

Managing a Collaborative State Department of Transportation–University Research Program in Washington State

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The administrative functions of a state department of transportation (DOT) research office are outlined and the way a collaborative, university-based research program interacts with these administrative functions is addressed. Also addressed is how a productive relationship has been established in Washington. The major administrative functions are broken down into funding, program development, program management, and implementation and technology transfer. Issues associated with a collaborative research program between a state DOT and university are identified. DOTs are principally interested in practical, implementable results from a tightly managed program and recognition for their agencies. Universities are interested in supporting students, obtaining access to operating transportation facilities, publishing in recognized academic journals, and funding for hard-to-obtain equipment, travel, and other benefits. With proper communication and interaction between technical personnel and university researchers, both entities can benefit substantially from a joint relationship. The university gains funding, students, equipment, and publications. The DOT gains research results, technical assistance, and training. Because there is substantial common interest and benefit from a collaborative, long-term program, increased emphasis in research at the national level will likely produce additional interaction in the future.

Inside a state department of transportation (DOT), a research program sometimes occupies a rather tenuous position. At times, budget cuts and shifting priorities have caused some states to limit or nearly eliminate their research programs, as recently happened in the state of Alaska. Within this environment, a collaborative research program between a state DOT and a university presents additional challenges and, at the same time, many opportunities. Collaborative research programs involving state DOTs and universities require compromises on both sides. However, once a strong relationship has been developed, the state DOT and university can receive value far beyond the research program. The Washington State DOT (WSDOT) has developed a strong, collaborative relationship and has avoided swings in budget support for research programs noticed in some state DOTs.

The state DOT-university research program puts additional burdens on the administrative aspects of the overall research effort. This paper looks at the administrative functions of the WSDOT program and explores how its relationship with two universities fits into the overall management structure of this research program.

UNIVERSITY-DOT COLLABORATIVE EFFORTS

Shuldiner and Collura (1) studied collaborative research between state highway agencies and universities in 1986. Their findings can be summarized as follows:

The most successful programs were characterized by the following features:

- a. joint participation by both the university and the highway agency in the initial development of the collaborative program;
- b. a willing commitment by both parties to make the program work;
- c. a truly collaborative rather than arms length relationship;
- d. lots of time, trust, and patience.

On the face of it, universities and state DOTs are very different organizations, staffed by people with different missions. A survey conducted in 1983 by WSDOT showed that of the 50 states and the District of Columbia, 29 preferred to have their research conducted somewhere other than universities, and 22 preferred to have their research conducted at universities (2). At that time, about 33 percent of the funding that states spent on research as a whole was conducted by universities (3). Although this survey indicated that not every state DOT has seen value in developing a strong relationship with a university, states such as California and Texas have developed long-term, noteworthy collaborative programs. The creation of the University Centers program from the Surface Transportation Act of 1987 has enhanced the contacts and the development of joint projects, if not programs between states and universities.

WSDOT-UNIVERSITY PROGRAM

WSDOT and Washington's two state research universities, Washington State University and the University of Washington, have for years had a research relationship. In 1983, WSDOT management decided to enhance its research program and build much stronger relationships with its state research universities. The Washington State Transportation Center (TRAC) had been formed in 1981 to help foster these relationships, and in 1983 additional emphasis and funding moved the two organizations much closer. At that time, DOT appointed a faculty member from the University of Washington to be its research director on a contract basis. This person was also director of the Transportation Center. This relationship lasted for 4 years, after which the size of both programs justified full-time management. However, this joint

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directorship provided a unique period during which each group could more clearly understand the others' needs and desires for a research program. As part of these changes, a new research program development process was adopted. It included university faculty participation in writing proposals, many times jointly with WSDOT personnel; evaluation of proposals by technical committees; and management of research projects in close collaboration with WSDOT personnel.

Key to the success of a cooperative program of any nature is the concept of partnerships. In Washington state, this concept is expressed first through the university center director's awareness of DOT needs and concerns and the DOT research director's awareness of university needs and concerns. These individuals believe in the benefits of the partnership and relay that belief to DOT technical and operational staff and university faculty. This leadership enforces the second level of partnership between the individual faculty member and the DOT technical monitor, who is normally a member of a technical staff (e.g., Bridge Office). Further, the DOT research director and the university director/deputy director encourage the joint authorship, and ownership, of the specific research by the particular faculty and DOT technical monitor. This concept adds immeasurably to the usefulness of the research products and to the support of the cooperative programs at both campuses.

ADMINISTRATIVE FUNCTIONS

An NCHRP synthesis provides a review of research programs within state DOTs (4). Many of the findings of that document have been incorporated into the Washington State Department of Transportation's research program (3). The WSDOT conducted a nationwide survey of research programs to ascertain their structure, mode of operation, and other administrative aspects to help restructure its own program (2). The NCHRP synthesis and the WSDOT study, although somewhat out of date, provide excellent background for an examination of typical administrative activities carried out within state DOTs.

The following discussion describes the administrative functions of the collaborative WSDOT-university research program. Program funding, development, management, and implementation and technology transfer are addressed.

Program Funding

The most traditional source of research funding for state DOTs is FHWA Highway Planning and Research Program (HPR), matched with state funds. Some states choose to use all state funds for research and use the HPR funds strictly for planning. These states presumably feel that they decrease their administrative burdens by reducing federal oversight of spending for research. Some states add state money to their HPR research plans and aggressively seek additional research funds from agencies such as FHWA and the former Urban Mass Transportation Administration (UMTA) (now FTA). WSDOT research funding was, for many years, based on HPR funds, state match, and limited state funding supplements. However,

in the last 4 years the state has added significantly more state funding to the HPR money and has obtained additional FHWA and UMTA funds to augment its research efforts.

One major advantage of the DOT-university collaborative effort is that DOT can tap university expertise in leveraging research funds to enhance the research program. University faculty are adept at writing proposals for funding. With cooperation from the state DOT, matching funds, and other DOT expertise or equipment, university faculty can develop strong proposals that are likely to be funded by federal agencies.

One example in Washington state is an UMTA grant for a study of the private development of park-and-ride lots. WSDOT provided state funds and in-kind support from staff, and in-kind matching was obtained from a local transit operator (Seattle Metro). UMTA provided the remaining 80 percent of the funding. The proposal was prepared by the university principal investigator. This project illustrates the leveraging of state funds possible through collaborative efforts.

The state DOT research program also needs a constituency that will help fight for its budget. This effort is enhanced if key managers within the DOT view components of the research program as their own and become strong advocates. Within the WSDOT, this advocacy is facilitated by the manner in which the research program is developed and administered. Research topics are identified, discussed, and prioritized in technical committees comprising WSDOT functional staff, university faculty, research office staff, and FHWA experts. This process, described in more detail in the following section, builds an understanding of research needs and priorities among the DOT participants, both in the functional-technical staff and with the executives who participate in each workshop. These executives and technical staff then become advocates for research funding in their area and assist in assuring funding continuity of the WSDOT research program. The collaborative conduct of the research, with WSDOT technical monitors directly involved, further enforces the concept of ownership by others outside the research office.

It is especially important that universities be given enough advance notice to attract high-quality graduate students, whose role on research projects can hardly be overstated, to work on the projects. Although it is difficult to program and select projects far enough in advance to recruit graduate students on a regular basis, some type of commitment between the university and the state DOT can encourage the recruitment of quality students.

In the WSDOT example, this problem is addressed by the establishment of a 2-year research program 7 to 9 months before the start of the next school year. This timing assures a 7- to 9-month notice to university faculty in the odd-numbered years and allows substantial advance planning for even-numbered years. By striving for predictable funding and selection of priority projects as early as possible, the WSDOT provides an opportunity for the universities to maximize planning and thereby maximize the potential for a satisfactory research product.

Program Development

Program development encompasses several factors. The most successful DOT research programs begin the program development process with some type of broad, grass-roots call for

research statements or problems. The NCHRP synthesis (4) presented a dilemma as follows: "Experience has shown that operational people often do not find the articulation of their research needs an easy matter. Without the solicitation of problems for research, either formally or informally, the research program truly responsive to department needs may be difficult to develop." In other words, although operations people may have trouble expressing their needs, it is important for their needs to be addressed in a meaningful way. One advantage in an ongoing DOT-university collaborative program is that faculty and graduate students who specialize in certain areas can act with practitioners to develop project statements that serve the needs of the department and are also achievable from a research standpoint. This collaboration assists the practitioners in articulating their needs and assists the researchers in understanding those needs.

The WSDOT program involves university faculty in program development. Faculty are part of the call for problem statements early in the program development process and are encouraged to contact department personnel to develop collaborative problem statements; in fact, they are told that without a department sponsor for their statement, the likelihood is small that the research will be funded. This process provides the necessary communications links and also initiates a relationship between the faculty and DOT technical personnel.

The next step in the program development process is the evaluation of the project statements. The NCHRP synthesis (4) points out that most states take advantage of some kind of technical committee to select research projects. At WSDOT there are separate technical committees for each major area in the department (e.g., bridge and structures, materials, traffic operations, design, marine operations, and planning). Each technical committee has as its chair a department manager who is responsible for that program within DOT (e.g., the bridge engineer or materials engineer). The district offices are generally represented on these committees, as is a cross section of relevant technical personnel. Also included on the committees are one or more university faculty members whose primary expertise is the relevant subject area, and an FHWA representative. These groups, consisting of approximately 10 people, rank the list of proposed projects within their technical areas and recommend funding levels for each project. At WSDOT, as at most other state DOTs, management has final approval of the research program.

Program Management

In a collaborative research program, management is needed at both the research office at the state DOT and at the university, typically at a university transportation center. The program management functions of these organizations must be closely integrated, but they have specific duties and functions as follows.

Research Office

Contract administration becomes a major activity of a research office that has a collaborative program with a university. Contract administration breaks into four areas:

1. Review, approval, and contracting for a detailed research plan,
2. Progress monitoring and reporting,
3. Expenditure management, and
4. Contract change processing.

Numerous steps can be taken in a collaborative effort to reduce the burden of contract administration. Standardized formats and review processes, editing and clerical support through the university center, and a streamlined but complete contracting process greatly facilitate project initiation. Progress reports that are quarterly rather than monthly, budgets without a burdensome number of line items to manage, and a process that expedites contract changes all help the research office and the researchers concentrate on the quality of the product rather than on contract administration. The research office has primary responsibility for maintaining a liaison between DOT and the university to assure that contacts are maintained and that misunderstandings do not develop. Because these programs are established on a long-term basis, individuals who cannot or will not participate in good faith can be easily identified and prevented from becoming a continuing problem.

Another important role that the research office can play is to broker relationships between the DOT-university researchers and FHWA and other government agencies. Research offices are one main point of contact with federal agencies, and through contacts and the promotion of particular ideas, the research office can assist the university in gaining federal funding.

University Centers

The transportation center at the university, if funded predictably, can provide a stable professional staff that can be counted on to monitor budgets, maintain high-quality reports, assist in reporting requirements, monitor progress and expenditures, and enhance contacts between university people and DOT.

The university center director's role is to direct the center's staff and functions and, more importantly, to represent the collaborative program at the university. This involves continuing the liaison with faculty; explaining DOT needs; recruiting faculty to participate in DOT-sponsored research; explaining the requirements of the collaborative program and contract research; and solving problems that occasionally arise.

The director must also maintain a liaison with the DOT research office and technical monitors to be aware of their needs and of any potential problems that may be developing. The director's advice to DOT on productive research proposals and opportunities, program balance, and university relations is also essential.

The center's word processing, editing, and graphics support staff can provide substantial services to individual research faculty, making the contract research with DOT more attractive to the faculty. The support staff also can provide significant assistance in budget monitoring and progress reporting, to the benefit of both the university researcher and DOT. Joint funding of the center staff, by the university and DOT, assures that both parties will support and utilize the center's services.

WSDOT-TRAC COLLABORATIVE BENEFITS

Once a solid relationship has built up between the university program and the state DOT, opportunities arise that never would have presented themselves in the absence of that relationship. For example, WSDOT recently decided to eliminate a bridge along Interstate 90 in the central part of the state. The bridge was no longer needed because of a railroad abandonment. This bridge presented a unique opportunity for a full-scale test of its earthquake resistance. Collaborative effort allowed researchers at the University of Washington to conduct earthquake experiments shortly before demolition of the bridge. This project required that contract execution, project design, and implementation proceed in an extremely short time so that the project would not impede the contractor's progress. This project could not have been completed without the long-standing, solid relationship that existed between the Washington State Transportation Center and the WSDOT.

The long-term existence of the university center and DOT's participation with that center has facilitated the involvement of a larger number of broader-based faculty at both state research universities. Intelligent vehicle-highway systems (IVHS), environmental legislation, intermodalism, and transit issues are now being productively explored to a much greater degree, building on the successful partnerships established over the years in materials, structures, and traffic operations. This broadening of the WSDOT research program has occurred as university faculty have involved their colleagues in their work, have introduced colleagues to WSDOT research and operational staff, and have seen transportation research productively pursued by their peers. WSDOT executives have also seen the benefits of research in traditional areas and have encouraged their subordinates to pursue research in less traditional areas.

Implementation and Technology Transfer

Perhaps the easiest and most effective way to implement research projects is to involve DOT personnel early in the development of the research program and often during its execution. At WSDOT, where strong relationships have been developed between individual faculty and DOT technical people, research projects have been conducted successfully and with a high degree of implementation. These relationships are beneficial to both DOT and the university because little time is lost in defining the projects and a strong program continues to build. Implementation may take place before the results of a project have been formally distributed in a research report, newsletter, or other technology transfer device. A program manager or engineer who has identified a problem and worked actively with internal or external research personnel to solve that problem is far more likely to adopt the project's conclusions than a person told to adopt a totally external product. This has often been referred to as the "not-invented-here" syndrome. Further, the literature concerning organizational change and innovation contains numerous references to the importance of fully understanding the creative (research) process to effectively use the innovation.

However, the technology transfer process goes beyond the selection and administration of high-quality research projects.

It must also include the normal array of information devices such as report distribution, newsletters, seminars, videotapes, and conference presentations.

Once again, universities can assist in the implementation and technology transfer process. Because their primary mission is education, universities have facilities available to help in the production and distribution of technology transfer products. In a collaborative program, faculty and DOT personnel can be encouraged to co-author technical papers presented at national conferences. This joint authorship provides recognition for the contributions of DOT people and also contributes to their professional development.

Short courses and other means of training have been a common outcome of this relationship. The training and short courses have related to both specific research projects and other academic subjects in which the WSDOT has an interest. WSDOT personnel have served on Ph.D. and master's student committees as referees. This service has enhanced the educational process. WSDOT has also located several of its technical personnel at the Transportation Center, where they participate jointly with faculty and TRAC employees on WSDOT research projects and other federal projects that have been developed. WSDOT personnel have taught graduate and undergraduate classes in transportation in the Civil Engineering Department at the University of Washington. They have also been guest lecturers in graduate and undergraduate classes. WSDOT has provided the universities with field trips for students, enhancing their education while gaining valuable research products.

University faculty provide ongoing technical assistance to WSDOT, the Washington State Transportation Commission, and legislative committees. The University has conducted conferences for the WSDOT. Other technology transfer activities have included the development of videotapes and newsletters and the operation of technology transfer vans in rural areas of Washington, Oregon, and Idaho.

WSDOT and the University of Washington have also developed a fellowship program with the cooperation of Transportation Northwest (TransNow), a federally supported, regional transportation center at the University of Washington. This fellowship program has sent as many as ten people per year to the university to obtain master's degrees in transportation planning and traffic engineering. These activities all have been direct outgrowths of the relationship built up through the collaborative research program. The activities have stretched far beyond the research projects to many other areas in education, training, and technical assistance.

WSDOT Executive Involvement

WSDOT executives are not involved in the day-to-day conduct of research, yet their knowledge of, and support for, the research effort is essential to program continuity. WSDOT and TRAC sponsor seminars on emerging issues and on ongoing WSDOT-university research. The day-long seminars feature nationally recognized experts in particular research fields, University of Washington and Washington State University faculty, and WSDOT technical staff. Also invited to the seminars are the university deans for engineering and research and interested private-sector individuals from such

transportation companies as Boeing, PACCAR, and Concrete Technology.

These seminars are an important aspect of providing continuing support for the collaborative research programs and of keeping WSDOT executives current on emerging issues, research needs, and research results. The university administrators and faculty gain insight into new work other than their own, and the resultant discussions of issues between the WSDOT and faculty enhance the mutual trust necessary for cooperative programs. In addition, the private-sector experts gain an understanding of WSDOT's problems and of its efforts to resolve these problems through technical research.

WSDOT executives also review and approve the biennial research progress of projects. An internal committee, chaired by WSDOT's deputy secretary and consisting of three other headquarters executives plus a district administrator, reviews the 2-year program of projects. The DOT research director and the university center director jointly present the program, illustrating the balance among functional areas and describing each proposal project. Significant changes proposed to the program are also approved by this committee.

ISSUES IN ESTABLISHING AND OPERATING A UNIVERSITY-DOT RESEARCH PROGRAM

As mentioned previously, universities and state DOTs have very different missions and are driven by different goals and objectives. The following sections examine the points of view of the state and the university. This discussion is not meant to be universally applicable to all states or all universities but is merely illustrative of the compromises that must take place to build a strong relationship.

State Perspective

State DOTs often assert that they need practical research results that can be implemented and are useful within their organization. The mission statement of the WSDOT Research Office specifically says that the research goal is to ". . . increase the effectiveness of transportation systems and programs in the state . . ." Implementation is often accomplished at the end of several multi-year research projects by asking the project's principal investigator to draft changes to the DOT design manual. This forces the researcher and DOT to agree on the true meaning of the research results, and although it can be a very painful process, it can also be a very practical one. It also helps to demonstrate that the research is being utilized.

Another item of importance is to ensure that everybody involved in the process receives some credit. WSDOT technical reports always identify on the cover with the authors the DOT person who was responsible for project oversight. The encouragement for collaborators to write co-authored technical papers also helps build relationships. DOT personnel sometimes express frustration at not being able to maintain telephone and face-to-face contact with researchers. This is a problem of which all parties need to be aware, and the solution may be as simple as installing electronic voice mail or fax machines to ensure that technical people can reach

each other when necessary. Project schedules can be difficult issues in an organization such as DOT, which is very schedule driven. Research projects do not always march to the same drummer. DOT may have to be flexible about research project schedules to gain the highest quality products. Often the reasons for delays are outside the researcher's control. Again, close contact and communication among the technical monitor, the research office, and the researchers is essential.

DOTs may complain that final reports are of poor written and visual quality—not up to the same standards that DOTs have become accustomed to with private consultants. This problem can be overcome by an ongoing relationship that allows the transportation center to maintain continuity in its staff by hiring editors, illustrators, word processors, and other personnel necessary to develop professional products. Inevitably, in a relationship between a university and DOT, a faculty member at the university will be in a position to criticize the operation or some other aspect of DOT management. This always causes a strain on the relationship, which can be overcome only by the overall strength of the relationship itself. All must understand that problems will arise that have to be ignored or overcome in some other way for the relationship to work.

University Perspective

University faculty are driven by the need to attract research support, which funds graduate students and produces publications in academic journals. Faculty gain tenure and promotion through these activities, and DOTs need to understand the reward structure in the university to understand faculty behavior. For many faculty, a grant from the National Science Foundation (NSF) is considered to be of higher value than a contract with the local DOT or other agency. However, NSF provides few grants in the transportation area, which has had the effect of pushing faculty to look for other funding sources, including state DOTs. The need to support students and equipment that is normally not provided by the university and to travel to conferences is important.

Further, the graduate students' education is often significantly enhanced by working closely with DOT practitioners. The students begin to see how their academic training can be applied in the field, in addition to contributing to problem solutions and advancing the state of knowledge. Faculty can also gain insight into new, productive areas of research by interacting with the DOT practitioners in the field. DOTs have facilities and other information that are important to university researchers. The attraction of these facilities, such as the bridge mentioned previously, can provide strong motivation for faculty to interact with state DOTs.

CONCLUSION

This paper examines the administrative aspects of a collaborative DOT-university research program and addresses the mutual benefits of this collaboration. In Washington state, researchers from two universities work collaboratively with technical staff in the Washington State Department of Trans-

portation to develop programs, conduct research, and implement research and technology transfer. This long-term relationship, established in 1983 and refined since that time, has yielded products with a high potential for implementation. The direct involvement of personnel from the WSDOT technical staff offices has resulted in an appreciation for the benefits of research; these people have in turn become advocates for continuing or enhancing research program funding. WSDOT executives are involved in the research program, which, combined with the success experienced in traditional areas, has allowed the research to expand further into emerging areas, such as intermodalism, IVHS, and environmental and transit issues. This expansion has involved new faculty and students at the universities. WSDOT needs practical research results that can be implemented. The universities are interested in supporting students, having access to operating transportation facilities, and publishing and funding. The WSDOT and the universities have made substantial efforts to understand the needs and motivations of the others and to be sensitive to those needs. Both parties have gained substantially from a

long-term relationship that has fostered interaction among faculty, students, and WSDOT professionals.

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