



For over 30 years, the staff of LTRC has strived to merge resources of state government and universities to help identify, develop, and implement new technology to improve the state's transportation system.

LTRC *impact*

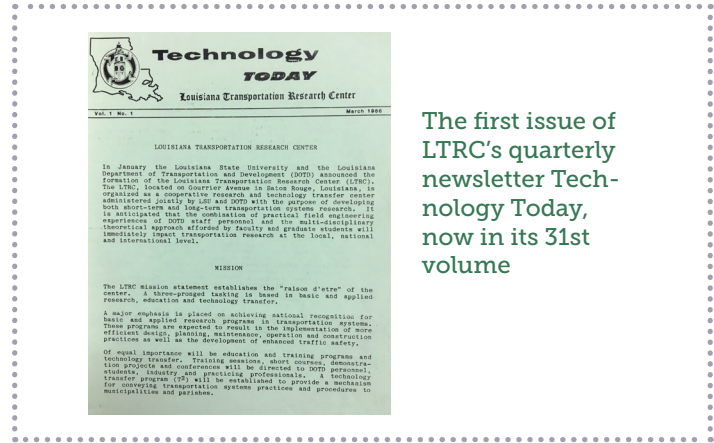
Research & Development

1970-1975

1975-1980

- A research study conducted in cooperation with Florida, Georgia, and FHWA developed the first comprehensive bridge inspectors training program. This program brought much needed attention to bridge maintenance and inspection.
- Research efforts in the asphalt materials arena moved specifications from method-based to statistically based. This change from method-based to statistically based specifications was the first step in making hot mix asphalt the highly engineered material it is today.
- Pavements research directed DOTD towards including and specifying smoothness criteria for control and acceptance of roadway construction projects.

- Impacts of highway noise on adjacent properties were investigated, leading to increased ability to access and estimate fair market value of expropriated property through better written environmental impact statements.
- Asphalt research looked at antistripping additives in lieu of mineral filler, greatly increasing the durability of asphalt pavements in Louisiana.



The first issue of LTRC's quarterly newsletter *Technology Today*, now in its 31st volume

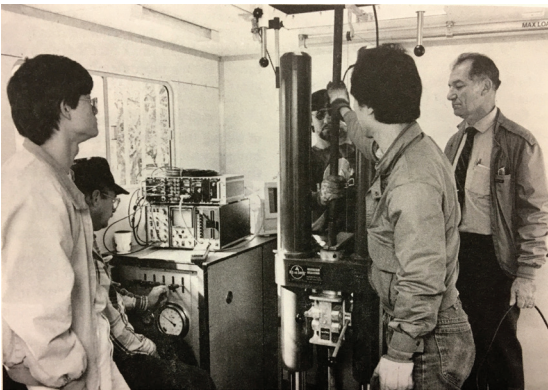
1980-1985

- The first formal "before and after study" evaluating safety improvements was completed. Results showed that the **benefits** derived from the projects **outweighed the costs on the order of 525%**, leading to the recommendation that future decisions be made utilizing the results of the study to properly allocate scarce safety funds.
- High-strength concrete and fly ash use in concrete was investigated leading to current class P concrete specifications for precast operations and standard specifications for fly ash concrete. Implementation of these results has led to increased life expectancy of structural concrete while significantly reducing the initial construction cost.
- Friction data was inventoried across the state, and a new methodology utilizing the Pavement Management System (PMS) was developed at this time and is still in use by the Department.
- The use of reclaimed asphalt pavement (RAP) was investigated and the results were implemented, saving on the cost of virgin materials for the last 37 years. Conservatively considering that DOTD paves 2 million tons of asphalt concrete per year and that asphalt concrete is approximately 5% asphalt cement and 95% aggregate, **DOTD has saved over \$300 million** with the implementation of these results.

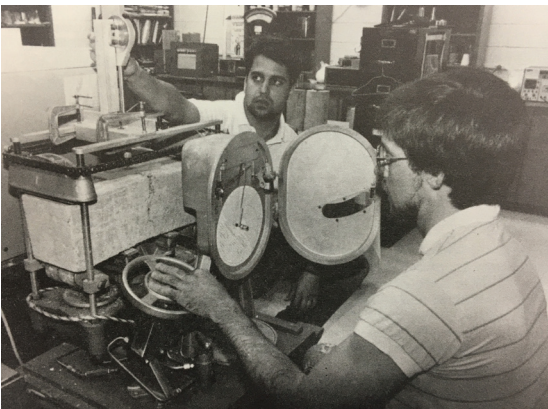
-1990



A group of ERDP participants with former LTRC director Joe Baker, second from left (1993)



Testing a new electronic cone penetrometer (1989)



Flexural beam tests on samples from an Interstate resurfacing project in Baton Rouge; LTRC was evaluating the effectiveness of fiber-reinforced concrete in resisting crack propagation in overlays (1990)

- The Engineering Resource Development Program (ERDP) was implemented after a successful research study aimed at addressing the rapid turnover of young engineers. Since its inception, over 95% of all engineer interns in the program have become full-time employees with DOTD.
- The use of weigh-in-motion scales (WIMs) were investigated and implemented, with 12 currently in use today. WIMs provide better data than static scales and an increased sample size with reduced manpower.
- The use of silica fume for concrete mixtures was investigated and implemented, leading to high-strength, durable, dense concrete mixtures for structural applications.

1990-1995

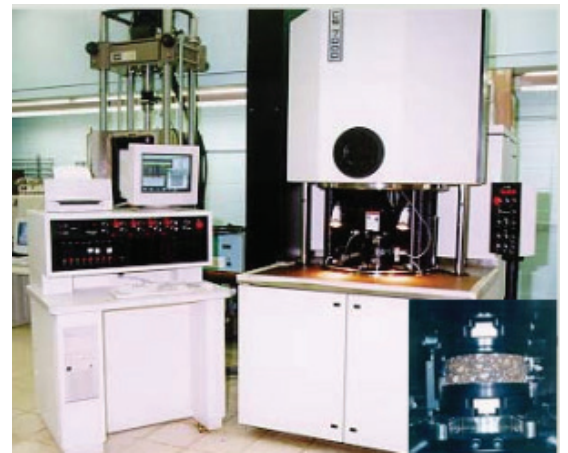
- The Pavement Research Facility (PRF) was formed and an Accelerated Loading Facility (ALF) was purchased. The interlayer base section was investigated, compared to eight other base sections, and found to be the most efficient. Results also showed that the pavement life for the interlayer system was about five times longer than current design methodologies of the day. The interlayer base section, also called an inverted pavement structure, is still in use and favored heavily in current design methodology, allowing crack relief from underlying soil cement.
- Research results showed that the existing 3 ½-in. diameter, single post, multi-directional slip base sign support met the AASHTO criteria. Therefore, DOTD was not required to remove and replace thousands of existing signs, thus **saving the Department millions of dollars**. This design is still used today by DOTD.
- Asphalt materials research resulted in the development of quality acceptance procedures currently used today including a payment system called percent within limits.
- Geotechnical research results, implemented and in use today, showed that cement stabilization of subgrades reduced sensitivity of native soils to moisture changes and provided a stable subbase which speeds construction.

1995-2000

- A speed limit study evaluated which roads could accommodate a higher speed limit, leading to the current 70 mph speed limit on urban and controlled-access interstate systems across Louisiana.
- Narrow transverse contraction joints were investigated and are now implemented in the current design standards, leading to construction efficiency and a slight noise reduction.
- A geotechnical study showed that geotextile fabrics, when designed and used properly, can mitigate slope failures in heavy clays. Videos were developed to aid maintenance forces in maintaining these problematic slopes today.
- SuperPave asphalt mixture design was investigated and implemented specifically intending to reduce rutting and cracking failures in flexible pavement sections.
- High performance concrete (HPC) was investigated, and the results were used in several follow-up studies. Portions of these results are currently incorporated in the latest version of the standard specifications.



The Accelerated Loading Facility



SuperPave shear tester

2000-2005

- The first comprehensive study of traffic safety was completed showing that small reductions in roadway crashes can translate to enormous costs savings to the state. Results showed that a 4.5% reduction in crashes would translate to **saving approximately 40 lives per year**.
- Pavement research updated the PMS by developing better, updated models that assist DOTD network and project-level PMS decision making efforts in planning and recommending appropriate maintenance and rehabilitation activities.
- Implementation of geotechnical research increased the use of treated subgrade layers and introduced target strengths. This work is reflected in today's current specifications.
- Asphalt research investigated the causes of failure for the early open graded friction courses (OGFCs) and the results were used to lift the moratorium on OGFCs allowing the use of OGFCs for specific safety purposes including surface drainage, minimization of hydroplaning, reduction of splash/spray, and improving wet weather visibility.
- Investigation and implementation of ground granulated blast-furnace slag (GGBFS) provided contractor and suppliers another material, which led to more competition and longer lasting pavements and structures.

2005-2010

- Concrete research showed that ternary mixtures with a supplementary cementing material (SCM) replacement level of 70% is reasonable for DOTD applications. The **costs savings to the Department could exceed \$1 million per year**, and the results have been implemented in the 2016 version of the standard specifications.
- Evaluation of submerged roads after Hurricane Katrina showed that the strength loss compared to non-submerged roads was equivalent to about 2 in. of asphalt structure. Cost estimates were developed showing that the repair costs neared \$50 million. The submerged roads program was developed using this data.
- Knowledge and information gained from a project modeling hurricane evacuation traffic, specifically contraflow operations, led to enhanced effectiveness of evacuation plans currently in use today.
- A study showed the effectiveness of differential speed limits for the I-10 over the Atchafalaya Basin **reduced crashes** despite an increase in traffic volume in the previous 7 years.
- The Geotechnical Information Database, in use today, was expanded to include more geotechnical information, such as shallow subgrade soil information and pile load test data.



Surface resistivity devices are providing an estimated annual savings in excess of \$1.5 million



Contraflow traffic is a logical and cost-effective strategy

2010-Present

- The Louisiana Safety Evaluation Tool (LaSET) was developed to assist with tracking the use and effectiveness of low-cost safety measures and is in use by the safety section today.
- An Immersive Virtual Learning Environment (IVLE) course of flagging was developed. The course has been implemented by other states and is being adopted by Nebraska LTAP.
- A summary report of HPC studies looking at strengths, beam sections, and implementation of HPC by the Department showed that implementation efforts have **saved DOTD a conservative \$14,690,000**.
- Mechanistic-Empirical Pavement Design Guide (MEPDG) implementation efforts are aiding DOTD design engineers in current design efforts, while other pavement research is looking into the impact of shale oil recovery operations in Louisiana by quantifying the damage using a variety of tools.
- Surface resistivity measures will save DOTD long-term maintenance costs by quantifying and specifying longer-service life concrete structures. Analysis of one project showed a **cost savings to the Department of \$40,000 in 3 months**. Annual cost savings are estimated to be in excess of \$1.5 million, and the newly revised standards and specifications include surface resistivity testing as a pay item.