



Texas A&M Transportation Institute 70 Years of Innovation





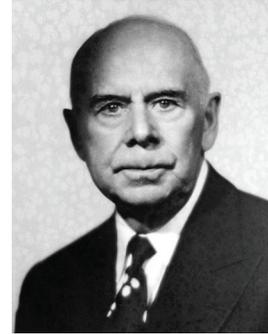
Texas A&M Transportation Institute's Founding Fathers



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

In the beginning...

When 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 THD from 1940 to 1967, had a vision that the state 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, Greer formulated the concept of a 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, 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, renamed Texas A&M Transportation Institute (TTI) in 2012, 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 Texas A&M and TTI, 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 65-plus years, through a 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 more than six decades, the Institute has conducted thousands of research studies addressing significant state and national transportation challenges. These highlights have been selected to tell the story of the Institute's work — and to illustrate the breadth, depth and diversity 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 director from 1955 to 1962, TTI's research contributions provided valuable guidance and technology to 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 Texas A&M, Benson was also an educator and mentor to many civil engineers who formed THD 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, creating new testing procedures, and developing new and improved pavement materials.

1955





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 paint. It was the forerunner of today's automated striping machinery.
3. TTI experiments proved the practicality of using a quality, lightweight structural 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



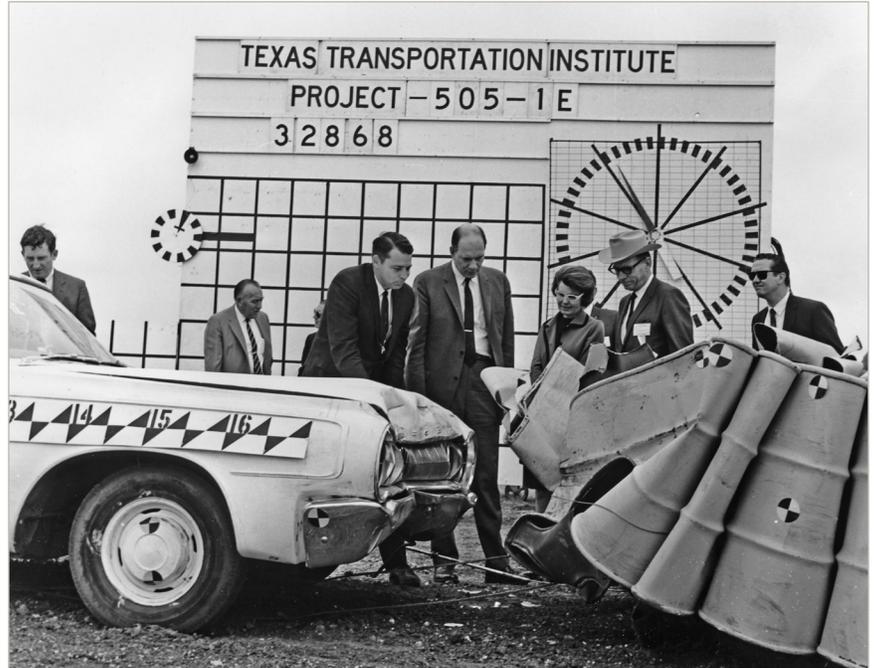
The Safety Boom...

Jack Keese
Director
1962–1976



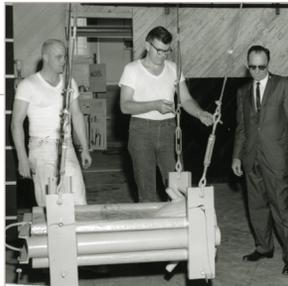
By far the most important aspect of highway transportation research between 1962 and 1976 was the recognition of the importance of highway safety issues to the traveling public, the government and the transportation community. Charles J. “Jack” Keese, a Texas A&M civil engineering professor and TTI researcher since 1955, led TTI during 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 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.

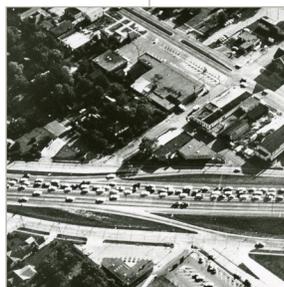
1962



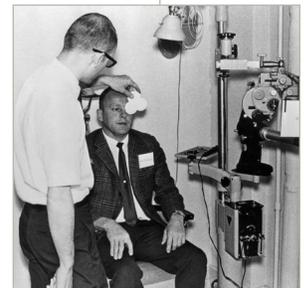
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The most lasting legacy of Keese's tenure is that despite a tripling in the number of vehicle miles traveled in Texas from 1965 to 1992, the number of deaths on Texas roadways each year remained virtually the same, and deaths per 100 million miles fell 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 the 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 the 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 structures at grade crossings.



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1976



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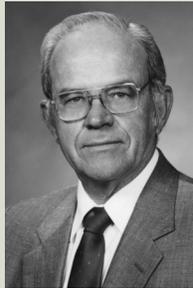
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Keepin' it Movin'...

Charley V. Wootan

Director
1976-1993



Dr. Charley Wootan took the reins in 1976, and 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. He also became the first president of the Council of University Transportation Centers. 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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TTI researchers began studying the integration of high occupancy vehicle (HOV) lanes on Texas freeways, with more emphasis given to research on 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 Progressive Analysis and Signal System Evaluation Routine (PASSER) II technology expanding to national use into the 1980s.

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 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 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 several performance measures 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 FHWA to approve its use on all federal-aid new construction and major reconstruction of freeways and other major roadways.



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1993



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Growing to Meet the Need...



Herbert H. Richardson
Director
1993–2006

In 1991, the U.S. Congress passed the Intermodal Surface Transportation Efficiency Act, 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. The institute successfully competed for four new national centers of excellence. 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, increasing 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 (ITSs) 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 a former airbase, the 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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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.

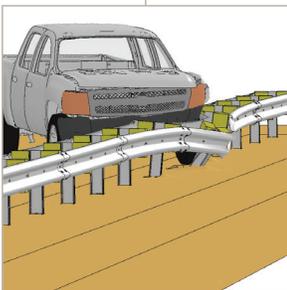
1993~2006

1. TTI had a pioneering role in early research on intelligent vehicle highway systems by using Texas urban areas as test beds for new real-time, automated technologies.
2. A continued study of the Gulf Intracoastal Waterway 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 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® 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 was designated as the home of the National Work Zone Safety Information Clearinghouse. With support from FHWA and the American Road and Transportation Builders Association (ARTBA), staff provided 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 across the state has resulted in hundreds of thousands of dollars saved in pavement maintenance and rehabilitation costs for TxDOT.



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2006



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Expanding Our Footprint...



Dennis L. Christiansen
Director
2006–2016

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 10 years that Christiansen served as director, research expenditures increased by 60 percent and the total operating budget increased by 52 percent. TTI facilities expanded from 216,000 square feet to more than 324,000 square feet with the addition of three new research facilities and offices in Waco, Texas; Washington, D.C.; and Mexico City, Mexico.

A major initiative guided by Christiansen was the repositioning of TTI to expand and diversify its research portfolio. Another major initiative was serving as a credible and objective policy resource to the Texas Legislature, leading to the formation of TTI's Transportation Policy Research Center.

Other significant milestones during Christiansen's tenure include 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 housed a state-of-the-art visibility laboratory, administrative offices and research staff.

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2006

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The Institute's researchers have received 62 U.S. patents, including 17 patents for the Freight Shuttle System, a revolutionary freight transportation system concept developed at TTI that was officially unveiled in September 2016 with the help of Texas Governor Greg Abbott.



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2016



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2006~2016

1. TTI researchers supported TxDOT on a landmark research study to analyze transportation needs in Texas from 2008 to 2030.
2. TTI increased its environmental research capabilities by opening the Environmental and Emissions Research Facility, the largest university-based, drive-in, environmentally controlled test chamber in the country, and expanding the capabilities of the Institute's Sediment and Erosion Control Laboratory.
3. Through TTI's annual Urban Mobility Scorecard, the definitive national study on congestion costs and trends, as well as its managed lanes and congested corridor research, the Institute gained national recognition for its expertise on congestion management.
4. TTI was recognized by the American Road and Transportation Builders Association with the Glass Hammer Award in 2011 for the advancement of women leaders at TTI and within the transportation industry.
5. TTI's work in homeland security expanded with a multimillion-dollar grant to conduct tests on perimeter security devices for the U.S. State Department to protect embassies and other government buildings against terrorists.
6. TTI was selected as team leader for two major FHWA multiyear contracts — one from the Office of Safety and one from the Office of Safety Research and Development — to provide technical support to improve highway safety, the first contracts of this nature and magnitude for which TTI has served as the lead institution.
7. TTI increased its capabilities in automated and connected transportation with the execution of more than \$12 million in connected vehicle/automated vehicle (CV/AV) research; the launch of the Campus Transportation Technology Initiative at Texas A&M to develop a smarter, safer and more efficient campus transportation ecosystem; and the signing of a memorandum of understanding with TxDOT to begin testing proven CV/AV technologies on the state highway system.
8. Christiansen championed the development of a new premier headquarters building at the A&M System's RELLIS Campus, which would house all College Station-based staff together in one location for the first time.



Embracing the Future...



Greg Winfree
Director
2016–present

In late 2016, The Texas A&M University System Board of Regents appointed Greg Winfree director of the Texas A&M Transportation Institute (TTI), bringing decades of legal, national transportation agency and private industry experience to the TTI leadership team. Winfree has embraced futuristic transportation technologies, including connected transportation, big data solutions, and the intersection of transportation and public health. He immediately developed a collaboration in transportation policy with the Texas A&M College of Law and was appointed an adjunct professor for the college in 2019.

Winfree's guidance has also led to the development and implementation of TTI's new five-year strategic plan, an enterprise-wide approach with broad buy-in from employees. The plan is designed to strengthen TTI's base and position the Institute for a successful future during this unprecedented time when mobility is being transformed through technology, data-driven decisions and, most recently, COVID-19 impacts. TTI's research expenditures have topped \$66.7 million under his leadership.



In 2019, TTI's new state Headquarters Building opened for business on The Texas A&M University System RELLIS Campus. The multilevel, 178,380-square-foot facility supports research programs and administrative offices for TTI's Bryan–College Station staff, previously housed in four different facilities. The TTI Headquarters Building at RELLIS marks the first time since TTI's early days that local staff are housed in a central location.



2016



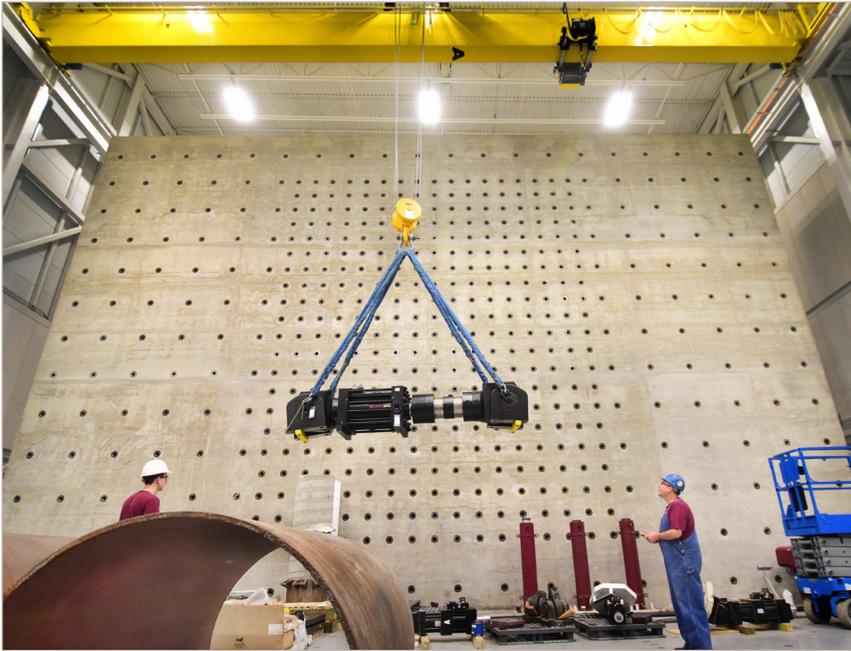
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TTI plays a lead role in ensuring the success and growth of the Center for Infrastructure Renewal (CIR), which opened on the RELIS Campus in 2018 and adjoins the TTI Headquarters Building. TTI maintains 7 of the 12 state-of-the-art laboratories in the CIR and routinely collaborates with the Texas A&M Engineering Experiment Station and CIR stakeholders to further the mission of infrastructure renewal for the state and nation.



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present



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2016-present

1. TTI's modernized and upgraded Driving Simulation Laboratory now includes a simulator that more closely resembles the inside of a vehicle, including an eye tracker and software, that researchers can use to create research scenarios involving automated vehicles. Smaller touch-screen displays complement the larger displays' ability to convey connected-vehicle information to drivers.
2. TTI developed a new industry partnership at the RELIS Campus with Neology. The company has installed a gantry for testing toll and intelligent transportation system technologies, and has office and warehouse space at RELIS and staff housed in the TTI Headquarters Building.
3. Working with the Permian Strategic Partnership (a coalition of 20 leading Permian Basin energy companies), TTI established an A&M System-level research agreement and task orders to document the economic impacts of needed roadway repairs in the Permian Basin and to develop safer highway access points for drilling and production activity in conjunction with the Texas Department of Transportation.
4. TTI is leading an online Master of Science degree program for the College of Engineering that is intended for transportation professionals with a minimum of five years of work experience. The target date to begin the program is the fall semester of 2021.
5. TTI released its biannual *Urban Mobility Report* in 2019, a comprehensive analysis of traffic congestion and mitigation measures in 494 urban areas across the nation. The report resulted in articles published in 1,764 print, online, radio and television media outlets.
6. Led by TTI, the Texas A&M University Campus Transportation Technology Initiative and the Transformational Mobility Plan have focused on innovatively improving transportation on campus. These efforts have resulted in the first trial of a low-speed autonomous shuttle on the road and in mixed traffic in Texas, demonstrating a marked improvement in traffic flows for large activities and sporting events.
7. TTI's progress in use of big data for innovative data applications and visualizations has led to expanded research in traffic congestion strategies, improved border planning and air quality, and safer roadway designs.



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