

Researcher

TEXAS TRANSPORTATION

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The Quest for Cleaner Air

*TTI's new Center
for Air Quality
Studies helps lead
the way toward
compliance with
federal air quality
standards*

Clear skies, wide-open spaces and beautiful countryside have always been central to Texas mystique. The Texas Department of Transportation (TxDOT) continually strives to build and maintain a transportation system that preserves these natural treasures while meeting the travel needs of a growing population. For over 50 years the Texas Transportation Institute (TTI) has helped TxDOT protect these resources through its environmental research programs — including vegetation management techniques, design of roadside aesthetics, erosion control measures, recyclable roadway materials, as well as air quality modeling and emissions data.

As Texas air quality and pollution rise on the public agenda, TTI adds a new dimension to its services in this area. Known for



Charley Wootan graciously accepts TxDOT's DeBerry Award.

Wootan honored with DeBerry Award

At the 2000 Transportation Short Course in College Station, Texas, Herbert Richardson, Texas Transportation Institute (TTI) director, joined Wes Heald, Texas Department of Transportation (TxDOT) executive director, in presenting the Luther DeBerry Award to Charley V. Wootan, director emeritus of TTI. Richardson said, "Charley Wootan is a true professional and a wonderful individual. I consider myself lucky to have worked with him."

Wootan was honored for a career spanning 45 years of service to transportation in Texas. He began his career at TTI in 1956 as an associate research economist. He

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The quest

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its research, regional air quality modeling and the development of specific emissions reduction measures, TTI, through its new Center for Air Quality Studies (CFAQS), is helping TxDOT and the Texas Natural Resource Conservation Commission (TNRCC) to explore air quality policy in Texas.

AIR QUALITY IN TEXAS

Most Texas air quality deficiencies are in ground-level ozone, which can damage lungs and cause respiratory disease. Air quality legislation passed in 1990 restricts federal transportation funds to any area failing to meet air quality standards and conform to certain requirements associated with achieving those standards.

Since that initial legislation, Texas' Victoria area has improved air quality and now meets standards. However, the Houston-Galveston, Dallas-Ft. Worth, Beaumont-Port Arthur and El Paso areas remain in non-attainment status. Under new standards currently being considered by the Environmental Protection Agency (EPA), the Austin, San Antonio, Tyler-Longview-Marshall and

Corpus Christi areas could also soon be classified as nonattainment areas.

What does this mean? "Well, for one thing, several areas in Texas are faced with air quality conditions that may be hazardous to the long term health of residents," says Brian Bochner, head of CFAQS. "Secondly, several of our areas could lose federal transportation funding if sufficient progress is not made." Both possibilities could have serious consequences for Texas. Failure to meet standards in areas within the state could make such areas, and even the state, less appealing for competitive businesses and potential residents. "CFAQS's goal is to help prevent that from happening," says Bochner.

THE CENTER'S GOAL

Formed in February 2000 to help Texas and national agencies find ways to improve air quality to meet federal standards, CFAQS's formal goal is to assist sponsors in analyzing transportation-related air quality issues and potential policies and measures to reduce mobile-source emissions and improve air quality. CFAQS is currently assisting TxDOT and TNRCC, but its services may one day aid EPA, the U.S. Department of Transportation, metropolitan planning organizations and transportation policy research sponsors.

RECENT AND CURRENT CENTER PROJECTS

Texas Transportation Air Quality Policy Analysis

CFAQS is assisting TxDOT, in association with TNRCC, in a statewide transportation air quality policy analysis. "We're considering and evaluating related issues, opportunities, potential policies and implementation of candidate emissions reduction measures, programs and rules," says Bochner. Some of the tasks conducted over the past year have included the following:

- **Innovative Emissions Reduction Measures.** CFAQS identified over 100 innovative ways to reduce mobile source emissions. Some methods offer potential transportation control measures, some use incentives, some include disincentives, and some suggest policies to facilitate emissions reductions. Based on projected effectiveness, likely acceptability and other implementation considerations, the TxDOT/TNRCC steering committee selected 15 of these measures for further exploration and transmittal to metropolitan planning organizations (MPOs) and others for potential use in their local programs. The list is currently undergoing review but will eventually be available via the Internet.
- **National Audit of Air Quality Public Outreach Campaigns/Initiatives.** CFAQS assembled and compiled information on air quality public outreach programs underway in Texas and other states. This audit revealed that a wide variety of approaches were used to address the specific problems and pollution reduction programs of each affected area or state. It also identified several very effective approaches to communicate information and the need to include existing local programs to improve air quality. No programs were found to be coordinated or orchestrated on a statewide basis.
- **Communications Plan for a Texas Statewide Public Outreach Program.** The TxDOT/TNRCC steering committee elected to consider a statewide public outreach program to change attitudes, moti-



Brian Bochner heads TTI's new Center for Air Quality Studies.

vate behavioral changes and improve air quality in Texas. Some of the actions likely to be encouraged are changes in travel habits and choices, purchase of low emissions vehicles, and use of fossil-fueled power equipment during nonpeak ozone periods. "It's important to get the message out," says Bochner. "Once people understand that they really can make a difference, and they know why and how they need to do it, it's likely that we'll see more Texans making efforts toward emissions reductions."

Air Quality Research Topics

In response to the request of a state legislator, CFAQS prepared a list of transportation air quality research needs that are important to Texas. These include science-related issues and evaluations of proposed or current innovative emissions reduction measures and policies. These suggestions will be considered for inclusion in agency budgets for the next biennium.

Other tasks addressed by the center include the following:

- Evaluate implementation of environmental speed limits;
- Evaluate cost-effectiveness of tailpipe emissions testing technologies;
- Identify promising fuel and vehicle engine technologies; and
- Identify land use transportation relationships and policies to reduce transportation-related emissions.

Air Quality Implications of High-Occupancy Vehicle (HOV) Facilities

Center researchers prepared an evaluation of the air quality implications of HOV facilities, including park-and-ride lots that serve travelers using HOV lane transit services. The evaluation showed the ingredients necessary for capitalizing on the strengths of HOV facilities to improve air quality. First, an HOV facility generally needs to result in the time savings of at least 10 minutes in a congested corridor for motorists to want to use it. Another key is the presence of park-and-ride lots convenient to the HOV lane to facilitate easy transfers of drivers from their personal vehicles to buses for their rides to work or elsewhere. Essentially, if an HOV facility can experience an increase in use, fewer cars on the road means reduced emissions — and that means better air quality.

THE CHALLENGE AHEAD

It appears that the biggest challenge facing Texas and this country is to educate the general public, our business communities and government decision makers. These groups need to understand that

- our air quality problem is serious;
- it needs to be fixed;
- there will be consequences if we don't;
- all of us must participate; and
- we will benefit from a concentrated effort to return our air to healthy quality.

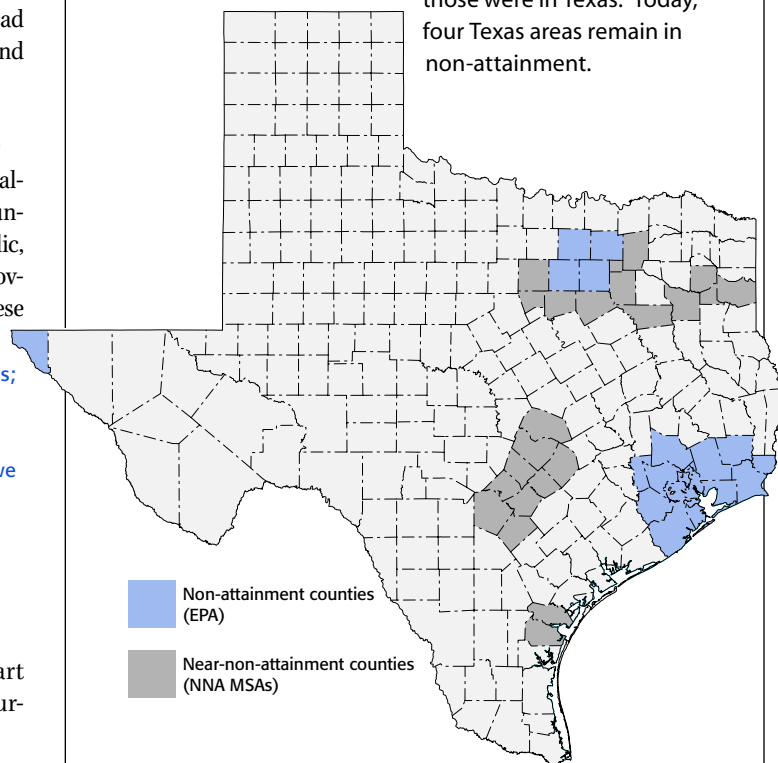
That challenge is at the heart of what TTI's CFAQS will be pursuing in the coming years.

Nonattainment RULES & RECS

In a national effort to improve the nation's air quality, the U.S. Congress enacted the 1977 Clean Air Act. The 1990 Clean Air Act Amendments strengthened this legislation. The combined legislation and the subsequent rules and programs created by the U.S. Environmental Protection Agency (EPA) mandate that air quality standards be met nationwide. These standards are based on safe levels of several pollutants in the air.

Areas not meeting the standards (nonattainment areas) in the 1990s were given schedules for improving their air quality. The schedules are based on the severity of each area's air quality deficiencies. Each deficient area has a deadline for achieving attainment, with the most severely deficient areas to reach standards no later than 2010. EPA initially designated over 100 areas

as nonattainment areas. Five of those were in Texas. Today, four Texas areas remain in non-attainment.



TTI research helps TNRCC and TxDOT battle ozone pollution

OZONE REDUCTION RULE

A research study in progress at the Texas Transportation Institute (TTI) (Project 0-4190) was prompted by a recent Texas Natural Resource Conservation Commission (TNRCC) proposed rule that shifts work hours on highway construction projects from early morning to other times of day. TNRCC expects this shift in work hours to reduce levels of ozone, which requires sunlight to form. The rule is part of comprehensive regulations proposed by TNRCC to clean up the state's air and bring Texas nonattainment areas into compliance with federal clean air standards.

TTI's investigation focuses on the impacts on cost, scheduling and air quality that are anticipated to result from implementation of the proposed change in work hours. It also looks at modeling methodologies and ways to obtain more accurate estimates of potential emissions.

"Traditionally, emission estimates are modeled using a population-based model," says Wayne Young, air quality specialist at the Texas Department of Transportation (TxDOT) and project director for the current study. "In this project, we're developing a dataset that specifically reflects the emissions and associated impacts from different types of highway construction projects."

PAST RESEARCH

The new project builds on previous findings regarding air quality impacts of highway construction work. Recent studies have explored the following aspects of air quality emissions:

- In the early 1990s, "Traffic Pattern Assessment and Road User Delay Costs Resulting from Roadway Construction Options" (Project 0-1108) performed and reported analyses of vehicle delays associated with major construction and associated lane closures. The current study uses results from this earlier effort to estimate on-road emissions connected with construction delays.
- Throughout the 1990s, "Air Pollution Implications of Urban Transportation Investment Decisions" (Project 0-1279) studied the urban airshed model in relation to mobile-source emissions. Results provided a strong foundation in transportation-related air quality impacts and indicated that the urban airshed model was not sensitive to small changes in regional source emissions.
- In the late 1990s, "Air Quality Impacts of Highway Construction and Scheduling" (Project 0-1745) assessed emissions from highway construction vehicles in work zones of the Dallas-Fort Worth area. Researchers collected information from field trucks, materials trucks and other construction equipment. Results showed that highway construction emissions were insignificant contributors to the region's total emissions inventory.

These and other cooperative projects contribute to a valuable collection of data and findings that help transportation professionals address the issue of ozone formation. The current project adds value by providing projected cost and schedule impacts from the proposed rule regarding construction-equipment operating restrictions.

CONSTRUCTION-RELATED EMISSIONS

TNRCC proposed the work-hours rule as a revision to the state implementation plans of the Houston-Galveston and Dallas-Fort Worth areas. To reduce the production of ground-level ozone, TNRCC places a restriction on the use of non-road, heavy-duty diesel construction equipment rated at 50 hp and greater. The rule would limit use of such equipment between 6:00 a.m. and noon in the Houston-Galveston region and between 6:00 a.m. and 10:00 a.m. in the Dallas-Fort Worth region.

"In order to prevent ozone production, TNRCC is taking one of the compounds out of the equation in the morning hours so there will be less ozone produced in the afternoon," explains Jason Crawford, assistant research engineer at TTI. "In this project, we're looking at impacts of that change as well as emissions modeling and potential alternate controls."

Though still underway, the TTI study has already identified results that could be expected from compliance with the proposed rule. For example, anticipated overall construction costs are expected to show average increases from 8 percent to 16 percent. Average duration of construction jobs would likely increase between 6 percent and 12 percent. Compliance with the rule may also affect outcomes difficult to quantify, such as worker morale and safety concerns of construction personnel.

*A series of TTI projects is helping
TxDOT and TNRCC discover the best
road toward reduced ozone pollution.*

COMBINED EFFORTS

Findings like these help transportation and environmental experts as they work to improve air quality in Texas. TNRCC, TxDOT and TTI will continue to work together to find the best ways to reduce ozone formation and decrease associated risks for Texans.

“The inventory resulting from this research is our best estimate of emissions that will come from different types of construction jobs like bridge replacements, paving and so forth. We’ll use this inventory in combination with TNRCC models to get a more accurate estimate of the construction-related share of emissions in the state,” notes Young. “That will let us know what steps transportation planners can take as the best solution to ozone formation.”



Under the proposed rule, heavy construction equipment would operate during restricted hours to retard ozone production.

For more information, contact **Jason Crawford** at (817) 462-0534 or jcrawford@tamu.edu.

Related research: Report 1745-1: *Activity and Emissions Associated with Highway Construction Projects: Case Studies in Dallas/Fort Worth, Texas*;
Report 1745-S: *Air Quality Impacts of Highway Construction and Scheduling*.

Ozone

*as a
pollutant*

Ground-level ozone is the most prevalent air pollutant in Texas and the nation. Ozone is formed by chemical reactions of volatile organic compounds and nitrogen oxides, both of which are emitted by vehicles and transportation construction activities. Ozone concentration contributes to smog formation and negatively

affects health, especially for children, high-risk individuals or people who spend long hours outdoors. Prolonged exposure to high concentrations of ozone damages products made from rubber, nylon or plastic and places food crops at risk.

For more information go to www.tnrcc.state.tx/air/monops/ozoneinfo.html.

Cleaning up water quality

TTI examines stormwater run off from TxDOT drainage facilities



The current project examined various structure designs such as large sand filter basins (top) and hybrid filter structures (bottom).

Severe thunderstorms endanger people and property, producing flash floods and high water levels. After immediate dangers are over, stormwater runoff causes continuing problems with water quality.

As water quality concerns increase with rising environmental awareness, cleaning stormwater runoff is becoming a recognized problem. Each storm brings with it unpredictable amounts of water — water that collects different types of pollutants, moves at changeable speeds and demonstrates other variables that complicate water cleanup processes.

Upcoming implementation of federal and state legislation will require that the Texas Department of Transportation (TxDOT) adopt stormwater quality measures across the state that meet stringent standards for roadway runoff. The National Pollutant Discharge Elimination System and related Texas regulations will require TxDOT districts to install and maintain permanent water quality structures that comply with the regulations. Stormwater mitigation structures remove suspended solids and chemical pollutants from runoff before it enters larger bodies of water, benefiting wide geographical regions.

Texas Transportation Institute (TTI) researchers are in the final stages of a TxDOT project (0-1837) that will help transportation officials design stormwater runoff structures to improve water quality. The recent project focused on practices and tools for sedimentation and filtration for stormwater cleanup and looked specifically at permanent surface structures. TTI researchers studied existing stormwater mitigation structures around the state to see how they performed.

“We looked at various structure designs for cleaning up stormwater discharge and how they handled sediment and other pollutants,” says Harlow Landphair, research scientist at TTI. “The problem is that these structures are faced with different needs during each storm event. How they perform depends on how dirty the water is, the volume of water, how fast it travels, intervening dry periods between storm events and multiple other factors. There are so many variables, it’s difficult to say how a structure will perform every time.”

To resolve some of the problems created by these variations, the stormwater quality project created a cost-to-performance index to evaluate permanent stormwater structures. The index analyzes data

regarding chamber size, pipe size, material mixes, watershed area and other variables. It provides a projected cost of removing pollutants, excluding land cost, in relation to performance characteristics.

In addition to providing the index to help designers choose systems, the project found that a number of stormwater quality structures will meet TxDOT's needs in addressing upcoming requirements. The project also discovered that the cost of upgrading facilities to handle stormwater effectively may not be as daunting as initially thought.

"There are no new technologies on the horizon that appear to offer major cost savings or significantly improve water quality more than existing technologies,"

notes Landphair. "We have miles of existing effective water quality structures already in place along our roadways in the form of holding ditches and vegetated swales. We have half of the solution to our problems already in place, and we probably will have to spend less than we think if we use what we've got in the right way."

A related project just getting under way at TTI will focus on ways to retrofit existing stormwater structures for improved water quality outcomes.

For more information, contact **Harlow Landphair** at (979) 845-7871 or h-landphair@tamu.edu.



Ming-Han Li, assistant transportation researcher, calibrates the sampler at the TTI hydrolab used during the project.

RETROFITTING *for improvement*

Texas Transportation Institute (TTI) researchers will continue their work to help the Texas Department of Transportation (TxDOT) improve the quality of stormwater discharge. Drainage facilities maintained by the department must comply with the recent Municipal Separate Storm Sewer System (MS4) Phase I permits issued by the National Pollutant Discharge System (NPDES). This means that they must be evaluated based on their ability to maintain water quality from stormwater run off and, if necessary, improved (retrofitted). Currently, NPDES does not provide guidance for evaluation methods.

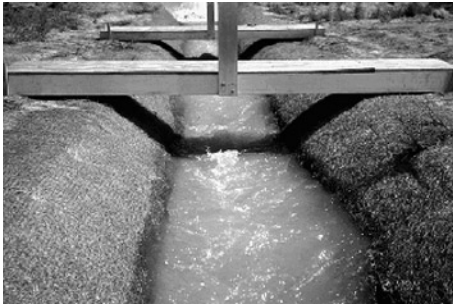
"In many cases, rather than building a whole new system, an existing facility just needs to be retrofitted to get the improvement necessary," says Jett McFalls, the key researcher on the project. "Our goal is to help TxDOT select and prioritize facilities needing improvements and start a pilot program that tests these retrofitting processes."

The first step in achieving this goal will be to review current research and practice. Based upon this review, the research team will compile a list of best management practices (BMPs). "Once we've got all the BMPs, we'll look at how well they remove pollutants and develop an effectiveness index," says McFalls. This index will include life-cycle costs for each BMP.

Using the guidance documents prepared for this project, TxDOT will be well equipped to select and evaluate the appropriate BMP for completing the retrofit process at the specific drainage facilities identified for improvement.

For more information, contact **Jett McFalls** at (979) 847-8709 or j-mcfalls1@tamu.edu. For more information on TTI's water and land improvement projects, see http://tti.tamu.edu/enviro_mgmt.

Field lab improvements will expand knowledge and save dollars



Channels at the erosion control lab test flexible lining materials.

Data gathered at the lab contribute to an understanding of surface erosion. Much of the work involves evaluation of erosion control products used to prevent erosion along highways.

Control of roadside erosion is essential to establish permanent vegetation. Maintaining healthy turf along a highway ultimately protects the roadbed and pavement and prevents the siltation of ditches and culverts. It's also necessary for meeting water quality mandates.

Since 1989, the TTI/TxDOT Hydraulics and Erosion Control Field Laboratory at the Texas Transportation Institute (TTI) proving grounds has provided erosion control research, data and performance information to the Texas Department of Transportation (TxDOT). TxDOT provides the principal funding for the project, and over 15 states and several international consulting firms use the data gathered.

Recently, as part of the lab's 10th anniversary, the one-of-a-kind facility underwent a thorough review of its research and testing program. Results of the review led to the proposal of significant improvements and additions to the laboratory infrastructure — improvements that are now underway with expected completion in March 2001.

"We conducted an extensive evaluation and essentially addressed questions of how to reduce cost and improve the quality and repeatability of the testing and research program," says Harlow Landphair, head of TTI's Environmental Management Program. The answers came in the form of new additions — including large indoor sediment beds, new state-of-the-art rainfall simulators, controlled sediment collection tanks, a flume and over 2500 sq ft of greenhouses, along with a variety of new instruments and lab equipment.

Data gathered at the lab contribute to an understanding of surface erosion. Much of

the work involves evaluation of erosion control products used to prevent erosion along highways. Over the years, product evaluations performed at the lab have resulted in improvements to the erosion control industry as a whole, as well as provided TxDOT with performance-based specifications needed to meet Environmental Protection Agency regulations on stormwater management.

The additions to the lab will improve the precision and control of measurements, allowing TTI researchers to further expand the knowledge base in erosion control science. According to Landphair, the improvements will also cut operating costs of the facility in half.

For more information, contact **Harlow Landphair** at (979) 845-7871 or h-landphair@tamu.edu.



For more than 10 years the TTI/TxDOT Hydraulics and Erosion Control Field Laboratory at the TTI proving grounds has provided erosion control research, data and performance information to TxDOT.

Old techniques gain new recognition

Demonstration projects collect data on biotechnical methods

Streambank erosion near bridges and roads threatens the stability and dependability of highway structures. As urban development increases, so does water runoff into streams. As a result, streambank erosion speeds up. This erosion can be costly and dangerous, so preventing erosion and stabilizing streams is a vital step in maintaining our highway infrastructure.

The Texas Department of Transportation (TxDOT) and Texas Transportation Institute (TTI) researchers are investigating biotechnical techniques for streambank stabilization. They plan to build five demonstration projects in the state. The demonstration sites will show stabilization techniques in operation and serve as monitoring sites to develop selection criteria for various techniques. Two sites have already been designed and let to construction in the Dallas and Houston areas. Both will be built this coming winter. Three more

are planned for installation next winter.

"We are rethinking stabilization techniques in terms of using nature to treat itself," says Ming-Han Li, lead researcher for the project. "Biotechnical approaches to stabilization are not new. In the U.S. we have relied on hard armored surfaces such as concrete and stone riprap because we thought they would be more durable than planted streambanks. Now we're finding that biotechnical approaches may work better for long-term stabilization, as well as provide environmentally friendly solutions."

Biotechnical stabilization techniques combine the use of vegetation with grading operations and manmade materials such as geosynthetics. The result is a long-term cost-effective approach that preserves or restores a natural character to the waterway. The project currently underway at TTI will identify selection criteria to help

determine which specific techniques work best in particular streambank situations. The demonstration sites will provide data on flow velocities, water levels, plant survival rates and other aspects of the stabilization designs.

"Biotechnical stabilization techniques are in place across the country, but technical data aren't available for them," notes Li. "People think the vegetation cover works well, but they can't tell you why they think that. We plan to collect data and correlate results with what we find in existing experience and literature."

The findings from the project will create the basis for a biotechnical streambank stabilization manual that TxDOT plans to incorporate as a part of its instructional manual series.

For more information, contact **Ming-Han Li** at (979) 845-6211 or m-li@ttimail.tamu.edu.

The Walnut Creek bridge in Austin displays evidence of washout around piers.



A streambank at Boggy Creek in Austin shows the effects of stream scour.



Researchers are working to prevent stream scour from eroding nearby roadway structure supports.

Restoring the roadside

TTI facilitates community partnerships

Everyone loves to see wildflowers along highways. In fact, some environmental activist groups often press departments of transportation (DOTs) to make changes in their roadside management practices and policies in the interest of preserving the many wildflowers, prairie plant communities or specific plants native to their regions. They want to see more “natural” management approaches and sometimes advocate broad changes in the DOT’s management policy and procedures on a state-wide level. In Texas, this is particularly true among native plant and naturalist clubs who actively lobby Texas Department of Transportation (TxDOT) division and district offices concerning mowing schedules and frequencies, herbicide usage, and the plant species on the roadside.

Recently, in an effort to create a dialog with TxDOT regarding these issues, two of these groups, the Lady Bird Johnson Wildflower Society and the North Texas Master Naturalists, invited research landscape architect Jim Schutt of the Texas Transportation Institute Environmental Management Program to discuss with them how they might go about facilitating a cooperative relationship with the department.

“We responded to this invitation with a goal to educate the groups about the nature and workings of the roadside,” says Schutt. “In addition, we wanted to explain the responsibilities, resources and policies of TxDOT.” Schutt’s approach during these discussions is to encourage the groups to fully develop their ideas about the roadside before they approach the department or the legislature.

“It’s important to address issues of safety, maintenance and public approval, along with developing very specific details about their proposed initiatives,” says Schutt. The key details include (1) the environ-

mental, ecological or aesthetic goals of a particular initiative, (2) the site criteria necessary to accomplish an initiative, (3) the management requirements necessary and (4) how the initiative will help TxDOT better meet its mission of safe, maintainable transportation facilities.

As discussions have progressed, the groups have invited TxDOT district landscape architects and vegetation managers to attend meetings, give additional guidance and evaluate ideas. This has resulted in an on-going, amicable dialog and mutual understanding of goals and intentions.

One positive outcome of these partnering efforts is a new project in Garland, Texas. This two-mile corridor project includes some interchanges that are to be replanted with native plant communities. The city of Garland will be responsible for maintenance of the entire project. The North Texas Master Naturalist group approached the city and offered to assist in the management of the sites, and the city eagerly accepted. Their duties will include monitoring of the sites for rates of plant growth, irrigation needs for establishment, encroachment of noxious species, monitoring wildlife and perhaps installing plants rescued from other roadway sites.

“We think continuing discussions will allow us to develop specific criteria for evaluating roadside projects that focus on native plants or ‘naturalization,’” says Schutt. “And

we’ll continue helping TxDOT and other local agencies communicate that they are willing partners looking for good ideas.”

For more information, contact **Jim Schutt** at (979) 847-8584 or j-schutt@tamu.edu.





Roadside picnic area renovation brings wildlife and human communities together

What can you do with three picnic tables in a field and a materials stockpile? The Lubbock District of the Texas Department of Transportation (TxDOT), with assistance from Texas Transportation Institute (TTI) researchers, is renovating an existing picnic area like this at the intersection of U.S. Highways 87 and 180 near Lamesa, Texas. The utilitarian nature of the 8-acre right-of-way parcel will turn distinctly recreational with the construction of a half-mile walking trail surrounding a wildlife feeding area. The renovation will also include viewing stations, a shallow lake, picnic tables and a human-scale sundial added to an existing historical marker. The site has vehicle parking and handicap accessibility.

“Community interaction at the site is a big part of this project,” says Beverly Storey, the lead researcher on the project. “So it’s designed to not only provide a food and water source for neighboring birds and wildlife, and to block the wind and view toward the stockpile, but also to entice walkers, nature-lovers, picnickers, and even educators, to stay and enjoy the scenery.”

The TxDOT materials stockpile is located at the eastern-most

boundary of the site. This area will be screened by placement of berms (raised areas) and plant material. Access to the stockpile is separated from public traffic. A double row of evergreens at the site boundary clearly defines the edge between neighboring landowners and TxDOT right-of-way. The evergreen screen also provides a wind and/or snow break.

The focus of this novel renovation is to combine native and drought-tolerant plant material with landscape enhancements to better integrate the right-of-way’s natural environment with a man-made storage facility. The prototype design approach for the entire site emphasizes low-maintenance amenities and minimal management requirements. The ‘no-mow’ wildlife feeding area is densely planted, supplying the necessary cover to entice birds and wildlife. The constructed shallow ‘playa lake’ has a water-level monitoring device to keep a constant supply available for use by wildlife. The surface of the walking trail is made of an environmentally safe, water-based polymer emulsion that mixes with the existing soil to form a low-maintenance, natural soil pavement for light traffic.

“The city of Lamesa is enthusiastic about the implementation of this project,” says Storey. The Lubbock District is coordinating with the Lamesa school classes to provide interpretive trail signs showing local or migratory wildlife that may frequent the site. Students can also measure time by standing in designated places within the 20 ft by 14 ft sundial.

According to Storey, the design of this picnic area is unique within the Texas highway system because it illustrates the conversion of standard right-

of-way into an environmentally friendly, positive and community-interactive facility. This location will serve as a study model to monitor and evaluate the impact, effectiveness and level of use for the future innovative designs of other large TxDOT right-of-way parcels designated as rest or picnic areas.

For more information, contact **Beverly Storey** at (979) 845-7217 or b-storey@tamu.edu.

Recycling for cyclists and pedestrians

TTI assists City of College Station with innovative shared use path

Have you ever wondered what happened to your old car tires? Many of them end up chopped into little pieces and dumped into our nation's overflowing landfills. But take a walk or ride a bike in College Station in the near future, and you may find some of your old tires where you would least expect them: right beneath your feet.

The Texas Transportation Institute (TTI), a longtime proponent of recycling efforts, has partnered with the Texas A&M Southwest University Transportation Center, the City of College Station and the Texas Department of Transportation (TxDOT) to construct an environmentally friendly bicycle trail/path in College Station's Lemon Tree Park. A portion of the trail will be constructed with conventional portland cement concrete; however, two test sections will consist of recycled tire rubber and a by-product of burned coal called fly ash.

This project is part of College Station's Bike Loop Project, which calls for off-street paths in Lemon Tree, Bee Creek and Central Parks, located in the vicinity of Southwest Parkway. TTI researchers Cindy Estakhri and Shawn Turner are working with Brett McCully, assistant city engineer for College Station. According to McCully, "In response to a request from TTI, and in support of community recycling promotion, we will include recycled materials in the Lemon Tree bike path construction. The idea is to evaluate any potential economic, performance and environmental benefits of using recycled materials in pedestrian and bicycle environments." The pathway will also include educational signs explaining its environmentally friendly composition.

"Aside from the obvious benefit of reducing waste in Texas landfills, tire rubber has the potential to lengthen the life of pavements by resisting aging," says TTI engineer Cindy Estakhri. Researchers in the Texas A&M Chemical Engineering Department and TTI have spent the past several years developing a highly engineered asphalt rubber binder which is specifically designed to resist the hardening caused by aging.

Along with tire rubber, the path will include fly ash in its concrete mixtures. Fly ash, which is also normally dumped in landfills, can replace a portion of the cement in a concrete mix. The ability to use fly ash is especially beneficial now because, Estakhri says, "Portland cement is in great demand, and recently many construction projects in the state have been on hold because the supply of portland cement could not meet the demand."

One concern has been the cost of including tire rubber in the pavement construction process. However, because the rubber should extend pavement life and improve performance, the long-term cost may be lower than with conventional materials. And according to Estakhri, "The winning contractor provided a bid to construct the bike loop with the test sections at a cost of \$34,700 lower than the base bid."

Over the years, the efforts to include recycled materials in roadways and trails have increased. With the potential cost savings, improved pavement performance and a healthier environment, the time and money spent have been worth it. Cyclists and walkers in College Station's Lemon Tree Park will almost certainly agree.

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



Illustrative information about the composition of the path will be displayed on signs posted in the park.

Environmental site investigation procedures and technologies

TTI looks at state-of-the-practice in hazardous materials assessment

Most of us have experienced the feeling of “20/20 hindsight.” If we had just known beforehand what we learned afterward, things would have turned out better. Hindsight might be accurate, but when dealing with hazardous materials, not knowing something early in the process can spell danger.

The issue of potential contamination on highway construction sites prompted the Texas Department of Transportation (TxDOT) to sponsor a Texas Transportation Institute (TTI) project to determine the current “state-of-the-practice” in environmental site assessment.

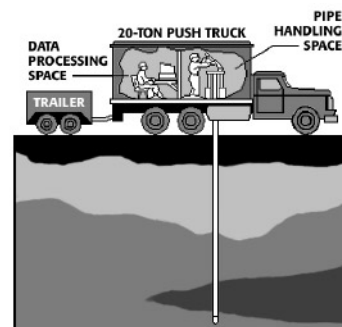
John Overman, associate research scientist at TTI, points out, “All transportation projects have potential for encountering hazardous material or contamination during right-of-way acquisition or construction.” This can come from various petroleum sources, hazardous waste sites, closed or operating gas stations, or other sources. This project looked at how to best locate sources that could affect construction projects. The answer involves an examination of the current, and everchanging, regulatory requirements; the process of performing Phase II site investigations; and the most current technology and investigative techniques.

With the recent completion of the Texas Risk Reduction Plan by the Texas Natural Resource Conservation Commission, the focus of hazardous materials assessments is now on “risk-based” corrective action and risk assessment models. What does that mean for the actual process used to assess a site? According to Overman, it means creating a “conceptual model” of the site that looks beyond the property boundaries and at the entire site in its context to determine what might be there before samples are ever taken.

“The regulations lean toward finding out as much as possible before you go out into the field,” says Overman, “Risk-based assessment means you locate and clean up those levels that present a risk, not just automatically clean up anything you find.” This shift in approach requires more efficient data collection, with an emphasis on the right information, rather than how much information, the assessment provides.

The resulting project report includes environmental site investigation procedures that incorporate this new approach into a process checklist to help investigators put the emphasis on planning. The report also provides a breakdown of the benefits and limitations of the geophysical survey methods and soil and groundwater investigation technology currently available, which is the second part of the shift in approach found by TTI. “The key is to use the right tool for the right

Cone Penetrometer Testing (CPT) (one of several techniques discussed in the project reports) is a less intrusive investigative technology because the CPT hole is small and no drill cuttings are produced.



job,” says Overman. “What tools you use can affect whether you get the right information to avoid contamination problems later in the project.”

David Boswell, director of the hazardous materials section of TxDOT says, “Having this information in one report is a tool we can use to consider the consultants’ scopes of work to see if we agree with what they are proposing. This will allow us to determine what the best tool or technique will be.” Boswell indicated that TxDOT is currently using the report internally, and the next step in implementation is to get the information to those people who are working on right-of-way and property acquisition. “We can do our jobs better by having this information in front of us to evaluate scopes of work,” says Boswell.

While TTI recognizes that technologies continue to change and that the cleanup and assessment business is a maturing science, this project takes hazardous materials assessment a step forward. “You have to be multidisciplinary in your approach to assessing sites,” says Overman, “It just takes good science and good investigation to go out and do good work. And, ultimately, it is people making the decisions based on the data they have before them.”

For more information, contact **John Overman** at (817) 462-0516 or joverman@tamu.edu.

Related publication: TTI Report 1806-S: *Phase II Environmental Site Investigation Procedures and Technologies for Property Transfer and PS&E Development*.

Wootan honored

—continued from cover

was named division head of transportation economics five years later and promoted to assistant director of the institute in 1965. He served in that position until 1976 when he became director of TTI. Wootan retired as director in 1993 but continues to serve TTI as director emeritus.

During his time at TTI, Wootan has made many significant contributions to the institute. Perhaps the most significant was his role in the development of the TxDOT Cooperative Research Program. As TTI's director, he worked closely with TxDOT leadership to take the concept, conceived by DeWitt Greer and Gibb Gilchrist, and develop it into a nationally recognized program. That program is responsible, directly and indirectly, for the implementation of research that has saved thousands of lives and billions of dollars in Texas and the U.S., and increased the awareness of transportation problems beyond traditional engineering applications.

Wootan's nomination for the award was done in secret. Even as chair of the awards committee, he was not aware of his nomination. He accepted the award, saying, "This is a real honor and something I'll be proud of for a long, long time. I appreciate those sneaky ones of you who did it behind my back!"



TxDOT Executive Director Wes Heald, left, and TTI Director Herb Richardson, right, congratulate Charley Wootan as they present him with the Luther DeBerry Award.



The Luther DeBerry Award is given to the person who makes the greatest contribution to transportation in Texas for the past year. It recognizes and encourages the continued dedication, innovation and performance excellence of personnel in the field of transportation. It not only is open to thousands of engineers in TxDOT, but also employees from all other transportation-related agencies.

PUBLICATIONS ORDER FORM

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THE BACK ROAD



Environmental concerns are among the more difficult issues facing Texas and the nation. And while transportation isn't the only element in the equation, innovative transportation planning and research can help improve overall environmental quality in more ways than just reducing vehicle emissions.

This issue of the *Researcher* highlights the Texas Transportation Institute's (TTI's) Center for Air Quality Studies, as well as timely air quality and environmentally related research, such as the use of recycled materials for roadway construction, improving stormwater quality, studies on identifying and clearing hazardous wastes, and how to make roadside rest areas more friendly to wildlife and human travelers. You'll also learn about improvements underway at the TTI/TxDOT Hydraulics and Erosion Control Field Laboratory. The only one of its kind in the state, the lab has been providing erosion control research, data and performance information to the transportation community since 1989.

A special feature of this issue is the report on TxDOT's presentation of the Luther DeBerry Award to Director Emeritus Charley Wootan. Charley was honored at the October TxDOT Short Course for his 45 years of service and contributions to transportation in Texas. A leader at the state, national and international levels, Charley served as chairman of the Transportation Research Board in 1983. All of us who have been fortunate to work with Charley were delighted to see him receive this well-deserved recognition.

I hope you continue to find this publication useful and interesting, and that you'll contact us if we can provide more information. All of us at TTI wish you the best for the new year.

TEXAS TRANSPORTATION *Researcher*

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