

BOWSER-MORNER, INC.

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LABORATORY REPORT

Report To: Asphalt Systems Inc./Biobased
Spray Systems LLC.
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2323 Campbell Road
Sidney, Ohio 45365

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Report No. 317458E
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Report On: Laboratory Evaluation of Asphalt Rejuvenator – Final Report

On November 25, 2003, a testing program was initiated to study the performance of an asphalt rejuvenator. Two (2) samples of the rejuvenator, diluted and concentrated, were submitted for the study. ODOT 404 hot mix asphalt was sampled from Butler Asphalt Company along with one gallon of asphalt cement (AC 20).

Phase 1 Testing – Marshal Stability

50 Marshal specimens were made from the hot mix. 50-blow effort resulted in an air content of approximately 9.2 percent. The 50 specimens were separated into three groups as illustrated in Table 4, and as follows: 1) control group: no treatment, 2) test group #1: treated at 24-hours, and 3) test group #2: to be treated at a future date. Group #2 was held for potential testing at a later date. It was decided by the client not to proceed with such testing at this time.

Three (3) of the control specimens were tested for stability 24 hours after molding in order to determine the initial condition. Specimens in test group #1 were sprayed with the diluted rejuvenator on all surfaces at 0.12 gallons per square yard (0.12 gal./ yd³). All specimens were then placed into an oven to cure at 140°F. Two (2) sets of three (3) specimens from each of the control and test group #1 were tested for stability after seven (7) days and after 1, 2, 3 and 4 months of oven-curing at 140°F. Percent change was calculated as a percent of the original stability value. Results are as follows:

Table 1 – Stability Results				
	Stability, lbs. (Average of 3 Specimens)			
	Control Group		Test Group #1	
	Stability	Change, %	Stability	Change, %
Initial (24 hours)	2517	0	2517	0
7-day Cure @ 140°F	2517	0	2250	-11
1-month Cure @ 140°F	2680	+6	2490	-1
3-month Cure @ 140°F	3086	+23	2553	+1
4-month Cure @ 140°F	3100	+23	2560	+2

Phase 2 Testing – Asphalt Cement Penetration and Viscosity

Three (3) samples were made with the asphalt cement: 1) control, 2) test #1 and, 3) test #2. Approximately 504 grams of the AC was placed into each of three round pans of approximately 15 inches diameter (177 in²), forming a film of approximately 0.17 inches thick. This AC volume was based on the AC content and application rate used in Phase 1 testing.

The initial viscosity and penetration values of the virgin AC were determined. The concentrated rejuvenator was applied to test specimen #1 at the rate of 12 percent of the 0.12 gal./ yd³. All three (3) pans were then placed into an oven to cure at 140°F.

The viscosity and penetration values were determined on the control specimen and test specimen #1 at 7-days, and at 1, 2, 3 and 4 months. Test specimen #2 is to receive treatment at a date to be determined according to results achieved during control and test specimen #1 testing, and as specified by Asphalt Systems, Inc. Results as a of Phase 2 testing to-date are as follows:

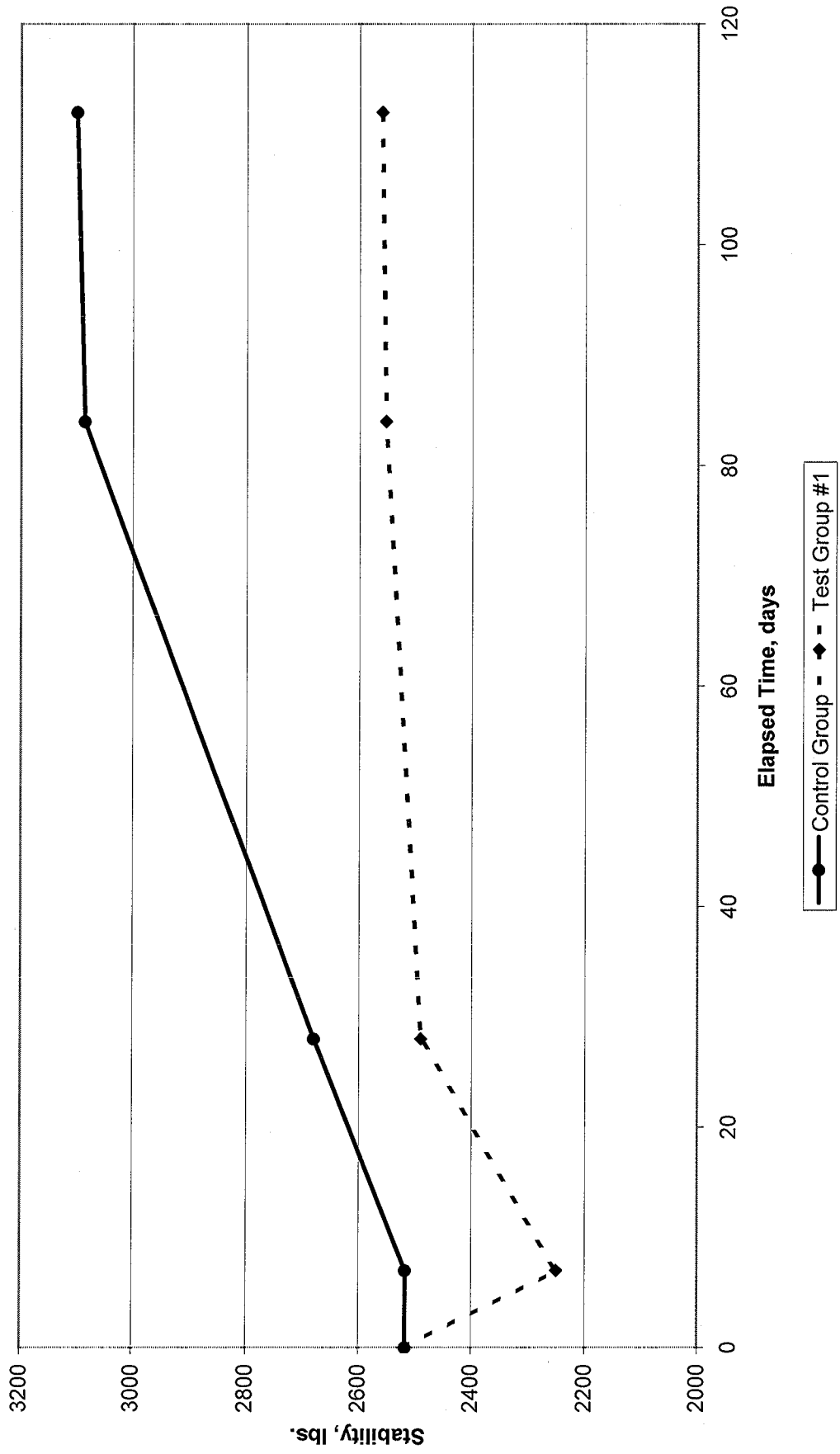
Table 2 – Penetration Results				
	Control Specimen		Test Specimen #1	
	Penetration, 0.01"	Change, %	Penetration, 0.01"	Change, %
Initial (24 hours)	52	+0	52	0
7-day Cure @ 140°F	52	+0	116	+123
1-month Cure @ 140°F	32	-38	57	+10
2-month Cure @ 140°F	27	-48	38	-27
3-month Cure @ 140°F	21	-60	30	-42
4-month Cure @ 140°F	21	-60	27	-48

Table 3 – Viscosity Results				
	Control Specimen		Test Specimen #1	
	Viscosity, poises	Change, %	Viscosity, poises	Change, %
Initial (24 hours)	1714	0	1714	0
7-day Cure @ 140°F	2070	+21	780	-54
1-month Cure @ 140°F	3949	+130	2427	+42
2-month Cure @ 140°F	16503	+863	8896	+419
3-month Cure @ 140°F	17621	+928	9593	+460
4-month Cure @ 140°F	21005	+1125	11618	+578

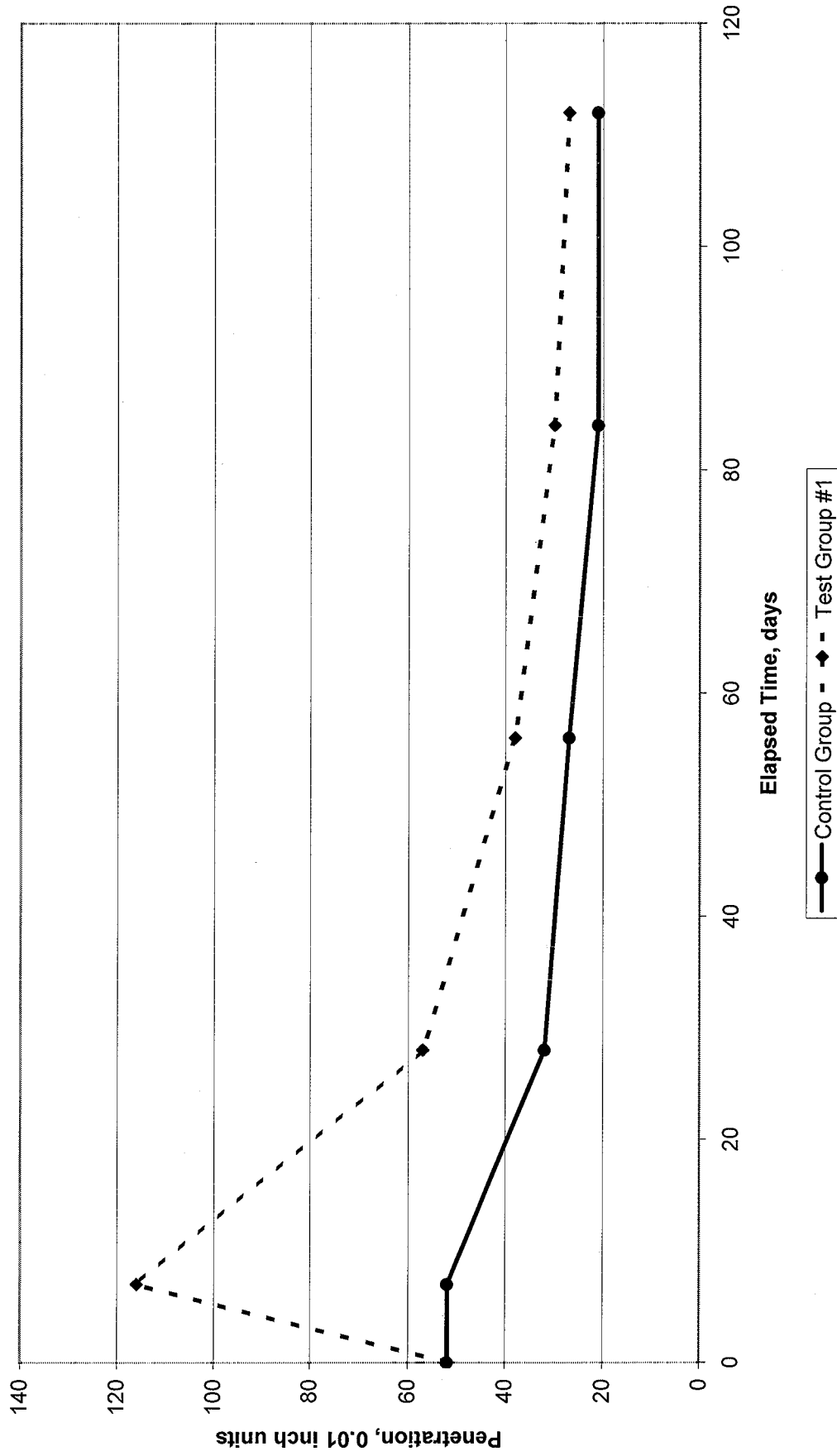
Should you have any questions, or if we may be of further service, please contact me at (937) 236-8805 extension 235.

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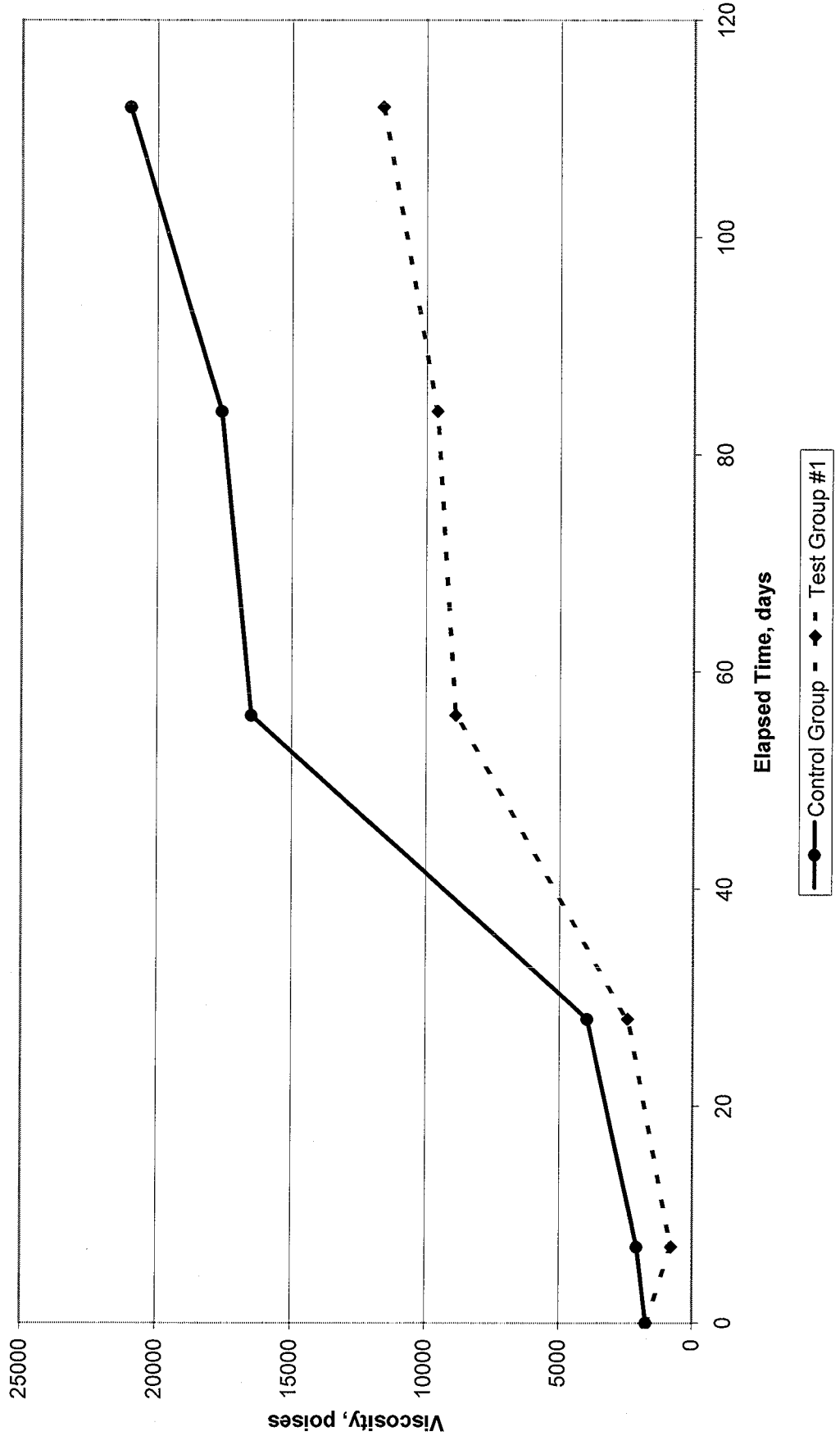
W.O. No. 129926 Asphalt Systems Inc./Biobased Spray Systems LLC
Laboratory Evaluation of Asphalt Rejuvenator
Elapsed Cure Time @ 140 Degrees F -vs- Stability



W.O. No. 129926 Asphalt Systems Inc./Biobased Spray Systems LLC
Laboratory Evaluation of Asphalt Rejuvenator
Elapsed Cure Time @ 140 Degrees -vs- Penetration



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Laboratory Evaluation of Asphalt Rejuvenator
Elapsed Cure Time -vs- Viscosity



W.O. No. 129926 Asphalt Systems Inc./Biobased Spray Systems LLC
Laboratory Evaluation of Asphalt Rejuvenator
Elapsed Cure Time @ 140 Degrees F -vs- Flow

