Collaborative Testing Services, Inc.

COLLABORATIVE REFERENCE PROGRAM FOR RUBBER

ANALYSES NO. 40
APRIL - JUNE 1979

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards

NBS COLLABORATIVE REFERENCE PROGRAMS

TAPPI Paper and Board (6 times per year)

- Bursting strength
- Tearing strength
- Tensile breaking strength
- Elongation to break
- Tensile energy absorption
- Folding endurance
- Stiffness
- Air resistance
- Grammage
- Smoothness
- Surface pick strength
- K & N ink absorption
- pH
- Opacity
- Blue reflectance (brightness)
- Specular gloss, 75°
- Thickness
- Concora (flat crush)
- Ring crush

FKBG-API Containerboard (48 times per year)

- Mullen burst of linerboard
- Concora test of medium

MCCA Color and Appearance (4 times per year)

- Gloss at 60°
- Color and color difference

CTS Rubber (4 times per year)

- Tensile strength, ultimate elongation and tensile stress
- Hardness
- Mooney viscosity
- Vulcanization properties

CTS Thermal Insulation Materials (2 times per year)

19 test methods for thermal insulation materials covering: thermal properties; strength properties; dimensions, stability, and density properties; fire properties; and properties of vapor barriers

ASTM Cement (2 times per year)

- Chemical (11 chemical components)
- Physical (8 characteristics)

AASHTO Bituminous

- Asphalt cement (2 times per year)
- Cutbacks (once a year)

NBS Collaborative Reference Programs
A05 Technology Building
National Bureau of Standards
Washington, DC 20234

Rev. 3/79

INTERLABORATORY PROGRAMS FOR RUBBER

Analyses No. 40
April - June 1979

J. Horlick
Office of Testing Laboratory Evaluation Technology
Office of Engineering Standards
National Engineering Laboratory

T. L. Cummings, Research Associate,
Collaborative Testing Services, Inc.

G. W. Bullman
Polymers Science and Standards Division
Center for Materials Research
National Measurement Laboratory

U. S. DEPARTMENT OF COMMERCE
National Bureau of Standards

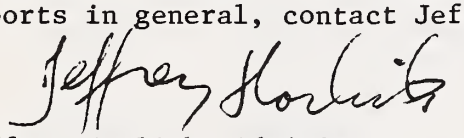
NBSIR 79-1805

INTRODUCTION

This report summarizes the test results for the second quarter of 1979. The tests cover the four areas in the NBS Collaborative Reference Programs for Rubber: Tensile Properties, Hardness, Mooney Viscosity, and Vulcanization Properties.

For each of the four areas, there is a set of summary tables followed by a table of data and analysis by laboratory and a graphical presentation of the data and analysis. Where applicable, the tables of data have the English and Metric expressions side-by-side. Additional details are given in the section "Key to Tables and Graphs."

If there are questions or comments on the notes, the analyses, or the reports in general, contact Jeffrey Horlick at (301) 921-2946.



Jeffrey Horlick, Administrator
NBS Collaborative Reference Programs
Office of Testing Laboratory Evaluation Technology

August 9, 1979

over the four areas in the ASTM Collaborative Reference
Programs for Rubber: Tensile Properties, Hardness, Mooney Viscosity,
Vulcanization Properties.

Each of the four areas, there are one or more tables followed
by a table of data (no quality by laboratory) and a graphical presenta-
tion of the data and summaries. Those supplying the tables of data have
the English and Metric conversions checked. Additional details are
given in the section "Ten Tests on Letters".

If there are questions or comments on the analyses, or the
reports in general, contact Jeffrey Horlick (301) 921-2946.

Jeffrey Horlick, Statistician
ASTM Collaborative Reference Programs
Office of Testing Laboratory Evaluation (Technology)

TABLE OF CONTENTS

KEY TO TABLES AND GRAPHS

LAB CODE Confidential laboratory identification number known only to the participant and the Collaborative Reference Program staff.

F A flag identifying results that are extreme in comparison with the other results.

- **X** - The plotted point for the indicated laboratory lies outside of the 99% error ellipse (not shown); ie, assuming normal distribution, 99% of laboratories similar to those participating in the program will be represented by points lying within the 99% ellipse.
- ***** - The plotted point for the indicated laboratory lies outside of the 95% error ellipse shown on graphs, but inside the 99% ellipse.

MEAN The arithmetic average of the two median values for the two sheets or samples of the same material.

% DEV The deviation or difference of the laboratory MEAN from the GR. MEAN (see below), expressed as a percent of the GR. MEAN.

REL SDR The ratio of the SDR (standard deviation of replicate measurements within a laboratory) to the AVER SDR (see below). Extreme values, ie, values that are likely to occur by chance less than one time in a hundred as determined by the chi-square test, are marked with an "X".

VAR CODE A code number designating a particular test instrument, set of environmental conditons, procedure, unit used, or other variation. The code "01" designates the instrument, conditions and procedure specified at the top of the page either explicitly or in the cited ASTM Standard, and the unit of test shown at the top of the first column of data. A '+' in front of the VAR CODE indicates that the data has been excluded from the grand means due to a non-standard variation of the possibilities mentioned above, or the data is extreme.

GR MEAN The arithmetic average (grand mean) of all the laboratory MEAN values, excluding those flagged (F) with an "X".

SD MEANS The standard deviation among the laboratory MEAN values included in the GR. MEAN.

AVER SDR — The arithmetic average of all the standard deviations of within laboratory replication, excluding those excluded from the GR. MEAN and excluding any additional ones for which the REL SDR has been flagged.

GRAPH

For each laboratory the MEAN for the second material is plotted against the MEAN for the first material, with each point representing a laboratory. The horizontal and vertical lines are the GR. MEAN values. The dashed line is drawn at 45°. The solid sloping line, which may or may not lie close to the 45° line, is the major axis of the ellipse. The ellipse is drawn so that, on the average, it will include 95% of the points representing the laboratories. The plotted symbols X and * used to represent results falling outside the ellipse are explained under "F" above. Laboratories inside the ellipse (no flag in the F column) are plotted as an O.

The graph is plotted with an ellipse when there are 20 or more laboratories in the analysis. When there are 10 through 19 laboratories in the analysis, the graph is plotted but the ellipse is omitted. When there are fewer than 10 laboratories retained in the Grand Mean the graph is not plotted.

For development of the theory, see the paper by J. Mandel and T.W. Lashof, Interpretation and Generalization of Youden's Two-Sample Diagram, J. of Quality Technology, Vol. 6, pp 22-36, Jan. 1974.

SUMMARY OF ANALYSES

LABS INCL — Number of laboratories included in the GR. MEANs.

LABS OMIT — Number of laboratories reporting data but excluded from the GR. MEANs.

STANDARD DEVIATIONS

LABS — Same as the SD MEANs (see above)

SHEETS — Standard deviation between the two sheets or samples of the same material.

REPL — Same as AVER SDR (see above)

PRECISION OF METHODS

REPL CRP — The number of replicate measurements per sheet or sample, as specified in the Collaborative Reference Program.

REPL ASTM — The number of replicate measurements specified for a test result in the designated ASTM Standard.

REPEAT The repeatability, a measure of the within laboratory precision, i.e., of the ability of the test technician to repeat his test result: two test results obtained by the same technician on the same homogeneous sample of material may be expected 95% of the time to agree within the repeatability.

REPROD The reproducibility, a measure of the between laboratory precision: two test results obtained in different laboratories may be expected 95% of the time to agree within the reproducibility.

ABSOLUTE Values of REPEAT and REPROD expressed in the units of measurement.

PERCENT Values of REPEAT and REPROD expressed as a percent of the GR. MEANs.

TENSILE STRENGTH, ULTIMATE ELONGATION, AND STRESS AT 300% ELONGATION

NOTES

Materials B91 and B92 were sheets of the same vulcanized rubber.
Similarly, materials B93 and B94 were alike.

V100 results were obtained at NBS using a pendulum tester.

All participants used Die C in ASTM D 412 with the following exceptions:

V126 used Die 2 in BS903
V0146 and V208 did not specify a Die
V225 used ASTM Die D

INSTRUMENTS

Instrument	Number of Labs	Percent
Electronic Manual	21	36%
Electronic Automatic	20	35%
Pendulum Manual	15	26%
Pendulum Automatic	2	3%
	58	100%

RELATIVE HUMIDITY

Relative Humidity	Number of Labs	Percent
Below 45%	14	24%
Above 55%	14	24%
45% - 55%	19	33%
Not Specified	11	19%
	58	100%

SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
TENSILE STRENGTH	B91-B92	56	2	2480.	82.	51.	53.	POUNDS PER SQUARE INCH
	B93-B94	56	2	2504.	85.	40.	60.	POUNDS PER SQUARE INCH
TENSILE STRENGTH	B91-B92	56	2	17.101	.568	.351	.366	MEGAPASCALS
	B93-B94	56	2	17.269	.583	.272	.412	MEGAPASCALS
ULTIMATE ELONGATION	B91-B92	54	4	568.	25.	8.	14.	PERCENT
	B93-B94	54	4	562.	21.	5.	15.	PERCENT
STRESS AT 300% ELONGATION	B91-B92	55	3	1281.	72.	21.	26.	POUNDS PER SQUARE INCH
	B93-B94	55	3	1283.	76.	16.	24.	POUNDS PER SQUARE INCH
STRESS AT 300% ELONGATION	B91-B92	55	3	8.835	.495	.183	.180	MEGAPASCALS
	B93-B94	55	3	8.847	.523	.140	.163	MEGAPASCALS

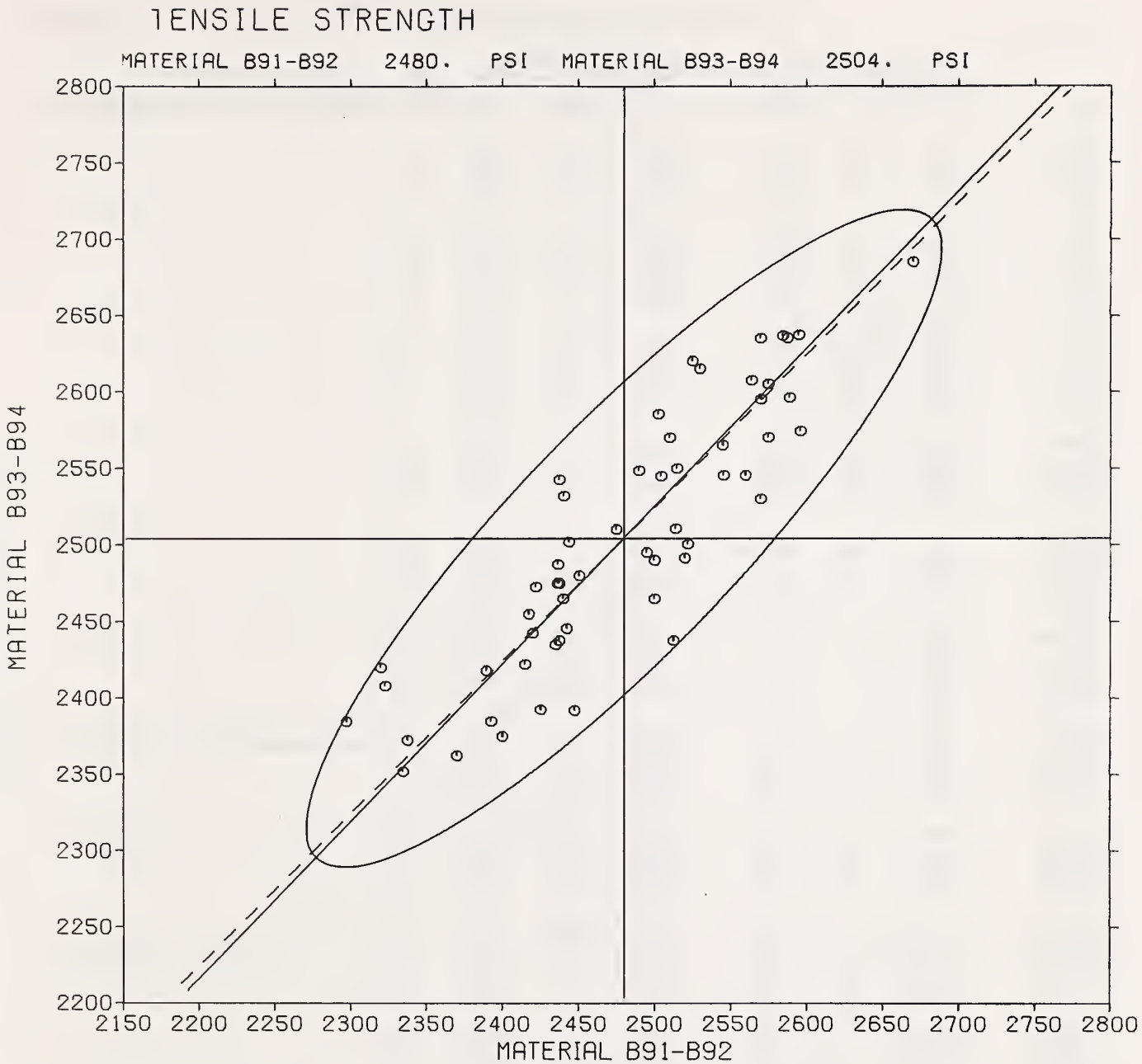
PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
TENSILE STRENGTH	B91-B92	5	5	2480.	147.	228.	PSI	5.9	9.2
	B93-B94	5	5	2504.	166.	234.	PSI	6.6	9.4
TENSILE STRENGTH	B91-B92	5	5	17.101	1.013	1.572	MEGAPA	5.9	9.2
	B93-B94	5	5	17.269	1.142	1.615	MEGAPA	6.6	9.4
ULTIMATE ELONGATION	B91-B92	5	5	568.	38.	68.	%	6.7	12.0
	B93-B94	5	5	562.	41.	59.	%	7.2	10.5
STRESS AT 300% ELONGATION	B91-B92	5	5	1281.	72.	199.	PSI	5.6	15.5
	B93-B94	5	5	1283.	66.	210.	PSI	5.1	16.4
STRESS AT 300% ELONGATION	B91-B92	5	5	8.835	.498	1.372	MEGAPA	5.6	15.5
	B93-B94	5	5	8.847	.452	1.449	MEGAPA	5.1	16.4

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 40 - 1 TENSILE STRENGTH - POUNDS PER SQUARE INCH APRIL 1979

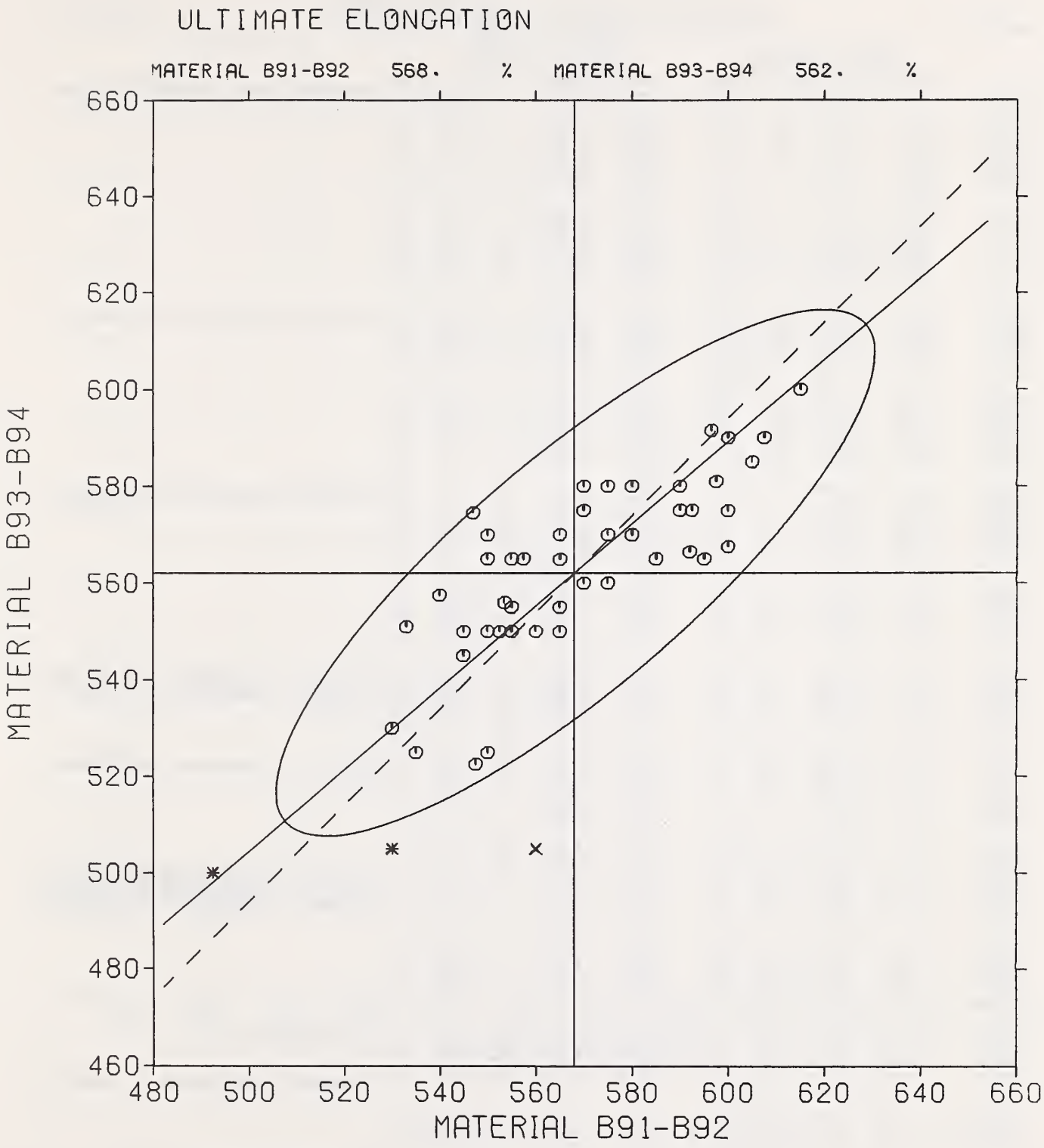
LAB CODE	F	MATERIAL B91-B92 COMMERCIAL TIRE TREAD MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	MATERIAL B93-B94 COMMERCIAL TIRE TREAD MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0062		2297.	15.845	-7.3	.84	2384.	16.445	-4.8	1.71	01	
V0063		2504.	17.272	1.0	.89	2545.	17.552	1.6	.69	01	
V0067		2417.	16.672	-2.5	.49	2455.	16.931	-2.0	.81	01	
V0069		2520.	17.379	1.6	1.50	2491.	17.183	-.5	1.59	01	
V0071		2442.	16.845	-1.5	1.06	2445.	16.866	-2.3	1.47	01	
V0072		2670.	18.414	7.7	2.28X	2685.	18.517	7.2	.94	01	
V0073		2512.	17.328	1.3	.99	2437.	16.810	-2.7	1.16	01	
V0076		2570.	17.724	3.6	1.09	2635.	18.172	5.2	.65	01	
V0078		2514.	17.338	1.4	.58	2510.	17.314	.3	.78	01	
V0083		2425.	16.724	-2.2	.97	2392.	16.500	-4.5	.66	01	
V0084		2545.	17.552	2.6	1.57	2565.	17.690	2.4	.32	01	
V0085		2444.	16.854	-1.4	1.13	2502.	17.254	-.1	1.39	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0087		2450.	16.900	-1.2	1.73	2480.	17.103	-1.0	.74	01	
V0088		2323.	16.021	-6.3	2.28X	2408.	16.607	-3.8	1.00	01	
V0092		2400.	16.552	-3.2	1.64	2375.	16.379	-5.2	1.47	01	
V0095		2500.	17.241	.8	1.37	2465.	17.000	-1.6	1.01	01	
V0100		2560.	17.655	3.2	.98	2545.	17.552	1.6	.66	01	
V0102		2320.	16.000	-6.4	1.11	2420.	16.690	-3.4	1.14	01	
V0111		2515.	17.345	1.4	.81	2550.	17.586	1.8	.68	01	
V0117		2437.	16.810	-1.7	.63	2437.	16.810	-2.7	.69	01	
V0123		2435.	16.793	-1.8	.73	2435.	16.793	-2.8	.38	01	
V0126		2596.	17.905	4.7	1.40	2574.	17.755	2.8	.74	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0128		2510.	17.310	1.2	2.30X	2570.	17.724	2.6	.60	01	
V0141		2584.	17.824	4.2	.63	2636.	18.183	5.3	.89	01	
V0144		2570.	17.724	3.6	.55	2595.	17.897	3.6	.34	01	
V0144B		2525.	17.414	1.8	.79	2620.	18.069	4.6	1.07	01	
V0146		2437.	16.810	-1.7	.97	2542.	17.534	1.5	.53	01	
V0149		2490.	17.172	.4	1.42	2548.	17.576	1.8	1.09	01	
V0150		2437.	16.810	-1.7	.50	2475.	17.069	-1.2	.89	01	
V0154		2530.	17.448	2.0	1.12	2615.	18.034	4.4	1.10	01	
V0156		2475.	17.069	-.2	1.21	2510.	17.310	.2	.71	01	
V0158		2495.	17.204	.6	.63	2502.	17.254	-.1	1.13	*72	ORIGINAL IN MEGAPASCAL RECEIVED LATE
V0160		2422.	16.704	-2.3	.53	2473.	17.054	-1.2	1.44	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0164		2337.	16.121	-5.7	.46	2372.	16.362	-5.3	.60	01	
V0166		2440.	16.831	-1.6	1.68	2532.	17.462	1.1	1.51	01	
V0168		2595.	17.897	4.7	1.81	2637.	18.186	5.3	.71	01	
V0169		2437.	16.804	-1.7	.85	2487.	17.154	-.7	.81	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0176		2495.	17.207	.6	.55	2495.	17.207	-.4	.53	01	
V0184		2420.	16.690	-2.4	.67	2442.	16.845	-2.5	.77	01	
V0190		2522.	17.393	1.7	1.09	2500.	17.245	-.1	.99	01	
V0199		2440.	16.828	-1.6	1.05	2465.	17.000	-1.6	.36	01	
V0207		2570.	17.724	3.6	.65	2530.	17.448	1.0	1.26	01	
V0208		2545.	17.555	2.7	.82	2545.	17.555	1.7	1.52	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0213		2503.	17.259	.9	1.06	2585.	17.830	3.2	1.07	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0214		2415.	16.654	-2.6	.65	2422.	16.704	-3.3	.90	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0220		2587.	17.845	4.3	1.27	2635.	18.172	5.2	1.69	01	
V0223		2500.	17.241	.8	.99	2490.	17.172	-.6	1.33	01	
V0224		2575.	17.759	3.8	1.08	2605.	17.966	4.0	1.69	01	
V0225		2436.	16.802	-1.8	1.06	2475.	17.069	-1.2	1.17	01	
V0232		2392.	16.500	-3.5	.63	2385.	16.448	-4.8	.55	01	
V0233		2447.	16.879	-1.3	.68	2392.	16.497	-4.5	1.76	01	
V0235		2440.	16.831	-1.6	.74	2470.	17.034	-1.4	.64	*70	DATA RECEIVED LATE
V0238		2370.	16.345	-4.4	1.15	2362.	16.293	-5.7	1.01	01	
V0243		2564.	17.683	3.4	1.72	2607.	17.983	4.1	1.14	01	
V0244		2589.	17.855	4.4	2.15X	2596.	17.905	3.7	2.13X	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0245A		2334.	16.100	-5.9	1.21	2352.	16.221	-6.1	1.58	01	
V0245B		2389.	16.479	-3.6	.69	2418.	16.676	-3.4	1.01	01	
V0250		2575.	17.759	3.8	.95	2570.	17.724	2.6	1.69	01	
		2480.	17.101	= GR. MEAN =		2504.	17.269				5 TEST DETERMINATIONS
		82.	.568	= SD MEANS =		85.	.583				56 LABORATORIES IN GRAND MEANS
		53.	.366	= AVER SDR =		60.	.412				58 LABORATORIES REPORTING
		PSI	MEGAPA	= UNIT =		PSI	MEGAPA				


TENSILE STRENGTH
MATERIAL B91-B92 2480. PSI MATERIAL B93-B94 2504. PSI
MATERIAL B93-B94
MATERIAL B91-B92
2800
2750
2700
2650
2600
2550
2500
2450
2400
2350
2300
2250
2200
2150 2200 2250 2300 2350 2400 2450 2500 2550 2600 2650 2700 2750 2800

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 40 - 1 ULTIMATE ELONGATION - PERCENT APRIL 1979

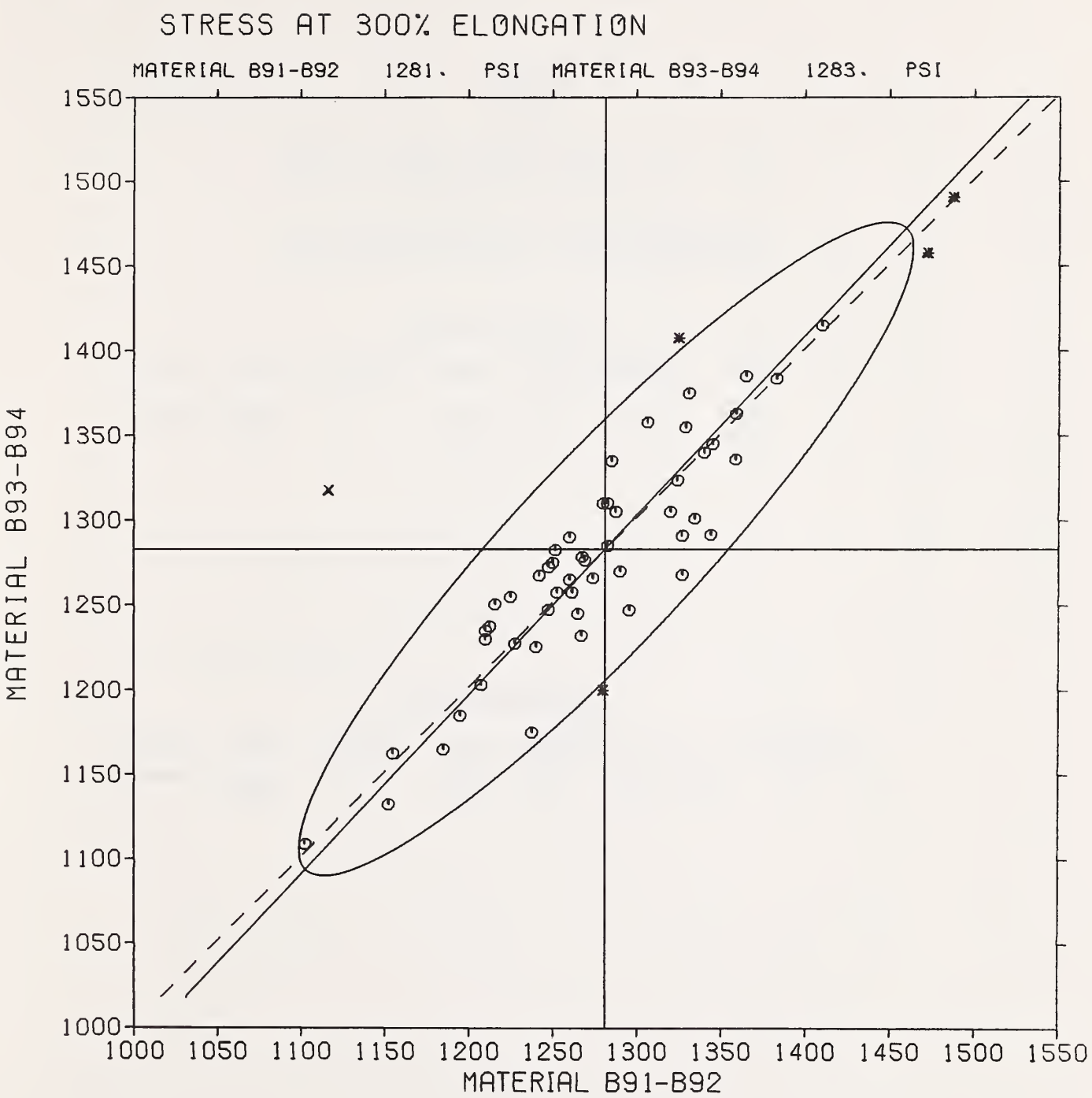
LAB CODE	F	MATERIAL B91-B92 COMMERCIAL TIRE TREAD MEAN %	% DEV	REL SDR	MATERIAL B93-B94 COMMERCIAL TIRE TREAD MEAN %	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0062	X	513.	-9.7	2.11X	436.	-22.3	.78	01	
V0063		590.	3.9	.48	575.	2.3	1.00	01	
V0067		550.	-3.2	.48	550.	-2.1	.58	01	
V0069		565.	-.5	1.21	565.	.5	.85	01	
V0071		592.	4.2	.97	566.	.8	1.59	01	
V0072		555.	-2.3	1.76	550.	-2.1	.61	01	
V0073		585.	3.0	.89	565.	.5	1.37	01	
V0076		565.	-.5	.85	570.	1.4	.90	01	
V0078		535.	-5.8	.87	525.	-6.6	1.37	01	
V0083		557.	-1.9	.76	565.	.5	.66	01	
V0084		555.	-2.3	1.40	550.	-2.1	.29	01	
V0085		580.	2.1	.99	580.	3.2	1.42	01	
V0087		547.	-3.7	2.04X	574.	2.2	1.07	01	
V0088		533.	-6.2	1.29	551.	-2.0	1.45	01	
V0092		580.	2.1	1.65	570.	1.4	1.29	01	
V0095		600.	5.6	1.87	567.	1.0	1.36	01	
V0100		605.	6.5	.64	585.	4.1	.73	01	
V0102		550.	-3.2	1.16	570.	1.4	.73	01	
V0111		597.	5.2	1.30	581.	3.4	1.03	01	
V0117		595.	4.7	.69	565.	.5	.73	01	
V0123		560.	-1.4	.74	550.	-2.1	.53	01	
V0126		596.	5.0	1.24	591.	5.2	.81	01	
V0128		570.	.3	1.68	580.	3.2	.72	01	
V0141		590.	3.9	.68	575.	2.3	.46	01	
V0144		615.	8.3	1.06	600.	6.8	.43	01	
V0144B		575.	1.2	.93	570.	1.4	1.16	01	
V0146		555.	-2.3	.85	565.	.5	.97	01	
V0149		540.	-4.9	1.07	557.	-.8	1.31	01	
V0150		530.	-6.7	.26	530.	-5.7	.92	01	
V0154		545.	-4.1	1.00	545.	-3.0	.96	01	
V0156		550.	-3.2	.97	565.	.5	.70	01	
V0158		555.	-2.3	1.56	560.	-.4	1.70	*70	DATA RECEIVED LATE
V0160		580.	2.1	.50	580.	3.2	1.57	01	
V0164	*	492.	-13.3	.78	500.	-11.0	.15	01	
V0166		545.	-4.1	1.33	550.	-2.1	1.36	01	
V0168		555.	-2.3	1.37	555.	-1.2	.75	01	
V0169		570.	.3	.64	575.	2.3	.54	01	
V0176		575.	1.2	.67	560.	-.4	.71	01	
V0184		565.	-.5	.84	550.	-2.1	1.49	01	
V0190		600.	5.6	.84	590.	5.0	1.01	01	
V0199		600.	5.6	2.31X	590.	5.0	1.46	01	
V0207		550.	-3.2	.58	525.	-6.6	1.07	01	
V0208	*	530.	-6.7	.75	505.	-10.1	1.27	01	
V0213		553.	-2.6	.90	556.	-1.1	.96	01	
V0217		565.	-.5	.85	565.	.5	1.36	01	
V0220		552.	-2.7	1.49	550.	-2.1	.99	01	
V0223		570.	.3	.94	560.	-.4	1.40	01	
V0224		592.	4.3	.95	575.	2.3	2.01X	01	
V0225		547.	-3.6	1.00	522.	-7.0	1.18	01	
V0232		607.	6.9	.85	590.	5.0	.68	01	
V0233		550.	-3.2	1.22	525.	-6.6	1.18	01	
V0235		576.	1.5	.88	569.	1.3	.71	*70	DATA RECEIVED LATE
V0238		565.	-.5	.96	555.	-1.2	.61	01	
V0243		575.	1.2	1.49	580.	3.2	1.04	01	
V0244		580.	2.1	1.22	580.	3.2	.86	01	
V0245		590.	3.9	1.20	580.	3.2	1.53	01	
V0245B	X	560.	-1.4	2.31X	505.	-10.1	1.37	01	
V0250		600.	5.6	.93	575.	2.3	.99	01	
		568.	= GR. MEAN =		562.			5	TEST DETERMINATIONS
		25.	= SD MEANS =		21.			54	LABORATORIES IN GRAND MEANS
		14.	= AVER SDR =		15.			58	LABORATORIES REPORTING
		%	= UNIT =		%				


ULTIMATE ELONGATION
MATERIAL B91-B92 568. %
MATERIAL B93-B94 562. %
660
640
620
600
580
560
540
520
500
480
460
480 500 520 540 560 580 600 620 640 660
MATERIAL B91-B92
MATERIAL B93-B94

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 40 - 1 STRESS AT 300% ELONGATION - POUNDS PER SQUARE INCH APRIL 1979

LAB CODE	F	MATERIAL B91-B92 COMMERCIAL TIRE TREAD MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	MATERIAL B93-B94 COMMERCIAL TIRE TREAD MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0062		1383.	9.538	8.0	1.13	1383.	9.541	7.8	.72	01	
V0063		1251.	8.631	-2.3	.64	1282.	8.845	-.0	.72	01	
V0067		1247.	8.603	-2.6	.88	1272.	8.776	-.8	.94	01	
V0069		1261.	8.700	-1.5	1.75	1257.	8.672	-2.0	2.13X	01	
V0071		1215.	8.383	-5.1	.72	1250.	8.624	-2.5	.43	01	
V0072		1265.	8.724	-1.3	1.36	1245.	8.586	-3.0	.90	01	
V0073		1237.	8.534	-3.4	1.52	1175.	8.103	-8.4	1.18	01	
V0076		1345.	9.276	5.0	.91	1345.	9.276	4.8	.54	01	
V0078		1359.	9.372	6.1	.64	1363.	9.400	6.2	2.13X	01	
V0083	*	1280.	8.828	-.1	.91	1200.	8.276	-6.5	.90	01	
V0084		1320.	9.103	3.0	.80	1305.	9.000	1.7	1.30	01	
V0085		1247.	8.602	-2.6	1.04	1247.	8.602	-2.8	1.91	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0087		1327.	9.152	3.6	1.55	1268.	8.745	-1.2	1.90	01	
V0088		1295.	8.934	1.1	1.91	1247.	8.600	-2.8	2.73X	01	
V0092		1185.	8.172	-7.5	.74	1165.	8.034	-9.2	1.56	01	
V0095		1227.	8.466	-4.2	1.01	1227.	8.466	-4.3	1.56	01	
V0100		1210.	8.345	-5.6	.58	1230.	8.483	-4.1	1.09	01	
V0102		1195.	8.241	-6.7	1.03	1185.	8.172	-7.6	1.35	01	
V0111		1225.	8.448	-4.4	.56	1255.	8.655	-2.2	.82	01	
V0117		1212.	8.362	-5.4	1.26	1237.	8.534	-3.5	.81	01	
V0123		1260.	8.690	-1.6	1.09	1290.	8.897	.6	.75	01	
V0126		1207.	8.327	-5.8	.90	1203.	8.297	-6.2	.65	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0128		1280.	8.828	-.1	.51	1310.	9.034	2.1	.74	01	
V0141		1329.	9.166	3.7	.35	1355.	9.345	5.6	.59	01	
V0144		1210.	8.345	-5.6	.51	1235.	8.517	-3.7	.60	01	
V0144B		1285.	8.862	.3	.41	1335.	9.207	4.1	.41	01	
V0146		1242.	8.566	-3.1	2.04X	1267.	8.741	-1.2	1.21	01	
V0149		1344.	9.269	4.9	1.79	1291.	8.907	.7	1.03	01	
V0150		1287.	8.879	.5	.79	1305.	9.000	1.7	.62	01	
V0154		1365.	9.414	6.5	1.32	1385.	9.552	8.0	1.03	01	
V0156		1290.	8.897	.7	.88	1270.	8.759	-1.0	.59	01	
V0158		1334.	9.202	4.2	2.50X	1284.	8.852	.1	1.97	+72	ORIGINAL IN MEGAPASCAL RECEIVED LATE
V0160		1269.	8.752	-.9	.73	1276.	8.802	-.5	.86	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0164	*	1487.	10.259	16.1	1.27	1490.	10.279	16.2	1.13	01	
V0166		1306.	9.010	2.0	1.09	1358.	9.366	5.9	1.23	01	
V0168		1358.	9.369	6.0	1.48	1336.	9.214	4.1	.61	01	
V0169		1240.	8.552	-3.2	.57	1226.	8.452	-4.5	.38	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0176		1340.	9.241	4.6	.60	1340.	9.241	4.5	1.02	01	
V0184		1282.	8.845	.1	1.18	1285.	8.862	.2	1.61	01	
V0190		1267.	8.738	-1.1	.75	1232.	8.497	-4.0	1.28	01	
V0199		1252.	8.638	-2.2	2.18X	1257.	8.672	-2.0	1.52	01	
V0207		1410.	9.724	10.1	1.46	1415.	9.759	10.3	1.64	01	
V0208	*	1472.	10.153	14.9	1.63	1458.	10.053	13.6	2.65X	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0213		1324.	9.132	3.4	.74	1323.	9.127	3.2	1.53	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0214		1327.	9.152	3.6	.12	1291.	8.902	.6	.39	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0220		1282.	8.845	.1	1.10	1310.	9.034	2.1	.58	01	
V0223		1260.	8.690	-1.6	.93	1265.	8.724	-1.4	1.17	01	
V0224	*	1325.	9.138	3.4	1.07	1407.	9.707	9.7	1.06	01	
V0225		1331.	9.179	3.9	1.14	1375.	9.483	7.2	2.06X	01	
V0232		1152.	7.948	-10.0	.97	1132.	7.810	-11.7	.64	01	
V0233		1267.	8.741	-1.1	.86	1278.	8.817	-.3	1.11	01	
V0235		1226.	8.453	-4.3	.27	1250.	8.624	-2.5	.68	+70	DATA RECEIVED LATE
V0238		1155.	7.966	-9.8	.61	1162.	8.017	-9.4	1.35	01	
V0243		1274.	8.786	-.6	.43	1266.	8.731	-1.3	.84	01	
V0244		1334.	9.202	4.2	1.39	1301.	8.972	1.4	2.14X	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0245A		1102.	7.603	-13.9	1.57	1109.	7.648	-13.6	2.14X	01	
V0245B	X	1116.	7.700	-12.8	3.43X	1317.	9.086	2.7	2.39X	01	
V0250		1250.	8.621	-2.4	.92	1275.	8.793	-.6	1.19	01	
		1281.	8.835	= GR. MEAN =		1283.	8.847			5	TEST DETERMINATIONS
		72.	.495	= SD MEANS =		76.	.523			55	LABORATORIES IN GRAND MEANS
		26.	.180	= AVER SDR =		24.	.163			58	LABORATORIES REPORTING
		PSI	MEGAPA	= UNIT =		PSI	MEGAPA				


STRESS AT 300% ELONGATION
MATERIAL B91-B92 1281. PSI MATERIAL B93-B94 1283. PSI
MATERIAL B93-B94
MATERIAL B91-B92
1550
1500
1450
1400
1350
1300
1250
1200
1150
1100
1050
1000
1000 1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550

HARDNESS

NOTES

Materials B91 and B92 were sheets of the same vulcanized rubber. Similarly, materials B93 and B94 were alike.

V100 results were obtained at NBS using ASTM D1415.

Four of the 28 participants reporting used ASTM D1415 (Wallace) for the hardness determination. All others used ASTM D2240 (Type A Durometer).

SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
HARDNESS	B91-B92	26	1	61.45	1.80	.19	.41	IRHD
	B93-B94	26	1	61.27	1.98	.18	.34	IRHD

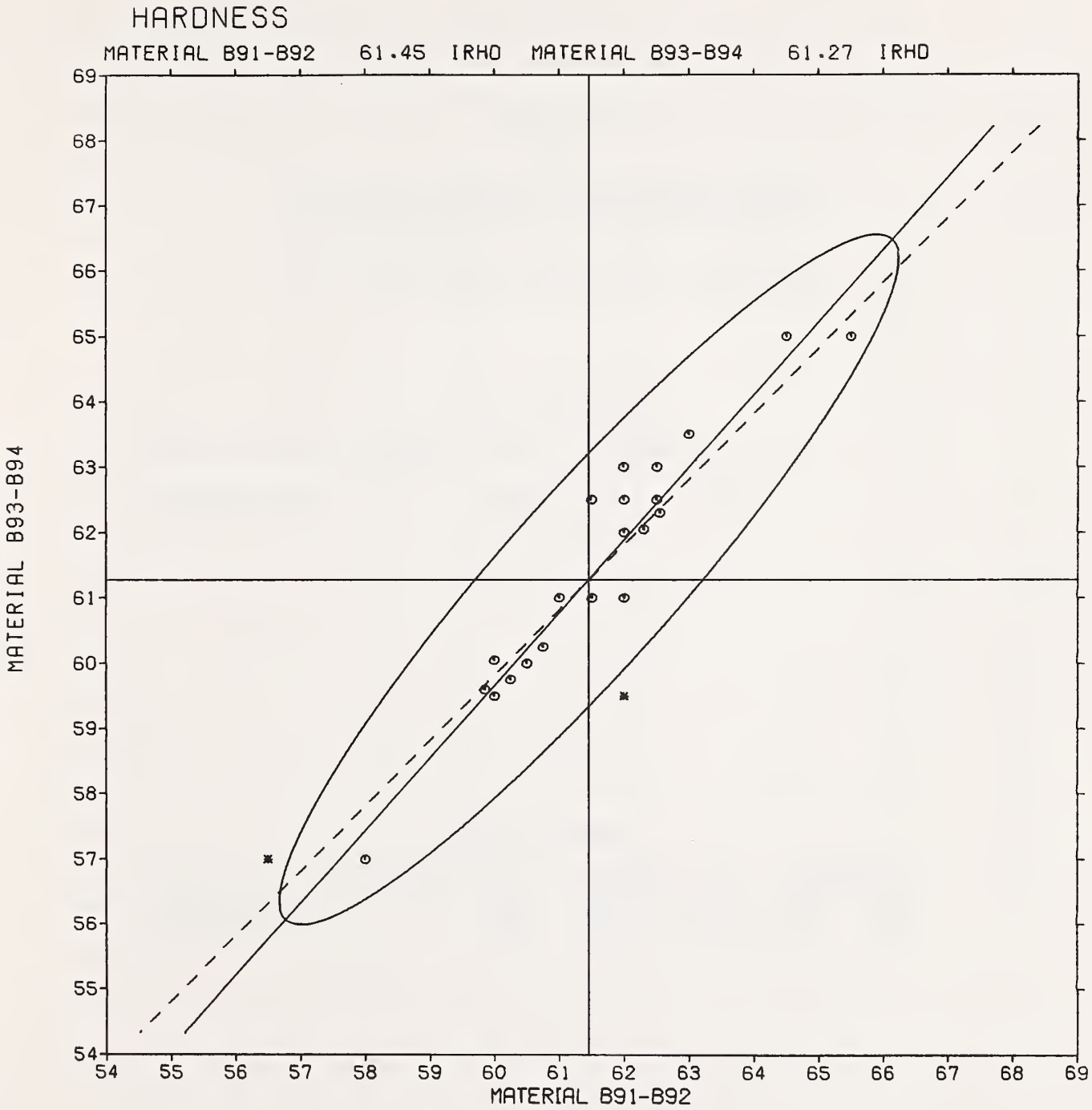
PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
HARDNESS	B91-B92	5	5	61.45	1.14	4.98	IRHD	1.9	8.1
	B93-B94	5	5	61.27	.93	5.50	IRHD	1.5	9.0

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 40 - 2 HARDNESS - IRHD APRIL 1979

LAB CODE	F	MATERIAL B91-B92 COMMERCIAL TIRE TREAD MEAN IRHD	% DEV	REL SDR	MATERIAL B93-B94 COMMERCIAL TIRE TREAD MEAN IRHD	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0062		60.25	-2.0	1.12	59.75	-2.5	2.49X	01	
V0069		60.75	-1.1	2.10X	60.25	-1.7	2.84X	01	
V0071		62.50	1.7	1.21	63.00	2.8	1.48	01	
V0078	*	62.00	.9	.54	59.50	-2.9	1.63	01	
V0084		62.00	.9	.67	62.00	1.2	.67	01	
V0085		62.30	1.4	1.11	62.05	1.3	1.35	01	
V0087		64.50	5.0	1.33	65.00	6.1	2.38X	01	
V0088		58.00	-5.6	.86	57.00	-7.0	2.61X	01	
V0092		62.50	1.7	1.33	62.50	2.0	1.87	01	
V0095		60.00	-2.4	1.33	59.50	-2.9	.67	01	
V0100		60.00	-2.4	.77	60.05	-2.0	.56	01	
V0102		65.50	6.6	1.33	65.00	6.1	.82	01	
V0111		62.00	.9	1.09	62.00	1.2	.67	01	
V0128	*	56.50	-8.1	.67	57.00	-7.0	.00	01	
V0141		60.50	-1.5	.00	60.00	-2.1	.82	01	
V0144		62.00	.9	.67	63.00	2.8	.00	01	
V0168		63.00	2.5	.84	63.50	3.6	.33	01	
V0169		61.00	-.7	.67	61.00	-.4	.00	01	
V0176		61.00	-.7	1.88X	61.00	-.4	1.48	01	
V0190		61.50	.1	.67	62.50	2.0	.67	01	
V0208		59.85	-2.6	1.84	59.60	-2.7	3.04X	01	
V0214		62.55	1.8	.60	62.30	1.7	.71	01	
V0224		62.00	.9	1.68	61.00	-.4	2.49X	01	
V0233		62.00	.9	.00	62.50	2.0	1.48	01	
V0235		62.00	.9	.88	61.00	-.4	1.38	+70	DATA RECEIVED LATE
V0243		61.50	.1	.00	61.00	-.4	.82	01	
V0244		62.00	.9	.67	61.00	-.4	.00	01	
		61.45	* GR. MEAN *		61.27				5 TEST DETERMINATIONS
		1.80	* SD MEANS *		1.98				26 LABORATORIES IN GRAND MEANS
		.41	* AVER SDR *		.34				27 LABORATORIES REPORTING
		IRHD	* UNIT *		IRHD				


HARDNESS
MATERIAL B91-B92 61.45 IRHO MATERIAL B93-B94 61.27 IRHO
MATERIAL B93-B94
MATERIAL B91-B92
69
68
67
66
65
64
63
62
61
60
59
58
57
56
55
54
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69

MOONEY VISCOSITY

NOTES

Materials S91 and S92 were the same rubber. Similarly, materials S93 and S94 were the same rubber. No sample preparation was required for materials S91 and S92 whereas, mill massing was required for materials S93 and S94.

V100 results were obtained at NBS on the manually closed viscometer used for determining the Mooney viscosities of the standard rubbers.

SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
MOONEY	S91-S92	40	3	67.53	2.00	.15	.37	ML
VISCOSITY	S93-S94	40	3	64.60	3.04	.57	.63	ML

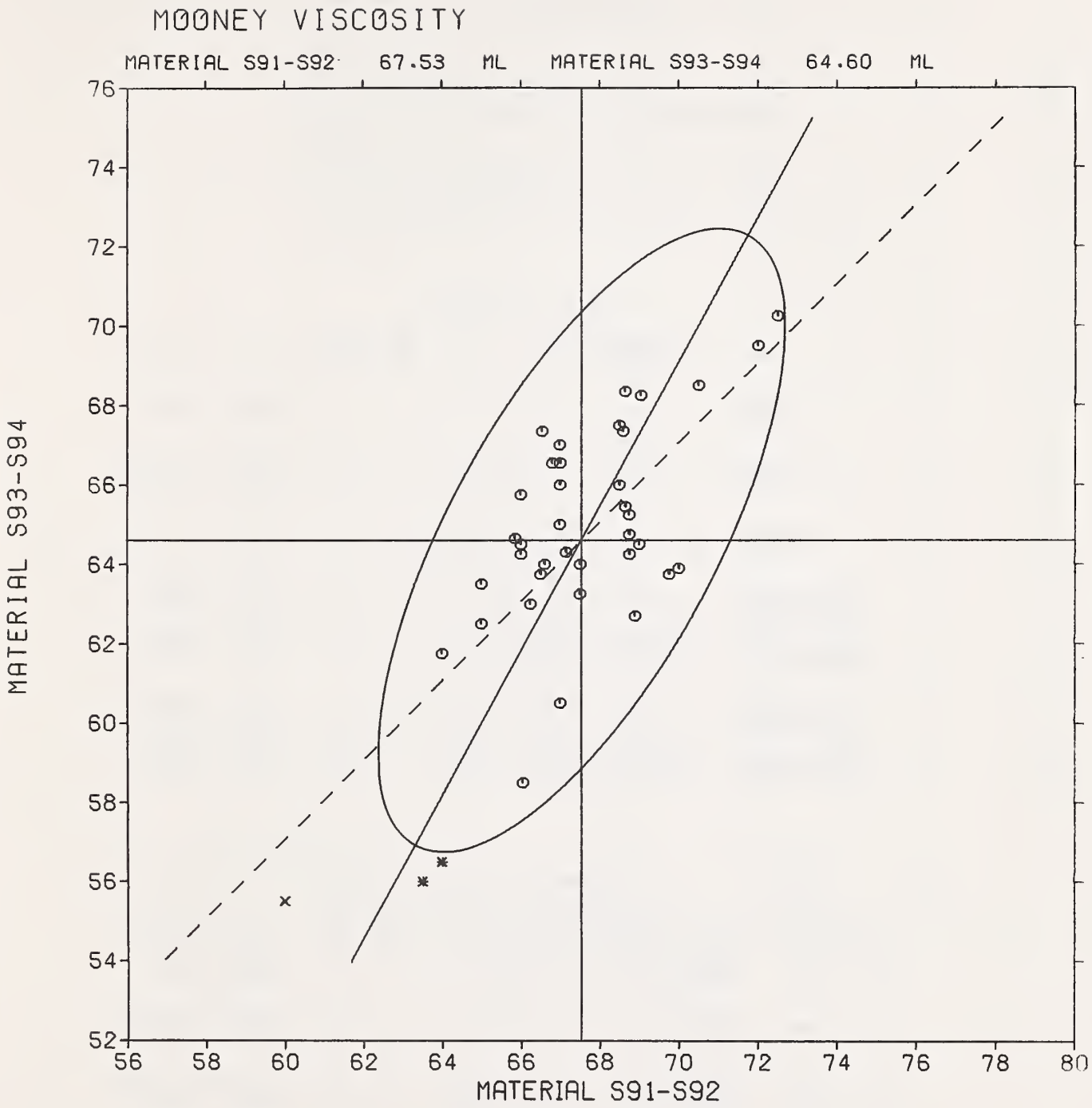
PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
MOONEY	S91-S92	3	3	67.53	1.03	5.53	ML	1.5	8.2
VISCOSITY	S93-S94	3	3	64.60	1.75	8.42	ML	2.7	13.0

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 40 - 4 MOONEY VISCOSITY - ML JUNE 1979

LAB CODE	F	MATERIAL S91-S92 BUTYL RUBBER MEAN ML	% DEV	REL SDR	MATERIAL S93-S94 SBR MEAN ML	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0060		67.00	-.8	.39	66.00	2.2	.83	01	
V0061		66.80	-1.1	.34	66.55	3.0	.36	01	
V0068		72.00	6.6	4.93X	69.50	7.6	2.00	01	
V0071		68.65	1.7	.54	68.35	5.8	.82	01	
V0072		69.00	2.2	1.16	64.50	-.2	1.37	01	
V0073		65.00	-3.7	1.55	63.50	-1.7	1.67	01	
V0077	X	66.05	-2.2	1.05	47.80	-26.0	.35	01	
V0078	X	60.00	-11.1	1.55	55.50	-14.1	1.39	01	
V0079		67.15	-.6	1.02	64.30	-.5	1.39	01	
V0080		67.00	-.8	1.78	66.55	3.0	1.10	01	
V0083		69.05	2.3	1.32	68.25	5.7	2.01	01	
V0085		72.50	7.4	1.45	70.25	8.8	.46	01	
V0090		69.75	3.3	.77	63.75	-1.3	.23	01	
V0092		67.00	-.8	1.55	67.00	3.7	.00	01	
V0095		68.75	1.8	1.06	64.75	.2	1.60	01	
V0100		68.75	1.8	.50	65.25	1.0	.46	01	
V0111	*	63.50	-6.0	.77	56.00	-13.3	1.21	01	
V0117		66.25	-1.9	1.55	63.00	-2.5	1.21	01	
V0128		70.50	4.4	.77	68.50	6.0	1.58	01	
V0144		68.75	1.8	.92	64.25	-.5	.32	01	
V0146		65.00	-3.7	.39	62.50	-3.2	.00	01	
V0149		68.65	1.7	.95	65.45	1.3	.60	01	
V0150		67.50	-.0	.77	64.00	-.9	2.04	01	
V0156		66.00	-2.3	.39	65.75	1.8	.40	01	
V0166		66.00	-2.3	.39	64.25	-.5	.92	01	
V0177		66.55	-1.4	1.25	67.35	4.3	1.26	01	
V0182		67.50	-.0	.77	63.25	-2.1	.46	01	
V0190		70.00	3.7	.84	63.90	-1.1	.88	01	
V0207		68.90	2.0	.66	62.70	-2.9	.40	01	
V0208		67.00	-.8	1.55	60.50	-6.3	1.58	01	
V0213		66.50	-1.5	1.16	63.75	-1.3	.63	01	
V0214		67.00	-.8	1.41	65.00	.6	.85	01	
V0217		64.00	-5.2	.39	61.75	-4.4	.69	01	
V0218		68.50	1.4	.77	66.00	2.2	.92	01	
V0220		65.85	-2.5	.96	64.65	.1	2.89X	01	
V0221		68.60	1.6	1.07	67.35	4.3	.45	01	
V0223		66.00	-2.3	.77	64.50	-.2	.92	01	
V0230		66.05	-2.2	.69	58.50	-9.4	.32	01	
V0236		69.00	2.2	2.12	64.50	-.2	2.00	01	
V0238	*	64.00	-5.2	2.12	56.50	-12.5	.92	01	
V0244		66.00	-2.3	1.55	65.00	.6	1.83	*70	DATA RECEIVED LATE
V0250		68.50	1.4	.77	67.50	4.5	.92	01	
V0251		66.60	-1.4	1.35	64.00	-.9	1.24	01	
		67.53	= GR. MEAN =		64.60				3 TEST DETERMINATIONS
		2.00	= SD MEANS =		3.04				40 LABORATORIES IN GRAND MEANS
		.37	= AVER SDR =		.63				43 LABORATORIES REPORTING
		ML	= UNIT =		ML				


MOONEY VISCOSITY
MATERIAL S91-S92 67.53 ML
MATERIAL S93-S94 64.60 ML
MATERIAL S93-S94
MATERIAL S91-S92
76
74
72
70
68
66
64
62
60
58
56
54
52
56
58
60
62
64
66
68
70
72
74
76
78
80

VULCANIZATION CHARACTERISTICS USING OSCILLATING DISK CURE METER

NOTES

Materials X91 and X92 were the same rubber formulation. Similarly, materials X93 and X94 were alike.

V100 results were obtained at NBS using a Model TM-100 Monsanto Rheometer with a disk oscillating at ±1° amplitude and 1.7 hertz frequency.

All participants used Monsanto Rheometers operated at one degree amplitude and 1.7 hertz frequency.

Labs V0064 and V0074 reported calculation problems in Cure Time (50% and 90% MH).

SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
SCORCH TIME	X91-X92	38	3	4.47	.33	.02	.05	MINUTES
	X93-X94	38	3	4.55	.33	.02	.05	MINUTES
CURE TIME (50% MH)	X91-X92	36	5	6.42	.35	.02	.06	MINUTES
	X93-X94	36	5	6.55	.36	.02	.06	MINUTES
CURE TIME (90% MH)	X91-X92	36	5	10.02	.63	.04	.10	MINUTES
	X93-X94	36	5	10.16	.61	.05	.10	MINUTES
MINIMUM TORQUE	X91-X92	37	4	5.18	.67	.03	.07	POUND-INCHES
	X93-X94	37	4	5.27	.65	.03	.08	POUND-INCHES
MINIMUM TORQUE	X91-X92	37	4	.5849	.0759	.0052	.0083	NEWTON-METERS
	X93-X94	37	4	.5955	.0737	.0048	.0089	NEWTON-METERS
MAXIMUM TORQUE	X91-X92	38	3	23.38	1.45	.05	.12	POUND-INCHES
	X93-X94	38	3	23.51	1.41	.04	.07	POUND-INCHES
MAXIMUM TORQUE	X91-X92	38	3	2.6413	.1643	.0082	.0132	NEWTON-METERS
	X93-X94	38	3	2.6559	.1595	.0063	.0075	NEWTON-METERS

PRECISION OF METHODS

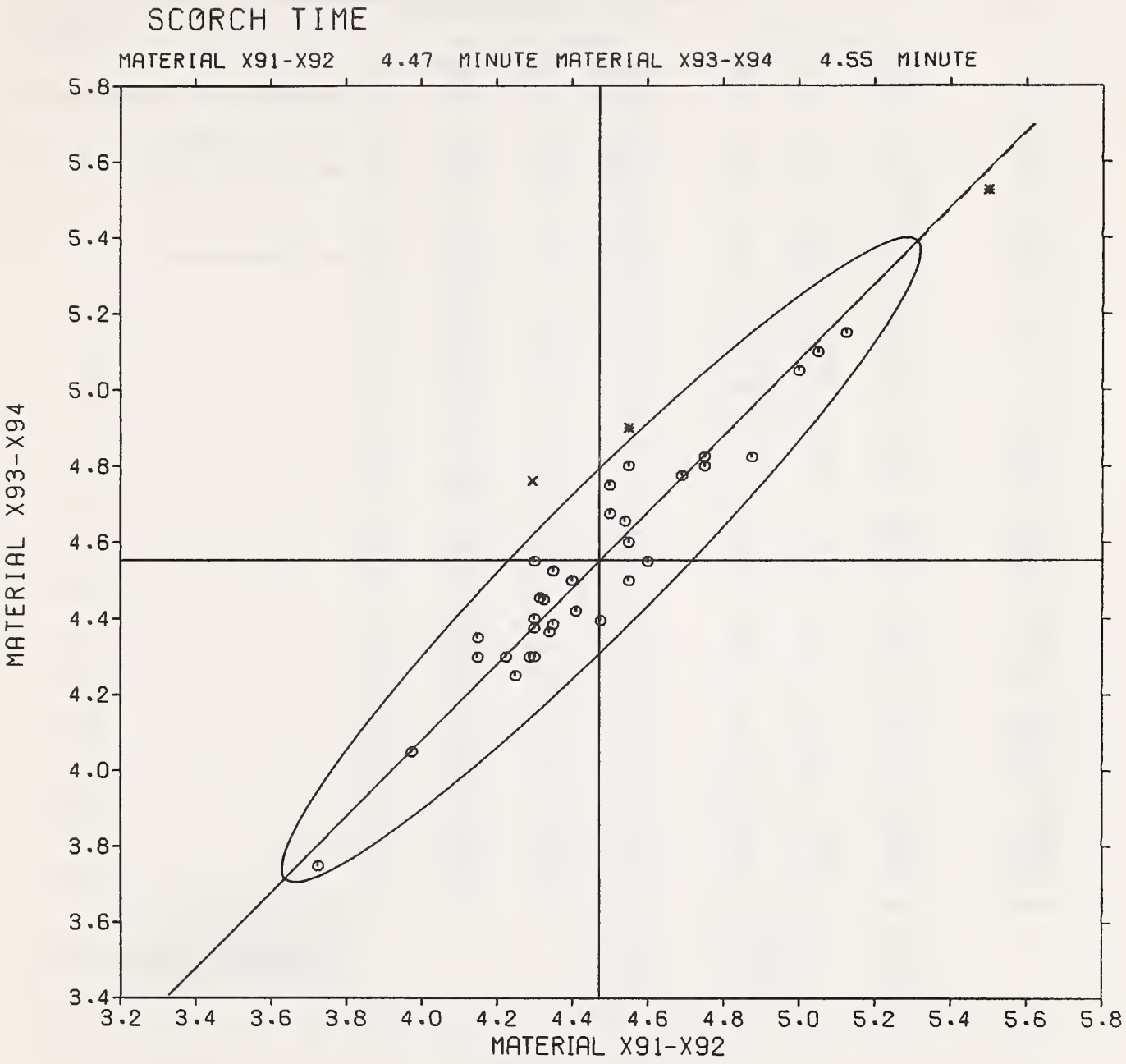
PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
SCORCH TIME	X91-X92	3	3	4.47	.15	.90	MINUTE	3.4	20.2
	X93-X94	3	3	4.55	.14	.91	MINUTE	3.1	19.9
CURE TIME (50% MH)	X91-X92	3	3	6.42	.17	.96	MINUTE	2.6	14.9
	X93-X94	3	3	6.55	.16	1.00	MINUTE	2.4	15.3
CURE TIME (90% MH)	X91-X92	3	3	10.02	.28	1.73	MINUTE	2.8	17.3
	X93-X94	3	3	10.16	.27	1.69	MINUTE	2.6	16.7
MINIMUM TORQUE	X91-X92	3	3	5.18	.20	1.86	LB-IN.	3.9	35.9
	X93-X94	3	3	5.27	.22	1.81	LB-IN.	4.1	34.3
MINIMUM TORQUE	X91-X92	3	3	.5849	.0229	.2102	N-M	3.9	35.9
	X93-X94	3	3	.5955	.0247	.2042	N-M	4.1	34.3
MAXIMUM TORQUE	X91-X92	3	3	23.38	.32	4.03	LB-IN.	1.4	17.2
	X93-X94	3	3	23.51	.18	3.91	LB-IN.	.8	16.6
MAXIMUM TORQUE	X91-X92	3	3	2.6413	.0366	.4552	N-M	1.4	17.2
	X93-X94	3	3	2.6559	.0208	.4419	N-M	.8	16.6

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 40 - 5 SCORCH TIME - MINUTES JUNE 1979

LAB CODE	F	MATERIAL X91-X92 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	MATERIAL X93-X94 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0061		4.30	-3.9	.53	4.37	-3.9	1.04	01	
V0064		4.69	4.8	.00	4.77	4.9	.17	01	
V0071		4.25	-5.0	.53	4.25	-6.6	1.12	01	
V0074	*	5.50	22.9	2.60X	5.52	21.4	2.81X	01	
V0078		3.72	-16.7	.00	3.75	-17.6	.00	01	
V0079		4.29	-4.2	.00	4.30	-5.5	.00	01	
V0083		4.40	-1.7	1.44	4.50	-1.2	1.12	01	
V0085		4.12	-7.8	.79	4.12	-9.4	.84	+70	DATA RECEIVED LATE
V0086		5.05	12.9	1.44	5.10	12.0	.00	01	
V0090		4.54	1.5	1.27	4.65	2.2	.93	01	
V0092		4.22	-5.6	.79	4.30	-5.5	.56	01	
V0095		4.55	1.7	.00	4.80	5.4	.00	01	
V0100		4.50	.6	.00	4.75	4.3	1.12	01	
V0120	X	4.29	-4.0	19.09X	4.76	4.6	14.72X	01	
V0128		4.30	-3.9	2.42X	4.55	-.1	.56	01	
V0144		4.41	-1.4	.32	4.42	-2.9	.40	01	
V0146		4.75	6.2	1.44	4.80	5.4	1.12	01	
V0149		4.35	-2.8	.46	4.38	-3.7	.45	01	
V0150		5.12	14.6	2.37X	5.15	13.1	4.11X	01	
V0152		4.15	-7.2	.00	4.35	-4.5	1.12	01	
V0154		4.75	6.2	.00	4.82	6.0	.28	01	
V0156		4.32	-3.3	.98	4.45	-2.3	1.02	01	
V0158		4.15	-7.2	.53	4.30	-5.5	1.12	01	
V0160		4.35	-2.8	1.93	4.52	-.6	1.33	01	
V0161		4.30	-3.9	.53	4.30	-5.5	1.12	01	
V0166		4.40	-1.7	.00	4.50	-1.2	.97	01	
V0169		4.30	-3.9	1.05	4.40	-3.4	1.53	01	
V0171		4.55	1.7	4.73X	4.60	1.0	.56	01	
V0182		3.97	-11.2	2.54X	4.05	-11.0	.76	01	
V0190		4.31	-3.6	.75	4.45	-2.1	1.16	01	
V0207		4.60	2.8	1.05	4.55	-.1	1.12	01	
V0208		4.34	-3.0	1.10	4.36	-4.1	1.57	01	
V0211		4.30	-3.9	.00	4.30	-5.5	1.12	01	
V0213		4.87	9.0	1.58	4.82	6.0	1.04	01	
V0214	*	4.55	1.7	2.02	4.90	7.6	2.12	01	
V0217		4.50	.6	.00	4.67	2.7	.00	01	
V0218		4.55	1.7	.00	4.50	-1.2	.97	01	
V0221		4.30	-3.9	.53	4.30	-5.5	1.12	01	
V0238		5.00	11.8	.00	5.05	10.9	1.18	01	
V0243		4.47	.0	.77	4.39	-3.5	1.23	01	
V0249		4.25	-5.0	4.80X	4.25	-6.6	2.42X	+70	DATA RECEIVED LATE

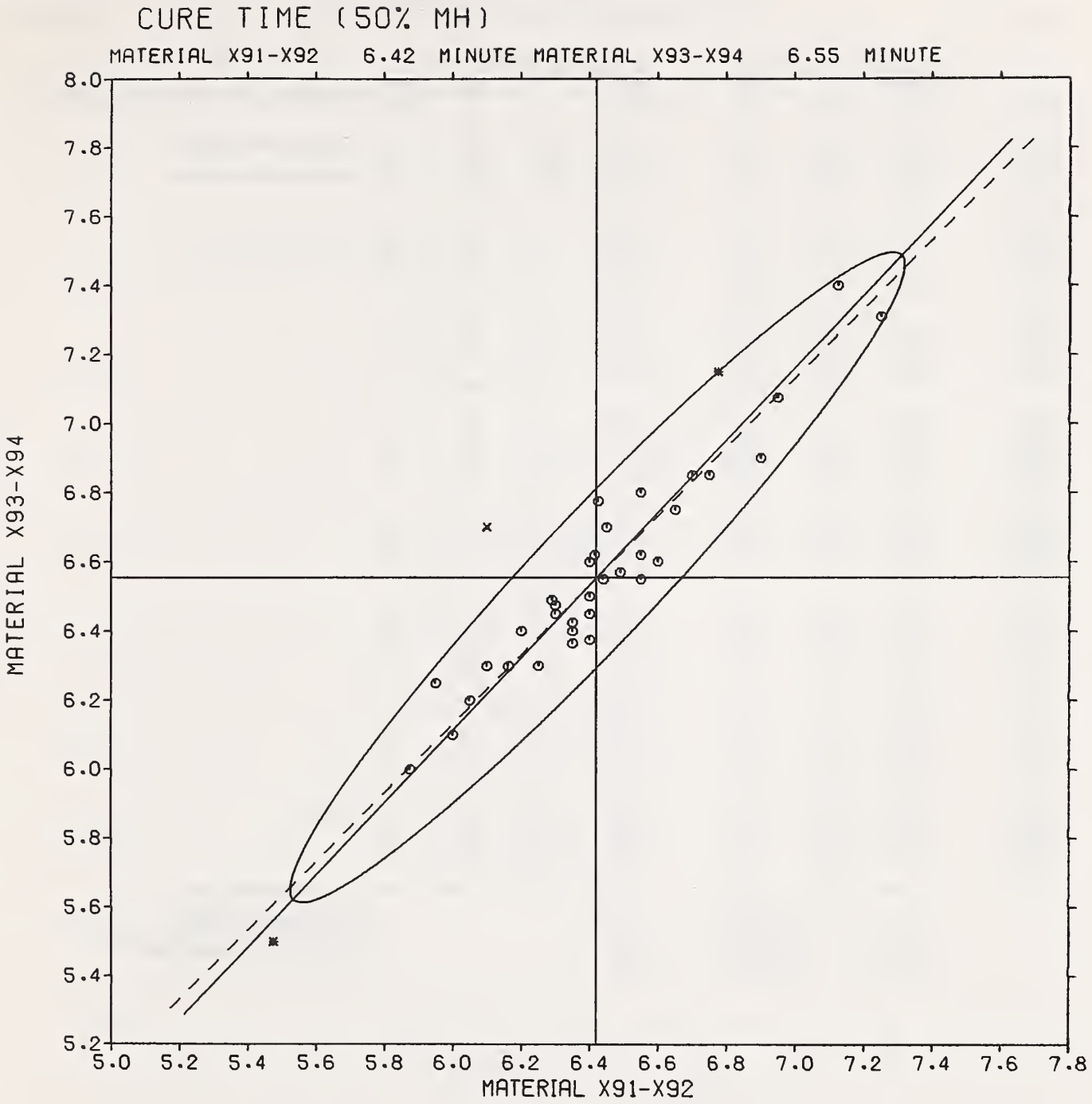
4.47	- GR. MEAN -	4.55	3 TEST DETERMINATIONS
.33	- SD MEANS -	.33	38 LABORATORIES IN GRAND MEANS
.05	- AVER SDR -	.05	41 LABORATORIES REPORTING
MINUTE	- UNIT -	MINUTE	


SCORCH TIME
MATERIAL X91-X92 4.47 MINUTE MATERIAL X93-X94 4.55 MINUTE
MATERIAL X93-X94
MATERIAL X91-X92
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8

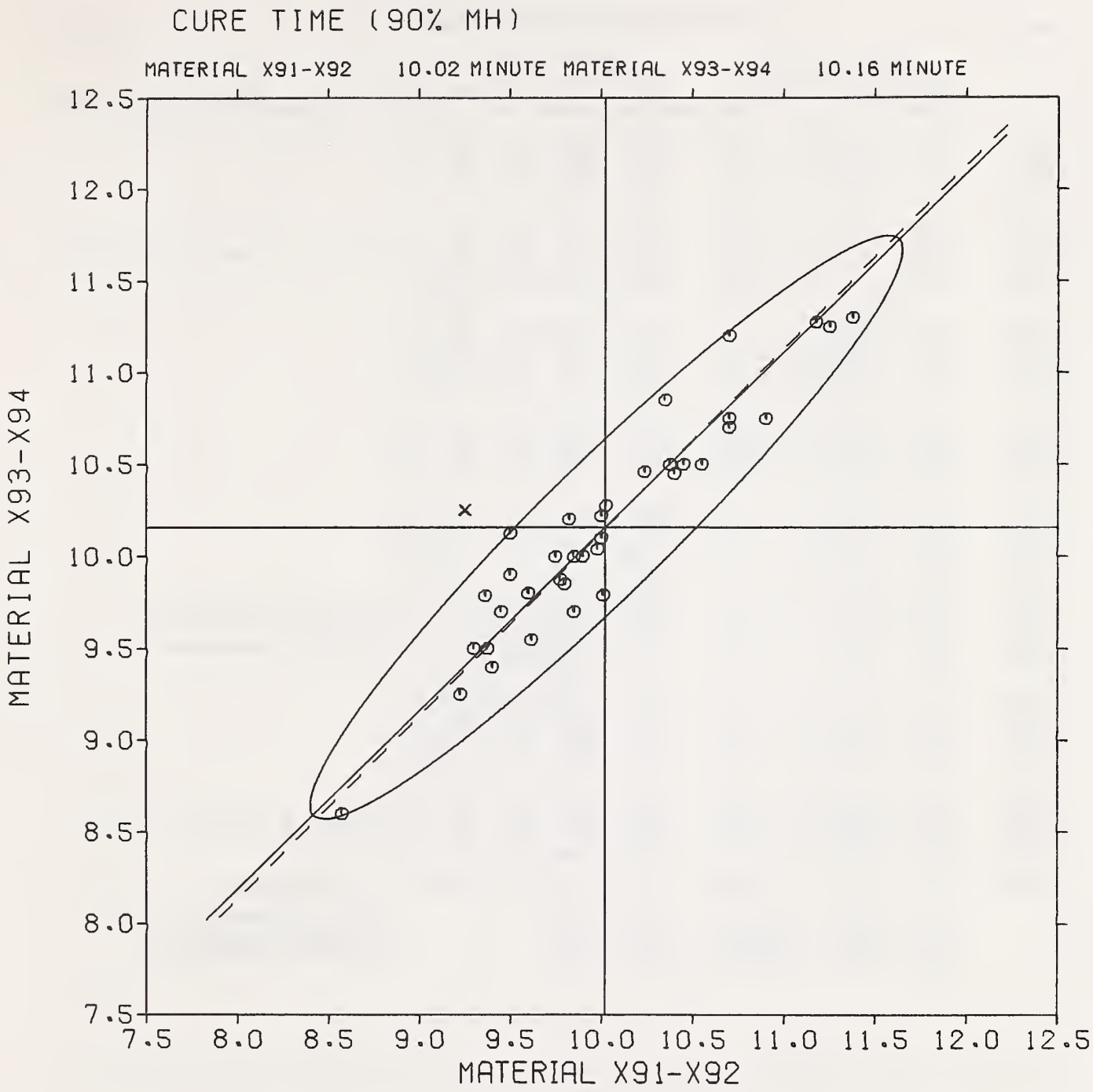
INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 40 - 5 CURE TIME (50% MH) - MINUTES JUNE 1979

LAB CODE	F	MATERIAL X91-X92 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	MATERIAL X93-X94 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0061		6.30	-1.9	.24	6.47	-1.2	.75	01	
V0064	X	13.57	99.9	.95	13.78	99.9	.20	*98	EXTREME TEST RESULTS
V0071		6.25	-2.7	.00	6.30	-3.9	1.51	01	
V0074	X	13.89	99.9	1.69	13.76	99.9	2.42X	*98	EXTREME TEST RESULTS
V0078	#	5.47	-14.7	.48	5.50	-16.1	.00	01	
V0079		6.16	-4.0	.00	6.30	-3.9	.00	01	
V0083		6.65	3.6	.95	6.75	3.0	1.00	01	
V0085		6.30	-1.9	.48	6.17	-5.8	1.00	*70	DATA RECEIVED LATE
V0086		6.60	2.8	.48	6.60	.7	.00	01	
V0090		6.44	.3	1.33	6.55	-.1	1.79	01	
V0092		6.05	-5.8	1.19	6.20	-5.4	.75	01	
V0095		6.70	4.3	.00	6.85	4.5	.00	01	
V0100		6.55	2.0	1.30	6.80	3.8	.50	01	
V0120	X	6.10	-5.0	12.19X	6.70	2.2	10.60X	01	
V0122		6.20	-3.4	1.30	6.40	-2.4	1.00	01	
V0144		6.49	1.1	.72	6.57	.2	.20	01	
V0146		6.75	5.1	1.43	6.85	4.5	1.00	01	
V0149		6.35	-1.1	.48	6.36	-2.9	.47	01	
V0150		7.12	11.0	4.13X	7.40	12.9	2.01	01	
V0152		5.95	-7.3	.48	6.25	-4.6	1.00	01	
V0154		6.95	8.2	.81	7.07	7.9	.75	01	
V0156		6.35	-1.1	.95	6.42	-2.0	.50	01	
V0158		6.00	-6.6	1.90	6.10	-6.9	2.01	01	
V0160		6.41	-.1	1.87	6.62	1.0	.44	01	
V0161		6.10	-5.0	1.30	6.30	-3.9	1.83	01	
V0166		6.40	-.3	.95	6.50	-.8	1.37	01	
V0169		6.30	-1.9	1.30	6.45	-1.6	1.00	01	
V0171		6.45	.4	1.90	6.70	2.2	.50	01	
V0182		5.87	-8.5	1.84	6.00	-8.5	1.17	01	
V0190		6.29	-2.0	.83	6.49	-1.0	.72	01	
V0207		6.40	-.3	.48	6.60	.7	2.68X	01	
V0208		6.55	2.0	.88	6.62	1.0	.59	01	
V0211		6.40	-.3	.48	6.45	-1.6	1.00	01	
V0213		6.90	7.5	1.80	6.90	5.3	2.40X	01	
V0214	#	6.77	5.5	2.95X	7.15	9.1	2.42X	01	
V0217		6.42	.1	3.09X	6.77	3.4	.50	01	
V0218		6.55	2.0	.48	6.55	-.1	1.87	01	
V0221		6.35	-1.1	.48	6.40	-2.4	1.00	01	
V0238		7.25	12.9	.00	7.31	11.5	.60	01	
V0243		6.40	-.3	.39	6.37	-2.7	1.13	01	
V0249		6.00	-6.6	3.15X	6.00	-8.5	2.17	*70	DATA RECEIVED LATE
		6.42	= GR. MEAN =		6.55				3 TEST DETERMINATIONS
		.35	= SD MEANS =		.36				36 LABORATORIES IN GRAND MEANS
		.06	= AVER SDR =		.06				41 LABORATORIES REPORTING
		MINUTE	= UNIT =		MINUTE				


CURE TIME (50% MH)
MATERIAL X91-X92 6.42 MINUTE MATERIAL X93-X94 6.55 MINUTE
MATERIAL X93-X94
MATERIAL X91-X92
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8

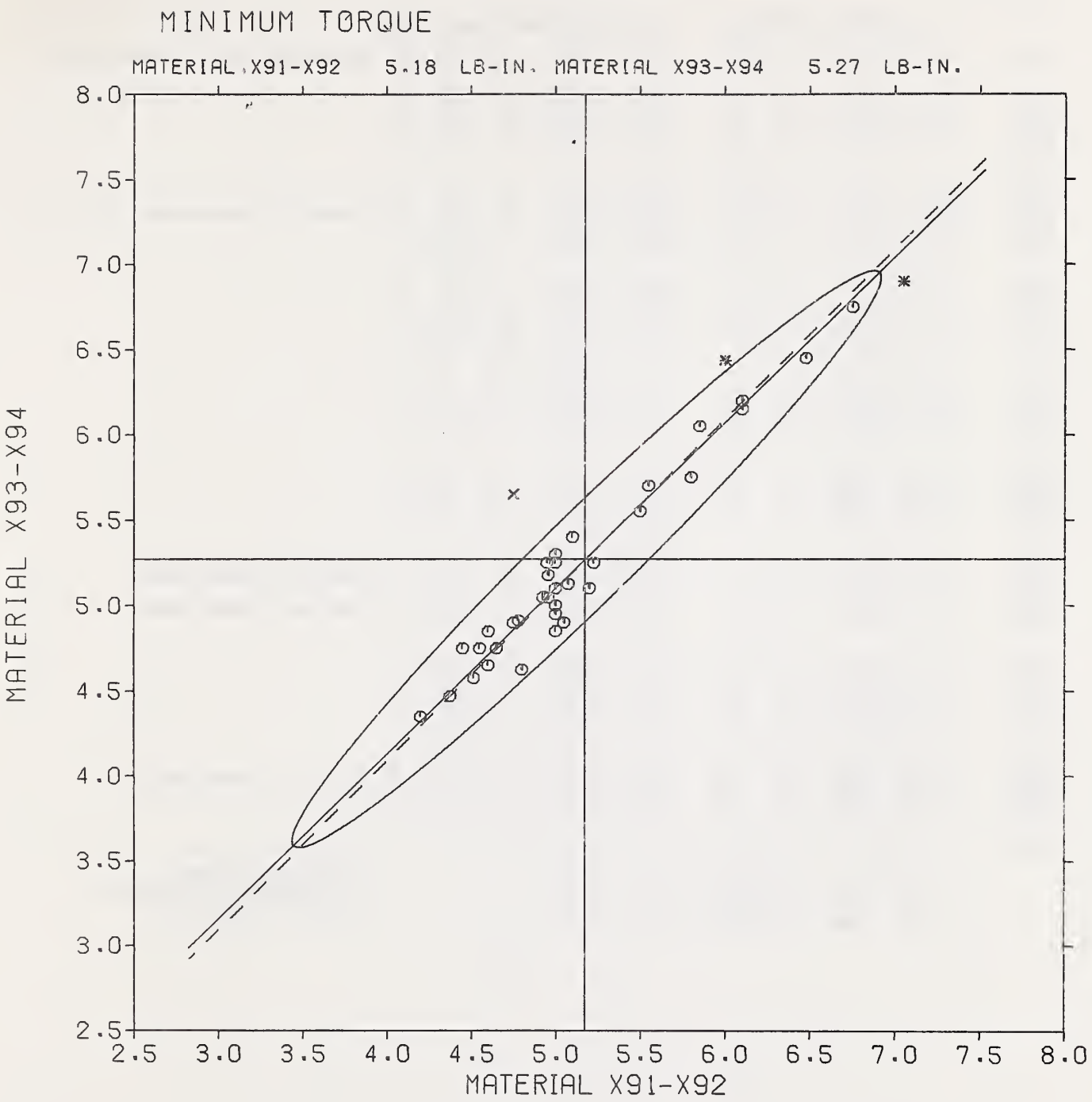
LAB CODE	F	MATERIAL X91-X92 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	MATERIAL X93-X94 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0061		9.82	-2.0	.28	10.20	.4	.82	01	
V0064	X	20.49	99.9	.80	20.77	99.9	.20	*98	EXTREME TEST RESULTS
V0071		9.80	-2.2	.57	9.85	-3.0	.90	01	
V0074	X	21.16	99.9	1.35	21.11	99.9	1.72	*98	EXTREME TEST RESULTS
V0078		8.57	-14.4	1.23	8.60	-15.3	1.28	01	
V0079		9.36	-6.6	.00	9.79	-3.6	.00	01	
V0083		10.70	6.8	1.14	10.75	5.8	1.12	01	
V0085		9.42	-6.0	1.14	9.55	-6.0	.75	*70	DATA RECEIVED LATE
V0086		10.40	3.8	1.06	10.45	2.9	.30	01	
V0090		9.98	-.4	1.29	10.04	-1.2	1.53	01	
V0092		9.37	-6.5	1.09	9.50	-6.5	.30	01	
V0095		10.45	4.3	.00	10.50	3.4	.00	01	
V0100		10.70	6.8	.78	10.70	5.3	.60	01	
V0120		10.37	3.5	12.05X	10.50	3.4	11.16X	01	
V0128		9.45	-5.7	1.61	9.70	-4.5	.60	01	
V0144		10.00	-.2	.53	10.22	.6	.39	01	
V0146		10.55	5.3	.49	10.50	3.4	.82	01	
V0149		9.77	-2.5	.52	9.87	-2.8	.80	01	
V0150		11.37	13.5	2.66X	11.30	11.3	1.91	01	
V0152		9.30	-7.2	.57	9.50	-6.5	.00	01	
V0154		11.17	11.5	1.00	11.27	11.0	1.01	01	
V0156		9.85	-1.7	.75	10.00	-1.5	.30	01	
V0158		9.40	-6.2	1.42	9.40	-7.5	1.50	01	
V0160		10.02	.0	2.02	10.27	1.2	.36	01	
V0161		9.50	-5.2	1.48	9.90	-2.5	1.20	01	
V0166		9.60	-4.2	.28	9.80	-3.5	.00	01	
V0169		9.75	-2.7	1.06	10.00	-1.5	.30	01	
V0171	X	9.25	-7.7	3.69X	10.25	.9	.60	01	
V0182		9.22	-8.0	.89	9.25	-8.9	.96	01	
V0190		10.23	2.1	.83	10.46	3.0	.57	01	
V0207		10.35	3.3	1.24	10.85	6.8	1.70	01	
V0208		10.01	-.1	1.70	9.79	-3.6	2.22	01	
V0211		10.00	-.2	1.32	10.10	-.6	1.20	01	
V0213		10.90	8.8	1.44	10.75	5.8	1.73	01	
V0214		10.70	6.8	2.98X	11.20	10.3	2.75X	01	
V0217		9.50	-5.2	1.42	10.12	-.3	.00	01	
V0218		9.90	-1.2	.28	10.00	-1.5	1.32	01	
V0221		9.85	-1.7	.57	9.70	-4.5	.30	01	
V0238		11.25	12.2	1.42	11.25	10.8	1.50	01	
V0243		9.61	-4.1	.70	9.55	-6.0	1.43	01	
V0249	#	9.00	-10.2	4.99X	8.75	-13.9	3.76X	*70	DATA RECEIVED LATE
		10.02	= GR. MEAN =		10.16				3 TEST DETERMINATIONS
		.63	= SD MEANS =		.61				36 LABORATORIES IN GRAND MEANS
		.10	= AVER SDR =		.10				41 LABORATORIES REPORTING
		MINUTE	= UNIT =		MINUTE				


CURE TIME (90% MH)
MATERIAL X91-X92 10.02 MINUTE MATERIAL X93-X94 10.16 MINUTE
MATERIAL X93-X94
MATERIAL X91-X92
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 40 - 5 MINIMUM TORQUE - POUND-INCHES JUNE 1979

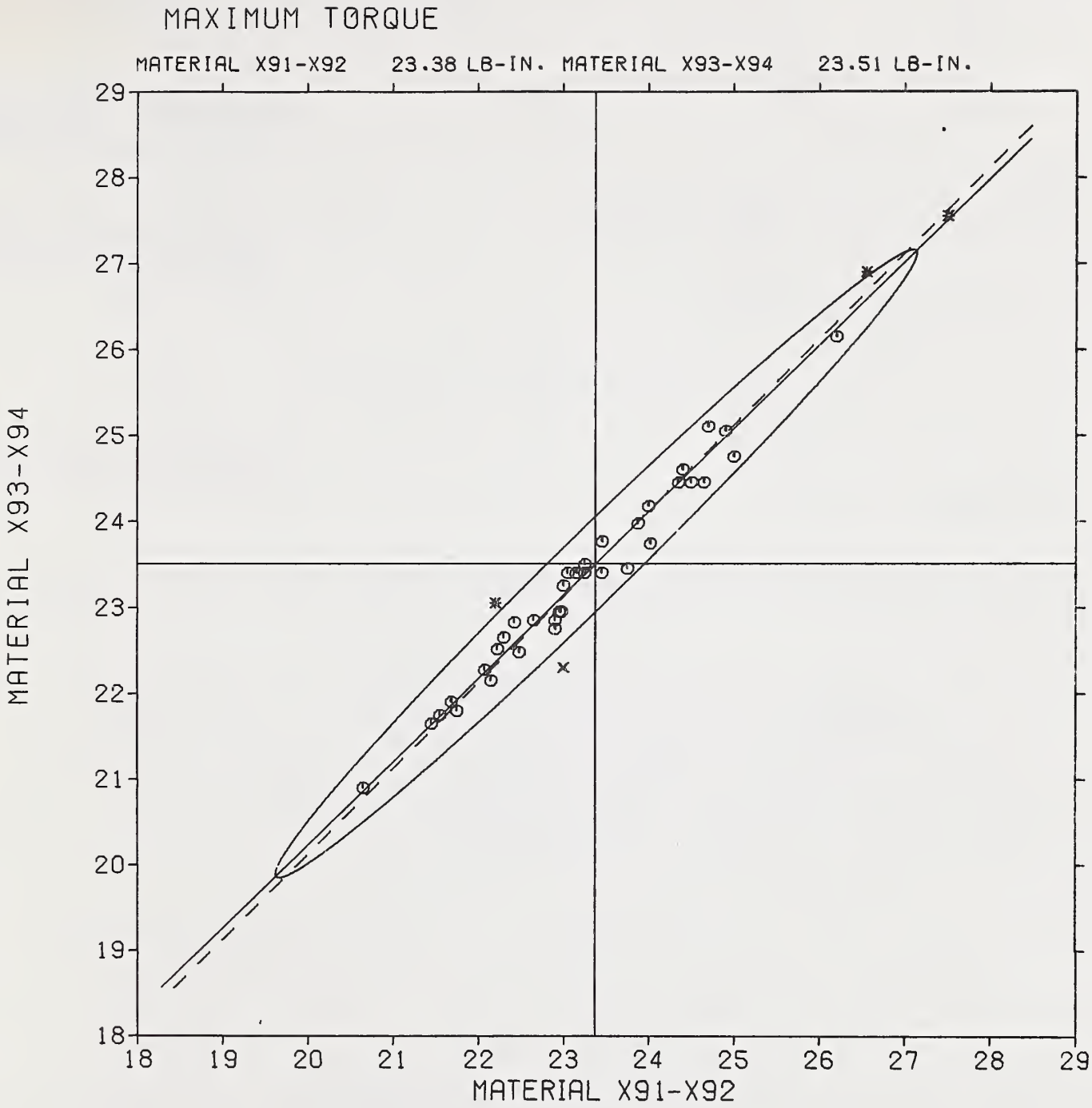
LAB CODE	F	MATERIAL X91-X92 COMMERCIAL TIRE TREAD MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	MATERIAL X93-X94 COMMERCIAL TIRE TREAD MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0061		4.95	.5593	-4.4	.54	5.25	.5932	-.4	1.28	01	
V0064		4.92	.5565	-4.9	.39	5.05	.5706	-4.2	.00	01	
V0071		4.65	.5254	-10.2	.00	4.75	.5367	-9.9	1.37	01	
V0074		4.80	.5424	-7.3	2.17	4.62	.5226	-12.3	2.24	01	
V0078		5.00	.5649	-3.4	.00	5.25	.5932	-.4	.00	01	
V0079		5.07	.5734	-2.0	.00	5.12	.5791	-2.8	.00	01	
V0083		5.85	.6610	13.0	2.10	6.05	.6836	14.8	1.69	01	
V0085		4.78	.5400	-7.7	.00	4.87	.5500	-7.6	.00	+74	ORIGINAL IN NEWTON-METER REC'D LATE
V0086		6.10	.6892	17.8	1.97	6.20	.7005	17.6	1.73	01	
V0090		4.51	.5101	-12.8	.56	4.57	.5169	-13.2	4.28X	01	
V0092		6.10	.6892	17.8	.79	6.15	.6949	16.7	.00	01	
V0095		4.60	.5198	-11.1	.00	4.65	.5254	-11.8	.00	01	
V0100		4.60	.5198	-11.1	.00	4.85	.5480	-8.0	.37	01	
V0120	*	7.05	.7966	36.2	13.32X	6.90	.7796	30.9	11.57X	01	
V0138		5.00	.5649	-3.4	.79	4.95	.5593	-6.1	.37	01	
V0144		4.75	.5367	-8.2	.39	4.90	.5537	-7.0	.73	01	
V0146		5.00	.5649	-3.4	1.18	5.10	.5762	-3.2	.00	01	
V0149		5.55	.6271	7.2	1.10	5.70	.6440	8.1	.71	01	
V0150		6.75	.7627	30.4	1.97	6.75	.7627	28.1	1.83	01	
V0152		4.20	.4746	-18.9	.39	4.35	.4915	-17.5	.37	01	
V0154		5.00	.5649	-3.4	.79	5.30	.5988	.6	.37	01	
V0156		5.80	.6553	12.0	1.42	5.75	.6497	9.1	1.60	01	
V0158		5.00	.5649	-3.4	.79	4.85	.5480	-8.0	.73	01	
V0160		5.10	.5762	-1.5	.39	5.40	.6101	2.5	1.10	01	
V0161		4.65	.5254	-10.2	1.18	4.75	.5367	-9.9	.73	01	
V0166		4.45	.5028	-14.0	.39	4.75	.5367	-9.9	1.00	01	
V0169		4.96	.5600	-4.3	.35	5.04	.5700	-4.3	1.62	40	ORIGINAL IN NEWTON-METER
V0171		5.00	.5649	-3.4	.20	5.00	.5649	-5.1	.00	01	
V0182		4.78	.5400	-7.7	.95	4.91	.5550	-6.8	1.50	40	ORIGINAL IN NEWTON-METER
V0190		5.20	.5875	.5	.79	5.10	.5762	-3.2	.37	01	
V0207	X	8.40	.9491	62.3	2.40	9.05	1.0226	71.7	4.16X	01	
V0208		4.37	.4943	-15.5	1.50	4.47	.5051	-15.2	.00	01	
V0211		5.50	.6214	6.2	.79	5.55	.6271	5.3	.73	01	
V0213		6.47	.7316	25.1	.98	6.45	.7288	22.4	.18	01	
V0214		5.22	.5904	.9	1.38	5.25	.5932	-.4	.37	01	
V0217		4.55	.5141	-12.1	.00	4.75	.5367	-9.9	.00	01	
V0218		5.05	.5706	-2.4	1.08	4.90	.5537	-7.0	1.27	01	
V0221		4.96	.5600	-4.3	2.22	5.18	.5850	-1.8	.97	40	ORIGINAL IN NEWTON-METER
V0238	*	6.00	.6779	15.9	.47	6.43	.7271	22.1	.79	01	
V0243	X	4.75	.5367	-8.2	5.91X	5.65	.6384	7.2	1.00	01	
V0249	*	5.25	.5932	1.4	7.35X	5.75	.6497	9.1	3.66X	+70	DATA RECEIVED LATE
		5.18	.5849	= GR. MEAN =		5.27	.5955				3 TEST DETERMINATIONS
		.67	.0759	= SD MEANS =		.65	.0737				37 LABORATORIES IN GRAND MEANS
		.07	.0083	= AVER SDR =		.08	.0089				41 LABORATORIES REPORTING
		LB-IN.	N-M	= UNIT =		LB-IN.	N-M				


MINIMUM TORQUE
MATERIAL X91-X92 5.18 LB-IN. MATERIAL X93-X94 5.27 LB-IN.
MATERIAL X93-X94
MATERIAL X91-X92
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 40 - 5 MAXIMUM TORQUE - POUND-INCHES JUNE 1979

LAB CODE	F	MATERIAL X91-X92 COMMERCIAL TIRE TREAD MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	MATERIAL X93-X94 COMMERCIAL TIRE TREAD MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0061		24.00	2.7118	2.7	.25	24.17	2.7315	2.8	.43	01	
V0064		22.22	2.5112	-4.9	.74	22.51	2.5440	-4.2	.33	01	
V0071		22.90	2.5875	-2.0	.65	22.75	2.5705	-3.2	1.58	01	
V0074		22.97	2.5959	-1.7	1.25	22.95	2.5931	-2.4	2.61X	01	
V0078		23.05	2.6044	-1.4	4.83X	23.40	2.6440	-.4	.43	01	
V0079		22.07	2.4943	-5.6	.00	22.27	2.5169	-5.2	.00	01	
V0083		24.90	2.8135	6.5	2.61X	25.05	2.8304	6.6	2.06	01	
V0085		23.06	2.6051	-1.4	.66	23.01	2.6001	-2.1	.00	+74	ORIGINAL IN NEWTON-METER REC'D LATE
V0086		23.45	2.6496	.3	2.47X	23.40	2.6440	-.4	1.74	01	
V0090		22.42	2.5338	-4.1	1.10	22.82	2.5790	-2.9	5.00X	01	
V0092		26.20	2.9603	12.1	1.14	26.15	2.9547	11.3	.75	01	
V0095		22.90	2.5875	-2.0	.00	22.85	2.5818	-2.8	.00	01	
V0100		24.40	2.7570	4.4	.49	24.60	2.7796	4.7	1.74	01	
V0120	X	23.00	2.5988	-1.6	30.40X	22.30	2.5197	-5.1	52.93X	01	
V0128		21.75	2.4575	-7.0	1.87	21.80	2.4632	-7.3	.00	01	
V0144		24.70	2.7909	5.7	.49	25.10	2.8360	6.8	.00	01	
V0146		22.65	2.5592	-3.1	1.96	22.85	2.5818	-2.8	.43	01	
V0149		23.25	2.6270	-.5	.97	23.40	2.6440	-.4	.85	01	
V0150		25.00	2.8248	6.9	1.24	24.75	2.7965	5.3	2.17	01	
V0152		22.15	2.5027	-5.2	.00	22.15	2.5027	-5.8	.43	01	
V0154		23.00	2.5988	-1.6	.49	23.25	2.6270	-1.1	.87	01	
V0156		24.65	2.7852	5.4	3.22X	24.45	2.7626	4.0	3.98X	01	
V0158		23.75	2.6835	1.6	1.24	23.45	2.6496	-.2	.75	01	
V0160	*	27.50	3.1072	17.6	.49	27.55	3.1129	17.2	.43	01	
V0161		21.55	2.4349	-7.8	1.08	21.75	2.4575	-7.5	.43	01	
V0166		21.45	2.4236	-8.2	.49	21.65	2.4462	-7.9	.43	01	
V0169		22.48	2.5401	-3.8	.79	22.48	2.5401	-4.4	1.15	40	ORIGINAL IN NEWTON-METER
V0171		20.65	2.3332	-11.7	1.82	20.90	2.3615	-11.1	1.15	01	
V0182		21.68	2.4501	-7.2	1.53	21.91	2.4751	-6.8	2.91X	40	ORIGINAL IN NEWTON-METER
V0190		22.95	2.5931	-1.8	.49	22.95	2.5931	-2.4	.87	01	
V0207	*	26.55	2.9999	13.6	4.72X	26.90	3.0394	14.4	6.04X	01	
V0208		24.02	2.7140	2.8	1.38	23.74	2.6824	1.0	3.26X	01	
V0211		24.50	2.7683	4.8	1.08	24.45	2.7626	4.0	1.30	01	
V0213		24.35	2.7513	4.2	1.31	24.45	2.7626	4.0	1.52	01	
V0214		23.87	2.6976	2.1	1.14	23.97	2.7089	2.0	1.24	01	
V0217		22.30	2.5197	-4.6	1.73	22.65	2.5592	-3.6	.00	01	
V0218		23.15	2.6157	-1.0	.49	23.40	2.6440	-.4	1.30	01	
V0221		23.45	2.6501	.3	.66	23.76	2.6851	1.1	1.15	40	ORIGINAL IN NEWTON-METER
V0238		23.25	2.6270	-.5	.62	23.50	2.6553	-.0	.00	01	
V0243	*	22.20	2.5084	-5.6	3.92X	23.05	2.6044	-1.9	.43	01	
V0249		22.25	2.5140	-4.8	3.71X	22.25	2.5140	-5.3	2.17	+70	DATA RECEIVED LATE
		23.38	2.6413	= GR. MEAN =		23.51	2.6559				3 TEST DETERMINATIONS
		1.45	.1643	= SD MEANS =		1.41	.1595				38 LABORATORIES IN GRAND MEANS
		.12	.0132	= AVER SDR =		.07	.0075				41 LABORATORIES REPORTING
		LB-IN.	N-M	= UNIT =		LB-IN.	N-M				


MAXIMUM TORQUE
MATERIAL X91-X92 23.38 LB-IN. MATERIAL X93-X94 23.51 LB-IN.
MATERIAL X93-X94
MATERIAL X91-X92
18
19
20
21
22
23
24
25
26
27
28
29

NBS-114A (REV. 9-78)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. RUBBER CRP 40	2. Gov't. Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE

INTERLABORATORY PROGRAMS FOR RUBBER
Analyses No. 40
April - June 1979

5. Publication Date

August 9, 1979

6. Performing Organization Code

7. AUTHOR(S)

J. Horlick, G. W. Bullman, T. Cummings

8. Performing Organ. Report No.

NBSIR 79-1805

9. PERFORMING ORGANIZATION NAME AND ADDRESS

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, DC 20234

10. Project/Task/Work Unit No.

7825578

11. Contract/Grant No.

12. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS *(Street, City, State, ZIP)*

Collaborative Testing Services, Inc., 9241 Wood Glade Drive, Great Falls, VA 22066

13. Type of Report & Period Covered

FINAL

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

Collaborative Reference Programs provide participating laboratories with the means for checking periodically the level and uniformity of their testing in comparison with that of other participating laboratories. An important by-product of the programs is the provision of realistic pictures of the state of the testing art. This is one of the periodic reports showing averages for each participant, within and between laboratory variability, and other information for participants and standards committees.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

Collaborative reference program; Laboratory evaluation; Precision; Reference samples; Rubber; Testing calibration.

18. AVAILABILITY ☐ Unlimited

☒ For Official Distribution. Do Not Release to NTIS

☐ Order From Sup. of Doc., U.S. Government Printing Office, Washington, DC 20402, SD Stock No. SN003-003-

☐ Order From National Technical Information Service (NTIS), Springfield, VA. 22161

19. SECURITY CLASS (THIS REPORT)	21. NO. OF PRINTED PAGES
UNCLASSIFIED	27
20. SECURITY CLASS (THIS PAGE)	**22. Price**
UNCLASSIFIED	

USCOMM-DC