SURFACE CHARACTERISTICS OF NEW PCC PAVEMENTS

Background

The traveling public desire pavements that are smooth, safe and quiet. This has generated research into developing pavements that optimize performance and are durable and affordable. Pavement Surface Characteristics include smoothness, frictional resistance, hydroplaning potential, texture, sound absorption properties, and tire-pavement noise including their effects in overall pavement performance.

Pavements like Mn/DOT's innovative Astro-Turf drag texturing technique, attempt to reduce tire-pavement noise while optimizing other desirable pavement characteristics. While surface characteristics are important, performance of Jointed Plain Concrete Pavements are substantially affected by joints, while the continuously reinforced concrete pavements are affected by the intermittent structural cracks. These features in conjunction with other distress and surface conditions affect performance characteristics of the pavements. This study focuses on fundamental surface characteristics of new Portland Concrete Cement (PCC) pavements, how they interact and how they change over time.

Astro-Turf Drag Texture

Interest in quieter pavements grew in response to a 1988 moratorium on noisy transversely-tined concrete pavements. Researchers studying pavement surface texturing methods that minimize noise without compromising friction developed an innovative use of **Astro-Turf Drag (ATD)** for finishing concrete pavements. In 2005, the Federal Highway Administration provisionally listed this as a concrete pavement texturing technique requesting data to demonstrate safety.

ATD texturing technique results in significantly quieter concrete pavements. It has a high contact area between the pavement and a tire. The long-term durability of the texture is important for maintaining tire-pavement friction standards. Studies at MnROAD show no short-term reduction in texture depth. Monitoring of four ATD cells at MnROAD will continue to evaluate the durability, safety and quietness of this texturing technique.

Project Goals and Objectives

Researchers at Mn/DOT Office of Materials and Roads Research and the FHWA have teamed-up to study how surface characteristics of test cells constructed at MnROAD change in a cold weather climate seasonally and over time. The test sections will provide initial conditions and degradation trends for the various texture types. Data obtained will be used to optimize textures and improve overall design of durable pavements. The project will also evaluate the interaction of various pavement characteristics to gain a better understanding of tire-pavement interaction and the performance (durability and potential for use) of quieter pavements. Finally the project will develop relationships and algorithms for optimization of friction, noise and

smoothness and long term prediction models towards safe and durable pavements. The data can also be used for FHWA's study to implement pavement effects into the Traffic Noise Model (TNM).

The Experimental Plan

In addition to monitoring the surface characteristics of previously constructed test cells, this project will create conventional and innovative texturing on new cells in the 2008 and 2009 construction seasons at MnROAD. The textures include Astro-Turf Drag, longitudinal tining, longitudinal broom drag, transverse broom drag, pervious concrete, porous concrete overlay and exposed aggregate finishes.

The research team will measure many surface parameters including On-Board Sound Intensity, ride quality, texture using the circular texture meter, skid resistance, friction using the dynamic friction tester (FHWA loan program) and sound absorption. Friction survival, acoustic durability and texture preservation (with respect to time and traffic) will be quantified. The team has improvised and calibrated a device that measures flow through pervious concrete to determine drainability of pervious concrete cells seasonally. These parameters will be monitored seasonally to observe survival trends, durability and seasonal effects.

Data will be analyzed to establish for each texture type, initial conditions and degradation patterns. Relationships between parameters will be determined through frequency/time domain and spatial analysis of the initial data, seasonal effects and survival/degradation patterns. These data will be developed into a surface performance/survival algorithm that will be useful in pavement design and management.

Project Status

The project is being conducted at MnROAD, a unique cold-climate pavement research facility in Minnesota. Testing of new cells began in the fall of 2008 and has continued with seasonal measurements. In 2008 construction, 10 different textures were created on nine cells. The exposed aggregate cells are scheduled to be placed the fall of 2009. This research project is scheduled to run for 5 years, with an approximate end date of 2013.

For more information:

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