

Pavement

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Project Title:

Towards Implementation of
Recycled Fibers from Novel
and Existing Source Materials in
Concrete

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Towards Implementation of Recycled Fibers from Novel and Existing Source Materials in Concrete

To identify source materials for recycled fibers in California and to evaluate their performance for concrete pavements.

WHAT IS THE NEED?

Fiber-reinforced concrete (FRC) can extend pavement life cycle and delay or eliminate crack/joint repair needs. However, many states do not have acceptance specifications for FRC, partly because the impact of fibers on field performance is not fully studied. For this reason, design parameters and procedures are not fully developed and validated. Furthermore, many studies show recycled fibers perform the same or better than virgin counterparts, yet recycled fibers are not implemented in concrete paving practices. Therefore, there is a need to review existing and emerging recycled fiber technologies compared to their counterparts from virgin materials considering their life-cycle costs and environmental impacts, supply-chain logistics, and performance.

WHAT ARE WE DOING?

The research team completed Phase I of this task in year 2022-2023 under Contract 65A0788. Phase II of the task includes identifying and evaluating commercially available recycled fibers and fibers with a potential for a robust supply chain development in California. The team will build a field demonstration project, and Heavy Vehicle Simulator (HVS) will be loaded to investigate the enhancements from fibers in the fatigue life of concrete slabs or other performance, such as joint load transfer. The team will develop a strategy to incorporate the benefits of fibers into pavement design.

This task includes the following subtasks:

- Source Material Sampling, Characterization, and Fiber Production



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- Optimization of Fibers Size and Loads
- Durability Evaluation of Selected recycled fiber-reinforced concrete (rFRC)
- Phase II Research Report
- Test Track Construction and Testing
- Mechanistic-Empirical Modeling of FRC Pavements
- Research Report and Proposal for Implementation in Caltrans Rigid Design Catalog

WHAT IS OUR GOAL?

The goal of this task is to identify viable feedstock of source materials for recycled fibers in California, to evaluate their performance for concrete pavements, and to develop pavement design guidelines and materials specifications for implementation. This includes addressing uncertainties in performance, overcoming commercial challenges, and determining the environmental and economic benefits of incorporating rFRC in concrete pavements.

WHAT IS THE BENEFIT?

The benefits for Caltrans in undertaking this task include environmental sustainability, potential cost savings, innovation leadership, improved infrastructure resilience, positive public perception, economic growth, reduced dependency on virgin materials, and enhanced project durability.

WHAT IS THE PROGRESS TO DATE?

The research team has made the following progress to date:

- Reviewed collected fiber samples and begun contacting suppliers to acquire additional fibers.
- Developed a fiber-reinforced concrete batching and testing plan. Initiated optimization for fiber size and load through trial batches and industry meetings.