APPLICATIONNOTES

LTPP Findings Pay Off for Pennsylvania

Change in Pavement Joint Design Standard Saves Pennsylvania Money and Reduces Construction Problems

The Challenge

Pennsylvania relies on concrete pavements as a tool to meet its customers' need for smooth, cost-effective, long-lived roadways. Indeed, Pennsylvania has 5150 km (3200 mi) of concrete pavements. To ensure that drivers get a smooth ride, several years ago, the Pennsylvania Department of Transportation (PennDOT) adopted the practice of building its concrete pavements with skewed joints.

Cracks in concrete pavement are inevitable. The key to good performance is not to prevent cracking, but to control the location and size of the cracks, so that overall deterioration of the pavement is minimized. In jointed concrete pavements, crack control is accomplished through the use of appropriately spaced joints. However, the joints that are used to control cracking may themselves be prone to another form of pavement distress—faulting. Faulting occurs in pavements with poor load transfer between adjacent slabs. Traffic passing over the joint induces a rocking motion of the slabs that causes the supporting material to be displaced so that one slab eventually becomes higher than the other. One of the practices that has been used to mitigate faulting is to change the orientation of the joints from perpendicular to skewed. In theory, skewing the joints so that the vehicle wheels pass over it one at a time reduces the impact on the joint and provides a smoother ride.

Although the practice of skewed joints has been standard for many years, there exists little evidence of its benefits. Indeed, for Pennsylvania, this practice has at times caused problems. "Skewed joints," explained Dan Dawood, PennDOT's chief of pavement design, "are just a lot more difficult to construct. They can be more susceptible to error out in the field in terms of angles and how the sawcuts line up." Getting the materials is also difficult and can be costly. "Dowel-basket makers," continued Dawood, "would initially have problems getting the skew right because they would have to retool their equipment to make them skewed. Since most States don't use skewed joints, the market for them, along with the vendors that supply them, is small. Since you only have a few vendors, competitive pricing is, at best, limited."

The biggest problem with skewed joints however was patching. "To patch a skewed joint, you'd have to do a lot of measuring and use both lanes to line up everything. You just couldn't do that," explained Dawood, "so we made the patches perpendicular."

U.S. Department of Transportation
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The Strategy

PennDOT decided to change its practice of using skewed joints after reviewing the results of a Long Term Pavement Performance (LTPP) program analysis project. The project analyzed LTPP pavement performance data to identify what worked and what didn't work to control the development of joint faulting.

"The LTPP study showed that when you look at jointed concrete roads over the years and under different environmental conditions," explained Gary Hoffman, PennDOT chief engineer, "skewed joints don't necessarily mitigate faulting. Rather, doweled perpendicular joints with reasonable subdrainage eliminate or control faulting. We don't need the extra insurance and cost of skewed joints."

Putting the Strategy to the Test

As of calendar year 1999, Pennsylvania policy specified perpendicular joints for any limited-access, four-lane concrete pavement highway projects. One project under the new policy is located right outside of Harrisburg. "We're using perpendicular joints for a long project with major ramps and interchanges that's on Routes 22 and 322. It's a four-lane new construction/reconstruction of the road going up to Pennsylvania State College, and should be finished about the middle of next year," said Dawood. Several other projects specifying perpendicular joints have also been started on Route I-80 in Pennsylvania.

According to Hoffman, Pennsylvania believes it will be able to save money with the new policy. "We'll be able to reduce costs initially because perpendicular joints are just less expensive than skewed joints," explained Hoffman. "In addition, we'll save money by eliminating construction problems and ensuring that future maintenance is easier to deal with. So not only will we save money initially, but also throughout the entire life cycle of pavement projects."

Benefits

By changing its pavement joint design standard, the Pennsylvania Department of Transportation can reduce the occurrence of joint faulting. The result is:

- A smoother ride for motorists.
- Reduced construction problems and related costs.
- Reduced maintenance requirements.
- Fewer maintenance-related disruptions to traffic.

For More Information

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