National Concrete Pavement Technology Center

CP Tech Center

Current Concrete Pavement Surface Texturing Practices in Iowa

tech transfer summary

Optimizing concrete pavement surface characteristics can better meet the needs of the traveling public and the owners.

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RESEARCH PROJECT TITLE
Field Experiments of Current Concrete Pavement Surface Characteristics Practices: Iowa Data Collection and Analysis

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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.

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Objective

Design, build, and evaluate various concrete pavement texture patterns that reduce noise while optimizing friction, smoothness, and texture

Problem Statement

The public reaction to pavement noise is increasing at the same time that highway agencies are being asked to construct long-lasting pavements that have both durability and adequate frictional characteristics during wet weather. In addition, drivers expect the pavement surface texture to provide a smooth ride. The concrete paving industry is searching for ways to optimize each of these public needs in an economical and constructible pavement surface texture.

Research Description

The research site was constructed on US Highway 30, approximately 2.41 km east of LeGrand, Iowa. The project area consisted of a roughly 4.02 km section of the eastbound lanes. The pavement slab was constructed at the site using conventional slipform paving equipment. The paving train consisted of a belt placer, followed by the full-pavement-width slipform paver, pre-texture bridge, and cure/texture machine. An additional bridge was added at the rear of the train to allow for the collection of texture depth data.

Eighteen different texture configurations that used combinations of longitudinal or transverse tining, burlap drag, AstroTurf, and grinding methods were constructed at the research site. Each test section was approximately 200 or more meters in length, placed end-to-end, with approximately 25 meters between each texture type.

The various pre-textures were produced by dragging a piece of either burlap or AstroTurf attached to the construction bridge behind the paving machine. The drag spanned the width of the slab. Three methods were then used to develop the surface texture. The first two were variations of the burlap and AstroTurf drag, in which additional weight was added to the pre-texture material. The third method used a tining machine (the cure/texture machine in the paving train) to produce various types, depths, and spacings of texture in both the longitudinal and transverse directions.

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As the pavement was placed, texture and weather data were collected. The depths of the tines were measured using a common tire tread gauge directly behind the paving machine. Four measurements per lane (one on the outer edge, one in each of the two wheel paths, and one at the quarter-point) were obtained at 50-meter increments. Five sets of measurements were recorded for each section. Handheld devices recorded weather data directly behind the tining machine, including pavement temperature, air temperature, relative humidity, and other data. Two weather stations were also used at the end of each day to record the climate conditions during placement.

Key Findings

The findings of this research focus on the issues involved with developing pavement surface texture during construction.

- Tining depth: Placing and maintaining tines at the required depths throughout the test sections was difficult, and most tining values were lower than required. For the sections in which only burlap or AstroTurf was applied, the texture depth was minimal, if present at all. The shallow textures may be the result of weather conditions, the speed of the paving train, length of haul of the concrete, or concrete moisture or aggregate content.
- Tining machine: While the tining machine is generally used to create surface texture, the machine's capabilities are limited. If the concrete slab is too dry, obtaining a deep texture can be difficult. Additionally, the broom angles cannot be adjusted during transverse tining with current equipment designs, which makes the depths of the tines vary across the slab.
- Weather: The hot and humid air observed during most days of the paving operation, which causes concrete to set quickly, may have contributed to the shallow tining depths. The surface of the slab may have been too dry for the tines to be placed deeply.
- Data collection: Because of the fresh concrete, obtaining accurate values for the tining depths was difficult. The tire gauge needle was so sharp that it would sink into the surface if placed roughly. Moreover, the tining measurements were rendered inaccurate if the bridge was bumped or moved while measuring.

Recommendations

- To achieve a specific tining depth, maintain a uniform concrete mixture and move the paving train forward constantly at a consistent speed. Concrete batches with varying moisture contents have varying tine depths. Uniform moisture content, which also accounts for atmospheric conditions, provides consistent texturing and edge control.
- The type of pre-texture and its method of application is important. AstroTurf must remain clean to avoid buildup on the slab surface. Achieving a clean AstroTurf drag may require several replacements during the day.
- The type of tines (shape, length, and stiffness) must be matched to the concrete mix and field conditions. Doing so will leave a specified mark depth on the fresh concrete without dragging materials to the surface and increasing profile and noise values.
- When applying longitudinal texturing in a transition to a super-elevation, adjust the horizontal angle of the brooms continually to maintain uniform tine depth across the slab.

Burlap drag attached to paver

Longitudinal texture on concrete pavement