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RESEARCH DIVISION

Research Bulletin

Development of a Joint Density Specification

The density of the hot mixed asphalt (HMA) at the longitudinal joint is usually lower than the density of the HMA throughout the regular mat away from the joint. This low in-place density translates into higher air voids around the longitudinal joint leading to the penetration of moisture into the mix. As the HMA pavement is subjected to environmental effects and traffic loads, the moisture-saturated mix at the joint becomes an easy target for moisture-related damages such as stripping and raveling.

Poor Longitudinal Joint

Good longitudinal Joint

One way to avoid such damages is to construct a dense longitudinal joint that would prevent the intrusion of water. Several joint geometries and compaction techniques have been recommended to optimize the density and performance of the longitudinal joint. A successful joint construction technique would provide a joint with a high density and strong bond between the two paved lanes.

In 2003, NDOT started a research effort with the Western Regional Superpave Center at the University of Nevada to develop specifications for the construction of longitudinal joints on HMA pavements. The research recommended an interim specification and a field testing program to evaluate the most effective method to construct longitudinal joints. The components of the research are briefly described on page 2.

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Interim Specification

Based on the review of the available longitudinal joint specifications and research studies on this subject, the following interim specification was recommended:

• Follow the normal procedure for measuring the mat density a) use a test segment of 6,000 yd^2; b) subdivide the segment into five subsections; and c) select a random location for mat density measurement.

• Measure the longitudinal joint density at the same random location selected for the mat density:

- Use the nuclear density gauge to measure the density at both the hot and cold sides of the longitudinal joint.
- For density measurement calculations: a) for the hot side, use the theoretical maximum density (TMD) corresponding to the hot mat location, and b) for the cold side, use the TMD corresponding to the station on the cold mat location.
- Conduct two nuclear gauge density measurements on the hot and cold sides of the joint. The two measurements should be parallel to the joint and 180 degrees apart. Average the two density measurements from each side and record them as the hot-side and cold-side densities, respectively.
- Identify the joint side (e.g. hot side or cold side) with the lower nuclear density.
- Cut a core (4" or 6") from the joint side with the lower density.
- Measure the density of the core.

• Check the density of the core against the following limits:

- Maximum of 2% less than the corresponding mat density ***AND***
- Minimum of 90% of theoretical maximum density at the specific location.

Field-Testing Program

The objective of this field-testing program is to evaluate the effectiveness of the various joint geometries and compaction techniques in increasing the joint density and providing improved performance. The proposed field-testing program calls for the evaluation of five joint geometries and two compaction techniques.

Joint Geometries

- *Natural Slope:* the HMA mix is left on its natural angle of repose as achieved by the paving process.
- *Edge Restraining Device:* this device provides lateral support at the edge of the first paving lane during compaction. It consists of a hydraulically powered wheel which rolls alongside the compactor's drum simultaneously pinching the mix.
- *Cut Edge with and without Rubberized Asphalt Tack Coat:* the edge of the first paving lane is cut to a vertical face after the compaction of the mat is completed. In this technique, the vertical cut face is either tack coated with rubberized asphalt or left uncoated.
- *Tapered Joint at 3:1:* the edge of the first paving lane is tapered at a 3:1 slope with a ½" notch at the end of the taper.

Joint Compaction Technique

- *Pattern I* - Rolling from the Hot Side with 6" Overlap on the Cold Side.
- *Pattern II* – Rolling from the Hot Side at 6" away from the Joint.

The field testing program will be implemented on three field projects during the summer of 2006. The overall objective of the field testing program is to identify the most effective combination of joint geometry and compaction technique that will generate the best performing longitudinal joint. The research will produce immediate recommendations based on the construction evaluations and short-term performance of the various techniques. Long-term recommendations will follow after the long-term performance of the sections is evaluated.

The research project is being conducted by Dr. Peter Sebaaly at the University of Nevada Reno and directed by a project panel consisting of NDOT Chief Construction Engineer, Mark Elicegui; Chief Materials Engineer, Dean Weitzel; Research Coordinator, Tie He; Principal Materials Engineer, Darin Tedford; and Construction Quality Assurance Engineer, Bill Hoffman.

Product Evaluation Committee (PEC) Meeting Recap

APPROVED

Field Test of Permanent Tape from Brite-Line Technologies

*I*n response to the manufacturer's request for reacceptance of its permanent pavement marking tape, the PEC approved a field test of permanent tape series 1000 from Brite-Line Technology. Evaluation options for permanent pavement marking tapes include acceptance under current standard specifications. However, because of durability and storage shelf life problems experienced with this tape in the past, the committee concluded that a field test of this product is warranted prior to its acceptance for use on NDOT projects

In 1995, the PEC conducted an internal review of Brite-Line permanent tape because of numerous documented complaints due to failures of this product. While the major issue was bonding failure, the shelf life of this product was considered as well because the product would deteriorate while in storage. As a result of this internal review, the PEC disqualified this permanent tape from use on any maintenance and construction project due to poor performance in the field and short shelf- life expectancy. As part of the product information review, a survey of other state DOTs was conducted to verify product past and current history. Maryland and New York DOTs indicated that they experienced some problems with the performance of this tape in the field. The proposed field evaluation will address the durability and performance of permanent tape series 1000 under various Nevada climatic conditions.

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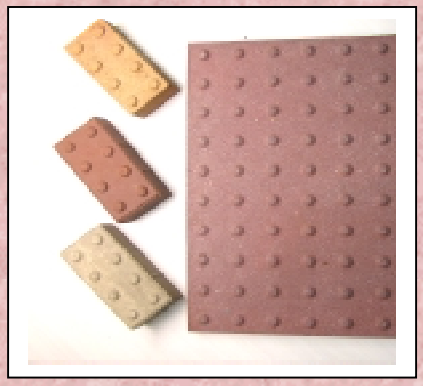
QPL for Detectable Warnings (Truncated Domes)

*B*ased on a request from the Specifications Section the PEC approved establishment of a QPL for detectable warnings (truncated domes) under specification section 613.02.01. NDOT standards for detectable warnings are covered in the 2005 edition of the Standard Plans and are shown on the sheets R-5.2.1 through 5.2.4 for sidewalks and curb ramps.



Detectable warnings (truncated domes) are standard design requirements to assist people with visual disabilities to determine the safe delineation between the sidewalk and the roadway. Truncated domes are something like half-inch “buttons” in the pavement. Truncated domes are important features specified by the Access Board. They provide an optimum compromise between detectability and safety. Any decrease to the dome’s dimensional aspects or increase to the spacing will adversely affect detectability; any increase in the dome’s dimensional aspects or decrease to the spacing will affect safety.

Since July 26, 2001, the Americans with Disabilities Act Accessible Guidelines (ADAAG) require the use of detectable warnings. The FHWA is obligated to enforce the requirements, and state and local agencies are required to apply at least minimum design standards when constructing and altering pedestrian facilities.

Recently the department was introduced to the new concept of pre-cast concrete panels that are inlaid into the curb ramp while the concrete is still in a plastic state.

The department, as an alternative to concrete pavers, has accepted this type of product; however, the panels are thin when

compared to pavers. To ensure that there is adequate control over the quality of pre-cast concrete panels and other types of detectable warnings (concrete pavers and plastic or ceramic panels), The Specifications Section developed acceptance criteria for detectable warnings and proposed establishment of a QPL for this type of product.

Currently, this QPL is comprised of four products: two concrete pavers and two concrete panels. Manufacturers/vendors will be directed to submit their proposal for acceptance of their product according to standard product evaluation procedures. Based on Specifications' review and recommendations, new products that meet the new acceptance criteria can be added to the QPL.

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Specification Revision for Reflective Pavement Markers

Based on a request from 3M Company the PEC approved a revision to our specifications for reflective pavement markers, subsection 633.02.02, paragraphs 1 and 2. 3M's proposal stated that the point of conflict is the specification for the marker body and lens composition.

The 290 series marker was evaluated in 1999, at which time it was determined that this product did not meet our specifications. However, based on the results of a field test by Caltrans, 3M's marker series 290 was added to the QPL without any revision to our current specifications. Traffic Engineering reviewed their proposal and recommended a change to our specifications since this marker has been included on NDOT's QPL since 1999. This marker has been installed on NDOT roadways since then and has performed well. The committee approved Traffic's recommendation to change the specification; thus, the pavement marker series 290 will be retained on the QPL.

The Research Division administers the Department's research, development and technology transfer program and serves as the "clearing-house" for product evaluations

Research and Technology Review
Is published quarterly by the NDOT Research Division. Its purpose is to provide the latest information on the NDOT research activities including product evaluation and other pertinent research topics.

The Nevada Department of Transportation
1263 S. Stewart Street
Carson City, Nevada 89712

Kenny C. Guinn, Governor
Jeff Fontaine, P.E., Director

If you have comments or need additional information regarding any of the topics discussed in this issue please contact the Research Division at (775) 888-7223.

Editor, Sheryl Lindquist