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University Transportation  
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#### Project Title

Concrete Bridge Deck Life  
Enhancement Through the  
Application of UHPC Overlays

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## Project Summary

Technology Transfer Outreach Publication

# Enhancement of Bridge Decks Through the use of Ultra High Performance Concrete Overlays

Bridge decks are susceptible to a variety of damage resulting from mechanisms such as freeze-thaw cycles, chemical attack from surface treatments, and mechanical stresses induced from dynamic vehicle loads. This damage is often exacerbated in "Salt States" where deicing chemicals are frequently used during the winter months, and are often the cause of premature deterioration of bridge deck. The primary function of a bridge deck overlay is to extend the life of the structure by providing an additional barrier for protection of the superstructure from contaminant penetration, but the overlay also serves to provide a durable wearing surface for traffic. For long-term performance, these overlays need to provide sufficient bearing capacity which is adequate for the loading on the bridge deck while remaining compatible with the existing bridge deck or substrate. These characteristics are fulfilled when the overlay concrete achieves optimal strength and resistance to crack propagation.

The purpose of this research project is to explore a concept that may help to minimize the aforementioned bridge deck deterioration problems by evaluating the efficacy of using thin UHPC overlays on concrete bridge decks. The potential benefit of this type of solution is a more sustainable solution for both repairs and new bridge decks without significant deviation from current established practices.

## Research Objectives

The Primary objective of the research is to explore the feasibility of using UHPC as a thin topping for conventional reinforced concrete bridge decks.

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## University Facts (2008-2009)

Total Enrollment	7018
Graduate Enrollment	984
Number of Faculty	445
Placement Rate	96%

Michigan Technological University is located in Houghton, Michigan on the south shore of Lake Superior. This rural area is known for natural beauty, pleasant summers, abundant snowfall, and numerous all-season outdoor activities. In addition, the University maintains its own downhill and cross-country ski facilities and golf course. There are numerous cultural activities and opportunities on campus and in the community. Michigan Tech has also been rated as one of the safest college campuses in the United States, and the local community provides excellent resources conducive to an outstanding quality of life.

For more information, visit the University's website.

[www.mtu.edu](http://www.mtu.edu)

## Methodology

- Perform thorough literature reviews of research related to UHPC, construction overlays, bonds between types of concrete, and material durability.
- Design experiments and fabricate scale specimens for proof of concept.
- Test fabricated specimens under a variety of conditions including interface bonding, freeze-thaw and cyclic loading.
- Investigate the potential challenges that exist for implementation of this concept.

## Research Findings

This investigation will analyze the performance of UHPC overlay for concrete bridge decks. This investigation will examine the effects loading has on the bonding interface between the bridge deck itself and the UHPC overlay. This study will also evaluate the minimum thickness for the overlay with considerations of functionality and economy.

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