Technology Transfer:

A Strategy for Innovation Adoption at the Washington State Department of Transportation

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Planning, Research and Public Transportation Division
in cooperation with the
United States Department of Transportation
Federal Highway Administration

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16. Abstract

This study was initiated as part of a department-wide strategic planning effort of the Washington State Department of Transportation to assess whether a coordinated technology transfer program will enhance innovation adoption. Interviews with WSDOT employees in all divisions and districts provide the basis of an inventory of current technology practices. A literature review describes the process of technology transfer and the issues relating to an individual's ability to adopt innovation. Additionally, the structure of the organization and the barriers to innovation adoption are discussed based on information obtained from a literature review. Examples of technology transfer programs in other organizations are described to understand how the process is used to adopt innovation.

Based on the employee interviews, and the literature review, specific recommendations and implementation plans are provided in the report. These recommendations are intended to enhance technology transfer in WSDOT and thus increase the ability of the organization to adopt innovations into work methods and practices.

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TECHNOLOGY TRANSFER: A STRATEGY FOR INNOVATION ADOPTION AT THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

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"Provide a program of research and development that integrates technological innovations, methods, and techniques into the activities of the Department." (Strategic Objective 4.1; WSDOT Strategic Objectives 1985-1987)

INTRODUCTION

The present mission of the Washington State Department of Transportation (WSDOT), as well as future conditions and transportation needs, require WSDOT to integrate innovative technologies, methods and techniques into the activities of the Department. One strategy for accomplishing this objective is the development of a coordinated technology transfer program.

Technology transfer is practiced through a variety of activities and materials, including conferences, reports, training, demonstrations and other activities that allow knowledge to be transferred from a source to a user. However, technology transfer is more than just information dissemination because the process requires actions that enable users to discover, identify, experiment, evaluate and adapt the knowledge they receive through dissemination activities.

Technology transfer is important to WSDOT because it plays a significant role in connecting sources of new knowledge with potential WSDOT users.

BACKGROUND

A coordinated technology transfer program is listed in the WSDOT 1985-87 strategic objectives because WSDOT decision makers recognize the need for the Department to fully utilize rapidly advancing technology and innovation in the transportation field.

Furthermore, members of the Transportation Research Council, comprising representatives from WSDOT executive management, the state's two research universities, the private sector, the Transportation Commission, and the Federal Highway Administration, discussed integrating innovation and research results into WSDOT at the July, 1985 annual meeting. Council members identified various technology transfer practices that could enhance the ability of WSDOT to use innovation.

This report was initiated in response to WSDOT management's interest in improving the organization's present methods of integrating innovation into WSDOT's work methods and operations.

PURPOSE

This study of technology transfer as a strategy for innovation adoption was conducted to accomplish the following:

1. identify the current WSDOT technology transfer practices;
2. assess those practices and determine if coordination is necessary;
3. determine if additional resources and procedures are necessary to enhance technology transfer; and
4. provide an implementation plan for improving technology transfer practices.

STUDY DESCRIPTION

Interviews with WSDOT employees from 32 work units in all WSDOT divisions and districts provide information on WSDOT's current technology transfer practices.

A review of the literature on technology transfer indicates that in the last 25 years, the focus of research and knowledge on technology transfer has changed. Earlier studies concentrated on factors that influence the individual's ability to discover and adopt innovation. More contemporary research has focused on organizational factors that

produce a climate conducive to producing and adopting innovation. These factors are discussed and provide a basis for assessing WSDOT technology transfer practices.

CONCLUSION

Technology transfer is an integral part of many of the Department's programs and functions and is conducted through various mechanisms such as conferences, reports, workshops, training, demonstrations, and the library.

This study identifies many WSDOT technology transfer practices that are provided to benefit other audiences and organizations. WSDOT employees also participate in activities sponsored by external sources such as other states, local governments and the private sector. These external sources provide new ideas, technologies and methods to potential WSDOT users.

Many WSDOT employees have or know of good ideas, innovative methods or better technologies, but need ways to integrate them into their work methods in order for WSDOT to benefit. This study concludes that an effort to coordinate technology transfer practices will

1. provide better utilization of the resources required by current practices;
2. increase opportunities for more employees to participate in technology transfer practices;
3. provide an evaluation capability to determine the level of activity, level of effort needed and the impact of technology transfer on department operations; and
4. create additional opportunities for technology transfer practices where none presently exist.

RECOMMENDATIONS

Six recommendations are made from these conclusions based on WSDOT employee interviews and the study's literature review. An implementation plan is provided for each recommendation in Chapter 6 that describes the action required, the benefits of the action, institutional issues, funding requirements and the procedures required for implementation. The recommendations include the following:

- Conduct a pilot project to coordinate WSDOT technology transfer activities for implementing research results.
- Establish and maintain contacts with individuals in each functional area of the Department.
- Involve members of the Research Implementation Committee with technology transfer activities.
- Increase WSDOT employees' involvement and participation with technology transfer practices.
- Develop performance measurements to evaluate technology transfer practices conducted by the pilot project to determine if research results are utilized in WSDOT operations.
- Evaluate the technology transfer pilot project to determine if project activities contribute to the adoption of innovation in WSDOT.

TECHNOLOGY TRANSFER: A STRATEGY FOR INNOVATION ADOPTION AT THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

"The mission of the Washington State Department of Transportation is to provide a multimodal transportation system which meets the social and economic needs of the state." (Strategic Planning Executive Seminar, 1984)

INTRODUCTION

In 1984, the Washington State Department of Transportation (WSDOT) began developing a long range "strategic plan". In order to define the issues the strategic plan would address, executive managers participated in a seminar to discuss conditions in 1995 that might affect the state's transportation system. Then they evaluated the present functions of the Department and identified immediate actions that would give WSDOT the capability to meet those future conditions.

WSDOT executive managers generally agreed that in the next two decades a number of changes would occur that will have a major impact on the amount and type of required transportation facilities and services.

The following future conditions and changes affecting transportation services and operations were discussed by the managers.

- Migration and population growth will increase in the state.
- The population of senior citizens will increase.
- There will be more vehicles per household.
- The suburbs and small communities will grow.
- The interstate highway system will be completed as mandated by Congress.
- Preservation of the 7,140 miles of the existing state highway system will have priority over any new highway expansion or new capital outlay projects.

- Maintenance will require a major portion of the agency's available resources.
- There will be a different distribution of federal transportation funds.
- Local governments will demand a larger share of available revenues.
- Public transit systems may need to expand in order to accommodate suburban and rural areas.
- The need for specialized transportation services (park-n-ride lots, HOV lanes, elderly and handicapped services) will increase.
- The number of pilots and larger private aircraft will tax general aviation facilities.
- The ferry system will expand to include passenger-only services.
- The abandonment of branch rail lines will continue with the result of increased truck traffic to move freight from production to unit train stations.

In regard to technology, the managers agreed that WSDOT will need to continuously evaluate the way in which it does business in order to fully utilize rapidly advancing technology and innovation in the transportation field.[1]

In light of these forecasted conditions, the managers evaluated the Department's present ability to meet future transportation challenges and needs. Seven major objectives were identified which required immediate actions by the Department. The objectives are:

1. provide adequate levels of accessibility, facilities, safety and mobility to ensure the efficient movement of people and goods;
2. obtain and prudently manage the revenues and other resources required to meet transportation needs;

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1 Staff Report 1995 Plan, Summary of Interviews, November 19, 1985.

3. assign the highest priority to maintaining the structural adequacy of existing pavements, bridges, ferry and general aviation facilities, and other capital facilities;

4. provide a program of research and development that integrates technological innovations, methods, and techniques into the activities of the department;

5. upgrade technical skill levels through innovative training programs and assign staff for maximum employee and job effectiveness;

6. provide a transportation system that facilitates modal integration and supports industrial, commercial, agricultural, and recreational activity within the state; and

7. develop improved internal and external communications and foster an attitude of public service among all employees.

Strategies were then developed by the managers to accomplish each of the objectives. One strategy suggested for Objective 4 is to "Develop a program of coordinated technology transfer."[2]

This study of technology transfer practices at the Department of Transportation was conducted to

1. identify the current technology transfer practices at the WSDOT;

2. assess the current practices and determine whether any coordination of activities is necessary;

3. recommend resources, procedures and activities required to enhance technology transfer practices; and

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2 "Strategic Objectives: 1985-1987"; Washington State Department of Transportation, 1985.

4. provide an implementation plan if a coordinated technology transfer program is required.

STUDY DESCRIPTION

Literature Search

The subject of technology transfer is not new or unique to the transportation field. Discussions of technology transfer, innovation adoption and other related subjects are found in literature from the fields of public and business administration, research utilization, social sciences, and communications. A review of this literature provided definitions of technology transfer, identified important principles of the process and showed a trend in the knowledge about technology transfer.

Technology transfer is also practiced by many private and public sector organizations. Interviews with technology transfer specialists and a review of the literature regarding these programs is provided to demonstrate the experiences, techniques and practices that are used by other organizations.

Department Interviews

Current WSDOT technology transfer practices were identified by surveying 32 work units in all WSDOT divisions and districts. The survey method consisted of interviewing one or more managers from each work unit. The interview format was borrowed from ethnographic research, such that the managers were encouraged to express their ideas and definitions on the subject of technology transfer, rather than the researcher providing a set definition. From this discussion, a consistent meaning of technology transfer was established for the purpose of this research.

In most of the interviews, managers were quite familiar with the term "technology transfer" and the associated process and practices. In a few interviews, managers associated the term "technology transfer" with only technological innovations and not innovations that resulted from changes in methods, procedures or techniques. In

these few cases, the interviewer tried to broaden the managers' definition by providing examples of how innovative actions could be transferred into work methods or practices. One example that was given is the case in which an employee observed how a peer uses a shovel to remove dirt from a ditch. The employee returned to his job and used the shovel in the manner in which he observed. The employee's task of removing the dirt from the ditch was made easier because he used the shovel in a manner different from the way he had used it previously. It was not the shovel that improved the method of removing the dirt from the ditch, rather it was the observed behavior of a peer and subsequent adoption of the peer's method of using the shovel that improved the work method.

After a consistent meaning of technology transfer for this research was established with the managers, an inventory of the existing technology transfer practices that are provided by the work unit was obtained. Technology transfer practices that WSDOT employees participate in but are provided by sources outside the unit were identified by the managers. Organizational constraints that present barriers to technology transfer in the work unit were also discussed with the managers.

The interviews from each work unit were documented and returned to the work unit to ensure accuracy and completeness.

Coordination Needs

The existing technology transfer practices were assessed based on the information found in the literature and the comments from managers who participated in the survey. To determine whether WSDOT technology transfer practices should be coordinated, the Research Implementation Committee, comprising members of various districts and divisions in WSDOT, reviewed this report and evaluated the recommendations.

Report Organization

Chapter 1 defines the term "technology transfer," identifies the role of technology transfer and provides examples of how technology transfer has impacted the transportation field.

Chapter 2 discusses important information and concepts about technology transfer extracted from a review of the literature. A discussion of important issues identified by various authors also shows a trend in technology transfer research from a focus on the individual to more recent research regarding organizational issues. Examples of technology transfer programs conducted by various agencies is also provided.

Chapter 3 introduces the technology transfer practices of the Department of Transportation. They are categorized by the techniques used to bring sources of knowledge to potential users. Specific examples of WSDOT's involvement within each category are provided from interviews with WSDOT managers. Relevant issues relating to the effectiveness of each category is also discussed.

Chapter 4 concludes that coordinating technology transfer will benefit present WSDOT practices.

Chapter 5 discusses ten recommendations for enhancing technology transfer practices at WSDOT.

Chapter 6 provides an implementation plan for each recommended action that describes the activity and discusses the benefits and institutional issues, funding requirements and procedures for implementation.

CHAPTER 1
THE IMPORTANCE OF TECHNOLOGY TRANSFER AT WSDOT

DEFINITION OF TECHNOLOGY TRANSFER

Technology transfer is simply the act of introducing, adapting or using innovation in the activities of an organization.

Innovations can be new or different procedures, ideas, methods, technologies, products, equipment, or actions. Innovations may change or improve the current operations of WSDOT. Innovative change occurs formally in WSDOT through policies, directives and published procedures. Innovation can also occur informally when employees discover innovations or have ideas and apply them to their work methods or tasks. Technology transfer is important in the WSDOT because it enhances the organization's ability to fulfill its mission of meeting future transportation needs, especially with uncertain future resources.

ROLE OF TECHNOLOGY TRANSFER

Technology transfer plays an important role in the process of adapting innovation because it fills a gap between research, knowledge and experience, and potential users of an invention, idea or technique. Technology transfer is more than just communicating ideas or disseminating information. Instead, technology transfer requires actions that create a climate conducive to the use of innovation. Technology transfer actions do not assume that just because a product exists it is used, or that someone will read, understand and use a published technical report.

EXAMPLES IN TRANSPORTATION

Obvious examples of technology transfer are found by considering important advancements in the transportation field such as development from dirt roads to super-

freeways, and from horse and buggies to cars, trains and buses. Technology transfer has also facilitated rapid changes in the transportation field. Consider that many people who were alive when the Wright Brothers took that first historic flight are still alive today to witness the exploration of space and other planets. Advancements in electronics have dramatically improved traffic management systems. The adaptation of computer technology in engineering has automated design and construction practices. Increased knowledge in environmental science has affected how roads are built and where they are located. Scientific research has led to discoveries of new chemicals and products that make stronger and more durable highway products.

Although there are many obvious examples of technology transfer and the innovations that have been adapted for transportation, less obvious innovations have improved work methods and saved tax dollars. Many of these innovations are related to human behavior, rather than technology, products, or equipment. For this reason, it is important to keep in mind that the term "technology transfer" not only applies to the process of adapting new technologies and inventions, it also applies to a broad scope of development in human actions and experience. New technology, inventions, experience, products, methods, procedures and practices are all innovations that can be transferred into the operations or activities of an organization.

CHAPTER 2
TECHNOLOGY TRANSFER PRACTICES IN INDUSTRY AND GOVERNMENT

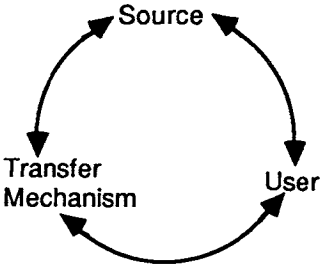
INTRODUCTION

A review of the literature on the subject of technology transfer is necessary to understand the definitions of technology transfer and some of the organizational issues that influence the process. The literature also shows a trend in technology transfer research. Earlier studies on the process of technology transfer focused on the ability of an individual to adopt innovations. More recently, their research has begun to examine issues that affect an organization's ability to produce or adopt innovation.

Technology transfer is practiced by several diverse groups including government policy makers, business executives and academic researchers. Examining technology transfer programs that exist demonstrates the variety of its use by different organizations.

TECHNOLOGY TRANSFER MODEL

Technology transfer has been written about by many professionals dating back to the 1950s. A review of books, journals and articles shows that most authors begin discussing technology transfer by providing a basic model of the process. The following popular illustration is used to describe technology transfer by many experts.



Three significant groups are identified in the process of technology transfer: source, user and transfer mechanism. The identities of these groups are described as

- SOURCE -- sources of knowledge created from scientific research, experimentation and human experience;
- USER -- the person or group who adapts or adopts the knowledge produced by a source; and
- TRANSFER MECHANISM -- the method used to bring innovation from the source to the user.

Stated simply, the process by which a source produces or modifies a technology, how it gets communicated to a potential user, and whether the user adopts such innovation consists of dynamic linkages between these groups.

SOCIAL PROCESS

Everett Rogers (1962), one of the early authors on the subject of technology transfer concentrated on the diffusion of innovation as a social process. Rogers described five stages involved in the process of individuals adopting an innovation;[3]

1) individuals become aware of the innovation;
2) there is interest or a need for the innovation;
3) an evaluation takes place that weighs the risks against the benefits;
4) the user must have the capability to try the innovation;
5) the individual adopts the innovation when the the trial of the innovation produces a significant improvement over the current practice or method.

In early 1980, researchers from the University of Wisconsin produced a more refined description of the characteristics that influence potential users in the technology

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3 Everett M. Rogers, *Diffusion of Innovations*. Free Press, New York, 1962.

transfer process. Their work focused on practitioners in the transportation field. These authors identified the the following stages of the technology transfer process:

> "Adaptation (the altering of innovation and the new setting to enhance the "fit" of the new innovation),
>
> Adoption (the testing of the innovation which leads to the implementation, modification or abandonment of the innovation),
>
> Implementation (the long-term incorporation of the innovation)
>
> Diffusion (both internal and external) of the results."[4]

ORGANIZATIONAL ACCEPTANCE

Almost a decade after Rogers published his first book on the diffusion of innovation, he co-authored another book that identified certain factors, in addition to costs, that affect the degree of acceptability of an innovation in the organization. These are

> "Relative advantage--the degree which an innovation is perceived as being better than the idea it supersedes;
>
> Compatibility--the degree to which the innovation is consistent with past experiences, values and present needs of the organization;
>
> Complexity--the ease at which potential adopters can understand the innovation;

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4 Schmitt and Beimborn et al., *Strategies for Improved use of Transportation Research*, Center for Urban Transportation studies, University of Wisconsin, Milwaukee, June 1981.

Robert P. Schmitt and Mary J. Mulroy, *Technology Transfer Primer*; Office of Statewide Transportation Programs; University of Wisconsin--Extension, and Edward A. Beimborn, Center for Urban Transportation Studies; University of Wisconsin--Milwaukee; August, 1984.

Trialability--the extent to which experimentation or limited testing is possible;

Observability--the degree to which the results of the innovation are easily visible and communicated to others."[3]

The attitudes of individual organizations were recognized in the late 70s as an important influence on the adoption of innovation. Three major organizational characteristics which affect adoption include

"Risk-taking climate--the general willingness of a firm to undertake new ventures which have a potential for failure;

Regulatory framework--the extent to which others, (legislature) can intervene (either positively or negatively) in the decisions of an organization by placing requirements on procedures and programs;

Labor reaction--the likely reaction of unions and employee groups to an innovation."[6]

INNOVATION IN CORPORATIONS

By the 1980s, the subject of innovation became an important topic to business leaders. Increased market competition, rapidly developing technology (particularly in the computer field), a changing work force and the economic climate were conditions that influenced managers to evaluate the way in which their organizations produce or adopted innovation. The analysis focused on not only the companies ability to produce new products and technologies, but also to adopt or adapt those that were being rapidly developed in the market place.

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5 Rogers, E.M. and Shoemaker, F.F., *Communication of Innovations*, Free Press, New York, 1971.

6 John Ettlie and David Vellenga, "The Adoption Time for Some Transportation Innovations," *Management Science*, May 1979)

In a major study of American corporations, Rosabeth Moss Kanter selected ten companies to determine the significant elements that contributed to their ability to be innovative. Kanter defined innovation as "the process of bringing new problem solving ideas into use. This process involves the generation, acceptance and implementation of new ideas. Innovation occurs in any part of the organization and can involve creative use as well as an original invention."

Kanter found that innovation was the result of companies who practiced integrative management and problem solving. "Integrative (management) is the willingness to move beyond received wisdom, to combine ideas from unconnected sources, and to embrace changes as an opportunity to test limits." The contrasting management style and structure is "anti-change oriented and prevents innovation." Kanter called this "segmentalism" because, "it is concerned with compartmentalizing actions, events, and problems and keeping each piece isolated from the others." Companies who have segmental operations find it difficult to innovate or to handle change.

Kanter made important recommendations to managers for providing innovation in an organization. These are summarized as follows:

- encourage an innovative culture in the organization by highlighting the achievements of its employees. This culture is established by providing rewards, introducing innovations to different areas in the organization, and letting the people who discover or produce the innovation be the marketers of the product or method.
- Provide employees with greater access to a responsive system by establishing multi discipline committees who review and support proposals for innovation.

- Improve lateral communications by bringing people from different departments together. Allow greater horizontal mobility for employees by allowing work groups or teams to work on projects.
- Create cross-functional links, even overlaps in functions, so that teams of people are responsible for the same end product.
- Reduce the layers of hierarchy that produce barriers to resources. Push decision-making downward, making it possible for people to directly pursue what they need. Allow employees to share information and provide quick intelligence about external and internal affairs.
- Reduce secrecy about the organization by providing employees more information about the company's plans. Avoid surprising employees with new plans by involving them in the development of such plans.
- Give people at lower levels in the organization a chance to contribute their ideas by involving them in task forces and problem-solving groups or through more open-ended, change-oriented assignments, with room for the employee to determine the approach.
- Establish an organizational structure for change that is parallel to the existing organization. Provide recognition of the change structure to employees.

Another important factor Kanter made was that "top executives need at least some of the qualities of corporate entrepreneurs in order to support this capacity at lower levels in the organization." In other words, executive managers must not only support innovation within the organization, they must be innovative leaders.[7]

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7 Rosabeth Moss Kanter, *The Change Masters: Innovation & Entrepreneurship in the American Corporation.* Simon & Schuster, Inc., New York, 1984.

INNOVATION IN PUBLIC ORGANIZATIONS

Peter Drucker, an author of many books on management, entrepreneurship and organizational excellence defined innovation as the "effort to create purposeful, focused change in an enterprises' economic or social potential. The success of an organization is based on its ability to adopt change and to provide a work environment that induces employees to be innovative."[6]

According to Drucker, most innovations in public agencies are imposed by outside sources or catastrophies. He explained that for many organizations the belief is that "if you invent a better mousetrap, the world will beat a path to your door." But what managers fail to consider is what makes the mouse trap "better" and for who?

Drucker proposed that the vehicle for a change in attitudes, values and behavior is a "technology" called management. Drucker sets forth principles for managing innovation that included analyzing the opportunities for innovation by looking, asking, listening and introducing simple focused changes on a small scale.

Drucker explained why innovative enterprises are difficult for a public agency. His reasons are summarized below:

- operations are based on a "budget" rather than results;
- innovation in the public sector must please many constituents, rather than just the customer; and
- change can be a threat to a public agency's existence, beliefs and values. Drucker recommended policies for organizations to establish that would provide a climate for innovation:
- establish a clear definition of the Department's mission,
- develop a realistic statement of goals,

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8 Peter F. Drucker, *Innovation and Entrepreneurship Practice and Principles.* New York: Harper & Row, 1985.

- failure to achieve objectives should be an indication that the objective is wrong;
- instill a constant search of innovative opportunities through policies and practices.
- allow opportunities for lower echelon employees to participate in the process of innovation.

BARRIERS TO INNOVATION

James Brian Quinn, author of books on strategic management and technological innovation, explained that innovative organizations must "recognize that the random, chaotic nature of technological change cuts across organizational and institutional lines, laps into a multitude of outside resources and user groups." Quinn described the bureaucratic barriers in an organization that affect its ability to innovate. These include the following:[9]

- executive managers have little contact with workers who might influence their thinking about technological innovation;
- people who go outside the chain of command are viewed as "fanatics," troublemakers or non-team players;"
- executive managers have expectations for immediate quantifiable results;
- the costs of assessing direct, indirect, overhead, overtime and service costs against a project add to development costs; big projects often become political targets;
- managers who want innovation to occur only through formal research and documented results rationalize excessively;

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9 James Brian Quinn, "Managing Innovation: Controlled Chaos," *Harvard Business Review* 85-3, p.34.

- in the name of efficiency, the organizational structure can require many approvals; it can take a chain of "yeses" to approve a project and only one "no"; and
- reward and control systems are designed to minimize surprise, yet innovation is full of surprises that can disrupt plans and control systems.

Technology transfer is practiced by several diverse groups including government policy makers, business executives and academic researchers. The following examples of technology transfer are provided to demonstrate the various technology transfer programs in other organizations.

U.S. DEPARTMENT OF AGRICULTURE (U.S.D.A.)

Since 1914, The U.S. Department of Agriculture has funded Cooperative Extension Services at universities around the country. As universities generated new knowledge through research, it soon became apparent that there was a need for technology transfer to teach the results of the research to practitioners in the field. The present-day Cooperative Extension Service centers were established in most states through a cooperative effort by the U.S.D.A., universities and local governments.

The Cooperative Extension's mission is to assist people in making informed decisions through research and experience based on educational programs; to improve agriculture and natural resource management; to improve the capabilities of individuals and families; to aid communities in developing and adapting to changing conditions and; to provide developmental opportunities for youth.

Cooperative Extension "agents" link the needs and problems of people and communities with rapidly developing technology. Extension Service centers practice technology transfer by teaching, distributing publications, newsletters and brochures, arranging

demonstrations, workshops and seminars and providing one to one technical advise and problem solving.[10]

FEDERAL HIGHWAY ADMINISTRATION

The Federal Highway Administration (FHWA) developed the Rural Technical Assistance Program, commonly called RTAP in 1982. This technology transfer program focuses on rural roads, bridges and public transportation. "Rural" in this program means counties, small cities and towns that are not part of urbanized areas. Twenty three technology transfer centers (T2 Centers) around the nation assist local transportation agencies in receiving the training and new technology they need. The T2 Centers provide materials to local agencies, distribute newsletters on the latest technology, conduct training and evaluate programs. Most of these T2 Centers are coordinated from a university, although some are administered from a state transportation agency. Under this program the latest in technology, as developed by research, industry and other sources, is transferred to a network of local transportation agencies.[11]

INTERNATIONAL

Technology transfer is practiced globally by the U. S. State Department and other federal and privately funded agencies to introduce new technology and knowledge to underdeveloped nations. Unique considerations in international technology transfer include geography, language and culture. The U.S. transfers knowledge to other countries about agricultural technology, population control, space technology and weapons.[12]

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10 "Cooperative Extension: Its Mission, Organization and Programs"; U.S. Department of Agriculture, Washington State University, College of Agriculture and Home Economics, February 1985.

11 Western Technology Transfer Tri-Regional Conference, Battelle Memorial Institute, Seattle, Washington, June 27-29, 1984.

12 A. Coskun Samli, *Technology Transfer*. Greenwood Press, London, England, and Westport, Connecticut, 1985.

SUMMARY

Research on the technology transfer process began by examining the factors that influence individuals to adopt innovation. Today, technology transfer is analyzed in the organizational context because of the conditions the organization will determine whether the individual seeks out and uses innovation in the work environment. Another reason that the focus of technology transfer research is now on organizations is that managers recognize the individual as an important source of innovation. Organizations must have the ability to capture innovation that is created or discovered by employees.

Programs of technology transfer play important roles in the functions of many different organizations. Educating farmers about new agricultural technology, transferring population control methods to underdeveloped nations, or bringing new products and methods to rural transportation workers are examples of the technology transfer process. Successful technology transfer is important to an organization because more knowledge, better utilization of resources, progress and the elimination of inefficiencies are all feasible outcomes. Technology transfer is important to individuals and communities for the same reasons.

CHAPTER 3
TECHNOLOGY TRANSFER PRACTICES OF THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

INTRODUCTION

Certain characteristics of the WSDOT organization are important in defining and describing technology transfer practices. Figure 1 presents the current organization of WSDOT and illustrates a familiar hierarchic structure found in many government organizations.

Members of the State Transportation Commission are appointed by the Governor. The Commission appoints the Secretary of Transportation. The Secretary appoints the five assistant secretaries and the six district administrators. The managers of the five other offices (e.g., legislative liaison, public affairs) report directly to the Secretary. This level of position is referred to as "executive management." Mid-management is defined as those positions that manage a WSDOT function, either in a district or division (e.g., highway maintenance). Field positions are held by WSDOT employees that report to mid management and carry out many of the transportation services and programs of the Department.

WSDOT is neither a decentralized or centralized department. Instead, some of the functions are decentralized such as highway maintenance, location and design, construction inspection, public transportation, personnel, and traffic engineering. These functions or programs are primarily managed by employees in the six district offices located throughout the state.

Other WSDOT functions, such as bridge engineering, the library, transportation planning, auditing, budgeting, and staff development are centralized operations that are managed in the Headquarters office, located in Olympia. This is not to say that these

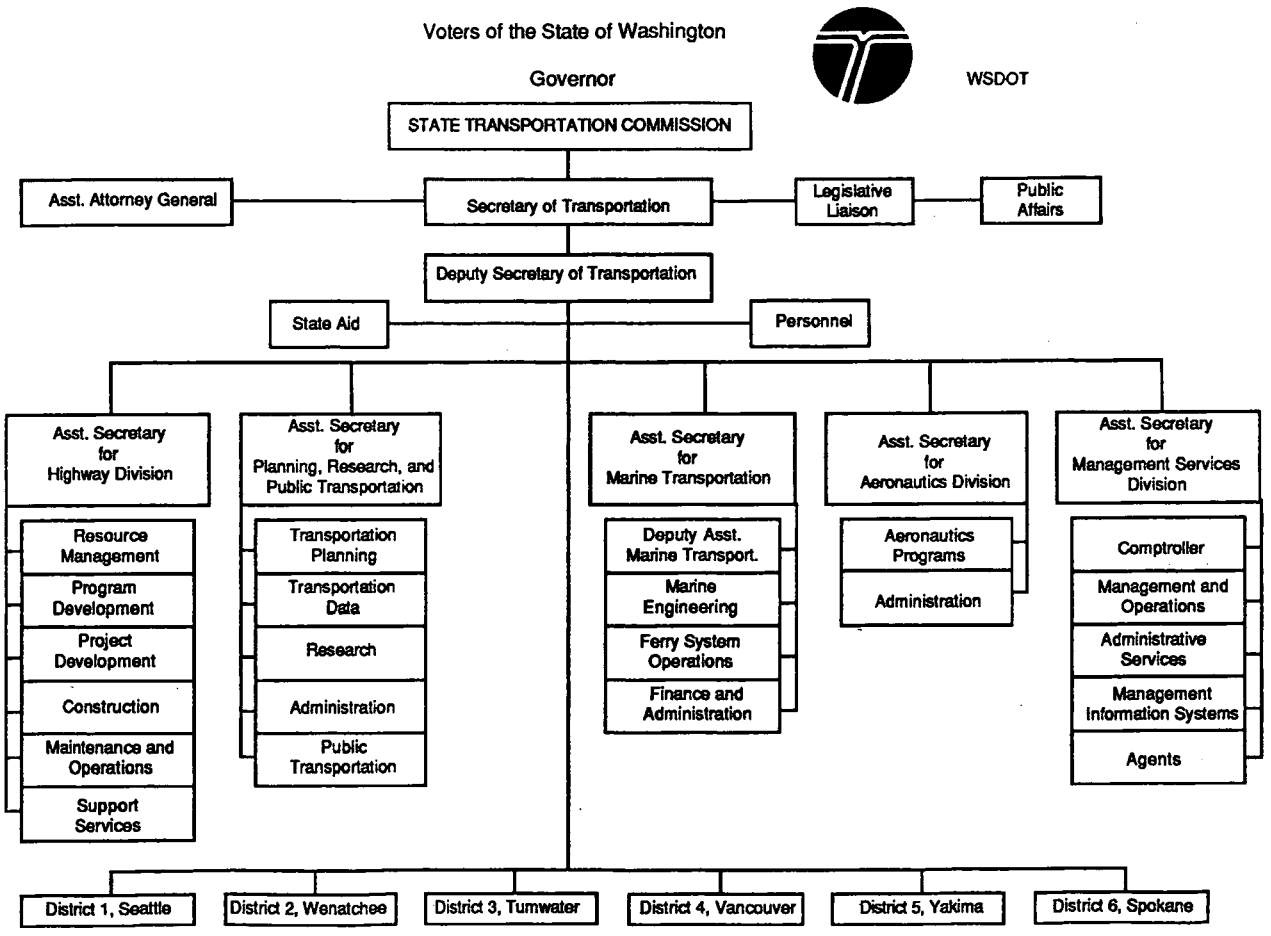

Figure 1. Current WSDOT Organization.

functions do not have any relationships with the district offices, but that they are primarily managed by Headquarters staff.

WSDOT TECHNOLOGY TRANSFER PRACTICES

Technology transfer is practiced in all WSDOT divisions and districts using a variety of methods and techniques. The techniques or "transfer mechanisms" used by individuals and work units to introduce sources of knowledge to potential users are categorized for the purpose of discussing the current practices in WSDOT.

Technology transfer is also provided by many external organizations and groups such as the U.S. Department of Transportation and private industry.

Figure 2 illustrates how innovation is transferred through conferences, meetings, reports, etc., into WSDOT divisions and districts. Technology transfer is clearly practiced within each district or division, but with no recognized connection between different sources, WSDOT offices or functions, so that much information simply never reaches appropriate users.

An overview of the technology transfer practices of each work unit that participated in the study is provided in a matrix (Figure 3). Specific technology transfer practices in each participating work unit are described in Appendix A. This information is collected from interviews with WSDOT managers from 32 work units.

The following WSDOT practices describe how each activity is used in technology transfer. Data gathered by the survey interviews provide specific examples for each practice. Relevant issues pertaining to the practice are also discussed.

Conferences

Many formal and informal opportunities for technology transfer occur at conferences. Displays, presentations, workshops, demonstrations and papers are all technology transfer mechanisms that can be part of a conference program and used to introduce innovations to potential users. Conferences provide an opportunity for attendees to gain

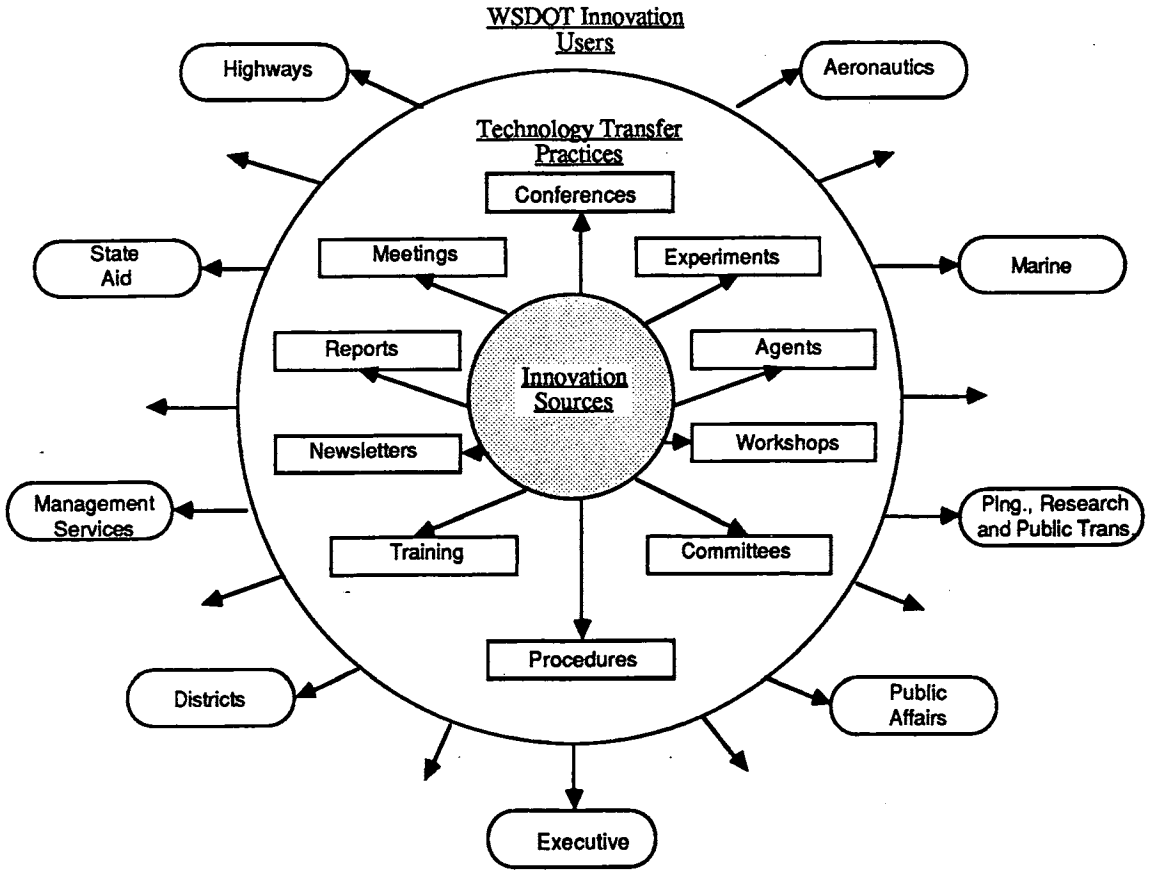

Figure 2. Current T2 Practices at WSDOT.

Group	Conferences	Workshops	Training	Demonstration	Experiment	Agent/Liaison	Reports	Newsletter	Procedures	Research	Commitee	Annual Meeting	Associations
Staff Development	—	AC	C Crd	C	—	—	PR	—	F	Y	Y	Y	Y
Public Affairs	S	—	ACS	S	—	—	PR	PR	I	Y	Y	—	Y
Aeronautic	ACS	AC	AC	AC	C	—	PR	PR	—	Y	Y	Y	Y
Highways													
Resource	—	—	C	—	—	Carr	—	—	I	—	Y	—	—
Bridge	ACS	AC	AC	AC	C	Henley	PR	R	F	Y	Y	Y	Y
Location/Design	A	AC	AC	AC	C	Gripne	PR	R	F	Y	Y	Y	Y
Construction	A	AC	AC	AC	C	—	PR	R	F	Y	Y	Y	Y
Materials	A	AC	AC	AC	C	Anderson	PR	R	F	Y	Y	—	Y
Maintenance	A	AC	AC	AC	C	Williams/Kessack	R	PR	F	Y	Y	Y	Y
Traffic	A	A	AC	AC	C	C. Mansfield	PR	R	F	Y	Y	Y	Y
Support	A	AC	AC	AC	C	—	PR	R	F	Y	Y	—	Y
Management Services													
Administration	AS	AC	AC	AC	C	—	PR	PR	F	—	Y	Y	Y
MIS	A	AC	AC	AC	C	Area Reps	PR	PR	F	Y	Y	Y	Y
Mgmt./Oper.	A	—	—	—	—	—	—	—	—	—	—	—	—
Library	—	—	ACS	—	—	Russo	RD	R	I	Y	Y	—	Y
Methods/Procedures	—	—	—	—	—	—	—	F	F	—	—	—	—
Marine Division	A	A	AC	AC	C	—	R	PR	F	Y	Y	Y	Y
PRPT													
Research	A	SC	A	C	C	—	PRD	PR	F	Y	Y	Y	Y
Public Trans.	AC	AC	AC	C	—	—	PRD	PR	I	Y	Y	Y	Y
State Aid	A	AC	AC	—	—	—	PR	R	F	Y	Y	Y	—
T2 Center	AC	AC	AC	AC	—	Crommes	PRD	PR	I	Y	Y	Y	Y
Districts													
1	A	AC	AC	C	C	Jacobson	PR	PR	F	Y	Y	Y	Y
2	A	A	AC	AC	C	Senn	PR	R	F	Y	Y	Y	Y
3	A	A	AC	A	—	George	PR	PR	F	—	Y	Y	Y
4	A	AC	AC	AC	—	Coffman	PR	PR	F	—	Y	Y	Y
5	A	A	AC	A	—	McNeil	R	PR	F	—	Y	Y	Y
6	A	AC	AC	AC	C	Larson	PR	PR	F	Y	Y	Y	Y

KEY

A = Attend, C = Conduct, Crd = Coordinate, D = Disseminate, F = Formal, I = Informal, P = Publish, R = Receive, S = Support, Y = Yes, — = Not identified

Figure 3. WSDOT Technology Transfer Practices — Overview.

knowledge about events that are external to their own organization. More importantly, conferences provide attendees opportunities for two-way communication and face-to-face contact with peers and other professionals. Important contacts can be made at conferences for future activities and problem solving.

An example of a conference that WSDOT sponsors is the annual Washington State Transportation Conference. This conference is attended by federal, state and local transportation officials. The conference is also supported by private industry for displaying and demonstrating new products to potential users. This conference is an example of a WSDOT technology transfer practice that is of benefit to people and organizations outside of the Department, as well as the WSDOT staff who can attend. The American Association of State Highway and Transportation Officials (AASHTO) is an organization comprised of state transportation officials. AASHTO sponsors an annual conference, an example of a technology transfer practice from which WSDOT benefits, that is sponsored by another organization. For example, the 1985 AASHTO conference was held in Seattle and many WSDOT managers had the opportunity to attend.

Although conferences are an excellent technique for providing technology transfer, the number of employees who can attend is limited by budget constraints and out-of-state travel restrictions. Opportunities for attending conferences in WSDOT are provided to executive managers and some employees from mid management levels. Therefore, it is important that managers who do attend conferences transfer their experiences to other members of the organization. Some managers accomplish this by conducting staff briefings on conference events. Other managers file "trip reports" which are distributed to other executive managers.

Workshops

Workshops can be a technology transfer practice because they give attendees an opportunity for hands-on experience with a new product or procedure, usually in a

"working session." Workshop topics are specific in nature and provide an opportunity for the attendees to discuss their experience with each other. The Management Information Systems (MIS) office conducts workshops on new software packages with informal groups of employees. WSDOT participates in workshops sponsored by the Federal Highway Administration and private industry. An example of this type of workshop is a Microcomputers in Pavement Construction Management workshop sponsored by FHWA and attended by WSDOT project engineers.

Training

Once an innovation has proven to be beneficial to the Department, a training activity is developed for adopting the innovation on a larger scale. Training is a mechanism of technology transfer when the training activity introduces new skills, products or methods, rather than instructing employees on established practices of the organization. Technology transfer training is concerned with more than just informing the student of the existence of new methods or products, the training is intended to help the student adopt the innovation. For this reason, training in technology transfer is most effective when it uses multiple communication methods and provides an interactive learning experience, whereby the participants and the trainer experience two-way communication.

Employees in all divisions and districts attend training of some type, as required by statutes concerning human resource development and the requirements of certain job classifications. However, this training is more concerned with employee development. Technology transfer training is more oriented towards organizational development because it strengthens knowledge and skills that are identified by the organizations' needs, rather than the individual employee needs.

Technology transfer training is often part of contracts with private industry vendors who supply WSDOT with new products or equipment. For example, after WSDOT purchases a new product, the vendor may be required to provide training on its use.

Training is also conducted by WSDOT employees with expertise in particular technical areas, such as bridge inspection. Many work units conduct training sessions to introduce new procedures or methods to employees. For instance, the Microcomputer Center conducts training on new software and computer equipment.

Cross training is another technology transfer practice because the knowledge and experience of an employee applied to a different area of the organization can provide a different perspective on a task. Cross training also provides employees an opportunity to learn a new skills, problems and issues of areas different or related to the jobs they are familiar with. Japanese organizations conduct regular cross training through job rotation. Japanese workers understand that the positions they hold will change over a two- or three-year period. Employees find new approaches, understand different work unit problems and learn about the broad mission of the organization from cross training or job rotation. WSDOT has no recognized cross training program. Instead, employees from different disciplines (e.g. construction) enter new positions through promotions and transfers. The field offices that perform highway maintenance functions provide some opportunities for cross training, but these opportunities are very limited.

The logistics and costs of technology transfer training have improved in recent years with the availability of video tapes. Training sessions can be produced on video tape and distributed to a wide range of audiences. The video tapes supplement the training activity by providing a visual demonstration of the product or method. Another advantage to utilizing video technology is that the training activity can be held with few logistical requirements (space, time and location). During slack work loads, supervisors can arrange training for employees by obtaining a video tape, monitor and player. Class size is not necessary to justify the training activity because the cost of the activity is the same if the tape is played for one employee or a group. WSDOT uses video tapes to conduct training for local public works agencies through the Rural

Technology Transfer Center. The Public Affairs office supports technology transfer training by producing video tapes of demonstrations of new procedures, products and programs. The Administration office produced a video tape on a computerized inventory system that was distributed to the district and field offices. The strategic planning program was introduced by distributing a video tape to introduce the program to employees and outside groups.

Demonstrations

Demonstrations are a technology transfer practice because they provide potential users an opportunity to witness or experience innovation in action. People are more likely to adopt or adapt a product or method when its use has been demonstrated. Demonstrations are conducted informally by various employees in WSDOT when a new product or method has been discovered. For example, a worker may discover a better method to secure a temporary sign post way to file reports. The worker may demonstrate the new method to the other workers in his unit and they agree with the advantages of the new method. An example of a technical demonstration is one provided by the CADD Users Group that demonstrates a new computer application during a meeting.

Demonstrations that give employees first hand information on innovations are also conducted at conferences and meetings. An example at a conference or meeting might be a demonstration of a new traffic control device that operates on light intensities. The inventor of the device might set up a booth at a conference and provides attendees an opportunity to witness the traffic signal's response to varying light intensities.

WSDOT employees also attend demonstrations of new products, equipment and technology that are provided by private industries. These demonstrations are conducted when vendors contact field offices directly to introduce new products and arrange

demonstrations. In many instances, local transportation or public works agencies will arrange to attend these local demonstrations.

The Federal Highway Administration (FHWA) develops demonstration projects from the results of research conducted by transportation organizations. WSDOT participates in these demonstrations sponsored by FHWA.

Experiments

Experiments can produce knowledge that requires a technology transfer practice in order for a user to adopt the innovation. The experiments that are included in WSDOT technology transfer practices are tests conducted by various offices without a formal connection to the WSDOT research program. These experiments are conducted by employees and work units outside the Research Office and tend to be more informal than formal scientific experimentation. For example, the MIS section might experiment with a new software program before considering its department-wide application. The Aeronautics Division also participates in experiments with signaling equipment used in air traffic control. The Marine Division experiments with materials used to find more durable products to use for loading docks.

Some experimentation in WSDOT is supported by private industry vendors, such as the Portland Cement Association. These experiments are conducted on a limited basis to test new products and equipment, before they are purchased.

The successful or failed results of experiments by WSDOT employees should be communicated or transferred to other work units and employees in order for WSDOT to benefit from experimentation.

Agent-Liaison

Technology transfer "agents" are persons whose job responsibilities includes keeping apprised of innovative developments in their fields and transferring the innovation to other users through various techniques. Agents also have credibility with users,

because they are usually at the same peer level as many others in the work unit. In WSDOT there are a few examples of employees who are designated "agents." In the Bridge and Structures Branch, there is a Bridge Technology Development Unit that has a technology transfer "agent." Examples of some of the technology transfer practices the agent provides are the development of proposals for incorporating new technology into bridge construction and maintenance; the review of published reports on innovations and consideration of their application in the work unit; and maintenance of a network with peers in other states with bridge operations.

In the Design Standards Section of the Location-Design Branch, proposed changes to design standards are reviewed and comments are solicited from those offices with expertise concerning the change. The comments are then reviewed and if the change is determined to be appropriate, changes to the Design Manual and/or Standard Plans are made. Each year an Operational Review is made on selected projects in each district. The review team consists of WSDOT Headquarters, District, and FHWA personnel. The purpose of this review is to see where standards can be improved, or where innovative ideas were used. Results are published in a report so that the new ideas can be implemented in upcoming projects.

The Highway Maintenance and Operations Office employs two maintenance specialists who are designated technology transfer "agents." These employees spend much of their time as "circuit riders" visiting field offices throughout the state. The agents give presentations to field crews on new products, methods and technologies that are produced by other work units, private industry and other organizations. They also identify unique procedures and products and develop information to be distributed to other field offices.

Various WSDOT work units or programs appoint liaisons as focal points for managing programs or resources. Liaisons perform many technology transfer practices such

as providing technical advice, disseminating information, and establishing networks among peers.

The Management Information System (MIS) designates area representatives who work directly with each district and division to analyze data processing needs, provide technical advice and conduct training. The Northwest Technology Transfer Center provides mobile agents who travel to rural areas and conduct training, workshops and other activities that introduce innovations to local government transportation officials. The Public Affairs office assigns staff to each division and district to provide public information services. The State Aid Office designates local government liaisons in each district office to provide services to local transportation agencies.

Research liaisons are designated in each District to serve as the focal point for identifying research needs and implementing research results. Research liaisons also serve as technical coordinators of research projects that are conducted by university researchers. There are two full-time research liaisons from the Highways Division and the Materials Lab. These liaisons provide an important link from the Research Office to the functional areas of the Department.

Not every program or work unit in WSDOT has a designated agent or liaison that can be used for technology transfer. In these instances, technology transfer practices occur more randomly and are more difficult to quantify.

Reports

Reports are a practice of technology transfer because they provide information about innovations from a source of knowledge to a potential user.

The WSDOT Library, located in the Headquarters office catalogs and maintains reports and other printed documents that are published by WSDOT and other organizations and persons. The WSDOT Library is also linked to a regional library system for accessing collections stored in the state and university library systems. The

Library publishes a regular listing of new acquisitions of interest to transportation officials. This list is distributed throughout WSDOT divisions and districts.

Examples of reports published by external sources are publications from the Transportation Research Board and other state transportation agencies. Many of these reports are disseminated directly to various persons in WSDOT.

Reports received by the Research Office are sent to various technical advisors for evaluation of their recommendations or results for implementation into the Department.

Reports are published by many work units in the Department. Examples of reports produced by WSDOT work units include the Operations Review Report which is developed from the Highway Location Design Office; the Training Study Report from the Management and Operations office; annual reports from the Administration Office; and the 1984 Public Transportation report produced by the Public Transportation Office. These reports are distributed within WSDOT but are also provided to local government transportation agencies, other state agencies and the public.

Research projects usually include a report on the researcher's results or recommendations. These reports are distributed to technical coordinators/committees for comment before final reports are published. The final research reports are also reviewed by the Research Implementation Committee, which evaluates the research results for implementation into WSDOT.

Reports are a passive practice of technology transfer because they rely solely on the reader's understanding of the material presented for the method, idea or product to be applied. There is no opportunity for the reader to ask questions or to communicate with the source of the innovation. Furthermore, research reports are often so technical that the potential user cannot understand the application of the research results. In many cases, research reports are written for other researchers. Brief, concise, summaries of the research result or report topic need to be produced, in order for employees to

consider using the information. An example of providing readable materials is the Rural Technology Transfer Center which interprets technical reports and disseminates "technical bulletins" to local government transportation workers.

Reading is also a time consuming task and is not always considered a legitimate work activity by some supervisors. For these reasons, there is a need for developing more abstracts and summaries of reports for WSDOT employees.

The dissemination of reports in WSDOT is limited. Field employees have very limited access to published reports by WSDOT or non-WSDOT sources.

Employees who discover innovative ideas, products or methods by reading reports have no established way to communicate the knowledge to the Department. Potential innovations are lost, because the knowledge employees receive from reports goes nowhere, except to the mind of the readers.

Newsletters

Newsletters are a communication tool that, by relating developments and advancements in various fields, can spark ideas in WSDOT employees. Newsletters are also a method to recognize the accomplishments and contributions of employees.

Technology transfer can be practiced through newsletters that introduce new subjects to their readers. Newsletters are published by various WSDOT offices including Public Affairs, Highway Maintenance, Management Information Systems, the Marine Division, Public Transportation, Transportation Center and State Aid. The content of these newsletters ranges from information on employees, to instruction on departmental procedures, to articles of interest to professional groups within WSDOT. WSDOT newsletters are distributed throughout the Department to employees in various work units and to persons and groups outside the Department.

Five of the six Districts publish employee newsletters. These newsletters provide information to employees on projects, personnel changes, departmental procedures and

various topics of perceived interest to the employee. Most of these newsletters have limited distribution; however, a few do go to Headquarters' offices and other Districts.

A recent newsletter, Breaking Tradition, is designed specifically for women in the transportation field. This newsletter highlights the achievements of women in the transportation field and provides useful information on workplace topics and issues.

WSDOT receives many newsletters that are produced by other organizations and associations. These newsletters are received by various people in WSDOT and their distribution is limited to within work units.

Research

The WSDOT research program operates under a formal Research Council that includes members from the Transportation Commission, WSDOT executive managers, representatives from the two research universities, staff of the Federal Highway Administration and people from private industry. At the annual Council meeting held in July, 1985, members addressed the issue of how to implement research results into WSDOT operations. The council identified the following ways of improving research implementation and utilization:

- involve more employees in the formulation of research projects;
- communicate results in more understandable formats;
- use more field employees to conduct training, workshops, demonstrations;
- provide more opportunities for personal contact;
- increase involvement with the private sector; and
- obtain feedback from Department innovators success and failures;

One important aspect of research utilization is the involvement of potential users in the definition of the problem and the creation of the solution. This is a practice of technology transfer because the process brings researchers and potential users together. An example of WSDOT users' involvement with the research process is the input WSDOT

managers provide on annual research solicitations. WSDOT technical coordinators and technical committees are also closely involved in defining research needs and evaluating possible implementation plans. The Research Implementation Committee is a group of managers who evaluate research results produced by WSDOT and other organizations and decide to develop implementation activities.

An example of WSDOT involvement with the research community is the formation of the organization called the Washington State Transportation Center. (TRAC). TRAC is a coordinated transportation research organization that combines the University of Washington, Washington State University and WSDOT in an active research program. TRAC provides the coordination necessary to keep the user (WSDOT) involved in the research conducted by university researchers. TRAC practices technology transfer by making presentations of research projects, publishing a newsletter, coordinating conferences and seminars and connecting the appropriate Department technical people with the university researchers.

Committees

Committees provide an opportunity for technology transfer to occur because members usually represent different organizations, work units, disciplines and levels of authority. The committee methods of management, decision making, problem solving and operation provide different perspectives. Innovations are introduced by committee members and the dynamics of the committee usually provide a vehicle for obtaining political support for their application.

There are both informal and formal committees in WSDOT and they are formed for a variety of purposes. Executive managers participate in committees to examine issues, assign responsibilities and mobilize resources. Examples of WSDOT executive committees include the Training Oversight Committee, the Research Executive Committee and the Operations Review Committee. Ad hoc executive committees comprising

executive and mid-management are formed to address specific topics, such as strategic planning and Expo 86.

The Highway Division forms interdisciplinary committees comprising employees from design, construction, maintenance, etc., to review project plans and evaluate completed projects.

WSDOT participates in interagency committees which are composed of other state agency employees. An example of an interagency committee that WSDOT participates in is the Traffic Safety Commision and the State Budget Committee .

The AASHTO organization has formed several national committees that include WSDOT managers. These committees keep WSDOT apprised of innovative developments in the transportation field. AASHTO committees include traffic engineering, bridge structures, marine transportation, and transportation administration. These national committees provide WSDOT managers an opportunity to address common problems in specialized transportation fields and to make important contacts for future operations.

WSDOT participates in committees with local jurisdictions and organizations. All of the Districts belong to some local jurisdiction committee, representing transportation issues. The Marine Division coordinates with local jurisdiction committees around the Puget Sound to involve local officials with the ferry system operations. District traffic engineers participate in local committees for safety and efficiency in operations.

Specific work units use Committees in their programs to recommend policies and program activities. Matrix committees are used by the Staff Development office to establish training criteria for certain job classifications; the Materials Lab uses a Product Evaluation Committee to evaluate new highway materials and products; and the Northwest Technology Transfer Center uses a Technology Transfer Advisory Committee to provide program guidance and direction.

Procedures

Procedures are used in the practice of technology transfer when WSDOT officially adopts an innovation that has departmentwide impact. When innovations become a procedure, a change or addition to the published WSDOT manual is required. Formal procedures are published for many of the Department's functions including highway maintenance, construction, design, administration and traffic engineering. The manuals describe the accepted standards, specifications, practices or methods of the Department. The manual holder may include WSDOT employees, local agencies and private contractors.

Formal procedures can impede technology transfer because they discourage employees from trying something different or deviating from established practice. Legal liabilities and tort claims present conditions which make a change in a proven method or standard riskier for the WSDOT. For these reasons, changes to formal procedures are carefully reviewed and tried before being adopted by the Department. Furthermore, a lot of time can pass between acceptance of a new procedure and the publication and distribution of the new procedure to manual holders.

New and revised procedures are produced by WSDOT employees, WSDOT contractors, other transportation agencies, the Legislature and federal agencies. The functional areas of highways (i.e., Location Design, Construction) coordinate the changes in manuals with the Engineering Publications office. WSDOT administrative procedures, those that have department-wide impact, are produced by the Methods and Procedures Office. Interim procedures may be distributed to manual holders because of the development and processing time to incorporate changes in the manuals.

Meetings

Technology transfer is practiced at meetings where peers discuss mutual issues and topics, share information, and communicate with employees who share similar job

responsibilities. Annual meetings are held by professional groups in WSDOT such as the traffic engineers, location engineers, construction engineers, project engineers and maintenance supervisors. Quarterly meetings are held by WSDOT professionals including the safety officers, personnel officers and the marine engineers. Staff meetings are held in most work units on varying schedules.

The safety meetings are about the only opportunity for field employees to meet in one location. Safety topics are presented by District safety officers and the employees provide feedback on various equipment and operations. These meetings also provide an opportunity for field employees to discuss work matters with their peers and supervisor.

In District 3, an Innovative Idea Program was initiated by the district administrator to give field employees an opportunity to present innovative suggestions and ideas to their supervisors during safety and staff meetings. The supervisors tell the District Administrator about the employees' ideas during staff meetings. If the ideas have merit, the district administrator approves their implementation. If the ideas cannot be tried, then the supervisor reports the reason to the employee. The District Administrator is attempting to establish two-way communications between himself and the field employees by responding to their ideas, either positively or negatively. Since the program was initiated last year, several employees have provided innovative suggestions for the District's operations.

Meetings, particularly the annual meetings, which are well attended by most professionals in WSDOT, provide many technology transfer opportunities. Workshops, demonstrations, presentations and displays are sometimes provided at these annual events. They can almost be considered "mini" conferences. The annual meetings provide an opportunity for peers to informally discuss projects and work topics and allow employees to establish and maintain networks within the Department.

Associations

Professional associations support technology transfer by providing materials, meetings, publications, newsletters and networks for employees. Associations also conduct research that produces innovations and report on the latest developments in their professional field. Examples of associations that WSDOT employees belong to are the American Society of Civil Engineers and the Portland Concrete Association.

WSDOT does not sponsor employee memberships to associations. Instead, employees use their own time and money to further the professional development that is important to their careers. WSDOT does pay dues for the Department to participate in associations, such as AASHTO. Employees are then selected to participate in events to represent the Department.

Many WSDOT employees are also members of non job related groups such as the Lion's Club or other civic associations. There is very little recognition for the accomplishments of WSDOT employees in civic associations.

OTHER TECHNOLOGY TRANSFER PRACTICES

There are several other technology transfer practices that are conducted in WSDOT not mentioned under the previous topics.

Electronic Mail

The Department's communication systems include a computer "mail service" and a telecommunications system. Since communication is so closely tied to technology transfer, using these systems for reaching more employees with more information about innovations should be developed. For example, the Northwest Technology Transfer Center uses a "bulletin board" which provides access by local transportation officials to various types of transportation information from the computer.

Brochures

There are also many brochures and other publications that are not reports but provide information on new products or practices of the Department. The U.S. Department of Transportation provides a Technology Sharing program that distributes 3-by-5 cards. Private industry vendors distribute brochures to many offices. These documents are written with a user in mind and provide an example of the clear, concise communication helpful for technology transfer.

NWT^2 Center

WSDOT has administered a regional Rural T^2 Center, called the Northwest Technology Transfer Center, since late 1983. The primary focus of the Center is to provide technology transfer to rural transportation officials. A successful technology transfer method used by the Center is the Van Program. Technology transfer agents travel to local locations and provide on-site training and technical advise. The van is equipped with video-tapes and other training materials. During the fall 1985, Van Program, 427 persons attended sessions. Although the Van Program is popular in local jurisdictions, only 3 percent of WSDOT field employees attended any of the Van Program's presentation during the three month "Fall" period. Low WSDOT attendance is attributed to the fact that the Van Program is funded for the purpose of providing technology transfer to local transportation officials. This program is an example of technology transfer that is provided by WSDOT to benefit other audiences.

CHAPTER 4
CONCLUSION

Technology transfer is and should be a decentralized process in WSDOT because innovation adoption is more likely if the mechanisms used to introduce innovations are generated and conducted from the users' work areas. Each WSDOT division and district conducts some type of technology transfer practice and employees participate in technology transfer provided by external sources.

The various technology transfer practices identified in this study should continue in each of the functional areas of the department. However, there must be a concerted effort to reduce department-wide barriers to innovation adoption in WSDOT.

Kanter suggests three elements that must be integrated into an organization in order for employees to be innovative and for innovation to be adopted. These "basic commodities" are

- information (data, technical knowledge, political intelligence, expertise),
- resources (funds, materials, space, time), and
- support (endorsement, backing, approval, legitimacy)."[13]

In some areas of the WSDOT organization, staff and time are only available through a predetermined budget, information only flows through the identified chain of command, and legitimacy is available only through the formal authority vested in specific areas, with no support available for considering innovations in work methods.

Kanter would call this a segmented organization because each piece is separated from the other in terms of information, resources, and support. Technology transfer requires a more integrative management style because typically, the creation or adoption

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13 Rosabeth Moss Kanter, *The Change Masters: Innovation & Entrepreneurship in the American Corporation.* Simon & Schuster, Inc., New York, 1984.

of innovation requires a search for information, resources and support from a variety of functions and work units in the department.

Coordinating technology transfer requires connecting people from different organizational boundaries as well as sharing information, resources and support from a variety of groups. Support is obtained for the adoption of innovation through peer groups and management. Strategies for innovation adoption can be more effective if existing resources can be shared and borrowed. Kanter describes three organizational operatives that are necessary to create an integrative management environment. These operatives should be part of a coordinated technology transfer program:

- open communication system so that employees can locate information that can be used to shape and sell a project,
- network forming arrangements that can help employees with innovative ideas build a coalition of supporters, and
- sharing and borrowing of resources to get technology transfer mobilized into action.

Developing a coordinated technology transfer program requires integrative management to have these operatives. Coordinating does not mean control or centralization of these activities; rather, coordination will provide information, resources and support for technology transfer in the Department.

These three elements -- resources, information and support for innovation -- are important to WSDOT's ability to utilize state-of-the-art technology and innovations in its work methods and operations. Resources exist within the Department that can be more effectively utilized if managers have the ability to share them to the benefit of the whole Department and not just the specific work unit. Information from sources outside the immediate work unit will provide workers with broader perspectives of the

transportation field, and support from peers and management will help facilitate the adoption of innovation in WSDOT.

WSDOT expends resources in technology transfer to benefit external organizations, communities and the public. WSDOT employees also participate in technology transfer practices that are conducted by WSDOT transfer agents, federal agencies, associations and private industry. However, more attention is needed to provide technology transfer activities by WSDOT for the WSDOT work force.

The inventory of existing technology transfer practices indicates that there are many opportunities for WSDOT employees to learn about innovative ideas, methods and technologies. However, the conclusion cannot be drawn that the knowledge employees are obtaining from participating in these technology transfer practices is actually applied to their work methods and activities. Certainly there is some impact, considering the improvements and innovations that have been made in the transportation field in recent years. However, there is no certainty that the WSDOT organization is capturing the most knowledge possible from its employees or using the latest innovation as a result of specific technology transfer practices. Examples of innovation adoption exist in the Department, but there is no clear explanation of how the innovation was discovered, how it was adopted, and whether its integration into work methods has had positive or negative effects. It cannot also be concluded that the majority of the work force is receiving information about new technology or that innovations they are creating are being shared with other work units.

One purpose of this study was to determine if any coordination of technology transfer is necessary to enhance the process of integrating innovation into the Department. Daniel Webster defines "coordinate" as "harmonize in a common effort." The conclusion of this study, based on information from literature and WSDOT employees is that a coordinated technology transfer program can be one strategy for

enhancing WSDOT's ability to adapt and adopt innovation. Figure 4 illustrates a "coordinated" technology transfer program wherein resources, information and support are shared by different work groups in WSDOT.

The advantages of coordinating WSDOT's technology transfer practices include the following:

1. WSDOT's resources would be more effectively used in technology transfer practices;
2. opportunities for technology transfer to occur in the Department's existing programs and activities would increase;
3. more employees would be involved in the existing technology transfer practices;
4. technology transfer practices would be evaluated to improve practices and to provide management with information on their impacts; and
5. new technology transfer practices would be developed in areas where a need was identified by changing conditions or work groups.

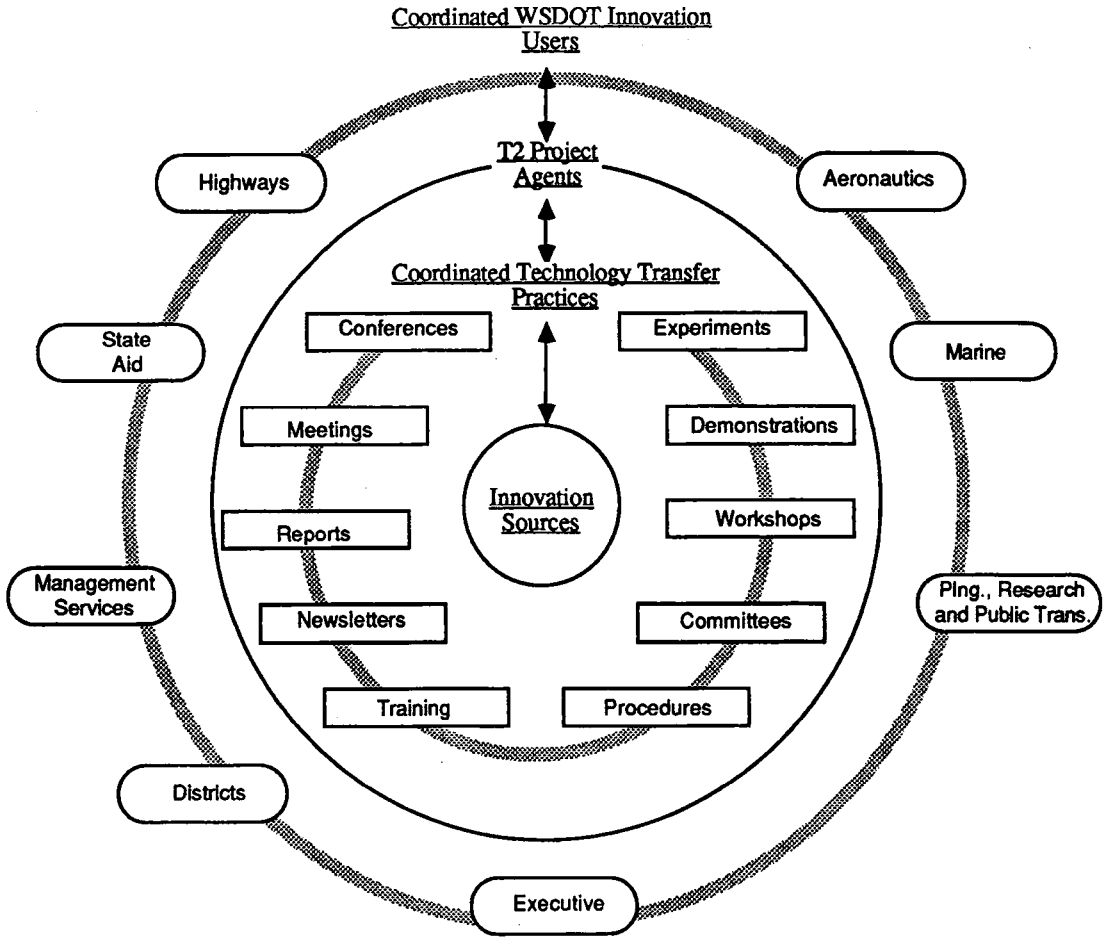

Figure 4. Proposed Coordinated T2 Program that Parallels Current WSDOT Program.

CHAPTER 5
RECOMMENDATIONS

The recommendations of this study are based on information obtained from review comments obtained from Department managers.

1. **Conduct a pilot project to coordinate WSDOT technology transfer activities for implementing research results.** A pilot technology transfer project that directs its efforts on implementing research results will establish relationships with all functional areas of the department. These relationships will establish procedures for future technology transfer efforts. A pilot project will provide WSDOT management evaluative information with which to consider a permanent program.

2. **Establish and maintain contacts with individuals in each functional area of the Department.** Coordinating technology transfer requires integrative management. The key to this integrative management is the open communication systems that are allowed between functional areas. Identifying persons to facilitate the technology transfer process in functional areas will allow networks and relationships to be established for the purposes of adopting innovation.

3. **Involve members of the Research Implementation Committee with technology transfer activities.** As an executive body, the Research Implementation Committee can provide support, information and resources necessary for innovation adoption. The Committee should be kept apprised of ongoing activities, as well as lend assistance when required to provide technology transfer practices.

4. **Increase WSDOT employees' involvement and participation with technology transfer practices.** Develop and implement technology transfer activities

for WSDOT employees to learn about new innovations, technologies and work methods. This can be accomplished by enhancing existing activities with information, presentations, demonstrations, etc., to introduce innovations to department employees.

5. **Develop performance measurements to evaluate technology transfer practices conducted by the pilot project to determine if research results are utilized in WSDOT operations.** Evaluations completed by technology transfer participants will provide information on the impact of a technology transfer practice as it relates to the utilization of research results. This evaluative information will provide WSDOT management with information to determine the merits of a technology transfer program.

6. **Evaluate the technology transfer pilot project to determine if project activities contribute to the adoption of innovation in WSDOT.** The project's technology transfer efforts can be compared to the current level of effort. This evaluation should be provided by the project manager, the Research Implementation Committee, and other persons involved with the delivery of technology transfer practices in WSDOT.

CHAPTER 6
IMPLEMENTATION PLANS

The following actions are required to implement the recommendations of this study. An implementation plan is provided for each recommendation, including a description of the action, its benefits, institutional issues, funding requirements and procedures.

RECOMMENDATION 1

Conduct a pilot project to coordinate WSDOT technology transfer activities for implementing research results.

Benefits of Action

The pilot project will increase and improve current methods of technology transfer in WSDOT by focusing efforts on implementing research results into Department operations. The accomplishments of the project can be evaluated to determine if a permanent program will benefit the Department.

Institutional Issues

Since the process of technology transfer requires a close relationship between the sources of rapidly developing technology and innovation and potential users in the transportation field, the pilot project will be conducted by staff at the Washington State Transportation Center and physically located in the WSDOT Headquarters Research Office. This will allow the project to develop working relationships with both the research community and potential WSDOT research users. Conducting the project from WSDOT will also provide a "seeding" period during which the project can establish an identity in the Department and will allow the resources of an established program to be more accurately determined. Due to personnel limitations, a formal technology transfer position will not be available until July 1987.

Funding Requirements

$60,000 will be required to provide project salaries, travel, and materials for one year.

Implementation Procedures

1. The pilot project will be referred to as Technology Transfer: WSDOT.
2. A TRAC staff person has been assigned to be the Research Implementation Manager, responsible for the pilot project.
3. The project will be funded for one to two years.
4. The Research Implementation Committee will monitor the quarterly progress reports of the project and evaluate the success of the project based on the established criteria.

RECOMMENDATION 2

Establish and maintain contacts with individuals in each functional area of the Department.

Benefits of Action

Representatives from WSDOT functional areas are required to identify appropriate technology transfer methods and to facilitate the implementation of research results. These contacts will lend their technical expertise to proposed technology transfer activities and support for conducting implementation activities.

Institutional Issues

WSDOT personnel are currently assigned to conduct technology transfer activities within their functional areas. In some areas, no identified person has the responsibility for technology transfer. Establishing new technology transfer contacts and coordinating with existing ones to provide activities will facilitate implementing research results.

Funding Requirements

None

Procedures

1. The Research Implementation Manager will maintain liaison with existing WSDOT staff with technology transfer capabilities.
2. In functional areas where no identified persons exist, the Research Implementation Manager will establish a contact.
3. Technical contacts and other WSDOT personnel will review proposed technology transfer activities and assist in developing work plans. These personnel may also be involved with conducting the technology transfer activity.
4. Technology transfer contacts will evaluate technology transfer within their own functional areas.

RECOMMENDATION 3

Involve members of the Research Implementation Committee with technology transfer activities.

Benefits of Action

As an executive body, members of the Research Implementation Committee can provide information support and resources for conducting technology transfer.

Funding Requirements

None

Procedures

1. When draft final reports are received from researchers, the Research Implementation Manager will review the research findings and contact the appropriate Committee member to discuss an implementation or technology transfer activity. An implementation plan will be developed and approved by the appropriate authority.

2. The Research Implementation Committee will receive quarterly progress reports of all implementation activities conducted by the project. Presentations, reports and other materials will be provided. The Committee will evaluate these technology transfer activities.

RECOMMENDATION 4

Increase WSDOT employees' involvement and participation in technology transfer practices.

Benefits of Action

The more involved and exposed WSDOT employees are to new technology and innovation the more likely these innovations will be adapted to the work place. Capturing employee audiences at regularly scheduled events, such as conferences, will enhance technology transfer in the department.

Institutional Issues

Many opportunities exist to introduce the results of research to Department employees. Staff meetings, safety meetings, publications, etc., offer opportunities to present new information. The technology transfer contact in each functional area is expected to provide information on events, so that a technology transfer activity can be incorporated into the agenda.

Funding Requirements

As identified by each activity. Some project funds may be used to provide materials, demonstrations, etc., to WSDOT employees.

Procedures

1. The Research Implementation Manager will work with technology transfer contacts to identify opportunities for introducing innovation.
2. Various methods of technology transfer will be analyzed to determine the method most appropriate for the audience.

3. Employees will be asked to evaluate the technology transfer activity.

RECOMMENDATION 5

Develop performance measurements to evaluate technology transfer practices conducted by the pilot project to determine if research results are utilized in WSDOT operations.

Benefits of Action

Evaluating technology transfer practices can improve methodologies and also provide information on the benefits of a permanent program.

Institutional Issues

The evaluation methods for each technology transfer activity must be determined prior to their conduct. The Research Implementation Manager will work with the appropriate technology transfer contact to develop performance measurements and to monitor the progress of the implementation activity.

Funding Requirements

None

Procedures

1. As technology transfer activities are identified for research results, the method of evaluation will be determined. Such methods may include quantitative and qualitative data.
2. On a quarterly basis, the Research Implementation Committee will review a synopsis of the evaluations.
3. Monitoring methods will be established that will assess the actual implementation of the research result.

RECOMMENDATION 6

Evaluate the technology transfer pilot project to determine if project activities contribute to the adoption of innovation in WSDOT.

Benefits of Action

Evaluating the pilot project will provide management information with which to determine the Department's technology transfer needs. A comparison of the existing technology transfer practices can be measured against the progress of the project, to determine if sufficient evidence exists to warrant a permanent WSDOT program.

Institutional Issues

Prior to committing regular WSDOT program funds to a technology transfer program, the pilot project will be evaluated to determine what resources are required. Evaluation from various perspectives will also improve the methods used to implement research results. The pilot project is expected to establish mechanisms and procedures for conducting technology transfer for implementing various kinds of innovations into Department operations.

Funding Requirements

None

Procedures

1. The Research Implementation Manager will prepare a final report of the project's progress and accomplishments. Recommendations for providing a permanent program will also be made.
2. The Research Implementation Committee and the Research Executive Committee will review the recommendations and determine the future of the project/program.

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APPENDIX A

WSDOT Offices that Participated in Technology Transfer Interviews

Administration
Aeronautics
Bridges and Structures Branch
Construction
District 1
District 2
District 3
District 4
District 5
District 6
Highway Maintenance and Operations
Highway Support Services
Highways - Traffic
Library
Location and Design
Management and Operations
Management Information Systems
Marine Division
Materials Laboratory
Northwest Technology Transfer Center
Public Affairs
Public Transportation Office
Research Office
Staff Development
State Aid

Administration

- The telephone system, an electronic mailgram system, and a teleconference unit are managed by the Administration section.
- Administrative staff provide training in new administrative methods and procedures such as purchasing, inventory, and release of public records. The media used for training include videotapes, slide presentations and other audio-visuals to inform employees of various administrative procedures.
- Directives are published and distributed to inform employees of management policies or procedures on specific activities. These directives are revised as necessary and distributed throughout the Department.
- Other publications are produced by the Administration section for Department employees and managers. Examples are the telephone directory, emergency procedures, organization charts/handbooks, personnel rosters, etc.
- Each manager within the Administrative Office develops measurable objectives for annual accomplishments.
- Conferences are coordinated for various groups. These include supply officers and records management personnel. Administrative staff also participate in conferences sponsored by other organizations such as the American Management Association, the Pacific Northwest Public Purchasing Association, etc.
- An annual on-site visit is made to the administrative office of each District.
- Every three months an "Ask the Boss" staff meeting is held to allow all Administrative Services employees to ask questions and provide feedback to managers.
- Administrative staff participate in interagency boards and task forces (i.e., Governor's Supply Management Advisory Board).
- Computer applications are researched and developed to improve the efficiency and cost effectiveness of administrative operations. Recently, microcomputers have been utilized for designing forms and for producing various accounting reports (i.e., expenditures to budget by object code at the six digit organization code level).
- A Correspondence Manual provides procedures and formats relating to written communication in the agency.
- A Purchasing and Inventory manual provides guidance and procedures relating to equipment and property management.
- Central Records Control is maintained for the Headquarters office. Districts maintain permanent records of respective documents.
- An Organizational Handbook is published that describes the functions of the WSDOT organization and the relationship of each division and program to one another. This is revised annually. Administration also produces organizational charts for various offices.

Aeronautics Division

- Publications are developed and distributed to the aeronautics community. These include a Frequency Guide, a Quarterly Newsletter and a Pilot Guide, as well as other publications.
- Training is provided for flight instructors.
- A trade fair is held annually. These fairs provide booths, demonstrations, flight instructor clinics, and aviation mechanics clinics. The most recent fair was attended by about 3,500 members of the aviation community.
- Aid and technical assistance is provided to publicly owned airports. This support includes property acquisition, navigation easements, construction, and improvements. Assistance to air carrier airports is primarily in the form of technical advice.
- The Aeronautics Division contributes to research sponsored by other aviation organizations.
- The Aeronautics Division develops a statewide aviation plan which is coordinated with all local publically owned airports.
- The Division participates in the Aviation Association of Airport Executives, which provides technology transfer.
- The Division participates in roundtable discussions with other state aviation officials to solve problems and share information.
- The Division participates in national associations of private industry vendors who produce new aviation products.
- The Division provides testing and other support for new technology.
- International contacts are maintained on an informal basis.
- The Division develops standards and guidelines for airport development.
- The Division participates in the National Association of State Aviation Officials. This organization also distributes a trade magazine.
- Briefings are being scheduled with all the WSDOT District offices to share information , provide specific standards for airport facilities and to describe unique maintenance requirements.
- The Assistant Secretary for Aeronautics participates in WSDOT Executive Committees, which address Department and transportation problems and issues.
- Aeronautics has participated in Demonstration Projects sponsored by the FAA.
- Consultants are used to perform tasks and planning for aeronautics.

- Division employees attend and support state and national search and rescue conferences. During the course of search and rescue missions new technology is used and created. Aeronautics also contributes other search and rescue newsletters, training sessions and publications.
- Division employees attend Washington Airport Management Association meetings where presentations and demonstrations of new products and innovations are made.
- The Division participates in the AASHTO Committee on Aeronautics.
- The Division receives publications from other state aviation agencies and organizations.
- The Division provides aviation information to schools, community organizations and the general public.

Bridge and Structures Branch

- The Bridge Engineer participates in national committees that initiate and review bridge research and bridge designs. These committees are sponsored by AASHTO, FHWA, state DOTs and other transportation organizations. The WSDOT representation on these committees is a valuable opportunity for exchanging information, making contacts and building paths toward bridge projects. These committees are also a sources of knowledge regarding new methods, techniques and practices in the bridge field.

- Within the Bridge and Structures Branch are professional engineers with expertise in various phases of design, construction and operations. These professionals have the responsibility to keep themselves informed about recent innovations. They attend seminars, conferences and professional association meetings; receive technical reports produced by the TRB, FHWA and other organizations that conduct bridge research and experiments; obtain information from vendors; and maintain direct contact with other state DOTs. The WSDOT Library's *Recent Acquisitions* publication is also used by the bridge engineering staff to obtain current published materials.

- Design manuals are the formal process for updating bridge design criteria. The Structural Bridge Design Manual is revised and maintained by the Bridge Branch. The AASHTO Committee Standard Specifications for Bridges manual is also used by the Bridge Branch.

- The Northwest Bridge Engineers Conference is a biennial event that provides an opportunity for bridge engineers to meet peers and discuss projects and problems. The conference is held in a different location every other year. The agenda is set by a tri-state DOT committee (California recently joined, making this a four-state joint venture). Product vendors, consultants, researchers and bridge engineers are invited to give demonstrations and presentations. The value of this seminar is the opportunity it provides for the exchange of information and networking with other bridge engineers.

- The Materials Lab is used to conduct tests on new bridge products and materials.

- The Bridge and Structures Branch is a centralized operation. Headquarters Bridge Engineers work directly with District engineers on bridge matters. Maintenance of bridges is managed within the Districts.

- Inventory and bridge condition surveys are conducted by the Bridge and Structures Branch. Data that is collected on the condition of bridges is used to analyze and evaluate bridge construction, rehabilitation, repair, and maintenance practices. This information is available to vendors, other state DOTs, and the research community.

- Technical training for staff is provided as needs are identified. Consultants are used to conduct some technical training to supplement "in house" staff development training.

- The Bridge Technology Development Unit was established in part for the purpose of providing the Branch with various technology transfer services. These services include coordinating the development of work plans to conduct FHWA sponsored Experimental Projects, Experimental Features and Demonstration Projects. This section also publishes reports; makes on-site inspections of experimental bridge work; disseminates various technical publications; and responds to inquiries from other state DOTs, vendors and consultants. Personnel from the

Branch also coordinate technical training needs and participate in seminars for local government agencies. Engineers participate in Value Engineering Teams that analyze bridge designs. This unit also manages the "Major Bridge Inspection Program," which is primarily performed under consultant services agreements.

- Private industry vendors provide introductions to innovations in the market. Advertising claims are carefully evaluated when considering the soundness and quality of any new product. Viable new innovations are generally supported by management, after an analysis of budget, time and implementation feasibility. This analysis is conducted prior to any purchases or new applications.

Construction

- The Construction Manual provides field people with standard procedures. When construction practices are changed, the manual is revised.
- When contracts are executed with construction contractors, specific standards and designs are incorporated into the contract. These instructions can be new procedures or different from the standard specifications.
- Construction contractors can suggest or recommend changes per their field experience or knowledge.
- Construction staff work closely with the Association of General Contractors. They attend association meetings and serve on subcommittees for specific tasks.
- Construction personnel attend the annual AASHTO subcommittee meeting on construction.
- Construction personnel participate in the Western State Transportation Organization comprising 17 transportation agencies in the western states. This organization presents and provides new technology and innovations at its meetings.
- Construction personnel participate in annual National Electric Contractors, Drillers Association, Asphalt Institute, Asphalt Pavement Association and Portland Concrete Association meetings.
- Construction personnel conduct or attend meetings with other state transportation agencies as necessary.
- Construction personnel conduct mini-construction conferences in the state. These are attended by Chief Inspectors and Office Engineers. Conference proceedings are published and distributed.
- Construction personnel attend a two-day , statewide Project Engineers meeting every year.
- Construction personnel participate in a Documentation Engineers meeting with field people.
- Each District has a full-time construction trainer. These personnel have just completed "train-the-trainer" courses. They are developing training materials and conducting courses for construction employees. The District trainers meet together for planning and information exchange. The trainers work across District lines and provide training before, during and after construction projects.
- Construction inspections are conducted to identify and correct problems as they become apparent.
- Construction trade magazines, newsletters and other publications are distributed among staff.
- Research is primarily focused on materials use.
- Construction personnel review some final research reports, but not too many.
- Construction personnel are part of an informal network with other state construction personnel and frequently are in contact to share information and discuss problems.

District 1

- District 1 conducts and contributes to major transportation research efforts. Examples of recent research projects include HOV lanes, Park and Ride lots, surveillance cameras, and electronic and changeable signs. Results of research are published in reports that provide a source of innovation to others in the transportation field.

- Headquarters provides many publications of research results from other states and nationally sponsored research. These publications are distributed to the appropriate personnel in the District.

- District 1 participates in a number of statewide meetings that are held every year. These meetings allow staff members to exchange ideas, learn of new methods and procedures and learn about new technology and innovations from peers. The District Traffic Engineer, Location Engineer, Project Engineer, Construction Engineer and Maintenance Engineer each attend an annual meetings with the other Districts.

- A team building approach to transportation problem-solving is used by District 1 for tackling many areas of concern. This approach has contributed to greater communication between disciplines and provided innovative solutions to problems.

- District 1 participates in training activities that are sponsored by the Headquarters' Staff Development Office. Technical training is limited in the traffic engineering field.

- Manufacturers and vendors of new products conduct seminars, workshops and demonstrations to introduce new products.

- The Transportation Library distributes technical publications and other materials to various personnel in the District. The Library's Recent Acquisition's publication is also used as a source of new innovation and technology in the District.

- The identification of a problem can provide a need which requires the use of some innovation or new technology in the District.

- District 1 uses all the manuals that are updated by the various offices in Headquarters. These manuals include subjects such as design, construction, maintenance, and bridges. These manuals produce formal changes to specifications and standards in the District's operations.

- District staff are encouraged to use the TRIS system.

- The District Research Coordinator solicits district personnel for research ideas. These ideas are screened to see if research has already been done. If not, proposals are written and funding sources sought.

- District personnel participate in all levels of the WSDOT research program.

- The District Administrator recently completed a term on an NCHRP panel.

District 2

- District 2 receives FHWA, TRB and other transportation reports, which are circulated to managers and staff in the District.
- District 2 uses the Department Library for requesting materials on specific subjects and distributes the Recent Library Acquisition newsletter.
- District 2 uses the FHWA Special Product Evaluation list to identify new or recent transportation products.
- An Accident Review Board reviews accidents and safety issues for inclusion in the safety program.
- The District participates in FHWA Demonstration projects.
- The District accesses the Electronic Bulletin Board for information.
- District 2 participates in conferences and seminars held by the state's universities and professional associations.
- Some professional staff belong to associations that conduct meetings and publish reports and other materials.
- District 2 reviews plans and tests products with local transportation agencies.
- District 2 is a member of the Utility Planning Commission, which meets regularly.
- The District provides the public, contractors and other interested parties with maps and other transportation information.
- The District Administrator attends some national meetings, such as AASHTO.
- District personnel participate in state meetings, including the Roads and Streets Conference, Maintenance Superintendents' meetings, Safety Officers' meetings, Traffic Engineers' meetings, Location Engineers' meetings and Construction Engineers' meetings.
- District personnel participate in the annual Road Builders Clinic, held at WSU and attended by Oregon, Washington and Idaho transportation officials.
- District personnel attend the Washington State Weed Conference.
- District personnel participate in meetings, demonstrations and seminars sponsored by private industry.
- District personnel are members of research technical and implementation committees to identify research projects and review research results.
- District 2 develops training programs to meet specific technical needs (surveying).

- Within the District, crew meetings are held regularly. Supervisors, project engineers and safety officers within the District also meet regularly.
- Manufacturers provide training when contracted to provide services or products.
- District personnel participate in ongoing research projects.
- District 2 provides technical advice and service to local transportation and government agencies.
- District 2 provides input on standards and designs that are published in formal procedure manuals for the Department.
- District 2 uses other Districts and Divisions in the Department as resources for problem solving and sharing information.
- District personnel participate in Operational Reviews to identify what worked and what did not work on completed projects.
- The District publishes project reports upon completion of projects.

District 3

- Monthly safety meetings provide an opportunity for technology transfer in the District. Through the course of discussing safety issues, employees express concerns with departmental operations and policies and sometimes make suggestions. A report by the safety officer is filed after the meeting and provides documentation on activities that need follow-up. Most of these items are safety related, since that is the purpose of the safety officer. Other suggestions or ideas should be noted by the supervisor.

- An "Innovative Idea" program was established as a formal program to allow employees ideas and suggestions to "bubble up" to District management. At the monthly staff meetings, supervisors solicit ideas from employees. Every idea or suggestions is transferred to the District I leadquarters office for evaluation. If the idea has merit, then approvel is given to proceed; if not, then a reason why the idea is not feasible is provided to the employee. This activity provides a two-way communication channel at all levels in order to improve operations. Participation has been limited and it was suggested that the program needs more credibility with the employees.

- New ideas, equipment, procedures, etc., can be initiated by a supervisor in the District, if the innovation only requires expenditures or personnel within a manager's authority.

- Quarterly management staff meetings with the District Administrator provide the opportunity for supervisors to directly communicate suggestions for new technology, schedules, equipment, etc. Ideas and suggestions from employees can also be relayed to the District Administrator through this channel.

- Recognition of employees with successful suggestions or ideas has been primarily a "pat on the back" by the supervisor. The District will consider using the Employee Recognition award provided by the Public Affairs office in the future to recognize employee contributions and accomplishments.

- Field employees conduct independent research on new methods, equpiment, processes and procedures. In many cases, this research is done on their own time because of the work load in the field.

- Opportunities for exchanging information and experience with other Districts is limited to managers and supervisors. Field employees have little interaction with peers form other Districts.

- Supervisors and managers attend statewide meetings with peers. These meetings provide opportunities to share information and experiences and introduce new products, procedures or information.

- Research reports and other publications are routed directly to the person in charge of a topic area (i.e., highway construction). There is no centralized place in the District where these reports are circulated from or maintained.

- A Change Order is a method of initiating change in a project or operations. These change orders can be issued after an evaluation of the existing plan is complete. Change Orders are being reviewed with an eye to improving future projects.

- Private contractors and industry equipment businesses provide advertising, demonstrations and information directly to the District.
- Standards and specifications published in manuals by the Headquarters office are used by the District. Updates and revisions to these manuals present formal changes in the District's operations.
- The District has a six year plan that can sometimes restrict the use of innovation. Lead time is critical to implementing new techniques and processes in the District.
- Technical training is needed and is being developed on a statewide basis in most areas to provide employees with additional skills with which to be innovative.
- Ideas tha require Headquarters approval are least likely to be implemented and also require the most time. The District Administrator is committeed to intervening when necessary to push "good" ideas.
- District personnel attend a variety of state conferences that are sponsored by WSDOT, private vendors, trade organizations and FHWA.
- There is a perception by employees that new ideas are not welcome by management staff. Employees who have had unfavorable experiences trying to introduce an innovation set an example for other employees. District management staff is comitted to reversing this perception and to fostering a climate which encourages innovation.
- District management is interested in improving efficiency and efffectiveness to increase the level of production and public service. It is not intended that productivity increases result in decreased personnel and other resources.
- The current Innovative Idea program is intended to get new ideas, methods, etc. to "bubble" up" the chain of command, not around it. District management wants the chain of command to function as a two-way communication pipe-line.
- District managers contribute ideas for research proposals when solicited from the Research Office.
- A District employee serves as a Research Liaison for exchanging research information and providing technical and evaluation input on research projects.

District 4

- Revisions to Department manuals introduce new procedures into the District's operations.
- The Maintenance Engineer, Project Engineers, State Aid Engineer, Location Engineer, Maintenance Superintendent,Construction Engineer, and Safety Officer each attend annual statewide meetings. These meetings provide a forum for exchanging ideas and information and for introducing new procedures or products.
- Magazines that contain new products and innovations are received by the District and distributed to staff. These include *Roads and Streets*, *Public Works*, and other transportation related publications.
- National and state transportation organizations provide technical publications and reports that are distributed to some staff in the District.
- A library is maintained to store most of the publications received by the District.
- The Headquarter's library is used to request information on specific topics.
- A newsletter is being developed for the District which will be distributed to District employees and other Districts. Newsletters published by other organizations are received by the District.
- Private industry sponsors seminars and workshops to introduce new products to the District.
- The District Administrator attends some out-of-state conferences and committees.
- A few employees are members of professional associations that hold meetings and publish newsletters and reports.
- There are some team meetings in the District where supervisors and employees work on problems together.
- The staff holds monthly meetings.
- The District develops and conducts training for employees on new procedures or subjects as necessary.
- Consultants are used by the District to provide expertise when required (i.e., microcomputers).
- District personnel sometimes attend specialized training conducted by local governments, private industry and other Districts.
- Private industry contractors provide training when introducing new products to the District.
- New equipment is evaluated by District personnel.
- The District participates with local government agencies (MPOs) in planning committees that provide an opportunity for the exchange of information.
- The District conducts Value Engineering on some projects and produces follow-up reports that provide information on what worked well and what did not.

District 5

- A centralized District Library is used to maintain reports and publications that are received by the District. These include AASHTO, TRB and other state transportation publications; journals and magazines; and reports published by WSDOT. The District disseminates the Headquarter Library's acquisition list to field personnel.
- District 5 personnel participate in local government planning committees.
- District personnel attend a maintenance conference held at WSU every year.
- District personnel attend the quarterly and annual meetings for Project Engineers, Maintenance Superintendents, Construction Engineers, Safety Officers and Personnel Officers. Minutes from these meetings are distributed to staff.
- The District publishes a quarterly District newsletter, which is distributed within the District and to other DOT offices.
- District personnel attend demonstrations and presentations by private industry vendors. The District also receives brochures, magazines and publications from industry.
- Within the District, supervisors meet regularly with employees to exchange information.
- When contractors supply products or services, a training requirement is included in the contract.
- The District conducts training in safety and construction inspection.
- The District uses the design and construction manuals for specifications and requirements on products. They provide input on proposed changes to standards.
- District personnel participate in meetings with the Good Roads Association.
- The District conducts field reviews of completed projects and publishes reports.
- When design standards are reviewed, a briefing is held with employees to go over changes.
- District personnel participate in projects that are under consideration for the Pay Incentive Program.
- The District participates in the FHWA Experimental Projects and Features program.
- District personnel participate in a variety of citizen advisory committees and panels.
- Individuals attempt to solve technical problems when they are encountered. This often involves time outside of working hours to read, calculate, make models and plan to solve problems.
- The Personnel Officer attends personnel officer quarterly seminars. The Personnel Officer routes personnel meeting minutes to the staff and informs employees of employee-related legislation.
- The District schedules annual safety seminars which are attended by all employees. Much general information is given to employees in these seminars, in addition to safety-related items.

District 6

- District personnel recommend changes and new methods to established procedures. These changes require the approval of the Headquarters office.
- Employees make suggestions to the District to improve work methods. Some of these employee suggestions have received Department awards.
- The District's work schedule is determined by the weather, which can affect the timing of technology transfer. Five months out of the year are devoted to design and maintenance activities (fall and winter) and the other seven months are devoted to construction (spring and summer). Location work continues year 'round for two crews.
- Funding requirements, liability of failure, and paperwork reuqired for approval, and established standardized criteria are all barriers to introducing innovation at the District level.
- Public relations is emphasized by the new District Administrator. The public can be a source of innovative suggestions as well as directly benefit from successful technology transfer in the District.
- District staff work with city and county transportation officials on projects. These contacts can be sources of new information or innovation.
- Engineers work informally with other District engineers. These contacts are usually established at annual meetings or conferences.
- Private contractors suggest new methods or activities which may be better or cheaper ways to accomplish tasks.
- A District Research Liaison is designated to coordinate research activity within the District.
- The District contributes to research ideas when a solicitation is isued by the Research Office.
- Selected employees participate in the evaluation of research results for possible implementation. However, most changes to standards or specifications are made in Headquarters before reaching the Districts.
- In the course of highway planning, design, construction or maintenance activities, problems are identified which result in the search for innovation.
- Representatives from District 6 attend the following statewide meetings:
    - A statewide Microcomputer User Group. These periodic meetings provide for the exchange of information, problem solving and the introduction of new products to microcomputer users in the District.
    - A statewide CADD User Group. Meetings are attended by team or project leaders in the District. These meetings provide an opportunity for employees to establish contacts, share information and witness demonstrations of new CADD applications.

- WSDOT annual meetings. These meetings are held in different locations in the state and provide an opporutnity for engineers and other profesional staff to meet with persons who share similar responsibilities. Annual meetings are held for Project Engineers, Construction Engineers, Maintenance Engineers, Location Design Engineers and personnel.

- Monthly safety meetings are held for all employees within the District. In addition to safety training, these meetings provide opportunities for exchanging information, receiving feedback from employees, introducing new procedures, and administrative matters.

- Biannual Distrtict Safety meetings are held by the District Administrator.

- It is a rare event for District employees to attend an out-of-state conference due to Departmental policies on out-of-state travel.

- The annual State Transportation Conference was held in Spokane last year and attended by staff.

- Professional associations sponsor conferences and meetings which are attended by some District staff.

- FHWA, universities and other transportation agencies sponsor conferences within the state which are attended by District employees.

- Vendors provide demonstrations, workshops and presentations to employees for introducing new products and materials.

- There is some cross training and job exchange activity which provides employees opportunities to learn about different functions in transportation.

- Most equipment operation and technical training is conducted by District staff. Employees who conduct training activities have usually attended some type of train-the-trainer course.

- The Materials Lab conducts inspector training with technicians on product testing.

- There is a District computer user group that meets informally to discuss applications and issues associated with microcomputers. One of the group's goals is to share information on a state-wide basis.

- A monthly employee newsletter is distributed to all employees within the District. This publication invites contributions and provides information to employees about projects, other employees, changes in policy and other useful information.

- Research reports published by WSDOT and other transportation organizations are distributed to selected staff within the District.

- District staff use the WSDOT library or the state library for requesting research materials.

- Reading is a luxury to most employees and is sometimes not considered a legitimate work task.

- Operation or project reviews can produce reports which are distributed to interested parties.
- A weekly calendar is used to inform managers of meetings and events. This calendar provides information to managers about other offices within the District.
- A District Committee on Excellence reviews all completed construction contracts. Interviews are held with the Project Engineer and recommendations to improve plans and construction methods are discussed. Findings from these reviews are made available to the appropriate District personnel.
- The District Administrator appoints key staff to investigate problem areas and determine improved operating methods. Findings from these studies are shared with Headquarters.

Highway Maintenance and Operations

- A Highway Maintenance newsletter is distributed to maintenance employees.
- Maintenance Information bulletins are distributed to Superintendents.
- Each District has several Highway Maintenance Superintendents. An annual meeting is held statewide which provides an opportunity for the exchange of information and problem sharing.
- A Highway Maintenance Engineers' meeting is held every six to nine months.
- Private industry vendors provide demonstrations on new products to Headquarters and District personnel.
- Maintenance personnel participate in Research Technical Committees to identify research needs and review research results.
- The State Maintenance Engineer participates in national committees and conferences that include demonstrations, presentations and contacts from other states.
- Two Maintenance Methods Specialists act as liaisons with District maintenance crews to provide work quality assurance, to review and enhance methods, to monitor standards and to transfer new technology and innovation from and to highway work crews. The specialists do the following:
    - introduce the practices of private contracts and the construction industry;
    - introduce new products or methods used by other Districts, cities or counties;
    - demonstrate new equipment and report on its cost effectiveness and other reasons why the subject should be utilized;
    - demonstrate new products developed by DOT that can replace products purchased on the market;
    - expose crews to the innovations of other states as described by DOT library publications and other technical resources;
    - provide contact with superintendents from Oregon and Idaho through the annual Tri-State Maintenance Meeting;
    - share the related experiences and operations of other state agencies;
    - assist supervisors in problem identification and look for solutions utilizing the experiences or resources of other road crews; and
    - review existing problems with road crews and provide support for policy and operations changes.
- A training coordinator from Staff Development works with maintenance engineers to conduct training.
- A Highway Maintenance Manual provides specifications, methods and procedures. This manual is revised as new methods are developed and new products are accepted.

Highways Support Services

- The Manager of Highway Support Services participates on national technical committees (AASHTO), university research review teams, and tehcnical committees established by private industry. The Highway Support Office participates in solicitations and projects sponsored by national transportation organizations (TRB, NCHRP, NBS).

- Highway Support Services publishes engineering publications that can be used to introduce new methods, procedures or standards into the operations of the Highway Division. Such documents include a Construction Manual, Design Manual, Standard Plans, and Standard Specifications. A Bridge List is also published. These publications are distributed to WSDOT employees, other state agencies, counties, cities, contractors, consultants, manufacturers, subcontractors and other interested people (i.e., truck drivers).

- There are four engineers who work with various highway managers to develop and revise the material in these manuals. Instruction letters are issued to change procedures in the manuals before they are incorporated into a formal manual change.

- Computerization has revolutionized the design and development of highway construction planning. The computer assisted design and development system (CADD) is a computerized system that provides geographic, drafting, design and analysis services to highway engineers. Programs are developed for this system to meet specific engineering requirements. Department Engineers can access the data bases in CADD to draft, design, revise, review and develop highway construction and improvements.

- Training is conducted by the CADD staff in conjunction with the Staff Development Office.

- The significance of the CADD system in relationship to the technology transfer process is the means it provides to incorporate new design, standards and specifications into the construction and improvements of highways.

- Photogrammetry in WSDOT is a high technology method of aerial mapping that provides base maps for road design and contract plans. Coupled with CADD, photogrammetry has made a significant breakthrough in increased productivity for the DOT. During the Department's recent modernization it has been the recipient of technology transfer in all areas, i.e., automated drafting, digital storage and recovery, aerial photography, photo laboratory field surveying, remote sensing, and map compilation.

Highways - Traffic

- Every District has a Traffic Engineer who coordinates with the Headquarters staff.
- Traffic Engineers participate in the three Research Technical Committees to identify research needs and review research results.
- Traffic staff work with other state agencies, such as the Washington State Patrol and the Washington State Traffic Safety Commission, on various traffic related issues and projects.
- Private vendors provide demonstrations of new products in the traffic field. Evaluations are made of these new products.
- The Materials Lab conducts tests and evaluations on new traffic signal equipment, pavement marking materials and signing materials.
- Research is conducted to find new products and materials for signing and other traffic devices.
- Staff attend meetings and form networks with other members of the Institute of Transportation Engineers, the Urban Traffic Engineers Council, and the Peninsula Traffic Engineer Association.
- Technical advice and services are provided to local governmental agencies. They also assist with finding solutions to local goverment traffic problems.
- The Traffic Office staff conduct training on safety, traffic operation requirements, work zone traffic control, flagging and other traffic related subjects.
- A Traffic Engineering and Safety Seminar has been sponsored by the Univeristy of Washington. A traffic engineers training series is being developed by the Traffic Office.
- Design reports and contract plans are reviewed by the Traffic Engineering Office.
- Chapters of the Design Manual related to traffic engineering topics are revised by the Traffic Engineering Office. Revisions to other chapters are reviewed.
- The State Traffic Engineer is a member of the AASHTO subcommittee on traffic engineering. He also participates on the Signs Technical Committee of the National Committee on Uniform Traffic Control Devices.
- A statewide annual meeting of traffic engineers is conducted to provide an exchange of information and an opportunity for peers to discuss traffic issues.
- Publications are received by the Traffic Office from TRB, AASHTO, FHWA, ITE, and other states and universities.
- The Manual on Uniform Traffic Control Devices (MUTCD) provides guidelines and requirements for traffic operations. This document is revised when revisions are adopted by the FHWA. The revisions are approved by the Secretary of Transportation and then sent to handbook holders.

- A Traffic Manual is being prepared by the Traffic Office to provide guidance on topics not covered in the MUTCD. Topics will include guidelines for installing various directional and warning signs, pavement markings, and other traffic control devices.

- Training is also developed in cooperation with the Staff Development Office.

Library

- The Library publishes a monthly list of new materials available in the Library.
- The Library selects materials for addition to the collection in view of current and future Department needs.
- The Library catalogs library materials, making them readily available for use.
- The Library provides a reference service, including on-line literature searches.
- The Library borrows needed materials not available in the DOT Library.
- The Library supports training by providing relevant information to instructors.
- The Library provides library service to WSDOT personnel engaged in academic pursuits.
- The Library conducts in-service training programs designed to promote knowledgeable use of the Library's resources.
- The Library participates with State Aid and Research to provide an electronic bulletin board service. Current audience: UTEC members.
- The Library's general audience comprises WSDOT personnel, including the Districts and the Materials Laboratory, county engineers, local agency personnel with transportation responsibilities, consultants, and academic personnel working with/for the Department.

Location and Design

- The Location and Design Branch develops new design policies, design standards and standard plans for the Design and Standard Plans manuals. Experimentation with a new procedure or method is sometimes conducted on a limited scale prior to formalizing it in the Design and Standard Plans manuals. If a standard is to be implemented prior to a manual change, then a letter is sent to the District Location Engineer so that any contract changes can be made prior to execution.

- A Special Studies unit analyzes AASHTO standards for modifying the Department's manuals. Implementation policies and procedures are also developed for review and approval.

- The technical staff serve as advisors to ongoing research projects. They provide expertise and analyze research results for possible implementation.

- Frequent communication is maintained with all District Location Engineers. Identified problems can sometimes result in a research effort to provide solutions.

- Twice a year, once in the spring and once in the fall, meetings are held for engineers at various locations around the state. These meetings are attended by the District Location Engineers and provide an opportunity for Headquarters and others to present new findings, exchange information on projects and identify problems in the location design field. The format is open and the topics that are presented are determined by the participants.

- As the designs or standard plans are being developed, it is sometimes decided that early implementation is essential. These changes are then formulated into instruction letters. Instruction letters on design changes are sent to all Design Manual holders.

- The State Aid office distributes Manual changes to local government agencies.

- In some cases, a change in the Design or Standard Plans manuals originates from private industry's experience or suggestion.

- The Product Evaluation Committee sometimes provides information and direction on new products or methods that should be incorporated into the Design or Standard Plans manuals. The District also conducts evaluations of new products.

- The Environmental, Hydraulics, Utilities and Railroads units are speciality areas that provide input on research projects when appropriate. These units also conduct statewide meetings to discuss issues with District personnel as necessary.

- The Division provides comments and recommendations on standards produced by other offices of the Department (i.e., construction).

- Operational Reviews are conducted annually on completed projects. An interdisciplinary team of highway engineers and specialists examine selected projects to identify new techniques, methods or results. The team does more diagnosis than evaluation. The teams look at what worked well on a project, what should have been done, and what the impact of standards, practices and policies were on the project. The results of the team's review are publisehd in a report and distributed throughout the agency. These findings frequently lead to updates and

changes in design policies and standard plans.

- The Location Design Office conducts technical training using its existing staff. Examples of this type of training are bicycle transportation design and certification acceptance training. Courses have also been conducted on Value Engineering.

- Branch personnel attend conferences sponsored by AASHTO, the Transportation Research Board and FHWA.

- There is concern that many new technologies and innovations are discovered in the course of highway projects but that there is little time to prepare formal reports so that others may benefit from the experience. The information is usually documented and distributed in less formal ways.

Management and Operations

- The Management and Operations office conducts organizational studies and reviews which evaluate and improve Departmental operations.

- The Employee Suggestion Program promotes efficiency, effectiveness and economy by recognizing and rewarding employees for ideas that improve the Department's operations. The objectives of this program include stimulating innovative suggestions, motivating employees to share ideas, evaluating employees' suggestions, and providing formal recognition and rewards for employees' ideas.

- The Incentive Pay Program rewards employees of work units for improving productivity levels and reducing operational costs. Cash rewards are authoirzed by the Productivity Board to work units that document accomplishments and associated costs for one year. The cash rewards stimulate innovation.

- Department policy and guidance documents promulgate directions and instructions to the Department. This formal process is used to introduce new procedures, methods or practices into the operation of the Department.

Management Information Systems

The Management Information Systems (MIS) office provides technical support and training to WSDOT Districts and divisions regarding computer applications and operations. The following activities describe MIS efforts to transfer technology and innovation into the operations of the Department:

Microcomputers

- A Microcomputer Center provides consultation and support to WSDOT on the use of microcomputers. Center staff assist MIS area representatives with managers in identifying appropriate software packages for applicable operations within their areas. Standards are developed for the acquisition and application of microcomputers into work practices.

- Another major activity of the Microcomputer Center is education and training for WSDOT management and staff. Last year MIS conducted 170 classes for 964 students. Classes included instruction on microcomputer use and the various software that is available (i.e. Lotus 123). Recently a train-the-trainer course was held in all Districts to provide a source of expertise on microcomputer operations in the Districts. Another prototype training course for maintenance engineers is being developed.

Office Automation

- An annual office automation (OA) plan is developed and published. This plan provides strategies for implementing various OA projects in the Headquarters and District offices. The goal of OA projects is to apply technology and systems where WSDOT employees can increase productivity in delivering programs and services. Many OA projects are accomplished as pilot projects to test concepts before they are adapted on a Department-wide basis.

- Some examples of OA projects include evaluating the means to integrate various document composition and publishing methods; increasing user awareness of test products that exist; and analyzing the feasibility of coupling voice and data services into an integrated network which will enhance Department communications.

Miscellaneous

- MIS maintains a Department-wide electronic mail system for communications. This system allows for the immediate transmittal of information throughout the Department.

- MIS produces written materials on computer technology to instruct and inform WSDOT staff members of changes that have been made to standard packages on the mainframe.

- MIS publishes a semi-annual newsletter which is distributed to all Department offices.

- The Information Center provides training classes on the use of standard software packages on the mainframe computer system.

- MIS represents WSDOT in dealing with the Data Processing Authority (DPA), other agencies and locals in data processing, telecommunications, office automation, and other related areas.

- MIS prepares WSDOT's long range data processing plan (LRP) that sets forth policy, direction, goals, and objectives in the WSDOT. The LRP is also submitted to the DPA as a contribution to the statewide direction and planning effort.

- MIS participates in training sessions and represents WSDOT at conferences held by professional groups and suppliers of various computer products. These sessions with peers and vendors are a major source of new ideas and technology innovation.

- MIS has a section of staff that are WSDOT's area representatives. Each division and each District has an area representative assigned to it. The purpose of the area representatives is to understand their assigned areas and to plan, assist, and advise them in determining the appropriate technology and/or software to improve productivity in their workplace.

- MIS publishes a manual of software that is used by WSDOT and the level of support provided by MIS.

- MIS supports telephone access by cities, counties and consultants using WSDOT mainframe programs.

Marine Division

General

- Consultants are used to identify new methods, technologies and systems for ferry operations when expertise is not available from within the Department.
- The Marine Division coordinates problem solving with other Divisions and Districts 1 and 3 to solve marine transportation problems and identify areas that need attention.
- The majority of Marine Division employees are under contract with seven different labor unions. The unions set work standards and requirements for many positions. Union contracts are a formal method of introducing new procedures and methods into the ferry system's operations.
- The Marine Division receives publications, brochures and information from private sector vendors and other tranpsortation agencies with a marine transportation function.
- There is an informal, active network of professionals in the Marine Division who communicate with each other on a regular basis.
- Transportation agencies from other countries provide a source of new technology and innovation in the Marine Division.
- Contracts with private industry vendors may include training programs to provide training sessions or workshops for introducing new technology to the Marine Division. Train-the-trainer courses are usually held to build expertise in selected employees, who then develop training programs and conduct training for the rest of the employees.
- A Ferry Operations Manual is used as a formal method for adopting new technology or innovation into operations. This manual needs to be updated.
- A monthly employee newsletter distributed within the Marine Division provides employees with information on new activities.
- Implementation of major new technologies (computerized tolls) is accomplished incrementally on a terminal by terminal basis.
- The Marine Division works with various city, county and port organizations to develop projects, exchange information and solve problems.
- A metropolitan planning committee comprises members from PSCOG, METRO, regional transportation agencies, District 1, local traffic agencies and other organizations. This multi-jurisdictional committee has planned and coordinated the introduction of innovations such as Park and Ride lots, regional ferry passes and HOV lanes.
- Informal meetings are held with smaller populated areas around Puget Sound to exchange information and coordinate ferry operations.
- A South Snohomish County coordinating committee that includes the cities of Lynnwood, Mountlake Terrace and Edmonds meets with the Marine Division to discuss transportation issues.

- Each Puget Sound county has a Ferry System Advisory Committee. Local members are appointed by the local government commission. The Marine Division meets with these local advisory committees regularly on an individual basis and regionally. The local committees provide suggestions, problems, and feedback on ferry operations.

- International conferences are sponsored by nations with marine transportation operations. These conferences provide a wealth of information regarding technology and innovation in marine transportation. The geographic location of these conferences sometimes makes it difficult to send a Department representative. The next international conference will be held in British Columbia, which should provide an opportunity for the Marine Division to participate.

- AASHTO has a subcommittee on marine tranpsortation. Historically, the subcommittee has been concerned with barge movement, but they are starting to address ferry operation issues.

- British Columbia is a prime transferer of marine technology internationally. The Marine Division has a close working relationship with the British Columbia marine authorities and coordinates ferry planning, research and operations with them.

- The State of Alaska has ferry operations and exchanges information with Washington.

- An annual Workboat Show in New Orleans is sponsored by private industry vendors and provides an excellent opportunity for Washington to make contacts, learn about innovations from other states and exchange information on operations.

- The executive managment staff in the Marine Division meet weekly to discuss marine operations and issues.

Vessels

- Each marine vessel has a Staff Chief for maintenance. All Staff Chiefs meet periodically to discuss operations and solve shared problems. Technology transfer occurs at these meetings.

- There is very little turnover within the vessel maintenance area and most employees know each other. They informally contact one another to share similar problems and seek solutions.

- The cellular telephone located in each vessel's engineering room provides a way for the Staff Chiefs to talk to each other while their vessels are between ports.

- The Maintenance Engineers have staff meetings to exchange information and coordinate activities.

- The Marine Foremen conduct meetings at Eagle Harbor when the vessels are in for maintenance or repair. The Staff Chief sometimes attends these meetings.

- When vessels are in Eagle Harbor for maintenance, employees have an opportunity to talk to trade people and other engineers.

Dock Area

- The engineering crew, located in Seattle, do design and manage contracts for maintenance, construction and rebuilding. These professionals belong to organizations, attend conferences and have a working relationship with private industry, other transportation disciplines and the shipyards.

- In the Dock Engineering Section, most of the employees have experience working in other DOT offices. They provide experience and knowledge from such disciplines as highway construction, maintenance, etc. These engineers also belong to professional organizations and attend conferences.

Materials Laboratory

- A Materials Manual is the primary source of laboratory and field procedures for the testing of materials. This manual is revised as new methods or information are created that relate to materials used for highway construction and operations.
- The AASHTO and ASTM books of test standards for highway materials provide specifications used nationally.
- The Mateirals Lab conducts original research on materials in conjunction with the universities and Districts.
- The Materials Lab is very active in research and the performance of materials through the use of FHWA's Experimencal Features and Experimental Projects programs.
- Materials Lab staff attend professional meetings and conferences for the exchange of information.
- Technical and professional staff belong to various state and national associations such as AASHTO and SHRP.
- The Materials Lab subscribes to various publications pertaining to materials and highways. Examples are *Road and Bridges, Materials News, Engineering News Report* and other technical publications.
- Each section of the Materials Lab collects information that is stored in a central library.
- Requests for Materials Lab publications from outside the Department are generally handled directly by the Lab.
- The Materials Lab tests and experiments on variations in standards before they are field tested.
- The Materials Lab evaluates new products through a Product Review Committee, which provides standardized review, determines if a product should be tested, and monitors the implementation of new products.
- The Lab exchanges information informally with District labs and other state agencies.
- Materials Lab personnel serve on national NCHRP panels.
- The Lab reviews other state's testing of materials.
- The Lab responds to state and national surveys and receives results of materials information and findings.
- The Materials Lab is the source for materials related information for the entire Department as well as many city, county and other state and federal agencies which operate in the state

Northwest Rural Technology Transfer (T^2) Center

- The T^2 Center maintains a mailing list of rural transportation officials and other persons for Idaho, Alaska and Washington, as well as persons involved in technology transfer nationwide.
- The Center publishes a quarterly technology transfer newsletter which is sent to persons on the mailing list.
- The T^2 Center publishes "operating tips" on specific technical subjects designed for placement on bulletin boards or other display areas.
- The T^2 Center gathers and distributes upon request various technical reports, documents, videotapes, and other materials on technology.
- The Center operates a technology transfer Van program for the rural areas of Idaho and Washington which involves showing videotapes, displaying technical literature, and training rural transportation public works personnel.
- The Center sponsors various technical conferences and seminars.
- The Centers acts as the focal point for the arrangement of RTAP training sessions.
- The Center reviews technical literature from numerous sources and prepares abstracts of reports and articles.
- The Center develops catalogs and other resource materials for conducting training and technology transfer.
- The Center acts as the focal point for technology transfer and the coordination of information dissemination between FHWA and rural local governments in Idaho, and Washington (Alaska was also served prior to spring 1986).
- The Center develops a T^2 Resource directory for use by local government officials.
- The Center's staff works closely with universities and associates that hold various workshops and conferences. These include the Road Builder's Clinic by WSU and UI, the Road Superintendent Schools; APWA, Association of Western Area Cities, ASCE.
- The staff also provides technical assistance and advice on various transportation subjects.
- The staff meets with technical groups to exchange ideas, make presentations and to define mutually common interests.
- Staff members belong to and participate in state and national professional associations, e.g., APWA, ASCE.
- An electronic bulletin board, housed in the WSDOT Library, provides direct access to transportation information.

Public Affairs

- The Public Affairs Office (PAO) is assigned to each Division and District in WSDOT to provide information services and support. These activities include providing information on programs through news releases and other printed materials, managing community activities that require transportation resources (e.g., rest areas), working with the business community for advertising on highways, and working on programs such as cooperative ride sharing promotions.

- Headquarters Public Affairs publishes *Interchange*, the WSDOT employees' newsletter. Most Districts and the Ferry System also publish a newsletter.

- Headquarters PAO provides information for the public, media, elected officials, the Legislature, the Transportation Commission, the Secretary of Transportation and other management staff. These information services include responding to requests for information, providing written transportation materials including maps, preparing speeches, and providing video and audio presentations.

- Headquarters PAO provides logistical support to conferences that are sponsored by other functional areas of the agency.

- PAO provides media and public relations training in conjunction with Staff Development.

- PAO produces videotapes for training and introducing new procedures, processes and techniques for the agency. An example of this activity is the production of a videotape on the Department's strategic objective planning effort.

- The Department's public affairs program is fairly decentralized within the organization. Senior managers are responsible for distributing transportation information to their staffs, the media and the public. Headquarters PAO provides advice and support to these managers.

- The Public Affairs Administrator discussed the exchange, dissemination and transferral of new technology and innovation within the Department. He believes that the line managers should remain primarily responsible, but that the agency needs a focal point from which to coordinate all the activities, considering the variety and broad spectrum of audience the agency serves.

Public Transportation Office

The Public Transportation Office coordinates all public tranpsortation activities of the Department with various local, state and federal organizations. One of its functions is to maintain an awareness of new developments, operations and the latest techniques and technology in the public transportation field. The following are some of the activities that provide a process or procedure for introducing new technology or innovation:

- The Public Transportation Office provides technical expertise in developing individual and integrated transportation systems.
- The Public Transportation Office prepares grant applications for studies of federal, state and local public transportation issues.
- The Office maintains a liaison with other state agencies, freight shippers, local and regional governments, port districts and civic and business groups.
- The Office develops and maintains interagency coordination in public transit matters.
- The Office provides technical assistance to paratransit, transit and ridesharing agencies.
- The Office provides a liaison among agencies for Transportation Systems Management (TSM). TSM is defined as any activity that increases the efficiency of the transportation system at minimal cost. The implementation of these activities represents a comprehensive strategy in traffic management. Examples of activities under TSM are HOV lanes, Park and Ride lots, subscription bus service, carpooling, and van pooling.
- The Office coordinates the annual State Transportation Conference for the exchange of information.
- Under the Urban Mass Transportation Act (UMTA), technical studies are funded and carried out. UMTA also provides training for transportation managers. UMTA funds are used for research, development and demonstration projects.
- The Public Transportation Office provides technical assistance to transit planning agencies (13 Public Transportation Benefit Areas). Workshops are developed and conducted for these agencies.
- The Office assists in publishing a public transit newsletter, ridesharing newsletters and other publications.
- Five out of the six Districts have some representation from public transportation in their offices. Only District 2 has no on-site person.

Research Office

- Ideas and suggestions for research projects are generated by the Research Executive Committee, WSDOT executive Program Managers, WSDOT Districts, the universities and local governments.

- Each research project has a technical coordinator or committee (task force) who represents the WSDOT functional areas in which the research results will be applied.

- Three Research Technical Committees (Highway Operations, Materials and Planning) are used to review and evaluate research proposals, provide guidance to Principal Investigators and review final research results.

- A Research Implementation Committee evaluates completed research projects for possible implementation. This multi-discipline committee recommends that work plans be developed for implementation projects and identifies responsibilities to work units. The Committee can also decide not to implement research results.

- The Research Executive Committee comprises executive Managers who recommend policy, program budgets and project approvals to the Secretary.

- The Transportation Research Council is an advisory body comprising private enterprise executives, members of the Transportation Commission's Research Committee, university research deans, WSDOT Headquarters and District executive staff, and an FHWA representative. The Council meets once a year to advise WSDOT and TRAC on research priorities.

- WSDOT Research Project Managers coordinate research proposals, manage research projects, review results and distribute results. The Project Managers oversee related work by functional area.

- The Washington State Transportation Center (TRAC) is a major research arm of the Washington State Department of Transportation. Most of the Department's research projects are carried out by the University of Washington and Washington State University through TRAC. The TRAC program provides support to research faculty, staff and students. The Department's technical representatives work closely with the university researchers. TRAC publishes a newsletter of research that is distributed to federal, state, local, university and private sector transportation officials.

- Each research project has an implementation plan that is a component of the project.

- Research reports that are received from other transportation organizations are distributed to seelct staff throughout the agency. These staff are asked to review the reports and evaluate them for possible implementation of results.

- Completed research reports are provided to libraries, other states, federal and local agencies, private sector companies, the universities and appropriate WSDOT staff.

- The Research Director, Associate Director, and Project Managers participate in state and national conferences. They give presentations of various aspects of planned, ongoing or completed transportation research. They attend workshops and exchange information with

Staff Development

- The Staff Development office coordinates most of the employee training activities within the Department. Training is one mechanism used to introduce new technology and innovation into the methods of the Department.

- Identification of training needs for Department employees is accomplished by utilizing a matrix system designed for specific job classifications. Various technical and professional managers are members of the committeees which identify training needs based on the current technology or state of the art.

- A course catalog is the means by which employees select training courses. This catalog is accessible by the mainframe computer and is revised annually.

- There are several training items that are planned to enhance technology transfer. These include access to the National Highway Institute (NHI) to keep apprised of new technology, the establishment of a Training Development Committee which will include the Research Director, a video library for circulation of transportation related tapes, and a fellowship program to provide more opportunities and interaction among Department employees and WSU/UW.

other transportation agencies.

- The Research Director, Associate Director and Project Managers serve on national research committees and other committees sponsored by transportation organizations.

State Aid

The State Aid Organization provides field engineers in the six Districts as liaisons for local transportation officials. The WSDOT District State Aid Engineers aid local transportation officials in receiving federal program information and funds. The WSDOT Headquarters State Aid organization provides support for federal programs for local agencies. The following State Aid activities provide innovations, technologies or information to local transportation officials:

- State Aid provides a manual on uniform traffic control devices which is distributed and updated.
- Design standards are developed and published by the State Aid Engineer.
- Federal regulations are interpreted for local agencies and provided in the Design Standard manuals.
- Engineering publications are distributed to local transportation officials.
- Federal and state sponsored workshops are conducted based on local agency needs, needs identified by sponsors of a program, or techical information. Approximately four to five workshops are conducted throughout the state each year.
- An electronic bulletin board provides access and exchange of transportation information to local agencies and other transportation officials.
- Individual applications of microcomputer software programs, sponsored by State Aid, will eventually be accessible through the bulletin board for other agencies' use. There are presently six categories of applications.
- The Urban Arterial Board is also coordinated under the State Aid organization. The Board provides a program of financial assistance to urban area cities and counties to help local governments meet the increasing need for arterial facilities. The Board comprises city/county officials. Six-year program plans are developed which include innovative ideas or the transfer of new technology.