CONCRETE-POLYMER MATERIALS FOR HIGHWAY APPLICATIONS

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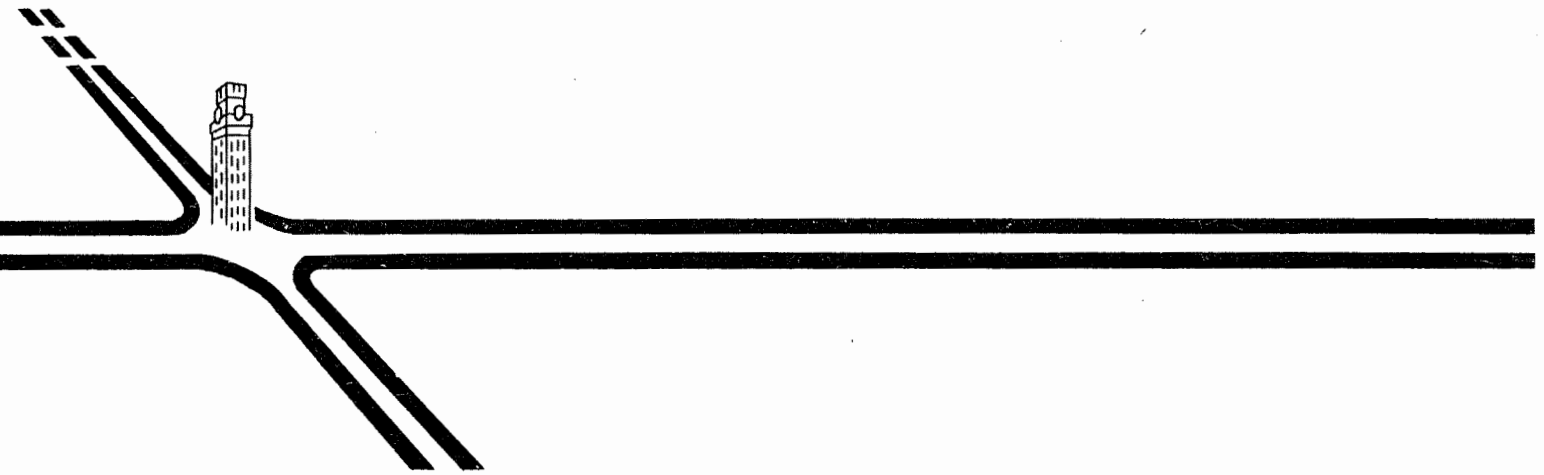

SUMMARY REPORT 114-9F(S)

RESEARCH REPORT 114-9F

PROJECT 3-9-71-114

COOPERATIVE HIGHWAY RESEARCH PROGRAM
WITH TEXAS
STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION
AND
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

CENTER FOR HIGHWAY RESEARCH
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SUMMARY REPORT 114-9F(S)

Foreword

Research Report 114-9F presents the results of a study on the use of concrete-polymer materials for highway application. This report is the ninth in a series which describes work done by Project 3-9-71-114, "Polymer-Impregnated Concrete for Highway Application."

Introduction

Concrete-polymer materials have been used for many highway applications. Research was begun at the Bureau of Reclamation and Brookhaven National Laboratory in 1966 on polymer-impregnated concrete for a wide range of applications.

In 1970 research was begun at the Center for Highway Research (now the Center for Transportation Research) for the Texas State Department of Highways and Public Transportation (DHT) with the objective of developing a partial-depth polymer impregnation process for bridge decks to provide greater durability. Later the scope was enlarged to include polymer concrete for repair of bridge decks. Research was also performed to determine the behavior of post-tensioned polymer-impregnated concrete beams. The final phase of the study was the development of a thin polymer concrete overlay for bridges.

Report 114-9F summarizes the highlights of the research findings. Previous reports of research under Study 114 should be referred to for more complete information on each topic.

Applications of Concrete-Polymer Materials Developed for Texas SDHPT

Some applications for which concrete-polymer materials have been developed are listed here.

(1) Partial-depth polymer impregnation procedures have been developed for the surfaces of bridge decks to provide improved durability. The polymer impregnation results in significantly less water and chloride penetration into the concrete.

(2) Post-tensioned PIC beams were made using concrete I-sections. Unbonded tendons consisting of two or more high-strength wires in conduits were cast into concrete. After impregnation, the wires were stressed. The beams could carry about 3 times more load than unimpregnated controls. Creep was about one-tenth that of control beams.

(3) Polymer concrete has proven to be a durable, strong material for the repair of concrete. The monomers used to make polymer concrete have a viscosity approximately the same as water that allows penetration of adjacent concrete surfaces and that provides a very good bond. Repairs can be made quickly, which permits the area to be returned to traffic sooner. The unit cost of polymer concrete is considerably higher than that of portland cement concrete but the very short repair time and durability of the repair make polymer concrete a cost effective repair material for highway repair.

(4) Polymer concrete overlays for bridge decks were developed as a method for waterproofing. Such overlays are thin and lightweight; they can be applied during the day between peak traffic periods and do not require long closing periods; they do not require special equipment to apply; they provide a very good skid resistant surface; and they are relatively economical.

Conclusions and Recommendations

Concrete-polymer materials have excellent strength and durability properties. In Research Study 114, several applications have been identified for use in highway construction. All of the applications listed above, except post-tensioned PIC beams, have been implemented.

KEY WORDS: monomers, polymers, polymer-impregnated concrete, polymer concrete, polymerization.

There was no invention or discovery conceived or first actually reduced to practice in the course of or under this contract, including any art, method, process, machine, manufacture, design or composition of matter, or any new and useful improvement thereof, or any variety of plant which is or may be patentable under the patent laws of the United States of America or any foreign country.

The full text of Research Report No. 114-9F can be obtained from Mr. Phillip L. Wilson, State Planning Engineer, Transportation; Transportation Planning Division, File D-10R; State Department of Highways and Public Transportation; P.O. Box 5051; Austin, Texas 78763.