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Superpave Shear Tester Performance-Related Tests for Los Angeles County, Alameda Corridor

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July 10, 1997

Below are performance-related test results of mixture specimens submitted to the Asphalt Institute from a Los Angeles County project (Alameda Corridor). A summary of the test results is shown in the attached table. Two graphs are also attached illustrating the results of the frequency sweep and repeated shear tests.

Eight specimens (150 mm diameter by 140 mm height) were submitted to AI for testing. Two specimens were produced at 3% target air voids. The remaining six specimens were produced at 7% target air voids. Each specimen was then cut into two test specimens, each 50 mm thick. The air voids were determined for each test specimen using a G_{mm} value (2.508) provided by the LA County Office. The specimens with 3% air voids were tested using the repeated shear test at constant height (RSCH) at 58° C. The specimens with 7% air voids were tested using the frequency sweep and simple shear tests at 40° C. The protocol in AASHTO TP7 was followed for these tests. An analysis of the data follows.

In general, the test results indicate a mixture with good mechanical properties at high temperatures. The RSCH results indicate a permanent shear strain of 0.77% at 5000 cycles. For the test conditions in AASHTO TP7, these are excellent results. AI experience with the RSCH for a variety of Superpave, and non-Superpave, mixtures has not indicated many mixtures with lower shear strain values than the mix submitted for this study. Frequency sweep and simple shear test results confirm this conclusion. The average complex shear modulus (G*) value at 10 Hz was 106,173 psi. At 40° C, these values are high, indicating good mixture stiffness. By way of comparison, a recently completed research study on a typical Kentucky Superpave mixture (19 mm nominal, 4.7% AC) indicated a G* value of approximately 28,000 psi at 41° C.

In the interpretation of the results, it is important to note that the actual air voids of the test specimens were lower than the targets. The set of specimens produced for the 3% air voids target actually averaged 1.8% air voids, with a range from 1.0% to 2.1%. The set of specimens produced for the 7% air voids target actually averaged 5.0% air voids, with a range from 3.4% to 6.8%. The difference in air voids among the specimens within a set caused higher than usual variability in the test results. AI experience has indicated typical coefficients of variation of 30% for the repeated shear test, 20% for the simple shear test, and 10% for the frequency sweep test. Coefficients of variation for these mixture specimens were 42%, 36%, and 19%, respectively. There also appeared to be a relationship between the specimen air voids and the mechanical property result. For example, the specimens with the highest air voids produced the

most shear strain. The specimens with the lowest air voids produced the lowest shear strain. However, the majority of the specimens were within ± 0.5% of the average air voids (5.0%). It is reasonable to assume that the G* will decrease and the maximum shear strain will increase as the specimen air voids increase to 7%. However, even using the results from the highest air void specimen (6.8%), the mixture still appears stiffer (64,981 psi at 10 Hz) than many comparable mixtures tested at AI.

The results of this testing should be used cautiously. While the test results indicate good high temperature properties, there was no testing performed to assess intermediate or low temperature properties. Also, the testing was performed assuming that the traffic would be operating at highway speeds. The same mixture may not perform as well in an intersection as it would on an Interstate highway.

SUMMARY: Los Angeles County				
PROJECT:				
Sample	Air Voids	g_{100}	g_{5000}	
ID	%	%	%	m_{RSST}
Aa	1.0	0.19	0.29	0.113
Ab	2.0	0.36	0.86	0.16
Ba	2.1	0.43	0.94	0.14
Bb	2.1	0.36	0.98	0.23
Mean	**1.8**	**0.34**	**0.77**	**0.160**
Std. Dev.	**0.5**	**0.10**	**0.32**	**0.053**
CV	**29.7%**	**30.5%**	**42.0%**	**32.9%**
Sample	Air Voids	Max. g	G^*_{10Hz}	$G^*_{0.1Hz}$
ID	%	mstrains	psi	psi
Ma	4.7	900		
Mb	5.3		98509	16267
Na	6.2	1500	87660	11548
Nb	6.8	1690	64981	8187
Oa	5.1	750	138051	27720
Ob	5.4	790	115173	19757
Pa	4.5	880	107205	17069
Pb	5.4	930	114750	17006
Qa	3.9			
Qb	5.0	850	114953	17708
Ra	3.4	620	120487	21261
Rb	4.5	780	99957	16323
Mean	**5.0**	**969**	**106173**	**17285**
Std. Dev.	**0.9**	**344**	**19974**	**5257**
CV	**18.5%**	**35.5%**	**18.8%**	**30.4%**

Los Angeles County Specimens (40C)
Air Voids (1)
Los Angeles County Specimens (58C)
Air Voids (2)