FALL 2021

RESEARCH INFORMER

A Newsletter by the Arkansas Department of Transportation Research Section

New Pruitt Bridge
Photo by Russell Hubbard

INSIDE THIS ISSUE

Pruitt Bridge: Then and Now

BY GLORIA HAGINS

In February of 1931, The Arkansas State Highway Department began considering replacing the bridge on scenic Highway 7 near Jasper despite an anonymous Department representative being on record saying, "the old bridge was almost as good today as when it was built." While the bridge was not considered to be in a condition that required urgent attention, it could not withstand a load that exceeded 3 tons due to its design.

In a letter dated April 8, 1931, State Highway Engineer W.M. Mitchell reported that bridge designers had not yet started plans due to other work ordered ahead of this. In early May, he urgently requested that the bridge engineers begin and complete the design as soon as possible to get the bridge job into the next letting. Although uncertain of the origin of the urgency, it is thought that there may have been a dire need for bridge projects to provide employment in the years of the Great Depression.

The bridge design was started on May 11, 1931, and completed in one day following the standardized work procedure and designs established by the Department. The contract was advertised on May 13, with an estimated cost of $65,461.43 or $1,170,105.83 in today's money. Fred Luttjohann of Topeka, Kansas, received the contract with the lowest bid of $55,226.09. Luttjohann had numerous dealings with bridges in Arkansas and was regularly advertised in the *Arkansas Highways* magazine of the period. Some of the advertisements declared that his bridges were "built for the ages." Construction began on July 18, with a contracted building period of 210 days. The bridge was completed on January 23, 1932, 21 days ahead of schedule. The bridge was 20 feet wide comprised of two 10-foot lanes and no shoulders.

Nearly 88 years after the bridge was constructed, in February of 2019, the Department and its contractors began preparation to replace the Pruitt Bridge, the last Pennsylvania through-truss bridge remaining

Pruitt Bridge: Then and Now
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in Arkansas. The existing bridge's condition had deteriorated over the years as traffic increased between Harrison and Russellville with an average of 2,800 vehicles per day, 13 percent of those being large trucks in 2016.

Many people felt that the area was losing a big piece of history, and efforts were made to save the bridge. The bridge was a reminder of another time, a project that provided jobs to many during the Great Depression.The bridge was part of family history for some in the area with relatives who helped construct it. Despite efforts to save the bridge, including a petition with over 3,000 signatures, no one wanted to accept responsibility for maintenance. The bridge was demolished on June 9, 2021.

The newly constructed bridge opened to traffic on May 14, 2021. The new bridge is also two lanes but is now 45 feet wide with 12-foot lanes, 8-foot shoulders, and a 5-foot-wide sidewalk on the west side protected from traffic by a concrete wall with metal railing. The new bridge was built with an underpass constructed in a cutout of the bridge embankment. Prior to this underpass, horseback riders and hikers had to cross Hwy. 7 in a blind corner.


Old Pruitt Bridge

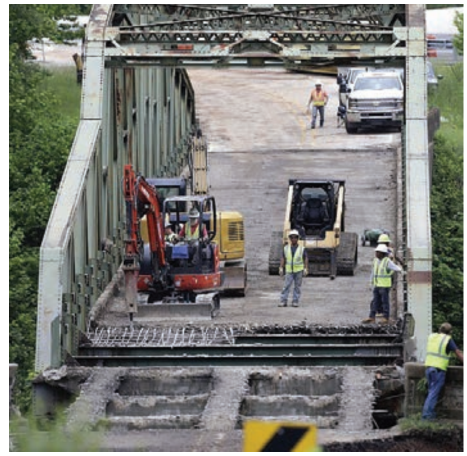



Photo still via demolition footage captured by Russell Hubbard

SPOTLIGHT ON LTAP:
The Arkansas Local Technical Assistance Program

BY LAURA D. CARTER

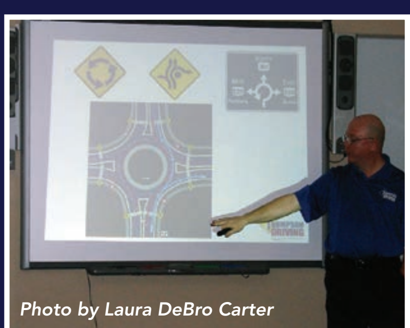
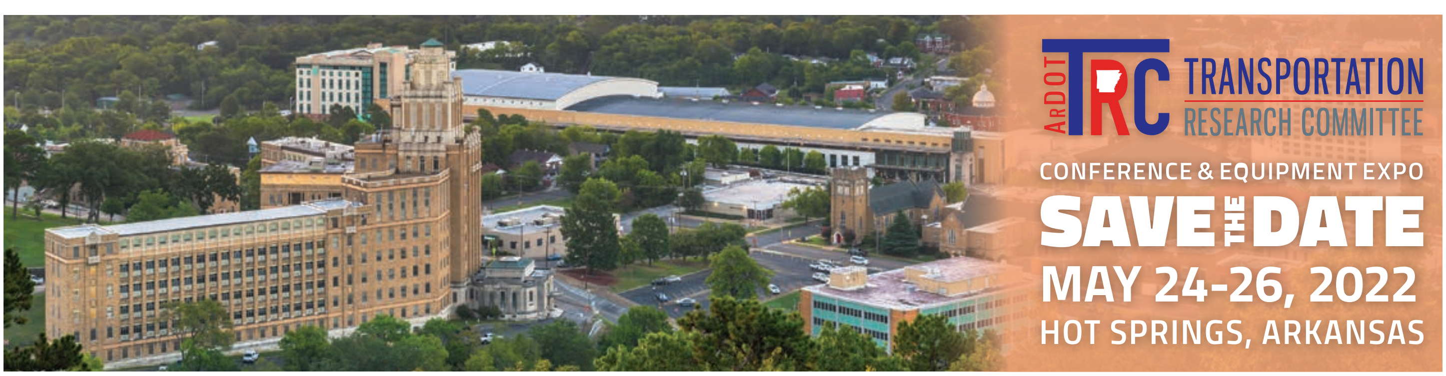


Photo by Laura DeBro Carter

While webinar training continues, the Arkansas Local Technical Assistance Program (LTAP) has resumed in-person training at various locations throughout the state. From January through June of this year, 28 classes and 19 webinars were held with 966 class participants. Training through this program remains free to class participants.

Dr. Stacy Williams, Director of the Center for Training Transportation Professionals (CTTP) at the University of Arkansas, continues to provide webinars and in-person infrastructure and safety training for this program. Training includes Asphalt Paving, Asphalt Maintenance, Pavement Distresses, Pavement Management, and Stormwater Management. Robert Bennett of Thompson Defensive Driving, Inc. also provides webinars and in-person training for Arkansas local partners regarding safe driving practices, intersection safety, and pedestrian safety. The training request form, class descriptions, federal infrastructure manuals, and other information is available at www.cttp.org/ardot/t2.



RESEARCH HIGHLIGHTS

PROJECT UPDATES

TRC2003 - Data Driven Methods to Assess Transportation System Resilience in Arkansas Update

BY ROSS PHILLIPS

For TRC2003, the research team is working to develop methods to assess transportation system resilience in Arkansas. This can be applied to situations like the 2011 flood that impacted I-40 near the White River. Alternate corridors can be established in order to reroute traffic to allow the continuation of flow. Further analysis can then be done to fully realize the impact created on industry and the traveling public at large. The project's main goal is to locate critical links and determine what can be done to fortify those links to mitigate the impact of natural disasters, such as strengthening existing assets. Deliverables for this project include a criticality map showing the most critical links in the system, and an implementation plan for resiliency within the organization going into the future. The Risk Analysis and Management for Critical Asset Protection (RAMCAP) framework is used to determine the likelihood of threats to the system, such as flooding or earthquakes. Once the researchers have those findings, they can measure resiliency on the most critical links in the system. Researchers are currently working on the criticality measurement of assets and will soon move on to ranking and identification. In order to do this, programs and data from a number of different organizations are combined to fit the Department's specific needs. Research is still ongoing, but the project is already providing some promising results.

UPCOMING PROJECTS

TRC2201 - Update to ArDOT Superpave Gyratory Compaction (SGC) Specification to Increase Pavement Durability

The overall objective of the proposed research is to increase the durability of asphalt pavements. This study will evaluate current mix designs for surface asphalt concrete hot-mix (ACHM) used around the state when reducing the number of design gyrations (N_{des}) and examine its effect(s) on change in mixture durability (rutting and cracking performance). The key is to assure that the mixtures produced with reduced N_{des} will have sufficient asphalt binder content to provide enhanced long-term cracking performance while maintaining adequate aggregate structure to resist the permanent deformation (rutting) in the field for a given traffic level. Increasing the durability of asphalt pavements will result in a reduction in necessary maintenance, preservation, and rehabilitation efforts/costs, and in a longer pavement life which will significantly reduce life-cycle costs. Also, the proposed study is the next logical step in fully implementing a performance engineered mixture design (PEMD) system for Arkansas. This project is expected to last 18 months.

TRC2202 - Updating ArDOT Liquefaction Evaluation and Mitigation Procedures

When designing bridge pile foundations in liquefiable soil, engineers at ArDOT use a Standard Penetration Test-based spreadsheet that was developed 10 years ago. Since then, more information has been published regarding liquefaction triggering procedures, skin friction, as well as end-bearing of piles in liquefiable soils, generating the need to create a more up-to-date version. This project aims to update ArDOT's spreadsheet and liquefaction triggering evaluation methodology as well as incorporate

TRC2202 continued...

additional means of evaluation and procedures. This project is expected to last 24 months.

TRC2203 - A Look into Low-Shrinkage Concrete Mixtures

Early age cracking has been identified as a common cause for Arkansas bridge decks not meeting their design life. It is suspected that dimensional changes in the concrete during the curing phase, known as shrinkage, are the culprit behind early age cracking. A possible solution to this issue revolves around concrete mixtures and curing procedures. This project is focused on evaluating the relationship that local aggregate and cement combinations have with shrinkage and early age cracking, finding optimal mix designs to prevent shrinkage cracking using locally available materials, and determining the curing methods required to best prevent shrinkage issues. This project is expected to last 36 months.

TRC2204 - Materials and Testing Specifications for Drilled Shaft Concrete

This project will study drilled shaft concrete and attempt to create a new mix design for self-consolidating concrete. Drilled shafts are common in bridge foundations used across the state, and due to the amount of rebar in drilled shafts, self-consolidating concrete is needed to ensure full cement coverage and correct aggregate displacement. Research has been conducted in the past to create a self-consolidating mix design, but not specifically for drilled shafts. Additionally, this research project will review the testing procedures for self-consolidating concrete and recommend new QA/QC testing. This project is expected to last 24 months.

Photo by Mark Simecek

Roller Compacted Concrete: Is It Concrete?

BY ANAZARIA ORTEGA

On May 13, 2021, Weaver-Bailey Contractors hosted a roller compacted concrete (RCC) paving demonstration. They placed a test strip at their headquarters in Conway. During the demonstration, many questions and comments regarding RCC arose. What is the water to cement ratio used in this RCC mix design? What type of admixtures are added to the concrete mixture? How do you fix the rough edges of the pavement? An attendee also pointed out that RCC did not look like concrete because the material was very dry. To answer these questions, Weaver-Bailey hosted a lunch and learn on June 10, where Dr. Stacy Williams from the University of Arkansas and Corey Zollinger with CEMEX aimed to provide examples and illustrate key concepts regarding RCC.

RCC pavement was first introduced in 1930 in Sweden. This type of pavement was mainly used for military and industrial construction. However, RCC usage has expanded to include transportation applications. Zollinger explained that RCC uses design principles of conventional Portland cement concrete, asphalt, and soil, all together. RCC and Portland cement concrete use the same materials. The RCC mix design is developed using moisture content instead of water-cement ratio. The moisture content is obtained from a Proctor test, typically used to determine optimum water content for soil compaction. Finally, RCC is placed like asphalt using a high-density paver.

Dr. Stacy Williams gave recommendations based on some of the problems she observed during her research. Ensuring that the production plant is working properly reduces the possibility of delays and significant moisture variability in the pavement. Williams explained that there is a proportional relationship between RCC compressive strength and density. She also suggested limiting the use of fly ash since it can delay the concrete strength gain. Additionally, Williams pointed out that there should be a change in perception of the material; the texture of the finished product is rough, and it does not look like regular concrete. However, Zollinger explained that if aesthetics is a major concern for the owner, troweling or broom finishing are also options. Even though the use of admixtures in RCC mix design is unusual, troweling aid products and curing compounds can be used to facilitate finishing and improve aesthetics.

Zollinger explained that the moisture content should be checked frequently to ensure it is evenly distributed. When making concrete cylinders, a vibratory tool should be used to consolidate the samples, to provide accurate compressive strength values. It is important to check that the pavement meets compressive strength requirements before it is open to traffic. Zollinger also added that the edges of the pavement can be either saw cut or a shoe can be installed at the end of the paver screed to provide smooth surfaces.

Both speakers agree that segregation can be a major problem when placing RCC. Thus, using blended aggregates and limiting the coarse aggregate size can mitigate this problem. The National Concrete Pavement Technology Center (CP Tech Center) held "Advancement in DOT uses for RCC" webinar on June 15, where it was discussed that the maximum aggregate size for RCC should be ¾" but ½" is preferred.

Zollinger mentioned that a plethora of resources are available for those who want to design and construct RCC pavement. Some of sources include American Concrete Pavement Association (ACPA), CP Tech Center, and the RCC Pavement Council.

Reference: The National Concrete Pavement Technology Center. Abdo, Fares Y. 2021. Advancement in DOT uses for RCC.
https://cptechcenter.org/webinars-and-videos/

Photo by Kim Romano

New Engineering Research Center Opens at University of Arkansas, Fayetteville Campus

BY KIM ROMANO, P.E.

The Grady E. Harvell Civil Engineering Research and Education Center (CEREC) officially opened its doors on Tuesday, July 20, 2021, with a steel ribbon-cutting ceremony. Phase I of the Center includes a 37,400 square foot building that will house several laboratories, a fabrication shop, and eventually, offices for staff and students.

The high-bay structures lab, featuring a four-foot deep concrete "strong floor" and a 25-ton overhead crane, will allow testing of full-scale structural elements in a controlled environment. This type of structural load testing has historically been outsourced to labs in other states such as Texas and Pennsylvania. Until now, structural testing in Arkansas has been limited.

Structural testing of steel, concrete, and timber will be the focus of the new research center. The role of CEREC in expanding the cross-laminated timber (CLT) industry in Arkansas is an especially exciting prospect. Research efforts are essential to certify local CLT and to include it in structural design codes.

It is anticipated that the CEREC will help position Arkansas as a national leader in the steel and timber industries. ArDOT contributed $1,000,000 to the construction of the CEREC through the Transportation-Related Research Grant Program (TRRGP).

Photo by Kim Romano

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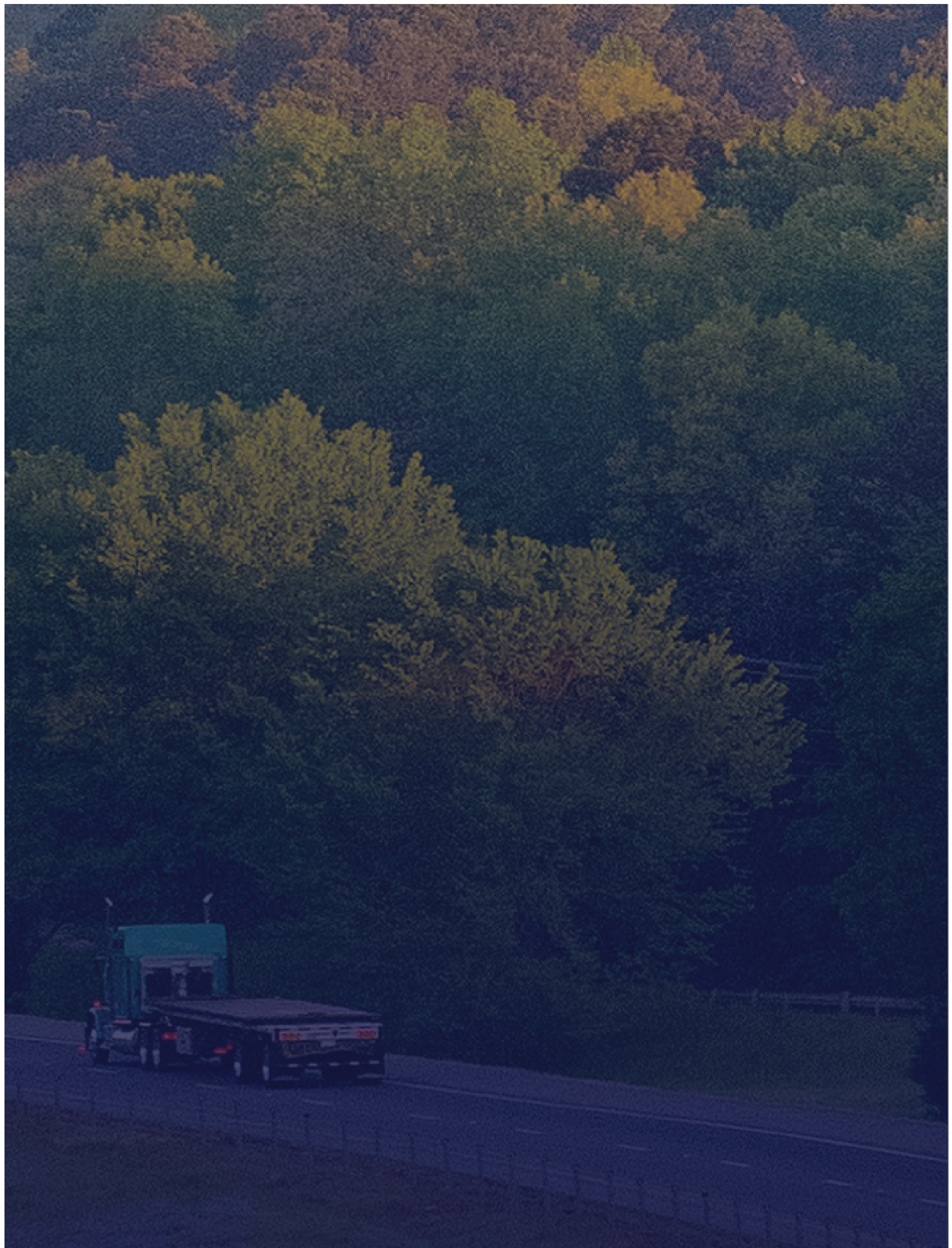

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