

MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 24-547 (project 695) | August 2024

Durability and Volumetric Stability of Non-Proprietary Ultra-High-Performance Concrete Mixes Batched with Locally Sourced Materials



the ISSUE

Ultra-high-performance concrete (UHPC) is distinguished by its superior performance and durability. These characteristics are attained through a precise mixture design that includes a low water-to-cement ratio, high fineness supplementary cementitious material, and steel fibers. Non-proprietary mix designs developed using locally available materials are needed to reduce costs by eliminating the need to purchase expensive proprietary UHPC mixes from specialized commercial suppliers.

the RESEARCH

This study uses response surface methodology and central composite design to optimize the UHPC mixture. The optimized UHPC mixture with 2% steel fiber by volume achieves a 22,113 psi (153 MPa) compressive strength. The study undertakes a comprehensive experimental program to evaluate compressive strength, freeze-thaw durability, surface resistivity, and autogenous and drying shrinkage on the non-proprietary mix using available test standards.



A University Transportation Center sponsored by the U.S. Department of Transportation serving the Mountain-Plains Region. Consortium members:

Colorado State University
North Dakota State University
South Dakota State University

University of Colorado Denver
University of Denver
University of Utah

Utah State University
University of Wyoming



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Project Title

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the FINDINGS

A local non-proprietary UHPC mixture with a compressive strength of 22,213 psi (153 MPa) was developed.

the IMPACT

The development of a non-proprietary UHPC mix for UDOT will decrease construction costs associated with the use of UHPC and will also allow for UHPC to be more widely used. Non-proprietary UHPC mixes are at least 50% less expensive than proprietary mixes.

For more information on this project, download the Main report at <https://www.ugpti.org/resources/reports/details.php?id=1199>

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.



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