monitor customer satisfaction and modify the product or service mix as required.

Matarazzo and Pruzak (1990) argued that, although top managers value the information their libraries provide, the majority have no means for measuring this value or for determining which services contribute to the firm's strategic goals. Their 1990 survey of 164 libraries found

that upper management supported libraries because they felt that information was important to the company. When asked to identify services that added the most value, however, nearly two-thirds of the respondents did not know or chose not to respond. In a follow-up survey in 1995, Matarazzo and Pruzak interviewed 103 respondents who were either the director or the vice president to whom the librarian reported. (About three-quarters of the firms surveyed in 1990 participated.) When asked to identify the primary means used to assess the library's value, 36 percent named annual surveys or informal feedback from users, and 25 percent measured the volume of requests handled. Only 7 percent could evaluate the quality of the information provided. While nearly three-quarters of the managers believed the library contributed to the firm's corporate strategy, only one-third viewed the library as improving the information base used to make strategic decisions.

Kantor and Saracevic (TRB, 1997) developed a basis for documenting and measuring libraries' value to their supporting organizations. They argued that, although much is known about how top management views the special library, these managers rarely use the library directly and thus have an unclear understanding of its value. They focused on how actual users of the library value its services and how they express that value.

For their interviews at 10 special libraries, Kantor and Saracevic developed a detailed *taxonomy of value* of information services, which not only considered fiscal savings, but also encompassed the new corporate concept of the *balanced scorecard.* Through interviews with 218 users of these libraries, they determined that individual users evaluate their library in terms of its ability to provide what they need to meet some corporate goal or objective. They concluded that "users of special libraries discuss value in terms of whether, and to what extent, the library or information service meets or does not meet their expectations of it" (p.37). Users will have already internalized corporate goals and shaped their own behavior to advance them. They then approach the library in furtherance of these goals and judge it on how well it meets these expectations. This information is important for anyone who seeks to express the value of the library to senior managers, whose focus is the bottom line.

VALUE OF INFORMATION FOR DECISION MAKING

Marshall (1993) examined the positive impact of information on corporate decision making. Between October 1991 and March 1992, she worked with 299 randomly selected managers and executives from five major financial institutions in Toronto. As part of the study, participants requested from their library information related to a current corporate decision-making situation and then evaluated the impact of the information on that decision. Eighty-four percent of the managers felt that the information had led to a better informed decision. Forty percent felt that the information had made them consider a new dimension, while 54 percent said they probably or definitely had handled some aspect of the decision-making situation differently. In cases where the decision involved a financial transaction, 74 percent of the managers estimated the value of the transaction at over $1 million.

MONETARY VALUE OF INFORMATION

In assessing the monetary value of information services, Griffiths and King (1993) drew upon 27 studies performed with 16 companies and 7 government agencies, as well as 4 national surveys of professionals, with a total of over 10,000 responses. They found that libraries cost between $400 and $1,000 a year per professional (in 1993 dollars) and that, due to economies of scale, companies require 50 to 75 professionals to justify one full-time librarian. Small firms without libraries spend about two to four times as much to acquire information as larger firms with in-house libraries. And it is 2.3 times more expensive to provide information from alternatives to special libraries than from an in-house library service.

Griffiths and King argued that the cost of a professional user's time and effort to obtain information elsewhere far exceeds the cost of providing a library. These estimated savings increase significantly if obtaining the library material prevents the need for primary research, provides confirmation of research, stops an unproductive line of research, modifies a research design, or modifies a method of analysis. In these cases, the estimated savings are $310 per journal article, $650 per book reading, and $1,090 per internal report. Griffiths and King concluded that the overall return on investment for supporting an in-house library ranges positively from a low of 7.8 to 1 to a high of 14.2 to 1.

Keyes (1995) evaluated techniques for determining the monetary value of special libraries and, in particular, benefit-cost methodology. She stressed that determining the monetary value of a library to its parent organization is a critical part of the library's overall evaluation. She pointed out that the corporate library, like other divisions within an organization, is under pressure to tie its value to that organization's strategic mission. This value needs to be presented in a monetary sense so that the library can compete with other departments. Keyes presented a four-step approach to valuing the special library: 1) extract all cost data for operating information services; 2) collect user estimates of the value of beneficial library services; 3) record the impact of the special library, measurable in qualitative terms and countable, if not easily converted into dollar values; and 4) analyze the cost and benefit information gathered and determine benefit-cost ratios.

VALUE OF INFORMATION IN TIME SAVED, PRODUCTIVITY, AND IMPROVED WORK QUALITY

Griffiths and King also assessed the value of information in terms of time savings and work quality. Surveys conducted in eight organizations asked professionals to indicate whether reading journal articles, books, or internal reports saved them (or their coworkers) any labor time or other resources. Table A-1, below, reports the percentage of these documents for which users reported time savings and the specific reasons given for the savings.

Table A-1. Information and Time Savings (%)			
Reason for Time Savings	**Journal Articles**	**Books**	**Internal Reports**
Overall time savings	26	42	50
Avoided primary research	49	22	51
Stopped unproductive research	10	21	22
Modified a research design	12	13	19
Modified an analysis method	16	30	9

To measure the impact of information on their work performance, the professionals were asked to indicate if their last reading of a journal, book, or internal report resulted in higher quality work. The table below shows how they rated the quality of their own work, on a scale of 1 to 7, both with and without these materials.

Table A-2. Information and Quality of Work (Scale of 1 to 7)			
	Journals	**Books**	**Internal Reports**
With Information	5.82	5.68	5.78
Without Information	4.04	3.57	3.52

Koenig (1992) investigated studies that demonstrated the correlation between expenses of information services and corporate productivity. Among these, he detailed a study performed at Exxon in the mid-1970s that showed a benefit-cost ratio of 11 to 1 and a NASA study conducted in the late 1970s that reported a benefit-cost ratio of 7.6 to 1. Koenig found that all of these studies showed a remarkable consistency: the most conservative estimate revealed the benefits of information services to be almost double the costs incurred. He concluded that information services are cost-effective investments and that information-dependent organizations should substantially increase investments in such services.

Information as a Competitive Corporate Strategy

McGee and Prusak (1993) argued that information is more than collected data; rather, information represents data that are organized, ordered, and imbued with meaning and context. Information must inform, they held, while data have no such mandate. Information must be bounded, while data can be limitless. For data to become useful to a decision maker as information, it must be presented in such a way that he or she can readily relate to it and act upon it.

For McGee and Prusak, the key to corporate competitiveness is the ability to acquire, manipulate, interpret, and use information. They argued that information is the basis of competition and provides the greatest potential payback to organizations. Information is an asset, and it requires management. Unlike other assets though, information is reusable. It does not deteriorate or depreciate, and it has a value that is determined solely by its users.

Information Needs of State and Local Agencies

In March 1997, FHWA, BTS, and the Federal Transit Administration held a conference to assess the information needs of State and local transportation decision makers in the 21st century. The conference provided a forum for participants to 1) identify the types of data that are collected, discuss data-collection requirements, and exchange ideas about the appropriate roles of Federal, State, and local agencies, and 2) review the impact of technology on data collection and dissemination.

The conferees stated the need for a clearinghouse that would store and disseminate all publicly available transportation data and provide technical assistance to its customers. They also called for the creation of an effective coordination process for data exchange, one that relies on common formats, flexibility, aggregation, sampling, and methods. Participants agreed that differences in data-collection and analysis methods among transportation agencies hinder the exchange of information. They felt that the problems faced by transportation data professionals are rooted less in the data itself and more in the absence of clear, concise, and compelling ways to demonstrate the data to decision makers.

The Role of the Information Professional

In their study of 12 major corporations, Owens and Wilson (1997) found that senior executives view the creation of an information culture in an organization as a critical step toward ensuring continued success. In fact, top managers' commitment to information as an asset is a major factor in the implementation of successful information systems. Through their interviews with senior executives, Owens and Wilson determined that the role of the traditional information specialist is being overshadowed by information technology personnel, who frequently put emphasis on the effective storage and retrieval of information rather than the quality of the information itself. They endorse a new set of attributes that information professionals need to survive, including political ability; business acumen; and skills in information technology, communications, innovation, and negotiation.

The Special Libraries Association is keenly aware of the changing information world. In 1996, the association published its report, *Competencies for Special Librarians of the 21st Century* (Marshall, 1996). The report affirmed the value that the information specialist adds by providing efficient and effective information services for a defined group of customers. The box below shows the two sets of skills that the association considers to be crucial for information specialists in the next decade. As defined by them, "professional competencies" relate to knowledge of information resources, information access, technology, management, and research—and the ability to use these areas of knowledge as a basis for providing library and information services. "Personal competencies" represent a set of skills, attitudes, and values that enable information professionals to work efficiently, communicate effectively, and survive in the new world of work.

Competencies for Information Specialists in the 21st Century

Professional Competencies	Personal Competencies
• Has expert knowledge of information resources	• Is committed to service excellence
• Has specialized subject knowledge	• Seeks out challenges and opportunities
• Develops and manages convenient, accessible, and cost-effective services	• Sees the big picture
• Provides instruction and support for information service users	• Looks for partnerships and alliances
• Assesses information needs and designs services to meet these needs	• Creates an environment of mutual respect and trust
• Uses appropriate information technology	• Has effective communication skills
• Uses appropriate business and management approaches	• Works well with others and recognizes the value of networking
• Develops specialized information products	• Provides leadership
• Evaluates the outcomes of information use	• Plans, prioritizes, and focuses on what is critical
• Continually improves information services	• Is committed to lifelong learning
• Is effective member of management team	• Has personal business skills and is flexible

Two leading high-technology companies, Microsoft and Digital Equipment, are preparing their library staffs for the future.

According to Jennifer Choate (1997), Microsoft's training program focuses on preparing its information staff for the company's fast-paced and ever-changing business environment. The staff recognizes that new technologies and complex pricing schemes demand that they have the technical knowledge required to do thorough evaluations of new technologies and the business acumen to perform complex cost comparisons. Additionally, as their customers became more information-savvy, the need for quality, value-added information services increases. In response to a corporate challenge to stay ahead of the curve, the research group of the Microsoft library designed a training program that provides guidelines and measurable performance criteria for all staff, from entry-level to senior members. Core competencies include basic research abilities, customer service skills, and work flow management. Once specialists master the entry-level program, they are assigned to one of three researcher roles: agents, navigators, or partners. Each level has its unique training program and skills to be mastered. Requirements in addition to the training program include presentations to library staff and attendance at outside professional-development events.

Digital Equipment also is responding to information specialists' changing roles (Kennedy, 1997). The Corporate Library Group at Digital met the challenge of the information explosion with a Web-based solution on Digital's Intranet: the Web Library. Staffed by interdepartmental teams, the Web Library evaluates, analyzes, synthesizes, qualifies, and disseminates externally created information. The library staff provides the expertise to carry out the Web Library's work and to validate its relevancy and content.

Appendix B
Interviews and Case Studies

In the course of preparing this report, the Volpe Center contacted a total of 50 experts from State DOTs, the private sector, associations, and universities. Their comments are summarized below.

Views from the States

CALIFORNIA DOT

Wes Lum of CALTRANS offers the inductance loop detector as an example of the importance of having accurate information. He explains that although operators in traffic management centers, highway officials, and vendors believe that the loop in the pavement performs poorly and needs to be replaced by a new technology, the loop itself is not the problem. Rather, the detector, the communications system, the maintenance program, or the individuals working with these systems are the actual causes of the performance problems. Thus, he adds, much effort is going into R&D around the world to fix a nonexisting problem. The performance of any system would experience the same problems when the root issues are not being addressed.

ILLINOIS DOT

Recently, Illinois DOT saved approximately $300,000 through access to research at Louisiana State University (LSU) on heat-strengthening of steel bridges. LSU's work, considered the only scientifically validated work in this area, saved the State unnecessary and expensive duplication.

In 1996, Illinois contracted with a professor at the Rensselaer Polytechnic Institute to search the literature on an obscure topic: corrosion fatigue of aluminum. The search yielded a valuable reference from the technical literature dating back to the early 1950s. This reference was extremely useful in a breakaway coupling study. The State DOT values the search results at about $50,000.

LOUISIANA DOT

One way in which Louisiana DOT demonstrates how it values information is through the numerous training courses that it offers. Dedra Jones, program manager for construction/materials training, receives requests monthly from other States to borrow Louisiana's training materials. Although Jones cannot quantify the costs of course development, she indicates that they are significant. She feels that Louisiana's training program has been so effective because it anticipates future training needs. For example, knowing that FHWA will require metrification or quality assurance inspectors allows the State DOT to prepare its staff prior to implementation.

MINNESOTA DOT

An important operational function of State DOTs is to justify their R&D programs. As a result, some States are reinstituting cost-benefit studies of R&D projects, a trend that Minnesota DOT's Jerry Baldwin finds troubling. Baldwin offers that a true cost-benefit assessment of research cannot be done on a case-by-case basis, since research often ends in null results or indicates only that more research is required.

Minnesota recently implemented a pilot project that assigned librarians to research projects needing in-depth information. These efforts were successful, and a marketing strategy encouraging the assignment of librarians to such projects in the future is under development. The librarian sits in on all team meetings, prepares literature reviews, and assists with other project-related information needs. Following the completion of the first of these projects, in which the librarian logged in approximately 100 hours, the project manager stated that the real value was the efficient documentation of project information. Because the information could be transferred easily among team members, a new member could be brought up to speed very quickly.

Minnesota DOT looked at its expenditures for library services in terms of actual on-line costs and staff time. It analyzed the benefits of having its librarians conduct on-line literature searches when TRIS first became available in the 1970s. The study results showed a benefit-cost ratio of between 9 and 10 to 1 over end-users finding similar information on their own. The study emphasized the competitive advantages that a professional librarian brings by reducing search times, minimizing search costs, and freeing time to conduct other activities for researchers, staff professionals, and managers.

Minnesota DOT is organizing the July 1998 Mississippi Valley conference on "Research Shaping Transportation's Future." The focus will be on convincing management to link R&D to the organization's strategic mission. Robert Benke, one of the organizers, plans to continue this theme at AASHTO's National Research Advisory Committee meetings in Nashville, within TRB committees A5001 and A5012, at the 1998 National Local Technical Assistance Program meeting, and at TRB's annual meeting in January 1999.

NEW JERSEY DOT

Arthur Roberts explains the value of information and libraries this way: Currently, FHWA requires a literature search for all federally funded highway projects. Even though a State may not be involved in state-of-the-art research, it needs to know what the state of the art is so that it can design its efforts to supplement the existing body of work. Roberts suggests that this study be performed as a benefit versus waste comparison. If there are new and more effective ways to do something, he says, an agency should be readily adapting these practices to its particular circumstances. Otherwise, an agency wastes resources by relying on outdated practices. New Jersey is trying to reestablish its departmental library. Due to the location of the main library, Roberts visits it only when absolutely necessary. Thus, keeping up to date on the current literature requires an extra effort. New Jersey's example demonstrates the uneven appreciation of the role of libraries in organizations.

NEW YORK DOT

New York State wanted to create a new concrete mixture for bridge decks that would have reduced permeability and decreased potential for cracking. In 1994, the Bridge Deck Task Force engaged in a very thorough literature search and gleaned the best ideas while developing these parameters. Paul Mack described the effort as "mining the literature." The resulting concrete is now the standard mix for bridge decks for the entire State and is being analyzed for adoption by other States as well. The anticipated service life is expected to be twice that of the 50-year life of the former mixture. From conception to implementation, the project took less than a year. The expected annual life-cycle cost saving is nearly $9 million.

In the early 1970s, New York was investigating horizontal drains to ameliorate a landslide problem at 17 locations. At a TRB meeting, the staff learned how two other States, Washington and California, had experienced good results with this type of drain. Analysis showed a net savings on horizontal drain projects across the State in excess of $2.5 million.

Another example from New York illustrates the cost of not having access to the newest innovations. In 1986, there was a slope stabilization problem south of Syracuse in Wadhams, near the Adirondack State Park. Due to environmental concerns, the normal solution for landslide stabilization was not appropriate. An innovative solution, stone feed columns, was discovered through TRB. The estimated cost savings were $20,000 to $50,000 per treatment.

NORTH CAROLINA DOT

Pat Strong identifies timeliness as the most significant characteristic of information. Each year, North Carolina DOT begins a limited number of research projects, and Strong knows that he is missing essential pieces of information. He points out the gaps that exist between the completion of a study, its publication date, and its appearance in databases such as TRIS. At the very least, Strong would like to see descriptive abstracts of research in progress and of recently completed research.

PENNSYLVANIA DOT

M.G. Patel states that he values information because it saves time. He expects the librarian to provide information that corrects or legitimizes important aspects of the subject. Literature reviews are valuable because they provide conflicting views that, for decision-making purposes, help in his analysis. Patel emphasizes the importance of well-trained and experienced library personnel for his organization's information needs.

TEXAS DOT

Jon Underwood is pleased that his agency's library is attached to their R&D office. He states that, while he was on an interstate departmental exchange program, one of his evaluation comments noted that the exchange State's library ought to be physically attached to the R&D organization. This highlights the special library's values of continuity and physical presence.

VIRGINIA DOT

Analyzing the market for its written products, the Virginia Transportation Research Council (VTRC) determined that engineers require concise synopses of research findings and do not want lengthy reports. VTRC responded by assembling a team of editors, graphic artists, and researchers to create four-page summaries of each research report and by strengthening its field support. Since a significant portion of VTRC's budget is dedicated to field support, their on-site researchers might respond to queries via the phone, a site visit, or a follow-on study. VTRC feels this strong field support provides researchers with hands-on experience and also fosters champions in the research department for practitioners. This research and information service is very popular among users: A recent customer survey yielded an overall rating of 4 on a 1-to-5 scale.

Views from Professional Associations

ASPHALT INSTITUTE

Edward L. Miller laments the loss of the Asphalt Institute's librarian, who left 4 years ago: the Institute's extensive, space-consuming collection dates back to the 1800s. The loss of the librarian did not prevent telephone calls and faxes from arriving, diverting the engineering staff's resources. In response to the ongoing inquiries, the Institute developed a Web site. All links are checked before they are added to the site and, where possible, the vocabulary is being standardized. Miller hopes to secure funding to hire a consultant to scan in the library collection. "Value is there," he says, "but logistics and cash get in the way."

INSTITUTE OF TRANSPORTATION ENGINEERS

Thomas W. Brahms, Executive Director of the ITE, is very attuned to the value his members place on information. Recently, he hired a librarian to assume responsibility for ITE's referral and information line. He felt that his engineers' time could be better spent on billable projects, providing a more efficient rate of return for their work. Brahms views information as a commodity. He hired a consultant to index all of ITE's publications for a CD-ROM product that conforms to the new TRIS thesaurus. A new project slated to begin shortly will use the same consultant to index the items in the ITE publication catalog. Brahms sees this project as a marketing tool that will also be available on the Internet.

Views from Universities, Clearinghouses, and TRB

UNIVERSITIES

Byron C. Blaschke of the Texas Transportation Institute comments on what he believes to be the two critical aspects of assigning value to information. The first is obtaining the right information for the decision-making process. This is particularly true when designing and developing projects.

Knowing what others have done, or how they have confronted seemingly unique circumstances, is valuable; it saves time by preventing researchers from repeating the same work. The second factor is how quickly a researcher can get the information he or she needs.

TRANSPORTATION INFORMATION CLEARINGHOUSES

Renee McHenry feels that the clearinghouse at Northwestern University's Infrastructure Technology Institute is very niche-oriented. Queries are often complicated but on target with the subject matter. She believes that her 12 years of transportation information experience is key to finding answers to these questions. Last year, she handled 83 queries in addition to posting current information on the Web site.

Lois Widmer, clearinghouse administrator at the Center for Transportation and the Environment, concurs with McHenry's assessment of the clearinghouse function. She spent 80 hours last year compiling special bibliographies. In 1996, there were 302 information requests; by the first half of 1997, there were already 213 requests. She hopes to institute follow-up surveys of requesters.

BTS established a Statistical Information Line in April 1993. In its first year, it averaged just over 10 questions per month. By 1997, there were a total of 4,394 questions, averaging over 365 queries per month. The primary users of the service are business (42 percent) and academia (14 percent). State government comprises only 5 percent of all users. Originally established to refer or answer statistical queries, the Information Line's callers are now asking for all types of information, often completely unrelated to transportation statistics.[3]

TRANSPORTATION RESEARCH BOARD

Information is the lifeblood of TRB. James Scott, a TRB transportation planner, spends a great deal of time in the field, keeping abreast of developments that could affect the organization on either a program or policy level. He offers cogent examples of the value of information to transportation agencies. For instance, while Scott visited the Wisconsin Planning Office, an engineer requested his assistance in developing a Statewide highway plan; the engineer sought to convene eight to ten States to provide a briefing on their experiences. Scott obtained $10,000 from FHWA for the information-exchange meeting. He recently heard from an engineer in Michigan who had used information learned at that meeting: By adapting what she had learned to her own State, she was able to help the DOT get a proposal through the State legislature.

Richard Pain offers the example of fatal crash data to show the impact of working with bad information. Fatal crash data is a very reliable series taken as part of a census. Data on injuries and property damage, however, are derived from samples taken from police accident reports (PARs) and are generally considered less reliable than fatality data. PAR data are collected without uniform standards, and the reporting forms lack the descriptive elements needed for

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[3] The value of this particular service was underscored in a recent *Washington Post* article on government information help lines. The BTS hotline, operated and staffed by the U.S. DOT's Volpe Center library, was specifically cited as having provided prompt and accurate information to queries posed by the author of the article.

analysis. Better quality data are required to evaluate programs and expenditures. Pain adds that, with the Critical Outcome Data Evaluation System, researchers can now link medical and crash data to help determine the societal costs of highway crashes. Studies performed by the National Highway Traffic Safety Administration estimate that crashes cost from $165 billion to $175 billion per year.

TRB's Steve Godwin comments on the decentralization of transportation functions and the need to share information among Federal, State, and local agencies to avoid duplication of effort and speed the fielding of innovative practices. Toward that end, he says, TRB plans to offer TRIS via the TRB Web site at no charge to all sponsors and their staff.

Views from FHWA Field Offices

[Note: Following the completion of this study, the FHWA organizational structure was reorganized. As part of this process, the nine FHWA Regional offices were eliminated and four Resource Centers were created. The reorganization does not affect the outcome of this study.]

An example of inexpensive technology transfer was the Enhancement Workshop held in October 1997 by the FHWA Region 8 office. This workshop provided a forum through which local agencies could exchange ideas to make better use of their resources and skills and advance their transportation programs. Participants included representatives from the State DOTs, the Local Technical Assistance Program coordinator, and FHWA Division personnel.

FHWA field staffs do not have access to on-site libraries. Should they require a TRIS search, they contact the state DOT or TRB directly. They agree that access to TRIS is cumbersome and that the service is not user-friendly. Among the desired enhancements are access to the World Wide Web, comprehensive research-in-progress reports (both Federal and State), and training. According to Gary White from the Indiana Division, TRIS saves money. When TRIS uncovers similar research, he says, in 90 percent of the projects the engineers will restructure the effort to take a different approach or to take the research one step further. Roger Port, former Region 7, believes that value will separate the competition: Time constraints permit access to only two or three information sources. The ones that will survive are those that are easy to use and that deliver a quality product. While in the former Region 5 office, Mary Stringfellow conducted an internal survey that revealed the staff's need for filtered information, a method to remove outdated information, and a single source for FHWA and related technical research.

Views From the Private Sector

In the corporate sector, a major U.S. manufacturer created an internal group tasked with looking for new business opportunities. This group used the corporation's library services,

especially for literature searches. The library manager recently received a memorandum from the group's manager in which he noted that there might have been serious confidentiality issues if the group had used a service outside the organization. His informal estimate of the value of the library's services was $400,000. The librarian estimates the cost of the tasks performed at just $17,000.

Parsons-Brinckerhoff instituted knowledge-sharing networks in 1995 to foster the flow of information and technology transfer within each of its engineering units. According to John Chow, after just 2 years, this program has fostered a heightened level of technical knowledge within the firm, and it appears to be unique in the engineering industry.

Several years ago, Paccar, Inc., performed a time-saved study on traditional library services. The librarian surveyed users on how often they used the library over the course of a month and on the amount of time saved as a result of these services. Her findings showed a benefit-to-cost ratio of 3 to1. However, she believes there is a problem with the time-saved methodology, because it assumes that the requester could have performed the same task, and found the same information, without the benefit of a librarian. That assumption is probably unfounded because of the skills that professional librarians bring to bear on searches, enabling them to conduct library services in a more efficient and cost-effective manner.

Corporate libraries are increasingly flexible and adaptive to changing demands. One library demonstrated its value by taking on a project that was unrelated to traditional library services but essential to the corporate mission. In this case, an in-house librarian joined a task force to reduce the turnaround time for findings from a vehicle test track. The test results, with digitized photographs, were made available on the corporate Intranet within 1 to 6 days instead of the usual 1 to 6 months. The speedier access to the test track data significantly reduced the engineering design cycle.

Appendix C
Marketing Strategy

This report, *The Value of Information and Information Services*, documents how information services help transportation agencies to operate more efficiently and effectively. It shows that the value of information can be measured in terms of reduced costs for research, development, and operations; time savings and quicker implementation of innovations; more effective decision making; and the satisfaction of management and users.

However, while information services are valuable to transportation agencies, this report also identifies a number of areas where existing information sources need to be improved. It recommends that FHWA and its partners 1) take the lead in building consensus on information issues and developing a national policy on transportation information; 2) develop a national marketing plan to raise awareness of the value of information, educate management on the need for information services, and promote information programs in transportation agencies; and 3) develop a comprehensive model of transportation information resources and programs. This appendix outlines an approach for the second recommendation, the development of a national information marketing plan. With the assistance of the technical panel, and in consultation with its partners, FHWA will employ this approach in developing appropriate tools to promote information services in transportation organizations.

Within the transportation community, there are a number of different customers for information services. For the purposes of this report, there are four target audiences for a marketing strategy: administrative management, research and development management, professional staff, and information specialists. In marketing to each audience, there are two major themes: 1) the value of information and 2) the value of information programs and services.

Administrative Management

Senior-level decision makers are largely concerned with the overall viability of their organizations and with their organizations' strategic goals. They are the chief administrative officers of State and local agencies and the directors and executives of transportation associations. The first group is accountable to taxpayers, legislators, and their staffs; the second, to their memberships and boards of directors. Overall interests of both groups include regulatory requirements; impacts of local, State, and national political decisions; and, possibly, new business opportunities.

VALUE OF INFORMATION

For top managers, information holds tremendous value in terms of:

- *More Effective Decision Making:* Senior managers need access to quality, timely information to make complex decisions; to be innovative; and to enhance their effectiveness. The types of

information required at this level include analyses of current political agendas in Washington, DC, the statehouse, and local arenas, and knowledge of how counterparts address similar issues.

- *Meeting Strategic Goals:* An information strategy plays a key role in an organization's overall mission. For instance, the R&D agenda at Minnesota DOT is linked to its strategic mission. Knowledge of successful benchmarks could be critical in implementing an information strategy to meet an agency's strategic goals.

- *Avoiding the Consequences of Not Knowing:* Transportation organizations at all levels are under pressure to maximize use of limited resources. Not knowing about the latest research and technology has economic consequences. Professional staffs need timely access to new practices and ideas.

VALUE OF INFORMATION SERVICES

Regarding the value of information services, the following messages apply to senior managers:

- *Supporting National Programs:* Transportation information should be easily available and kept up to date. Currently, TRIS is the primary resource for identifying transportation information in the United States; however, gaps in this service exist and require adequate funds to ameliorate. Top management should recognize these gaps and support national efforts to address them.

- *Funding New Reference Services:* The World Wide Web and other electronic services facilitate information delivery. In particular, fee-based services hold tremendous potential. Management should adjust agencies' budgets to accommodate these products and support continuous improvements in information services.

- *Training:* Training on information literacy increases the efficiency of information programs. Management should make such training available to all transportation professionals and should ensure that information specialists are trained to make effective use of the World Wide Web and other new information resources.

- *Facilitating Internal Information Transfer:* Information programs can make information accessible to all staff. Managers should promote services such as databases of in-house experts, catalogs of unpublished staff findings or technical reports, ongoing databases of current research projects, and Intranets.

- *Outsourcing or Downsizing:* Research shows that, although cost savings is the primary motive for outsourcing or downsizing a library, the savings are offset by shifting costs to other areas of an agency. For example, transportation researchers may spend many hours on unproductive information searches, removing them from their real work responsibilities. Reports show that organizations without libraries pay 2 to 4 times more to obtain

information than those with libraries. Management should be aware that issues of quality, efficiency, and prompt service delivery are obscured by a "bottom-line" mentality.

Research and Development Management

R&D managers need to be aware of recent scientific and engineering developments and technical information. They initiate their agencies' research agendas and determine staff allocations for research assignments. To achieve their research goals, these managers must be knowledgeable about the information services available both within and outside their organizations and be champions for such services. Typically, they will lobby for adequate information services budgets.

VALUE OF INFORMATION

The message to R&D managers is similar to that for senior management, but the focus should be on program implementation and supporting the information needs of R&D staff. Key themes include:

- *More Effective Decision Making:* To make informed decisions, transportation researchers must have access to all relevant technical and scientific information. Although this information is often published in technical journals or reports, it is not always easily accessed.

- *Reducing Costs:* Failure to keep up to date with innovative techniques can cost an agency, and the public, money. Implementation of innovations can reduce costs for research, maintenance, and operations—freeing resources for new transportation services.

VALUE OF INFORMATION SERVICES

Benefits of information services that are particularly relevant to R&D managers include:

- *Eliminating Duplication of Effort:* Access to research results allows agencies to benefit from the experiences of others and avoids costly duplicative research. Thus, R&D managers should ensure that their agencies' research in progress is submitted to TRIS in a timely manner.

- *Providing an Information "Filter":* Information services and programs can alleviate the problems of insufficient information or information overload. R&D managers should promote the use of information professionals to filter information that is most relevant to transportation projects.

- *Promoting the Benefits of Transportation R&D:* Information specialists can document successful research projects for State legislatures and senior managers and assist with electronic publication of research results. R&D management needs to encourage the use of information experts for this purpose.

- *Assisting with R&D Projects:* When included on a project team or task force, an information specialist can anticipate and document the information gathered. R&D managers need to promote the use of information specialists on project teams from initiation to implementation.

Professional Staff

Composed of transportation researchers and other technical professionals, this group is primarily interested in project-related information that is narrowly focused on their area of expertise.

VALUE OF INFORMATION

- *More Effective Decision Making:* Transportation professionals need access to timely and comprehensive information to make effective project-related decisions. They may be unaware of the latest information sources or may be struggling to master others, such as the Internet, without benefit of proper training.

VALUE OF INFORMATION SERVICES

- *Providing Access to a Range of Information Sources:* Electronic delivery options enhance reference services for transportation professionals. New fee-based information services may be particularly valuable. Transportation professionals should make optimum use of the full range of information services and products.

- *Assisting with Project Management:* As members of a project team, information specialists assist transportation professionals with accessing and organizing project-related information, documenting project activities, and reporting research in progress. Transportation professionals need to make full use of information specialists in this important role.

- *Making Efficient Use of the Internet:* Although the Internet is a desktop tool, researchers need not perform all searches. Transportation professionals should call on information experts for assistance with the more complicated searches and queries.

Information Specialists

Although information specialists recognize the value of information, they may need training in implementing and marketing the latest information resources. Budget constraints or reduced staff levels often impact the services that they provide. Information professionals need to acknowledge the value of obtaining feedback from customers and to learn how to implement changes based upon these inputs.

VALUE OF INFORMATION

- *Meeting Organizational Objectives:* Quality information is essential to fulfilling an agency's mission and to meeting its strategic goals.

VALUE OF INFORMATION SERVICES

Information professionals can enhance the value of information services to their organizations by:

- *Being Proactive:* Information specialists need to take a proactive role in the collection, organization, analysis, and distribution of information in their organizations.

- *Being Cost-Efficient:* Information programs compete with other departments for limited resources. Information specialists should provide managers and transportation professionals with filtered, quality information.

- *Quantifying the Value of Information Services:* Information experts should implement valid methods for measuring their effectiveness and their contributions to agency goals.

- *Educating Management and Staff:* It is important to educate management and staff on the value of information services. Information specialists should teach managers to appreciate the investment required for high-quality information and to use this investment effectively.

- *Expanding Traditional Services:* Information specialists should disseminate new products and services that provide staff with relevant information and improve decision making, for example, by providing desktop access to internal technical and reference databases.

- *Harnessing Internal Information:* Now perceived as keepers of external information, information specialists must convince management of their value in collecting and organizing internal information assets.

- *Volunteering for Special Projects or Task Force Assignments:* Information professionals should volunteer for special assignments that enhance the visibility of and appreciation for an organization's information programs.

- *Offering Internet Training:* As teachers and experts, information professionals should encourage staff to defer to them their complicated Internet searches.

- *Continuing Training and Education:* Information professionals should keep up with new technologies and best practices through ongoing education and training.

Appendix D
Individuals and Organizations Contacted

INDUSTRY

Helene A. Brown, *General Motors Corporation*
Patricia L. Camozzi-Ekberg, *Weyerhaeuser Company*
Corinne A. Campbell, *Boeing Company*
Jennifer Choate, *Microsoft Corporation*
John Chow, *Parsons-Brinckerhoff*
Marsha A. Herman, *Parsons-Brinckerhoff*
Alison Keyes, *Golden Associates*
Barbara J. Peterson, *Minnesota Mining and Manufacturing Company*
Frederick Quan, *Corning, Inc.*
Ruth Van Dyke, *Hewlett-Packard Company*
Maryanne Ward, *Paccar, Inc.*

STATE DEPARTMENTS OF TRANSPORTATION

Gary R. Allen, *Virginia Transportation Research Council*
Joe T. Baker, *Louisiana Transportation Research Center*
Jerry Baldwin, *Minnesota DOT*
Robert J. Benke, *Minnesota DOT*
Carolyn Goodman, *Virginia Transportation Research Council*
Judy H. Gutshall, *Pennsylvania DOT*
Christopher Hahin, *Illinois DOT*
Eric E. Harm, *Illinois DOT*
Dorothy Hogan, *New York DOT*
Dedra Jones, *Louisiana Transportation Research Center*
Wesley S.C. Lum, *California DOT*
Paul Mack, *New York DOT*
Galen McGill, *Oregon DOT*
Verne C. McGuffey, *New York DOT (retired)*
Wesley P. Moody, *New York DOT*
M.G. Patel, *Pennsylvania DOT*
James Radmacher, *Missouri DOT*
Jon W. Reincke, *Michigan DOT*
Arthur W. Roberts III, *New Jersey DOT*
Mary D. Silva, *Arizona DOT*
Pat Strong, *North Carolina DOT*
Jeanne F. Thomas, *Michigan DOT*
Jon P. Underwood, *Texas DOT*

TRANSPORTATION ASSOCIATIONS

Ruth Arnold, *Special Libraries Association*
Thomas Brahms, *Institute of Transportation Engineers*
Connie N. Field, *Portland Cement Association*
Laura Hazen, *Institute of Transportation Engineers*
Billy Higgins, *American Association of State Highway and Transportation Officials*
Kyung Kyu Lim, *American Association of State Highway and Transportation Officials*
Edward Miller, *Asphalt Institute*

TRANSPORTATION RESEARCH BOARD

Stephen R. Godwin
Crawford F. Jenks
Jerry Maddock
Stephen F. Maher
Shirley Morin
Richard F. Pain
Barbara L. Post
James A. Scott

UNIVERSITIES

John Anderson, *Pennsylvania LTAP*
Byron Blaschke, *Texas Transportation Institute*
Forrest M. Council, *University of North Carolina*
Paul Kantor, *Rutgers University*
Donald King, *Rutgers University*
Renee E. McHenry, *Northwestern University Infrastructure Technology Institute*
Sandra L. Tucker, *Texas Transportation Institute*
Lois J. Widmer, *Center for Transportation and the Environment*

U.S. DEPARTMENT OF TRANSPORTATION

Sue Ann Connaughton, *BTS Statistical Information Line*
Bill Evans, *FHWA, former Region 8*
Patrick Kennedy, *FHWA, former Region 3*
Andrew Mergenmeier, *FHWA, Virginia Division*
Roger Port, *FHWA, former Region 7*
John Sweek, *FHWA, former Region 6*
Mary Stringfellow, *FHWA, former Region 5*
Robert Tally, *FHWA, California Division*
Gary White, *FHWA, Indiana Division*

Appendix E
Value of Information Technical Panel

Nelda Bravo, *Federal Highway Administration, U.S. Department of Transportation*
Anna Bennett, *Federal Highway Administration, U.S. Department of Transportation*
William P. Carr, *Washington State Department of Transportation*
Claudia Devlin, *Washington State Department of Transportation*
Denis Donnelly, *Research Consultant*
Barbara T. Harder, *B.T. Harder, Inc.*
Kathryn Harrington-Hughes, *Harrington-Hughes & Associates, Inc.*
Christopher Hedges, *Transportation Association of Canada*
Robert J. Perry, *New York State Department of Transportation*
Barbara Post, *Transportation Research Board*
Robert B. Schmiedlin, *Wisconsin State Department of Transportation*
Sandra Tucker, *Texas Transportation Institute*
Robert Zarnetske, *Bureau of Transportation Statistics, U.S. Department of Transportation*

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☆U.S. GOVERNMENT PRINTING OFFICE: 1999 - 450-787/10188