

High Performance Concrete with Post-Tensioning Shrinking Fibers

PROJECT TITLE

High Performance Concrete with Post-Tensioning Shrinking Fibers
TIDC Project 2.7

STUDY TIMELINE

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KEYWORDS

Prestressing fiber, concrete durability, chitosan, steel ring

Introduction

This research improves upon the technique of reinforcing concrete with dispersed fibers by having the fibers axially shrink after curing to produce a dispersed multi-axial post-tensioned state. Such reinforcing may increase the crack resistance and durability of the concrete. Chitosan is a natural nitrogen-based biopolymer derived from shrimp shells that shrinks in high pH, as in fresh Portland cement concrete.

Methodology or Action Taken

Concrete blocks reinforced with chitosan fibers were freeze-thaw thermal cycled in an environmental chamber and impact resonance frequency tested. Specimens are wrapped in wet towels and cycled between -20°C and 20°C . 5 specimens per group are used to achieve a valid average. Each weight ratio has active and passive groups to examine if shrinkage causes potential benefits.

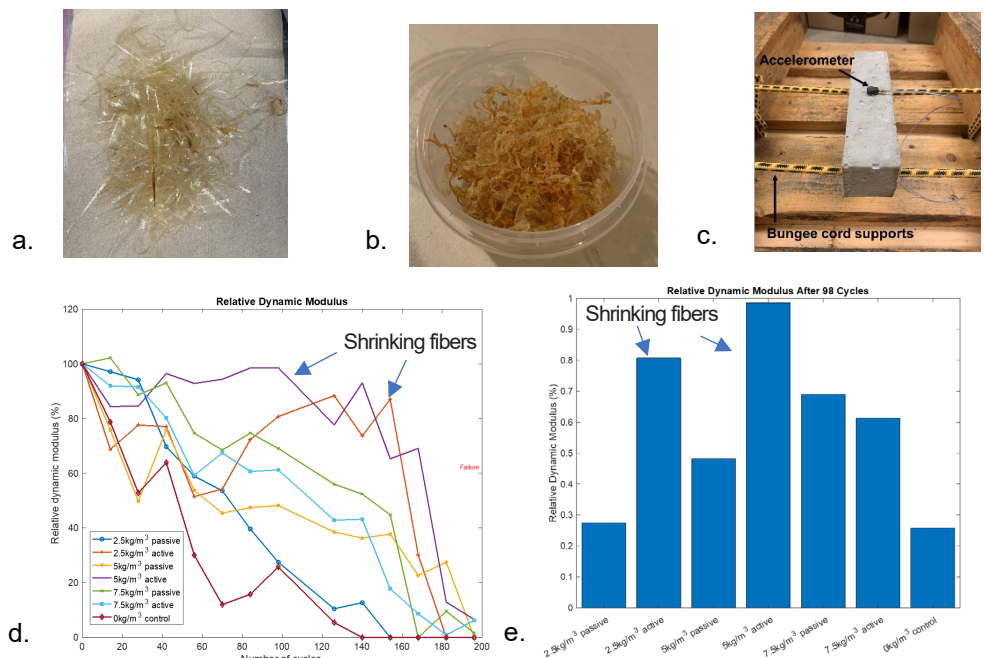


Figure 1. Experiments and results: a. Active shrinking chitosan fibers, b. Preshrunk fibers, c. Flexure frequency test of durability, d. Durability frequency versus freeze thaw cycles, e. Dynamic modulus versus fiber content and freeze thaw

Conclusions and Next Steps

Concrete samples with 2.5 and 5.0 kg/m³ chitosan shrinking fibers performed best in freeze-thaw durability tests. Promising results also with shrinking steel rings show increased post-cracking strength. Next steps include further testing of durability and strength and improved manufacture of shrinking fibers.

Potential Impacts and VTrans Benefits

This is an early stage research, but results to date confirm that prestressing fibers are a potential means of increasing the durability and strength of concrete.

More information about the VTrans Research Program, including additional Fact Sheets, can be found at: <http://vtrans.vermont.gov/planning/research>