DEVELOPMENT OF SPECIFICATIONS FOR HIGH-PERFORMANCE FIBER CONCRETE FOR NEVADA

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Key Points:

Project Number:
366-16-803
Start Date:
June 1, 2016
Duration:
24 Months
Project Cost:
$186,719

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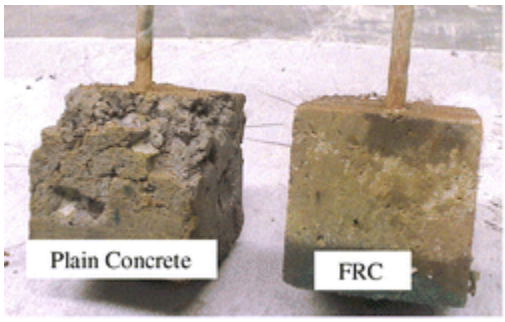
PROBLEM

By using high-performance fiber concrete (HPFC), also known as high performance fiber-reinforced concrete (HPFRC), for bridge decks and connections, the service life of a bridge deck can be significantly improved. Research is needed to determine what are the most effective applications of HPFC for NDOT to optimize both structural performance and economic efficiency, and to investigate if HPFC can be produced and placed with locally available materials and commonly used methods.



OBJECTIVE

With the higher demands for a durable concrete capable of extending the service life of bridge structures, the use of HPFC may provide a viable option for NDOT that is both structurally and economically efficient.

METHODOLOGY

Task 1 Literature Review

A comprehensive literature review will be conducted to collect and summarize the current state of knowledge regarding FRC and HPFC. The comprehensive review will include the use of fibers of different types (steel, polymer, glass, carbon), shapes (straight, hooked, twisted), and sizes (macro, micro).

Task 2 Laboratory Study

An experimental program will be developed and conducted to fill the knowledge gap and to investigate the structural and material behavior of bridge decks joints with HPFC.

Task 3 Field Study

To evaluate the constructability and structural efficiency of HPFC mixtures, the research team will conduct a field study with promising HPFC mix(s). Representative NDOT bridges experiencing significant deck cracking, especially transverse cracks, will be included in a preliminary field investigation. The objective of this investigation is to identify causes of extensive deck cracking of bridges and whether they can be mitigated or eliminated through the application of HPFC. Visual inspections will also be made periodically to identify any cracking and access the degree of cracking. To ensure the evaluation of the impact of seasonal changes, i.e., temperature and humidity, the research team will perform visual inspections and collect strain measurements approximately every two months

after the bridge in service until the end of the project.

Task 4 Cost Analysis

With the use of HPFC, although the initial cost may be higher than the case with using conventional concrete, frequencies of deck overlays, and replacement may decrease, which could result in an overall saving with the total life-cycle costs. A cost analysis for the use of HPFC in Nevada is to be performed to justify the cost effectiveness of the application.

Task 5 Recommendations and Specifications Development

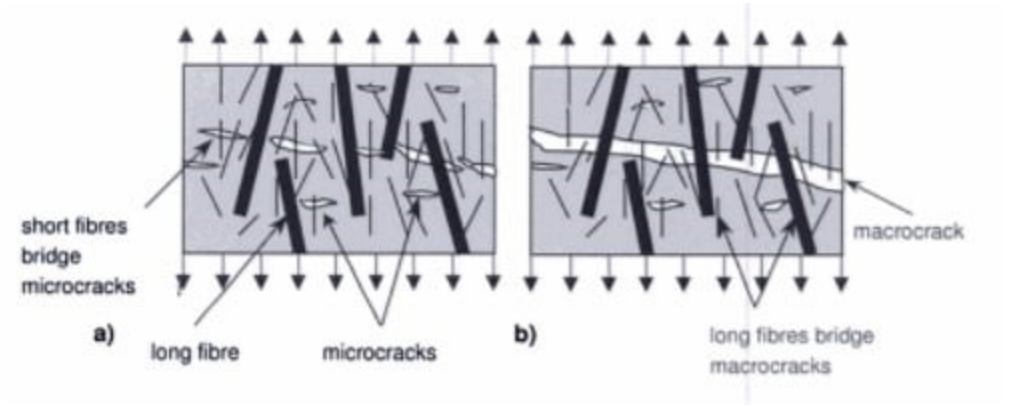
Based on the findings of the laboratory and field tests, a set of recommended fibers, mixture design, and construction practices will be developed. Practical recommendations will be provided, discussed, and agreed upon NDOT.

Task 6 Final Report

A draft final report and draft executive summary will be prepared and submitted for NDOT to review 90 days prior to project completion.

IMPLEMENTATION POTENTIAL

The result of this research program will be design and construction requirements that can be integrated statewide. The research will provide the guidelines and a draft specification that can be incorporated by NDOT to make effective use of the local materials yet providing a high-performance quality and long-life structures.



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