R&T UPDATE
Concrete Pavement Research & Technology

LONG TERM PAVEMENT PERFORMANCE STUDY SHOWS THE EFFECTS OF SEALED VS. UNSEALED JOINTS

Despite the conventional wisdom concerning the need to keep concrete pavement joints well-sealed, previous studies on the subject have not demonstrated that plain concrete pavement with sealed joints and plain concrete pavement with unsealed joints perform differently in terms of spalling, faulting, deflections, or roughness (International Roughness Index - IRI). ACPA encouragement of research on the benefit of sealing joints has led to new findings.

NCHRP Project 20-50(2) was supported by ACPA National Staff and was conducted to compare the performance of plain concrete pavement designed and constructed with unsealed joints to that of plain concrete pavement with sealed joints using Long Term Pavement Performance (LTPP) data. There were just five LTPP sites suitable for this analysis: the SPS-4 sites in Arizona, Colorado, and Utah (see back of page for locations and data). These sites are all located in the dry western region of the United States. For this reason, it would be unwise to extrapolate the results of this analysis to other regions of the country which receive more precipitation. Nonetheless, it is expected that the analysis methods from this study may serve as useful examples for future analyses of other sealed-versus-unsealed joint experiments.

The analyses conducted in the study do not indicate that unsealed joints are any more likely to develop joint spalling than sealed joints. The narrow unsealed-joint test sections did, in general, exhibit more faulting and higher rates of IRI increase than most other treatment groups. However, the same is true of one particular sealed-joint group: 9-mm (3/8-in.) silicone-sealed joint group. It would thus be inaccurate to conclude that the unsealed-joint treatment resulted in more faulting and roughness than the sealed-joint treatments. It is important to note that in every case, the ranking of the different joint treatment groups with respect to roughness was no different after several years of service than it was in the first year after construction.

The narrow unsealed-joint test sections have exhibited better deflection load transfer and other joint deflection responses than the sealed-joint test sections. At some sites, the unsealed-joint test sections exhibited higher total deflections (loaded plus unloaded sides of the joint) than the sealed-joint groups. However, it is not concluded on the basis of these analysis results that higher total joint deflection is correlated to higher faulting and IRI, because, for one thing, it would not explain the higher faulting and IRI in the 9-mm (3/8-in.) silicone-sealed test sections.

It should also be kept in mind that at three of the five sites, the sealed-joint test sections have moderate to severe joint seal damage. The condition of the sealant in the sealed-joint test sections is mainly a factor that should be considered in future analyses of the longer-term performance of the pavements at these five sites, as well as analyses of sealed-versus-unsealed joint experiments in other climates.

This summary of findings was obtained from the NCHRP Project 20-50(2) final report, "LTPP Data Analysis: Relative Performance of Sealed versus Unsealed Joints," by Kathleen Hall and James Crovetti, January 2001.

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Table 1. Summary of Selected Data from NCHRP 20-50(2).

Joint Configuration	Distress Measurement	Mesa, AZ		Campo, CO		Tremonton, UT		Salt Lake City,UT		Heber City, UT	
		1997	1999	1996*	1998	1993	1997	1993	1997	1993	1997
3mm (1/8-in.) unsealed ("A" group)	Sealant Damage										
	Faulting, mm (in.)	0.876 (0.034)	0.984 (0.039)	0.440 (0.017)	0.423 (0.017)	1.250 (0.049)	1.061 (0.042)	0.848 (0.033)	1.474 (0.058)	1.133 (0.045)	0.714 (0.028)
	Roughness, m/km (in./mi.)	0.885 (56.1)	0.958 (60.7)	1.577 (100.0)	1.636 (103.7)	1.640 (103.9)	1.898 (120.3)	1.573 (99.7)	2.113 (133.9)	1.574 (99.7)	1.816 (115.1)
9mm (3/8 in.) asphalt ("C" group)	Sealant Damage	3.93	3.93			2.50	3.98	1.25	2.02	1.00	3.83
	Faulting, mm (in.)	0.663 (0.026)	0.885 (0.035)			0.969 (0.038)	0.594 (0.023)	0.706 (0.028)	0.192 (0.008)	0.833 (0.035)	0.568 (0.022)
	Roughness, m/km (in./mi.)	0.881 (55.8)	0.960 (60.8)			1.611 (102.1)	1.782 (112.9)	1.352 (85.7)	1.599 (101.3)	1.324 (83.9)	1.573 (99.7)
3mm (1/8-in.) silicone ("D" group)	Sealant Damage	2.52	2.93	1.00	1.07	1.00	3.00	1.00	1.00	1.00	3.75
	Faulting, mm (in.)	0.611 (0.024)	0.759 (0.030)	0.549 (0.022)	0.333 (0.013)	0.781 (0.031)	0.617 (0.025)	0.749 (0.029)	0.156 (0.006)	0.950 (0.037)	0.263 (0.010)
	Roughness, m/km (in./mi.)	0.829 (52.5)	0.906 (57.4)	1.505 (95.4)	1.666 (105.6)	1.561 (98.9)	1.699 (107.6)	1.439 (91.2)	1.715 (108.7)	1.233 (78.1)	1.342 (85.0)
9mm (3/8-in.) silicone ("F" group)	Sealant Damage	1.53	1.53	1.00	1.00	1.00	2.93	1.01	1.75	1.00	3.35
	Faulting, mm (in.)	0.537 (0.021)	0.651 (0.026)	0.449 (0.018)	0.411 (0.016)	1.002 (0.039)	0.561 (0.022)	0.761 (0.030)	0.276 (0.010)	0.858 (0.033)	1.042 (0.041)
	Roughness, m/km (in./mi.)	0.920 (58.3)	0.985 (62.4)	1.396 (88.5)	1.530 (96.9)	1.784 (113.0)	1.854 (117.5)	1.559 (98.8)	1.855 (117.5)	1.527 (96.8)	1.741 (110.3)
9mm (3/8-in.) neoprene ("J" group)	Sealant Damage	2.06	2.06	1.00	1.00	1.66	3.97	1.00	1.87	1.00	4.00
	Faulting, mm (in.)	0.564 (0.022)	0.651 (0.026)	0.538 (0.021)	0.538 (0.021)	0.719 (0.028)	0.413 (0.016)	0.855 (0.034)	0.274 (0.010)	0.813 (0.032)	0.338 (0.013)
	Roughness, m/km (in./mi.)	0.850 (53.9)	0.926 (58.7)	1.443 (91.4)	1.645 (104.2)	1.672 (105.9)	1.830 (115.9)	1.256 (79.6)	1.574 (99.7)	1.139 (72.2)	1.378 (87.3)

* Campo, CO: IRI data from 1997 (IRI not taken in 1996)

Sealant Damage = weighted seal damage, ranging from 1 (all joints low severity) to 4 (all joints high severity)
Faulting = average absolute faulting, mm (in.)
Roughness (IRI) = International Roughness Index, m/km (in./mi.)

For more information, consult NCHRP Project 20-50(2) Final Report, "LTPP Data Analysis: Relative Performance of Jointed Plain Concrete Pavement with Sealed and Unsealed Joints."