

## **Appalachian Transportation Institute (ATI) Research Project Description**

**Project Number:** ATI TRP 99-06-2

**Project Title:** Potential Use's of Fly Ash and Other Recoverable Materials in New Transportation Infrastructure Components

### **Primary Investigator Contact Information:**

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**Project Objective:** The objective is to develop new and valid transportation concrete components from Fly Ash to help reduce the costs and perhaps improve performance of concrete transportation components.

**Abstract:** CCPs are abundant waste products that are used in numerous applications, such as reinforced concrete, and have proven to be a very valuable environmentally compatible resource. Fly ash is the principal coal combustion product (CCP) of modern boiler plants, together with bottom ash and boiler slag. The amount of fly ash and abandoned tires to be disposed of is a significant environmental concern and financial liability, due mainly to the difficulty in finding sufficient landfills for economic disposal. Prototypical applications for transportation infrastructure components using recoverable materials such as fly ash and other innovative recoverable materials and processes will be designed and developed. Initial emphasis will be placed on concrete railroad ties using coal combustion by products but other concrete like transportation components will also be addressed. Consideration for utilization of other recoverable materials and innovative technologies and processes will also be addressed.

### **Task Descriptions:**

Task 1: Literature Review

(Estimated 3 months)

UNL team will search literature to find the latest advancement for fly ash utilization in concrete applications.

Task 2: Chemical composition of fly ash (Estimated 4 months)

Three to five fly ash samples, carefully chosen to represent the majority of the fly ash produced in West Virginia, will be selected by Marshall University. These samples will be chemically tested to determine their composition and their compatibility with the ASTM C 618 Standard.

Task 3: Identify concrete applications for fly ash utilization (Estimated 2 months)

Based on the information gathered from the literature review (Task 1) and the fly ash chemical composition (Task 2), UNL jointly with Marshall University will identify three of the most promising applications where large volume of fly ash can be used. Among the possible applications are: (1) lightweight masonry blocks, (2) concrete pipes, (3) concrete overlay for highway bridges, (4) precast retaining walls, and (5) prestressed concrete ties. Marshall University will provide a preliminary feasibility study to help UNL in choosing the most promising applications.

Task 4: Optimization of concrete mixes with fly ash (Estimated 12 months)

UNL will make trial mixes using fly ash and test these mixes for the following properties: (1) Fresh concrete properties: workability, segregation, bleeding, and air entrainment, (2) Hardened concrete properties: strength, freeze and thaw resistance, and permeability. These concrete mixes will be made with fly ash, sand and gravel that come from West Virginia. Marshall University will send the material to UNL.

Since fly ash will be used in more than one application, it is expected to have a recommended mix for each application.

Task 5: Feasibility Study (Estimated 4 months)

Upon completion of Task 4, Marshall University with help from UNL will prepare a feasibility study of utilizing fly ash in the predetermined applications. The study should consider short and long term effects.

Task 6: Recommendations for Implementation Plan (Estimated 3 months)

UNL jointly with Marshall University will prepare a plan for implementing the developed mixes. This plan should be submitted, discussed, and finalized with proposed users of these mixes. For example, concrete pipe producers, material division of Highway Agencies (i.e. WVDOT, Nebraska Department of Roads), concrete masonry producers.

Task 7: Final Report (Estimated 4 months)  
A final report of the project will be prepared by UNL including an executive summary and abstract. The final report will cover details of the: (1) chemical composition of fly ash produced in West Virginia, (2) possible applications of fly ash utilization, (3) developed mixes and their properties, and (4) recommendations for implementation plans.

**Milestones, Dates, Schedule:** Start Date: 06/01/00 End Date: 05/31/02

**Budget:**

Year One	\$288,746
Year Two	\$288,746
Total	\$577,492

**Student Involvement:** The project will provide employment support for several undergraduate and graduate students. The student workers will support the Principal Investigator as project assistants. This project is anticipated to lead to at least one Master's Thesis in Engineering.

**Relationship to Other Research Projects:** None at this time.

**Technology Transfer Activities:** Final reports will be available on the ATI website. All, ATI Principal Investigators will present findings through the ATI Transportation Seminar Series to invited guests from WVDOT, USDOT, other ATI Principal Investigators, students and other invited guests. Other opportunities to present the project results will be explored including conferences and peer reviewed journals, etc.

**Potential Benefits of this Project:** Recycle waste products into useable materials within the current transportation infrastructure in an environmentally friendly capacity.

**TRB Keywords:** Recycle, Fly Ash, Coal Combustion Products, Concrete