MONTANA Department of Transportation
Research

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Performance Measures Report
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FEASIBILITY OF NON-PROPRIETARY ULTRA-HIGH PERFORMANCE CONCRETE (UHPC) FOR USE IN HIGHWAY BRIDGES IN MONTANA: IMPLEMENTATION

https://www.mdt.mt.gov/research/projects/mat/high_performance_concrete.aspx

More Info:

The research is documented in Report FHWA/MT-23-002/9925-818

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Ultra-high performance concrete (UHPC) has mechanical and durability properties that far exceed those of conventional concrete. However, using UHPC in conventional concrete applications has been cost prohibitive, with commercially available/proprietary mixes costing significantly more than conventional concrete. The focus of the research conducted at MSU has been on developing a nonproprietary UHPC mix that is less expensive than proprietary mixes, and demonstrating the feasibility of using such a mix on the field.

A breakdown of the cost of using MT-UHPC in this project are provided in the Table below. These costs were estimated by the contractor after the completion of the project in November 2021. As can be observed in this table, the cost of the constituent materials was $1550/yd3, with the most expensive component being the steel fibers, which accounted for approximately half the total cost. These material costs include the freight from the source to the contractor's yard in Helena. The premixing and bagging of the dry mix was estimated to cost $850/yd3. This brings the total cost for the materials to $2400/yd3, including pre-bagging.

Table 1: *Cost of MT-UHPC per cubic yard.*

Item	Cost/cy
Materials	
Cement	$ 237
Silica Fume	$ 174
High Range	$ 204
Fly Ash	$ 68
Steel Fibers	$ 790
Sand	$ 77
Materials Subtotal	**$ 1,550**
Mixing/Packaging	**$ 850**
Total Material Cost	**$ 2,400**

The exact cost of commercially available or proprietary UHPC mixes is often not transparent, with prices varying based on the specific formulation and vendor. In contrast, developing a nonproprietary UHPC mix in-house generally offers a more cost-effective solution.

This approach not only allows for greater control over material costs but also enables customization

to meet specific project requirements. Moreover, as research and development in this area progress, the cost of producing nonproprietary UHPC is expected to decrease further. For example, the elimination of costly components like fly ash and the optimization of mixing and batching processes show promise in reducing the overall costs of the nonproprietary mix.

In addition to the direct cost savings from in-house production of nonproprietary UHPC, significant economic advantages are realized over the long term when UHPC is used in place of conventional concrete. While the initial application of UHPC may be higher, the enhanced durability and strength of UHPC contribute to its longer lifespan and reduced need for maintenance, and the associated costs.

This research investment will lead to an increased use of nonproprietary UHPC in Montana, ultimately leading to a more sustainable and economical infrastructure in the state.