

# OHIO DEPARTMENT OF TRANSPORTATION OFFICE OF PAVEMENT ENGINEERING RESEARCH IMPLEMENTATION PLAN

---



**Title:** An Evaluation of the Cost Effectiveness of D-Cracking Preventive Measures

**State Job Number:** 14683

**PID Number:**

**Research Agency:** Bowling Green State University

**Researcher(s):** Travis Chapin, John Dryden

**Technical Liaison(s):** Aric Morse, Roger Green

**Research Manager:** Karen Pannell

**Sponsor(s):** Howard Wood, David Humphrey

**Study Start Date:** 10/27/1997

**Study Completion Date:** 1/27/2001

**Study Duration:** 39 Months

**Study Cost:** \$25,310.00

**Study Funding Type:** 100% State, ODOT SPR (2)

---

## **STATEMENT OF NEED:**

Laboratory studies have found that reducing the particle size of D-cracking susceptible coarse aggregates will greatly improve the durability of concrete exposed to freeze-thaw conditions. A test road located on State Route 2 near Vermilion, Ohio, was built in 1974 and 1975 with specific sections to investigate the role aggregate source and size, as well as subbase drainage systems, pavement joint design, subbase materials, joint sealants, cement, type of cure, and joint spacing on concrete durability. The test sections were rehabilitated in 1992. While developing plans for the 1992 rehabilitation, a significant difference in repair quantity was needed for the various sections due to the difference in performance. Research was initiated to determine the cost effectiveness of the various treatments.

## **RESEARCH OBJECTIVES:**

The objectives of this research were:

1. Conduct a literature search on solutions to D-cracking in general
2. Conduct a background evaluation of the Vermilion SR 2 project
3. Assess the effectiveness of various D-cracking preventive measures.
4. Evaluate the cost effectiveness of these measures.

## **RESEARCH TASKS:**

1. Conduct a literature search on solutions to D-cracking in general
2. Conduct a background evaluation of the Vermilion SR 2 project
3. Assess the effectiveness of various D-cracking preventive measures.
4. Evaluate the cost effectiveness of these measures.

## **RESEARCH DELIVERABLES:**

- Final report

## **RESEARCH RECOMMENDATIONS:**

1. To reduce D-cracking, a high quality and/or small sized coarse aggregate should be used.
2. To reduce mid-slab cracking, larger aggregate sizes should be used.
3. Use of vapor barriers does not increase pavement performance.
4. Subbases with drains performed about the same as ones without drainage.

5. The use of no joint sealant prevented joint deterioration due to D-cracking as well or better than hour pour or neoprene. Neoprene was significantly worse.
6. Pavement should not be placed directly on subgrade.

**PROJECT PANEL COMMENTS:**

Evaluation of the aggregate size was not considered when setting up the experimental design for the original construction on ERI/LOR-2. Insufficient sections were included for a statistical analysis of effect of aggregate size on pavement performance. Therefore, it was difficult for the researchers to draw statistically valid conclusions from the data but there were obvious trends.

**IMPLEMENTATION STEPS & TIME FRAME:**

The requirement to use larger size aggregate (AASHTO #57 or #67) in concrete pavement was incorporated into the 2002 Construction and Material Specifications.

**EXPECTED BENEFITS:**

The use of larger size aggregate will reduce the potential for concrete pavement to form midslab cracks. Based on the survey of producers conducted for this research, the use of AASHTO #57 aggregate would result in an average savings of \$0.16/ton when the #57's are available locally. If #57's are not available locally, the increased cost of not using #8's would be \$0.80 per square yard.

**EXPECTED RISKS, OBSTACLES, & STRATEGIES TO OVERCOME THEM:**

None

**OTHER ODOT OFFICES AFFECTED BY THE CHANGE:**

None

**PROGRESS REPORTING & TIME FRAME:**

Implementation is complete

**TECHNOLOGY TRANSFER METHODS TO BE USED:**

The Final Report of the research has been distributed to 49 state transportation departments, different FHWA offices, selected national libraries, and others.

**IMPLEMENTATION COST & SOURCE OF FUNDING:**

Areas without local sources of acceptable #57 or #67 aggregate could see an increase in construction cost of \$6,000 per lane mile.

---

---

**Approved By:** (attached additional sheets if necessary)

**Office Administrator(s):**

Signature: David Humphrey Office: OPE Date: 12/07/2006

**Division Deputy Director(s):**

Signature: Howard Wood Division: Planning Date: 12/07/2006