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CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION
TRANSFORMING IDEAS INTO SOLUTIONS

Research Notes

Further Development and Piloting of Supplementary Cementitious Materials in Concrete

Evaluating and advancing new supplementary cementitious materials for durable, sustainable concrete.

Pavement

MAY 2025

Project Title:
Partnered Pavement Research Center (PPRC) 23: Recycling

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Task Manager:
Vipul Chitnis
Research Engineer
Vipul.Chitnis@dot.ca.gov

WHAT IS THE NEED?

Traditional supplementary cementitious materials (SCMs) such as coal fly ash and blast-furnace slag are essential for reducing Portland cement content and improving concrete durability. However, fly ash supplies are declining with coal-plant closures, and slag availability cannot meet growing demand. California and other regions may offer alternative SCMs – calcined clays, volcanic ashes, biomass ashes, recycled glass, and historic deposits – but their chemical properties vary by source. This study seeks to identify, test, and characterize these local materials so they can reliably replace conventional SCMs in pavements, flatwork, and concrete structures.

WHAT ARE WE DOING?

The work breaks down into four main areas:

- Identifying and sourcing SCM candidates from California and other regions, including biomass ashes and glass.
- Laboratory testing and characterization of each material's reactivity, durability, and optimal replacement rates in concrete mixtures.
- Constructing and instrumenting trial slabs to gather field performance data for pavement, curbs, pipes, and flatwork designs.
- Updating life cycle cost and environmental assessments to compare new SCM options against existing materials and formulating recommendations for pilot projects.

WHAT IS OUR GOAL?

The main goal of this study is to develop clear guidance and

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specification language for using alternative SCMs in concrete pavements and related applications, ensuring performance, sustainability, and cost-effectiveness match or exceed the current standard materials.

WHAT IS THE BENEFIT?

By validating locally available SCMs, the California Department of Transportation (Caltrans) can reduce reliance on dwindling fly ash and slag supplies, lower the carbon footprint of concrete, and maintain or improve durability. This supports California's sustainability goals and helps keep concrete production both green and resilient.

WHAT IS THE PROGRESS TO DATE?

- Nearly all targeted suppliers have provided new SCM samples, with 95% of the collection process complete.
- Pozzolanic reactivity screening on new SCM samples is 80% complete, while alkali-silica reaction testing and concrete mix trials with over 20 pozzolans and five biomass ashes are 85% and 70% complete, respectively.
- Trial slab layouts are finalized, and earthwork, leveling, and instrumentation procurement for the UCPRC "SCM Test Bed" have reached 40%.
- Collaboration with the Materials and Engineering Technology Services group continues to refine testing requirements, and initial exchanges on specification language are underway.