PROJECT NUMBER: 01220

PROJECT TITLE: Design and Quality Control of Concrete Overlays and Repairs

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PROJECT OBJECTIVES:
The objectives of this project will be:
• To develop materials selection and proportioning criteria for overlays and repairs
• To develop construction and quality control criteria for overlays and repairs
• To develop finite element models incorporating interface characteristics to evaluate candidate materials and repair methods
PROJECT ABSTRACT:
The United States has a significant investment in civil infrastructure, which is deteriorating under heavy use, age, and environmental attack. A large proportion of this infrastructure consists of plain and reinforced concrete. Many of these facilities are already well beyond their planned design lives. Selection, design, and quality control of appropriate materials are critical for economical and durable repairs. Appropriate models to evaluate repair materials and strategies are also necessary. Safety of concrete bridge decks and pavements can be considerably improved by providing increased skid resistance through thin concrete overlays. Improved economy and reliability of overlays will facilitate management of transportation networks.

In some cases, poorly planned or constructed repairs, inappropriate materials selection, or a combination of factors have resulted in early failure. This has happened in several cases for concrete pavement and bridge deck overlays. Such cases lead to even more severe infrastructure problems, with continued impaired use of the facility in addition to a need to remove the original repair before a new repair can be constructed. In addition, other elements of infrastructure may be overloaded during extended repairs of one portion. Rehabilitation of a major bridge may route heavy trucks onto nearby bridges that were not designed for that level of fatigue loading.

This project will address these difficulties through a laboratory-testing program of overlay and repair materials and methods, coupled with finite element modeling for verification, that can lead to important advances in concrete overlay technology.

PROJECT TASK DESCRIPTIONS:
Task 1 - Literature review
Task 2 - Materials testing
Task 3 - Nondestructive testing
Task 4 - Finite element modeling
Task 5 - Model testing
Task 6 - Field-testing
Task 7 - Final report

MILESTONES AND DATES:
Startup, start Tasks 1-2 – Jan 1, 2001
Start Tasks 3-5 – Apr 1, 2001
Interim Report (conclude initial year, conclude project 01220) – Dec, 2001
New UTCA project, start Task 6 – Apr 1, 2002
Finish Task 7 – Dec 31, 2002

TOTAL BUDGET:
This is a two-year effort for a total of $200,000. Project 01220 is for the first year; UTCA $50,000; American Concrete Institute Concrete Research Council $20,000; total budget of $100,000.

STUDENT INVOLVEMENT:
Project 01220 will support at least two students per year. In addition, there will be an opportunity for students on another Dr. Delatte’s projects, the NSF-funded “Research Experiences for Undergraduates,” to participate in this research. Total student involvement will be two to four per year over two years, for paid assistantships. At least two students will write their MS theses on this project.

RELATIONSHIP TO OTHER RESEARCH PROJECTS:
Dr. Delatte’s recently completed UTCA project 99247, “Transfer of Transportation Materials Technology for Concrete Pavements,” leads directly into this project. The expertise in data analysis, pavement performance prediction, and use of the SHRP LTPP database developed under 99247 leads directly into this research. The students trained under 99247 are also available to participate in this research.

TECHNOLOGY TRANSFER ACTIVITIES:
This project will enable a high level of technology transfer in this area. Project results will be published and, where appropriate, integrated into ACI Committee 325 documents. Results of this project will be submitted for publication to Concrete International, which will constitute a final project report to the CRC. In addition, appropriate technical papers will be submitted to the ACI Materials or Structures Journal and the Transportation Research Board Annual Meeting. A project advisory board will be assembled, which will include industry and ALDOT representatives and will meet quarterly to provide input to the conduct of the project, and will be asked to help disseminate project results.

POTENTIAL BENEFITS OF THE PROJECT:
This research will have applications to all repairs using cementitious materials by helping further define the materials selection, proportioning, and quality control considerations that improve the behavior and performance of repairs and overlays.

TRB KEYWORDS:
Overlays (pavements), concrete pavements, bridge slabs, fiber reinforced concrete, admixtures, bond strength (materials), nondestructive testing, test methods.