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Committee on Science and Technology

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"An Overview of Transportation R&D:

Priorities for Reauthorization"

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THE TEXAS PLAN

Reduce Congestion ▪ Enhance Safety ▪ Expand Economic Opportunity

Improve Air Quality ▪ Preserve the Value of our Transportation Assets

Introduction

This testimony will provide the Committee on Science and Technology with the State of Texas perspective on the federal research investment, barriers we face, and stakeholder involvement in transportation research and development. It will also address the impact to states and possible improvements that might make the entire R&D endeavor more useful.

At TxDOT we strive to be a progressive state transportation agency that provides safe, cost-effective, efficient, environmentally sensitive and aesthetically appealing transportation systems to the citizens of Texas.

Federal Investment

The federal investment in research and development has impacted transportation practices and investments in many positive ways. First, the federally funded national programs are the basis for the development of national, state and local operating processes, standards and specifications. These programs consolidate information and experience from around the United States and produce usable documentations for new methods. They also obtain results that might otherwise take individual states decades to complete. Federal research and development has brought the transportation industry high performance concrete, high performance steel and accelerated bridge construction, which have significantly improved the efficiency and the durability of bridges. These, of course, are not the only examples.

In Texas, the safety devices along all of our highways are based on design criteria developed through national research. For example, the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features," has been used for selecting cable barrier systems. The installation of these barriers on Texas highways has dramatically reduced crash severity and saved several lives. NCHRP projects have helped TxDOT in other programs as well, like the repair of prematurely failing modular joints on bridges. If these systems are poorly designed, specified or installed, which had happened previously due to a lack of national specifications, they can underperform and result in costly bridge damage and premature replacement.

NCHRP has assisted Texas in many ways. It helps us provide secure highway and bridge infrastructure by presenting the results and findings that enable transportation professionals to deal with emergency preparedness functions. The NCHRP reports also help TxDOT identify and quantify environmental impacts in the earliest phases of project planning, making that complex process more effective and avoiding costly changes later. The research associated with new regulatory requirements can address lawsuit findings and help facilitate more efficient and effective environmental clearance and improve project delivery.

Another great federal program example is the Strategic Highway Research Program (SHRP) Concrete and Structures initiative, which promoted the interchange of ideas and information among representatives of federal, state and local government agencies; the construction industry; and the academic community, an effort which provided High Performance Concrete (HPC). The Texas Louetta Road Overpass in Houston was underway and was the first highway bridge construction project in the United States to use HPC throughout the bridge.

Additional benefits from SHRP continue today. The current Superpave asphalt binder specifications that the nation uses today were developed through the initial SHRP. For example, Expert Task Groups, or ETGs, for binders and mixtures that were originally organized for implementing Superpave still function to research changes needed in testing and specifications that were not adequately addressed during the original funding for SHRP. The FHWA formed a working group for the implementation of the Mechanistic Empirical Pavement Design Guide that is being developed to replace the existing American Association of State Highway and Transportation Officials (AASHTO) design guides. The end product should improve the accuracy and reliability of pavement design in the United States. An ETG for pavement models was organized to evaluate prediction models including fundamental properties to predict pavement performance. This Long Term Pavement Performance project was used to develop the new pavement design guide and provided several valuable lessons from the Special Pavement Sections. FHWA also uses ETGs to evaluate the measurement of pavement performance characteristics such as smoothness, rutting and cracking with goals to standardize the practices of calibration and data collection.

TxDOT has built a very robust research program funded through the federal State Planning and Research Program involving many of the Texas universities. We perform research in areas such as pavements, materials, construction, planning, environment, right of way, public transportation, operations, safety, hydraulics and structures. Some of our recently completed research projects are:

- **The Role of Preferential Treatment for Carpools in Managed Lane Facilities**, which involved a review of carpool preferences on managed and tolled lanes; a stated-preference survey of HOV lane users with respect to carpool preferences relative to price; development of a predictive demand model; and an assessment of mobility, revenue and environmental impacts.
- **Impacts of Current and Future Demographic Trends on Transportation Planning in Texas.** One of the deliverables from this project was a *One-Stop Demographic Data Analysis Tool,* which will provide a starting point for reporting and comparing demographic characteristics of selected areas for transportation professionals.
- **Synthesis Study of Programs Used to Reduce the Need for Inspection Personnel.** TxDOT is looking for more effective ways to manage the workload involved in construction project testing and inspection. This project identified strategies that could help TxDOT do this while maintaining quality.

- **Development of An Advanced Overlay Design System Incorporating Both Rutting and Reflection Cracking Requirements.** TxDOT spends millions of dollars each year designing and placing overlay on its existing highways. The tools developed in this study will assist TxDOT engineers in designing and implementing longer lasting overlays. The software can address issues such as where to use high-performance mixes and optimal thicknesses, particularly in the area of jointed concrete pavements where joints must be repaired prior to placing any overlay.

A January 2003 TxDOT report titled "The Value of Texas Transportation Research" stated the following:

"To demonstrate the impact that research has on transportation system safety and cost effectiveness, 21 improved technologies and methods produced by TxDOT's research program were selected from a three-year period, 1999 through 2001. The selected products are considered to be among the best of over 200 beneficial initiatives implemented from those three years of the research program. A benefit period of ten years was used for determining the returns from the selected research program products. This is a conservative assumption, since many benefits never become truly obsolete as newer technology is layered on earlier innovation."

"The estimated ten-year cost savings in department operations, stemming from these 21 research products, are more than $322 million. The research program budget total for fiscal years 1999, 2000, and 2001 was approximately $54 million (less than 0.4% of the department's budget). The total operational cost savings derived from these 21 products exceed the cost of the research program by approximately $268 million. This is a net return on investment ratio of 5:1, without considering the value of the numerous other products implemented from that three-year period of the research program."

This report is currently being updated by the Texas Transportation Institute. However, preliminary indications are that the original findings remain valid.

Research and Development Barriers

The competing challenges of relentless congestion, lack of adequate funds and the need to move people and goods across town and across the country demand that we generate answers quickly. In some instances, we need the answers today – so we cannot wait on a research question to be posed with answers to be presented two years down the road. The public expects the best transportation system at the lowest cost, and research facilitates this but we have to do a better job of anticipating our questions and issues. We must begin research now so we have the answers available when tomorrow comes.

A key barrier we have to overcome is institutional inertia and resistance to change based on rational aversion to risk. Contractors in Texas, as in other states, are used to standards and consistency, so when we introduce new specifications, standards or construction techniques, resistance and cost increase is certain. Another barrier to implementing research is quite simply staffing and funding shortages. As you know, there is a cost to implementation and changeover to a new technology. With reduced budgets today and our uncertain economy, our resources are already stretched in our ability to just maintain our existing systems.

Some other barriers include failure to get useful information to decision-makers, reluctance by some to embrace advanced technologies (perhaps due to lack of understanding), lack of clarity or understanding of potential benefits, and unavailability of specifications. Some research outcomes may have to be validated by environmental regulatory agencies and go through rule making by multiple regulatory agencies before being implemented (for example, alternative mitigation strategies that research has shown to be superior to earlier practice). This barrier is exasperated by the chronic shortage of staff in the federal regulatory agencies.

Proprietary issues continue to hinder implementation. Frequently, successful research must be converted to hardware, software or new materials by vendors before it can actually be effectively used. Sometimes we must wait to implement a research result until we have enough vendors for competitive bidding. Manufacturers are often reluctant to add new features or applications that resulted from research. Another potential obstacle is that there must be agreement on the limits of the use of data available from the new technology (i.e. electronic tolling).

The federal government can help states, counties and cities use the newest available technologies in several ways. First, there must be an understanding at the federal level of state and local issues and needs. It's a long way from Washington, D.C. to Austin, Texas, and things can get lost in translation. Information, guidance and requirements developed at the national level should be based, where necessary, on sound research. This information should then be provided in clear, "ready to use" format and language. Distributing reports that are unread and put on the shelf or stored on the Internet is not the answer. Research results need to be communicated at all levels. Professionals and first-tier government decision-makers must share the details of research results and agree on standard processes and methods; i.e., safety related road design, clearance zones and access management. Transportation department regional and discipline specialist leaders must agree with local leaders on the value of, and the resources for, implementing research results; i.e., real-time monitoring at Traffic Management Centers. Senior transportation leaders and elected or appointed officials must ask for and then implement research on major requirements; i.e., alternative funding methods, linking planning with the National Environmental Policy Act, global warming and greenhouse gases. The federal government can assist in developing specifications and standards. Perhaps funding more demonstration projects highlighting technologies with potential big pay-off could also help.

At TxDOT, we have made some changes in policy to assist in overcoming some of these barriers. For example, deliverables required on some TxDOT research projects include a specification, standard, or "manual pages" in the proper format ready to insert into our documents. This makes it easier and quicker to implement the results. Some research project results are such that a formal implementation project is developed. An implementation project is typically triggered by the need for specific funding to help integrate a product, new method or process, or innovation into department operations. Examples include:

- The incremental cost for the first use of a product or innovation in construction or maintenance operations.
- The purchase of newly developed equipment for use in the field.
- Training of field personnel in the use of new equipment or methods.

Training is also a significant tool for ensuring that planning and construction use the newest available technologies. Universities must also maintain strong research programs to attract high quality students to continue graduate level study. Continuing research progress must be matched with money, resources and materials to understand and implement new technologies. Basic and continuing education and technical skills training at multiple levels is needed equitably across the country. In Texas, for example, over 300 department employees have been trained in the past 18 months on research project specific best practices and implementations. Topic areas include Wireline Communication Design, PASSER V Signal Optimization, Dynamic Message Signs, Managed Lanes, Measuring Access to Public Transportation, Procedures for Setting Curve Advisory Speeds and Spall Repair.

Recently, the research project on Transversely Varying Asphalt Rates has been added as a course that will be available to the department employees in March 2009. We have also partnered with the National Highway Institute and the Transportation Curriculum Coordinating Committee (TCCC) to place all new TCCC Web-based training on the department's Learning Content Management System. This allows immediate access to these new courses in a secure environment for department employees. We are involved with the Texas Pavement Preservation Center, a collaborative association with the department, Center for Transportation Research, the Texas Transportation Institute and private industry, and have developed a series of training courses that are delivered on an established schedule to department employees and private industry. Over 400 employees have been trained on best practices in asphalt preservation methodology and design in the past 15 months.

The department is a firm believer in the use of technology not only in application in the design, build and maintenance of roadways, but also in the delivery of training and access of the latest cutting-edge technologies for its employees. The department has an extensive video teleconferencing system that has been in place since 2002. In FY08 alone, TxDOT used over 8,700 hours of connectivity to delivery training. TxDOT's Learning Content Management System now hosts over 400 course titles and is used by every employee for a variety of courses and access to resources. The Local Technical Assistance Program (LTAP) is also a valuable

program for assisting cities and counties with technical issues and training. Some of the specifics of the LTAP in Texas include:

- Distributing technology transfer materials (videos, CDs and publications) to local government officials upon request.
- Providing technical information, advice and guidance upon request of local agencies.
- Conducting or arranging seminars or training courses including Bridge Maintenance, Road Maintenance, Culverts and Drainage, Vegetation Control/Herbicide Use and Using a Motorgrader to Shape Gravel Roads.

Stakeholder Involvement

Lastly, we believe the current level of stakeholder involvement in determining DOT RD&T priorities at the federal level is sufficient but needs improvement. The stakeholders included at the federal level, for example, are FHWA, RITA, TRB, state DOTs, local agencies, highway industry and highway users. But sheer volume does not necessarily mean that the programs and priorities are well coordinated and focused. As a result, we have unnecessary duplication, significant research gaps and increased difficulty in sharing results that can be used across the country. The challenge is big. All 50 states are conducting their own research. In addition, RITA, TRB and the FHWA have numerous research programs (for example, NCHRP, SHRP 2, and STEP). Some possibilities for improvement include:

- Defining the roles and "boundaries" of the various programs more clearly. It should be much clearer at the federal level how the "pieces of the puzzle" fit together. For example, how does the research conducted by RITA relate to the research conducted by FHWA? Is there duplication? Are there gaps? How and where does one see how this "puzzle" fits together?
- The goals and focus areas of the multitude of research programs at the federal level should be clearly and succinctly outlined, put in the same format for easy comparison and kept current in one electronic document. In essence, "What is everyone doing and where do I find it?"
- Focus the coordination efforts so that the right stakeholders are involved in the right programs. More importantly, ensure that the "products" resulting from these stakeholder meetings and interactions are specific, meaningful and measureable. Too often, many groups at all levels meet to develop research agendas. The problem occurs when there is no accountability and no follow-up.

The National Vision and Transportation Research

As Congress looks to reauthorize the nation's surface transportation program and the research that underpins it, some simple but important changes would not only reenergize that research but would cost little or nothing to do.

As we look forward to the 2009 authorization cycle, Congress should define a national strategy and provide the policy framework that empowers states and regions to set goals, make decisions and deliver projects that implement the national strategy. Not since President Eisenhower have we had a national plan for infrastructure, and if I had to guess, Congress is starting to we think should have one, too.

Our national plan should not only be for highways. It must include all modes of transportation: mass transit, high-speed rail, freight rail, aviation and ports. Congress should enact consumer-focused legislation and recognize that Americans expect congestion relief, cleaner air, improved economic opportunity, well maintained roads and increased safety.

And we're going to have to measure how well we have succeeded, or occasionally, how spectacularly we have failed. In the stimulus legislation that's presently under consideration, a good portion of the discussion is on measuring results. Right now it tends to be about the number of jobs created, which is good, but we're going to need to move into measuring real congestion relief, lasting clean air impacts, safety improvements and sustainable maintenance programs. That way we can know if we get what we expected to get out of our transportation investments, a level of thinking that is absent these days.

The national research program to some degree mimics the transportation plan we have today. There's little central coordination or vision, everyone's off doing their own thing with inadequate funding and we generally do nothing more than follow processes. When we spend a federal dollar, the question we're asked isn't "Did you relieve congestion?" but rather "Did you follow all of the processes?" If we happened to actually accomplish something, then we got lucky.

If Congress is serious about making us perform (and I hope it is), then a well organized national research program can get us there. It can define what we measure and how to best measure it. I think it could also develop the software to do it so we we're not all developing systems independent of each other at a tremendous cost or buying it from different vendors at an equally high cost.

A nationally coordinated approach worked for mapping the human genome project, and it can work for mapping the next advances in our transportation system.