



## POST-MORTEM JPCP CASE STUDY: FAULTING DOCUMENTATION

**Case Study Topic:** *After 10 years of use, a concrete pavement is faulting. Why is this behavior occurring?*

### BACKGROUND

The faulting of an undoweled JCP in Austin, Texas is increasing and Joe Engineer is determined to find out why. With the HIPERPAV II Guidelines in hand, he turns to section IV.4.1: Faulting of JPCP without Dowels. He wants to connect the early-age behavior of this pavement to its long-term performance. The early-age joint design is cited as being one of the most influential factors. The joint opening of an undoweled pavement is a function of the temperature change, joint spacing, slab-subbase restraint and the load transfer efficiency.

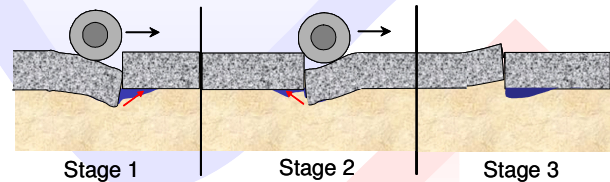
Joe Engineer decides to use HIPERPAV to help him understand how these four influential parameters affect JPCP performance. He will perform a post-mortem analysis on this 10" thick JPCP. Looking at the construction records, Joe finds that the slab length varied between 15 and 25 feet, and that the pavement was constructed on a smooth asphalt concrete subbase. Information and measurements collected during a field inspection visit are presented below:

- Joint spacing: 15 to 25 ft.
- 28-day Lab Indirect Tensile Strength: 520 psi
- The mix design specified a Type I cement mix with 18% Class F fly ash replacement. The aggregate used in this project is of siliceous origin.
- The air temperature at the time of placement ranged from a high of 90°F to a low of 60°F.
- The placement time was around noon on September 1, 1995. Skies were sunny and the wind speed averaged 6 mph.

- The slab was covered soon after placement with a single coat of the white curing compound. The initial PCC mix temperature recorded at placement was 75°F.
- Sawing operations occurred at the optimum time.

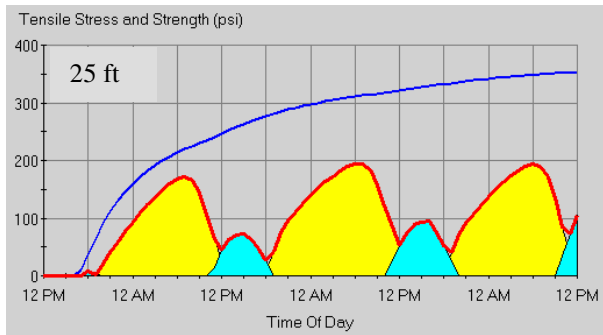
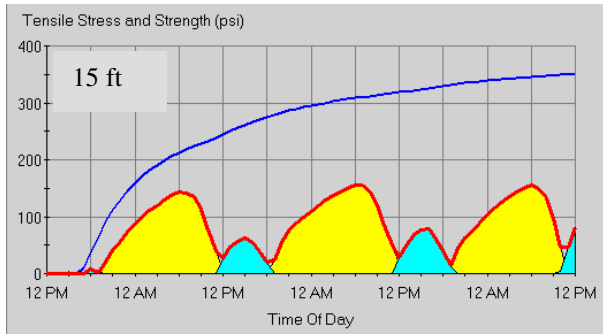
### ANALYSIS STRATEGY

Faulting occurs in JPCP as a result of several factors. Water enters the joint in the JPCP and the subbase under the pavement becomes saturated. As the truck loads pass over the joint, the loose subbase material pumps. It comes out of the joint and causes the difference in elevation, as shown in the following figure.

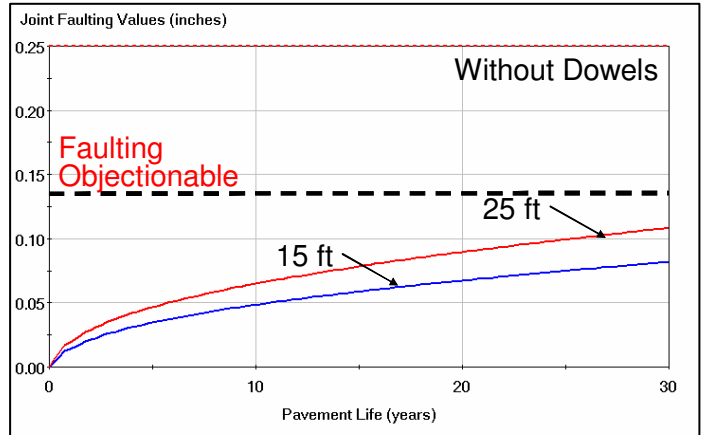


### SOLUTION

Joe Engineer uses HIPERPAV to look at the effect of slab length, from 15 to 25 feet, and dowels on JPCP early-age and long-term performance. The early-age critical stresses for the 15 and 25 foot slab lengths are shown in the following figures. As expected, the stresses in the 25 foot slabs are higher. The longer slabs experience more contraction and expansion about their centerline.



A long-term HIPERPAV analysis yields the faulting results for the 15 and 25 foot undoweled jointed pavements. The faulting of the 25 foot slabs is approaching an objectionable level at 30 years. Comparatively, the faulting of the 15 foot slabs is about 25% less, as shown in the following figure.



Several design changes can be made to the JPCP to reduce its faulting. One possible alternative is to use dowels at the joints. Dowels have been proven to be one of the most effective means to reduce faulting. The HIPERPAV results show this to be true. Faulting of the pavements with dowels is 36% to 50% less than it was when the pavement was undoweled (shown in the following figure).

