Transportation Literature Search

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Full-Depth Concrete Base Patching

Prepared for
Bureau of Highway Construction
WHRP Flexible Pavements Technical Oversight Committee

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Transportation Literature Searches are prepared for WisDOT technical staff in highway development, construction and operations. The bibliography below is representative, rather than exhaustive, of available studies on the topic. Primary online resources for the literature searches are the Transportation Libraries Catalog (TLCat), the Transportation Research Information Service (TRIS Online), and various academic and scientific databases. Online copies of publications are noted when available. Hard copies of all cited literature may be obtained through the WisDOT Library.

KEYWORDS
Search terms effective in finding these sources included: pavement rehabilitation; full-depth patching; reflection cracking; full depth repair; cracking of concrete pavements; patching; slab replacement.

LIBRARY OF CONGRESS DESCRIPTORS
Library of Congress descriptors identified were: Pavements, Concrete—Maintenance and repair; Concrete pavement restoration; Reflection cracking.

CITATIONS

BOOKS/TECHNICAL REPORTS

Title: Design, construction, and analysis of CRCP patching techniques in Illinois
Author(s): Illinois Department of Transportation, submitted by Jenkins, Paul F.
Date: 1998
Doc ID/URL: Available through the National Technical Information Service

Title: Patching materials for Portland cement concrete pavements
Author(s): Transportation Research Board and the Federal Highway Administration, submitted by Dougan, CE
Date: 1981
Doc ID/URL: FHWA-TS-82-208
Description: Materials and methods for patching portland cement concrete (PCC) pavements are discussed. Distinction is made between full-depth patches and the more common "pothole"-type patch. The evaluation of five materials to be used for pothole patching in PCC pavements are presented and discussed in terms of projected durability and cost effectiveness.

Title: Laboratory testing of Portland cement concrete patch material modified to reduce or eliminate shrinkage
Author: Bischoff, Debra L.; Toepel, Amanda. Publication: Madison, WI : Wisconsin Dept. of Transportation, Division of Transportation Infrastructure Development, Bureau of Highway Construction, Pavements Section, Technology Advancement Unit
Date: 2004
Description: This study was initiated in response to the development of early distresses in the patch material of a dowel bar retrofit (DBR) project located in Marshfield, Wisconsin. Primarily, the slightly modified Minnesota Department of Transportation (Mn/DOT) 3U18 patch material used on the Wisconsin Department of Transportation (WisDOT) DBR project exhibited microcracking and debonding from the sidewalls of the DBR slots. These

distresses are a result of shrinkage. Since the Mn/DOT 3U18 patch material is significantly less expensive than other proprietary rapid setting patch materials and its components are readily available, WisDOT deemed it worthwhile to seek an inexpensive way to improve the performance of the material. Three main concepts were identified as possible techniques for reducing shrinkage in the Mn/DOT 3U18 patch material: expansive cements or additives, shrinkage reducing admixtures, and internal curing through the use of saturated lightweight fine aggregate. The 11 products used to modify the Mn/DOT 3U18 patch material in this study were Type K cement, Komponent, Denka CSA #20 (50.56 lb/cu yd or 30 kg/cu m), Denka CSA #20 (42.14 lb/cu yd or 25 kg/cu m), Denka CSA 100R (50.56 lb/cu yd or 30 kg/cu m), Denka CSA 100R (42.14 lb/cu yd or 25 kg/cu m), Peramin SRA330, Eclipse Plus, Tetraguard AS20, Solite, and Hydrocure. Sealtight 2255-White, a poly-alphamethylstyrene-based concrete curing compound, was also evaluated for its effectiveness in preventing water loss from the surface of the patch material in comparison with Sealtight 1600-White, a water-based, wax-based curing compound. After extensive laboratory testing, it was found that only the Denka CSA #20 product, at a 50.56 lb/cu yd (30 kg/cu m) dosage rate, and the Tetraguard AS20 were able to successfully reduce shrinkage in the Mn/DOT 3U18 patch material without negatively impacting other vital properties required for concrete patch materials. Patch material containing Denka CSA #20 is approximately 10% less expensive than patch material containing Tetraguard AS20, but both products provide significant cost savings when compared to some proprietary rapid setting patch materials. It was also found that the Sealtight 2255-White showed 69% less water loss than the Sealtight 1600-White, but is also three times more expensive than the Sealtight 1600-White. Both curing compounds, however, met WisDOT specifications for both water retention and reflectance.
URL: http://www.dot.wisconsin.gov/library/research/docs/finalreports/tau-finalreports/concretepatch.pdf

Title: Concrete Patching Guide
Author: Oregon Dept. of Transportation, Research Unit
Date: 2003
Report: FHWA-OR-RD-04-03
Description: Maintenance personnel often select a material for patching concrete based on what they have used in the past. However, each patching job has particular demands, which may be different from what was required in past applications. Also, the list of available products changes often with manufacturers producing new patching materials, discontinuing some products and changing the name of products.

The Oregon Department of Transportation recognized the difficulty in selecting the right patching material and developed a patching guide to help maintenance personnel determine which product to use. The selection tool is based on a Microsoft Excel spreadsheet and matches the attributes of specific products to the needs of a particular patching job. An output report is then generated and provides a list of qualified and conditional products from the QPL (Qualified Products List).
URL: http://www.oregon.gov/ODOT/TD/TP_RES/docs/Reports/ConPatchGuide.pdf

Title: Evaluation of Concrete Patching Materials
Author: Virginia Highway & Transportation Research Council, Wyant, David C.
Date: 1985
Report: FHWA/VA-84/35

Title: Evaluation of Pothole Patching Materials
Author: New Jersey Dept. of Transportation, Trenton. Div. of Research and Technology.; Rutgers - The State Univ., Piscataway, NJ. Center for Advanced Infrastructure and Transportation.; Federal Highway Administration, Trenton, NJ. New Jersey Div
Date: 1999
Report: FHWA/NJ-2001-02
Description: The following report summarizes the results of the research that has been conducted on the evaluation of pothole patching materials and repair procedures. The Purpose of the project is the identification of improved bituminous pothole patching materials and repair procedures for bituminous concrete pavements and the establishment of laboratory techniques for quality assurance of those materials.

JOURNAL ARTICLES

Title: A mix match: group of repair techniques may be the right way to go
Author: Voigt, GF
Source: Roads and Bridges
Date/Pages: Vol. 42, issue 4 2004, pp. 24-25
Abstract: This article describes education efforts by the American Concrete Pavement Association to dispel misconceptions about the difficulty of rehabilitating concrete pavements. Among the mistakes the campaign hopes DOTs will avoid are placing flexible overlays on concrete pavements that need only restoring or resurfacing, or premature destruction of concrete pavements and their replacement when other alternatives would have served just as well and cost less. Among the alternatives discussed are concrete pavement maintenance, restoration and reconstruction, which include engineered procedures to manage the rate of concrete pavement deterioration. Preventive and corrective techniques include joint and crack resealing, retrofitting concrete shoulders, edge drain work, dowel bar retrofits, slab stabilization, full-depth patching, partial-depth patching and diamond grinding. Concrete overlays are also discussed.

Title: Utah tests concrete fast-patch
Author: Basha, M; Sharp, B
Source: Better Roads
Date/Pages: Vol. 70, issue 2, 2000, p30
Abstract: This article describes a recently completed 5-year study of various concrete fast-patch products used for concrete joint repairs by the State of Utah Department of Transportation Research and Development Division. 12 different brands of products were installed on Interstate 15 (I-15) in northern Utah. Evaluations of the concrete fast-patch and saw-cut joints were conducted semi-annually with inspections of soundness, degradation, and joint performance. The test section included transverse joints on mainline I-15 and longitudinal joints at on- and off-ramps at the Willard Bay interchange near Ogden, Utah. The results of the testing and the performance of some of the products are discussed.

Title: Risks of Cracking and Delamination in Patch Repair
Author: Mohammed H. Baluch, Mohammad K. Rahman, Ali H. Al-Gadhib
Source: Mat. in Civil. Engineering., Volume 14, Issue 4, pp. 294-302
Date/Pages: 2002
Abstract: The durability of concrete repair may be measured in terms of its resistance to cracking and to ingress by aggressive species. This paper addresses the various issues that form the nucleus of cracking resistance, including the role of material parameter indices such as free drying shrinkage and specific tensile creep. Data for these indices are presented for two new generation repair materials, and attention is drawn to the inherent anomalies existing in international specifications for shrinkage measurement. The paper concludes by defining risk factors associated with the probability of failure of a patch repair in one of three identified modes. The risk factors are computed for a patch repair using a rigid substrate idealization, and the probability of failure in cracking, delamination, or peeling modes is assessed.