Profile of an Organization

Texas Transportation Institute

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The following article is part of an occasional series appearing in TR News *in which transportation research organizations are profiled. The activities and goals of the Texas Transportation Institute are discussed here.*

The Texas Transportation Institute (TTI) was created in 1950 as a separate state agency of The Texas A&M University System "to conduct highway research for and on behalf of the state of Texas." Since that time, TTI's scope has been broadened beyond Texas and highways to include other modes of transportation (air, rail, water, and pipeline), and different facets of transportation including the environmental and economic impacts of highway maintenance, the support of international trade, multimodal transit, and the preparation of future transportation engineers. Today the Institute performs research for Texas, sponsors at all levels of government, and the private sector.

Profile

TTI is the largest university-based transportation research agency in the United States, conducting nearly $24 million of research for some 75 sponsors in 1992.

The Institute is located on the Texas A&M University campus in College Station and operates regional offices in Houston, Arlington, San Antonio, and Dallas. TTI maintains a full-service proving grounds facility, test pavement sites, structural bay, and asphalt and plant/erosion control laboratories. In addition, a communications program supports technology exchange. TTI also accesses other support services including the Computing Services Center (Cray Y-MP2/216 supercomputer), the Sterling C. Evans Library, and wind tunnel and wave tank facilities.

More than 500 TTI researchers and support staff conduct multidisciplinary research, drawing from Texas A&M University's resources in a variety of areas from science and engineering to economics, range science, landscape architecture, sociology, and psychology. TTI combines these resources to conduct transportation research and technology transfer under 33 programs in 7 separate divisions: economics and planning; materials, pavements, and construction; safety; transportation systems; traffic operations; systems planning; and structural systems.

The Institute is an official research partner of the Texas Department of Transportation (TxDOT) through the Cooperative Research Program. Additional research is funded through the Federal Highway Administration (FHWA), U.S. Departments of Transportation and Defense, departments of transportation from other states and nations, and private industry.

As a member of the Texas A&M System, TTI maintains a strong commitment to higher education. Many of TTI's researchers hold joint appointments with Texas A&M's academic colleges, particularly the College of Engineering. The Institute's research program supports some 300 transportation students both financially and by supplementing their classroom training with real-world experience to prepare them for future careers in transportation.

With the University of Texas and Texas Southern University, TTI is home to the Federal Southwest Region University Transportation Center (SWUTC) and was one of the 10 founding centers in this cooperative federal education and research program. Texas A&M University is also an Advanced Institute under the SWUTC program. The Advanced Institute specializes in transportation systems engineering with initial emphasis on transportation systems operations and management education.

TTI recently became a research partner in the newly established, industry-funded Center for Aggregates Research. The center, a joint venture between TTI and the Center for Transportation Research at the University of Texas, will be supported through a $4 million endowment established by the Aggregates Foundation for Technology, Research and Education. The purpose of the center is to conduct scientific and technical research related to aggregates and to provide transportation officials, the aggregates industry, and the construction industry with the knowledge to put the latest aggregates research into practice.

TTI's headquarters in College Station on Texas A&M University campus.

TTI's Partnership with TxDOT

The Texas Cooperative Research Program is an example of one way that a state transportation agency and a university system have organized to maximize their resources.

Over the years, TxDOT has sponsored and implemented TTI's research findings. For each dollar it invests in TTI research, TxDOT estimates that it returns an average of $22 in benefits to taxpayers.

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TTI's partnership with Texas Department of Transportation has increased the safety and efficiency of Texas highway system.

Both agencies benefit from this arrangement. The Department secures low-cost, high-quality research support to guide it in solving complex policy and technical problems. It also gains access to transportation professionals to staff its organization, and continuing education opportunities to keep its existing personnel up to date with rapidly changing technologies. TTI and the university, on the other hand, have a stable base of funding that enables them to recruit and retain top faculty and students, upgrade research facilities, and strengthen the academic and transportation research programs.

Through its many partnerships, TTI has been responsible for numerous advances in highway technology during the last 40 years, and will continue to develop technologies that will make the road safer, improve highway infrastructure, assess the economic impact of transportation, and increase the operating efficiency of transportation systems.

Making the Road a Safer Place

In the area of safety, TTI has made many advances in the past and is working on a number of safety improvements for the future.

One of the earliest contributions to roadway safety was the development of breakaway supports for roadside signs. The breakaway support, developed cooperatively by TTI and TxDOT engineers, allows a vehicle colliding with a sign support to pass under the sign, minimizing injuries and increasing passengers' chances of survival. A similar concept was developed for luminary supports and later applied successfully to modified, hinged timber utility poles in an effort to prevent the thousands of fatalities that occur each year as a result of collisions with poles.

TTI structures engineers also designed impact attenuators—cushioning agents that absorb kinetic energy and bring vehicles to a stop in collisions with fixed highway structures. The success of impact attenuators led to a later project in which TTI researchers developed performance standards for truck-mounted attenuators (TMA)—crash cushions designed for trucks that follow and protect highway maintenance personnel. Like other impact attenuators, the objective was to bring the vehicle to a stop with minimum damage and injury to the occupants of either vehicle. TTI's safety experts were instrumental in establishing minimum performance standards for TMA manufacturers.

One of the newer safety devices developed by Institute researchers is the Advanced Dynamic Impact Extension Module (ADIEM), a series of barriers composed of concrete made with perlite. The revolutionary design, funded by TxDOT, allows the barriers to absorb energy from a collision by controlled disintegration on impact.

In addition to ADIEM, TTI has developed a revolutionary guardrail end treatment, the ET-2000, designed to travel down the rail's path, absorbing the force of the crash and bringing the vehicle to a safe stop.

Traffic safety officials have expressed confidence in the ET-2000's performance—a fact supported by the decision of more than half of the DOTs in the United States to install the system. The ET-2000's success was recognized by FHWA when TxDOT received the 1991 Administrator's Safety Improvement Award for its development.

In recent years transportation safety has included not only the roadside but the roadway too. An example of TTI's commitment to safer roadways is TRASER, a traffic records management software for analyzing traffic accident, citation and arrest data. Through better analysis, police departments can make the best of limited personnel and scarce resources, making the streets safer in the process.

Since its development three years ago by TTI—with the support of the TxDOT's Traffic Safety Section—TRASER has been employed by numerous public safety agencies throughout the nation. TRASER was selected as a 1991 winner in FHWA's Biennial Safety Award Competition.

Although most TTI safety advances have focused on the roadway environment, the Institute has also conducted extensive research in railway safety.

TTI is targeting new areas in safety research for the future. Researchers will place more emphasis on human factors such as the impact of an aging driving population, motorist understanding of traffic signs and signals and use of drugs and alcohol, and driver performance and interaction with the roadway.

Improving Highway Infrastructure

When TTI first began its work in the 1950s, researchers focused primarily on the place-

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Road workers apply base material using industrial byproduct gypsum at TTI's Riverside Proving Grounds.

ment of asphalt to create a driving surface and seal coating to maintain it. Today, researchers study all aspects of materials science from the molecular structure of asphalt to the microstructure of portland cement concrete.

Under a contract with the Strategic Highway Research Program, TTI researchers developed new tests to measure and relate engineering properties to accurately predict pavement performance. Under other contracts, researchers are developing performance models to provide a basis for life cycle cost analysis for asphalt concrete.

Materials researchers at TTI were among the first to conduct research in asphalt recycling. Under a contract with the National Cooperative Highway Research Program in 1979, TTI produced a publication (*NCHRP Report 224, Guidelines for Recycling Pavement Materials*) that provided an asphalt recycling industry standard for more than a decade.

Today, TTI materials engineers are studying better ways to use reclaimed materials, turning worn-out tires into rubberized asphalt and using old pavement, or reclaimed asphalt pavement (RAP), to maintain and construct new roads. The Texas legislature recently passed laws requiring TxDOT to maximize the use of RAP. This mandate prompted TTI to study the most economical and effective uses of milled RAP in maintenance and develop videotapes that teach and promote the findings of this research.

One of the fastest growing waste products in the United States, calcium sulfate (gypsum), is being tested as a low-cost aggregate alternative in roadbase construction, and researchers report that the results so far are encouraging. The material is two to three times stronger than conventional cement, is cheaper to make, and using it helps to solve a major environmental problem: disposal of industrial waste.

Assessing the Economic Impact

The United States has devoted more than $100 billion to its Interstate highway network, and billions more are spent each year maintaining state and federal roadways. Even larger sums are spent on railways, waterways, and airports.

At TTI, researchers focus their studies on all modes of transportation and in a variety of areas from the development and implementation of transportation project analyses to environmental impact assessments, integrated multimodal project and program analyses, and computer-based video portrayals of transportation problems and solutions.

In addition, TTI researchers study the economic impacts of new policies on the transportation industry. One new policy is the North American Free Trade Agreement (NAFTA). TTI is forecasting the transportation costs and benefits of NAFTA, which is intended to eliminate existing barriers that restrict trade among Canada, the United States, and Mexico.

In another project related to new policies, TTI researchers are developing improved planning procedures to help Texas cities, TxDOT, and the Texas Air Control Board comply with the new transportation/air quality requirements of the Clean Air Act Amendments of 1990.

Airport system planners at TTI are working on the Texas Aeronautical Facilities Plan for TxDOT's Aviation Division, which describes how the state's aviation infrastructure can be developed to support the economic development goals of the state.

TTI researchers are also developing an impact model designed to assess the effects of closing the Gulf Intracoastal Waterway (GIWW) because of erosion, natural disaster, or other causes. GIWW stretches more than 400 miles along the Texas coastline. Through it, the state's oil, chemical, and mining industries gain access to important markets, playing a vital role in the economy of the southwestern United States.

Increasing Operating Efficiency

In TTI's early days, much of its work was in traffic operations planning for major urban areas. This has not changed today. What has changed is the amount and sophistication of the work undertaken.

TTI researchers are studying the issues of urban congestion and mobility in cities throughout the United States. To add to these studies, TTI is developing new technologies that will make traffic more manageable. Researchers have worked on high-occupancy vehicle (HOV) lanes, which provide an incentive for carpoolers and transit users often caught in the peak hour traffic jam by allowing them to pass by single occupancy vehicles. TTI is currently involved in HOV projects in all the major Texas cities, and in seven other states.

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Research at TTI is helping to ensure most efficient use of high-occupancy vehicle lanes in Dallas and other cities in Texas.

TTI researchers are also keeping traffic moving on highways and arterials by coordinating the timing of traffic signals with TTI's PASSER© computer software.

In addition to these improvements in roadway efficiency, TTI has been involved in a new technology that will also make rail trips faster: high-speed rail. The Institute worked closely with the Texas High Speed Rail Authority in the evaluation of franchise proposals that led to the selection of a high-speed rail consortium for the state.

Now TTI is looking to the future with research on Intelligent Vehicle-Highway Systems (IVHS). Congress has recommended some $800 million in federal funding for IVHS over the next six years, with much of that total to be invested in research and development. In response, TTI researchers have directed substantial effort toward numerous projects in IVHS. During 1992, more than 20 projects were under way in all five functional areas of IVHS: Advanced Public Transportation Systems, Advanced Traveler Information Systems, Advanced Traffic Management Systems, Commercial Vehicle Operations, and Advanced Vehicle Control Systems. In addition, TTI reorganized in early 1992 to more effectively address emerging research issues, including those in the IVHS arena.

TxDOT has already begun implementing IVHS technologies developed by TTI in the following areas:

- Institute researchers are making commuting less stressful by providing technical support for the Houston Intelligent Transportation Systems (HITS) project. This project uses real-time traffic information provided through workplace kiosks and other means, enabling commuters to make decisions about travel, thereby encouraging the use of mass transit, carpools, and alternate driving routes.
- Dallas-based TTI researchers developed a compressed video surveillance system for TxDOT to monitor activity on the Dallas North Central Expressway reconstruction project. The system helps alert police and emergency personnel to accidents almost immediately.
- Other institute researchers began to assist Dallas-area jurisdictions in developing a comprehensive, area-wide plan to maximize efficiency throughout the Metroplex's crowded transportation network.

TTI is conducting experiments in the area of advanced vehicle control systems with a vehicle developed by TTI's Binocular Autonomous Research Team (BART). The vehicle is one of only four in the world that can drive on the road or follow another vehicle without human help. Vehicles like BART can reduce accidents caused by human error and also increase capacity on highways.

In the area of commercial vehicle operations, Institute researchers are working to streamline the Interstate trucking industry's travel with weigh-in-motion sensors and electronic bills of lading designed to improve efficiency and competitiveness. TTI is developing a port of entry system for the Idaho Department of Transportation. This system will increase the enforcement capacity of port of entry facilities by identifying overloaded and oversized vehicles and directing them to the enforcement areas, while allowing legally operating vehicles to pass through the station.

Institute leaders, who were instrumental in organizing Mobility 2000 (the predecessor to IVHS America), hosted transportation experts from throughout Texas in 1992 to chart a course for the future of Texas IVHS. Currently TTI is taking the lead in forming an IVHS Texas group similar to IVHS America.

TTI's IVHS efforts will support an ambitious set of goals for the national IVHS movement. Among these are a substantial reduction in traffic fatalities and slashing the multibillion dollar costs of U.S. traffic jams each year.

Moving Ahead

TTI has a history of accomplishment in transportation research. The Institute is currently studying and developing new applications for emerging technologies—IVHS, high-speed rail, video imaging, policy issues and safety factors associated with these new vehicle and road technologies—that will have an impact on the future of transportation.

"For more than four decades, TTI has developed innovative and effective solutions for the transportation problems of Texas and the nation," said TTI Director Emeritus C.V. Wootan, who retired in January. "And while our challenges may be new and different, our mission to serve as a leader in transportation research for Texas and the nation remains unchanged."

C.V. Wootan Retires as Director of Texas Transportation Institute

C.V. Wootan retired from his position as Director of the Texas Transportation Institute in January 1993 after 37 years of service to TTI and 41 years with the Texas A&M University System.

Wootan began his career with TTI in 1956 as an associate research economist and project leader. He became head of the Transportation Economics and Planning Division in 1961, was promoted to Associate Director in 1965, and assumed the position of Director of TTI in 1976.

As Director, Wootan has guided the Institute through a period of unparalleled growth. From the time that he became Director, the number of employees has increased from 114 to more than 500. TTI's funded research budget has nearly quadrupled since 1985, making it the largest university-based transportation research agency in the nation.

Wootan is an internationally recognized transportation economist with a career of service to the profession. He helped create and twice served as President of the Council of University Transportation Centers, an organization composed of more than 40 universities conducting transportation research.

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C. V. Wootan

He served as Chairman of the Executive Committee of the Transportation Research Board in 1980, and organized and chaired a new TRB research group, Group 5—Intergroup Resources and Issues, in 1983. He has also served as Chairman of the Division A Council, which oversees all TRB technical activities. Other TRB committee work includes chairmanship of the Executive Committee Subcommittee for the National Cooperative Highway Research Program and the Group 1 Council; and membership of many TRB committees.

In recognition of his outstanding achievements in transportation research, Wootan was the 1984 recipient of TRB's W. N. Carey, Jr., Distinguished Service Award. In 1987 TRB presented him with the George S. Bartlett Award for his contribution to transportation research and education. This award was co-sponsored by the American Association of State Highway and Transportation Officials, the American Road and Transportation Builders Association, and TRB.

Wootan has received numerous other honors during his career. For establishing educational seminars on behalf of the International Right-of-Way Association, in 1981 Wootan was presented with the prestigious Y.T. Lum award. In 1992 he was given the S.S. Steinberg Award, sponsored by the Educational Division of the American Road and Transportation Builders Association in recognition of his contributions to transportation education. Shortly before his retirement, the Texas Department of Transportation recognized Wootan and his many years of work with the department by presenting him with its highest honor, the Road Hand Award.

Upon his retirement as director, the Texas A&M University Board of Regents honored Wootan with the title of director emeritus. In that capacity he remains with the Institute, leading special initiatives.