Local Edition: Vol. 15, No. 1a
July 2009

LOCAL HIGHWAY TECHNICAL
NEWS

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Perpetual Pavements Last Decades Without Major Reconstruction

The structural features of perpetual pavements have been the most discussed issues over the past few years. It has been acknowledged that beginning with a solid foundation for construction and long-term stability, the pavement structure needs to consist of a thick cross section of hot mix asphalt (HMA) with the layers engineered to resist specific types of distresses.

Preventing fatigue cracking – Fatigue cracking, which can be the most devastating form of failure, can be handled by first considering the level of traffic.

In high-volume facilities such as Interstate and primary highways, fatigue is best countered using a total HMA thickness that keeps the bending strain under the vast majority of heavy traffic loads below a threshold of about 70 microstrain. This will ensure that cracks do not originate at the bottom of the structure and propagate up to the surface. Thus, the need for full-depth patching or complete reconstruction of the HMA can be avoided.

For medium-volume roads, this may mean a minimum HMA thickness of about 11 inches, and for heavier trafficked roads, it could mean structures of 15 inches to 16 inches at the thickest. Of course, the thickness in a given situation depends upon the traffic, soil, foundation and climate.

In low-volume roads, heavy loads may be very infrequent. So it would not be cost effective to consider the same 70 microstrain criterion to resist fatigue. Instead, it would be better to consider the accumulation of damage and minimize the accumulation over a long period of time. Depending upon climate, support conditions and the particular traffic, this leads to low-volume road HMA thickness of 6 inches to 8 inches.

Rut resistance – In addition to designing against bottom-up fatigue cracking, it is also important to consider the possibility of deep rutting within the pavement structure.

This is controlled in design by the vertical compressive strain at the top of the subgrade. If this strain is high, more than 200 microstrain, it indicates that the pavement structure is weak and incapable of resisting permanent deformation deep within itself.

The rut resistance must start at the top with a high quality surface mix, followed by a binder and base courses that allow the aggregate structure to transmit the load to the pavement foundation. It may be a granular layer or a stabilized subgrade with sufficient thickness to minimize the effects of seasonal weakening.

Per Road (version 3.0) can be used to design perpetual pavements for low to high traffic volumes. It is available for free download from the Asphalt Pavement Alliance at www.asphaltallicance.com.

Life-cycle costs – Not completely divorced from the pavement design is the issue of economy.

If one compares a typical rural interstate highway pavement design using the 1993 AASHTO Pavement Design Guide for a 25,000 ADT 4-lane facility, a conventional design might be 8 inches of HMA over 10 inches of granular base material versus a perpetual pavement consisting of 14 inches of HMA over 6 inches of granular base.

Assuming a typical surface for the conventional design and a high-quality SMA for the perpetual pavement, with the initial overlay intervals of 15 years and 18 years respectively, the conventional HMA section might need to be replaced in 35 years whereas the perpetual section would only need periodic resurfacing.

The perpetual pavement would require 25 percent less aggregate and 20 percent less liquid asphalt. This is a significant savings of resources that can be used elsewhere.

Reference: Nevada Milepost, Fall 2007, Vol. 17, No. 3