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MCCA

MANUFACTURERS COUNCIL ON COLOR AND APPEARANCE

COLLABORATIVE REFERENCE PROGRAM COLOR AND APPEARANCE

ASTM 60° GLOSS

REPORT NO. 29



U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards

QC
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.U56
79-1815
1979
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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	Moisture content
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

CTS Rubber (4 times per year)

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

ASTM Cement (2 times per year)

Chemical (11 chemical components)
Physical (15 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. 10/79

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**MANUFACTURERS COUNCIL ON
COLOR AND APPEARANCE**

**COLLABORATIVE REFERENCE PROGRAM
FOR
COLOR AND APPEARANCE**

ASTM 60° Gloss

**T. L. Cummings
CTS-NBS Research Associate**

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

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

NBSIR 79-1815

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 on (301) 921-2946.

November 30, 1979

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:
- 0 - Included in grand mean and inside 95% error ellipse
 - * - Included in grand means but plotted point would fall outside of the 95% error ellipse.
 - X - Excluded because plotted point would fall outside of the 99% error ellipse, (see below for explanation of Graph).
 - # - Excluded because data were not understood, late or because analysis indicates extreme performance values or noncompliance with required test procedures.
- 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.

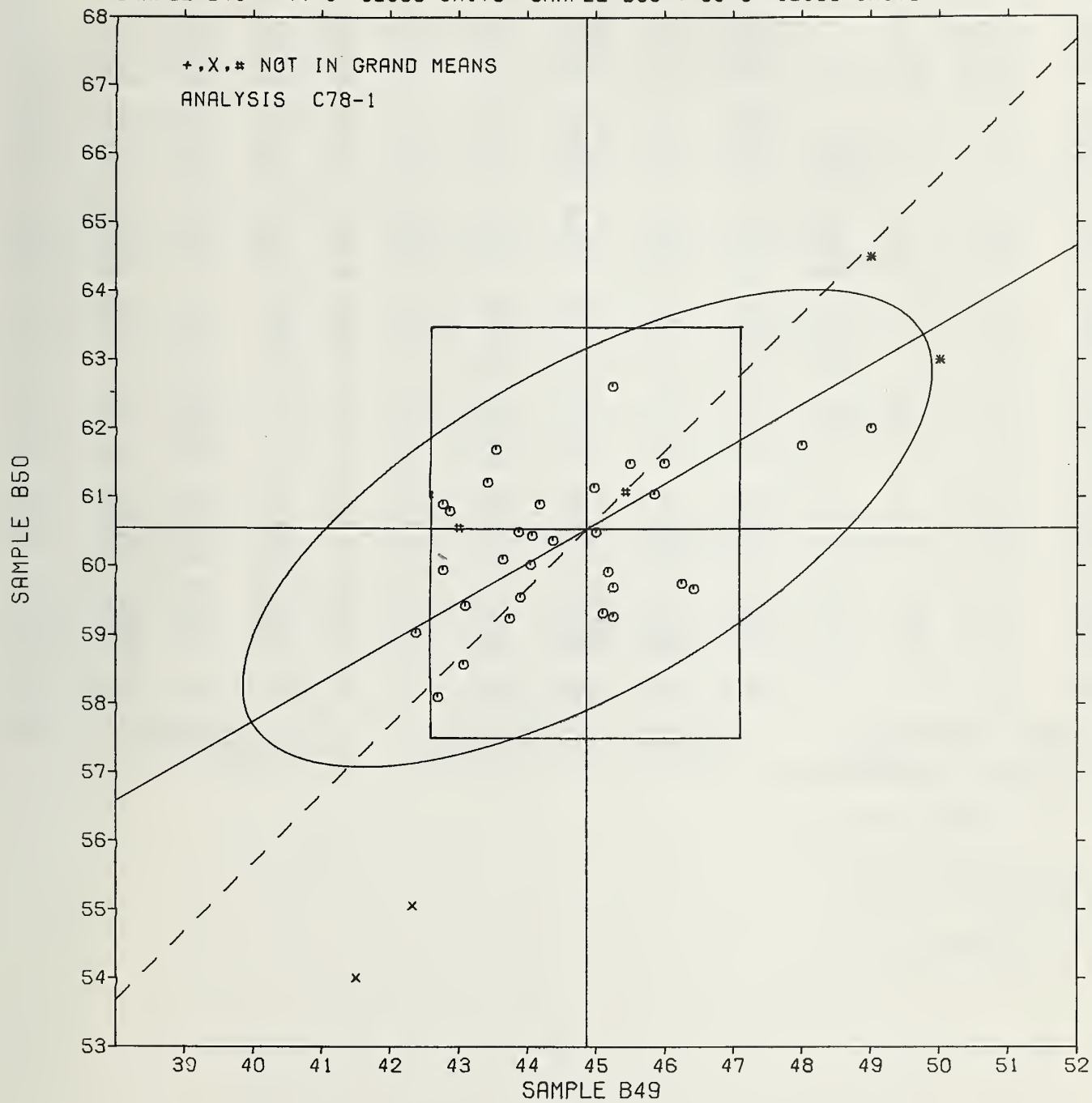
Note: Graphs are plotted with an ellipse when there are 20 or more instruments in the analysis. When there are 10 through 19 instruments in the analysis, the graph will be plotted but ellipses will be omitted. When there are fewer than 10 instruments retained in the analysis, the graph will not be plotted.

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 (+) limits, which are shown along with the best values.

ASTM 60-DEGREE GLOSS

SAMPLE B49 = 44.9 GLOSS UNITS SAMPLE B50 = 60.5 GLOSS UNITS



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

LAB CODE	SAMPLE B49 GLOSS SPECIMENS					SAMPLE B50 GLOSS SPECIMENS					TEST D.= 4		
	MEAN	DEV	N.DEV	SDR	R.SDR	MEAN	DEV	N.DEV	SDR	R.SDR	VAR	F	LAB
C200	45.25	.39	.20	1.04	1.43	59.70	-.85	-.64	.12	.19	78S	C	C200
C206	45.25	.39	.20	.31	.43	59.27	-1.27	-.96	.45	.72	78F	C	C206
C251	45.37	.51	.27	.25	.34	61.00	.45	.34	.41	.66	78H	#	C251
C253	42.77	-2.09	-1.09	.56	.77	60.90	.35	.26	.39	.63	78H	C	C253
C256	44.07	-.79	-.41	1.30	1.79	60.45	-.10	-.07	.58	.93	78F	O	C256
C281	45.10	.24	.12	.42	.58	59.32	-1.22	-.92	.33	.53	78O	O	C281
C410A	46.00	1.14	.59	.00	.00	61.50	.95	.72	.58	.93	78H	O	C410A
C4108	48.00	3.14	1.63	1.15	1.59	61.75	1.20	.90	.96	1.54	78H	C	C4108
C410C	50.00	5.14	2.67	.00	.00	63.00	2.45	1.84	.00	.00	78H	*	C410C
C4100	49.00	4.14	2.15	.00	.00	62.00	1.45	1.09	1.15	1.86	78H	O	C4100
C410E	49.00	4.14	2.15	.00	.00	64.50	3.95	2.97	1.73	2.79	78H	*	C410E
C417	43.90	-.96	-.50	.96	1.32	59.55	-1.00	-.75	.13	.21	78F	O	C417
C418	43.87	-.99	-.51	.25	.34	60.50	-.05	-.04	.41	.66	78C	O	C418
C420	46.42	1.56	.81	.49	.68	59.67	-.87	-.66	1.26	2.02	78F	C	C420
C422	42.38	-2.48	-1.29	.90	1.24	59.03	-1.52	-1.14	.52	.83	78S	O	C422
C427	44.97	.11	.06	.42	.58	61.15	.60	.45	.31	.50	78F	O	C427
C437	43.07	-1.79	-.93	.15	.21	58.57	-1.97	-1.48	.67	1.07	78D	O	C437
C440	43.42	-1.44	-.75	.30	.41	61.22	.68	.51	.75	1.21	78F	C	C440
C444	45.85	.99	.51	1.98	2.72	61.05	.50	.38	.93	1.50	78C	C	C444
C446	42.77	-2.09	-1.09	.26	.36	59.95	-.60	-.45	.30	.48	78S	O	C446
C454	44.18	-.68	-.35	.95	1.31	60.90	.36	.27	.38	.62	78E	O	C454
C455	43.55	-1.31	-.68	.77	1.06	61.70	1.15	.87	.32	.51	78F	O	C455
C462	43.65	-1.21	-.63	.58	.80	60.10	-.45	-.34	1.15	1.86	78F	O	C462
C467	44.37	-.49	-.25	1.76	2.43	60.37	-.17	-.13	.50	.80	78C	O	C467
C475	43.75	-1.11	-.58	1.50	2.07	59.25	-1.30	-.98	.50	.80	78B	O	C475
C484	45.00	.14	.07	.82	1.12	60.50	-.05	-.04	.58	.93	788	O	C484
C494	44.05	-.81	-.42	.51	.70	60.02	-.52	-.39	1.22	1.96	788	O	C494
C495	45.25	.39	.20	1.26	1.73	62.62	2.08	1.56	.75	1.21	78H	O	C495
C506	42.32	-2.54	-1.32	.88	1.22	55.05	-5.50	-4.13	1.00	1.61	78E	X	C506
C508	45.17	.31	.16	1.17	1.61	59.92	-.62	-.47	.30	.48	78F	O	C508
C517	43.10	-1.76	-.92	.22	.30	59.42	-1.12	-.84	1.07	1.72	78F	O	C517
C520	42.95	-1.91	-1.00	.66	.91	60.47	-.07	-.05	.64	1.03	78K	#	C520
C538	46.25	1.39	.72	.50	.69	59.75	-.80	-.60	.96	1.54	78H	O	C538
C543	42.70	-2.16	-1.13	.32	.44	58.10	-2.45	-1.84	.42	.68	78I	O	C543
C574	42.87	-1.99	-1.03	1.10	1.52	60.80	.25	.19	.71	1.15	78S	C	C574
C705	41.50	-3.36	-1.75	.58	.79	54.00	-6.55	-4.92	.82	1.31	78H	X	C705
C709	45.50	.64	.33	.58	.79	61.50	.95	.72	.58	.93	78C	O	C709

GR. MEAN = 44.86 GLOSS UNITS GRAND MEAN = 60.55 GLOSS UNITS TEST DETERMINATIONS = 4
SD MEANS = 1.92 GLOSS UNITS SD OF MEANS = 1.33 GLOSS UNITS 33 LABS IN GRAND MEANS
AVERAGE SDR = .73 GLOSS UNITS AVERAGE SDR = .62 GLOSS UNITS
TOTAL NUMBER OF LABORATORIES REPORTING = 37

Best values: B49 44.05 ± 3 gloss units
B50 59.83 ± 3 gloss units

Data from labs C251 and C520 were received late and not included in the Grand Mean.

Data from lab C612 was not received in time to appear in this report.

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

1979-1980

LAB CODE	F	MEANS		COORDINATES		AVG		PROPERTY---	TEST	INSTRUMENT---	CONDITIONS
		B49	B50	MAJOR	MINOR	R.SDR	VAR				
C705	X	41.50	54.00	-6.19	-3.99	1.05	78H	GLOSS, 60	DEGREE,	GARDNER GLOSSGARD-60	
C506	X	42.32	55.05	-4.95	-3.49	1.41	78E	GLOSS, 60	DEGREE,	HUNTER D16 GLOSSMETER	
C422	O	42.38	59.03	-2.91	-0.07	1.03	78S	GLOSS, 60	DEGREE,	SPECIAL INSTRUMENT	
C543	O	42.70	58.10	-3.10	-1.04	.56	78I	GLOSS, 60	DEGREE,	LOCKWOOD+MCLORIE GLOSSMETER	
C253	O	42.77	60.90	-1.63	1.35	.70	78H	GLOSS, 60	DEGREE,	GARDNER GLOSSGARD-60	
C446	O	42.77	59.95	-2.11	.53	.42	78S	GLOSS, 60	DEGREE,	SPECIAL INSTRUMENT	
C574	O	42.87	60.80	-1.60	1.21	1.33	78S	GLOSS, 60	DEGREE,	SPECIAL INSTRUMENT	
C520	#	42.95	60.47	-1.69	.89	.97	78K	GLOSS, 60	DEGREE,	BYK-MALLINKRODT MULTIGLOSS	
C437	O	43.07	58.57	-2.54	-.81	.64	78O	GLOSS, 60	DEGREE,	GARDNER PRECISION GLOSSMETER	
C517	O	43.10	59.42	-2.09	-.09	1.01	78F	GLOSS, 60	DEGREE,	HUNTER D48 GLOSSMETER	
C440	O	43.42	61.22	-.91	1.31	.81	78F	GLOSS, 60	DEGREE,	HUNTER D48 GLOSSMETER	
C455	O	43.55	61.70	-.56	1.66	.78	78F	GLOSS, 60	DEGREE,	HUNTER D48 GLOSSMETER	
C462	O	43.65	60.10	-1.28	.22	1.33	78F	GLOSS, 60	DEGREE,	HUNTER D48 GLOSSMETER	
C475	O	43.75	59.25	-1.61	-.57	1.43	78B	GLOSS, 60	DEGREE,	GARDNER MULTIANGLE GLOSSMETER	
C418	O	43.87	60.50	-.88	.45	.50	78C	GLOSS, 60	DEGREE,	GARDNER PORTABLE GLOSSMETER	
C417	C	43.90	59.55	-1.33	-.38	.76	78F	GLOSS, 60	DEGREE,	HUNTER D48 GLOSSMETER	
C494	O	44.05	60.02	-.97	-.05	1.33	78B	GLOSS, 60	DEGREE,	GARDNER MULTIANGLE GLOSSMETER	
C256	O	44.07	60.45	-.73	.31	1.36	78F	GLOSS, 60	DEGREE,	HUNTER D48 GLOSSMETER	
C454	O	44.18	60.90	-.41	.65	.56	78E	GLOSS, 60	DEGREE,	HUNTER D16 GLOSSMETER	
C467	O	44.37	60.37	-.51	.10	1.61	78C	GLOSS, 60	DEGREE,	GARDNER PORTABLE GLOSSMETER	
C427	O	44.97	61.15	.40	.47	.54	78F	GLOSS, 60	DEGREE,	HUNTER D48 GLOSSMETER	
C484	O	45.00	60.50	.09	-.11	1.03	78B	GLOSS, 60	DEGREE,	GARDNER MULTIANGLE GLOSSMETER	
C281	O	45.10	59.32	-.41	-1.18	.56	78O	GLOSS, 60	DEGREE,	GARDNER PRECISION GLOSSMETER	
C508	O	45.17	59.92	-.04	-.69	1.05	78F	GLOSS, 60	DEGREE,	HUNTER D48 GLOSSMETER	
C200	O	45.25	59.70	-.09	-.93	.81	78S	GLOSS, 60	DEGREE,	SPECIAL INSTRUMENT	
C206	O	45.25	59.27	-.30	-1.30	.58	78F	GLOSS, 60	DEGREE,	HUNTER D48 GLOSSMETER	
C495	O	45.25	62.62	1.37	1.61	1.47	78H	GLOSS, 60	DEGREE,	GARDNER GLOSSGARD-60	
C251	#	45.37	61.00	.67	.14	.50	78H	GLOSS, 60	DEGREE,	GARDNER GLOSSGARD-60	
C709	O	45.50	61.50	1.03	.51	.86	78C	GLOSS, 60	DEGREE,	GARDNER PORTABLE GLOSSMETER	
C444	D	45.85	61.05	1.10	-.06	2.11	78C	GLOSS, 60	DEGREE,	GARDNER PORTABLE GLOSSMETER	
C410A	O	46.00	61.50	1.46	.26	.46	78H	GLOSS, 60	DEGREE,	GARDNER GLOSSGARD-60	
C538	O	46.25	59.75	.80	-1.38	1.11	78H	GLOSS, 60	DEGREE,	GARDNER GLOSSGARD-60	
C420	O	46.42	59.67	.91	-1.54	1.35	78F	GLOSS, 60	DEGREE,	HUNTER D48 GLOSSMETER	
C410B	O	48.00	61.75	3.32	-.53	1.57	78H	GLOSS, 60	DEGREE,	GARDNER GLOSSGARD-60	
C410E	*	49.00	64.50	5.56	1.35	1.39	78H	GLOSS, 60	DEGREE,	GARDNER GLOSSGARD-60	
C410D	O	49.00	62.00	4.31	-.81	.93	78H	GLOSS, 60	DEGREE,	GARDNER GLOSSGARD-60	
C410C	*	50.00	63.00	5.67	-.44	.00	78H	GLOSS, 60	DEGREE,	GARDNER GLOSSGARD-60	
GMEANS:		44.86	60.55			1.00					
		95% ELLIPSE:		5.64	2.35	WITH GAMMA = 30 DEGREES					

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