Feasibility of Forming Transverse Joints with Joint Forming Devices

tech transfer summary

National Concrete Pavement Technology Center

CP Tech Center

This technology uses concrete materials knowledge and the environment to form transverse joints naturally in concrete pavements.

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RESEARCH PROJECT TITLE
Evaluation of Transverse Joint Forming Methods for PCC Pavement

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The mission of the National Concrete Pavement Technology Center is to unite key transportation stakeholders around the central goal of advancing concrete pavement technology through research, tech transfer, and technology implementation.

Objectives

- Evaluate known and conceptual joint-forming equipment that can be used efficiently and cost effectively during concrete pavement construction to form transverse joints or induce vertical cracks that act as joints.
- Identify potential materials and methods that can be used to form joints from within the plastic concrete.

Problem Statement

To control drying and thermal shrinkage in concrete pavements, current practice in Iowa is to develop transverse joints by sawing the pavement surface during placement to induce cracks. Because the appropriate sawing time is influenced by weather conditions, concrete mix design, and set time, determining the proper window for sawing is often difficult. The joints must be sawed during the concrete set time, but must not dislodge the aggregates in the concrete surface. Joint sawing also costs time and money and raises environmental issues.

Recent research has suggested possible ways of using a joint-forming device (Bobsled) with the slip-form paver to induce a plane of weakness in the longitudinal direction of the pavement surface. The need for longitudinal sawing would thus be eliminated. The paving industry is currently researching a similar joint-forming device or method for transverse joints.

Technology Description

The joint-forming devices tested each consisted of a galvanized, L-shaped piece of metal placed in the area of the dowel basket to form the joint.

Six separate installations of six joints each (a total of 36 joint-forming devices) were made. The joint formers were placed either below the dowel baskets or on top of the dowels. The joint formers placed on the base were secured with dowel basket pins on approximately 610 mm centers along the joint formers. The pins were driven behind the L-shaped metal of the joint-forming devices (away from the paver) to prevent the metal from being overturned during paving. The joint formers above the dowels were secured with wire ties to the dowels themselves at 305 mm intervals to prevent rollovers.

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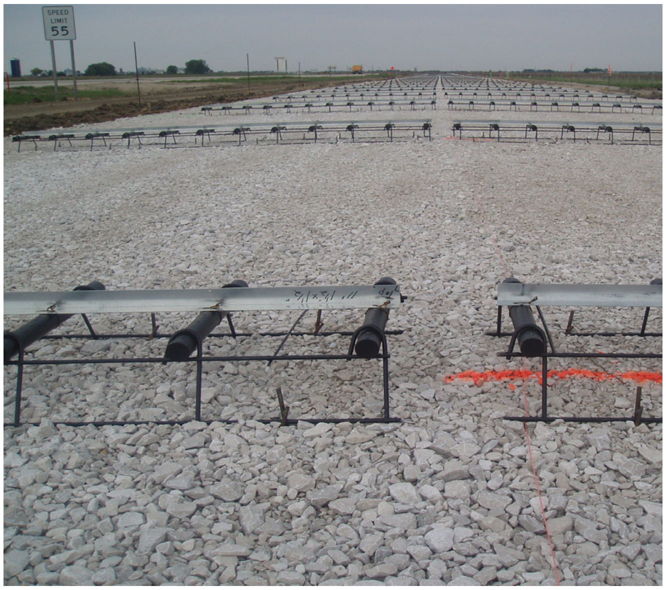
Monitoring began immediately. Prior to paving, measurements were taken to reference the relative location of the joint-forming devices in each joint. Paving over the test sections took place over two days, and no alignment problems were observed. Photographs were also taken from various points around each test site before, during, and after the concrete was poured. Similarly, pavement condition data were recorded during the paving process and after the concrete had set enough to walk on (approximately one day after pouring). Over the following two weeks, each test section was checked for transverse cracks. During this time, weather data indicated scattered rain showers and mild temperatures (peaking in the high 70s °F), as is expected during spring paving. On final monitoring survey six months after paving, no transverse cracks had yet developed, apart from one centerline crack.



Cross-section of joint-forming device on top of the dowels

Key Findings

- Most of the sawed joints around the test sites did not crack completely through the slab in the first 30 days after paving. In many cases, a crack only occurred late in the month on every sixth to eighth joint.
- Weather may have significantly influenced the results. The cool spring temperatures and small amounts of rain may have hindered the slab from curing and cracking.
- One core, taken from a section where the joint former is above the dowels, contains a crack that extends between the top of the joint former and bottom of the sawed joint. However, it is not possible to determine which way the crack initiated.
- In the cores taken across the test sections, the joint former is offset from the sawed joint by up to 25 mm. This process may have initiated a long-term spalling problem or an irregular surface crack, but to date no such activity has been noted.

Core sample showing a crack extending from the joint former

Implementation Readiness

- A county road project should be selected for the next test.
- The joint formers used for this project should be placed in the same manner for the next project.
- Joints in the test areas should be left in place and monitored for one year before any other actions are taken by the highway owner.
- Other devices identified in conjunction with dowel assemblies and other joint-forming devices, such as the plastic JRI+ joint device developed in Spain by Farobel, should also be tested.
- Transverse joint-forming devices show promise, but more testing is needed before this device can be implemented.