

# Texas A&M Transportation Institute — over 60 years of innovation



*Saving Lives, Time and Resources*



## Texas A&M Transportation Institute's Founding Fathers

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**Gibb Gilchrist**  
State Highway Engineer,  
1924-1925; 1928-1937  
First Chancellor of The Texas A&M  
University System  
1948-1957



**DeWitt C. Greer**  
Texas State Highway Engineer  
1940-1968  
State Highway Commissioner  
1969-1981; Chairman 1969-1972



**Thomas H. MacDonald**  
Chief, U.S. Bureau of Public Roads  
1919-1953  
Distinguished Research Engineer  
Texas Transportation Institute  
1953-1957

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### In the beginning...

**W**hen the Texas Highway Department (THD) was formed in 1917, it immediately began using the laboratory facilities of the Agricultural and Mechanical College of Texas (AMC). This marked the creation of a partnership that has continued to this day. Legendary State Highway Engineer DeWitt Greer, who headed the THD from 1940 to 1967, had a vision that the universities could be valuable partners in developing the finest and safest highway system in the world. Along with Gibb Gilchrist, a former engineer-director of the department and the first chancellor of The Texas A&M University System, the two formulated the concept of the cooperative research program and, with a land-grant charter to serve the people of Texas, created the formal relationship between the highway department and AMC in 1948. An early contributor to the leadership of this new cooperative research program was provided by Thomas H. MacDonald. As the former chief of the U.S. Bureau of Public Roads for 33 years, Mr. MacDonald saw the need to have a strong research program to support the effective development of the roadway system. Also important to the founders of the Texas Transportation Institute, now Texas A&M Transportation Institute (TTI), was the charge to give graduate students the opportunity to study and work in the transportation profession. During his time as a distinguished research engineer at A&M and TTI, Mr. MacDonald laid the groundwork for the Institute's core philosophies and future success.



The original charter of TTI, as given by the Texas A&M Board of Directors in 1950, charged the Institute with enlisting the broad resources of the College in all forms of transportation research. Over the last 60-plus years, through the cooperative agreement and the support of the research program, TTI has consistently applied the principles of interdisciplinary investigation, including all modes, while addressing the state and nation's most pressing transportation concerns.

The following highlights are only a small representation of the extensive body of research performed at TTI since its inception. In over six decades, the Institute has published over 3,000 research reports covering hundreds of state and national transportation problems. The studies included in these highlights have been selected to tell the story of the Institute's work—and to illustrate the breadth and depth of the research accomplished at TTI since its beginning.



# Building the Base...

**Fred J. Benson**  
*Director*  
1955-1962



Between 1953 and 1962, the Texas Highway Department (THD) approved the construction of almost 16,000 miles of highways, bringing the state's total system to 59,300 miles, more than any other state in the nation. Under the leadership of Fred Benson, dean of engineering at Texas A&M University and TTI's director from 1955 to 1962, TTI's research contributions provided valuable guidance and technology to the THD throughout this rapid expansion of both rural highways and urban freeways.

Having served as civil engineering department head, dean of engineering and deputy chancellor at A&M, Benson was also an educator and mentor to many civil engineers who formed the Texas Highway Department and represented transportation interests at the national level.

During his tenure, the Institute's early research on freeways and highway materials quickly became well-known, and its work in measuring the economic contributions of transportation opened new research opportunities for the entire transportation community.



Researchers developed bridge design specifications for prefabricated concrete beams and girders. They then took the research a step further by applying mass production principles to the construction, storage, and use of these structures, saving the state a tremendous amount of time and money. Much of TTI's early research efforts focused on improving the quality and consistency of asphalt and aggregate; new testing procedures; and developing new and improved pavement materials.

## 1955



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In its first decade, TTI assisted in the design, construction, operation and improvement of urban interstates. Researchers created a new standardized accident reporting form for police in cities with freeways. TTI also confirmed the need for illumination to reduce nighttime congestion and crash rates.

## 1955~1962

1. The Institute began extensive research to improve the durability of pavements through analysis and testing of asphalt, aggregate and concrete.
2. The thermoplastic pavement striper, invented at TTI, employed an innovative use of sulfur and heat with the paint. It was the forerunner of today's automated striping machinery.
3. TTI experiments proved the practicality of using a structural quality, light weight concrete with prestressed and prefabricated concrete bridge structures. The recommended field practice was adopted on a national scale.
4. TTI conducted early groundbreaking research on the use of hydrated lime and other industrial waste products, such as fly ash and bottom ash, to stabilize the soil of a road's base.
5. The Institute's researchers began using towers and motion picture cameras to assist in the design, construction, operation and improvement of Houston's Gulf Freeway and arterial system.
6. TTI research confirmed the need for illumination of intersections and freeways to enhance safety.
7. Research on establishing desirable vegetation for erosion control and beautification resulted in innovative vegetation spraying equipment.
8. Early economic studies focused on estimating future needs of trucking, rail, water, and air, and on the future of the interstate highway system.



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## 1962



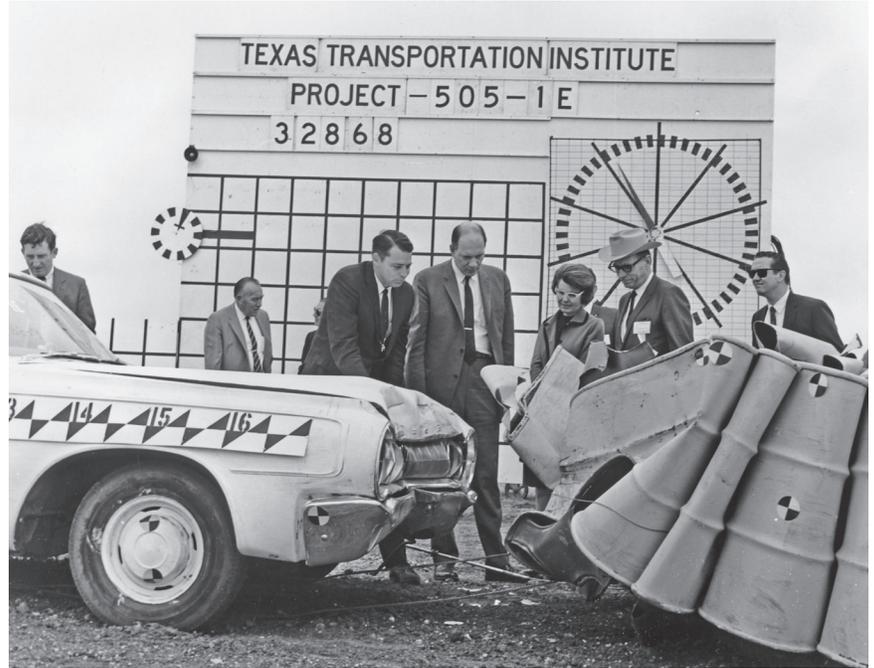
# The Safety Boom...



**Jack Keese**  
*Director*  
1962-1976

By far the most important aspect of highway transportation research between 1962 and 1976 was the recognition of the importance of highway safety issues to the traveling public, the government, and the transportation community. Charles J. "Jack" Keese, an A&M civil engineering professor and TTI researcher since 1955, led TTI through this period. Under Keese, who had also worked as a traffic engineer for the city of Midland, Texas, TTI began assisting highway planners and engineers with a focused effort to improve safety for motorists, creating the concept of the "forgiving" roadside.

In addition to milestone safety innovations and improvements, the Keese years marked a great expansion in the scope of TTI's work. Researchers began analyzing and addressing more urban transportation problems, such as freeway design and operations, traffic congestion, and efficiency of emergency services. While the Institute continued to improve highway construction and maintenance methodologies, it also allocated more time and resources to studying the social, economic and environmental implications of all transportation modes.

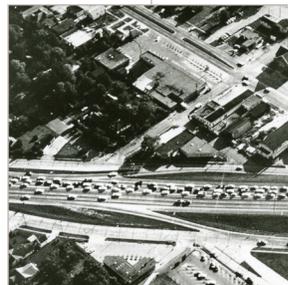


As highway construction and usage continued to increase through the 1960s, so did injury and death rates per vehicle mile, rising every year except in 1966. Some of the innovations developed at TTI in this period were breakaway sign supports, the "Texas Crash Cushion" (shown above), guardrail and end treatments, railroad grade-crossing inventories, median barriers and culvert grates—all becoming a more integral part of the highway landscape moving into the 1970s.

## 1962



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The most lasting legacy of Keese’s tenure is that despite a tripling of the number of vehicle miles traveled in Texas from 1965 to 1992, the number of deaths on Texas roadways each year remained virtually the same, and deaths per one hundred million miles had fallen from 5.8 to 1.9. While TTI shares credit for these improvements with many other state, federal and private sources, its leadership and commitment to conducting safety experiments and quickly sharing its results with others in the field helped the Institute make a highly respected name for itself among members of the transportation community.

## 1962~1976

1. TTI’s skid prevention and hydroplaning research initiative consisted of analyzing water, driver behavior, friction coefficients, aggregates and tire types to identify skid and hydroplaning prevention methods. The decade-long effort led the Federal Highway Administration (FHWA) to establish the Central Western Field Test Center at the TTI Proving Grounds.
2. TTI researchers, sponsored by the Bureau of Public Roads, used computer simulations to redefine the “state-of-art” in prestressed concrete pile driving. Years of research in this area pioneered the wave equation method of analysis for pile driving problems and eliminated breakage of expensive piles.
3. Researchers developed a practical aerial photography technique for the study of traffic characteristics on heavily used facilities such as Houston’s Gulf Freeway and Dallas’ North Central Expressway.
4. TTI pioneered the “breakaway” design for freeway sign supports, later applying the same principle to light poles, utility poles, sign bridges and mailbox supports. Since the 1960s, this implemented concept has saved thousands of lives.
5. Human factors research focused on measuring driver visibility and tension as a result of changes in weather, traffic signs or vehicle handling.
6. TTI began research to improve safety and effectiveness of vehicle merging on urban freeways, eventually developing one of the first automated ramp control systems.
7. The Texas Crash Cushion Trailer, when properly attached to a roadside maintenance vehicle, protected the maintenance or construction personnel and the driver and passengers of an errant vehicle.
8. Researchers developed a centralized, comprehensive national data file for all rail-highway grade crossings—some 500,000 of them—in the United States. In addition, TTI proposed safety improvements of signage and pavement structure at grade crossings.



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## 1976



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# Keepin' it Movin'...

## Charley V. Wootan

Director  
1976-1993



When Dr. Charley Wootan took the reins in 1976, the Institute experienced its most rapid growth period during his ensuing 17 years of leadership. Having been with Benson and Keese from the beginning as a transportation research economist, Wootan knew what it would take for TTI to become the largest and one of the most highly regarded university-affiliated transportation research organizations in the country.

He was instrumental in growing the Texas Department of Transportation (TxDOT) cooperative research program from a brilliant concept to a nationally recognized program of excellence. He became a respected national spokesperson for the value of transportation research, expanding TTI's reach by serving on the executive committees of the Transportation Research Board (TRB) and American Association of State Highway and Transportation Officials (AASHTO). He also became the first president of the Council of University Transportation Centers (CUTC). Wootan led TTI into the international arena by supporting research and outreach projects in Mexico, Korea, Sweden, France and China. The Institute also began focusing much more of its research on traffic operations, transportation systems and multimodal planning.



By the late 1970s, it had become apparent that road builders could not count on further road construction alone to control congestion. As one traffic engineer remarked, the demand for freeways grew so substantially that some roadways were "becoming obsolete the minute that they opened." Having pioneered the use of video surveillance and television monitors in Houston and Dallas, TTI researchers continued advancing freeway and traffic operations technologies and techniques.

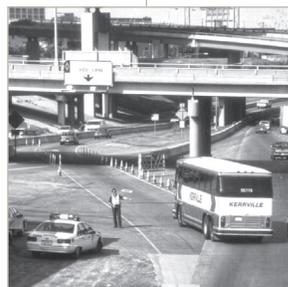
## 1976



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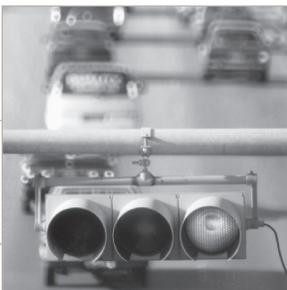
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TTI researchers began studying the integration of High Occupancy Vehicle (HOV) lanes on Texas freeways, with more emphasis given to research into expanding transit services in urban and rural areas. Advancement of more sophisticated and precise computer programs for effective traffic management continued as well, with the PASSER II technology expanding to national use into the 1980s.



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## 1993



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### 1976~1993

1. TTI's work in the area of motorist information systems, incident detection and response, and motorist services began to advance the operational hardware and the management techniques needed for capacity reducing situations.
2. TTI and the State Department of Highways and Public Transportation constructed the first sulfur-extended asphalt pavement project in the United States, later confirming that sulfur could replace 15-25 percent of the asphalt in a pavement mixture.
3. TTI helped plan and design Houston's first HOV bus and vanpool contraflow on the North Freeway and conducted numerous evaluations of systems that followed.
4. TTI assisted local urban officials in developing park-and-ride systems and in analyzing creative methods of financing transit facilities, all in the interest of combating urban congestion.
5. Safety researchers came up with the Hawkins Breakaway System for wooden utility and telephone poles, a design that, when hit, enhances the motorist's survival chances, but also allows the pole to remain intact.
6. By 1991, TTI's PASSER (Progressive Analysis and Signal System Evaluation Routine) software had become one of the two most widely used signal timing software packages in the world.
7. TTI began evaluation of mobility levels on Texas street and freeway systems. This effort eventually expanded to include other major U.S. cities and the development of the Roadway Congestion Index (RCI), which is now used nationally.
8. Safety researchers developed the ET-2000, a guardrail "extruder" end treatment that bends and curves away from the vehicle upon collision. This technology performed flawlessly in its first real collision in 1991, leading the FHWA to approve its use on all federal-aid new construction and major reconstruction of freeways, and other major roadways.



# Growing to Meet the Need...



**Herbert H. Richardson**  
*Director*  
1993–2006

In 1991 the U.S. Congress passed the Intermodal Surface Transportation Efficiency Act (ISTEA), encouraging multimodal transportation planning and collaboration. Two years later, The Texas A&M University System Board of Regents selected the right man for the continued job of positioning TTI as a world-class, international leader in advancing transportation research, technology transfer, and education. Under Dr. Herbert Richardson's leadership, TTI significantly broadened its mission to include all modes of transportation. Four new national centers of excellence were won, and in 2001 the Texas Legislature established TTI's Center for Transportation Safety, making the Institute home to nine formal centers of excellence.

Richardson presided over steady growth in cutting-edge transportation research funding, bringing the operating budget to approximately \$40 million and the staff to some 600 dedicated professionals and graduate students. TTI continued as a key leader in advancing Intelligent Transportation Systems (ITS) and congestion management, pavement rehabilitation strategies, sustainable transportation systems, and state-of-the-art crash tests to help ensure the protection of our nation's embassies from terrorist attacks.



TTI grew from laboratory facilities housed in a remodeled veterinary diagnostic building in 1954 to numerous buildings and outdoor test facilities at the former airbase, Texas A&M University Riverside Campus. By the 1970s, TTI had also far outgrown its campus offices in the original Highway Research Center.



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## 1993



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Even after expanding to a newly built eight-story building built for TTI and the Texas A&M Zachry Department of Civil Engineering in 1987, the Institute's growth and success demanded more space. Richardson succeeded in securing funds and support for a facility in the Texas A&M University Research Park. The Gibb Gilchrist Building was dedicated in 1999 and was the first building to be solely occupied by and designed for TTI's research needs.

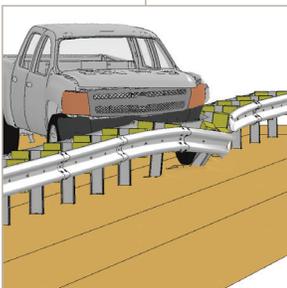
### 1993~2006

1. TTI had a pioneering role in early research on Intelligent Vehicle Highway Systems (IVHS) by using Texas urban areas as test beds for new real-time, automated technologies.
2. The continued study of Gulf Intracoastal Waterway (GIWW) helped ensure that the water freight industry remained an effective carrier of goods in Texas. TTI contributions to ports and waterways research led to the establishment of the Center for Ports and Waterways.
3. With help from TxDOT's Traffic Safety Section, TTI developed TRASER, a computer database program that allows easy storage and retrieval of traffic records information.
4. TTI became home to an Association of American Railroads (AAR) Affiliated Laboratory, continuing research for safety at grade crossings and increased efficiency through Intelligent Transportation System (ITS) technologies.
5. With the passage of NAFTA, TTI contributed valuable research on innovative concepts and tools to facilitate trade flow and economic effects in Texas.
6. To address the growing crisis of teen deaths from driving, TTI (sponsored by TxDOT) developed the Teens in the Driver Seat® (TDS) peer-to-peer driving safety program, the first of its kind in America. Since its inception, the teen driver fatal crash rate has dropped faster and more steadily in Texas than in any other state.
7. TTI began using computer simulation software to enhance its full-scale, live crash testing services.
8. TTI is designated as the home of the National Work Zone Safety Information Clearinghouse. With support from the FHWA and the American Road and Transportation Builders Association (ARTBA), staff provide contractors, workers and safety officials with quick and easy access to a wide array of information and materials via a website.
9. TTI's innovative development, testing and implementation of Ground Penetrating Radar (GPR) across the state has resulted in hundreds of thousands dollars saved in pavement maintenance and rehabilitation costs for TxDOT.



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## 2006



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# Building On Our Strengths...



**Dennis L. Christiansen**  
*Director*  
2006–Present

When the A&M System Board of Regents selected Dr. Dennis Christiansen as agency director in late 2006, the board tapped a seasoned leader, with 35 years of experience heading various areas and initiatives within the Institute. In the six years since Christiansen has been director, research expenditures have increased by 30 percent and state appropriations by 28 percent. With the addition of three new research facilities and six statewide and national centers, TTI is now unmatched in size, depth and breadth of its research program.

A major initiative guided by Christiansen is the repositioning of TTI to expand and diversify its research portfolio. Another major initiative is serving as a credible and objective policy resource to the Texas Legislature, addressing such issues as transportation finance, safety and mobility to support state economic competitiveness and quality of life.

Other significant milestones during Christiansen's tenure include the opening of TTI's first-ever state headquarters building, which includes additional research space, and the commercializing of TTI-developed technologies in roadside safety and physical security, freight movement and innovative data collection methods.



TTI moved into its state headquarters next door to the Gibb Gilchrist Building in the Texas A&M University Research Park in 2010, the Institute's 60th anniversary year. The three-story, 66,700-square-foot building houses a state-of-the-art Visibility Laboratory, administrative offices and research staff.

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## 2006

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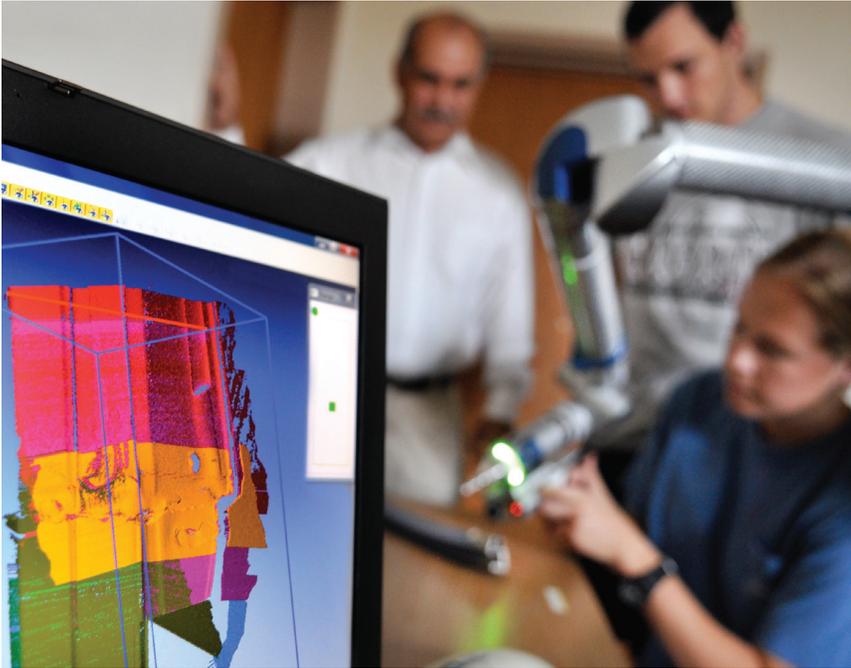


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TTI's work in homeland security is expanding with a \$7 million, five-year grant to conduct tests on perimeter security devices for the U.S. State Department to protect embassies and other government buildings against terrorists. To further these efforts, TTI opened an Advanced Scanning and Modeling Laboratory at its Proving Grounds Research Facility to conduct sophisticated computer-simulated crash tests.



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## 2006~Present

1. TTI researchers supported TxDOT on a landmark research study to analyze transportation needs in Texas from 2008 to 2030.
2. TTI has become well known for research on transportation finance and policy issues. Some of the areas in which TTI is supporting policy makers include transportation funding options, impacts of the energy sector on roadways, and border security and mobility.
3. Six research centers were created at TTI since 2006, including three national centers focused on railway, economics and mobility research and two centers created by the Texas Legislature.
4. TTI invented a traffic data-collection technology that reads unique addresses from anonymous wireless devices (such as Bluetooth® enabled devices) from vehicles and measures the travel time. The technology is significantly less expensive than previous technologies and aids in hurricane evacuations.
5. The Institute's researchers have received almost 50 U.S. patents, including a patent for the Freight Shuttle, a revolutionary freight transportation system concept developed at TTI that moves freight on an elevated guide way propelled by electric linear induction motors.
6. TTI has increased its environmental research capabilities by opening a new drive-in Environmental and Emissions Research Facility, the largest of its kind in the country.
7. Through TTI's annual *Urban Mobility Report*, the definitive national study on congestion costs and trends, as well as its managed lanes and congested corridor research, the Institute is gaining national recognition for its expertise on congestion management.
8. The names of all seven of the agencies under The Texas A&M University System had "A&M" added to their names by the Board of Regents in 2012. Texas Transportation Institute became Texas A&M Transportation Institute.
9. TTI's academic relationships are significant, with the addition of a graduate certificate in transportation planning developed in collaboration with its academic partners at Texas A&M University. TTI researchers employ and help train more than 200 students per year.



## Planning for the Future...

**T**he need for results-oriented transportation research has never been greater. Transportation connects all aspects of our lives: home, work, education, commerce and recreation. At TTI, we study all areas of transportation—including mobility, safety, economics, freight movement, human and behavioral factors, infrastructure, security, environment and workforce development.

The ever-changing landscape of transportation needs and new technologies, as well as funding issues and a rapidly growing population, create competing transportation priorities and opportunities. The Institute's research results provide reliable, objective information to industry leaders and policy makers to guide good decisions.

Through TTI's strategic planning efforts, the Institute has identified three imperatives that will receive primary focus over the next few years:

- **Strengthen the research program** - Building the TTI research program in a manner that produces long-term stability, diversifies the Institute's research portfolio and achieves a targeted annual growth rate of 3 to 5 percent.
- **Attract and retain exceptional staff** - Sustaining TTI's reputation as a premier transportation research institute by attracting the best minds and skills to support the Institute's research program and identifying the staff needed to address emerging transportation issues.
- **Develop and maintain key relationships** - Enhancing TTI's relationships with its research sponsors, A&M System officials, academic partners, legislative and congressional stakeholders, and key transportation industry leaders.

The goals, strategies and performance measures established for these imperatives are guiding the Institute in its pursuit of better ways to develop and maintain a safe and efficient transportation system—saving lives, time and resources.





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