VERMONT
AGENCY OF TRANSPORTATION

FACT SHEET

Low Carbon Footprint Concrete

PROJECT TITLE
Low Carbon Footprint Concrete

STUDY TIMELINE
June 2022 – August 2022

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

Introduction or Problem Statement

This project aims to study and establish mixes and construction practices to achieve durability with low carbon footprint environmentally friendly concrete (EFC) for use in transportation structures. Conventional Portland Cement Concrete (PCC) has a large carbon footprint, about 8% of the annual worldwide production of CO_2. A variety of low carbon cements and admixtures have been proposed, but a track record for durability and optimal mix designs need to be established.

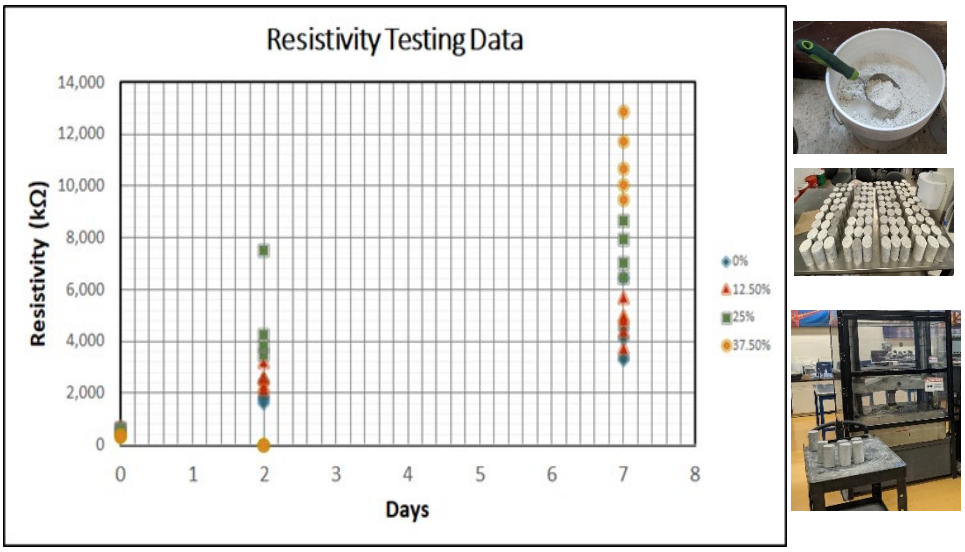

Figure 1. Electrical resistance of concrete samples versus amount of Pozzotive ground glass cement substitute, with increased resistance potentially indicating increased durability

Methodology or Action Taken

Identified EFCs with potential for widespread usage in transportation structures. Based on availability and potential for scale up, glass-based cement admixtures were selected for further study. The plan is to conduct laboratory tests of durability, such as freeze thaw, chloride penetration, alkali silica reactivity, shrinkage cracking, and sensitivity to mix variability. Identify potential durability issues, including nonconventional issues. Work to develop mitigation methods to improve durability. The first set of tests examined ground glass with micron scale dimensions that produce a pozzolanic action. The Wenner probe electrical resistance increased with the amount of Pozzotive glass in the cement, potentially indicating increased durability. Next steps are to expand strength and durability tests for various ground glass cement mixes, and then examine silica fume admixtures, ground glass sand substitutes, possibly glass aggregate substitutes, and other potentially viable EFCs, especially Portland Limestone Cement..

Potential Impacts and VTrans Benefits

Reduced carbon and related environmental impact of concrete in transportation structures, while maintaining and enhancing durability. Reduced need for lengthy and expensive durability certification studies as required for new and proprietary EFC mixes.