

TEXAS TRANSPORTATION

Researcher

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SAFETY SAVES



Special Section: Forty Years of Crash Testing



Center for Transportation Safety



Planning and Design



DISCUSSING THE FUTURE OF TRANSPORTATION SAFETY

{ *Center for Transportation Safety Advisory Council meets for the first time* }

Transportation-related deaths and injuries in Texas and throughout the United States are unacceptably high. Motor vehicle crashes are the leading cause of death for persons between the ages of three and 34. Clearly motor vehicle crashes present an incredible burden to individuals and society as a whole. The Center for Transportation Safety (CTS) at the Texas Transportation Institute (TTI) is at the forefront of exploring ways to prevent vehicle crashes and soften the blow society suffers from each one.

Since its establishment by the Texas Legislature in 2001, CTS has sought to become the focal point for transportation safety in Texas by:

• **E D U C A T I N G**

Providing students hands-on training and guidance in transportation safety and safety-related research

• **A N A L Y Z I N G**

Conducting research to reduce the morbidity and mortality associated with transportation in all its modes

• **S H A R I N G**

Providing safety information to other professionals and the public

• **C O L L A B O R A T I N G**

Promoting collaboration between professionals from different disciplines in the cause of transportation safety

• **E V A L U A T I N G**

Assessing the effectiveness of different plans, programs, and policies that have been implemented to reduce transportation-related deaths and injuries

• **D I S T R I B U T I N G**

Serving as a resource to the Legislature and various state agencies by developing new plans, programs and policies that may reduce transportation-related deaths and injuries in Texas

The legislation that created CTS, Senate Bill 586, provided for the activities of CTS to be guided by input from a “board.” By the fall of 2003, it was decided that CTS had grown to the point that it could productively use the guidance of an advisory “board.” The Center, therefore, recruited a formal Advisory Council.

Because, like most other parts of TTI, the Center’s work tends to be “Texas-centric,” the makeup of the Advisory Council reflects the Center’s need to be well informed about the traffic safety needs of the Lone Star State. Nine of the ten Advisory Council members are Texans.

Advisory Council member Carlos Lopez represents the Texas Department of Transportation. Two other Texans, Georgia Chakiris and Dan Reagan, are the local representatives of federal agencies with major traffic safety responsibilities – the National Highway Traffic Safety Administration and the Federal Highway Administration. The Texas Department of Public Safety is an important source of safety data (crash statistics and driver records) for CTS research and is represented by David McEathron.

Traffic crashes are increasingly being viewed as a public health problem, and that perspective is brought to the Center’s Advisory Council by Sharon Cooper from Texas A&M’s College of Rural Public Health. Similarly, the insurance industry is interested in the work of the Center and is represented on the Advisory Council by David Melton of the Liberty Mutual Research Institute for Safety in Hopkinton, Massachusetts.

Two local government representatives also serve on the Center’s Advisory Council – Ned Levine from the Houston-Galveston Area Council and Beth Ramirez from the City of Dallas.

The Advisory Council roster is rounded out by Bill Webb, CEO of the Texas Motor Transportation Association, which represents the trucking industry in Texas, and Quinn Brackett, the Council’s chair, a retired TTI researcher with wide experience in dealing with traffic safety issues.



TTI Agency Deputy Director Dennis Christiansen welcomes the Center for Transportation Safety (CTS) Advisory Council during their first meeting at the Gilchrist Building in College Station. The Advisory Council was formed to offer guidance to CTS.

“There was good interaction among the committee members and we had many questions when we did our presentations. It was a real productive meeting.”

David Willis, TTI senior research scientist

The Advisory Council met for the first time in May at the Gilchrist Building in College Station. The meeting helped familiarize the board about the different programs within CTS and the research the Center has been performing the last two years.

“I think we were all satisfied at what a successful meeting it was,” says David Willis, senior research scientist with TTI. “There was good interaction among the committee members and we had many questions when we did our presentations. It was a real productive meeting.”

TTI Agency Deputy Director Dennis Christiansen kicked off the meeting with a welcome and introductions. CTS Director John Mounce followed with an overview of the program. Then CTS staff made presentations throughout the day on topics ranging from human factors to survey research. The meeting closed with a tour of the driving simulator.

“One of the things we wanted to do is get the council’s input on what we ought to be doing,” says Willis. “There were a number of suggestions made, for example, in driver training, and trying to demonstrate about whether it does good from a safety perspective.”

Other topics discussed during the meeting were communicating TTI’s research by publishing research in peer-reviewed journals and trade publications, and quantifying the true costs to society of crashes. **R**



MORE INFORMATION

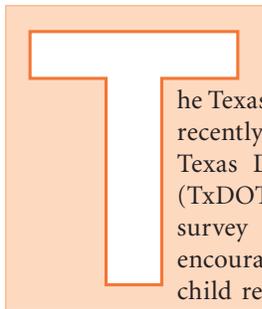
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Additional information on the Center for Transportation Safety can be found at <http://tti.tamu.edu/cts/>.

Small Straps Save Lives

Twentieth year of TTI survey shows positive trends in child restraint use



The Texas Transportation Institute (TTI) recently completed its 20th year of the Texas Department of Transportation (TxDOT)-sponsored child restraint survey in Texas. Among the most encouraging observed trends is that child restraint use has increased from 22 percent to 73 percent during that time period.



Dana Parks makes sure her son, Mitchell, is properly secured in his car seat.

The survey is conducted by collecting data at day care and shopping centers in selected cities throughout the state for children from birth through 4 years.

“From the time we first began conducting the survey, the child passenger safety industry has evolved, and new laws have been written prompting updates in the equipment available,” says Katie Womack, senior research scientist with TTI who has led the survey for 17 of its 20 years.

Among the factors in the rise of child restraint use was the passage of several key pieces of legislation governing how children should be restrained in vehicles.

- 1984: Texas becomes the 49th state to pass a law requiring children to be restrained. This landmark bill made it illegal for any person operating a car or light truck to transport a child under the age of 2 without being secured in a child restraint seat. It also required that children under the age of 4 either be secured in a child restraint seat or safety belt. Before the law passed, TTI observed only 22 percent of children restrained in a child seat. The next year that figure jumped to 39 percent.

- 1986: The mandatory seat belt law for all front seat occupants was passed. Child restraint use increased to 60 percent. Usage levels off after that and begins a slow but steady upwards trend to where we are today.

- 2001: Children under 36 inches in height or under 4 years are required to be in a child safety seat. Prior to this, children under 2 were required to be in child safety seats, but children ages 2 and 3 were allowed to be restrained in vehicle safety belts. The fine also increased to “up to \$200.”

Despite the positive trend in child restraint use, Womack is quick to point out that there is much room for improvement. “There is even more that can be done to boost that level,” she says. “We still have an enormous misuse problem in addition to nonuse.” Common mistakes include placing children in forward-facing seats too soon, having the harness straps too loose and having the seat itself not secured to the vehicle tightly enough.

“An annual survey is important to show the progress that Texas has made, to assist in securing child passenger safety funding for our state, and to help map the direction for the future,” says Susan Warren, TxDOT occupant protection program manager. **R**

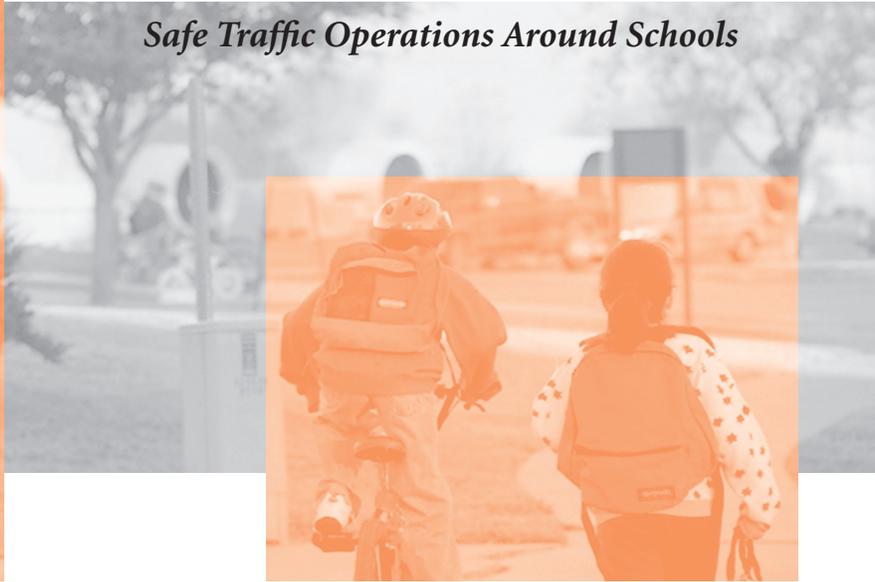


MORE INFORMATION

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Children First!

Safe Traffic Operations Around Schools



All across Texas, old schools are closing, and new ones are being built. It is an effort to meet educational demands and also account for shifting populations and explosive growth in suburban and rural areas. Many of the newest schools, especially in rural areas, were constructed adjacent to highways designed for low volume and high speeds. Stop-and-go traffic as well as long lines of vehicles backed up on roadways created safety concerns.

In recent years, the Texas Department of Transportation (TxDOT) embraced a unique program known as *Precious Cargo*. Its goal: review school site plans and recommend traffic pattern improvements and estimated costs prior to construction. So far, more than 180 schools in 70 districts statewide have benefited from the program and more are considering participation.

"This project has been very successful," says Linden Burgess, traffic systems manager in TxDOT's Dallas District. TxDOT recommended a number of safety improvements at these schools including improved signage and the addition of left- and right-turn lanes on the highway. "It improves the safety of parents and students entering schools by providing a "storage effect" of traffic moving onto school property," Burgess said. The addition of those turn lanes and

movement of traffic off the highway helped traffic safety engineers avoid gridlock during peak traffic times.

The success of *Precious Cargo* has led to the need and development of statewide guidelines that could also be customized to meet distinctive demands of local school districts. A two-year research project sponsored by TxDOT and conducted by the Texas Transportation Institute (TTI) is doing just that. "We're developing transportation-related guidelines that TxDOT can propose and disseminate to local school districts," says TTI researcher Scott Cooner.

Following two years of research and field studies at 20 school sites, the research team developed guidelines and good examples for design and operation of transportation improvement structures around schools. Some of those guidelines include a review of the school's trans-

portation layout and its relationship to nearby highways. For new school construction, site selection criteria are recommended. Other guidelines include general site requirements and design, parking options, bus operations, parent drop-off and pick-up zones, pedestrian and bicycle access, driveways, turn lanes and traffic control devices. "Our critical goal is to ensure that children are loaded and unloaded on school grounds avoiding the queuing of vehicles on the highway," says Cooner.

TxDOT's commitment to this safety program is widespread. Partnerships with local governments, architects and consulting engineers were key in the formulation of the guidelines. That collaborative effort could prove crucial to the success of the program.

Even though the research is complete, the work is only beginning. In addition to providing printed materials, TxDOT is sharing the guidelines through direct contact with school districts, local governments and the architecture industry. ■



MORE INFORMATION

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WRONG-WAY TRAGEDIES

A Persistent Freeway Predicament



MORE INFORMATION
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They account for less than 1 percent of the accidents that occur on Texas roadways each year. But when they happen, they're often deadly.

“We looked at four years of Texas crash data for the Texas Department of Transportation (TxDOT),” says Scott Cooner, a Texas Transportation Institute (TTI) researcher working to pinpoint guidelines that will help reduce the number of wrong-way accidents by proposing a series of countermeasures. “The recommended guidelines documented in this report are very important because they provide TxDOT staff with preventive measures for reducing the frequency as well as the severity of wrong-way accidents,” says Roy Parikh, assistant director of Traffic Operations in TxDOT’s Fort Worth District.

Drivers entering freeways going the wrong way pose a serious risk for themselves, the passengers they might be carrying and motorists they’re likely to meet. “Wrong-way driving on freeways accounts for about 25 fatalities a year statewide and a significant amount of serious injuries,” according to Cooner. The economic impact is substantial, totaling between \$23 to \$25 million a year, he says.

Since the 1950s, with the implementation of the interstate highway system, wrong-way accidents have been a persistent problem, despite continuing efforts to improve highway design, marking and signing at freeway interchanges. Several accidents in TxDOT’s Fort Worth District brought renewed attention to the problem.

According to research conducted by TTI, several factors contribute to wrong-way accidents in Texas. Of the 323 crashes investigated, almost half, 48 percent of the drivers, were between 18 and 35 years old. Men were more likely to be involved. Alcohol and other drugs were most likely a contributing factor. “We discovered that most of the accidents happened in the middle of the night,” said Cooner. “About 2 a.m.—that’s about the time bars close, and more often than not, men are behind the wheel,” says Cooner.

Contributing factors aside, the research documents best practices nationwide and recommends guidelines for use in Texas. Some guidelines target “left-side” exit ramps on freeways. Although left exits are rare, the research recommends wrong-way pavement arrows if they are not already in place. In future freeway construction, left-side exit ramps should be avoided. The guidelines also recommend repairing deficient pavement arrows and making their maintenance a priority.

The research also suggests the use of lower “DO NOT ENTER” signs and “WRONG WAY” signs mounted together on the same post to address alcohol and nighttime problem locations. “We just want to convey the right message at the right place and save some lives,” says Parikh. **R**

Safety: Highway Design Initiatives

Taking safety from the roadside to the roadway

The Texas Department of Transportation's (TxDOT) proactive commitment to highway safety is moving toward including quantitative safety analysis earlier in the project development process than has been possible in the past. Its sponsorship of a six-year Texas Transportation Institute (TTI) research project is targeting safety at the earliest stages of highway planning. The results could save lives on state highways.

"Safety has always been a primary focus," says Elizabeth Hilton of TxDOT's Design Division. "We have the tools necessary to measure the quantitative aspect of a highway project, its construction cost, its environmental impact and influence on traffic. However, we do not have the quantitative tools necessary to determine the level of safety of a particular roadway design. This research project will give us that," she said.

The research is considering all highway travel modes including pedestrian and bicycle. When complete, highway engineers can expect safety design guidelines, participate in safety awareness workshops and share information through a web-based safety design clearinghouse. The information would address new construction, major reconstruction and 3R construction, which includes resurfacing, restoration and rehabilitation.

"Our cooperative efforts have contributed immensely to protecting drivers from the hazards of the roadside but the roadway itself hasn't received much attention," says TTI Research Engineer James Bonneson. "This project will help us understand improved roadway safety design in terms of curvature, slope, median treatments and shoulder widths."

Another key component of the research includes a proactive rather than reactive element. TxDOT is seeking solutions to performance problems prior to construction. "Traditionally we design and build highways and when a problem occurs, we go out and fix it," says TTI Research Engineer Kay Fitzpatrick. "We need to look at safety early in the design process and develop tools to predict safety performance and identify solutions."

Design considerations will incorporate the needs of rural and complex urban transportation configurations. "In dense and populated urban areas there are numerous consequences to every design choice," says Bonneson. "We want to give TxDOT evaluation tools to help engineers determine the safety challenges and solve them in the design phase without adding undue burdens in the planning or construction process," he says.

Researchers expect to produce a customized Texas safety design plan by applying current practices and incorporating national safety initiatives. "It is important that the national efforts to develop these safety tools are incorporated into the civil design and other software packages routinely used by engineers during project development," says Hilton.

TxDOT design engineers will not have to wait until the research project is complete before learning about and implementing new safety initiatives. As researchers accumulate information during the six-year research period, it will be shared with TxDOT in the development of new safety tools and through manual updates. The ultimate goal: save lives and reduce the number of accidents. **R**

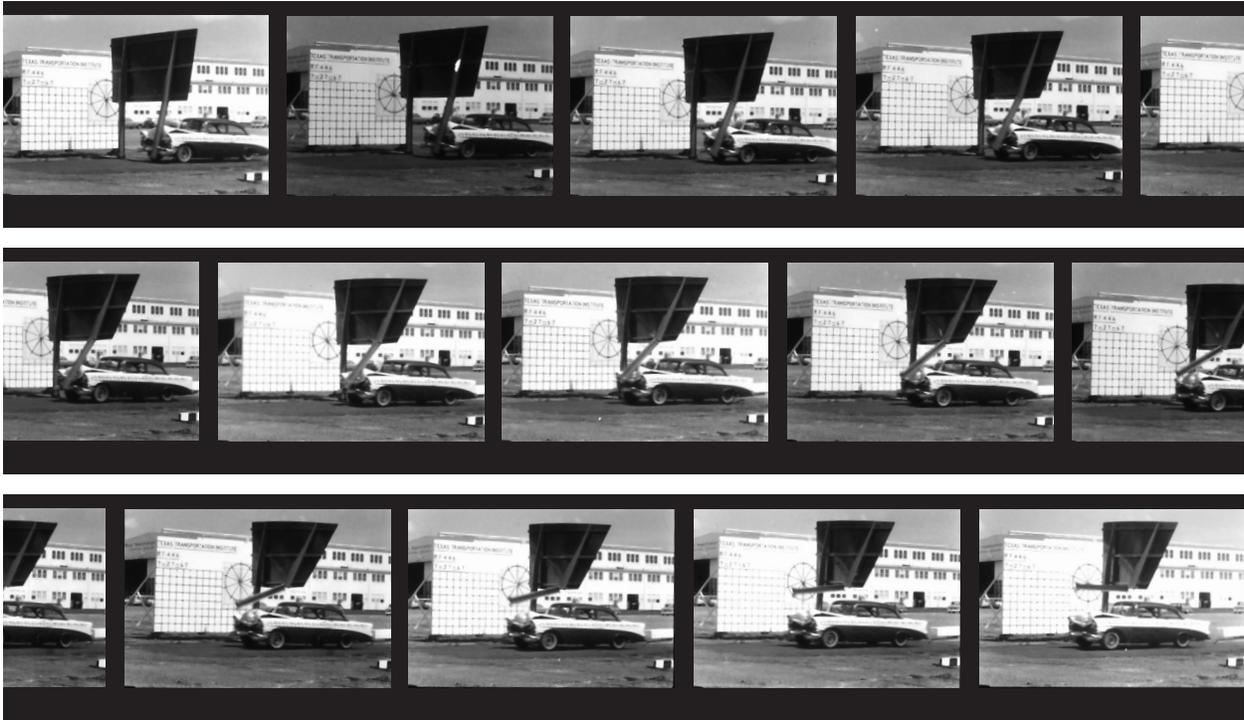


MORE INFORMATION

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These jumbled remains: revealing the secrets of roadway safety and homeland security

Riverside Facility is among the elite centers of crash testing



From 1943 to 1961, a primary objective at the Bryan Army Air Field was to avoid crashes. Activated in 1943 as an instructors' school, the pilots at the field were tasked with developing a standardized system of instrument flying. The 2,000-acre Bryan Air Force Base, located 12 miles west of Texas A&M University, was the only instrument-training school of its kind.

When the air force separated from the army in 1947, the Bryan Army Air Field became the Bryan Air Force Base, a title it held until it was deactivated in May of 1961. It was deeded to Texas A&M University in 1962 and became known as A&M's Riverside Campus.

Two years later, in 1964, the focus of work at the facility was still centered on crashes, but now transportation engineers were causing safety-related crashes for research, rather than scrambling to prevent them. With sponsorship from the Federal Highway Administration and the Texas Department of Transportation (TxDOT), breakaway signposts were the first safety innovation developed at the Texas Transportation Institute's (TTI) newly named Proving Grounds Research Facility.

"The work at the Riverside Crash Facility was probably the most important thing in the development of TTI's worldwide reputation in safety research and development," says Neil Rowan, retired TTI research engineer and Civil Engineering professor at A&M. "On January 1, 1965, Leon Hawkins of the Texas Highway Department (THD) Bridge Division announced the new breakaway sign design that was on that date adopted as the THD standard. I tell you this to illustrate the value of the crash test facility. Had it not been for the facility, the dedicated TTI and THD people, and the cooperative effort of the TTI/THD team, such an accomplishment would have been impossible."



Aerial photos of the Proving Grounds Research Facility, an expanse of paved runways ideally suited to perform full-scale testing of safety designs.

According to Gene Buth, head of TTI's Safety and Structural Systems Division, the breakaway post slips from its base when struck by a vehicle, allowing the vehicle to safely pass underneath. These specialized safety devices were tested in 1964, and a scant eight months later they had already appeared on roadsides and were saving lives.

"For over four decades, TTI's proving grounds at Riverside have provided some of the most visible and best-known research ever undertaken at TTI," says Dennis Christiansen, TTI's deputy director. "Working with sponsors such as the (then) Texas Highway Department and the Federal Highway Administration (FHWA), in the 1960s and 1970s, safety innovations such as the breakaway signs, breakaway light poles and crash cushions were first developed and tested at the TTI Riverside Facility. These are now routinely deployed in roadways all over the world."

The Proving Grounds Research Facility is entering its fifth decade as a world-class center of safety research. TxDOT, FHWA, and the U.S. Departments of State, Energy and Homeland Security continue to turn to this facility for cutting-edge research, because researchers there have nimbly adjusted and increased the research program to accommodate safety needs today and to anticipate such needs in the future.

"During the last 10 years I have been involved with various crash tests at the Riverside Facility," says Dick Albin, assistant state design engineer for the Washington State Department of Transportation. "The testing performed there has produced designs that have saved lives, reduced maintenance cost and exposure, and provided safe, aesthetic alternatives for use in our State, in our nation and around the world. The engineers at the Riverside campus are well-respected experts."

Homeland security is a major area the safety program is now addressing. Dean Alberson, associate research engineer in TTI's crashworthy structures program, estimates that homeland security makes up one-quarter of their current research program. The other 75 percent is dedicated to highway safety.

"We had some homeland security research proposals in progress prior to 9/11," says Alberson. "Having that in place before September 11th gave us a jumpstart."

Much of the work underway involves testing fortifications for sensitive locations around the world. Gates, retractable bollards (posts that prevent vehicles from entering an area), net systems, and other means of stopping potential vehicle bombs are tested to ensure that they comply with federal standards.

"September 11th changed our whole way of thinking," says Alberson. "And it obviously changed where we put our money," says Alberson.

Mark Bloschock, special projects engineer for TxDOT's Bridge Division, says the rewards he sees from TTI crash testing research exceed economic savings for taxpayers.

"Highway safety research can easily be shown to save taxpayer dollars, but more important are the human lives saved and the motorist injuries that are lessened or altogether eliminated as a result of this work," says Bloschock.

When Buth speculates about the crash test program over the next decade, he sees growth both in homeland security research and in the aesthetics of highway facilities—a marriage, of sorts, between the landscape engineering and highway safety engineering. Such testing ensures that engineers know the effects that even subtle changes to landscape materials, colors, textures and thickness can have. Creating harmony between safety and beauty is just one aspect of work that will keep the engineers at the TTI Proving Grounds busy.

"I thoroughly enjoy what I do," says Buth. "I feel as if I'm making a good contribution."

Alberson echoes those sentiments from his perspective as a former crash reconstruction engineer.

"Everyone here is pulling in the same direction," says Alberson. "All I have to do is look at the declining number of deaths per vehicle mile, and I can go home at night and feel I've made a difference." **R**



MORE INFORMATION

For more information, contact Gene Buth at (979) 845-6159 or g-buth@tamu.edu and Dean Alberson at (979) 458-3874 or d-alberson@tamu.edu.



To visit the Safety and Structural Division's website, see <http://tti.tamu.edu/inside/cdv/>.



▲ 1943

Bryan Army Air Field, six miles west of Bryan, was activated as an instructors' school for standardizing a system of instrument flying.

▼ 1947

The US Army and US Air Force separate, and Bryan Army Air Field becomes Bryan Air Force Base, Bryan AAF. It would be deactivated in May 1961.



▼ 1962

Bryan AAF is deeded to the Agricultural and Mechanical College of Texas (now Texas A&M University). 1,991 acres are handed over; the site is operated as A&M Research and Extension Center.



▼ 1964

TTI opens a research and development center at the Texas A&M University. Numerous buildings, a concrete runway, and nearly 2,000 acres of space for testing.



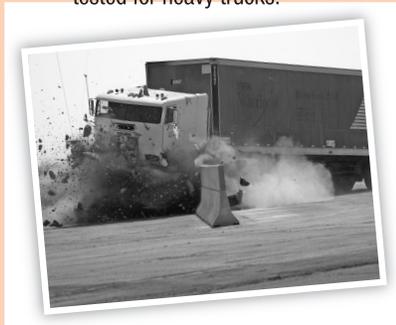
RIVERSIDE CRASH TESTING

▲ 1973

Researchers took advantage of a rare snowfall to test skidding and stopping distances under icy conditions. These studies proved so successful that in 1978, FHWA established the Central/Western Field Test Center at the Annex.

▼ 1978

Prior to this time period, crash testing of bridge rails was not widespread. TTI researchers pioneered design and testing criteria throughout this era, and some of the first bridge rails were designed and tested for heavy trucks.



▲ 1984

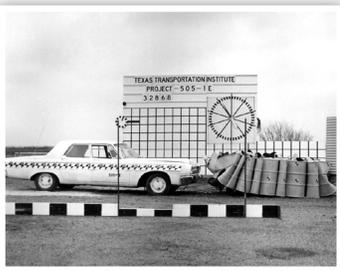
TTI researchers proved the inaccuracy of a 20-year-old myth—that truck tires do not hydroplane. The test trailer "Myth Buster No. 1" was constructed to provide vital information in understanding truck-trailer loss of control in wet weather.

▼ 1988

ET-2000—(E) was designed by TTI researchers at the Texas Transportation Institute. This device, seen in numerous tests of guardrails, is the first of its kind in the country by which impact tests are conducted to a controlled 200,000 ETs i



Research laboratory
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 nt Annex, with
 ings, 250 acres of
 ys and taxiways,
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 g.



▲ 1964

A major development early in TTI crash testing was the breakaway sign. This technology allowed a vehicle to impact a sign and pass safely underneath.

▼ 1965

The first documented case of a life saved by TTI crash testing technology. In September a driver skids into an "EXIT" sign on IH-10 near Beaumont. Less than 24 hours before the accident a breakaway sign support had been installed, likely saving this driver's life.



▲ 1968

TTI develops the first cushion technology, the 55-gallon drum, or barrel crash cushion. The importance of this first-ever crash cushion cannot be overstated, as vehicles that otherwise would have smashed into bridge supports were more safely brought to a non-lethal stop.



CRASH TEST FACILITY: 1943-2004



▲ 1991

TTI develops a low profile portable concrete barrier that is especially well suited for two-way traffic. This barrier, some 12 inches shorter than the previous standard, allows drivers a greater field of vision. The barrier's shape, somewhat larger at the base, is designed to reduce the tendency for a vehicle to vault through the air on impact with the barrier.

▼ 2002

New Terminal for cable/wire/rope guardrail—currently licensed to two companies, this innovative terminal system allows posts along a roadway to safely break over and release the cable rather than vaulting errant vehicles.



▲ 2001-Today
Homeland Security

—now represents fully one-quarter of crash test research at TTI. The U.S. Department of State and other governmental departments have asked TTI to evaluate anti-ram walls, bollards, gates, nets, and other means of protecting embassies and other buildings from the threat of vehicle bombs.

extruder Terminal - 2000)
 developed and tested by
 at the Texas Transportation
 yellow-and-black-striped
 nationwide on the end
 is saving lives across
 bringing vehicles
 the end of a guardrail
 stop. There are over
 n use across America.



>> IMPACT FACTS >

What weighs 40 tons, is covered in stickers and barrels into concrete walls at 60 MPH? Answer: Riverside's next victim. After decades of testing and hundreds of violent collisions, this elite research facility has seen automobiles perform acrobatics, seen them pilot themselves driverless down runways and seen one voraciously gobble up a high-speed camera.

BIGGEST

vehicle crashed: an 80,000-lb tanker truck

smallest

car crashed: a 1,250-lb Daihatsu Domino

Highest

speed crash: 70 MPH

Slowest

speed crash: 20 MPH

COST

of an average test—in round terms, \$28K for a pickup test, not counting installation of test article; \$80K for a tractor trailer test

MOST Exciting

one car jumped off the cable guidance system and headed down the runway; another leapt over the guardrail and swallowed a high-speed camera into the truck's engine compartment; some test installations have flipped cars 5 or 6 times

Climate

Whereas snow shuts down testing facilities up north for months, Riverside is accessible for testing virtually 365 days a year. "Our year-round ability to test helped secure a large test for the Department of Energy," says Dean Alberson. "They wanted to run the test early in the spring, and we were the only facility available to do that."

SPECIAL FEATURES

Riverside is unique among similar facilities for its ample, paved runway space and wide-open acreage, which allows for multiple, simultaneous research projects. "We're always building and always wrecking," says Gene Buth.

Recipe for a crash test.

(Don't try this at home)

So, you're interested in preparing a crash test? Well, with the steps listed below, a degree in engineering, a healthy dose of research sponsorship and a world-class testing facility, you're on your way to wrecking a vehicle and perhaps discovering what it takes to keep motorists safe.

Engineers at the Texas Transportation Institute's (TTI) Proving Grounds Research facility say the first step is to find an appropriate vehicle.

STEP 1



TTI regularly crashes 1,800-lb Geo Metros (within 6 model years), single-cab three-quarter ton GM pickups, which weigh in at roughly 4,500 lb, or F-700, U-Haul-type trucks that tip the scales at a hefty 15,000-lb. No salvage or rebuilt vehicles are allowed. TTI uses vehicle wholesalers who compete against each other on cost for vehicles that meet TTI specs. The wholesaler brings the vehicle to TTI once a price is agreed upon.

STEP 2

Next it's important to get the vehicle in good operating condition. Suitable tires are fitted, the front end is aligned if needed and sometimes a disabled engine



is repaired to speed up moving the vehicle into place for the crash test.

STEP 3

Then, the welders take over. They weld a tow hook under the front of the vehicle, and install machined assemblies on either



the left or the right front spindle. Meaning, this is the anchor point where a cable system is attached in order to guide the vehicle into impact. Workers strip out most of the occupant compartment seats and carpet. In some cases researchers mount instruments to the raw metal inside the now sparsely decorated vehicle.

STEP 4

Remove the fuel and/or fuel tank. Finish putting the instrumentation (to measure results) in the vehicle. Ballast



to make sure the vehicle is the proper test weight, then apply measurement stickers all over the exterior. These are used to measure speed and displacement on high-speed video and 16 mm film.

STEP 5

Very large vehicles are driven to their doom by remote control. However, most vehicles are propelled to impact with a tow cable. A tow cable hooks to the front of a vehicle. Then, a cable is attached to the tow hook. The cable loops around two pulleys on the ground, and then it hooks to a tow truck driving the opposite direction and anchored to the ground. The system of



pulleys double the speed of the towed vehicle, so the vehicle crashes into an obstacle at twice the speed of the towing truck. Meaning, if the tow truck is traveling 15 MPH the vehicle being towed into the crash is traveling at 30 MPH. Just prior to impact, both the guide and tow cables are released.

STEP 6

The spectacular end of the crash test is only the beginning of a detailed analysis of crash photos and videos and an intensive study of the crash data supplied by instruments on the wrecked vehicle.



MORE INFORMATION

For more information, contact Gene Buth at (979) 845-6159 or g-buth@tamu.edu.

SAFETY CUTS BOTH WAYS

Roadside solutions & safer travel benefit both transportation professionals and the traveling public

From a technology that helps us safely cross bridges, to guardrails unfriendly to weeds but benevolent to vehicles, to easily portable barriers that keep vehicles out of places they shouldn't be, such research developments are regularly sponsored by the Texas Department of Transportation (TxDOT) and conducted at the Texas Transportation Institute (TTI).

Bridging the gap

Guardrails and bridge rails are related family members, but their designs are quite different. Whereas a guardrail is meant to be somewhat flexible (so it can reduce impact severity), a bridge rail needs to be rigid enough to keep your SUV out of the swamp. There are thousands of instances in Texas where a guardrail leads up to the beginning of a bridge, at which point the bridge rail begins. Without some kind of transition between these two safety features, the guardrail can deflect enough to permit a crashing vehicle to impact the leading edge of the bridge rail—an extremely serious crash in the making.

Following NCHRP Report 350, a national guideline for crash testing, researchers at TTI significantly im-

proved safety by designing specialized lengths of guardrail that smoothly transition the stiffness between the approach guardrail and bridge rail. Recognizing that light trucks (pickups, SUVs, minivans, full size vans, etc.) now comprise more than half of all new vehicle sales, Roger Bligh, manager of TTI's Roadside Safety Program, and his team crash tested 4,400-lb pick-up trucks into guardrail to bridge rail transitions at an angle of 25 degrees and a speed of 62 MPH. Accommodating vehicles with high centers of gravity, such as light trucks at high speeds, requires the use of transitions that are costly and complex to install. Often, a curb is required along the transition section to help redirect the vehicle, thus adding to the overall cost and complexity of high-speed transitions.

"We were able to reduce the overall length of the transition, eliminate the need for a curb, reduce the number of posts in the ground, and demonstrate the new low-speed transition is safe for roadways with speeds of 45 MPH or less," says Bligh.

The low-speed transition meets safety specifications but costs significantly less than high-speed transitions. This frees up money that Bligh says could benefit other parts of the transportation system.

Solving a summertime hassle

Mowing. We can't escape it, especially not along our 79,000 miles of Texas roadways. Though many roadsides can be maintained from high atop a tractor with a mower trailing behind, mowing around guardrail posts is a major headache for maintenance workers.

Guardrail posts have traditionally been installed in soil, which allows the post to move, or deflect, on impact with a vehicle. This deflection helps absorb the energy of a crash.

Many roadway maintenance groups extend the pavement to encase the posts and prevent weeds

A bridge guardrail crash test illustrates the effectiveness of the new bridge rail transition designed to smoothly transition the stiffness between the approach guardrail and bridge rail.





The new guardrail post design resists vegetation growth.

and grass from growing up around them. This solves the mowing issue, but encasing the post in concrete or asphalt prevents it from doing its most important job—deflecting safely in a crash.

TTI studied a number of ways to eliminate vegetation around posts while allowing the guardrail post to perform acceptably in a crash. The solution was as simple and inexpensive as it was innovative and elegantly simple. Grout.

Researchers paved around posts, leaving a gap, or “leave-out,” in the pavement layer around the posts, then filled the top several inches of the leave-out with a two-sack grout mixture of sand, cement and water. This grout material resists vegetation growth but crushes when subjected to impact loads. This permits the guardrail posts to deflect through the underlying soil as desired and gives transportation landscape workers a low cost, low maintenance, safe solution to a common problem. A standard detail sheet has been developed for this practice, and TxDOT is implementing this approach across the State.

Lowest in the country, and that’s a good thing

Ask most any roadway worker in Texas if they could make use of a pre-cast concrete barrier that is a third the size of their standard barriers, performs well under crash circumstances and that can be moved into place with readily available equipment, and they’d probably say, “you bet.”

“Having the ability to develop and crash test new innovations in Texas, at TTI, has given TxDOT an opportunity to witness and be part of the improvements in safety to our roadside environment.”

Rory Meza, Director, Roadway Design Section
TxDOT Design Division

With TxDOT sponsorship, TTI developed a new, portable concrete barrier with an innovative connection that has the *lowest deflection* of any such barrier in the country. And rather than waiting days to schedule a crane to move standard, 30-ft barriers into place, the 10-ft lengths can be moved with a commonplace front-end loader—thus speeding up emergency responses and lessening the time it takes to deploy barriers on a job site.

“The development of a temporary concrete barrier connection with significantly reduced lateral deflection than those connections being used now has national significance,” says Rory Meza, Director, Roadway Design Section TxDOT Design Division. “The safety of the traveling public and the workers behind the barrier are of utmost importance to TxDOT.” **R**



MORE INFORMATION

For more information, contact Roger Bligh at (979) 845-4377 or rbligh@tamu.edu.

For more information about low-speed transitions see Report 0-4564-1. To learn more about guardrail encased in pavement mow strips see Report 0-4162-2. Additional information on the newly developed portable concrete barrier can be found in Report 0-4162-3 and Report 0-4692-1.



The portable concrete barrier being tested in the above series of photos has the lowest deflection of any such barrier in the country.

TEXAS TRANSPORTATION INSTITUTE ADVISORY COUNCIL

The Texas Transportation Institute (TTI) wishes to recognize members of the TTI Advisory Council by featuring profiles in each issue of the *Texas Transportation Researcher*. The TTI Advisory Council meets once a year to hear updates on research projects and program initiatives, discuss critical transportation issues facing Texas and provide guidance on potential future research efforts.

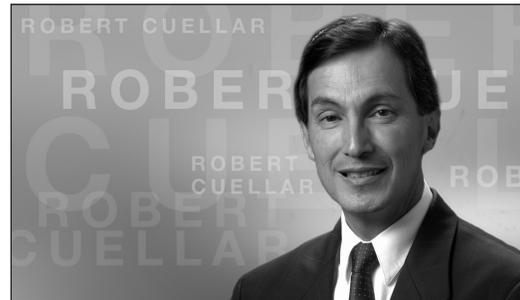


JOHN BARTOSIEWICZ, Executive Vice President and Chief Operating Officer, provides executive management oversight for McDonald Transit's 25 transit management contracts, leads the consulting division and manages all labor relations activities for the company.

From July 1977 until February 2003, Bartosiewicz was Executive Director with the Fort Worth Transportation Authority. His responsibilities included the complete operation of fixed route bus service, paratransit service and ride-share programs in four cities and he played a key role in the planning, design, construction and operation of RailTran, a commuter rail program linking Fort Worth and Dallas and a related Central Business District Intermodal Transportation Center. Bartosiewicz implemented significant innovative projects in response to anticipated community needs.

Committed to clean air initiatives, the T became the first Texas public transit system to put compressed natural gas (CNG) powered vehicles into revenue service in 1989. By educating citizens about ozone pollution problems, the T's vanpool program expanded significantly, making it the third largest in the United States.

Bartosiewicz's leadership of an aggressive affirmative action and employee development program won the 1995 American Public Transit Association (APTA) Women and Minority Advancement Award and a 1998 award from the Conference of Minority Transportation Officials (COMTO). Bartosiewicz was named the Employer of the Year award in 1994 from the Dallas Fort Worth Chapter of Women's Transportation Seminar and the 2001 Outstanding Public Transportation Manager in North America by APTA. ■

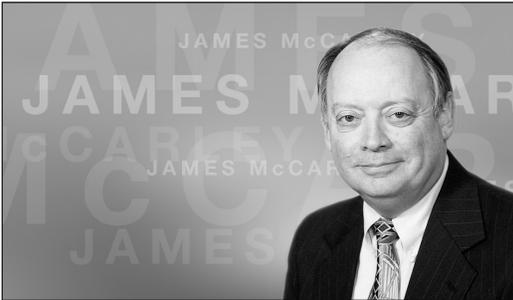


ROBERT CUELLAR, Executive Vice President of Transportation at Turner Collie & Braden Inc. (TC&B), has provided transportation engineering services to public and private clients for nearly 30 years. He currently serves as a member of the Texas Transportation Institute Hall of Honor Steering Committee and is a member of the Texas A&M University Civil Engineering Advisory Council. He is a registered Professional Engineer in Texas and Kansas.

Cuellar earned his bachelor's degree in civil engineering from Texas A&M University in 1969 and his master of engineering in transportation planning and operations from the University of Florida in 1977. He began his professional career with the Kansas Department of Transportation and later served as the Director of Transportation for the North Central Florida Regional Planning Council. Cuellar joined the Texas Department of Transportation in 1977, where he served in various roles including the Interim Executive Director of TxDOT. Since 1998 Cuellar has been with TC&B as the firm's lead transportation officer. He oversees staffing, performance and business development aspects for the transportation practice area.

He has served on various committees for the Transportation Research Board and the National Cooperative Highway Research Program. He has made numerous presentations to university students and at national conferences.

Cuellar is the recipient of the Gibb Gilchrist Award for outstanding service to Texas and to the Texas Department of Transportation. ■



JAMES McCARLEY is Executive Director of the Dallas Regional Mobility Coalition (DRMC) and a principal of James McCarley Consultants. McCarley recently served as interim Executive Director of the newly established North Texas Tollway Authority (NTTA) from 1997 through 1998. NTTA is a regional tollway authority authorized by the 75th Texas Legislature and assumed all operations of the Texas Turnpike Authority in Collin, Dallas, Denton and Tarrant counties.

McCarley also serves as Chairman of the Community Credit Union (CCU) Board of Directors. CCU operates in the North Texas area, with over \$1 billion in assets and 200,000 members. He also serves on the Executive Committee for the Texas Credit Union Coalition, a group of 20 credit unions in Texas focusing on state administrative and legislative issues affecting larger credit unions.

A native of McKinney, Texas, James served as Assistant City Manager of Plano from 1987-1996 and had previously served as Plano's Police Chief from 1979-1987. Prior to his positions in Plano, and after service in the U. S. Army, he was with the McKinney Police Department from 1963 to 1976 serving in a number of positions through the rank of lieutenant. He attended Texas A&M and North Texas State University with studies in finance and sociology.

James is past president of a number of State and National organizations, including the Texas Police Chiefs' Association, Texas Police Association, North Texas Police Chiefs' Association and the State Civil Service Task Force. He retired in January 1996, after 32 years of municipal service.

His wife, Jane, teaches in the Plano ISD, and their daughter Juli lives in Colorado Springs, Colorado. ■



ROGER HORD is President and Chief Executive Officer for the West Houston Association, an organization of major developers, landowners, employers and service firms dedicated to growth and quality in the fast growing western region of the Greater Houston area. The organization promotes growth and quality environment-oriented projects and addresses public policies and regulations on major infrastructure issues, land use, environment and education. The Association was formed in 1979.

Prior to joining the West Houston Association, Hord was Vice President, Infrastructure for the Greater Houston Partnership where he worked on technical studies and financing strategies for transportation, water supply, wastewater treatment and flood control. He was involved in the preparation of Houston's Regional Mobility Plan and subsequent implementation strategies. He has been involved in Houston's efforts to gain improved domestic air service and additional international air routes. He helped form and managed the Alliance for Interstate 69, a statewide group of cities, counties and the private sector to promote the development of Interstate 69 in Texas.

Hord has worked in areas of regional economic development, small business development, education and land use policies. He is a member of the Executive Committee of the Texas Good Roads & Transportation Association and is a national speaker on urban transportation policies.

Hord is a 1971 graduate of the University of Texas at Austin with a degree in business administration. He and his wife, Gwen, have two children. ■

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RESEARCH/PSRs/SUMMARY/GUIDELINES/TTI

2004 Urban Mobility Report Released

The 2004 Urban Mobility Report shows traffic congestion growing across the nation in cities of all sizes, consuming more hours of the day and affecting more travelers and shipments of goods than ever before.

This year's installment increases the number of urban areas studied from 75 to 85, and includes all urban areas exceeding a population of 500,000.

To order this report or other reports related to research highlighted in this issue, check online at <http://tti.tamu.edu/product> or call 979-845-0481

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IN MEMORIAM

Shondeep Lal Sarkar, research scientist with the Texas Transportation Institute, president of the ACI Houston Chapter and an internationally respected member of the concrete community passed away on July 29, 2004, at the young age of 58, after a long, courageous battle with cancer.

Born and raised in India, Shondeep received an undergraduate degree in geology from Jadavpur University. His interest in the chemistry of cements took him to the Birbeck College of the London University where he earned M. Sc. and Ph. D. degrees in crystallography under the supervision of Professor J.W. Jeffery, famous for discovering the crystal structure of tricalcium silicate, the principal mineral in Portland cement. His rigorous training under Professor Jeffery played an important role in Shondeep's outstanding contributions to the field of concrete mineralogy.

Sarkar's teaching, research and consulting career in cement and concrete science began at the University of Ilorin in Nigeria where he spent six

years before migrating to Canada. He worked for 10 years as a member of the Civil Engineering faculty at the University of Sherbrooke in Canada. In 1994, he moved to Houston, Texas, and eventually became Principal of his own firm Sarkar and Associates, Inc. – a consulting company specializing in forensic petrography of concrete. He was a licensed Professional Engineer and a licensed Professional Geoscientist in Texas and a member of the American Society of Civil Engineers. As the author or coauthor of more than 150 scientific publications and a featured speaker at numerous national and international meetings, Sarkar was well known for his contributions in mineralogy and microstructure of cement based products.

Survived by his mother, his wife Sharmistha, his daughter Shalini and his son Saurabh, Shondeep Sarkar will be deeply missed not only by the members of his family but also by many of his friends and associates throughout the world. ■

Finley, Crawford receive TextITE honors

Two Texas Transportation Institute (TTI) researchers recently garnered accolades from the District 9 chapter of the Texas Institute of Transportation Engineers (TextITE) during its 50th Anniversary celebration meeting in Austin.

Melisa Finley, assistant research engineer with the Operations and Design Division, was awarded the "Young Professional of the Year" Award from TextITE. Dennis Christiansen, TTI deputy director, made the presentation at the TextITE business meeting. Finley has worked at TTI since 1999 and received her Bachelor of Science in Civil Engineering and her Master of Science in Civil Engineering from Texas A&M University in 1997 and 1999, respectively. Her research experience includes work zones, traffic control

devices, photometrics and freeway management systems.

The annual award is given to a TextITE member age 35 or younger that has demonstrated unusual or continuing and outstanding contributions to TextITE and other professional groups through their leadership, commitment to excellence and activism.

Jason Crawford, associate research engineer, was recently elected Secretary-Treasurer of TextITE, District 9, at the summer meeting. Crawford takes office on January 1, 2005. Jason has been very active in all areas of TextITE and was named Young Member of the Year in 2002.

Crawford is a member of TTI's Urban Analysis Program, located in Arlington, Texas. He has led and



Crawford



Finley

assisted on several transportation/air quality research projects since joining TTI in 1990.

The Institute of Technical Engineers (ITE) is an international, individual-member educational and scientific organization. ITE members are traffic engineers, transportation planners and other professionals who are responsible for meeting society's needs for safe and efficient transportation. ■

Messer Retires

The Texas Transportation Institute (TTI) honored Carroll Messer's 37 years of service in a retirement ceremony August 26 at the CE/TTI Building in College Station.

Messer served as a research engineer in the Transportation Systems Division of TTI and also as a professor of Civil Engineering. He was division head for five years and served 12 years as program manager of the Traffic Operations Program at TTI. This program was instrumental in developing the PASSER family of traffic signal optimization computer programs under Messer's leadership. Messer joined the faculty at Texas A&M as an assistant professor in 1969 following the completion of his dissertation. His dissertation, which integrated prior TTI research work, has represented the published state-of-the-art

technology in freeway ramp control systems for 25 years. Messer gained considerable insight and expertise in integrated freeway corridor traffic management systems with his on-site work on the Dallas Corridor Project for the Federal Highway Administration from 1969-1973, and on the Gulf Freeway Surveillance and Control Project in Houston for the Texas Department of Transportation from 1967-1969.

Herb Richardson, director of TTI, noted that "during Carroll's career, he has brought a lot of respect to TTI and the Civil Engineering Department because of his pioneering work in the



Left to right: Tamara, Barbara, Carroll, Todd Messer.

areas of traffic operations and management." Messer received several retirement gifts including a gold and silver watch and a gold commemorative book clock.

Messer's immediate retirement plans include dusting off his old hunting rifle and vacationing in Pagosa Springs, Colorado. ■

TTI Researchers Join TAMU Civil Engineering

The Transportation Engineering Program in Texas A&M's Civil Engineering Department has hired three new faculty members: Gene Hawkins, division head with the Texas Transportation Institute's (TTI) Operations and Design Division; Dominique Lord, associate research scientist with the Center for Transportation Safety, and Yunlong Zhang from Mississippi State University. All three are joint appointments between the Civil Engineering Department and TTI.

The new hires are part of a new effort to strengthen the Transportation Engineering Program in the Civil Engineering Department.

Over the last 10 years, Lord has participated in numerous traffic safety studies as researcher and consultant in Canada. He has led studies on the development of safety performance functions, pedestrian safety, the application of traffic conflicts at signalized intersections and the investigation of safety issues for Intelligent Transportation Systems (ITS) technology.



Lord



Hawkins



Zhang

Zhang's most recent position was in the Civil Engineering Department at Mississippi State University, where his research areas include transportation modeling and simulation, transportation planning, intermodal transportation and ITS.

Hawkins' primary fields of interest are traffic control devices, retroreflectivity and visibility. He will step down as Division Head of the Operations and Design Division, but will continue to do research at TTI. "Teaching Aggies has been a lifelong dream of mine and I am really excited about the opportunity to connect with Aggie students. This new opportunity has many benefits, one of which is that I will be able to see and work with my TTI friends on a daily basis," says Hawkins. ■

Short Course Golf Tourney

The 37th Annual Gallaway Invitational golf tournament will be held October 10 at the Briarcrest Country Club in Bryan. The shotgun start will be at 1 p.m.

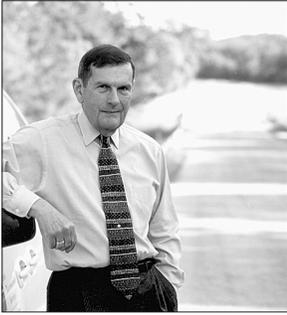
The tournament, sponsored by Trinity Industries, Inc. and Williams Brothers Construction Co., Inc. among many others, is a charitable event benefiting the Texas Transportation Institute's Research Champions Program, a new initiative to recognize those whose vision, energy and resources make important transportation research happen. This Research Champions Program is envisioned as a long-term initiative to recognize transportation research leaders at the federal, state and local levels of government, as well as in private industry, the non-profit sector and academia.

Registration includes:

- green fees and carts,
- box lunches prior to start,
- beverages on the course and numerous gifts,
- dinner and awards reception, and
- prizes.

To register for the tournament or request additional information, please contact Shanna Yates at 979-845-1713 or e-mail s-yates@ttimail.tamu.edu. ■

THE BACK ROAD



TTI has been involved in roadside safety research since it was established more than 50 years ago. One can hardly drive a mile on Texas highways without encountering safety devices developed by TTI researchers. And the benefits in lives saved and property damage avoided has paid for the cost of the research many times over. Premier testing facilities established in the 1960s at A&M's Riverside Campus

(formerly the Bryan Air Force Base) provide long runways that are ideal for testing a variety of roadside safety devices. Devices you see every day like breakaway light poles, breakaway signs and crash cushions are among the innovations developed and tested at the Riverside facility by TTI safety researchers. While roadside safety remains one of our most important research programs, in recent years the program has been broadened and since 9/11 has moved into the area of facilities protection. In this issue of the *Researcher*, you'll learn more about TTI's safety research program, and see how it has evolved to meet the changing needs of the transportation industry. For example, in recent years, TTI safety engineers have been testing fortifications such as gates, retractable bollards (posts that prevent vehicles from entering an area), net systems and other means of stopping potential vehicle bombs from getting into sensitive locations.

Getting children to school safely is another focus of our research program, one we've been working on with TxDOT for the past few years. Many schools are now located near roads designed for high speeds and relatively few cars. This means that it's important to look at all aspects of roadway design in order to keep the traffic environment around our schools as safe as possible. A related project is studying how best to incorporate safety into all highway design through a comprehensive, state-of-the-art program that includes resource and reference materials and workshops for design engineers.

TTI's Center for Transportation Safety, created by the Legislature in 2001 is also highlighted in this issue. The CTS serves as a focal point for traffic safety research, policy analysis, education and outreach in Texas, working with the public and private sectors to develop strategies to help implement transportation safety research findings. In this issue the Center's new Advisory Council is described. This distinguished group brings important perspectives to, and helps guide, the Center's research program.

As always, we welcome your comments about the *Researcher* and look forward to hearing from you if you'd like additional information on any of the subjects in this issue.

Thanks for your continued interest in TTI research.

Researcher

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