ASPHALT INSTITUTE
Executive Offices and Research Center
Research Park Drive
P.O. Box 14052
Lexington, KY 40512-4052
USA
Telephone 859-288-4960
FAX No. 859-288-4999

Superpave Shear Tester Performance-Related Tests for Colorado IH-70 Project (CO9625A)

Mike Anderson, Asphalt Institute April 2, 1997

Below are the results of the performance-related tests on specimens supplied by FHWA Mobile Lab "A" for the Colorado IH-70 project. Two design specimens (140 mm height) were produced in the lab for this project to approximately seven percent air voids. Also, two specimens were produced from field sampled mixture. After cutting there were four performance specimens for the lab design and four for the field mix. Each specimen was tested as follows:

- Frequency Sweep Constant Height at 20°C
- Simple Shear Constant Height at 20°C
- Repeated Shear Constant Height at 50°C

The data are summarized in the tables and graphs below.

The frequency sweep test results looked very good, with a low coefficient of variation. The average coefficient of variation for the two sets of data was 5.4%. The field specimens had slightly lower G* values than the lab specimens. However, the difference between the G* values of the field and lab specimens was not considered statistically significant (Student's t-test, a=0.05).

The simple shear test results also looked good, although the coefficient of variation was higher. The average coefficient of variation for the two sets of data was 10.4%. The field specimens exhibited higher maximum shear strain values as a set than the lab specimens. This finding matches with the lower G* values from the frequency sweep test, indicating that the field specimens were less stiff, and more susceptible to shear strain than the lab specimens. Again, the difference between the lab and field was not statistically significant.

The results of the repeated shear test (constant height) were more confusing. Unlike the frequency sweep and simple shear tests, the repeated shear test indicated that the lab specimens were more shear susceptible than the field specimens. The coefficient of variation was much higher for the set of lab specimens (35.1%) than for the set of field specimens (11.0%). The differences between the sets were not statistically significant.

The repeated shear curves plotting shear strain versus number of cycles on a log-log scale indicate that all of the test specimens displayed an unusual response. All of the repeated shear curves exhibit a "hump and plateau" within the first 20 cycles. This is an unusual response previously not seen in analyzing repeated shear data. We may be seeing some aggregate particle reorientation after the initial loading cycles. This may be a function of the aggregate structure (gradation, or aggregate type) or air voids in the test specimens. Normally, the

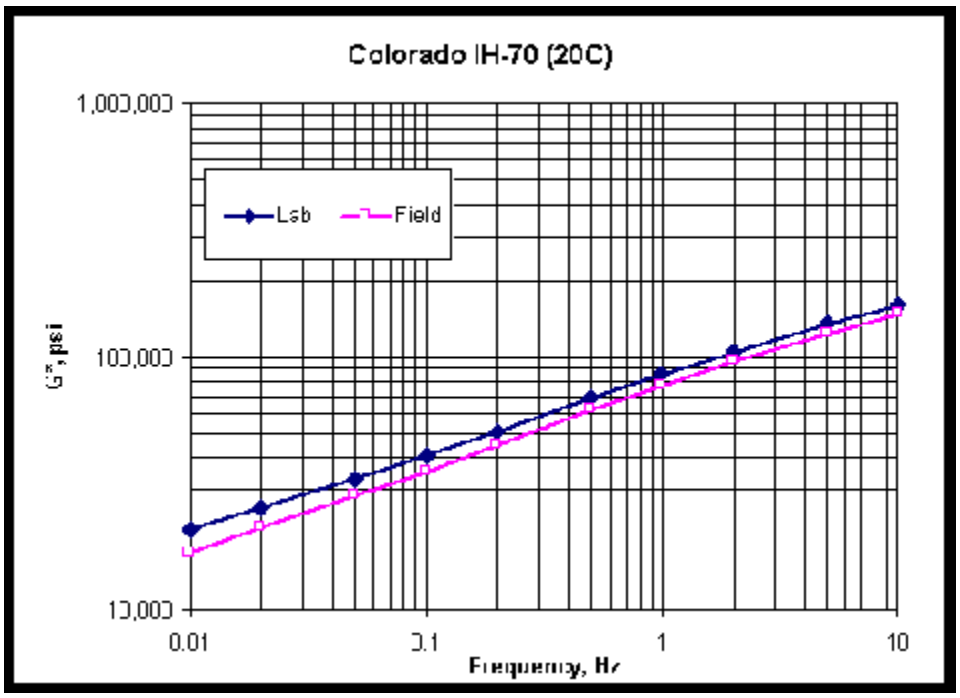
repeated shear test is performed using specimens at approximately three percent air voids. This normal air void level was selected as the point when mixtures no longer undergo volume change due to densification. At this approximate air void level, shear begins to develop in a constant volume state. It is possible that at the higher air void levels in these specimens, repeated shear loads applied to a constant volume causes initial aggregate reorientation. In this instance, the expected response would be a high initial shear strain with a plateau.

No data was available for specimen A-2 because of a problem with the shear LVDT during the test.

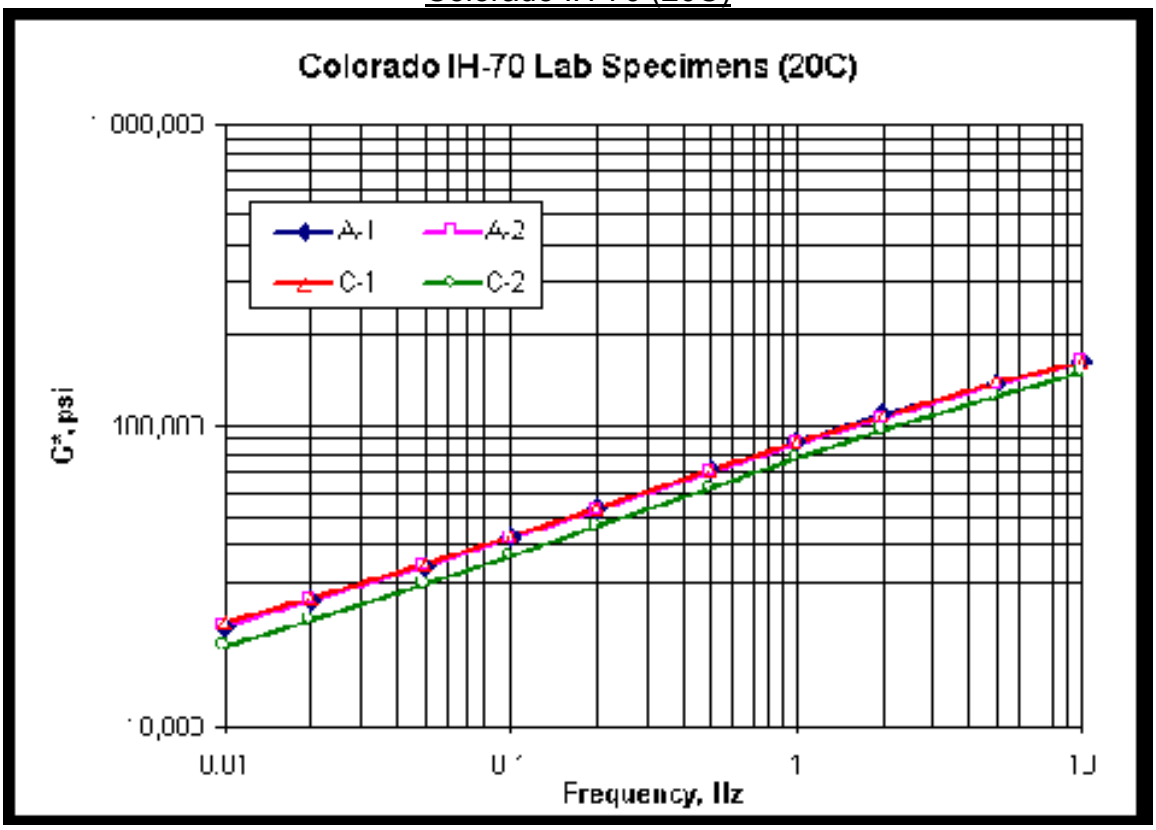
SUMMARY: Colorado IH-70
PROJECT: CO9625A

Mix	Sample ID	Air Voids %	Max. γ µstrain	G^*_{10Hz} psi	Perm. γ %
Lab	A-1	5.9	1100	163017	2.00
	A-2	5.8	1030	163078	
	C-1	6.3	1155	161051	1.32
	C-2	6.4	1227	149193	1.01
	Mean	**6.1**	**1128**	**159085**	**1.44**
	Std. Dev.	**0.3**	**84**	**6661**	**0.51**
	CV	**4.8%**	**7.4%**	**4.2%**	**35.1%**
Field	D-1	5.6	1188	145790	1.08
	D-2	6.1	1225	151212	1.37
	F-1	6.1	1094	159768	1.11
	F-2	7.1	1489	136428	1.19
	Mean	**6.2**	**1249**	**148300**	**1.19**
	Std. Dev.	**0.6**	**169**	**9785**	**0.13**
	CV	**10.1%**	**13.5%**	**6.6%**	**11.0%**

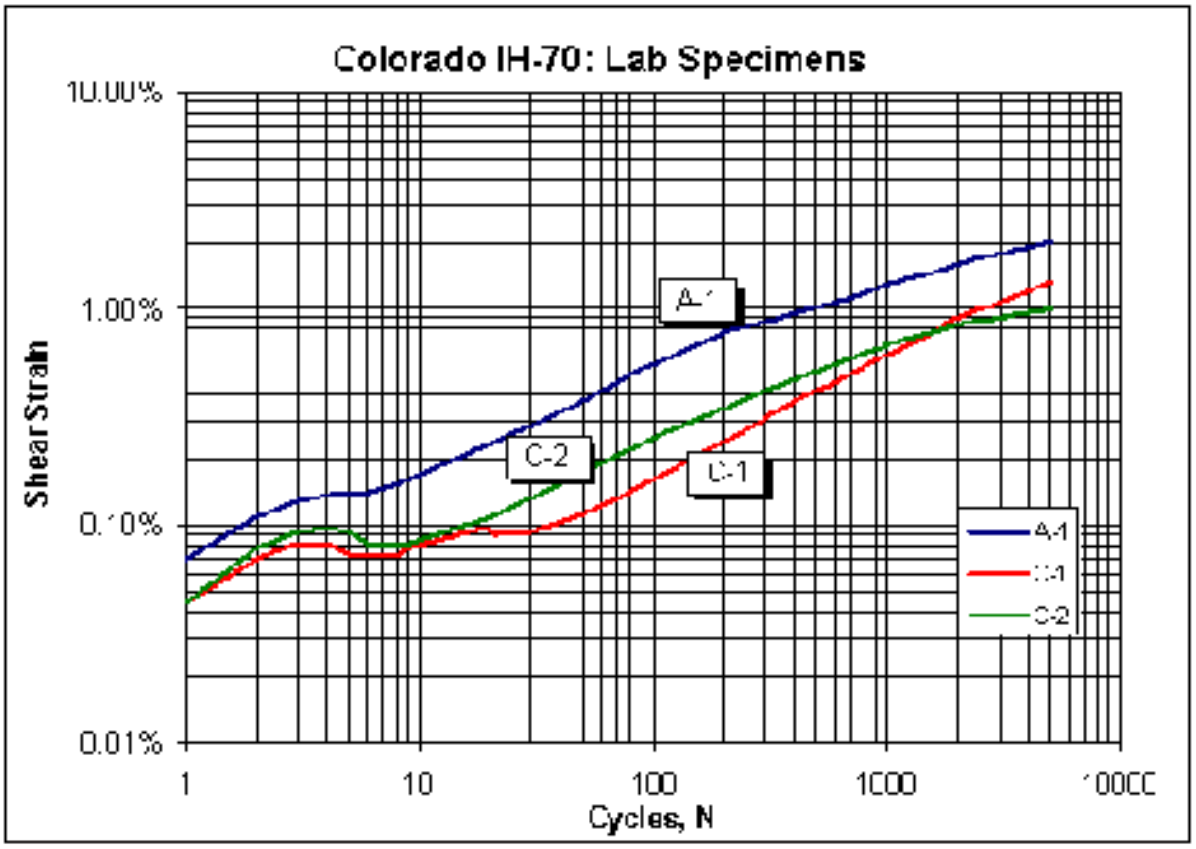
Permanent shear strain values from repeated shear (constant height) test at 5000 cycles.



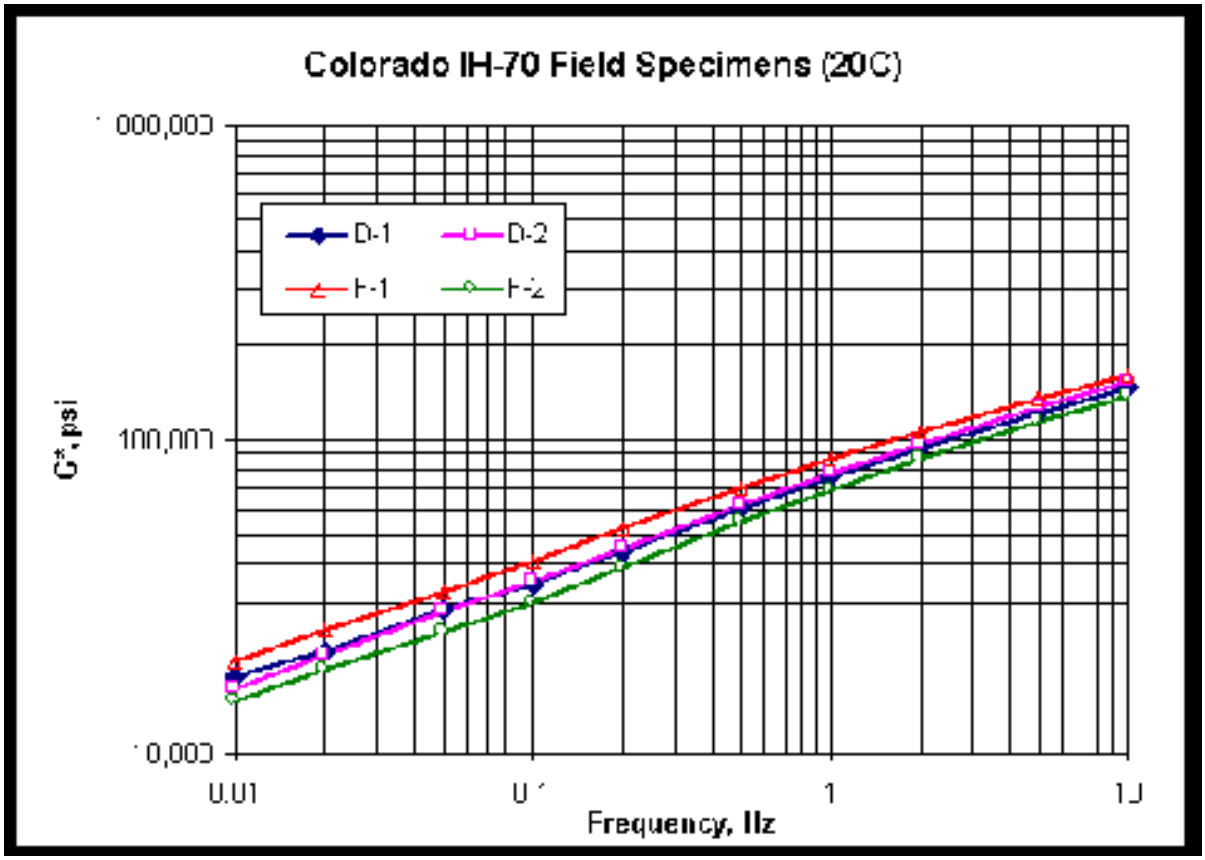
Colorado IH-70 (20C)



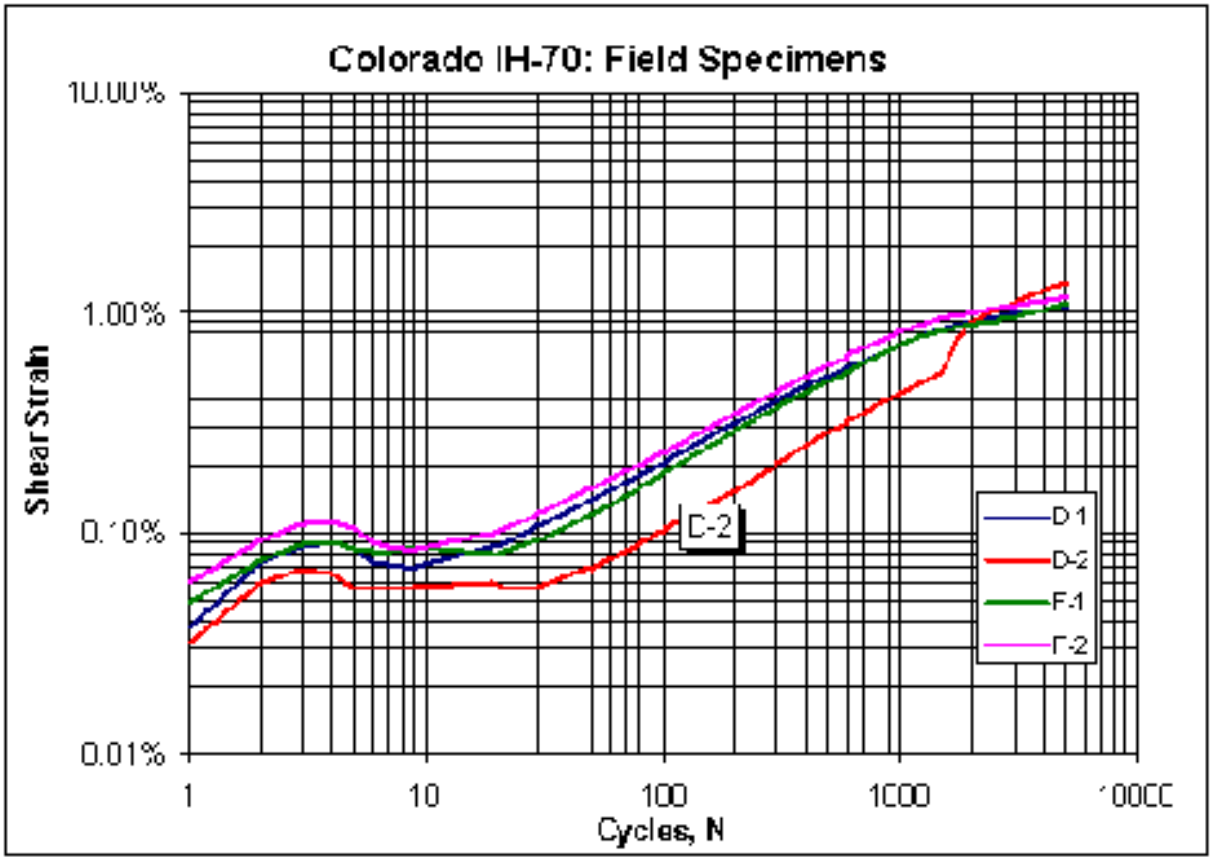
Colorado IH-70 Lab Specimens (20C)



Colorado IH-70 Lab Specimens



Colorado IH-70 Field Specimens (20C)



Colorado IH-70 Field Specimens