



## A Sustainable Upgrade of Bridge Decks with Ultra-High Performance Concrete Overlays

CTIPS-028 – UTC Project Information

<b>Recipient/Grant Number:</b>	North Dakota State University, University of Colorado Denver Grant No. 69A3552348308
<b>Center Name:</b>	Center for Transformative Infrastructure Preservation and Sustainability
<b>Research Priority:</b>	Preserving the Existing Transportation System
<b>Principal Investigator(s):</b>	Yail Jimmy Kim, Ph.D.
<b>Project Partners:</b>	USDOT, Office of the Assistant Secretary for Research and Technology – \$60,000 University of Colorado Denver—\$30,000 Department of Academic Attaches and Scholarship Affairs, Libya Government—\$30,000 (graduate student scholarship)
<b>Total Project Cost:</b>	\$120,000
<b>Project Start and End Date:</b>	8/17/2024 to 8/16/2026

### Project Description

The overarching goal of the research is to explore a sustainable solution that can extend the longevity of constructed bridge decks by placing an overlay system with a state-of-the-art construction material, ultra-high performance concrete (UHPC). Specific objectives are: 1) To fundamentally understand interactive mechanisms between bridge decks and UHPC-overlays, contingent upon the degree of composite action; 2) To perform theoretical studies that can encompass various situations involving assorted material and geometric properties; and 3) To develop practice guidelines for the sake of bridge engineers and government officials who are in charge of bridge management.

### USDOT Priorities

The research program aligns with the two major goals of USDOT: *Safety* and *Sustainability*. The proposed rehabilitation system with UHPC overlays will significantly increase the level of safety by reducing the probability of failure. As part of the aforementioned theoretical modeling, risk levels will be quantified with and without the overlays. In so doing, specific information will be available to justify the use of the overlay system with regard to safety. As far as sustainability is concerned, the research conforms to the broadly accepted definition stipulated by the United Nations ‘*meeting the needs of the*

*present without compromising the ability of future generations to meet their own needs'* because it will preserve built-environments in a rigorous manner.

## **Outputs**

Dr. Kim will deliver technical presentations during professional gatherings (e.g., American Concrete Institute conventions). This plan differs from routine presentations for a typical conference in that he will elaborate on research backgrounds, scientific approaches, ensuing outcomes, and practical applications. Active discussions are expected with engineers, researchers, and students. Dr. Kim will also communicate with industry people so that research can be translated into practice. Peer-reviewed publications will be another means to accomplish technology transfer around the globe.

## **Outcomes/Impacts**

By comprehending the efficacy of UHPC overlays in upgrading bridge structures under a wide variety of circumstances, bridge professionals can apply this cutting-edge rehabilitation method with confidence. The experimental and analytical approaches will result in guidelines that can be implemented in the field. The cost-effective and sustainable technique will extend the service life of bridge members and will preclude unexpected failure. The design recommendations to be drafted can be adoptable in the bridge design manuals of state DOTs. Findings will be shared with other engineers and researchers through the three bridge committees of the American Concrete Institute (ACI): ACI 342 (*Evaluation of Concrete Bridges and Bridge Elements*), 343 (*Concrete Bridge Design*), and 345 (*Bridge Construction and Preservation*).

## **Final Report**

Upon completion, the final report link will be added to the [project page on the CTIPS website](#).