R&T UPDATE
Concrete Pavement Research & Technology

# ACPA REPORTS HIGHLIGHTS OF 83RD ANNUAL TRB MEETING

The 83rd Annual Meeting of the Transportation Research Board was held in Washington, DC from January 11-15, 2004. ACPA Members, chapter/state paving association executives, and ACPA National staff participated in many sessions and committee meetings, sharing and learning about new concrete paving technology with specifying agencies and researchers from throughout North America.

As the primary forum for nationwide technology transfer for transportation research, the TRB Annual Meeting offers a unique opportunity to present concrete pavement advancements directly to key decision makers. Additionally, concrete industry representatives gain first-hand knowledge of the issues, opportunities, and new technical developments that concern our customers and members.

This report summarizes most of the significant presentations from the Annual Meeting. Copies of most of the technical and research papers can be downloaded from ACPA's website through the links after each article via the online version of this R&T issue at www.pavement.com/techserv/RT5.02.pdf. Please contact Debbie Howard at dhoward@pavement.com or 847-966-2272 if you have any questions.

## ACPA Reception Again Draws Top Officials

For the eighth consecutive year, ACPA sponsored a reception at the Willard-Intercontinental Hotel, attracting almost 250 top transportation officials, ACPA members, chapter/state association executives, ACPA national staff, consultants, and university professors. ACPA's TRB reception was once again a highlight of the 5-day conference and the premier annual gathering at TRB for ACPA members, governmental officials, academia, and others interested in concrete pavement.

***ACPA gratefully acknowledges the generous contributions of the members that made this event possible:***

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### Effects of Stringline on Concrete Pavement Smoothness

The idea that improved smoothness can be obtained by simply going to a shorter spacing of the stringline stakes is not always true. In fact, an optimum stringline spacing can be realized by recognizing each of three stringline effects described in this paper … Modern concrete pavement construction typically employs slipform paving equipment, especially on major highways and airfields. Guidance of this equipment is commonly provided by sensing a stringline that is set in advance by an engineering survey. While use of stringline guidance has improved the quality of the pavement with respect to pavement smoothness, some limitations of this technique are also known to exist. This paper explores three of these limitations in detail. The impact to concrete pavement smoothness as a result of the chord effect, sag effect, and random survey error are described here both conceptually and analytically. Of these three effects, the random error introduced during the engineering survey is found to be the most pronounced. Furthermore, there are contradictions with what is sometimes considered good practice for concrete pavement construction. (04-4950)

### Thickness Tolerances for Paving

The analysis in this paper clearly shows that thickness tolerance and associated pay adjustment factors in today's paving specs should be dependent on the pavement thickness … The thickness tolerance limit currently used by the Texas Department of Transportation for portland cement concrete pavements was developed about 50 years ago when pavement thicknesses were typically less than 10 inches, and no additional study on the tolerance limit has been conducted since its development. Because the current thickness tolerances are independent of the design pavement thickness, they are very tight especially for thicker pavements. These tight tolerances give difficulties in construction and in the use of non-destructive testing (NDT) methods for slab thickness determination, because errors of NDT methods typically depend on the thickness. In this study, the sensitivity analysis of the slab thickness has been conducted to investigate whether the current thickness tolerance can be loosened and to propose acceptable thickness tolerance limits. Thickness tolerance concepts were based on various methods, including the AASHTO pavement life prediction equation, a mechanistic distress prediction model, and fatigue failure models. The sensitivity of the slab thickness to pavement performance has been investigated using those methods. (04-2209)

### Performance Specifications

This report reviews a performance-related specification developed by Indiana, which was well received by both the agency and the contractors. It also describes lessons learned on this project, enabling future modifications to the specification and longer lasting, more cost effective pavements … Performance-related specifications (PRS) are specifications that base pavement acceptance and pay adjustment on the projected performance and predicted life-cycle cost (LCC) for a specific pavement. PRS relate measurable quality characteristics with pavement performance through computer simulations that incorporate physical distress models. Prototype PRS

have been developed in the past for jointed plain portland cement concrete pavements (PCC) through Federal Highway Administration (FHWA) research projects. The Indiana Department of Transportation (INDOT) has had recent experience with developing and implementing a Level 1 PRS during the re-construction of a portion of I-465 east of Indianapolis in the summer of 2000. The paper includes an overview of the concepts behind PRS, the process of developing a Level 1 PRS, and observations from implementing the first PRS in the construction of the pavement. (04-5016)

## Sealant Application Temperatures

The information on sealant installation temperature in this paper will likely improve kettle designs and change sealant installation practices … To achieve the longest possible sealant service life, careful consideration must be given to the selection of the sealant and the pavement, and to sealant application. This study measured sealant temperatures at various points in three different kettles during sealant installations. Kettle temperature gauge readings were compared to true sealant temperatures and to recommended application temperatures. Temperature gradients within kettles were calculated and related to the kettle stirring mechanisms and the speed of stirring. The results indicate that contractors often install sealants near the lowest suggested application temperature, but that because of faulty kettle gauges, sealants are often underheated. Large temperature gradients were found to exist in some kettles. The gradients, which can reach 110°F (60°C), depend on the stirring system and speed, with a rapid circumferential stirring providing for the lowest gradients. (04-2555)

## Joint Sealant Performance in Ohio

A report on the performance of joint sealants and the structural condition of the pavement at the Ohio Route 50 test site presents preliminary results after three years in service … The project involves ten different sealant compounds, including four silicone, two hot-applied and four compression seals, as well as four unsealed sections. A total of fifteen different sealant-joint configuration combinations are examined. Compression seals generally outperform the other materials, and sealants in the westbound lanes are more effective than those in the eastbound lanes. These observations suggest that crew experience in sealant installation is a critical factor. Nonetheless, structural performance and surface profile smoothness appear to be unrelated to sealant condition. Many of the sealant sections that have high effectiveness values also exhibit high percentages of structural distresses and decreases in pavement surface smoothness. Flooding following an intense rainfall event may have been responsible for softening of the subgrade and the development of transverse cracking and corner breaks. Implementing a drainage outlet maintenance program that includes cleaning silt and debris from the outlets on an annual basis is recommended. The complex interactions among all these factors requires long-term monitoring of both sealant and structural performance. (04-2990)

## Dowel and Pavement Performance

A comparative analysis of pavement performance in Wisconsin shows that dowels influence performance more than tied concrete shoulders … The specification of dowels as a component of concrete pavement construction became a design policy standard in Wisconsin in 1988. The impact of dowels on the performance of asphalt shoulders adjacent to concrete pavements has, however, not been evaluated. As part of a research study to develop an improved methodology for the design and construction of paved shoulders adjacent to concrete pavements in Wisconsin, a comparative analysis was conducted on the extent and severity of distresses occurring on the asphalt-surfaced component of composite shoulders adjacent to doweled and undoweled jointed plain concrete pavements. A composite shoulder is defined as an extended concrete pavement width beyond the striped white line plus a specified width of asphalt shoulder. In addition, for dowel-jointed concrete pavements, further comparative analysis was conducted for distresses on asphalt-only shoulders and the asphalt-surfaced component of composite shoulders. On the basis of the analysis, it is concluded that for composite shoulders, higher levels of distress exist on the asphalt-surfaced component of shoulders bordering undoweled jointed plain concrete pavements than on those bordering dowel-jointed plain concrete pavements. In addition, for dowel-jointed plain concrete pavements, there is no statistical difference in distress levels between asphalt-only shoulders and the asphalt-surfaced component of composite shoulders. (04-4222)

## Expediting Concrete Pavement Construction using Alternate Pavement Sections

This research shows that it may be possible to minimize the number of layers and shorten construction time for CRCP designs, without sacrificing load carrying capacity. Considering the user costs, the expedited pavement cross sections may be more economical alternatives … State and local highway agencies are highly motivated to open a newly-constructed or reconstructed highway to traffic as soon as possible. To carry heavy traffic on these roads, several layers of high-quality or stabilized materials are normally placed during construction. For the Texas Department of Transportation, this usually consists of one or more layers of stabilized subgrade and subbase, a layer of asphalt to act as a bond breaker, and a continuously reinforced concrete pavement (CRCP). The large number of layers may be cost-effective from the standpoint of agency costs; however, the number of steps involved increases construction times, thereby increasing the user costs borne by the motoring public. (04-3496)

## Evaluation of Fly Ash for Subgrade Stabilization

Laboratory and field testing of soils treated with fly ash show fly ash stabilization as effective treatment … Class C fly ash has been used to improve the properties of subgrade soils for several decades. A University of Kansas study quantified the level of improvement provided by Class C fly ash and the degree to which those improvements are effectively permanent. A series of dynamic cone penetrometer values were obtained for 12 streets with fly ash treated subgrades, and for five streets with untreated subgrades. Streets ranged in age from zero to nine years. For subgrades with fly ash, the penetration resistance was recorded for the fly ash treated layer as well as the untreated soil beneath. Higher strengths were recorded for all fly ash treated subgrade layers as compared with the untreated soil beneath. No deterioration with age was observed for the subgrades evaluated. Fly ash contributes to soil strength and stiffness while plasticity and swell potential were reduced, although swelling was not eliminated. (04-2414)

## Use of Lime Kiln Dust for Soil Modification

The results of tests in Indiana indicate that lime kiln dust is a viable, cost effective alternative to hydrated lime in enhancing the strength of fine grained soils … The Indiana Department of Transportation (INDOT) has permitted the use of lime kiln dust (LKD) as a low-cost construction material in creating a workable platform for soil modification (not for soil stabilization) since the early 1990s on selected projects. However, the enhanced strength of soils with LKD has not been accounted for in the subgrade stability calculations in the design process. A study was initiated to evaluate how the lime kiln dust is a comparable material to hydrated lime. A series of laboratory tests were performed to assess the mechanical benefits of lime kiln dust in combination with various predominant fine grained soils encountered in Indiana such as A-4, A-6, and A-7-6 soils. In the course of the study, several tests such as the Atterberg limits, standard Proctor, unconfined compression, CBR, volume stability, and resilient modulus were performed. The increase in subgrade stability could translate into thinner pavements, leading to significant cost savings in pavement construction. This is in addition to that of expediency in construction during wet weather. (04-4147)

## How the Shape & Depth of Partial-Depth Repairs Relates to Performance

The most advantageous partial-depth repair configuration depends upon the repair material used according to this study … A research project conducted in Taiwan demonstrated different configurations of repair materials and repair outline designs in partial-depth corner repairs of concrete slabs. 3D finite element models were constructed to study how wheel loads affect the stress along the boundary of the repaired area. The results show that less stress will occur along the boundary as the repaired area becomes smaller. When cementitious repair materials are used, the depth of a square-shaped repair area determined the effectiveness of the repair more strongly than the side length; i.e. the deeper the repair (up to 1/3 the depth), the more effective the repair should be. Epoxy mortar was not found to be appropriate for use in square repaired areas, but could be used in small, spherically-shaped repair areas. Epoxy mortar was also more effective in shallow repairs than in deep repairs. (04-4470)



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