

TEXAS TRANSPORTATION

# Researcher

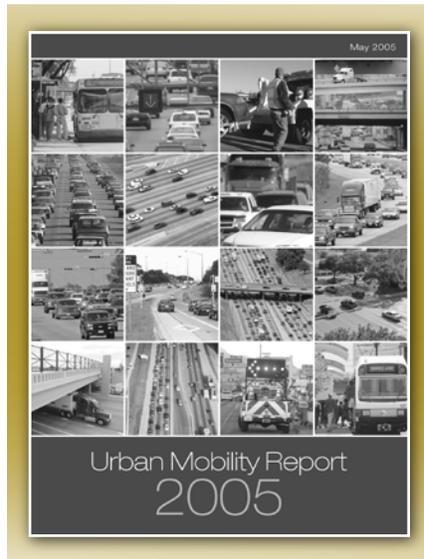
A PUBLICATION OF THE TEXAS TRANSPORTATION INSTITUTE ■ MEMBER OF THE TEXAS A&M UNIVERSITY SYSTEM ■ VOL. 41 ■ NO. 2 ■ 2005

## Building *and* Preserving THE Nation's Roads

*Annual Urban Mobility  
report released*  
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# Nation's traffic troubles growing worse

**D**espite slow growth in jobs and travel, traffic congestion continues to worsen, researchers say, costing Americans \$63.1 billion a year.

The 2005 Urban Mobility Report measures traffic congestion trends from 1982 to 2003, reflecting the most recent data available. If today's higher fuel prices are factored in, the cost jumps another \$1.7 billion.

The release of the annual study by the Texas Transportation Institute (TTI) comes at a time when the U.S. Congress is considering legislation to re-authorize funding for transportation programs and projects across the nation. The House-passed version of the six-year bill includes a Congestion Relief Program to address urban congestion problems.

"The bill includes important sections dedicated to developing a strategy to improve mobility by attacking congestion in a systematic way using an array of traffic congestion relief activities," says study author Tim Lomax, a research engineer at TTI. Those include building more roads and public transportation capacity, operating that capacity for the most efficient service, and innovative pricing and truck-only lane projects.

"There is no single solution that can reverse the growth in congestion," Lomax says. "The deliberations in Congress, decisions by state and local elected officials, the results of voter initiatives last fall, and our research findings recognize that reality," he added.

The TTI study ranks areas according to several measurements, including:

- Annual delay per peak period (rush hour) traveler, which has grown from 16 hours to 47 hours since 1982,
- Number of urban areas with more than 20 hours of annual delay per peak traveler, which has grown from only 5 in 1982 to 51 in 2003,
- Total amount of delay, reaching 3.7 billion hours in 2003, and
- Wasted fuel, totaling 2.3 billion gallons lost to engines idling in traffic jams.

"Congestion is a complicated issue and can't be solved with one approach nationwide," Lomax says. "We need to think about how policies and programs enacted at the federal, state and local levels affect congestion." **R**



**MORE INFORMATION**

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Components of the Congestion Problem, 2003 Urban Area Totals						
Urban Area	Travel Delay		Excess Fuel Consumed		Congestion Cost	
	(1000 Hours)	Rank	(1000 Gallons)	Rank	(\$ Million)	Rank
Los Angeles-Long Beach-Santa Ana, CA	623,796	1	407,147	1	10,686	1
New York-Newark, NY-NJ-CT	404,480	2	198,217	2	6,780	2
Chicago, IL-IN	252,822	3	150,728	3	4,274	3
San Francisco-Oakland, CA	152,352	4	96,571	4	2,605	4
Dallas-Fort Worth-Arlington, TX	151,840	5	82,862	7	2,545	5
Miami, FL	147,294	6	87,249	6	2,486	6
Washington, DC-VA-MD	145,484	7	87,567	5	2,465	7
Houston, TX	135,652	8	80,707	8	2,283	8
Detroit, MI	119,581	9	72,796	9	2,019	9
Philadelphia, PA-NJ-DE-MD	112,309	10	60,323	11	1,884	10

# TTI establishes new Constructed Facilities division

*Texas A&M Civil Engineering takes over Large Structures Laboratory*



(l-r) Pete Keating, David Trejo and David Rosowsky in the newly acquired Civil Engineering High-Bay Structural and Materials Testing Lab.

It's a very exciting time in Texas A&M University's Department of Civil Engineering (CE) and at the Texas Transportation Institute (TTI). The two organizations have joined together in a renewed commitment to the successful and cooperative relationship that has placed the transportation and civil engineering education and research programs at A&M among the best in the country. The creation of a new Constructed Facilities division within TTI, CE's acquisition of the TEES Large Structures Laboratory, and an aggressive new faculty hiring plan being implemented over the next three years are the cornerstones of the plan.

"The goal of these changes is to make the transportation, materials, and structural engineering research and education programs in CE and TTI even bigger and better than they have ever been," says TTI Director Herb Richardson.

"One of the first things I realized when I came to A&M was that what TTI has done for CE goes well beyond just transportation operations. In fact, we have one of the best materials programs in the country due in large part to the cooperative relationship between TTI and CE," says David Rosowsky, the new Civil Engineering Department Head at A&M. "I also saw faculty and graduate students in other areas in the department who were interfacing and working with TTI researchers on a variety of joint projects. Our plan is to continue actively pursuing opportunities to work with TTI on additional research topics—particularly in the area of heavy structural testing—bridge elements, components, and systems."

CE's acquisition of the TEES laboratory, now called the Civil Engineering High-Bay Structural and Materials Testing Lab, is another important component of the planned growth and improvement in large structures research and education at A&M and TTI. "The Department is investing, the College is investing,

and TTI is investing in the laboratory, which will be administered by the Department of Civil Engineering," Rosowsky says. The cooperation will allow both CE and TTI researchers to make better use of the lab.

Finally, CE is hiring new faculty aggressively to bring the program back to the size and stature that it was before a number of retirements and departures in the area of transportation operations and systems occurred. The department is looking for those with expertise in advanced and emerging technologies that might cross multiple disciplines, and that are at the cutting edge. According to Rosowsky, "We have great people at TTI who are eager to teach, and we hope to utilize that tremendous talent pool to guide our CE students and help us teach classes."

David Trejo has been appointed as head of the newly established Constructed Facilities division at TTI. As a member of CE's Constructed Facilities division, and an experienced TTI researcher, Trejo has worked closely with TxDOT and is also an expert in a very interesting technical area, concrete materials, which relates to both the transportation materials group and the structural and construction group. "I'm looking forward to facilitating discussions about increased cooperation and to helping educate some of our new faculty about new opportunities at TTI," says Trejo.

TTI and CE have a rich history together, but with these new initiatives and developments in both organizations, there will be many more opportunities to blend expertise, skills, interests and capabilities. "Ultimately, the goal is to recreate and continue the synergy and success that we have proven benefits students, researchers, and sponsors—everyone working together to educate, provide real-world experience and produce cutting edge, effective research results," says Trejo. **R**

## TTI Council navigates research via ship channel

Cain takes over chairmanship  
Trinity Industries  
pledges continued support

The sun was just breaking through the morning mist when 20 members of the Texas Transportation Institute (TTI) Advisory Council boarded the M/V Sam Houston in May for its annual meeting.

The Houston Ship Channel was the setting for the 2005 meeting, courtesy of Thomas Kornegay, executive director of the Port of Houston Authority. As the second-largest port in the United States, the Port of Houston provided a stunning backdrop for council discussions ranging from new transportation research to updates on legislative activities.

TTI draws on the expertise and guidance of the council in the development and conduct of its programs. The council is comprised of distinguished, high-level transportation professionals from across Texas and the nation. As the ship got underway, TTI Director Herb Richardson brought the meeting to order and introduced David Cain, long-time supporter of transportation issues in the Texas legislature, as the TTI Council's new chairman. Arnold Oliver, retired Texas Department of Transportation (TxDOT) executive director, stepped down as chairman after leading the council for several years.

Following an update by Richardson on recent TTI activities, Mike Behrens, TxDOT's executive director, updated the council on the recent activities in Austin in

both the legislature and at TxDOT. "All eyes are on Texas for transportation," he remarked as he explained that all states are trying to keep programs moving with limited funding, but that Texas is in a relatively better position than most. The morning session was rounded out with updates from TTI Deputy Director Dennis Christiansen on TTI's Southwest Center for Transportation Research and Testing in Pecos and the proposed use of TTI's facilities to establish a traffic management center for the Bryan-College Station area.

The highlight of the morning was a presentation of a check from Mark Stiles, senior vice president of Trinity Industries for the Research Champions Program. Stiles presented a check for \$50,000 to TTI and pledged the company's continuing support of the Research Champions Program. "Trinity Industries is proud to consider our company a partner with TTI in recognizing excellence in transportation research," says Stiles.

The Research Champions Program consists of a National Reporter of the Year award presented at the TRB meetings in Washington D.C., a distinguished



- A) Mark Stiles of Trinity Industries presents a \$50,000 check for the Research Champions Program to Katie Turnbull
- B) Mike Behrens, TxDOT's executive director, updates the council on the recent activities in both the legislature and at TxDOT
- C) Thomas Kornegay of the Port of Houston Authority welcomes council members on a tour of the Houston Ship Channel aboard the M/V Sam Houston
- D) Steve Roop provides an update on TTI's Center for Transportation Safety
- E) David Cain, new chairman of the TTI Council, addresses council members

lecture series and other activities aimed at recognizing transportation research leadership.

"TTI gratefully accepts this generous check from Trinity Industries and would like to thank them for their support of the Research Champions Program," says TTI Director Herb Richardson.

As the M/V Sam Houston docked at the San Jacinto Monument and lunch was brought onboard, Thomas Kornegay provided an in-depth briefing on the Port Authority of Houston. His update included a description of new funding methods used by the U.S. Army Corps of Engineers and the handling of port security in the wake of the September 11th terrorist attacks. In addition, a very significant 12-18 percent increase in container

traffic over the last decade has created new logistics and security concerns for the port.

As the ship made its way back to its berth after lunch, each member of the council was invited to the podium to reflect on major, current issues and topics. Workforce development, funding, public relations and communication, safety, planning, and numerous other issues were addressed. "The background and experience these council members bring to the table is invaluable to TTI," notes TTI Deputy Director Dennis Christiansen. "In forums like this one, we receive the benefit of their vast knowledge and experience that helps guide the institute in effectively planning our research program." **R**

# Braden joins state's elite transportation honorees



Left: Former Houston Mayor and Mrs. Louis Welch

Top: Bill Braden, Rebecca Nordeman, Wes Braden, Jim Royer, Lee Braden, Myra and Barry Allison, and Tripp Braden

Bottom: Tripp Braden, Wes Braden, Bill Braden and Lee Braden

**R**obert Braden, partner in the engineering firm of Turner Collie & Braden and a longtime champion of transportation advancements in Houston and statewide, became the newest member of the Texas Transportation Hall of Honor on May 3.

After earning degrees from both the University of Texas and the Massachusetts Institute of Technology, Braden joined Freese, Nichols, Turner & Collie, and later served as both president and CEO of the company that eventually bore his name. He earned an honorary

degree from Texas A&M University in 1984 and retired in 1987.

Admirers have praised Braden's leadership and vision for his role in helping to create the Harris County Tollroad Authority and the Grand Parkway Transportation Corporation. He was an advisor to numerous local elected officials, including former Houston Mayor Robert Lanier (another Hall of Honor inductee).

The Texas Transportation Hall of Honor, established in 2000, was set up to recognize in a formal and permanent manner those visionary leaders who have helped to

provide Texas with an outstanding transportation system.

"The Hall of Honor is intended to recognize that small group of people whose exceptional leadership and vision made possible the outstanding transportation system we enjoy today in Texas," says Texas Transportation Institute Deputy Director Dennis Christiansen. "Bob Braden believed that an engineer's number one duty and responsibility was to provide society with an improved environment. In doing so, he is a prime example of those leaders who so richly deserve this recognition." **R**

## TEXAS TRANSPORTATION

## HALL OF HONOR

2005 INDUCTEES



ROBERT S. BRADEN

Robert Braden (UT '53, MIT '54), known as Bob to his friends, was born in West Texas in 1931. In 1955, Bob joined the consulting firm of Freese, Nichols, Turner & Collie with a staff of 27 people. When he retired 35 years later after serving as both president and CEO, the name of the firm had changed to Turner Collie & Braden and employed over 300 people.

In addition to developing one of the major full service engineering consulting firms in Texas, Bob was a transportation visionary and a key advisor to elected community leaders. He recognized that communities should have funding options to accelerate needed transportation projects, and this vision became a reality when voters approved the creation of the Harris County Tollroad Authority. He also worked closely with state and community leaders to develop approaches for public-private partnerships and was instrumental in the creation of the Grand Parkway Transportation Corporation.

Bob Braden believed an engineer's number one duty and responsibility was to provide society with an improved environment.

Robert Braden was awarded an honorary degree from Texas A&M University and was named a Distinguished Graduate of the College of Engineering at the University of Texas at Austin. ■



E. NEVEILLE COLSON

Born in Bryan in 1902, Neveille Colson would serve 28 years in the Texas legislature. She was the first woman elected to both the Texas House and Senate. Throughout her political career, she was a strong transportation advocate.

From 1939 to 1948, Ms. Colson served in the Texas House. In 1946, she became the first woman to introduce a constitutional amendment that was approved by the legislature and passed by the voters. The "good roads" amendment ensured that road user taxes would be used for highway purposes by dedicating 75 percent of motor fuel taxes and vehicle registration fees to constructing and maintaining state highways.

She served in the Texas Senate from 1948 to 1966. In 1949, along with then State Representative Dolph Briscoe, she co-sponsored the Colson-Briscoe Act. Funded by a special appropriation, this act provided for the construction of a network of paved roads in rural areas designed to, in her words, move rural school transportation and mail delivery "out of the mud." These Farm-to-Market roads now comprise over half of the TxDOT road system.

The longest girder bridge in Texas, near historic Washington-on-the-Brazos, was named the Neveille H. Colson Bridge in recognition of her contributions to Texas roads. ■



JAMES D. "DOUG" PITCOCK, JR.

Doug Pitcock (A&M '49), with Claude and John Williams, formed Williams Brothers Construction Company in 1955. Mr. Pitcock is owner, chairman of the board, and CEO. Under his leadership, Williams Brothers has become one of the largest highway/heavy contractors in the nation.

Mr. Pitcock has been a prominent transportation leader for over 40 years. He served as chairman of the Houston Chamber of Commerce transportation committee, and was twice president of the Texas Highway Branch of the Associated General Contractors. In 1984 he was national president of the Associated General Contractors of America.

President Ford named Doug to serve on the National Transportation Policy Study Commission, and Governor Smith appointed him to serve on the Texas State Board of Registration for Professional Engineers.

As testament to his abilities to advance transportation issues, a 1984 Engineering News Record cover story referred to Mr. Pitcock as the "gentle persuader." Doug was inducted into the Texas Good Roads/Transportation Association's Hall of Fame, and was named one of the "Top 100 Private Sector Transportation Construction Professionals of the 20th Century" by the American Road and Transportation Builders Association. He is a Distinguished Civil Engineering Alumnus of Texas A&M University. ■



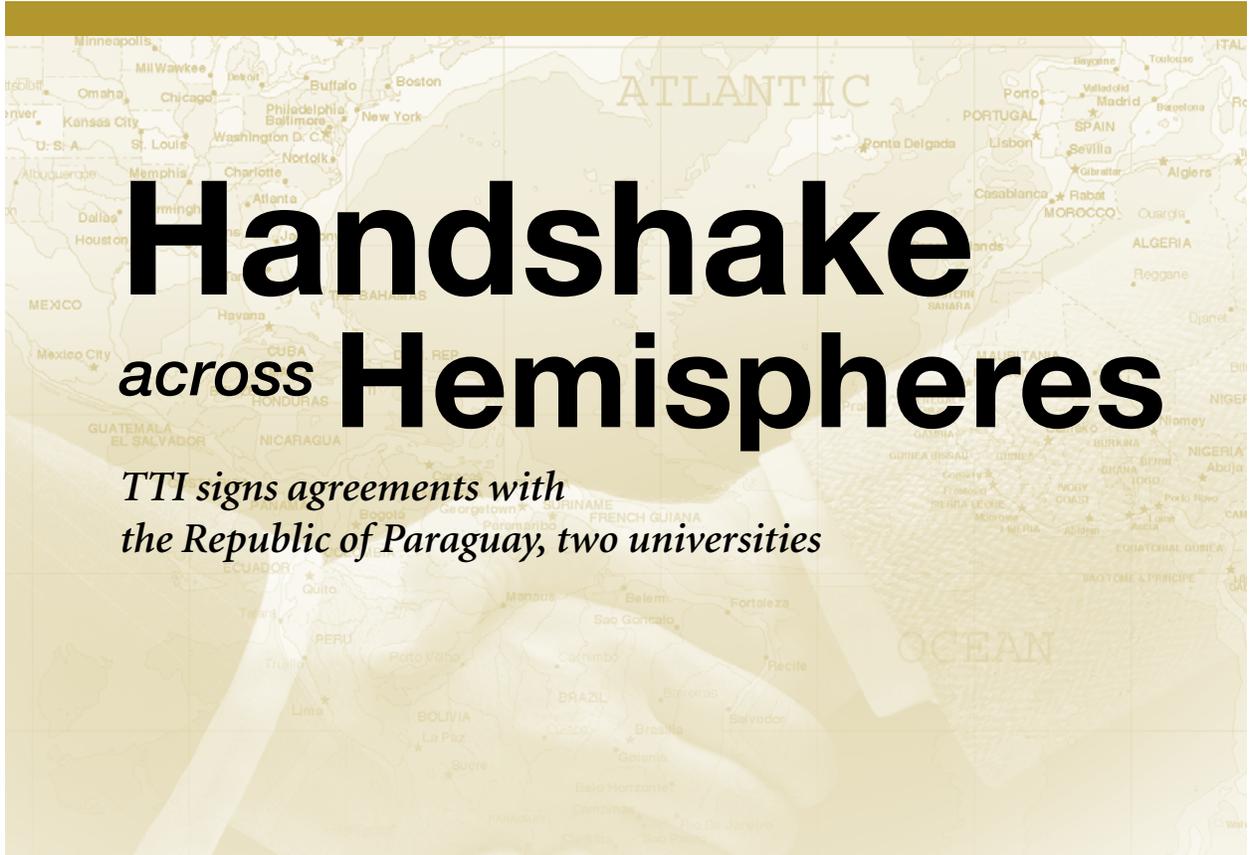
RAY STOKER, JR.

A lifelong resident of Odessa, Ray Stoker (Baylor '61, Baylor Law School '64) has been a tireless advocate for Texas transportation programs for over three decades. Ray is one of only four Texans appointed to the state transportation commission by two different governors.

He was first appointed to the State Department of Highways and Public Transportation Commission in 1985 by Governor White. In 1991, after successfully shepherding the Department through both a penetrating sunset review of its mission and the creation of the Texas Department of Transportation, Governor Richards named Ray Stoker as the first chairman of the new Texas Transportation Commission.

Mr. Stoker helped lead successful initiatives to increase the state motor fuel tax in 1986, 1987 and 1991. He advocated both rural and urban transportation issues and was instrumental in the development of the Texas Highway Trunk System, a 10,500 mile system of rural highways. He broadened the Department's scope by working to create divisions devoted to civil rights, environmental affairs, public transportation and general aviation.

After leaving the commission in 1993, he became the longest serving chairman of the Texas Good Roads/Transportation Association, serving in that capacity until 2003. ■



# Handshake across Hemispheres

*TTI signs agreements with  
the Republic of Paraguay, two universities*

## **MOA with Paraguay**

Evaluating early signs of wear on roads in need of study-based solutions is nothing new to researchers at the Texas Transportation Institute (TTI)—but when the road runs through a steamy stretch of South America, that’s new territory.

In the fall of 2004, Associate Transportation Researcher Carlos Chang-Albitres led efforts to help improve the transportation infrastructure in the Republic of Paraguay. Along with Joe Button, TTI’s Materials and Pavements Division Head, Chang-Albitres used fluency in Spanish and his transportation research background to help craft a five-year memorandum of agreement (MOA) between TTI and the Republic of Paraguay. Button signed the MOA with Public Works and Communications Minister Dr. Jose Alberto Alderete Rodríguez on behalf of TTI Director Herb Richardson.

“The MOA is the first step in developing several specific research projects in cooperation with local partners to strengthen the road engineering practice in Paraguay and to leave behind some legacy knowledge for future generations,” says Chang-Albitres. “TTI’s aim is to contribute to developing better infrastructure facilities for a better future. Our first project involves the development and implementation of Technical Specifications and Construction Guidelines for Long-Lasting Pavements. Joe Button, Dallas

Little, Cindy Estakhri, Tom Freeman and I will be involved in this project. We expect that this project will be the beginning of many other projects in Latin America.”

The Institute also entered into similar MOAs with Paraguay’s National University of Asuncion and the Catholic University of Asuncion. National University was founded in 1889 and serves more than 25,000 students. The Catholic University emphasizes a solid understanding of science and technology among its graduates.

“Both universities have already conducted research in various engineering fields,” says Chang-Albitres. “These agreements will open new channels of cooperation.”

The MOAs between these schools, the Republic of Paraguay, and TTI create an exchange of technical information, a mutually beneficial research atmosphere between respective staff and researchers, and a tangible expression of support and collaboration. The agreements also allow professional training and technical assistance between these organizations, thus establishing an information exchange between one of Paraguay’s primary infrastructure ministries, two top centers of learning in the Republic’s capital city of Asuncion and TTI.



TTI Senior Research Engineer Joe Button signs the five-year memorandum of agreement between TTI and the Republic of Paraguay.

## Why TTI?

“The Inter-American Development Bank (IDB) is concerned that they are getting early failures of roads that they have financed for the developing Republic,” says Button. “They contacted Carlos Chang-Albitres to discuss conducting some TTI research to help them understand the source(s) of these problems so they could make corrections and avoid major maintenance or rehabilitation of these roads in a few short years after construction.”

Button says Paraguay lacks a standard specification manual for road construction.

“We spent two long days and drove nearly the length of the country to examine some of their roads and construction methods, and it’s going to be a from-the-ground-up struggle,” Button says. “Paraguay wants our help. And to help make this possible, the IDB stepped forward to fund this five-year agreement with TTI.”

Fernando Orduz, an infrastructure specialist and civil engineer with the IDB, led the bank’s effort to choose TTI and negotiate the MOA. Orduz says the IDB considered two key factors when selecting TTI—climate and expertise.

“Of particular importance, besides the academic and technological excellence achieved by TTI, was the similarity of technical challenges met when dealing with similar weather and geological conditions [present in Texas] as those existing in El Chaco region in western Paraguay.”

## The IDB from A-to-Z

Established in 1959, the IDB is the oldest and largest regional development bank in the country. It is the main source of multilateral financing for institutional development projects as well as some economic and social endeavors in Latin American and the Caribbean. Forty-seven member countries own the bank. Voting power is split between the 26 Latin American and Caribbean states (50 percent control), the United States (30 percent control), Canada (4 percent), the 16 European countries and Israel (just over 10 percent), and Japan (5 percent).

“This [agreement with TTI] is a typical win-win situation,” says Orduz. “While Paraguay stands to gain by incorporating the cutting-edge of materials and pavements technology by applying it to an area of the country with extremely adverse geotechnical environmental conditions—similar to those in certain areas in Texas—TTI will have the opportunity to confirm the appropriateness of these technological advances by testing them overseas. It is expected that Paraguayan engineering will also benefit through the hands-on involvement of the two most prestigious local universities, the engineering associations and the Ministry of Public Works personnel.” 



### MORE INFORMATION

For more information, contact Carlos Chang-Albitres at (979) 862-2981 or c-chang-albitres@ttimail.tamu.edu or Joe Button at (979) 845-9965 or j-button@tamu.edu.

## POCKET FACTS OF PARAGUAY\*

**Independence**  
from Spain  
May 14, 1811

**Population**  
6.35 million (July 2005 est.);  
more than 57 percent of the population  
is between 15- and 64-years-old;  
the median age is 21.2 years

**Size**  
Slightly smaller  
than California,  
or about 252,797  
square miles

**Language(s)**  
Spanish, Gurani

**Natural Resources**  
hydropower, timber,  
iron ore, manganese,  
limestone

**Political System**  
Constitutional republic headed  
by a directly elected president, with a  
bicameral (two chambers) legislature

**Borders**  
Argentina,  
Bolivia, Brazil

**Agriculture**  
cotton, sugarcane, soybeans, corn,  
wheat, tobacco, cassava (tapioca), fruits,  
vegetables, beef, pork, eggs, milk, timber

**Coastline**  
None, the  
Republic is  
landlocked

\*<http://www.cia.gov/cia/publications/factbook/geos/pa.html> & [http://www.dfat.gov.au/geo/paraguay/paraguay\\_brief2.html](http://www.dfat.gov.au/geo/paraguay/paraguay_brief2.html)

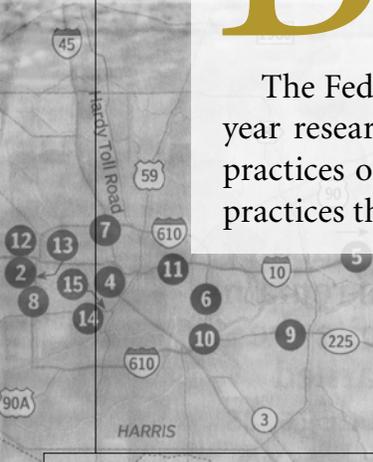
# PROMISE OF A PAYOFF

Project focuses on reducing long-term roadway project delays



**B**othered by traffic delays, worried about safety or concerned about long-term highway construction projects? Research underway at the Texas Transportation Institute (TTI) could lead to solutions to all three major headaches faced by drivers as well as transportation agencies.

The Federal Highway Administration (FHWA) is sponsoring a three-year research project examining traffic management and construction practices on high-volume concrete roadways aimed at identifying those practices that can minimize the impact of construction zones.



**MORE INFORMATION**  
For more information, contact Stuart Anderson at (979) 845-2407 or s-anderson5@tamu.edu.

“Several years ago, FHWA’s Office of Pavement Technology heard from transportation departments in a number of states, the concrete paving industry and academia, concerning the need to conduct a study that would identify and document successful concrete paving practices on high-volume roadways,” says Samuel S. Tyson, FHWA concrete pavement engineer. “The current research project with TTI is a direct result of that stakeholder input.”

FHWA is seeking strategies to minimize disruption and improve safety for highway workers, drivers and local communities. Prior research offers little insight into the effectiveness of traffic and construction management and public awareness strategies for pavement preservation, rehabilitation, and/or reconstruction projects in high traffic environments.

“This research attempts to address this issue through case studies of actual construction projects that document success factors related to traffic, construction, and public awareness campaigns used on high traffic volume concrete paving projects,” says Stuart Anderson, TTI program manager.

Researchers have been working to identify the perceptions of motorists and nearby communities affected by traffic management during construction projects. They are also looking at key factors for successful rehabilitation or reconstruction of roadways. Public information strategies are also key to the research.

“Performing concrete repair and replacement is extremely difficult and complex,” says TTI research engineer Gerald Ullman. According to Ullman, public information and outreach is critical because in these types of situations, transportation agencies and contractors must plan, organize and perform the work with priority given to adequately managing the large amounts of traffic that normally use the facility.

“It requires a broad comprehensive approach to arrive at the best combination of traffic demand management, traffic delay mitigation, contract acceleration and constructability techniques that accomplishes the work to the satisfaction of all affected parties at a fair and competitive price,” says Ullman.

In a careful review of public information strategies, the TTI research team found that some transportation agencies hired public relations firms to develop and coordinate information before and during the project.

Strategies used include:

- radio and television interviews before and during construction;
- speaking to local civic groups;
- manning telephone hotlines to field questions about projects;
- developing and disseminating printed materials;
- coordinating informational mailings;
- conducting outreach meetings for local businesses and neighborhood groups;

- establishing outreach to the public and business community;
- developing partnerships with employers, transit agencies and trucking companies;
- setting up kiosks at various public locations; and
- developing a project website.

**“Public information and outreach is critical because in these types of situations, highway agencies and contractors must plan, organize and perform the work with priority given to adequately managing the large amounts of traffic that normally use the facility.”**

**Stuart Anderson, program manager  
in TTI’s Construction Division**

Additional public information strategies include the installation of warning signs, banners and changeable message signs along the affected travel corridor, using highway advisory radio (HAR) to provide up-to-date traffic and travel information, and the distribution of materials at rest stops, welcome stations, truck stops and ports of entry.

Efficient and cost effective construction practices are also crucial. In Michigan, researchers examined a 5-mile rehabilitation project on US 23. The four-lane divided highway is a major tourism route. The reconstruction work, which included all paving and bridgework, could not affect traffic flow between Memorial Day and Labor Day. Contractors had a 45-day window to complete the work. And despite an unexpected snow storm, the project was completed early and within the budget.

Some of the techniques employed on this project include:

- highly accelerated schedule based on incentives/disincentives,
- use of dowel bar inserter to increase production of concrete paving operation,
- use of on-site centrally located batch plant to support construction and ensure quality,
- co-located DOT/Contractor staff to expedite decision-making, and
- contingency plans to cover uncertainties such as bad weather.

FHWA hopes to use the findings for training purposes with the ultimate goal of reducing delays and costs, improving highway performance and fostering innovation as state transportation agencies across the country build and maintain the transportation system. “The results from this project are expected to make a significant contribution to FHWA’s vital few priorities—especially safety and congestion mitigation,” says Tyson. **R**

# EXPLODING ROADS

*Seeking new alternatives to prevent sulfate heave*



Left: Closeup of pavement heave. Soils underneath the surface can swell causing the pavement to heave.  
Right: Calcium deposits taken from a section of roadway in Laredo.

Two years ago, the Texas Department of Transportation (TxDOT) sponsored a project to develop new guidelines and test procedures for stabilizing sulfate soils in roadway construction. Phase one of that project resulted in the development of two test methods to identify sulfates in the field. Now Texas Transportation Institute (TTI) researchers are working with TxDOT districts to determine the allowable sulfate limits in a soil and alternative stabilizing agents to lime.

Soil sulfates occur when the wrong chemical reactions occur beneath new pavements. The soil can swell and cause the pavement to heave. Sulfate-induced heave, as it is called, has presented challenges to pavement designers and transportation agencies around the world for the past 20 years. The ensuing reactions sometimes result in the formation of minerals that occupy more space than the original soil constitutes. Thus, after the pavement is placed, the soil beneath it undergoes an increase in volume, and heave takes place—as if a minor explosion has occurred under the pavement. The test methods developed by TTI represent an important step in preventing this costly and sometimes catastrophic problem.

“The test methods developed in the first phase of the project have been implemented in all the districts in TxDOT,” says Pat Harris, associate research scientist and project supervisor for TTI.

Once the sulfates are identified, the next challenge is determining the best method of solving the problem. “Using lime and cement, which we traditionally use here, you get a lot of expansion and swelling on the

roads,” says Harris. “But it does not happen until you get to a certain level of sulfates. We identified levels of sulfates that cause problems using lime and cement.”

In Laredo, TxDOT and TTI personnel are working to solve a problem on a highway that tested positive for sulfates.

“Recently, during the construction phase of a new highway project, we had a section of a roadway that tested positive for sulfates,” says Rene Soto, laboratory supervisor for the TxDOT Laredo District. “Historically, the Laredo District has used calcium-based stabilizers such as lime and cement. With sulfate concentrations greater than 8,000 parts per million, we are no longer able to use these stabilizers. We are hoping that TTI can offer us some cost effective alternatives.”

Based on laboratory tests with the Laredo soils, TTI suggested two alternatives to calcium-based stabilizers in Laredo. They are a product called Claystar7 (a phosphoric acid) and Ground Granulated Blastfurnace Slag (GGBFS). The Claystar7 was too cost prohibitive, so the Laredo District will be stabilizing approximately 1 mile of FM 3338 with 5 weight percent GGBFS and 1 weight percent lime. **R**



**MORE INFORMATION**

For more information, contact Pat Harris at (979) 845-5845 or pat-harris@tamu.edu

**RELATED PUBLICATIONS**

Report 4240-1, *Laboratory and Field Procedures for Measuring the Sulfate Content of Texas Soils*

# DESIGNING PAVEMENTS

New computer program is a leap forward for pavement design

When the Texas Transportation Institute (TTI) completed work on the review of a revised mechanistic-empirical (M-E) pavement design guide (see figure below), a new question emerged: What will it take to implement the new procedure in Texas?

The Texas Department of Transportation (TxDOT) had the same question and enlisted the help of TTI in a project aimed at successfully finding a means to implement the M-E Design Guide in its districts.

“The M-E Design Guide represents a substantial leap forward in the way we analyze pavement performance,” says Tom Freeman, engineering research associate at TTI. “But there are also many more inputs versus the old method.”

The M-E Design Guide is capable of evaluating pavement designs for both rigid and flexible pavements. It also accounts for local environmental conditions, local highway materials, and highway traffic distribution and payload.

“We analyzed existing data and developed trends on how pavement performed and the attributes of these pavements, such as thickness and stiffness of layers. This design program is based on actual in-service pavements, and the inputs we enter will tell us how the pavement is expected to perform under certain conditions,” says Freeman.

With these improvements, the Design Guide is more complex to use compared to the previous design method, which required only six or

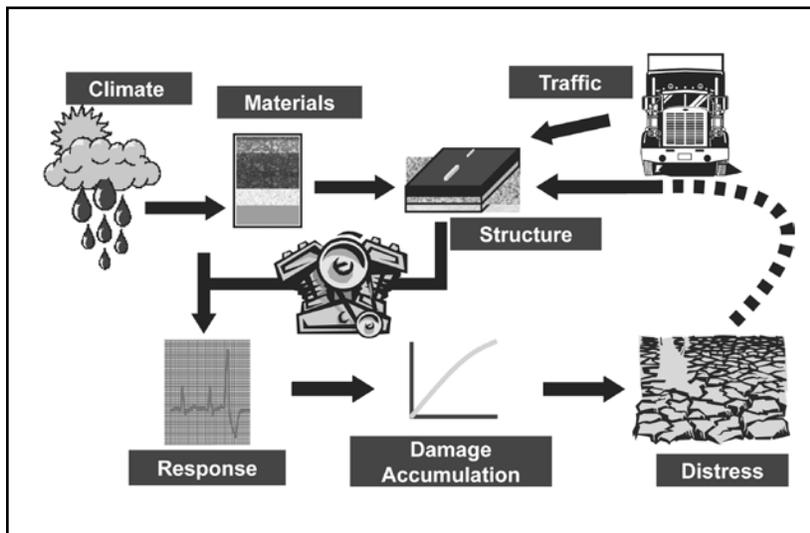
seven inputs. The revised procedure has room for approximately 150 inputs. The challenge is identifying which inputs are important for applications in Texas and how to gather that information.

To help find a solution, TTI researchers developed two case studies in varying climatic regions within Texas. Because the Design Guide was developed for national use, it was important for researchers to note which inputs were necessary for designing pavement on Texas roadways.

“This new procedure allows TxDOT to account for the effects of various materials in the design process as well the environmental effects over time,” says Gregory Cleveland, the project director and technical operations manager at TxDOT.

The implementation recommendations from TTI involve advanced training for TxDOT engineers. The trained engineers can then calibrate the program for their area in conjunction with the current design method.

“With this program, we now have the capability of analyzing various combinations of materials for a specific project to achieve the best pavement performance which in turn will translate into fewer maintenance costs down the road,” says Cleveland. 



The M-E Design Guide software starts by characterizing the climatic effects of the location, including daily and annual temperature cycles, precipitation, etc. The layer types, thicknesses and properties are entered and in conjunction with the proposed traffic (including the axle load distributions), the stresses and strains (material responses and damage) are calculated over a short time period. The damage is summed up over the time period and the quantity of distress accumulated over the time period is reported. If the distress is more than the amount allowed by the pavement designer, the layer types, thicknesses or properties are changed.



#### MORE INFORMATION

For more information, contact Tom Freeman at (979) 845-9923 or [t-freeman@tamu.edu](mailto:t-freeman@tamu.edu).

These four images show the progression of a typical seal coat application where asphalt materials are applied to a single layer of aggregate.



**MORE INFORMATION**  
For more information, contact Cindy Estakhri at (979) 845-9551 or c-estakhri@tamu.edu.

# Miles and Miles of Texas Seal Coats

TTI helps craft a 20-year update to TxDOT's "Seal Coat and Surface Treatment Manual"

The Texas Department of Transportation (TxDOT) spends nearly \$180 million each year to maintain more than 186,600 lane miles of roadway—a road that, stretched out in single-file, would loop around the earth more than seven-and-a-half times. It's a staggering amount of roadway to feed and care for, as it were, with asphalt seal coats.

Joe Graff, deputy director for the TxDOT's Maintenance Division, says the Department performs or contracts for about 18,000 lane miles of seal coat maintenance annually. Though not extremely complicated to create, mostly consisting of a layer of asphalt binder covered with a layer of aggregate (appropriately sized and shaped rocks), seal coats are an integral shield against relentless rain and pounding tires. When applied correctly, the average life of a seal coat is about six to eight years—some even make it to 20.

The previous TxDOT seal coat manual, designed to specify the procedures and techniques for properly protecting roadways, was released in 1984. TxDOT sponsored an implementation project for TTI researchers to develop a new manual based on research from the past two decades. Cindy Estakhri, TTI associate research engineer, created the new *Seal Coat and Surface Treatment Manual* with consultation and co-authorship from Sanjaya Senadheera, assistant professor at Texas Tech University.

"The manual provides contemporary guidelines for the design, construction and inspection of seal coats and surface treatments," says Estakhri.

The manual was introduced last year at the Seal Coat Seminar,

**"The manual is excellent and is used statewide by maintenance and area engineer employees. It is an outstanding example of the good work being performed with TxDOT implementation funds."**

**Joe Graff, deputy director, TxDOT's Maintenance Division**

which was jointly hosted by TxDOT and the Texas Asphalt Pavement Association.

"The manual is excellent and is used statewide by maintenance and area engineer employees," says Graff. "It is an outstanding example of the good work being performed with TxDOT implementation funds."

According to Estakhri, the volume of lane miles in Texas needing maintenance with seal coats is the driving force behind the creation of this comprehensive manual.

"There is probably no other State that even comes close to the amount of seal coat maintenance we have in Texas," says Estakhri. "It's a pretty astounding amount, which is why this comprehensive manual is so important."

The *Seal Coat and Surface Treatment Manual* was released in July 2004. To access the TxDOT *Seal Coat and Surface Treatment Manual*, visit: <http://manuals.dot.state.tx.us/docs/colinfra/forms/scm.pdf>.

# An Invisible Eye for Quality

*Infrared imaging used to spot potential problems*



Left to Right: TxDOT's Steve Smith, TTI's Stephen Sebesta, TxDOT's Hector Flores and a member of the contractor crew use the first generation infrared imaging tool to test for segregation.

Many of the roadways in Texas are constructed with hot-mix asphalt because of its benefits—improved smoothness, reduced pavement noise and weather durability. Unfortunately, during the paving process an abnormality known as segregation can occur, which leads to poor performance and higher maintenance costs.

In dual projects sponsored by the Texas Department of Transportation (TxDOT), Texas Transportation Institute (TTI) researchers studied the use of infrared imaging as a method of detecting segregation.

“Historically, segregation was identified visually,” says Stephen Sebesta, associate transportation researcher at TTI. “The real need for this research was to get away from the subjective, and to develop an objective means of identifying and quantifying segregation.”

The research team performed tests on four sections of roadway during the paving process. Using an infrared camera, researchers tested the sections by conducting an infrared imaging survey. Cores were taken where abnormalities were identified in the readings, and a range of tests were conducted in TTI laboratories on the cores to measure important material properties, such as air void content, percentage asphalt and gradation.

The tests proved that the infrared imaging tool is effective in screening for and locating potential problem areas. However, the bulkiness of the infrared camera did not make it practical for implementation. Therefore, another TxDOT-sponsored project began aimed at developing and implementing a more practical means of

using infrared technology to locate segregation during asphalt paving.

The new infrared imaging device consists of a bar with a row of sensors that is pulled behind the paver. The device shoots images at predetermined intervals and creates a data file of the asphalt mat temperatures. Software plots the data, and areas inconsistent in temperature can be identified, located and investigated. Currently, the device is undergoing fine tuning on several projects.

“The infrared bar is a good tool for providing information to the contractors on the first day of paving,” says Magdy Mikhail, project director and assistant director of the Flexible Pavements Division at TxDOT. “If the contractor is not getting uniform temperatures, they can make adjustments and help prevent potential problems with segregation.”

Ultimately, Mikhail hopes to implement the infrared device statewide as a quality control tool on hot-mix paving projects. “This tool can help improve pavement performance and save money on future maintenance costs.” **R**



#### MORE INFORMATION

For more information, contact Stephen Sebesta at (979) 458-0194 or s-sebesta@tamu.edu.

#### RELATED PUBLICATIONS

Report 4126-1, *Using Infrared Imaging and Ground-Penetrating Radar to Detect Segregation in Hot-Mix Overlays.*

Report 4577-1, *Evaluation of Non-Nuclear Density Gauges for HMA: Year 1 Report.*

# Cracking up is Serious Business

*TTI workshops illustrate the importance of having proper density in longitudinal roadway joints*

**A**chieving a butter-smooth driving surface that lasts years and offers the public a safe, pleasant driving experience is no mean feat. Modern, multi-lane roadways require complex engineering and exacting construction to help maximize a road’s lifespan and eliminate the scourge of asphalt surfaces—cracking.

With sponsorship from the Texas Department of Transportation (TxDOT), researchers at the Texas Transportation Institute (TTI) conducted a study evaluating the construction of longitudinal joints in hot-mix asphalt pavement. If you envision a road laying north and south in front of you, the “longitudinal joints” run parallel (north/south) with the roadway.

Paving full-width lanes in one pass is usually impossible—given the width of most lanes—so road builders join the lengthwise segments of asphalt together with longitudinal joints. Binding the road together like this can sometimes leave inferior strips, or “joints,” (i.e., poor joint density) in the road’s surface that allow deterioration and the dreaded asphalt cracks familiar to drivers everywhere.

“We started a research project to document the condition of the longitudinal joint density around the state,” says TxDOT’s Assistant Director of Flexible Pavement Branch Magdy Mikhail. “TTI designed a statistically valid experiment and collected data on several different projects around the state. As a result of this research project, TxDOT implemented a joint density specification that we think will help the performance of hot-mix asphalt mixes.”

Once TTI researchers completed the study, Mikhail organized six TTI-led workshops in TxDOT districts. Cindy Estakhri, TTI associate research engineer, and Tom Scullion, TTI research engineer, developed the content for the workshops and co-taught them in the Beaumont, Laredo, San Antonio, Bryan, Childress and Odessa Districts. About 40-70 people attended each of the workshops, held January through March of this year.

Estakhri and Scullion presented handouts and specifications on roadway compaction, density, appropriate procedures for superior compaction and techniques for constructing proper, long-lasting pavement joints.

“The workshops were very helpful and useful,” says Mikhail.

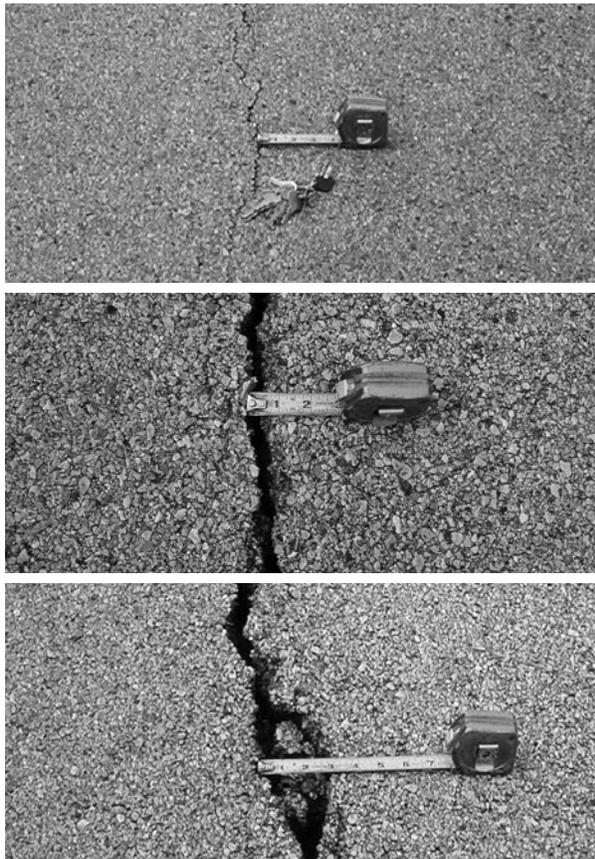
Attendees included TxDOT construction inspectors, engineers, laboratory personnel and private contractors.

“The workshops helped explain the new TxDOT specification, which requires contractors to meet a minimum density at the longitudinal joint,” says Estakhri. “The density that is achieved through compaction is one of the most important aspects in the construction of hot-mix asphalt. If you don’t achieve good density throughout the mat including the joint, you have a mix that will let water into the underlying layers, which can lead to premature failure. The workshops helped meet the goal of providing the best educational tools available for achieving quality longitudinal construction joints which will ultimately lead to longer lasting asphalt pavements in Texas.” **R**

Photos below: (top) Low-severity longitudinal cracking.

(middle) Medium-severity longitudinal cracking.

(bottom) High-severity longitudinal cracking.



**MORE INFORMATION**

For more information, contact Cindy Estakhri at (979) 845-9551 or c-estakhri@tamu.edu.

**RELATED PUBLICATIONS**

Report 1757-1, “Density Evaluation of the Longitudinal Construction Joint of Hot-Mix Asphalt Pavements,” or summary report 01757-S.

# Maintenance, Materials and Money

Researchers study cost benefits of high performance materials

**I**t never seems to end, and it's a constant criticism from drivers. Lane closures and traffic delays caused by highway repairs and maintenance top the list of complaints from the traveling public.

Approximately 60 percent of the nation's 538,000 bridges are constructed using either conventionally reinforced or pre-stressed concrete. Of those bridges, some 50,000 are considered structurally deficient due to corrosion of the reinforcement. The estimated annual direct cost for repairs is over \$8 billion, and that does not include indirect (user) costs due to traffic delays.

On highway bridges, the deck is usually the first element to experience deterioration, and bridge deck repairs have a significant impact on the traveling public. Deterioration is enhanced by corrosive environments, such as salt spray from the Gulf of Mexico or application of de-icing salts after snowfalls. Conversely, deterioration can be retarded by the use of high-performance materials, such as denser concrete and corrosion resistant steel, which delay the onset of corrosion.

To help bridge engineers in assessing the costs and benefits of high performance materials compared to conventional materials, Texas A&M Civil Engineering Professors David Trejo and Ken Reinschmidt:

- Developed simplified methods, based on scientific first principles, for estimating the time-to-corrosion, time-to-repair, and service life for both conventional and high performance materials. The resulting predictive models are then used to evaluate the sensitivity of the time-to-repair to various values of the material parameters. That is, these models determine the relative effect on the time-to-repair of changes in each parameter.

- Developed simple economic models based on the present value of the initial construction cost and the future repair costs for both conventional and high-performance materials. That is, the initial extra cost of high-performance materials can be offset by the reduced frequency of future repairs, compared to conventional materials.

The development of these methods and models were identified through research supported by the Texas A&M University (TAMU) Department of Civil Engineering and the J. L. Frank / Marathon Ashland Petroleum LLC Chair in Engineering Project Management. The investigations were conducted in response to many inquiries from Texas Department of Transportation engineers regarding the selection of high-performance (lower maintenance) construction materials versus conventional (steel and concrete) materials.

Using the results on sensitivity of time-to-repair to various design parameters, plus the simple cost models, a bridge designer can quickly and easily determine how much can be spent on high-performance materials while still gaining a net benefit in life-cycle costs. It is hoped that this easy-to-use method will make it more convenient for bridge designers to consider the economics of life-cycle costs, leading to more use of high-performance designs that will greatly reduce the frequency of repairs and the inconvenience to the traveling public. 



#### MORE INFORMATION

For more information, contact David Trejo at (979) 845-2416 or [trejo@civil.tamu.edu](mailto:trejo@civil.tamu.edu) or Ken Reinschmidt, (979) 845-8599 at [kreinschmidt@civil.tamu.edu](mailto:kreinschmidt@civil.tamu.edu).



## Gallaway golf tourney registration

The 38th Annual Gallaway Invitational Golf Tournament will be held October 9 at the Briarcrest Country Club in Bryan, Texas. The shotgun start will be at 1 p.m. The tournament's Platinum Sponsors include Trinity Industries, Inc., Williams Brothers Construction Co., Inc. and KBR (Kellogg, Brown & Root).

Registration includes:

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

To register for the tournament or request additional information, please contact Shanna Yates at (979) 862-3914 or e-mail s-yates@ttimail.tamu.edu. ■

## Pickett presented 2005 Research Champion award

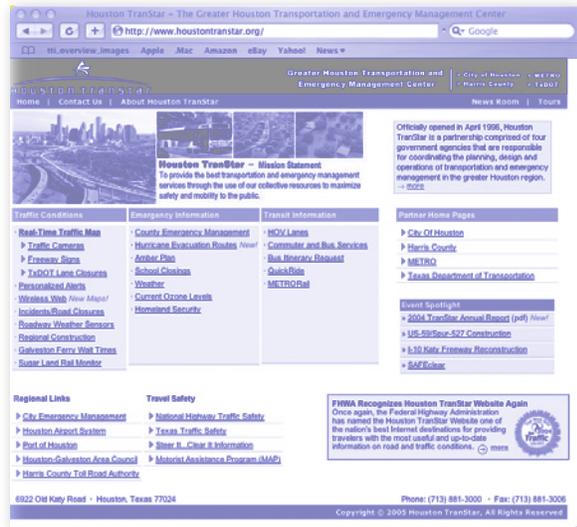
The 2005 TTI Research Champion Award was presented to Kirby Pickett on May 5 at the Hirshfield-Moore House in Austin. Kirby was recognized for over 40 years of innovative and outstanding leadership at the Texas Department of Transportation (TxDOT). As district engineer in the Waco District, Kirby was a leader in the use of micro-surfacing, a then new pavement surfacing technique, and other innovations. As deputy executive director, Kirby was responsible for TxDOT's research program. Kirby streamlined the Research Management Committee (RMC) process,



Left to right, Katie Turnbull, Kirby Pickett and Dennis Christiansen.

elevated the research program to office status with the creation of the Research and Technology Implementation (RTI) Office, and established a new Research Implementation Program. Kirby was also instrumental in acquiring TxDOT's first U.S. Patent, which covers the use of waste photocopier toner in asphalt cement. ■

## Houston TranStar website wins national honors



The homepage of the Houston TranStar website, [www.houstontranstar.org](http://www.houstontranstar.org), allows users to find information on traffic conditions, emergency information and transit information.

The Houston TranStar website, sponsored by TxDOT and operated by Texas Transportation Institute (TTI) staff Mike Vickich, Kathy Tran and Darrell Borchardt, has earned the prestigious Accenture and Massachusetts Institute of Technology (MIT) Digital Government Award for 2005. The award recognizes the best examples of how government is using technology to transform the delivery of citizen services and to showcase high performers in government innovation.

In preparation for the 6th Annual Digital Government Awards, Accenture and MIT assembled a world-class panel of leaders in academia, government and other organizations to view and judge the submitted nominations. Awards for each category were based on the degree of creative thinking and innovative use of technology used to create or enhance service delivery; the extent to

which the nomination successfully addressed a significant problem faced by the users or the organization; and the level of transformation and demonstrated effectiveness and tangible results achieved in the delivery of the program or service.

The website, located at [www.houstontranstar.org](http://www.houstontranstar.org), continues to be an innovator and a model for providing seamless, real-time transportation and emergency management information to government agencies, the media and the general public.

At the request of TxDOT, Mike Vickich traveled to the Federal Office Systems Expo's E-Town Awards Luncheon on April 7 in Washington D.C. to accept the award from Acting Assistant Secretary of Defense and Department of Defense Chief Information Officer, Linton Wells. ■

## Gene Goolsby retiring

After over 15 years of service with the Texas Transportation Institute (TTI), Merrell “Gene” Goolsby has announced his retirement from the Institute at the end of June. Goolsby has been involved in transportation engineering and planning over 35 years, practicing in the public sector (City of Houston), the private sector (Wilbur Smith Associates) and in university-related research (TTI). He began his engineering career as head of the Planning and Special Projects Division, City of Houston Department of Traffic and Transportation. He designed and conducted numerous “problem oriented” operations studies which resulted in physical and operational roadway improvements. He also served as the city’s technical representative on the Houston-Galveston Area Transportation Study.

Goolsby initially joined TTI in 1967 and served for four years on the Gulf Freeway Surveillance and Control System. He participated in research

projects related to freeway operations, level of service, ramp control, bus use of freeways, emergency call boxes and impacts of incidents on freeway operations. Goolsby rejoined TTI in 1993 as a Research Engineer in the Freeway Operations Program (currently known as the Research and Implementation Division), where he has worked primarily on Intelligent Transportation Systems (ITS) assignments involving local transportation agencies in Houston. These assignments included development of the Houston ITS Priority Corridor Program Plan, development of early action priority corridor projects and development of the I-45 corridor information delivery systems for the Smart Commuter ITS operational test. A retirement reception will be held in



Gene Goolsby working on the Gulf Freeway surveillance project in the late 1960s.

the TTI Houston office on June 28. We all wish Gene and Marlyce the best as they make their home in Carmine, Texas, and we express our gratitude to Gene for all the contributions he has made. ■

## Deakin visits TTI

Elizabeth Deakin, director of the University of California Transportation Center and Professor at the University of California, Berkeley, recently visited the Texas Transportation Institute (TTI) to deliver a presentation on “A Regional Express Bus Plan for the San Francisco Bay Area.” “Professor Deakin’s presentation illustrated the importance of the express bus and rail system in the San Francisco Bay Area,” noted Katie Turnbull, TTI associate director.

The presentation was sponsored by TTI, the Southwest Region University Transportation Center, the Bush School and its Institute for Science, Technology and Public Policy, and the Texas A&M Department of Landscape Architecture and Urban Planning. “We appreciated the opportunity to co-sponsor Professor Deakin’s presentation,” noted Arnie Vedlitz, Bob Bullock Chair in Government and Public Policy and Director of the Institute for Science,



Elizabeth Deakin, director of the University of California Transportation Center and professor at the University of California, Berkeley, spoke to TTI researchers about “A Regional Express Bus Plan for the San Francisco Bay Area.”

Technology and Public Policy “and we look forward to working with TTI to host other speakers in the future.” ■

## TTI Researchers receive award

Three researchers at the Texas Transportation Institute (TTI) were recently presented an award for best scientific paper by the International Journal of Road Materials and Pavement Design. The authors, Dallas Little, Eyad Masad and Rajni Sukhwani, all work in the Materials and Pavement division at TTI.

The title of the paper was “Sensitivity of HMA performance to aggregate shape measured using conventional image analysis methods.”

The International Journal of Road Materials and Pavement Design is a worldwide journal established for the exchange of current leading research and research applications within the area of pavement research. Once a year, the journal selects a published paper for the award. ■

## THE BACK ROAD



Making sure that our roads are well-constructed and well-maintained has been a major focus of TTI research since the Institute was formally created more than 50 years ago. Well before TTI was officially created in 1950, engineers at the-then A&M College of Texas were working with their colleagues at the Highway Department to help develop the materials, structures and processes needed

to create the state's highways. That tradition of cooperation continues today, more than half a century later as TTI staff and their colleagues from A&M's Department of Civil Engineering, and other departments across the University conduct research that helps ensure successful construction and maintenance of our transportation system. We've recently established a Constructed Facilities Division within the Institute to focus on this important area of research.

This issue highlights a range of construction and maintenance-related topics, including how to develop warranty-based specifications for bids, and a project on the testing of corrosion and degradation of concrete. You'll learn what helps combat the "exploding roads" caused by sulfate heave, and how new high-tech devices can measure the quality of all layers in an asphalt pavement. TTI researchers have also worked with a team of TxDOT Materials and Test personnel to update and revise the TxDOT Seal Coat Manual, which is now online for use by all TxDOT employees. Because the topic is so important to road maintenance, TTI researchers are giving six workshops over the next few months to help educate maintenance personnel.

Because of our reputation for excellence and strong commitment to innovation, TTI continues to have new partnership opportunities. In this issue you'll learn about a proposal for TTI to start a transportation institute in Paraguay to help that country with the construction and maintenance of its highway infrastructure.

As you travel Texas's highways, I hope you'll remember that our good roads don't just happen. A strong partnership between researchers, TxDOT and the highway construction industry has given Texas some of the safest and best maintained roads in the nation, and we're proud of TTI's role in making that possible.

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## Researcher

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