JOINT TRANSPORTATION RESEARCH PROGRAM

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Longitudinal Joint Specifications and Performance

Introduction

One of the advantages of asphalt pavements is that they can minimize traffic disruptions by being paved and opened to traffic quickly. Frequently, asphalt paving is performed while traffic is maintained in an adjacent lane. The disadvantage of this type of construction operation, however, is that it leads to paving one lane at a time, which requires construction of a longitudinal joint between the lanes. A weak joint can cause an otherwise sound pavement to deteriorate prematurely.

The joint area can form a weak plane within the pavement. In addition, the mat near the joint may be less dense and more permeable than the interior of the mat. Both of these factors can allow the ingress of water and air into the pavement, potentially leading to moisture damage and accelerated oxidation of the mixture near the joint, respectively. Joint damage typically results in cracking and raveling, which lets in more water and air, accelerating the deterioration. In cold climates, like Indiana's, this water can freeze and expand, increasing the chances for raveling and joint failure.

Because the creation of longitudinal joints is virtually inevitable and because poor joint quality can lead to premature failure of the pavement, guidance is needed on how to ensure that high quality joints are constructed. Ensuring joint

quality requires knowledge of successful joint construction techniques, methods for testing joints to measure quality, and specifications to encourage (or require) proper joint construction. Therefore, this report summarizes an extensive review of the pertinent literature, a review of state specifications, and inspection of several trial projects in Indiana related to longitudinal joint construction and performance. Recommendations are given for continuing and possible future efforts to encourage or require the construction of durable longitudinal joints.

The outcome of this study is intended to provide guidance to the Indiana Department of Transportation (INDOT) and contractors on the proper construction techniques for joints and ensuring the performance of longitudinal joints.

Findings

Many different methods for compacting longitudinal joints have been used in the past with varying degrees of success. The ability to compact a joint that will be durable and will perform well is heavily mix and site specific, which may help to explain why so much of the research is somewhat contradictory. Therefore, it seems advisable to allow many options

Low density material around the joint can allow for the ingress of water, as illustrated by drier area near centerline.

Joint deterioration continues and extends further into the mat.

that contractors can choose from to suit the particular circumstances at individual jobsites, particularly with regard to roller patterns.

That said, however, some things do seem to be true in most cases. For example, there are decisions made during the design phase of a project that may affect compactability. These include such things as lift thickness, nominal maximum aggregate size, mix type, lane configuration, traffic control requirements, project scheduling and sequencing, and more.

There are also factors that are within the control of the contractor. Since contractors in Indiana design their own mixes, they can opt to use a fine mix, which may prove to be easier to compact. In addition, they can establish their own rolling patterns to achieve the best density in an efficient manner (with the exception of 402 mixes where the options are limited). The use of notched wedge joints is an option that is available to contractors in Indiana, and they have proven successful in many states, but there is currently little incentive for contractors to use them in Indiana.

Joint sealers and joint adhesives have not been proven to be effective at reducing permeability in all cases but have rarely, if ever, caused construction or performance problems. They are, therefore, considered to be reasonable preventative measures and their use should continue for the time being. The performance and cost effectiveness of these techniques should be examined and a decision to continue or revise the requirements should be made in the future.

A joint quality specification can be an effective way to improve performance. Most specifications are based on establishing minimum joint densities in comparison to either the mat density or the maximum theoretical density of the mix. A density of 90% of the maximum theoretical density is sometimes used as the minimum for 100% pay. Another common requirement is that the joint density be not more than 2% lower than the density near the center of the mat. Indiana may consider the implementation of a longitudinal joint density specification in the future after assessing the success and cost implications of the current recurring special provision.

Visual inspections of nine projects that included special joint treatments, including double tack coats and, mostly, joint adhesives, revealed that these projects are generally performing quite well, although most are relatively recent. The two oldest projects date to about 2003–2004; they are beginning to show some minor joint separation and cracking but the density of the mat surrounding the joints appears to be fairly uniform. These joints should perform for much longer given routine crack sealing. The double tack coat appears to be less effective at bonding the joint. Monitoring of these existing projects should continue to assess their performance and guide future refinements to the specifications for longitudinal joint construction.

Implementation

Based on the conclusions reached through a review of the pertinent literature, survey of state practices and current INDOT experience with longitudinal joint construction, the following implementation suggestions are offered.

- Continue the use of joint adhesives and joint sealers, which together may prolong joint life by reducing permeability and improving durability and bonding of the joint.
- Continue to allow the contractors to establish appropriate rolling patterns for 401 mixes.
- Revisit the requirement to pull up adjacent lanes when using a notched wedge joint to once again make this an attractive alternative for contractors to use; the improved productivity associated with not pulling up the adjacent lane would encourage contractors to use this generally successful technique.
- Consider implementation of a PWL (percent within limits) joint density specification in the future as a logical next step after assessing the success and cost implications of the current use of joint adhesives and sealers. A joint density specification would provide a means for assessing whether various joint construction techniques or new materials are truly beneficial.
- Initiate a project to monitor joint performance before the collective memory of what has already been attempted is lost.
- Communicate best practices to promote better longitudinal joint construction to a wide range of audiences.

Through these new and continuing efforts, INDOT and the asphalt paving industry can strive to improve pavement performance by focusing on what is often the “weak link”—the longitudinal joint.

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