Portland Cement Association

Concrete Pavement Design: '93 Guide vs. the MEPDG

The current American Association of State Highway and Transportation Officials (AASHTO) pavement design manual – *Guide for the Design of Pavement Structures* ('93 Guide) – is based on data collected during a road test conducted in the late 1950's and is widely used in the design of new and rehabilitated highway pavements. The road test was a series of experiments carried out to determine how traffic contributed to the deterioration of highway pavements. Different pavement structures were constructed and then subjected to repeated loading by a specific vehicle type and weight so that the interaction of vehicle loads and pavement structure could be investigated.

The road test introduced many concepts in pavement engineering, including the load equivalency factor, layer coefficients, Structural Numbers, and the equivalent single axle load (ESAL). Because the road test could not possibly evaluate all the different combinations of roadway materials and sections, the data collected is only applicable under the specific conditions of the test with regards to the time, place, environment, and material properties present during the test. Extrapolating the original data to different situations and current pavement design conditions has been extremely difficult and often extremely arbitrary.

Pavement engineers realized that the limitations of the current '93 Guide stemmed directly from the limitations of the road test itself. To address this concern, an effort is currently underway by the National Cooperative Highway Research Program to develop a new pavement design procedure based upon mechanistic principles. Mechanistic pavement design is basically an approach where a model is used to calculate the reaction of a pavement structure when subjected to traffic loading. The greatest advantage of the mechanistic design approach is that it will allow for a rapid analysis of the influence of changes in pavement materials and traffic.

When it comes to designing concrete pavements, the proposed AASHTO *Mechanistic-Empirical Pavement Design Guide*, or MEPDG for short, will offer pavement design engineers greater flexibility over the current '93 Guide, in terms of:

- Evaluating the effects of various pavement materials, traffic loading conditions, design features, and construction practices
- Considering both long-term (age) and short-term (temperature and moisture) changes in material properties
- Providing more accurate performance predictions so that the frequency of premature failure is reduced

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- Improving the ability to evaluate premature failures and the factors contributing to exceptionally good performance
- Compiling databases for the updating of pavement design input values as information becomes available

This increased awareness of material capabilities and their shortcomings should lead to the smarter use of construction materials and the increased durability of concrete pavements. The economic advantage should result in more concrete pavements being selected by user agencies. However, the MEPDG does have its limitations when it comes to concrete pavements including the following:

- Not applicable to concrete overlays as the minimum allowable thicknesses are six inches for jointed plain concrete pavement (JPCP) overlays and seven inches for continuously reinforced concrete pavement (CRCP)
- Joint spacing is limited to a minimum of ten feet for concrete overlays
- Jointed reinforced concrete pavement (JRCP) sections cannot be designed at all
- 28 days is the minimum time for opening concrete sections to traffic
- Provides an optimum maximum concrete thickness of about 13 inches, above which there is little value realized

While the MEPDG addresses all new (including lane reconstruction) and rehabilitation design issues, and provides an equitable design basis for all pavement types, many state agencies have resisted adoption because of the complexity and the lack of local empirical data to incorporate into the MEPDG. Economizing concrete pavements is not difficult but does require a thorough understanding of the benefits and costs of various design features.