

# Workforce Development Symposiums for UHPC



*Offers two workforce development symposiums on UHPC to promote its use, provide guidance, and further assist in its adoption and implementation*

Ultra-high performance concrete (UHPC) is a cementitious material with a dense microstructure that contributes to high compressive strengths as well as enhanced durability properties. UHPC also possesses significant post-cracking strength and ductility due to the addition of fibers. These characteristics produce a material that provides advantages over conventional concrete; however, high costs attributed to materials and production, lack of industry familiarity and knowledge, and the absence of standardized design procedures have impeded its wide-spread use. To help disseminate knowledge on UHPC, two workforce development symposiums on UHPC will be held in New Mexico. The symposiums will consist of presentations and hands-on demonstrations to introduce UHPC and distribute the findings of almost a decade of research conducted in New Mexico to a diverse audience including members of the New Mexico Department of Transportation, contractors, designers, researchers, and concrete suppliers.

constructed as the first UHPC bridge in New Mexico. One span of the bridge used UHPC and the other used high performance concrete (HPC). Bridge 9706 is currently being tested and monitored to investigate the performance of UHPC compared to HPC. Using the data gathered from the bridge, analytical models are being developed to further investigate the behavior Bridge 9706 and improve design methods for UHPC.

UHPC offers many advantages as its improved material and durability properties allow for smaller structural members to be used in designs, longer spans on bridges, and greatly increase the lifespans of structures. It also reduces maintenance activities, maintenance costs, and life-cycle costs of concrete structures. With UHPC being a relatively new material, there are not many working professionals with experience or significant knowledge of the mixing, casting, curing, and testing of UHPC. Furthermore, many of the projects incorporating UHPC in their design have been in collaboration with researchers. Recently, testing standards became available for UHPC, however, there are currently no design codes that incorporate the material properties of UHPC. These issues have created a lack-of-knowledge in regards to the incorporation of UHPC with other materials in projects. Therefore, to disseminate the results of almost a decade of research and encourage the use of UHPC, workforce development and training seminars are necessary.

## Background

Over the last several years, a research project in collaboration with the New Mexico Department of Transportation (NMDOT) has investigated the feasibility of incorporating UHPC into bridge design in the State. Through the findings of a comprehensive literature and historical application review, trial designs, and cost analyses on typical prestressed concrete bridges using UHPC, it was determined that UHPC could potentially benefit design, construction, maintenance, and the lifespan of structures. Optimized mixture proportions and a curing regimen for an UHPC that uses materials local to New Mexico were developed that meet the strength and durability design requirements of the NMDOT. The creep and shrinkage behavior of the local UHPC has been investigated and Special Provisions have been developed for the implementation of UHPC in bridge design. To verify the design and behavior of UHPC girders, large scale flexural tests were conducted. Using the results of the research Bridge 9706, a two simple-span structure, was designed and

## Project Summary

The symposiums for NMDOT personnel, practicing engineers, contractors, and other transportation related organizations and practitioners will help to create more informed and educated workforce on the use and implementation of UHPC. Due to the its excellent durability properties, UHPC is a material that can potentially improve service lives of bridge superstructures in both rehabilitated bridges and new construction and lead to lower life-cycle costs. The dissemination of knowledge through these symposiums will improve

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awareness, skills, provide training, and help to influence decision making regarding the use of UHPC leading to more economical and sustainable designs for the region.

The main objectives for the project are:

- Prepare, plan, and coordinate first workforce development symposium;
- Prepare, plan, and coordinate second workforce development symposium; and
- Document and reporting of activities.

## Status Update

The first of two UHPC symposiums was hosted by New Mexico State University (NMSU) on April 17 - 18, 2018 at the Las Cruces Convention Center in Las Cruces, New Mexico. The Symposium focused on defining UHPC, identifying benefits of UHPC, and sharing experiences with mixing, casting, and curing UHPC. Through the knowledge gained through the research program, presentations helped to demonstrate how UHPC can be incorporated into precast facilities with little to no changes made to the facility or typical casting procedures.



**Figure 1. Demonstration and participants at the first conducted UHPC Symposium.**

Furthermore, through the design of test specimens and the girders for Bridge 9706, engineers were exposed to how the improved properties of UHPC were incorporated into structural designs. Results of small and large scale testing were also presented to demonstrate the difference in behavior of typical high performance concrete and UHPC. Finally, hands-on demonstrations were provided to allow individuals to see the difference in the material from traditional concretes.

## Impacts

The first workforce development symposium on UHPC helped to provide a diverse community of design engineers, contractors, and concrete suppliers knowledge on the characteristics and use of UHPC. The Symposium provided an opportunity to ask questions, learn, share knowledge, and gain guidance on how to implement UHPC in different applications. Through the hands-on demonstration, attendees were able to learn what specific changes (if any) are needed for the mixing, placing, curing, and testing of UHPC. By observing the mixing and placing process, the difference between normal / high strength concretes and UHPC could be observed.

## Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

## Learn More

For more information about Tran-SET, please visit [our website](#), LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Mr. Christopher Melson (Tran-SET Program Manager) directly at [transet@lsu.edu](mailto:transet@lsu.edu).

