

# Technology

## Today

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### SASHTO 2000: DOTD Hosts 59th Annual Conference

Officials welcome delegates to the opening session of SASHTO 2000.



The Louisiana Department of Transportation and Development recently hosted the 59th Annual

Southeastern Association of State Highway and Transportation Officials (SASHTO) Conference in

New Orleans. The conference provided an opportunity for DOTD to demonstrate its pride in the state of Louisiana and spotlight the technological innovations of the transportation community.

The annual meeting, presided over this year by Louisiana DOTD Secretary Kam Movassaghi, emphasizes SASHTO's longstanding commitment to improving the transportation industry throughout

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### LTRC Research Supports CPT as Cost/Benefit Success

Transportation structures in Louisiana require deep foundations to safely carry superstructure loads. Over 90 percent of these foundations use driven piles, with the overwhelming majority consisting of precast, pre-stressed concrete piles.

From design to construction, pile projects are always costly. In 1995 alone, the Louisiana Department of Transportation & Development spent about \$19 million in construction costs for driven piles.

The current DOTD practice of pile design is based on a static analysis using basic soil properties. These properties are obtained by conducting time consuming and expensive field and laboratory tests, including soil bor-

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## SASHTO 2000 (cont. from page 1)



*The SASHTO 2000 opening reception was held at the Aquarium of Americas and hosted by Louisiana Associated General Contractors.*

the nation, and particularly the southeastern regions. Over 1,000 delegates attended the SASHTO conference, including the chief administrative officers and their top assistants from the Departments of Transportation of 12 southeastern states and Puerto Rico and numerous industry representatives.

One of the most significant aspects of the conference included the official induction of Puerto Rico into the organization, bringing membership to 13.

Technical sessions presented during the conference focused on a wide range of issues facing the transportation communities of the

southeastern states: hurricane experiences, the National Research Program, the Future Strategic Highway Research Program (FSHRP), asset management, implementation of transportation materials, infrastructure rehabili-

tation, traffic management, community impact assessments, work zone safety, quality control/assurance/warranties, the Louisiana Quality Initiative, planning, bridges, intelligent transportation systems, Latin American trade and transportation, and human, environmental, and management concerns in transportation.

Since these delegates are always interested in new and innovative technologies, one of the special features of the SASHTO Conference was the Trade Show, which provided vendors an opportunity to exhibit new and innovative merchandise and services.

Participants enjoyed the ambience and the flavor of historic New Orleans while at the conference, which was held at the Hilton New Orleans Riverside, located in the famous French Quarter and overlooking the mighty Mississippi River. The conference hosted golf and tennis tournaments, various tours of the local area, and an opening reception held at the Aquarium of Americas. The events of the conference culminated in a closing reception that featured an authentic Mardi Gras parade and the musical talents of jazz great Pete Fountain.

The conference represented a tremendous commitment of time and talent by the department and by LTRC staff, who were heavily involved in the planning and conduct of the conference. Committees comprised of DOTD employees from throughout the department were formed to orchestrate the conference and the Technology Fair.

*The 2001 Annual SASHTO conference will be held in Asheville, North Carolina.*



# Breaking Down Communication Barriers in Training

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LTRC's Technology Transfer and Training Office has long worked to facilitate education and training of department and industry personnel, but the results of a recent survey conducted by the Division of Administration and Louisiana State University School of Vocational Education at the request of DOTD will assist the department in breaking down barriers to learning and opening up new levels of performance and delivery of services.

The needs assessment identified areas perceived by employees as barriers to or catalysts in support of learning in the workplace. The assessment identified, classified, and prioritized those factors most in need of attention to improve learning transfer in the department.

The Learning Transfer Systems Inventory (LTSI), as the assessment instrument was named, focused on the employee perceptions of 16 key factors influencing on the job use of

skills and learning acquired during training.

The conclusions called for greater recognition of impediments to supporting learning transfer and classification of areas most in need of improvement within the training areas.

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In an attempt to tear down those barriers, DOTD will provide training for training staff, department supervisors, managers, work groups, and trainees to explicate and redefine their role in supporting transfer of learning and identifying those areas that have been stumbling blocks in the past.

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The department is focused on building a work environment that provides greater support for the application of learning on the job.

The training needs assessment was a systematic process used to identify opportunities to improve the education and quality of the department's workforce.

The assessment helps determine how employee training might be used to improve job and organizational performance and/or delivery of services. Assessment results will be used for developmental purposes and not to evaluate individual performance.

Four areas were chosen for assessment in the survey: management skills, first-line supervisory skills, barriers to learning transfer, and basic skills. The results have been presented and now the department is in the process of addressing those needs.

Participants were randomly selected by LSU and their identities were protected. The assessments for management and supervisory skills and barriers to learning transfer were administered in the form of a questionnaire, each containing up to 100 questions. Basic skills (i.e. math and reading) were assessed using timed tests developed through the American Collegiate Testing's (ACT) Work Keys™ program.

## CPT: Cost/Benefit Success (cont. from page 1)

ings, standard penetration tests, unconfined compression tests, and soil classifications.

LTRC researchers Dr. Hani Titi and Dr. Murad Abufarsakh have been investigating what they believe to be a more efficient and cost effective answer, cone penetration testing (CPT).

CPT can be used for a wide range of geotechnical engineering applications. The CPT technology is fast, reliable, and cost effective—especially when compared to the traditional site characterization method.

The predominate soil type in Louisiana is a saturated silty clay subject to remolding and set up properties. However, other than a few exceptions, past implementation of CPT technology by DOTD has been limited to providing supplemental subsurface information to identify dense sand layers required to support end-bearing piles. This effort has been in addition to obtaining a full complement of soil borings. The capabilities of CPT are much greater than the department is currently applying. Full utilization of the CPT can drastically

decrease the number of soil borings and reduce the cost and time required for subsurface characterization.

LTRC researchers have identified the most appropriate CPT methods for predicting the axial load carrying capacity of piles driven into Louisiana silty clay soils. The research considered only the square precast, prestressed concrete (PPC) piles predominate in Louisiana bridge structures.

As part of the research, pile load tests performed on state projects that have corresponding CPT soundings were identified and collected from DOTD files. The Butler-Hoy method, the primary load test interpretation method used by DOTD, was used to determine the ultimate axial load carrying capacity for each pile. A traditional static analysis was performed from soil borings located close to the test pile.

Eight methods for predicting the ultimate pile capacity by CPT were selected. These methods were: Schmertmann, de Ruiter and Beringen, Bustamante

and Gianceselli (LCPC/LCP), Tumay and Fakhroo, Aoki and De Alencar, Price and Wardle, Philipponnat, and the penpile method. A statistical evaluation was used to compare the CPT methods based on their ability to predict the measured ultimate pile capacity. Based on this evaluation, two methods, the deRuiter/Beringen and Bustamante/Gianceselli, showed the best performance in predicting the load carrying capacity of square PPC piles driven into Louisiana soils.

The results of this study demonstrated the capability of CPT methods to predict the ultimate load carrying capacity of square PPC piles driven into Louisiana silty clay soils. In order to facilitate the implementation process, a Windows-based computer program, Louisiana Pile Design by Cone Penetration Test (LPD-CPT), was developed for design/analysis of square PPC driven piles from CPT data. The program is user-friendly and provides a profile of pile load carrying capacity with depth. Besides the deRuiter/Beringen and Bustamante/Gianceselli pre-

**For more information contact: Mark Morvant, P.E., Geophysical Research Manager, Louisiana Transportation Research Center. Ph. (225) 767-9124 email: mmorvant@dotd.state.la.us**

diction methods, the AASHTO recommended Schmertmann method is also included in the software.

One DOTD materials field crew can perform an average of 25 to 30 CPT soundings per week as compared to completing only eight conventional deep soil borings in the same time frame. An additional one to two weeks of laboratory and office work is then required before conventional results are available. Materials Section records indicate the average cost of a traditional boring, including lab and field tests, is \$50/ft with DOTD forces and \$60/ft by consultants. The average cost of CPT soundings is \$14/ft for the DOTD forces and \$28/ft for

consultants, a cost reduction between 2 and 3.5 to 1.

Due to uncertainties associated with pile design, load tests are often conducted to evaluate the actual response of the pile to load capacity. The cost of driving and loading a test pile in Louisiana ranges from \$13,000 to \$25,000. On large bridge projects, more accurate foundation evaluations will produce cost savings by allowing a reduction in the required number of test piles. On small bridge projects, it is often more cost-effective to increase the safety factor (i.e. increased pile length) rather than conduct a pile load test. This research has shown that utilizing CPT

technology in pile design will reduce the level of uncertainties associated with traditional design methods. On these projects, an accurate design leads to less uncertainty, less factor of safety (i.e. length), and therefore lower costs.

The results of this research indicate that CPT methods are more accurate in predicting the load carrying capacity of PPC driven piles in Louisiana soils compared to the currently used static methods. Cost benefit analysis has shown that implementation would result in cost reductions and time savings without compromising the safety and performance of the pile supported structures.

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## LTRC Congratulates CPM Award Winners:

### Centers' Own Plus DOTD Among Recipients



Recent graduates of the Louisiana Comprehensive Public Training Program (CPTP) were honored at a ceremony held October 27, 2000, at the Governor's mansion in Baton Rouge.



Among the Human Resource Development certification recipients were three LTRC employees: **Reta G. "Tinka" McFarland**, **Dedra R. Jones**, and **Wilma M. Chustz**.

Among those named Certified Public Managers were six DOTD employees: **Gary A. Gisclair**, **Khiet H. Ngo**, **Patty O. Parsons**, **Elizabeth A. Wills**, **Richard R. Steele**, and **Lloyd E. Porta, Jr.**

The Comprehensive Public Training Program was established by Act 656 of the 1979 Legislature to upgrade professional, technical, and managerial skills of state employees and non-elected officials in Louisiana. LTRC manages the program for DOTD.

The Management and Development Program has had two certification tracts, both of which are currently being redesigned to incorporate new and revised courses to specifically address statewide training needs. The Certificate in Supervisory Techniques (CST) has been awarded to participants who complete the first three levels of management training plus tests, work related projects, and other tract requirements. This tract was designed for any supervisor.

The Certified Public Manager (CPM) designation has been awarded to participants who completed all six levels of the management program plus tests, work-related projects, 60 hours of electives, and other tract requirements. This tract was designed for middle and top managers.

This is the first year for the Human Resource Development Certification Program, a joint effort of the CPTP and the undersecretaries in the administration of Governor Mike Foster.

The HRD certificate curriculum includes 32 days of classes, two exams, and a practical application project. This certification has been especially designed to meet the professional development needs of trainers currently working in state government.

## Piles and Piles:

# LTRC Research Investigates Bridge Approaches

A smooth transition from a freshly paved highway to a bridge makes the change almost imperceptible to the average motorist, but when that same approach has settled over time, the transition can be jarring, to say the least.

It is a problem that can be found across Louisiana's highway infrastructure system. Those jolting bumps are caused by differential settlement, the large settlement of the approach embankment and the relatively fixed pile-supported abutment.

In south Louisiana, where subsoil settlement potential is the greatest, the bridge structures are extended as much as possible in order to reduce the height of the approach embankment. On major structures, pile-supported approach slabs have been used to mitigate the embankment settlement with varying degrees of success.

Tulane researchers, under an LTRC contract, have been working to identify which factors have contributed to total approach settlement in pile supported approach slabs in south Louisiana. The research included identifying and

locating about 90 bridge sites with pile-supported approach slabs. The identified sites constituted the majority of these type structures in Louisiana. The information collected included approach slab dimension, approach slab reinforcement, pile spacing, pile length, embankment dimensions, embankment material, and soil conditions. A database was developed by the researchers to compile and analyze the data.

Using the information in the database, analyses were made to determine the possible causes for approach slab settlement. Bar graphs and pie charts were used to compare various parameters of concern for both pile-supported and non-pile supported approach slabs selected for this study. Ratings from the current condition records as well as a newly developed rating system using the International Roughness Index

(IRI) obtained from LTRC's mobile laser profiler were used to compare performance of the different approach slabs. The IRI rating system indicated that 26 percent of the slabs were in good to very good shape, 33 percent in fair shape, and 41 percent in poor shape to very poor shape. The results of the study indicate that the standard design being used by DOTD does not always produce acceptable field performance.

Seven representative sites were selected for thorough in situ investigations and sampling. Field work performed by Tulane, DOTD, and LTRC personnel at the sites included visual inspection of the pavement, bridge, approach slabs and ramps, settlement measurements, slab crack measurements, assessment of drainage conditions, etc. Field instruments used included a walking profiler, Dynatest, laser profiler, geodetic total station, soil borings, and cone penetrometer.

## Piles and Piles (cont. from page 7)

A simplified soil/structure interaction procedure has been developed for the design of pile supported approach slabs that accounts for specific site characteristics. The procedure takes into consideration effects of downdrag, embankment height, pile length, pile arrangement, and maximum allowed settlement to achieve an acceptable level of rideability.

A spreadsheet computer program has been developed for use by DOTD

design engineers for parametric studies of pile supported approach slabs. The software allows input of various site conditions and design parameters required for downdrag calculations. This input consists of pile characteristics, approach slab configuration and the output of other computer programs directly involving pile load capacity with depth and subsurface soil settlement profile with depth.

The methodology proposed by this research provides a

pile-supported approach slab with an estimated settlement based on anticipated drag loads and specific site characteristics. The predicted settlements were compared with those of the existing settlements of several approach slabs with good correlation. By varying the length of piles along the longitudinal approach slab for new designs, the desired "ideal" approach slab settlement profile could be obtained.

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