An Improved Longitudinal Paving Joint?

Well, we'll see. Longitudinal asphalt paving joints, whether at the centerline or at other paver passes, are common starter kits for distresses in the asphalt surface.

There are a few reasons for longitudinal joints being problem children. When a project allows the luxury of echelon paving, where one paving pass is followed close behind by the next pass, the first mat temperature is still high enough that a first rate crew can achieve high compaction at the joint interface.

But these projects are rare or even nonexistent for most of us and so our reality is that the second paving pass is placed against a cold mat. Think intuitively about what happens there. In the first pass, the roller is attempting to compact an unconfined edge and because the asphalt material can move laterally, it is inevitable that the compactive effort of the roller is less efficient at the edge; hence, the density suffers at this unconfined edge. As the second pass comes through, the roller may achieve relatively good density in the second pass (and, depending upon the choice of joint construction technique crush some aggregate along the way), but it doesn't repair the lessened density in the first pass. If the joint construction involves overlapping and pinching material in, aggregate is often crushed in the process and, because it is not coated in asphalt binder, is prone to raveling from the joint early in its life.

In both passes, the longitudinal joint is being formed at the edge of the paver screed and the material is often beyond the end of the auger system. As a result, there is greater potential for material segregation. Another segregation generator is excessive handwork as the material is luted back onto the hot side of the mat.

Between compromised density at the longitudinal joint and the potential for early loss of material from the crushing of aggregate, the conditions become ripe for water to enter and be trapped in the joint. Lower density translates to higher air voids and that is where the water settles in. We all know what a powerful force water can be in our pavement, with its freezing and thawing and expanding and contracting, and when it finds no route of escape it makes a general nuisance of itself. The longitudinal joint then progresses towards premature distress as it rips itself apart.

There are a number of construction practices that can mitigate the problem, although not all of them are available for a given project. On narrower roadways, it may be possible to eliminate the joint altogether by paving the whole roadway at once (this pretty much maxes out at about 24'), but this means shutting the whole roadway down and that is usually not permissible. Echelon paving can achieve great results but this is limited to some multi-lane highways as a practical matter. Good techniques on mat overlap and roller patterns are essential.

Devices can be used to construct the joint as well. Examples include notching wedges, cutting wheels, edge restrainers, and joint makers. Enhanced adhesion between the cold and warm mat is attempted by heating the cold joint or tack coating it in advance of the next pass.

The mix of techniques, equipment devices, and best practices vary quite a bit across the country and paving professionals often have strong opinions about their particular approach (e.g., see the passionate comments following Marshall Klinefelter's Maryland Method Longitudinal Joint video). However, there is from time to time a willingness to try new approaches, and we recently had the opportunity to see a new one (for us) locally.

While new to us, so called void reducing asphalt membranes (VRAM) (or sometimes, just "joint sealants") have been toyed with to some extent. Joint sealants such as J-Band or QuickSeam attempt to develop an impermeable barrier directly under the joint that is drawn up into the air voids within the joint by virtue of the heat of the asphalt mat (or at least that is a simplistic overview of it) or placed directly within the joint in the case of QuickSeam. There are others, such as Propex's Petrotac, that have more generic applications as well. Illinois Department of Transportation is one agency that has taken a look at these a bit – see their Physical Research Report No. 69).

The general idea is to combat part of the problem with weak joints by providing bituminous sealing material that will fill many of the air voids and reduce the potential for water's destructive actions. When Cecil County (Maryland) Public Works tried J-Band for the first time, we were able to capture part of the job (sadly, we missed it going down) and post a video of it to our YouTube Channel. They applied the material to two of their paving projects this year and left a portion of one roadway as a control section. We are looking forward to seeing the results of cores taken at the joint and, of course, watching how the pavement performs over the next 15 years or so.

Will one or more from this community of products improve the durability of longitudinal joints and do so with a positive benefit/cost ratio? We will only know that in time as we have a chance to observe installations like these and see how they perform over time.

The Delaware T2/LTAP Center's Municipal Engineering Circuit Rider is intended to provide technical assistance and training to local agencies and so if you have pavement management questions or other transportation issues, contact Matt Carter at matheu@udel.edu or (302) 831-7236.