PROJECT OBJECTIVE:
The objective of this research is to develop guidelines for the use of supplementary cementitious materials in hydraulic cement concrete for the purpose of enhancing durability of cast-in-place concrete bridge decks. The research shall consider the use of fly ash, silica fume, slag, and natural pozzolans either singularly or in combination. It will be important for the guidelines to provide clear recommendations for:

- Selection of appropriate cementitious materials, singularly and in combination.
- Mix proportioning of durable concrete for bridge decks containing hydraulic cement and supplementary cementitious materials.
- Selection, implementation, and quality control and assurance of construction procedures for bridge decks to prevent cracking and ensure durability, with special attention to curing.

PROJECT ABSTRACT:
Bridge deck durability is an issue of great interest and concern to state highway agencies. The use of supplementary cementitious materials such as fly ash, silica fume, slag, and natural pozzolans has been shown to enhance durability. Since some of these materials are cheaper than Portland cement, there is an economic advantage to wider use. However, clear and conclusive guidelines are lacking as to the optimum use of these materials and the curing practices required to achieve the desired performance and durability. Concrete with silica fume, in particular, has been shown to be more sensitive...
to curing practices than more conventional mixtures. Therefore, there is a need for
guidelines to help transportation agency personnel specify the materials, proportions, and
procedures that will ensure long-term performance of concrete bridge decks.
Transferring the latest materials technology to transportation professionals in Alabama
will substantially enhance the management and safety of transportation systems both
during construction and in service.

PROJECT TASK DESCRIPTIONS:
1. Collect and review literature and current practices relative to the use of
supplementary cementitious materials in concrete bridge decks. The review will
focus on the use of fly ash, silica fume, slag, and natural pozzolans to enhance
cement durability.
2. Preliminary guidelines will be developed for the use of the identified supplementary
cementitious materials. The guidelines will also address the effects of combinations
of climatic conditions, materials, and construction practices on the use of these
materials.
3. Evaluate guidelines to determine those areas requiring further investigation. Develop
a research plan for the investigation to address these areas, and to develop guidelines
for the selection and use of supplementary cementitious materials in hydraulic cement
concrete to enhance durability of bridge decks.
4. Execute plan and refine the guidelines for the use of supplementary cementitious
materials in hydraulic cement concrete to enhance durability of bridge decks.

MILESTONES AND DATES:
Jan 1-Feb 15 - Task 1
Feb 15-May 15 - Task 2
Apr 15-Sep 30 - Task 3
Sep 30-Dec 31 - Task 4

TOTAL BUDGET:
One-year project: UTCA $48,850; total budget $98,127.

STUDENT INVOLVEMENT:
The project will support one graduate student and one undergraduate student from each
institution. It will give the students an opportunity to learn about the use of new
supplementary cementitious materials in bridge decks and highway structures.

RELATIONSHIP TO OTHER RESEARCH PROJECTS:
This project will benefit from the efforts of two other UTCA projects in a peripheral
manner. Project 99247 "Transfer of Transportation Materials Technology for Concrete
Pavements" by Dr. Norbert Delatte is investigating the effects of long-term pavement
performance and may develop information useful to the current project. Project 00202
"Transfer of Transportation Management and Safety Technology" by Drs. Norbert
Delatte, Houssam Toutanji, and John McFadden is preparing technology transfer projects
dealing with concrete technology for transportation professionals and use of aggregates in
transportation.
TECHNOLOGY TRANSFER ACTIVITIES:
It is anticipated that the proposed research will result in safer and more durable Portland cement concrete bridge decks using supplementary cementitious materials. Despite the technical sophistication of the statistically based formulation and testing program, the focus of the Research Team will be to produce guidelines that will be immediately implemented by the state Department of Transportation.

POTENTIAL BENEFITS OF THE PROJECT:
By utilizing the latest technologies for construction materials and safety, transportation professionals will be able to improve the durability and economy of Alabama’s constructed facilities. The results of this project will assist bridge maintenance engineers to allocate resources more efficiently and effectively for conducting maintenance and rehabilitation programs.

TRB KEYWORDS:
Concrete, durability, admixtures, bridges, cementitious materials.