

NBS 12 78-1331

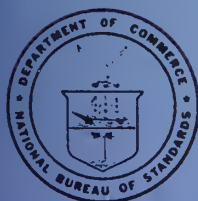
MCCA

MANUFACTURERS COUNCIL ON COLOR AND APPEARANCE

**COLLABORATIVE REFERENCE PROGRAM
COLOR AND APPEARANCE**

ASTM 60° GLOSS

REPORT NO. 22



**U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards**

NBS COLLABORATIVE REFERENCE PROGRAMS

TAPPI Paper and Board (6 times per year)

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

Rubber (4 times per year)

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

ASTM Textiles (3 times per year)

Flammability (FF3-71 and FF5-74)

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)

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Collaborative Reference Programs
B360 Polymer Building
National Bureau of Standards
Washington, D.C. 20234

**MANUFACTURERS COUNCIL ON
COLOR AND APPEARANCE**

**COLLABORATIVE REFERENCE PROGRAM
FOR
COLOR AND APPEARANCE**

ASTM 60° Gloss

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**U. S. DEPARTMENT OF COMMERCE
National Bureau of Standards**

INTRODUCTION

This Collaborative Reference Program is sponsored jointly by the Manufacturers Council on Color and Appearance and the National Bureau of Standards. Four times per year, gloss chip samples are distributed to each participating laboratory. After the data has been returned to and analyzed by NBS, two reports are sent to each participant. The first, the "preliminary" report, is an individualized report comparing a laboratory's results with the mean of all the results received by the data due date. The second, the "final" report, is a longer report (as illustrated by this report) showing the data from all participants.

A key to the tables and graphs is given on the following pages. Please make special note of the explanation of the "best values" given on page 2 of this report.

If there are any questions on the notes, the analyses, or the reports in general, contact Jeffrey Horlick or Jeffrey Stevenson or Edwin B. Randall on (301) 921-2946.

February 10, 1978

KEY TO TABLES AND GRAPHS

- MEAN - The average of individual TEST DETERMINATIONS. The number of TEST DETERMINATIONS in the mean is given in the upper right corner of the first table (TEST D.) and again at the bottom of this table.
- GRAND MEAN -
(GR. MEAN) The average of the individual laboratory MEANS, excluding laboratories flagged (see column F) with an X or # .
- DEV - The DEVIation of difference of the laboratory MEAN from the GRAND MEAN.
- N. DEV - The Normal DEVIate or ratio of the DEV to the SD OF MEANS; an indication of the degree of divergence of the laboratory MEAN from the GRAND MEAN.
- INST CODE - Code for instrument type or variation in condition, see second table.
- F - Flag, with following meaning:
- # - Excluded because data were not understood or because analysis indicates extreme performance values or non-compliance with required test procedures.
 - X - Excluded because plotted point would fall outside of the 99% error ellipse, (see below for explanation of Graph).
 - * - Included in grand means but plotted point would fall outside of the 95% error ellipse.
 - O - Included in grand mean and inside 95% error ellipse.
- Graph - For each laboratory the MEAN for the second sample is plotted against the MEAN for the first sample, with each point representing a laboratory. The horizontal and vertical lines are the GRAND MEANS. The dashed line is drawn at 45°. The solid sloping line, which may or may not lie close to the 45° line, is along the major axis of the error ellipse. The ellipse is drawn so that, on the average, it will include 95% of the points representing the laboratories.
- The rectangular area represents the ± 5 percent of magnitude of reading which is the ASTM precision statement for reproducibility for 60° gloss.

Plotted symbols are as explained above (under F). A participant whose plotted point falls outside of the ellipse or the rectangular area should carefully re-examine the testing procedure he is following.

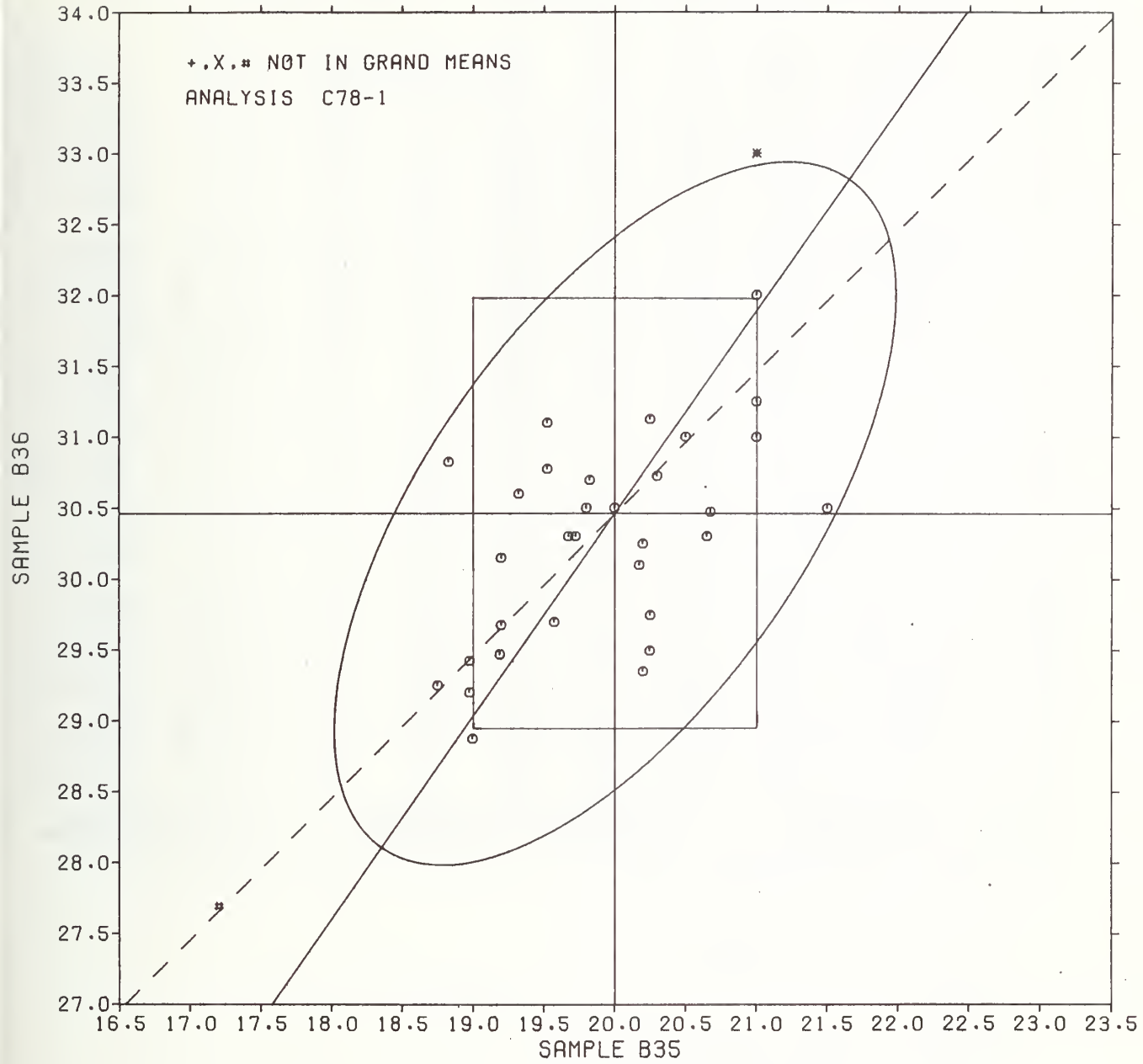
Note: Graphs are plotted with an ellipse when there are 20 or more instruments in the analysis. When there are 10 through 19 instruments in the analysis, the graph will be plotted but ellipses will be omitted. When there are fewer than 10 instruments retained in the analysis, the graph will not be plotted.

Best values -

Given at the end of Table 1 for 60° gloss. These values are based on the results obtained by the National Bureau of Standards and the National Research Council of Canada. All participants using equipment that is standard for the analysis should be able to achieve results within the plus-minus (\pm) limits, which are shown along with the best values.

ASTM 60-DEGREE GLOSS

SAMPLE B35 = 20.0 GLOSS UNITS SAMPLE B36 = 30.5 GLOSS UNITS



MCCA COLLABORATIVE REFERENCE PROGRAM
ANALYSIS C78-1 TABLE 1
60-DEGREE GLOSS
ASTM METHOD D523

LAB CODE	SAMPLE B35 MEAN	GLOSS SPECIMENS					SAMPLE B36 MEAN	GLOSS SPECIMENS					TEST D. * 4		
		DEV	N.DEV	SDR	R.SDR	DEV		N.DEV	SDR	R.SDR	VAR	F	LAB		
C200	20.20	.20	.26	.69	2.15	30.25	-.21	-.22	.75	1.89	78S	Ø	C200		
C251	15.75	-4.25	-5.59	.29	.90	27.12	-3.34	-3.51	.85	2.14	78H	#	C251		
C253	19.00	-1.00	-1.32	.22	.67	28.87	-1.59	-1.67	1.20	3.02	78H	Ø	C253		
C256	19.80	-.20	-.26	.08	.25	30.50	.04	.04	.52	1.31	78F	Ø	C256		
C281	17.17	-2.83	-3.72	.38	1.17	27.65	-2.81	-2.96	.37	.93	78D	#	C281		
C410A	21.00	1.00	1.31	.00	.00	31.00	.54	.57	.00	.00	78H	Ø	C410A		
C410B	21.00	1.00	1.31	.00	.00	32.00	1.54	1.62	.00	.00	78H	Ø	C410B		
C410C	21.00	1.00	1.31	.00	.00	31.00	.54	.57	.00	.00	78H	Ø	C410C		
C410D	21.00	1.00	1.31	.00	.00	33.00	2.54	2.67	.00	.00	78H	#	C410D		
C410E	21.00	1.00	1.31	.00	.00	33.00	2.54	2.67	.00	.00	78H	#	C410E		
C417	19.20	-.80	-1.05	.28	.88	29.67	-.79	-.83	.15	.38	78E	Ø	C417		
C418	20.25	.25	.33	.29	.90	29.50	-.96	-1.01	.41	1.03	78C	Ø	C418		
C420	18.97	-1.03	-1.35	.39	1.20	29.20	-1.26	-1.33	.22	.54	78F	Ø	C420		
C422	18.83	-1.17	-1.54	.14	.44	30.82	.36	.38	.54	1.37	78S	Ø	C422		
C426	19.72	-.28	-.36	.33	1.03	30.30	-.16	-.17	.14	.36	78E	Ø	C426		
C427	20.30	.30	.39	.22	.67	30.72	.26	.28	.30	.75	78F	Ø	C427		
C437	19.82	-.18	-.23	.15	.47	30.70	.24	.25	.47	1.18	78D	Ø	C437		
C440	20.65	.65	.85	.30	.93	30.30	-.16	-.17	.58	1.45	78F	Ø	C440		
C443	20.25	.25	.33	.96	2.98	29.75	-.71	-.75	.50	1.26	78C	Ø	C443		
C444	19.20	-.80	-1.05	.14	.44	30.15	-.31	-.33	.13	.32	78E	Ø	C444		
C445	20.20	.20	.26	.14	.44	29.35	-1.11	-1.17	.13	.32	78F	Ø	C445		
C446	19.57	-.43	-.56	.43	1.35	29.70	-.76	-.80	.23	.58	78S	Ø	C446		
C454	19.19	-.81	-1.07	.39	1.22	29.47	-.99	-1.04	.44	1.10	78E	Ø	C454		
C455	14.52	-5.48	-7.20	1.17	3.64	23.40	-7.06	-7.43	1.24	3.10	78F	#	C455		
C462	19.67	-.33	-.43	.05	.16	30.30	-.16	-.17	.22	.54	78F	Ø	C462		
C467	18.97	-1.03	-1.35	.44	1.38	29.42	-1.04	-1.09	.38	.95	78D	Ø	C467		
C475	20.50	.50	.66	.58	1.79	31.00	.54	.57	.00	.00	78B	Ø	C475		
C477	19.32	-.68	-.89	.54	1.67	30.60	.14	.15	.42	1.07	78F	Ø	C477		
C479	20.17	.17	.23	.24	.73	30.10	-.36	-.38	.29	.74	78B	Ø	C479		
C494	21.50	1.50	1.57	.58	1.79	30.50	.04	.04	.58	1.45	78C	Ø	C494		
C504	17.00	-3.00	-3.95	.58	1.79	26.50	-3.96	-4.17	.00	.00	78S	#	C504		
C506	19.52	-.48	-.63	.05	.16	30.77	.31	.33	.56	1.40	78E	Ø	C506		
C510	21.00	1.00	1.31	.00	.00	31.25	.79	.83	.50	1.26	78K	Ø	C510		
C517	19.60	-.40	-.53	.36	1.11	26.90	-3.56	-3.75	5.49	13.80	78F	#	C517		
C520	20.00	-.00	-.00	.00	.00	30.50	.04	.04	.58	1.45	78K	Ø	C520		
C531	20.25	.25	.33	.96	2.98	31.12	.66	.70	.43	1.09	78C	Ø	C531		
C538	18.75	-1.25	-1.65	.50	1.55	29.25	-1.21	-1.27	.50	1.26	78H	Ø	C538		
C543	20.67	.67	.89	.66	2.05	30.47	.01	.01	.68	1.71	78F	Ø	C543		
C576	19.52	-.48	-.63	.56	1.73	31.10	.64	.67	.90	2.26	78F	Ø	C576		

GR. MEAN = 20.00 GLOSS UNITS GRAND MEAN = 30.46 GLOSS UNITS TEST DETERMINATIONS = 4
SD MEANS = .76 GLOSS UNITS SD OF MEANS = .95 GLOSS UNITS 34 LABS IN GRAND MEANS
AVERAGE SDR = .32 GLOSS UNITS AVERAGE SDR = .40 GLOSS UNITS
TOTAL NUMBER OF LABORATORIES REPORTING = 39

Best Values: B35 19.89 ± 3 gloss units
 B36 29.98 ± 3 gloss units

NOTES:
C251, C281, C455, C504 - reported extreme test values
C517 - extreme within-lab standard deviation on sample B36

MCCA COLLABORATIVE REFERENCE PROGRAM
 ANALYSIS C78-1 TABLE 2
 60-DEGREE GLOSS
 ASTM METHOD D523

LAB CODE	F	MEANS		COORDINATES		AVG		PROPERTY---TEST	INSTRUMENT---CONDITIONS
		H35	H36	MAJOR	MINOR	R.	SDR VAR		
C455	#	14.52	23.40	-8.92	.44	3.37	78F	GLOSS, 60 DEGREE,	HUNTER D48 GLOSSMETER
C251	#	15.75	27.12	-5.17	1.57	1.52	78H	GLOSS, 60 DEGREE,	GARDNER GLOSSGARD-60
C504	#	17.00	26.50	-4.97	.19	.90	78S	GLOSS, 60 DEGREE,	SPECIAL INSTRUMENT
C281	#	17.17	27.65	-3.92	.70	1.05	78D	GLOSS, 60 DEGREE,	GARDNER PRECISION GLOSSMETER
C538	Ø	18.75	29.25	-1.71	.33	1.40	78H	GLOSS, 60 DEGREE,	GARDNER GLOSSGARD-60
C422	Ø	18.83	30.82	-.37	1.17	.90	78S	GLOSS, 60 DEGREE,	SPECIAL INSTRUMENT
C467	Ø	18.97	29.42	-1.44	.25	1.16	78D	GLOSS, 60 DEGREE,	GARDNER PRECISION GLOSSMETER
C420	Ø	18.97	29.20	-1.62	.12	.87	78F	GLOSS, 60 DEGREE,	HUNTER D48 GLOSSMETER
C253	Ø	19.00	28.87	-1.87	-.09	1.84	78H	GLOSS, 60 DEGREE,	GARDNER GLOSSGARD-60
C454	Ø	19.19	29.47	-1.28	.10	1.16	78E	GLOSS, 60 DEGREE,	HUNTER D16 GLOSSMETER
C444	Ø	19.20	30.15	-.71	.48	.38	78E	GLOSS, 60 DEGREE,	HUNTER D16 GLOSSMETER
C417	Ø	19.20	29.67	-1.10	.21	.63	78E	GLOSS, 60 DEGREE,	HUNTER D16 GLOSSMETER
C477	Ø	19.32	30.60	-.27	.63	1.37	78F	GLOSS, 60 DEGREE,	HUNTER D48 GLOSSMETER
C506	Ø	19.52	30.77	-.02	.57	.78	78E	GLOSS, 60 DEGREE,	HUNTER D16 GLOSSMETER
C576	Ø	19.52	31.10	.25	.76	1.99	78F	GLOSS, 60 DEGREE,	HUNTER D48 GLOSSMETER
C446	Ø	19.57	29.70	-.87	-.09	.97	78S	GLOSS, 60 DEGREE,	SPECIAL INSTRUMENT
C517	#	19.60	26.90	-3.15	-1.71	7.45	78F	GLOSS, 60 DEGREE,	HUNTER D48 GLOSSMETER
C462	Ø	19.67	30.30	-.32	.18	.35	78F	GLOSS, 60 DEGREE,	HUNTER D48 GLOSSMETER
C426	Ø	19.72	30.30	-.29	.13	.69	78E	GLOSS, 60 DEGREE,	HUNTER D16 GLOSSMETER
C256	Ø	19.80	30.50	-.08	.19	.78	78F	GLOSS, 60 DEGREE,	HUNTER D48 GLOSSMETER
C437	Ø	19.82	30.70	.09	.28	.82	78D	GLOSS, 60 DEGREE,	GARDNER PRECISION GLOSSMETER
C520	Ø	20.00	30.50	.03	.02	.73	78K	GLOSS, 60 DEGREE,	BYK-MALLINKRODT MULTIGLOSS
C479	Ø	20.17	30.10	-.20	-.35	.74	78H	GLOSS, 60 DEGREE,	GARDNER MULTIANGLE GLOSSMETER
C445	Ø	20.20	29.35	-.80	-.80	.38	78P	GLOSS, 60 DEGREE,	HUNTER D48 GLOSSMETER
C200	Ø	20.20	30.25	-.06	-.28	2.02	78S	GLOSS, 60 DEGREE,	SPECIAL INSTRUMENT
C418	Ø	20.25	29.50	-.64	-.75	.96	78C	GLOSS, 60 DEGREE,	GARDNER PORTABLE GLOSSMETER
C531	Ø	20.25	31.12	.69	.18	2.03	78C	GLOSS, 60 DEGREE,	GARDNER PORTABLE GLOSSMETER
C443	Ø	20.25	29.75	-.44	-.61	2.12	78C	GLOSS, 60 DEGREE,	GARDNER PORTABLE GLOSSMETER
C427	Ø	20.30	30.72	.39	-.09	.71	78F	GLOSS, 60 DEGREE,	HUNTER D48 GLOSSMETER
C475	Ø	20.50	31.00	.73	-.10	.90	78H	GLOSS, 60 DEGREE,	GARDNER MULTIANGLE GLOSSMETER
C440	Ø	20.65	30.30	.24	-.62	1.19	78F	GLOSS, 60 DEGREE,	HUNTER D48 GLOSSMETER
C543	Ø	20.67	30.47	.40	-.54	1.88	78P	GLOSS, 60 DEGREE,	HUNTER D48 GLOSSMETER
C410C	Ø	21.00	31.00	1.01	-.51	.00	78H	GLOSS, 60 DEGREE,	GARDNER GLOSSGARD-60
C510	Ø	21.00	31.25	1.22	-.37	.63	78K	GLOSS, 60 DEGREE,	BYK-MALLINKRODT MULTIGLOSS
C410D	#	21.00	33.00	2.65	.64	.00	78H	GLOSS, 60 DEGREE,	GARDNER GLOSSGARD-60
C410E	#	21.00	33.00	2.65	.64	.00	78H	GLOSS, 60 DEGREE,	GARDNER GLOSSGARD-60
C410A	Ø	21.00	31.00	1.01	-.51	.00	78H	GLOSS, 60 DEGREE,	GARDNER GLOSSGARD-60
C410B	Ø	21.00	32.00	1.83	.06	.00	78H	GLOSS, 60 DEGREE,	GARDNER GLOSSGARD-60
C494	Ø	21.50	30.50	.89	-1.21	1.62	78C	GLOSS, 60 DEGREE,	GARDNER PORTABLE GLOSSMETER
GMEANS:		20.00	30.46			1.00			
		95% ELLIPSE:		2.88	1.34	WITH GAMMA = 55 DEGREES			

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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.			
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