



Investigation of Spall Repair Materials for Concrete Pavement: Summary Report

PROJECT SUMMARY REPORT

Spalling that occurs at transverse cracks or joints in portland cement concrete (PCC) pavement is a visible surface distress caused by pieces of delaminated concrete being dislodged under traffic and roughening the surface of the pavement. The effective repair of this distress type in a short period of time requires more ‘exotic’ materials to ensure that sufficient strength, bond, and stiffness are provided to restore the ride quality of the pavement surface.

For many years, the Texas Department of Transportation (TxDOT) has been confronted with the repair of spalled concrete pavement in a short period of time to avoid traffic delays and has tried a number of different

repair products with varying degrees of success. This project, 0-5110, focused on understanding which repair products work best under these conditions based on laboratory tests and field performance surveys. The project also developed guidelines to assist engineers in selecting cost-effective spall repair materials and procedures that work well for rapid repair.

What We Did...

The main objective of this project was to assemble the best repair practices and material selection process to address rapid repair of spall damage in concrete pavement. In order to accomplish this objective, the Texas Transportation Institute (TTI) and the Center for Transportation

Research (CTR) evaluated the effectiveness of repair materials and procedures currently used in the state of Texas and performed laboratory tests to determine the properties of each material toward providing a basis for comparison. To collect information about materials in the field, performance surveys and field placements were carried out with TxDOT assistance. On this basis, the research team developed guidelines for material selection and repair procedures.

What We Found...

As a part of this project, 10 spall repair products shown in Table 1 were selected from a wide variety of types with different chemistries and physical properties.



Based on measured mechanical properties, the repair materials were grouped into three stiffness categories: rigid, semi-rigid, and flexible. They were further characterized as Type I and II materials based on their tendency to crack and to bond to existing concrete surfaces. The magnesium phosphates represent the more rigid materials (Type II), while the polymer concretes indicate more flexible materials (Type I). The ultimate compressive and flexural strengths could only be obtained for Type II materials.

Tests of elastic modulus, shrinkage, and coefficient of thermal expansion (CoTE) were performed to determine the compatibility properties of the repair materials. From these tests, the research team found that materials which have high CoTE values should have lower modulus to allow for the volume changes that can occur.

Likewise, higher-modulus materials should have a lower CoTE value similar to that of substrate to avoid the high bond stresses along the interface due to temperature effects. Figure 1 shows that, for the materials tested, modulus is the larger influence on strain due to

Table 1. Types of Repair Materials Selected.

Products	Type of Material	General Properties
RSP	Polyurethane Polymer Concrete	Semi-rigid
Delpatch		Flexible
Wabo ElastoPatch		Flexible
FlexPatch (SSI)	Epoxy Polymer Concrete	Semi-rigid
FlexKrete	Thermosetting Vinyl Polymer Concrete	Semi-rigid
EucoSpeed MP	Magnesium Polyphosphate	Rigid
MgKrete		Rigid
Pavemend 15		Rigid
Rapid Set	Hydraulic Cement	Rigid
Fibrescreed	Polymer Modified Bitumen	Flexible

temperature change. The thermal stress induced at the interface between the concrete subsurface and the repair material should be compared to the bond strength, which resists the stress.

Even though the results of the bond strength testing—conducted using small artificial slabs with repair materials—were variable, it did show that a saw-cut edge is preferred for the Type II repair materials to avoid thin layers that result when a feathered edge is formed. On the contrary, flexible materials with good bond strengths would be able to perform well in a feathered-edge configuration.

The field investigation of several repair materials was carried out in the Houston and Waco Districts, where cores were taken to observe

the quality of the bond. Bond strengths appeared to be good, as was the capability to resist reflective cracking. The materials with low modulus did not reflect the cracking from the existing pavement, while the high-modulus materials did. Both types of materials appeared to provide adequate performance in the patched area.

Field placement of six products was performed in the Fort Worth District to ascertain the placeability of each material under field conditions (see Figure 2). A variety of placement-related challenges were presented during this exercise, including those provided by the weather. For some materials, runoff water from a rain shower activity prevented placement, while for other products placing on a



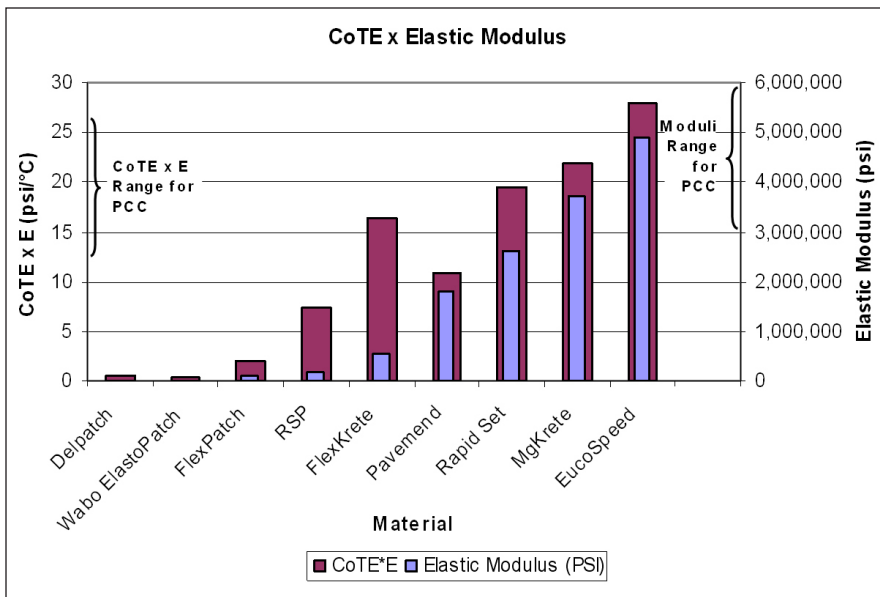


Figure 1. CoTE Times Elastic Modulus.



Figure 2. Placement of FlexPatch by Crews in Ft. Worth.

wet surface was not an issue. The importance of a material's viscosity and set time in the field was also manifest. A material should have sufficient viscosity to be finishable and easily worked, but be stiff enough to keep its shape so that it does not overflow the patched area.

The Researchers Recommend...

Spall repair materials should be selected through consideration and comparison of material behavior characteristics and properties. The acceptability of a material is heavily dependent upon the ability of it to bond to an existing concrete surface. Specifically, materials can be ranked according to material bond strengths, stiffness, cost, placeability, and overall utility. A list of materials, ranked on these criteria, can be used to select an appropriate material for a given repair project.



For More Details...

This research is documented in Report 0-5110-1, *Investigation of Spall Repair Materials for Concrete Pavement*.

Research Supervisor: Dan G. Zollinger, Ph.D., P.E., TTI, (979) 845-9918, d-zollinger@tamu.edu

Researchers: David W. Fowler, Ph.D., P.E., CTR, (512) 471-4498, dwf@mail.utexas.edu
Anal Mukhopadhyay, Ph.D., TTI, (979) 458-4618, anal@tamu.edu

TxDOT Project Director: Mike Alford, P.E., Houston District, (713) 802-5551, malford@dot.state.tx.us

TxDOT Research Engineer: German Claros, P.E., Research and Technology Implementation Office, (512) 465-7403, gclaros@dot.state.tx.us

To obtain copies of reports, contact Nancy Pippin, Texas Transportation Institute, TTI Communications, at (979) 458-0481 or n-pippin@ttimail.tamu.edu. See our online catalog at <http://tti.tamu.edu>.

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