Kansas Showcases Perpetual Pavements Construction

By Dwight Walker, P.E.

The Asphalt Pavement Alliance defines a Perpetual Pavement as an asphalt pavement designed and built to last longer than 50 years without requiring structural rehabilitation or reconstruction, and needing only periodic surface renewal in response to distresses confined to the top of the pavement.

Perpetual Pavements are not new. Some of them were constructed in the 1960s or even earlier. Pavements that were well designed and well constructed have performed without structural failures for many years—even under heavy traffic.

Kansas is one of the latest states to evaluate Perpetual Pavement technology. The Kansas Department of Transportation and the Asphalt Pavement Associations of Kansas, Arkansas, Missouri and Oklahoma, along with Dobson Brothers Construction Company and the Federal Highway Administration, hosted an open house in July 2005 to showcase a Perpetual Pavement installation. The pavement was constructed on U.S. 75 about 50 miles north of Topeka, Kansas, near Sabetha.

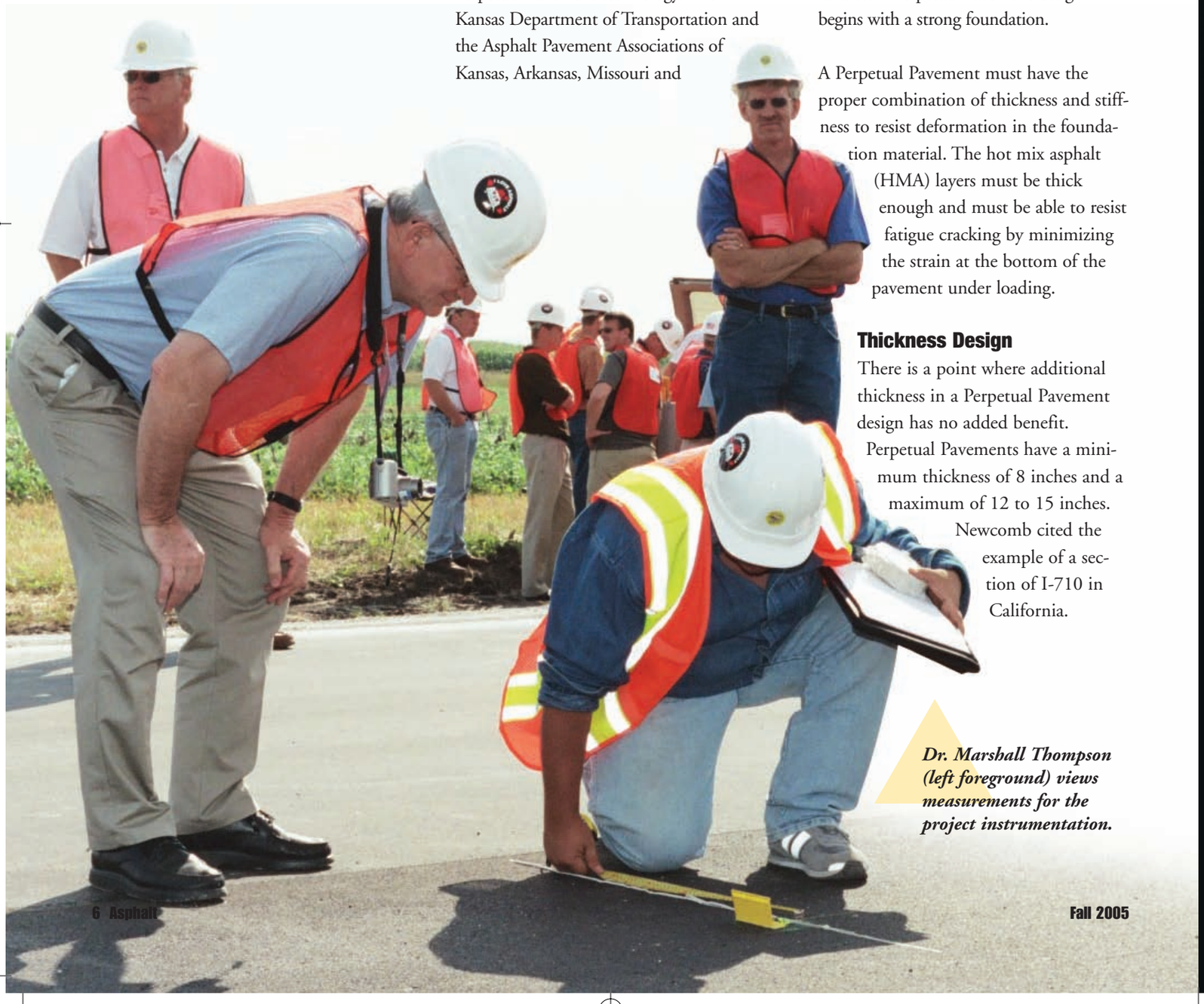
Design Objectives

Workshop participants learned the basics of producing a long-lasting asphalt pavement. According to David Newcomb, Vice President for Research and Technology of the National Asphalt Pavement Association, a Perpetual Pavement is designed and built from the bottom up to eliminate structural failures. A Perpetual Pavement design begins with a strong foundation.

A Perpetual Pavement must have the proper combination of thickness and stiffness to resist deformation in the foundation material. The hot mix asphalt (HMA) layers must be thick enough and must be able to resist fatigue cracking by minimizing the strain at the bottom of the pavement under loading.

Thickness Design

There is a point where additional thickness in a Perpetual Pavement design has no added benefit. Perpetual Pavements have a minimum thickness of 8 inches and a maximum of 12 to 15 inches. Newcomb cited the example of a section of I-710 in California.



Dr. Marshall Thompson (left foreground) views measurements for the project instrumentation.

According to the 1993 AASHTO Pavement Design Guide methodology, the pavement needed to be 23 inches thick to carry the design traffic volume. Using the PerRoad Perpetual Pavement design software, the design thickness was 14 inches.

Layer Considerations

In addition to thickness considerations, the various layers within a Perpetual Pavement need to satisfy materials concerns. The base layer is made more resistant to fatigue cracking from bending under traffic loads by increasing the asphalt content to provide increased flexibility. Typically, an asphalt binder content which corresponds to 3 percent air voids in the mix is used.

The intermediate layer of a Perpetual Pavement has to be both stable and durable. This layer must provide rutting resistance. This is accomplished by achieving stone-to-stone contact in the coarse aggregate and using an asphalt binder with sufficient stiffness to meet the high temperature needs.

Marshall Thompson, Professor Emeritus at the University of Illinois, indicated that achieving rutting resistance should not be an issue—given current asphalt technology.

If the Perpetual Pavement is designed and built correctly, any distresses are limited to the surface course and can be readily fixed. The necessary wearing course properties depend on traffic, weather conditions and economics. Particular requirements include resistance to rutting and cracking, skid resistance and noise mitigation. The wide range of available types of HMA mixes allows the surface mix to be customized to fit the specific application.

Kansas Approach

The Kansas project evaluated several pavement cross-sections. The thickness of the base layer varied from about 7.5 inches to 11.8 inches. The intermediate layer (about 2.5 inches) and the surface course (about 1.5 inches) were constant for all sections.

The Perpetual Pavement design approach is based upon providing enough thickness to limit the bending strain at the bottom of the HMA layer to less than the strains associated with fatigue damage, a concept known as the fatigue limit. Kansas installed instruments at the test site to measure the strains that occurred at the bottom of the asphalt layer when a load moves over the pavement. Information and experience gained from this project will be used to build longer lasting asphalt pavements.

For more information on Perpetual Pavements, visit the Asphalt Pavement Alliance's website, www.AsphaltAlliance.com.

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