MCCA

MANUFACTURERS COUNCIL ON COLOR AND APPEARANCE

COLLABORATIVE REFERENCE PROGRAM

COLOR AND APPEARANCE

COLOR AND COLOR DIFFERENCE

REPORT NO. 29

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
- Moisture content
- 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

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

MANUFACTURERS COUNCIL ON
COLOR AND APPEARANCE

COLLABORATIVE REFERENCE PROGRAM FOR COLOR AND APPEARANCE

COLOR AND COLOR DIFFERENCE

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U. S. DEPARTMENT OF COMMERCE
National Bureau of Standards

NBSIR 79-1818

INTRODUCTION

The NBS-MCCA Collaborative Reference Program for Color and Appearance is sponsored by the Manufacturers Council on Color and Appearance and the National Bureau of Standards. Four times per year, paint chip samples and near white paper samples, along with a white calibration check sample, are distributed to participating laboratories. Participants in the paint chip test receive two pairs of color samples (from the full color spectrum) along with a white calibration sample. Participants in the near white paper test receive two sets of eight near white papers along with a white calibration sample. Laboratories can participate in either or both tests. The samples are tested by the laboratories and the data is returned to NBS for analysis.

Each test is analyzed in both X,Y,Z and L,a,b color spaces. The X,Y,Z space analysis is primarily for spectrophotometers while the L,a,b space analysis is primarily for colorimeters. A laboratory must specify in which space it wishes to receive its analyses.

Data from each laboratory is processed in a "normal" and an "adjusted" analysis. In the "normal" analysis, the laboratory's data is used as reported. In the "adjusted" analysis, the laboratory's data is first adjusted using a correction factor generated from that laboratory's white calibration sample data (see Explanation of Data For White Sample).

For comparison purposes, reflectance values for single specimens of the paint chip samples at 40 wavelengths ranging from 380 to 770 nm and colorimetric data for 45/0 reflectance factor have been provided by NBS.

Also for comparison purposes, a plot of the spectrophotometric curves of single paint chip specimens was provided by Hemmendinger Color Laboratory, Belvedere, New Jersey.

If there are any questions on the notes, analyses, or the report in general, contact Jeffrey Horlick or Thomas Cummings on (301) 921-2946.

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KEY TO TABLES

MEAN - The average of individual test determinations.

GRAND MEAN - (GR. MEAN) The average of the individual laboratory MEANS, excluding laboratories flagged (see column F) with an X, #, or +.

SD OF MEANS - The standard deviation of the laboratory MEANS about the GRAND MEAN: an index of the among-laboratory precision.

INST CODE - Code for instrument type and color space used to report measurements, see Table of Instrument Codes

F - Flag, is based on ΔE column with the following meaning:

- 0 - Included in grand mean analysis.
- * - Included in grand means but results are between two and three standard deviations. The participants should take this as a warning to reexamine testing procedures.
- X - Excluded from all calculations because ΔE is beyond (3) standard deviations.
- + - Excluded from all grand mean calculations because lab is using a nonstandard instrument or test method.
- # - Excluded from all grand mean calculations because data were not understood, data were extreme, late, or insufficient information was supplied concerning instrument and test method used.

Note: In addition to flag (F) based on delta E column, it is also possible to have either an X or an * on individual MEANS as follows:

X - following a MEAN signifies that the mean is greater than 3 SD of MEANS from the Grand Mean. The values for this laboratory have been omitted in the calculations involving the MEAN for the column.

* - following any of the MEANS signifies that the quantity is greater than 2 but less than 3 of the appropriate standard deviations from the corresponding average. The participant should take this as a warning to reexamine his testing procedures.

ΔE - Total color difference between two samples. In X, Y, Z analysis it is calculated in MacAdams (FMC II) units. For L, a, b analysis it is calculated in Hunter units.

ΔE Calculation

ΔE is calculated in the Color and Color Difference Collaborative Reference Program by the FMC2* equations (X, Y, Z analysis) as follows:

The yellow-blue chromatic difference is

$$\Delta C_1 = K_1 S(P\Delta P + Q\Delta Q)/bD^2 - K_1\Delta S/b;$$

the lightness difference is

$$\Delta L = 0.279K_2(P\Delta P + Q\Delta Q)/aD;$$

and the red-green chromatic difference is

$$\Delta C_3 = K_1(Q\Delta P - P\Delta Q)/aD.$$

The quantity, D, is an abbreviation,

$$D = (P^2 + Q^2)^{1/2}.$$

$$K_1 = 0.55669 + 0.049434\,Y - 0.82575\cdot10^{-3}Y^2 + 0.79172\cdot10^{-5}Y^3 - 0.30087\cdot10^{-7}Y^4,$$

$$K_2 = 0.17548 + 0.027556\,Y - 0.57262\cdot10^{-3}Y^2 + 0.63893\cdot10^{-5}Y^3 - 0.26731\cdot10^{-7}Y^4,$$

$$a^2 = 17.3\cdot10^{-6}(P^2 + Q^2)/[1 + 2.73P^2Q^2/(P^4 + Q^4)],$$

$$b^2 = 3.098\cdot10^{-4}(S^2 + 0.2015\,Y^2)$$

$$P = 0.724\,X + 0.382\,Y - 0.098\,Z,$$

$$Q = -0.48\,X + 1.37\,Y + 0.1276\,Z,$$

$$S = 0.686\,Z,$$

$$\Delta E = [(\Delta C_1)^2 + (\Delta L)^2 + (\Delta C_3)^2]^{1/2}$$

*Friele-MacAdam-Chickering metric

NBS-MCCA COLLABORATIVE REFERENCE PROGRAM

TEST METHOD CODES

FOR PAINT CHIPS AND NEAR WHITE PAPERS

INSTRUMENT CODE PAINT	INSTRUMENT CODE PAPER	INSTRUMENT	COLOR SPACE	DATA CODE
C70AC	C71AC	ACS SPECTRA SENSOR	X Y Z	9014
C70BL	C71BL	B+L 505 SPECTROPHOTOMETER	X Y Z	9014
C70CA	C71CA	CARY 14	X Y Z	9014
C70CD	C71CD	COLOR EYE SMALL SPHERE	X Y Z	9014
C70CE	C71CE	COLOR EYE SMALL SPHERE	XX'YZ,4V	9016
C70CF	C71CF	COLOR EYE SMALL SPHERE	XYZ,BaSO4	9017
C70CG	C71CG	COLOR EYE SMALL SPHERE	XX'YZ,Ba	9018
C70CH	C71CH	COLOR EYE SMALL SPHERE	XYZ,3V	9011
C70CL	C71CL	COLOR EYE LARGE SPHERE	XX'YZ,4V	9016
C70CM	C71CM	COLOR EYE LARGE SPHERE	XX'YZ,Ba	9018
C70CN	C71CN	COLOR EYE LARGE SPHERE	XYZ,BaSO4	9017
C70DC	C71DC	DIANO CHROMASCAN SPECTROPHOTOMETER	X Y Z	9014
C70DH	C71DH	DIANO MATCH SCAN SPECTROPHOTOMETER	X Y Z	9014
C70DK	C71DK	DIANO/LSCE AUTOMATE	XYZ,BaSO4	9017
C70DL	C71DL	DIANO/LSCE AUTOMATE	XYZ,3V,4F	9019
C70DM	C71DM	DIANO/LSCE AUTOMATE	XX'YZ,4V	9016
C70DS	C71DS	DIANO/SSCE AUTOMATE	XX'YZ,Ba	9018
C70DT	C71DT	DIANO/SSCE AUTOMATE	XYZ,BaSO4	9017
C70GA	C71GA	GARDNER AUTO AC2/AC3	L a b	9013
C70GB	C71GB	GARDNER AUTO AC2/AC3	X Y Z	9014
C70GC	C71GC	GARDNER XL-20/XL-30 SERIES	X Y Z	9014
C70GD	C71GD	GARDNER XL-20/XL-30 SERIES	L a b	9013
C70GE	C71GE	GE/DIANO/HARDY SPECTROPHOTOMETER	X Y Z	9014
C70GK	C71GK	GARDNER XL-70	X Y Z	9014
C70GL	C71GL	GARDNER XL-70	L a b	9013
C70GM	C71GM	GARDNER MULTIPURPOSE REFLECTOMETER	X Y Z	9014
C70GP	C71GP	GARDNER XL-200 SERIES	L a b	9013
C70GX	C71GX	GARDNER XL-10	L a b	9013
C70GY	C71GY	GARDNER XL-10	X Y Z	9014
C70HA	C71HA	HUNTER D25A (DA,D1A,D2A)	L a b	9013
C70HB	C71HB	HUNTER D25A (DA,D1A,D2A)	X Y Z	9014
C70HF	C71HF	HUNTER D25AA	L a b	9013
C70HG	C71HG	HUNTER D25AA	X Y Z	9014
C70HM	C71HM	HUNTER D25M (DM,D1M,D2M)	L a b	9013
C70HN	C71HN	HUNTER D25M (DM,D1M,D2M)	X Y Z	9014
C70HP	C71HP	HUNTER D25P (DP,D1P,D2P)	X Y Z	9014
C70HQ	C71HQ	HUNTER D25P (DP,D1P,D2P)	L a b	9013
C70HR	C71HR	HUNTER D25A (DA,D1A,D2A)	Rd a b	9012
C70HT	C71HT	HUNTER D54 SPECTROPHOTOMETER	X Y Z	9014
C70HU	C71HU	HUNTER D54 SPECTROPHOTOMETER	L a b	9013
C70IB	C71IB	IBM SPECTROPHOTOMETER	X Y Z	9014
C70KC	C71KC	KCS-18	XX'YZ,4V	9016
C70KD	C71KD	KCS-18	XX'YZ,Ba	9018
C70KS	C71KS	KCS-18	X Y Z	9014
C70KT	C71KT	KCS-40	X Y Z	9014
C70LS	C71LS	LERES TRILAC	X Y Z	9014
C70LT	C71LT	LERES TRILAC	XYZ,3V	9011
C70MD	C71MD	MACBETH MS2000 SPECTROPHOTOMETER	X Y Z	9014
C70ME	C71ME	MACBETH MS2000 SPECTROPHOTOMETER	L a b	9013
C70MG	C71MG	MACBETH MC1010	L a b	9013
C70MH	C71MH	MACBETH MC1010	X Y Z	9014
C70MS	C71MS	MARTIN SWEETS	X Y Z	9014
C70MT	C71MT	MARTIN SWEETS	XX'YZ,Ba	9018
C70ND	C71ND	NEOTEC 220 DU COLOR	R G B	9015
C70NE	C71NE	NEOTEC 220 DU COLOR	X Y Z	9014
C70SA	C71SA	SPECIAL INSTRUMENT - INCLUDED	X Y Z	9014
C70SB	C71SB	SPECIAL INSTRUMENT - INCLUDED	Rd a b	9012
C70SC	C71SC	SPECIAL INSTRUMENT - INCLUDED	L a b	9013
C70SL	C71SL	SPECIAL INSTRUMENT - INCLUDED	R G B	9015
C70SP	C71SP	SPECIAL INSTRUMENT - EXCLUDED	X Y Z	9014
C70SQ	C71SQ	SPECIAL INSTRUMENT - EXCLUDED	Rd a b	9012
C70SR	C71SR	SPECIAL INSTRUMENT - EXCLUDED	L a b	9013
C70SS	C71SS	SPECIAL INSTRUMENT - EXCLUDED	R G B	9015
C70ZD	C71ZD	ZEISS DMC25	X Y Z	9014
C70ZE	C71ZE	ZEISS ELREPHO	X Y Z	9014
C70ZF	C71ZF	ZEISS ELREPHO	R G B	9015
C70XX	C71XX	GIVE INSTRUMENT MAKE AND MODEL	NOT SPECIFIED	9020

FORMAT OF COLORIMETRIC (INPUT) DATA

DATA CODE	COLOR SCALE
9011	X,Y,Z 3 FUNCTION VITROLITE CORRECTION
9012	Rd,a,b
9013	L,a,b HUNTER
9014	X,Y,Z
9015	R,G,B
9016	X,X',Y,Z 4 FUNCTION VITROLITE CORRECTION
9017	X,Y,Z, BaSO4 CORRECTION
9018	X,X',Y,Z BaSO4 CORRECTION
9019	X,Y,Z 4 FUNCTION VITROLITE CORRECTION
9020	(NON-STD. INST. SCALE SPECIFIED WITH DATA)

Notes on Specific Laboratory Results for Paint Chips

C233, C547	- Reported extreme values compared to other labs for four colored samples
C251, C253, C437, C472, C476, C524, C567, C726	- Data included in body of report but received too late for checking and therefore not used in statistical computation
C255,C446, C521A, C521B, C526, C612	- Data received too late to be included in this report
C320	- Apparent reporting or measurement problem
C514A, C662, C717A, C717B, C727A, C727B, C720	- Used illuminant D 65
C442	- Reported no difference between samples D09 and D10 on Means L and a
C524	- Reported extreme values compared to other labs on Mean X and Mean Y for samples D09 and D10
C534	- Reported extreme values compared to other labs on Mean Z for samples D09 and D10, reported extreme values for Means for X, Y. and Z for samples D11 and D12
C705, C707, C716	- Reported extreme values for all five samples
C709	- Made corrections to Data too late to be included in statistical computation

X, Y, Z SPACE ANALYSIS, NORMAL DATA
COLOR • COLOR DIFFERENCE
FOR PAINT CHIPS

LAB CODE	F	SAMPLE D09 MEAN X	MEAN Y	MEAN Z	SAMPLE D10 MEAN X	MEAN Y	MEAN Z	DIFFERENCE D10 - D09 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C157	X	60.56	59.56	14.67	60.15	58.69	14.72	-.41	-.87	.05	3.07X	70GE	C157
C162	ó	60.65	60.16	15.86	60.31	59.25*	15.85	-.34	-.91	-.01	3.78	70DH	C162
C251	#	60.28	58.35	14.68	59.73	57.25	14.80	-.55	-1.10	-.08	3.93	70ZE	C251
C253	#	60.32	58.86	15.79	59.98	57.90	15.89	-.34	-.96	.10	4.16	70GC	C253
C278	ó	60.70	59.60	16.60X	60.30	58.65	16.60X	-.40	-.95	.00	3.67	70NE	C278
C407	ó	60.43	59.57	15.42	60.01	58.55	15.64	-.42	-1.03	.22 X	3.86	70SA	C407
C412	ó	60.04	59.42	15.39	59.75	58.49	15.36	-.28	-.93	-.02	4.27	70GE	C412
C414	ó	58.76	57.84	14.98	58.39	56.81	14.79	-.37	-1.03	-.19	4.66	70MD	C414
C416A	ó	60.42	59.05	15.16	59.96	57.90	14.99	-.46	-1.15	-.17	4.80	70GE	C416A
C416B	ó	60.31	58.83	15.08	60.06	57.96	15.08	-.25	-.87	.00	4.09	70GE	C416B
C418	ó	57.68*	57.87	15.02	57.44*	56.92	15.06	-.24	-.95	.03	4.68	70CE	C418
C422	ó	58.36	56.85*	14.88	58.07	55.92*	14.80	-.28	-.94	-.07	4.54	70GC	C422
C424	ó	59.78	58.79	15.55	59.60	57.99	15.62	-.18	-.80	.07	4.06	70CA	C424
C428	ó	60.16	59.09	15.06	59.92	58.12	15.03	-.24	-.97	-.03	4.87	70HB	C428
C437	#	58.66	57.32	15.56	58.31	56.34	15.38	-.35	-.98	-.18	4.50	70GC	C437
C444	ó	60.08	59.15	15.34	60.03	58.44	15.37	-.05 *	-.71 *	.03	4.31	70GE	C444
C451	ó	59.80	58.79	15.12	59.33	57.64	14.97	-.47	-1.15	-.15	4.73	70AC	C451
C459	ó	59.21	58.38	15.10	58.77	57.30	15.05	-.44	-1.08	-.04	4.35	70GE	C459
C460	ó	59.91	59.09	14.75	59.55	58.02	14.72	-.36	-1.07	-.03	4.75	70GE	C460
C462A	ó	60.50	59.10	14.80	60.10	58.05	14.80	-.40	-1.05	.00	4.38	70HB	C462A
C463	ó	59.91	59.02	15.13	59.66	58.13	15.16	-.25	-.89	.03	4.22	70ZD	C463
C467A	ó	59.61	58.01	15.39	59.17	56.97	15.27	-.43	-1.04	-.13	4.31	70GE	C467A
C467B	ó	60.50	59.25	14.94	60.15	58.21	14.85	-.35	-1.04	-.09	4.70	70HN	C467B
C469	ó	60.07	59.54	15.54	59.67	58.50	15.55	-.40	-1.04	.01	4.22	70GE	C469
C470	ó	60.62	60.38*	15.04	60.29	59.41*	15.68	-.33	-.97	.04	4.15	70DH	C470
C472	#	59.66	58.82	15.07	59.35	57.95	15.71	-.31	-.87	.04	3.70	70KT	C472
C473	ó	59.68	59.21	15.31	59.72	58.59	15.30	.04 X	-.62 X	-.01	4.33	70DH	C473
C474	ó	59.24	58.09	14.77	58.83	57.04	14.61	-.41	-1.05	-.16	4.55	70GE	C474
C476	#	59.68	58.79	15.15	59.36	57.87	15.21	-.32	-.93	.06	4.00	70SA	C476
C479B	ó	60.82	59.86	15.04	60.23	58.68	15.57	-.59	-1.18	-.07	4.09	70SA	C479B
C481	ó	60.00	58.90	14.90	59.70	57.95	14.90	-.30	-.95	.00	4.34	70HB	C481
C482	ó	60.08	57.56	15.04	59.58	56.45	14.91	-.50	-1.11	-.13	4.50	70GC	C482
C483	ó	59.65	56.95*	14.59	59.47	56.15*	14.64	-.19	-.80	.06	4.19	70ZF	C483
C495	ó	60.05	59.02	15.38	59.64	57.94	15.22	-.41	-1.08	-.16	4.61	70KS	C495
C496A	ó	60.42	59.34	15.28	60.09	58.41	15.39	-.33	-.93	.11	3.88	70GE	C496A
C499B	ó	61.14	59.23	15.39	60.66	57.97	15.32	-.49	-1.26 *	-.06	5.31*	70BL	C499B
C503	ó	60.13	59.27	15.31	59.68	58.14	15.22	-.45	-1.13	-.09	4.65	70GE	C503
C508	ó	59.83	59.04	15.16	59.54	58.09	15.03	-.30	-.95	-.15	4.51	70GE	C508
C511	ó	59.77	59.02	15.40	59.36	57.98	15.39	-.41	-1.04	-.02	4.19	70DH	C511
C512	ó	59.94	59.14	15.11	59.73	58.31	15.13	-.21	-.84	.02	4.11	70AC	C512
C524	#	63.22X	63.57X	15.74	62.81X	62.45X	15.62	-.41	-1.12	-.12	4.54	70GE	C524
C528	ó	60.10	59.24	15.63	59.82	58.32	15.63	-.28	-.93	.00	4.30	70HT	C528
C529	ó	58.08	57.98	14.14	57.76	57.00	14.13	-.32	-.97	-.01	4.35	70DH	C529
C532	ó	59.86	58.97	14.88	59.47	58.03	14.88	-.39	-.94	.00	3.73	70GE	C532
C534	#	60.11	59.03	21.03X	59.79	58.03	21.51X	-.32	-1.00	-.17	4.63	70MD	C534
C536	ó	58.24	55.89X	13.82*	57.76	54.84X	13.67*	-.48	-1.05	-.15	4.24	70AC	C536
C540	ó	60.02	58.86	15.75	59.57	57.78	15.67	-.45	-1.08	-.08	4.32	70GE	C540
C545	ó	57.67*	57.02*	14.45	57.24*	55.98*	14.32	-.43	-1.04	-.13	4.33	70SA	C545
C549	ó	59.97	59.28	15.42	59.67	58.30	15.34	-.30	-.97	-.08	4.53	70DH	C549
C552	ó	59.26	58.05	14.80	59.01	57.13	14.71	-.25	-.93	-.09	4.64	70HN	C552
C567	#	60.44	58.33	15.04	60.20	58.34	14.88	-.24	.01 X	-.16	1.54X	70HB	C567
C613	ó	59.98	59.72	14.11	59.63	58.70	14.03*	-.34	-1.02	-.07	4.51	70MD	C613
C627	ó	59.34	58.47	15.24	59.08	57.59	15.27	-.26	-.88	.03	4.08	70SA	C627
C630	ó	59.77	58.49	15.40	59.32	57.41	15.21	-.45	-1.08	-.20	4.48	70KS	C630
C631A	ó	59.94	59.12	15.10	59.47	57.96	14.98	-.47	-1.16	-.12	4.73	70AC	C631A
C632	ó	59.75	58.81	15.04	59.53	57.91	15.02	-.22	-.90	-.02	4.57	70AC	C632
C638	ó	59.00	57.70	15.35	58.60	56.55	15.20	-.40	-1.15	-.15	5.26*	70GC	C638
C639	ó	59.26	59.05	15.45	58.77	57.89	15.25	-.49	-1.16	-.20	4.67	70DH	C639
C644	ó	59.22	58.33	14.77	58.81	57.31	14.73	-.41	-1.01	-.04	4.13	70MD	C644
C645	ó	59.86	58.46	15.14	59.44	57.38	15.04	-.41	-1.08	-.10	4.64	70AC	C645
C656	ó	59.10	57.80	15.01	58.72	56.81	14.90	-.38	-.99	-.12	4.25	70SA	C656
C657	ó	58.47	58.55	14.04*	58.24	57.66	14.08	-.23	-.89	.04	4.32	70AC	C657
C660	ó	58.19	55.70X	13.71*	57.79	54.81X	13.86*	-.40	-.88	.14 *	3.42*	70AC	C660
C662	•	58.14	57.82	14.24	57.75	56.80	14.04	-.39	-1.03	-.20	4.52	70SP	C662
C672	ó	59.05	57.85	15.50	58.90	57.10	15.50	-.15	-.75 *	.00	4.03	70GC	C672

REPORT NO. 29 — MCCA COLLABORATIVE REFERENCE PROGRAM — 1979-1980

X, Y, Z SPACE ANALYSIS, NORMAL DATA

COLOR • COLOR DIFFERENCE

FOR PAINT CHIPS

LAB CODE	F	SAMPLE D09 MEAN X	SAMPLE D09 MEAN Y	SAMPLE D09 MEAN Z	SAMPLE D10 MEAN X	SAMPLE D10 MEAN Y	SAMPLE D10 MEAN Z	DIFFERENCE D10 - D09 ΔX	ΔY	ΔZ	ΔE	INST CODE	INST LAB
C675	G	60.01	59.01	15.22	59.47	57.86	15.12	-.54	-1.16	-.10	4.26	70AC	C675
C683	G	60.08	57.79	14.82	59.56	56.62	14.68	-.52	-1.17	-.15	4.70	70GC	C683
C691	G	60.04	58.28	18.34X	59.43	57.19	18.19X	-.61 *	-1.09	-.15	3.54*	70SA	C691
C699	G	59.07	57.86	15.72	58.65	56.91	15.58	-.42	-.95	-.13	3.73	70BL	C699
C700	G	59.26	58.44	15.18	58.84	57.36	15.03	-.42	-1.08	-.15	4.56	70DH	C700
C705	#	59.91	.45X	.43X	59.05	.45X	.43X	-.85 X	.00 X	-.00	.33X	70HP	C705
C707	#	43.39X	42.05X	10.86X	43.20X	41.39X	10.97X	-.20	-.65 *	.11	3.79	70SA	C707
C716	#	72.80X	57.90	12.50X	72.30X	56.90	12.40X	-.50	-1.00	-.10	4.26	70ZE	C716
C717A	•	58.22	58.14	14.26	57.97	57.16	14.27	-.25	-.99	.00	4.87	70BP	C717A
C717B	•	58.27	58.25	14.21	58.00	57.31	14.25	-.27	-.94	.05	4.40	70SP	C717B
C718A	G	59.15	59.21	14.31	58.69	58.08	14.16	-.45	-1.14	-.15	4.63	70AC	C718A
C718B	G	58.81	58.96	14.01*	58.50	57.99	14.05	-.31	-.97	.03	4.34	70AC	C718B
C719C	G	57.63*	57.77	14.77	57.29*	56.65	14.63	-.34	-1.12	-.14	5.33*	70KC	C719C
C720	•	58.36	58.28	14.37	58.10	57.40	14.35	-.26	-.88	-.02	4.10	70SP	C720
C721	G	66.74X	63.30X	20.00X	66.13X	62.06X	19.86X	-.61 *	-1.24	-.14	4.34	70KS	C721
C722	X	59.83	58.59	15.17	59.58	57.18	15.14	-.25	-1.40 X	-.03	7.76X	70AC	C722
C723	G	58.36	57.62	14.93	58.26	56.89	14.99	-.11 *	-.74 *	.07	4.16	70MD	C723
C724	G	59.92	58.85	15.15	59.46	57.77	15.06	-.46	-1.08	-.09	4.27	70SA	C724
C725	G	60.15	59.35	15.80	59.90	58.40	15.95	-.25	-.95	.15 *	4.49	70KS	C725
C726	#	60.61	60.31*	15.89	60.20	59.26	15.86	-.41	-1.05	-.03	4.17	70SA	C726
C727A	•	58.59	58.65	14.34	58.09	57.47	14.20	-.50	-1.18	-.14	4.59	70SP	C727A
C727B	•	58.30	58.18	14.22	57.98	57.20	14.20	-.32	-.98	-.02	4.44	70SP	C727B
GRAND MEANS		59.62	58.71	15.07	59.27	57.71	15.02	-.36	-1.01	-.06	4.37		
SD OF MEANS		.79	.75	.48	.78	.76	.49	.12	.12	.09	.37		
INCLUDED LABS FOR THIS MEAN		66	64	64	66	64	64	66	66	66	67		

X, Y, Z SPACE ANALYSIS, NORMAL DATA
COLOR • COLOR DIFFERENCE
FOR PAINT CHIPS

LAB CODE	F	SAMPLE D11 MEAN X	MEAN Y	MEAN Z	SAMPLE D12 MEAN X	MEAN Y	MEAN Z	DIFFERENCE D12 - D11 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C157	6	12.09	13.14	30.05	11.98	12.78	29.78	-.11	-.36	-.27	2.55	70GE	C157
C162	6	12.81	13.77	30.89	12.63	13.36	30.50	-.19	-.40	-.39	2.25	70DH	C162
C251	#	12.11	13.60	29.70	11.99	13.20	29.53	-.12	-.40	-.23	2.62	70ZE	C251
C253	#	12.11	13.48	29.52	11.92	13.05	29.19	-.19	-.43	-.33	2.28	70GC	C253
C278	6	12.15	13.55	29.40	12.00	13.20	29.10	-.15	-.35	-.30	1.94	70NE	C278
C407	6	12.73	13.98	30.60	12.70	13.72	30.43	-.03	-.25	-.17	2.39	70SA	C407
C412	6	12.46	13.64	30.13	12.35	13.31	29.83	-.11	-.33	-.30	2.25	70GE	C412
C414	6	12.09	13.41	29.10	12.09	13.18	29.00	.00	-.23	-.10	2.47	70MD	C414
C416A	6	12.22	13.56	29.95	12.18	13.28	29.83	-.04	-.28	-.12	2.45	70GE	C416A
C416B	6	12.29	13.63	30.17	12.16	13.27	29.91	-.13	-.37	-.26	2.18	70GE	C416B
C418	6	12.45	13.32	29.84	12.35	12.97	29.62	-.10	-.35	-.22	2.57	70CE	C418
C422	6	11.65	12.97	28.40	11.54	12.63	28.20	-.12	-.34	-.20	2.13	70GC	C422
C424	6	12.56	13.81	30.26	12.38	13.40	29.91	-.18	-.41	-.35	2.24	70CA	C424
C428	6	11.99	13.26	29.58	11.86	12.90	29.32	-.13	-.37	-.25	2.27	70BB	C428
C437	#	12.10	13.47	29.00	11.97	13.10	28.79	-.13	-.37	-.21	2.22	70GC	C437
C444	6	12.65	13.86	30.41	12.45	13.41	29.94	-.20	-.44	-.47	2.50	70GE	C444
C451	6	12.30	13.62	29.39	12.27	13.37	29.29	-.03	-.25	-.11	2.27	70AC	C451
C459	6	12.25	13.48	29.42	12.06	13.07	29.05	-.19	-.41	-.36	2.23	70GE	C459
C460	6	11.90	13.15	29.33	11.83	12.66	29.20	-.07	-.29	-.13	2.19	70GE	C460
C462A	6	11.80	13.20	29.75	11.70	12.85	29.40	-.10	-.35	-.35	2.62	70HB	C462A
C463	6	12.45	13.69	30.18	12.33	13.34	29.87	-.12	-.34	-.31	2.30	70ZD	C463
C467A	6	12.61	14.26	30.02	12.44	13.84	29.75	-.17	-.43	-.27	2.29	70GE	C467A
C467B	6	11.77	13.12	29.67	11.55	12.66	29.25	-.23	-.47	-.42	2.29	70HN	C467B
C469	6	12.57	13.76	30.11	12.47	13.45	29.93	-.09	-.31	-.18	2.15	70GE	C469
C470	6	12.46	13.56	30.42	12.33	13.21	30.13	-.13	-.35	-.29	2.25	70DH	C470
C472	#	12.50	13.68	30.27	12.35	13.29	29.92	-.15	-.39	-.36	2.37	70KT	C472
C473	6	12.38	13.46	29.93	12.13	12.98	29.47	-.25	-.47	-.46	2.28	70DH	C473
C474	6	12.13	13.38	29.55	11.90	12.91	29.12	-.23	-.47	-.43	2.40	70GE	C474
C476	#	12.45	13.67	30.03	12.17	13.16	29.14	-.28	-.51	-.89 X	2.88X	70SA	C476
C479B	6	12.65	13.91	30.51	12.50	13.48	30.23	-.16	-.43	-.27	2.63*	70SA	C479B
C481	X	11.80	13.10	29.20	11.80	12.80	29.10	.00	-.30	-.10	3.16X	70HB	C481
C482	6	11.76	12.74	28.16	11.75	12.50	28.09	-.01	-.24	-.07	2.39	70GC	C482
C483	X	12.11	13.75	29.70	11.94	13.45	29.41	-.18	-.30	-.35	1.22X	70ZF	C483
C495	6	12.48	13.72	30.07	12.34	13.35	29.82	-.14	-.37	-.25	2.16	70KS	C495
C496A	6	12.55	13.85	30.28	12.34	13.39	29.87	-.21	-.46	-.41	2.38	70GE	C496A
C499B	6	12.63	14.37	30.45	12.55	14.05*	30.48	-.08	-.32	.03 *	2.09	70BL	C499B
C503	6	12.23	13.42	30.03	12.17	13.13	29.81	-.07	-.30	-.22	2.41	70GE	C503
C508	6	12.13	13.33	29.63	12.05	13.02	29.39	-.08	-.31	-.24	2.45	70GE	C508
C511	6	12.29	13.50	29.73	12.19	13.19	29.54	-.10	-.31	-.19	2.12	70DH	C511
C512	6	12.19	13.39	29.35	12.02	13.02	29.08	-.16	-.36	-.27	1.93	70AC	C512
C524	#	12.93	14.39	31.08	12.65	13.87	30.67	-.29	-.51	-.41	2.17	70GE	C524
C528	6	12.71	13.95	30.52	12.46	13.47	30.03	-.25	-.48	-.49	2.24	70BT	C528
C529	6	11.79	13.49	27.46*	11.58	13.05	27.10*	-.21	-.44	-.36	2.23	70DE	C529
C532	6	12.03	13.32	29.64	11.93	12.99	29.46	-.10	-.33	-.18	2.20	70GE	C532
C534	#	17.60X	18.70X	33.52X	17.63X	18.54X	33.50X	.03 *	-.16 *	-.02	1.98	70MD	C534
C536	6	12.04	14.56*	27.11*	11.83	14.11*	26.78*	-.21	-.45	-.33	2.05	70AC	C536
C540	6	12.99*	14.36	30.57	12.75*	13.88	30.13	-.24	-.48	-.44	2.31	70GE	C540
C545	6	11.55*	12.67*	28.47	11.57	12.48	28.53	.01	-.19 *	.06 *	2.11	70SA	C545
C549	6	12.37	13.51	30.00	12.25	13.16	29.74	-.13	-.35	-.27	2.24	70DE	C549
C552	X	13.03*	11.77X	29.21	11.75	12.77	28.96	-1.29 X	1.00 X	-.25	35.35X	70HN	C552
C567	#	11.83	13.14	29.57	11.69	12.77	29.32	-.14	-.37	-.25	2.17	70HB	C567
C613	6	11.84	13.49	29.12	11.82	13.23	28.93	-.02	-.26	-.19	2.57	70MD	C613
C627	6	12.37	13.66	30.31	12.27	13.33	30.09	-.11	-.33	-.22	2.17	70SA	C627
C630	6	12.51	13.65	30.11	12.35	13.25	29.74	-.16	-.40	-.37	2.45	70KS	C630
C631A	6	12.45	13.67	29.68	12.28	13.28	29.36	-.17	-.38	-.32	2.17	70AC	C631A
C632	6	12.42	13.66	29.69	12.19	13.20	29.26	-.23	-.45	-.43	2.24	70AC	C632
C638	6	11.60	13.00	28.60	11.50	12.70	28.50	-.10	-.30	-.10	1.82*	70GC	C638
C639	6	12.21	13.23	29.53	12.06	12.86	29.19	-.14	-.37	-.34	2.35	70DH	C639
C644	6	12.06	13.43	28.64	12.07	13.23	28.64	.01	-.21 *	-.00 *	2.20	70MD	C644
C645	6	12.27	13.61	29.38	12.25	13.35	29.30	-.02	-.25	-.08	2.33	70AC	C645
C656	6	12.17	13.50	29.31	12.05	13.16	29.15	-.12	-.35	-.16	2.04	70SA	C656
C657	6	11.69	13.53	26.98*	11.58	13.20	26.81*	-.11	-.33	-.17	2.04	70AC	C657
C660	6	12.16	14.71*	27.21*	11.96	14.27*	26.94*	-.20	-.45	-.27	2.02	70AC	C660
C662	•	11.74	13.48	27.34*	11.56	13.07	27.05*	-.18	-.41	-.29	2.14	70SP	C662
C672	6	11.65	12.85	28.45	11.50	12.50	28.20	-.15	-.35	-.25	1.95	70GC	C672

X, Y, Z SPACE ANALYSIS, NORMAL DATA

COLOR * COLOR DIFFERENCE

FOR PAINT CHIPS

LAB CODE	F	SAMPLE D11 MEAN X	MEAN Y	MEAN Z	SAMPLE D12 MEAN X	MEAN Y	MEAN Z	DIFFERENCE D12 - D11 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C675	G	12.48	13.75	29.78	12.26	13.30	29.40	-.22	-.45	-.38	2.23	70AC	C675
C683	G	10.83X	12.36*	27.24*	10.74X	12.06*	27.07*	-.10	-.30	-.17	2.00	70GC	C683
C691	G	12.23	13.53	28.94	12.00	13.07	28.50	-.23	-.45	-.44	2.26	70SA	C691
C699	G	12.78	14.25	30.04	12.57	13.77	29.68	-.21	-.48	-.36	2.52	70BL	C699
C700	G	12.20	13.40	29.40	11.95	12.94	28.96	-.25	-.46	-.44	2.11	70DH	C700
C705	#	12.89	.21X	.24X	12.54	.21X	.24X	-.35 *	.00 X	-.00	.59X	70HP	C705
C707	#	8.68X	9.61X	20.75X	8.54X	9.28X	20.37X	-.14	-.33	-.38	2.35	70SA	C707
C716	#	9.30X	13.60	25.20X	9.20X	13.20	24.90X	-.10	-.40	-.30	2.14	70ZE	C716
C717A	*	11.76	13.50	27.40	11.53	13.02	27.00*	-.23	-.48	-.40	2.36	70SP	C717A
C717B	*	11.78	13.49	27.54	11.71	13.17	27.36	-.07	-.32	-.18	2.37	70SP	C717B
C718A	G	11.87	13.74	27.38*	11.85	13.49	27.26*	-.02	-.25	-.13	2.43	70AC	C718A
C718B	G	11.70	13.55	27.29*	11.71	13.32	27.22*	.01	-.23	-.08	2.51	70AC	C718B
C719C	G	12.15	13.22	29.39	11.89	12.74	28.97	-.26	-.48	-.42	2.27	70KC	C719C
C720	*	11.86	13.59	27.56	11.72	13.21	27.28	-.14	-.38	-.28	2.26	70SP	C720
C721	G	15.05X	17.05X	34.15X	14.79X	16.58X	33.74X	-.26	-.47	-.41	1.78*	70KS	C721
C722	G	12.38	13.65	29.62	12.27	13.32	29.41	-.12	-.33	-.21	2.12	70AC	C722
C723	G	12.01	13.23	29.11	11.81	12.83	28.77	-.20	-.40	-.34	2.01	70MD	C723
C724	G	12.41	13.67	30.01	12.24	13.27	29.69	-.17	-.40	-.32	2.28	70SA	C724
C725	G	12.85	13.90	31.00*	12.60	13.50	30.75	-.25	-.40	-.85 X	2.17	70KS	C725
C726	#	12.79	13.84	31.06	12.64	13.47	30.74	-.14	-.38	-.33	2.31	70SA	C726
C727A	*	11.75	13.45	27.45	11.65	13.12	27.20*	-.10	-.33	-.25	2.31	70SP	C727A
C727B	*	11.74	13.49	27.41	11.66	13.17	27.18*	-.08	-.32	-.23	2.42	70SP	C727B
GRAND MEANS		12.25	13.56	29.47	12.11	13.19	29.20	-.14	-.36	-.27	2.25		
SD OF MEANS		.34	.42	1.00	.32	.39	.95	.08	.08	.13	.19		
INCLUDED LABS FOR THIS MEAN		64	65	65	64	65	65	66	66	65	66		

L, a, b SPACE ANALYSIS, NORMAL DATA
COLOR - COLOR DIFFERENCE
FOR PAINT CHIPS

LAB CODE	F	SAMPLE D09 MEAN L	MEAN A	MEAN B	SAMPLE D10 MEAN L	MEAN A	MEAN B	DIFFERENCE D10 - D09 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C121	d	76.40	4.65	43.00*	75.90	6.15	42.35*	-.50	1.50	-.65	1.71	70HM	C121
C148	d	76.90	5.55	42.20	76.35	7.00	41.60	-.55	1.45	-.60	1.66	70SC	C148
C152	d	77.10	6.05	41.80	76.45	7.60	41.20	-.65	1.55	-.60	1.78	70HA	C152
C166	X	78.16X	5.95	41.64	76.15	7.40	41.10	-2.01 X	1.45	-.54	2.54X	70HA	C166
C183	d	76.95	4.60	41.00	76.40	6.15	41.05	-.55	1.55	-.55	1.73	70HA	C183
C223	d	76.48	5.89	41.58	75.88	7.34	41.02	-.60	1.45	-.56	1.66	70HA	C223
C233	#	74.37X	14.99X	39.90X	73.82X	15.39X	39.43X	-.55	.40 X	-.47	.83X	70SC	C233
C241	d	77.45	4.55	42.25	76.80	6.00	41.60	-.65	1.45	-.65	1.72	70HA	C241
C256A	d	76.52	5.48	42.08	75.91	7.07	41.51	-.61	1.59	-.56	1.79	70HM	C256A
C256B	d	76.40	4.99	41.96	75.78	6.43	41.37	-.62	1.44	-.60	1.68	70HU	C256B
C259	d	76.75	5.50	41.70	76.10	7.05	41.15	-.65	1.55	-.55	1.77	70HA	C259
C288	d	76.40	5.15	42.20	75.80	6.80	41.65	-.60	1.65	-.55	1.84	70HM	C288
C291	d	76.85	5.10	41.60	76.15	6.75	41.15	-.70	1.65	-.45	1.85	70HA	C291
C317	d	76.40	4.80	41.50	75.70	6.20	40.90	-.70	1.40	-.60	1.68	70HM	C317
C320	#	76.45	5.80	41.80	75.75	7.10	41.15	-.70	1.30 *	-.65	1.61	70HA	C320
C325	d	76.16	3.87	41.05	75.56	5.46	40.51*	-.59	1.59	-.54	1.78	70HR	C325
C356	d	76.65	6.05	41.95	76.00	7.70	41.40	-.65	1.65	-.55	1.86	70HM	C356
C380	d	77.00	6.20	42.00	76.40	7.70	41.60	-.60	1.50	-.40 *	1.66	70HA	C380
C382	d	76.80	4.30	41.70	76.15	5.85	41.15	-.65	1.55	-.55	1.77	70HA	C382
C390	d	76.55	5.95	42.00	75.95	7.30	41.35	-.60	1.35	-.65	1.61	70HF	C390
C402	d	76.79	5.01	41.89	76.22	6.51	41.27	-.57	1.50	-.62	1.72	70HA	C402
C420A	d	76.70	5.00	40.35*	76.20	6.50	39.80X	-.50	1.50	-.55	1.67	70HA	C420A
C420B	d	76.90	5.15	40.50*	76.30	6.65	39.85X	-.60	1.50	-.65	1.74	70HA	C420B
C427	d	77.15	6.30	42.05	76.40	7.70	41.45	-.75	1.40	-.60	1.70	70HA	C427
C440	d	76.73	6.19	42.09	76.15	7.65	41.96	-.58	1.47	-.63	1.70	70HA	C440
C442	X	76.90	5.20	41.90	76.90*	5.20	41.80	.00 X	.00 X	-.10 X	.10X	70HM	C442
C454	d	76.09	4.42	41.46	75.46	5.99	40.87	-.63	1.57	-.59	1.79	70HA	C454
C458	d	76.60	5.67	41.80	76.08	7.30	41.32	-.52	1.63	-.54	1.79	70HM	C458
C475	d	76.51	6.21	41.78	75.73	7.68	41.14	-.78 *	1.46	-.64	1.78	70HA	C475
C494	d	77.55*	5.80	41.80	76.85*	7.50	41.35	-.70	1.70	-.45	1.89	70HA	C494
C496B	d	76.74	4.41	44.39X	76.04	6.08	43.80X	-.70	1.67	-.60	1.91	70GP	C496B
C499A	d	76.95	6.10	40.15X	76.25	7.35	39.45X	-.70	1.25 *	-.70 *	1.59	70HA	C499A
C499C	d	76.85	7.80*	41.85	76.15	9.40*	41.30	-.70	1.60	-.55	1.83	70HA	C499C
C506	d	77.15	6.10	41.80	76.45	7.60	41.25	-.70	1.50	-.55	1.74	70HA	C506
C514A	*	76.15	6.38	41.52	75.59	7.90	40.95	-.56	1.52	-.57	1.72	70SR	C514A
C517	d	77.20	5.35	42.00	76.65	6.80	41.50	-.55	1.45	-.50	1.63	70HQ	C517
C538	X	77.35	6.00	41.50	77.10*	7.30	40.90	-.25 X	1.30 *	-.60	1.45X	70GX	C538
C541	d	76.65	5.50	41.40	76.10	7.15	40.90	-.55	1.65	-.50	1.81	70GP	C541
C543	d	77.02	6.23	41.68	76.51	7.73	41.05	-.50	1.50	-.63	1.70	70HA	C543
C547	d	73.34X	5.48	44.31X	72.76X	7.29	43.81X	-.58	1.81 *	-.50	1.96*	70HQ	C547
C574	d	77.30	5.50	42.70	76.75	7.10	42.20*	-.55	1.60	-.50	1.76	70HQ	C574
C576	d	76.36	6.82	41.50	75.72	8.44	41.00	-.64	1.62	-.50	1.81	70SB	C576
C600	d	76.20	7.40*	41.00	75.65	8.90*	40.50*	-.55	1.50	-.50	1.67	70GD	C600
C619	d	76.30	5.50	41.70	75.70	7.20	41.20	-.60	1.70	-.50	1.87	70SC	C619
C620	d	74.43X	4.62	41.16	73.83X	6.17	40.68	-.60	1.55	-.48	1.73	70MG	C620
C628	d	77.48	4.58	42.24	76.50	6.06	41.73	-.98 X	1.48	-.50	1.85	70ME	C628
C655	d	77.09	4.07	42.30	76.47	5.61	41.69	-.62	1.54	-.61	1.76	70HU	C655
C677	d	76.61	7.27	42.60	75.82	8.77	42.04	-.78 *	1.51	-.56	1.78	70SC	C677
C690	d	76.60	5.30	41.75	76.00	6.80	41.20	-.60	1.50	-.55	1.71	70HM	C690
C709	#	76.47	5.00	41.57	75.72	6.45	40.94	-.75	1.45	-.63	1.75	70SC	C709
C719A	d	76.85	5.00	42.10	76.15	6.50	41.60	-.70	1.50	-.50	1.73	70HA	C719A
C719B	d	76.95	7.05	42.00	76.45	8.40	41.45	-.50	1.35	-.55	1.54*	70HA	C719B
GRAND MEANS		76.77	5.52	41.81	76.14	7.05	41.33	-.62	1.53	-.56	1.75		
SD OF MEANS		.35	.89	.52	.34	.88	.41	.07	.10	.06	.09		
INCLUDED LABS FOR THIS MEAN		43	45	42	43	45	40	44	45	45	45		

L, a, b SPACE ANALYSIS, NORMAL DATA
COLOR • COLOR DIFFERENCE
FOR PAINT CHIPS

LAB CODE	F	SAMPLE D11 MEAN L	MEAN A	MEAN B	SAMPLE D12 MEAN L	MEAN A	MEAN B	DIFFERENCE D12 - D11 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C121	d	36.05	-4.50	-23.30*	35.50	-3.40	-23.95*	-.55	1.10	-.65	1.39	70BM	C121
C148	d	36.75	-5.25	-22.20	36.10	-4.25	-22.95	-.65	1.00	-.75	1.41	70SC	C148
C152	d	36.90	-5.00	-22.10	36.25	-4.05	-22.90	-.65	.95	-.80 *	1.40	70HA	C152
C166	d	36.20	-5.55	-22.60	35.85	-4.45	-23.15	-.35	1.10	-.55	1.28	70HA	C166
C183	d	36.30	-4.85	-22.25	35.80	-3.85	-22.85	-.50	1.00	-.60	1.27	70HA	C183
C223	d	37.25	-4.92	-21.59*	36.75*	-3.87	-22.18*	-.49	1.05	-.59	1.30	70HA	C223
C233	#	38.02X	-8.62X	-20.49X	37.35X	-7.13X	-21.14X	-.66	1.49 X	-.64	1.75X	70SC	C233
C241	d	36.25	-4.85	-22.75	35.65	-3.85	-23.30	-.60	1.00	-.55	1.29	70HA	C241
C256A	d	36.07	-5.03	-22.68	35.60	-3.94	-23.29	-.48	1.09	-.60	1.33	70HM	C256A
C256B	d	36.01	-4.24	-22.04	35.54	-3.21	-23.15	-.47	1.03	-.51	1.24	70HU	C256B
C259	d	36.30	-4.95	-22.60	35.90	-3.90	-23.20	-.40	1.05	-.60	1.27	70HA	C259
C288	d	35.90	-4.60	-22.70	35.60	-3.50	-23.20	-.30	1.10	-.50	1.24	70HM	C288
C291	d	36.10	-5.15	-22.40	35.75	-4.10	-23.10	-.35	1.05	-.70	1.31	70HA	C291
C317	d	36.00	-4.70	-22.20	35.60	-3.60	-22.80	-.40	1.10	-.60	1.32	70HM	C317
C320	#	37.10	4.60X	21.40X	36.60	3.55X	21.95X	-.50	-1.05 X	.55 X	1.29	70HA	C320
C325	d	36.74	-4.23	-21.70	36.19	-3.22	-22.29	-.55	1.01	-.59	1.29	70HR	C325
C356	d	36.00	-5.20	-22.90	35.50	-4.20	-23.60	-.50	1.00	-.70	1.32	70HM	C356
C380	d	36.35	-5.40	-22.70	35.80	-4.35	-23.35	-.55	1.05	-.65	1.35	70HA	C380
C382	d	36.40	-4.55	-22.10	35.95	-3.55	-22.75	-.45	1.00	-.65	1.27	70HA	C382
C390	d	36.55	-5.05	-22.50	36.15	-4.05	-23.15	-.40	1.00	-.65	1.26	70HF	C390
C402	d	36.42	-5.04	-22.43	36.03	-3.99	-23.01	-.40	1.05	-.58	1.26	70HA	C402
C420A	d	36.90	-4.40	-26.90X	36.50	-3.40	-27.50X	-.40	1.00	-.60	1.23	70HA	C420A
C420B	d	37.00	-4.30	-26.80X	36.50	-3.15	-27.50X	-.50	1.15	-.70	1.44	70HA	C420B
C427	d	36.55	-5.25	-22.70	36.10	-4.25	-23.35	-.45	1.00	-.65	1.27	70HA	C427
C440	d	36.74	-5.01	-22.34	36.29	-3.98	-22.97	-.45	1.03	-.63	1.29	70HA	C440
C442	d	35.90	-5.10	-22.80	35.50	-4.10	-23.40	-.40	1.00	-.60	1.23	70BM	C442
C454	X	37.44*	-4.34	-21.76	36.71	-3.20	-22.58	-.73 *	1.14	-.82 *	1.58X	70HA	C454
C458	d	35.98	-5.23	-22.78	35.53	-4.13	-23.30	-.45	1.09	-.52	1.29	70BM	C458
C475	d	36.70	-4.84	-22.57	36.17	-3.76	-23.17	-.53	1.08	-.60	1.34	70HA	C475
C494	d	36.95	-5.30	-22.60	36.30	-4.10	-23.00	-.65	1.20 *	-.40 X	1.42	70HA	C494
C496B	d	36.40	-4.71	-22.62	35.71	-3.72	-23.24	-.69	.99	-.63	1.36	70GP	C496B
C499A	d	36.30	-5.55	-25.50X	35.80	-4.55	-26.20X	-.50	1.00	-.70	1.32	70HA	C499A
C499C	d	36.40	-6.30*	-22.55	35.90	-5.25*	-23.20	-.50	1.05	-.65	1.33	70HA	C499C
C506	d	36.20	-5.25	-22.65	35.95	-4.20	-23.20	-.25 *	1.05	-.55	1.21	70HA	C506
C514A	•	36.49	-5.39	-22.14	36.03	-4.34	-22.69	-.46	1.05	-.55	1.27	70SR	C514A
C517	d	36.50	-3.80*	-22.30	36.00	-2.80*	-22.95	-.50	1.00	-.65	1.29	70HQ	C517
C538	d	36.95	-1.90X	-26.00X	36.50	-.90X	-26.60X	-.45	1.00	-.60	1.25	70GX	C538
C541	d	36.25	-4.85	-22.15	35.60	-3.80	-22.80	-.65	1.05	-.65	1.40	70GP	C541
C543	d	36.24	-5.67	-22.77	35.86	-4.58	-23.37	-.38	1.09	-.60	1.30	70HA	C543
C547	X	28.88X	-6.47*	-26.82X	28.23X	-5.15*	-27.76X	-.65	1.32 X	-.94 X	1.74X	70HQ	C547
C574	d	36.90	-4.40	-22.20	36.30	-3.40	-22.85	-.60	1.00	-.65	1.34	70HQ	C574
C576	X	36.04	-5.30	-22.71	35.40	-4.80	-22.98	-.64	.50 X	-.27 X	.86X	70SB	C576
C600	d	36.80	-6.50*	-21.50*	36.20	-5.40*	-22.15*	-.60	1.10	-.65	1.41	70GD	C600
C619	d	36.20	-4.80	-22.00	35.60	-3.70	-22.60	-.60	1.10	-.60	1.39	70SC	C619
C620	d	35.13X	-5.10	-21.45*	34.65X	-4.08	-22.02*	-.48	1.02	-.56	1.27	70MG	C620
C628	d	37.55*	-5.16	-22.36	36.98*	-4.06	-22.86	-.57	1.10	-.49	1.33	70ME	C628
C655	d	36.62	-4.42	-22.13	36.17	-3.46	-22.69	-.45	.95	-.56	1.20	70HU	C655
C677	d	37.31*	-5.47	-23.03	36.43	-4.60	-23.79	-.88 X	.88 *	-.76 *	1.46*	70SC	C677
C690	d	35.80	-4.90	-22.65	35.20*	-3.90	-23.30	-.60	1.00	-.65	1.34	70HM	C690
C709	#	36.79	-4.09	-21.91	36.45	-3.01	-22.41	-.35	1.08	-.50	1.24	70SC	C709
C719A	d	36.65	-5.00	-22.80	36.05	-4.00	-23.40	-.60	1.00	-.60	1.31	70HA	C719A
C719B	d	36.20	-6.00	-22.80	35.65	-5.05*	-23.40	-.55	.95	-.60	1.25	70HA	C719B
GRAND MEANS		36.47	-5.01	-22.44	35.96	-3.97	-23.05	-.50	1.04	-.62	1.31		
SD OF MEANS		.41	.53	.40	.38	.53	.41	.10	.06	.07	.06		
INCLUDED LABS FOR THIS MEAN		44	44	41	44	44	41	44	45	44	45		

EXPLANATION OF DATA FOR WHITE SAMPLE FOR PAINT CHIPS

Specimens of a white calibration sample (Paint Chips) were distributed to the participants along with the usual two pairs of colored specimens, and each participant was asked to return measurement data for the white calibration sample (Paint Chips), reporting results in the same manner as for the colored specimens.

As a first step, three laboratories were selected to serve as "reference" laboratories for the purposes of this analysis and the average of their X, Y, Z values for the white sample were computed. Next, the ratios of the participants data to the combined reference laboratory values were calculated for each participant (transformed to X, Y, Z space if necessary). These ratios are shown in the White Sample Analysis tables.

Two observations can be made about the data in the White Sample Analysis tables. First, the participants as a whole tend to be high compared with the combined average values obtained by the selected reference laboratories. Second, a few participants had noticeably extreme values for one or more of the components and these participants especially should look to the cause.

Next, the ratios in the White Sample Analysis tables were used to "adjust" the data of the normal data tables to obtain the adjusted data table values. The adjustment consisted of dividing the X, Y, Z values of the normal data tables by the respective ratios in the White Sample Analysis tables.

The significant change is the adjusted data tables is in the SD OF MEANS. Comparison of these among-laboratory standard deviations with those in the normal data tables, shows considerable reduction for X, Y, Z. Thus part, at least, of the disagreement among participants is due to errors in standardization that could be corrected through use of an agreed-upon white standard. There is no similar significant change for ΔX, ΔY, and ΔZ.

WHITE SAMPLE ANALYSIS FOR PAINT CHIPS
X, Y, Z LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C157	.9647	.9618	.9899	70GB	-3.53	-3.82	-4.01
C162	1.0134	1.0082	1.0171	70DM	1.34	.82	1.71
C251	1.0052	1.0002	1.0043	70ZB	.52	.02	.43
C253	1.0165	1.0120	1.0140	70GC	1.68	1.20	1.40
C278	1.0301	1.0294	1.0291	70MB	3.01	2.94	2.91
C407	1.0217	1.0196	1.0308	70SA	2.17	1.96	3.08
C412	1.0082	1.0080	1.0104	70GE	.82	.80	1.04
C414	.9905	.9912	.9824	70MD	-.95	-.88	-1.76
C416A	1.0228	1.0210	1.0252	70GE	2.28	2.10	2.52
C416B	1.0222	1.0213	1.0263	70GB	2.22	2.13	2.63
C418	.9848	.9800	1.0010	70GH	-1.52	-2.00	.10
C422	.9880	.9843	.9836	70GC	-1.20	-1.57	-1.64
C424	1.0034	1.0034	1.0092	70CA	.34	.34	.92
C428	1.0064	1.0029	1.0099	70HB	.64	.29	.99
C437	.9925	.9894	.9934	70GC	-.75	-1.06	-.66
C444	1.0148	1.0127	1.0185	70GE	1.48	1.27	1.85
C451	1.0186	1.0144	1.0340	70AC	1.86	1.44	3.46
C459	1.0003	1.0001	1.0010	70GE	.03	.01	.10
C460	1.0105	1.0126	1.0164	70GE	1.05	1.26	1.64
C462A	1.0065	1.0036	1.0145	70HB	.65	.36	1.45
C463	1.0097	1.0068	1.0149	70ZD	.97	.68	1.49
C467A	1.0098	1.0103	1.0184	70GB	.98	1.03	1.84
C467B	.9973	.9947	.9982	70HN	-.27	-.53	-.18
C469	1.0154	1.0135	1.0251	70GB	1.54	1.35	2.51
C470	1.0224	1.0221	1.0364	70DH	2.24	2.21	3.64
C472	1.0031	1.0007	1.0074	70KT	.31	.07	.74
C473	.9743	.9677	.9631	70DH	-2.57	-3.23	-3.69
C474	1.0024	1.0026	1.0038	70GE	.24	.26	.38
C476	1.0021	.9993	1.0062	70SA	.21	-.07	.62
C479B	1.0201	1.0194	1.0265	70SA	2.01	1.94	2.65
C481	1.0059	1.0025	1.0100	70HB	.59	.25	1.00
C482	1.0154	.9886	.9861	70GC	1.54	-1.14	-1.39
C483	.9954	.9929	.9973	70ZP	-.46	-.71	-.27
C495	1.0062	1.0052	1.0017	70KS	.62	.52	.17
C496A	1.0173	1.0171	1.0136	70GB	1.73	1.71	1.36
C496B	1.0274	1.0267	1.0346	70HL	2.74	2.67	3.46
C503	1.0160	1.0145	1.0278	70GB	1.60	1.45	2.78
C508	1.0046	1.0046	1.0040	70GE	.46	.46	.40
C511	1.0027	1.0011	1.0038	70DH	.27	.11	.38
C512	1.0111	1.0098	1.0017	70AC	1.11	.98	.17
C524	1.0617	1.0809	1.0552	70GB	6.17	8.09	5.52
C528	1.0113	1.0055	1.0040	70HT	1.13	.95	.40
C529	.9705	.9923	.9241	70DH	-2.95	-.77	-7.59
C532	1.0110	1.0126	1.0147	70GE	1.10	1.26	1.47
C534	.9854	.9860	.9719	70MD	-1.46	-1.40	-2.81
C536	.9827	1.0120	.9097	70AC	-1.73	1.20	-9.03
C540	1.0090	1.0085	1.0100	70GE	.90	.85	1.00
C545	.9710	.9715	.9735	70SA	-2.90	-2.85	-2.65
C549	1.0098	1.0064	1.0108	70DH	.98	.64	1.08
C552	.9943	.9913	.9579	70HN	-.57	-.87	-.21
C567	1.0016	.9978	1.0057	70HB	.16	-.22	.57
C613	1.0201	1.0194	1.0220	70ZD	2.01	1.94	2.26
C627	.9977	.9949	.9971	70SA	-.23	-.51	-.29
C630	1.0037	.9953	1.0028	70KS	.37	-.47	.28
C631A	1.0097	1.0075	1.0014	70AC	.97	.75	.14
C632	1.0117	1.0098	1.0032	70AC	1.17	.98	.32
C638	.9961	.9935	.9935	70GC	-.39	-.65	-.65
C639	.9965	.9942	.9986	70DH	-.35	-.58	-.14
C644	.9974	.9978	.9870	70MD	-.26	-.22	-1.30
C645	1.0111	1.0091	1.0021	70AC	1.11	.91	.21
C656	.9933	.9915	.9864	70SA	-.67	-.85	-1.36
C657	.9791	1.0079	.9225	70AC	-2.09	.79	-7.75
C660	.9813	1.0110	.9116	70AC	-1.87	1.10	-8.84
C662	.9679	.9898	.9170	70SP	-3.21	-1.02	-8.30
C672	1.0013	.9991	.9980	70GC	.13	-.09	-.20
C675	1.0123	1.0110	1.0090	70AC	1.33	1.10	.90
C683	1.0129	1.0085	1.0016	70GC	1.29	.85	.16
C691	.9987	.9917	1.0031	70SA	-.13	-.83	.31
C699	.9928	.9956	.9933	70HL	-.72	-.44	-.67
C700	.9939	.9924	.9932	70DH	-.61	-.76	-.68
C705	1.0371	.0035	.0032	70HP	3.71	-99.65	-99.68
C707	.7375	.7367	.7323	70SA	-26.25	-26.33	-26.77
C716	1.0341	.9991	.8505	70ZE	3.41	-.09	-14.95
C717A	.9713	.9939	.9263	70SP	-2.87	-.61	-7.37
C717B	.9716	.9934	.9254	70SP	-2.84	-.66	-7.46
C718A	.9854	1.0138	.9309	70AC	-1.46	1.38	-6.91
C718B	.9814	1.0100	.9285	70AC	-1.86	1.00	-7.15
C719C	.9710	.9668	.9823	70KC	-2.90	-3.32	-1.77
C720	.9717	.9940	.9258	70SP	-2.83	-.60	-7.42
C721	1.1279	1.1259	1.1328	70KS	12.79	12.59	13.28
C722	1.0134	1.0126	1.0008	70AC	1.34	1.26	.08
C723	.9845	.9846	.9713	70MD	-1.55	-1.54	-2.87
C724	1.0080	1.0069	1.0111	70SA	.80	.69	1.11
C725	1.0180	1.0142	1.0466	70KS	1.80	1.42	4.66
C726	1.0099	1.0078	1.0107	70SA	.99	.78	1.07
C727A	.9739	.9967	.9303	70SP	-2.61	-.33	-6.97
C727B	.9766	.9991	.9342	70SP	-2.34	-.09	-6.58

NCCA COLLABORATIVE REFERENCE PROGRAM
WHITE SAMPLE ANALYSIS FOR PAINT CHIPS
L, a, b LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C121	.9903	.9869	.9965	70HM	-.97	-1.31	-.35
C148	.9950	.9922	1.0003	70SC	-.50	-.78	.03
C152	.9948	.9911	.9993	70HA	-.52	-.89	-.07
C166	.9867	.9849	.9928	70HA	-1.33	-1.51	-.72
C183	.9821	.9796	.9851	70HA	-1.79	-2.04	-1.49
C223	1.0010	.9973	1.0067	70HA	.10	-.27	.67
C233	.9942	.9880	.9959	70SC	-.58	-1.20	-.41
C241	.9876	.9849	.9912	70HA	-1.24	-1.51	-.88
C256A	.9849	.9825	.9885	70HM	-1.51	-1.75	-1.15
C256B	.9916	.9901	.9890	70HU	-.84	-.99	-1.10
C259	.9824	.9796	.9866	70HA	-1.76	-2.04	-1.34
C288	.9863	.9838	.9956	70HM	-1.37	-1.62	-.44
C291	.9879	.9869	.9918	70HA	-1.21	-1.31	-.82
C317	.9845	.9817	.9919	70HM	-1.55	-1.83	-.81
C320	1.0013	.9943	1.0009	70HA	.13	-.57	.09
C325	.9898	.9681	.9950	70HR	-1.02	-1.19	-.50
C356	.9833	.9817	.9911	70HM	-1.67	-1.83	-.89
C380	.9941	.9922	1.0019	70HA	-.59	-.78	.19
C382	.9912	.9890	.9971	70HA	-.88	-1.10	-.29
C390	.9936	.9911	1.0016	70HF	-.64	-.89	.16
C402	.9478	.9436	.9447	70HA	-5.22	-5.64	-5.53
C420A	1.0031	.9859	.9962	70HA	.31	-1.41	-.38
C420B	1.0058	.9880	.9992	70HA	.58	-1.20	-.08
C427	.9942	.9911	.9961	70HA	-.58	-.89	-.39
C440	.9938	.9903	.9934	70HA	-.62	-.97	-.66
C442	.9854	.9838	.9925	70HM	-1.46	-1.62	-.75
C454	.9931	.9894	.9969	70HA	-.69	-1.06	-.31
C458	.9793	.9761	.9905	70HM	-2.07	-2.39	-.95
C475	.9943	.9896	.9993	70HA	-.57	-1.04	-.07
C494	1.0022	1.0006	1.0090	70HA	.22	.06	.90
C496B	1.0031	1.0019	.9935	70GP	.31	.19	-.65
C499A	.9881	.9859	.9923	70HA	-1.19	-1.41	-.77
C499C	.9878	.9838	.9909	70HA	-1.22	-1.62	-.91
C506	.9915	.9890	.9940	70HA	-.85	-1.10	-.60
C514A	.9758	.9735	.9729	70SR	-2.42	-2.65	-2.71
C517	1.0114	1.0079	1.0055	70HQ	1.14	.79	.55
C538	.9643	.9672	.9684	70GX	-3.57	-3.28	-3.16
C541	1.0043	1.0027	1.0032	70GP	.43	.27	.32
C543	.9884	.9850	.9948	70HA	-1.16	-1.50	-.52
C547	.9435	.9415	.9404	70HQ	-5.65	-5.85	-5.96
C574	1.0194	1.0153	1.0138	70HQ	1.94	1.53	1.38
C576	.9804	.9775	.9873	70SB	-1.96	-2.25	-1.27
C600	.9857	.9817	.9857	70GD	-1.43	-1.83	-1.43
C619	.9980	.9964	1.0015	70SC	-.20	-.36	.15
C620	.9340	.9345	.9200	70MG	-6.60	-6.55	-8.00
C628	1.0095	1.0114	1.0149	70ME	.95	1.14	1.49
C655	.9809	.9776	.9837	70HU	-1.91	-2.24	-1.63
C677	1.0150	1.0113	1.0236	70SC	1.50	1.13	2.36
C690	.9809	.9776	.9837	70HM	-1.91	-2.24	-1.63
C709	.9872	.9859	.9888	70SC	-1.28	-1.41	-1.12
C719A	1.0090	1.0058	1.0263	70HA	.90	.58	2.63
C719B	.9860	.9817	.9904	70HA	-1.40	-1.83	-.96

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA

COLOR • COLOR DIFFERENCE

FOR PAINT CHIPS

LAB CODE	F	SAMPLE D09 MEAN X	MEAN Y	MEAN Z	SAMPLE D10 MEAN X	MEAN Y	MEAN Z	DIFFERENCE D10 - D09 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C157	X	62.78X	61.92X	15.28	62.35X	61.02X	15.33	-.43	-.90	.05	3.11X	70GE	C157
C162	d	59.85	59.68*	15.60	59.52	58.77*	15.58	-.34	-.91	-.01	3.76	70DH	C162
C251	#	59.97	58.34	14.82	59.42	57.24	14.74	-.55	-1.10	-.08	3.92	70ZE	C251
C253	#	59.34	58.17	15.58	59.01	57.21	15.67	-.33	-.95	.09	4.14	70GC	C253
C278	d	58.93	57.90	16.13X	58.54	56.97	16.13X	-.39	-.92	.00	3.64	70NE	C278
C407	d	59.15	58.43	14.96	58.74	57.43	15.17	-.42	-1.01	.21 X	3.84	70SA	C407
C412	d	59.55	58.95	15.23	59.27	58.02	15.21	-.28	-.92	-.02	4.26	70GE	C412
C414	d	59.33	58.35	15.25	58.96	57.31	15.06	-.37	-1.04	-.19	4.68	70MD	C414
C416A	d	59.08	57.84	14.79	58.63	56.71	14.62	-.45	-1.13	-.17	4.76	70GE	C416A
C416B	d	59.01	57.61	14.69	58.76	56.76	14.70	-.25	-.85	.00	4.06	70GE	C416B
C418	d	58.57*	59.05	15.01	58.33*	58.08	15.04	-.24	-.97	.03	4.71	70CE	C418
C422	d	59.07	57.76	15.13	58.78	56.81	15.05	-.29	-.95	-.08	4.56	70GC	C422
C424	d	59.58	58.60	15.41	59.40	57.80	15.48	-.18	-.80	.06	4.05	70CA	C424
C428	d	59.78	58.92	14.92	59.54	57.96	14.89	-.24	-.97	-.03	4.86	70HB	C428
C437	#	59.11	57.94	15.67	58.75	56.94	15.49	-.35	-.99	-.18	4.51	70GC	C437
C444	d	59.21	58.41	15.06	59.16	57.71	15.09	-.05 *	-.70 *	.03	4.29	70GE	C444
C451	d	58.71*	57.95	14.62	58.25*	56.82	14.47*	-.46	-1.13	-.15	4.71	70AC	C451
C459	d	59.21	58.38	15.10	58.77	57.30	15.05	-.44	-1.08	-.04	4.35	70GE	C459
C460	d	59.28	58.35	14.52*	58.93	57.30	14.49	-.35	-1.05	-.03	4.74	70GE	C460
C462A	d	60.11*	58.89	14.59	59.71*	57.84	14.59	-.40	-1.05	.00	4.37	70HB	C462A
C463	d	59.34	58.62	14.91	59.09	57.74	14.94	-.25	-.88	.03	4.21	70ZD	C463
C467A	d	59.03	57.42*	15.12	58.60	56.39*	14.99	-.43	-1.03	-.12	4.30	70GE	C467A
C467B	d	60.66X	59.57*	14.97	60.31X	58.53*	14.88	-.35	-1.05	-.09	4.70	70HN	C467B
C469	d	59.16	58.75	15.10	58.77	57.73	15.17	-.39	-1.03	.01	4.20	70GE	C469
C470	d	59.29	59.08	15.09	58.97	58.13	15.13	-.32	-.95	.04	4.12	70DH	C470
C472	#	59.48	58.79	15.55	59.17	57.92	15.59	-.31	-.87	.04	3.70	70KT	C472
C473	d	61.26X	61.19X	15.90*	61.30X	60.54X	15.89*	.04 X	-.64 *	-.01	4.37	70DH	C473
C474	d	59.10	57.95	14.71	58.70	56.90	14.55	-.40	-1.05	-.16	4.54	70GE	C474
C476	#	59.56	58.84	15.06	59.24	57.91	15.12	-.32	-.93	.05	3.99	70SA	C476
C479B	d	59.63	58.72	15.24	59.05	57.56	15.17	-.58	-1.16	-.07	4.07	70SA	C479B
C481	d	59.65	58.76	14.75	59.35	57.81	14.75	-.30	-.95	.00	4.34	70HB	C481
C482	d	59.17	58.23	15.26	58.68	57.10	15.13	-.49	-1.13	-.13	4.48	70GC	C482
C483	d	59.93	57.36*	14.62	59.74*	56.55	14.68	-.19	-.81	.06	4.20	70ZF	C483
C495	d	59.68	58.71	15.35	59.27	57.64	15.19	-.41	-1.07	-.16	4.60	70KS	C495
C496A	d	59.40	58.35	15.08	59.07	57.43	15.19	-.33	-.91	.11	3.86	70GE	C496A
C499B	d	59.52	57.69	14.88	59.04	56.46	14.81	-.47	-1.23	-.06	5.27*	70BL	C499B
C503	d	59.19	58.42	14.90	58.75	57.31	14.81	-.44	-1.11	-.08	4.63	70GE	C503
C508	d	59.56	58.77	15.12	59.27	57.83	14.97	-.29	-.95	-.15	4.50	70GE	C508
C511	d	59.62	58.96	15.35	59.20	57.92	15.33	-.41	-1.04	-.01	4.19	70DH	C511
C512	d	59.29	58.57	15.08	59.08	57.75	15.11	-.21	-.83	.02	4.09	70AC	C512
C524	#	59.55	58.81	14.92	59.16	57.77	14.81	-.39	-1.04	-.11	4.46	70GE	C524
C528	d	59.43	58.69	15.57	59.16	57.77	15.57	-.27	-.92	.00	4.28	70HT	C528
C529	d	59.85	58.43	15.31	59.52	57.45	15.29	-.33	-.98	-.02	4.39	70DH	C529
C532	d	59.21	58.24	14.66	58.83	57.31	14.67	-.39	-.93	.00	3.71	70GE	C532
C534	#	61.00X	59.87*	22.31X	60.68X	58.86*	22.13X	-.32	-1.01	-.18	4.65	70MD	C534
C536	d	59.27	55.23X	15.20	58.78	54.19X	15.03	-.49	-1.04	-.16	4.25	70AC	C536
C540	d	59.49	58.37	15.60	59.04	57.30	15.52	-.45	-1.07	-.08	4.31	70GE	C540
C545	d	59.39	58.69	14.84	58.95	57.62	14.71	-.44	-1.07	-.13	4.37	70SA	C545
C549	d	59.39	58.90	15.25	59.09	57.93	15.18	-.30	-.97	-.07	4.52	70DH	C549
C552	d	59.60	58.56	14.83	59.35	57.63	14.74	-.25	-.93	-.09	4.65	70HN	C552
C567	#	60.35*	58.46	14.95	60.10X	58.47	14.80	-.24	.01 X	-.16	1.54X	70HB	C567
C613	d	58.80	58.59	13.80X	58.46	57.59	13.73X	-.34	-1.00	-.07	4.48	70MD	C613
C627	d	59.48	58.77	15.29	59.22	57.88	15.32	-.27	-.88	.03	4.09	70SA	C627
C630	d	59.55	58.77	15.36	59.10	57.68	15.17	-.45	-1.09	-.19	4.47	70KS	C630
C631A	d	59.36	58.68	15.08	58.90	57.53	14.96	-.47	-1.15	-.12	4.71	70AC	C631A
C632	d	59.06	58.25	14.99	58.85	57.36	14.97	-.21	-.89	-.02	4.55	70AC	C632
C638	d	59.23	58.08	15.45	58.83	56.92	15.30	-.40	-1.16	-.15	5.26*	70GC	C638
C639	d	59.47	59.40	15.47	58.98	58.23	15.28	-.49	-1.17	-.20	4.67	70DH	C639
C644	d	59.38	58.46	14.96	58.97	57.44	14.92	-.41	-1.02	-.04	4.13	70MD	C644
C645	d	59.20	57.94	15.11	58.79	56.86	15.01	-.41	-1.08	-.10	4.62	70AC	C645
C656	d	59.50	58.30	15.22	59.12	57.30	15.11	-.38	-.99	-.12	4.25	70SA	C656
C657	d	59.72	58.09	15.22	59.49	57.21	15.26	-.23	-.88	.04	4.34	70AC	C657
C660	d	59.30	55.09X	15.04	58.90	54.22X	15.20	-.41	-.88	.16 *	3.42*	70AC	C660
C662	•	60.07*	58.42	15.53	59.67	57.38	15.32	-.40	-1.04	-.22	4.57	70SP	C662
C672	d	58.97	57.90	15.53	58.82	57.15	15.53	-.15	-.75	.00	4.03	70GC	C672

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA
COLOR * COLOR DIFFERENCE
FOR PAINT CHIPS

LAB CODE	F	SAMPLE D09 MEAN X	MEAN Y	MEAN Z	SAMPLE D10 MEAN X	MEAN Y	MEAN Z	DIFFERENCE D10 - D09 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C675	G	59.22	58.37	15.08	58.69	57.23	14.98	-.53	-1.14	-.10	4.24	70AC	C675
C683	G	59.32	57.30*	14.80	58.81	56.14*	14.66	-.51	-1.16	-.14	4.68	70GC	C683
C691	G	60.12*	58.77	18.29X	59.51	57.67	18.14X	-.61 *	-1.10	-.15	3.54*	70SA	C691
C699	G	59.50	58.12	15.83*	59.07	57.17	15.69*	-.42	-.95	-.14	3.74	70BL	C699
C700	G	59.62	58.89	15.28	59.20	57.81	15.13	-.42	-1.08	-.15	4.57	70DH	C700
C705	#	57.76X	128.78X	135.66X	56.94X	129.49X	134.72X	-.82 X	.71 X	-.94 X	2.55X	70HP	C705
C707	#	58.84	57.08*	14.83	58.58	56.19*	14.98	-.26	-.89	.15 *	4.17	70SA	C707
C716	#	70.40X	57.95	14.70	69.92X	56.95	14.58	-.48	-1.00	-.12	4.28	70ZE	C716
C717A	*	59.94	58.50	15.40	59.68	57.51	15.41	-.26	-.99	.01	4.92	70SP	C717A
C717B	*	59.98	58.64	15.35	59.70	57.69	15.40	-.28	-.95	.05	4.44	70SP	C717B
C718A	G	60.03*	58.41	15.38	59.57	57.29	15.22	-.46	-1.12	-.16	4.66	70AC	C718A
C718B	G	59.92	58.37	15.09	59.61	57.41	15.13	-.31	-.96	.04	4.36	70AC	C718B
C719C	G	59.35	59.76*	15.04	59.00	58.60*	14.90	-.35	-1.16	-.14	5.37*	70KC	C719C
C720	*	60.07*	58.63	15.53	59.79*	57.75	15.50	-.27	-.89	-.02	4.14	70SP	C720
C721	G	59.17	56.22X	17.66X	58.63	55.12X	17.54X	-.55	-1.11	-.12	4.18	70KS	C721
C722	X	59.04	57.86	15.16	58.80	56.48	15.13	-.24	-1.39 X	-.03	7.73X	70AC	C722
C723	G	59.28	58.53	15.37	59.18	57.78	15.44	-.11 *	-.75 *	.07	4.18	70MD	C723
C724	G	59.45	58.45	14.98	58.99	57.38	14.89	-.46	-1.07	-.09	4.26	70SA	C724
C725	G	59.09	58.52	15.10	58.84	57.58	15.24	-.25	-.94	.14 *	4.47	70KS	C725
C726	#	60.02	59.84*	15.72	59.61	58.80*	15.69*	-.41	-1.04	-.03	4.16	70SA	C726
C727A	*	60.16*	58.85	15.42	59.65	57.67	15.27	-.52	-1.18	-.15	4.63	70SP	C727A
C727B	*	59.70	58.23	15.22	59.38	57.25	15.21	-.32	-.98	-.02	4.47	70SP	C727B
GRAND MEANS		59.38	58.47	15.12	59.02	57.47	15.07	-.36	-.99	-.06	4.36		
SD OF MEANS		.32	.51	.29	.33	.52	.30	.11	.12	.09	.37		
INCLUDED LABS FOR THIS MEAN		65	63	63	65	63	63	66	67	66	67		

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA

COLOR • COLOR DIFFERENCE

FOR PAINT CHIPS

LAB CODE	F	SAMPLE D11 MEAN X	SAMPLE D11 MEAN Y	SAMPLE D11 MEAN Z	SAMPLE D12 MEAN X	SAMPLE D12 MEAN Y	SAMPLE D12 MEAN Z	DIFFERENCE D12 - D11 ΔX	ΔY	ΔZ	ΔE	INST CODE	INST LAB
C157	6	12.53	13.66	31.30X	12.42	13.29	31.02X	-.11	-.37	-.28	2.57	70GE	C157
C162	6	12.65	13.66	30.37	12.46	13.26	29.99	-.18	-.40	-.38	2.25	70DH	C162
C251	#	12.05	13.60	29.03	11.93	13.20	29.40	-.12	-.40	-.23	2.61	70ZE	C251
C253	#	11.91	13.32	29.12	11.73	12.90	28.79	-.19	-.42	-.33	2.26	70GC	C253
C278	6	11.80	13.16	28.57	11.65	12.82	28.28*	-.15	-.34	-.29	1.91	70NE	C278
C407	6	12.46	13.71	29.09	12.43	13.46	29.52	-.03	-.25	-.16	2.38	70SA	C407
C412	6	12.36	13.53	29.82	12.25	13.21	29.52	-.11	-.32	-.30	2.24	70GE	C412
C414	6	12.21	13.53	29.62	12.21	13.30	29.53	.00	-.23	-.10	2.47	70MD	C414
C416A	6	11.95	13.29	29.22	11.91	13.01	29.10	-.03	-.27	-.12	2.44	70GE	C416A
C416B	6	12.03	13.35	29.40	11.90	12.99	29.15	-.13	-.36	-.25	2.16	70GE	C416B
C418	6	12.64	13.60	29.81	12.54	13.23	29.59	-.11	-.36	-.22	2.60	70CE	C418
C422	6	11.80	13.18	28.87	11.68	12.84	28.67	-.12	-.34	-.20	2.13	70GC	C422
C424	6	12.52	13.77	29.98	12.34	13.36	29.64	-.18	-.41	-.35	2.24	70CA	C424
C428	6	11.91	13.23	29.29	11.78	12.86	29.04	-.13	-.36	-.25	2.27	70HB	C428
C437	#	12.20	13.62	29.20	12.06	13.25	28.99	-.14	-.37	-.21	2.22	70GC	C437
C444	6	12.47	13.69	29.86	12.27	13.25	29.40	-.20	-.44	-.46	2.49	70GE	C444
C451	6	12.08	13.43	28.41*	12.05	13.18	28.31*	-.02	-.24	-.10	2.27	70AC	C451
C459	6	12.25	13.48	29.42	12.06	13.07	29.06	-.19	-.41	-.36	2.23	70GE	C459
C460	6	11.78	12.99	28.80	11.71	12.70	28.73	-.07	-.29	-.13	2.19	70GE	C460
C462A	6	11.72	13.15	29.32	11.62	12.80	28.98	-.10	-.35	-.34	2.62	70HB	C462A
C463	6	12.33	13.60	29.74	12.22	13.26	29.43	-.12	-.34	-.31	2.29	70ZD	C463
C467A	6	12.49	14.12	29.48	12.32	13.70	29.22	-.17	-.42	-.26	2.30	70GE	C467A
C467B	6	11.81	13.20	29.72	11.58	12.73	29.30	-.23	-.47	-.42	2.29	70HN	C467B
C469	6	12.38	13.58	29.38	12.29	13.27	29.20	-.09	-.31	-.18	2.15	70GE	C469
C470	6	12.19	13.27	29.35	12.06	12.92	29.08	-.13	-.35	-.28	2.25	70DH	C470
C472	#	12.47	13.67	30.05	12.31	13.28	29.70	-.15	-.39	-.35	2.37	70KT	C472
C473	6	12.71	13.91	31.08X	12.45	13.42	30.60X	-.26	-.49	-.48	2.29	70DH	C473
C474	6	12.11	13.35	29.44	11.88	12.88	29.01	-.23	-.47	-.43	2.40	70GE	C474
C476	#	12.43	13.68	29.85	12.15	13.17	28.96	-.28	-.51	-.88 X	2.88X	70SA	C476
C479B	6	12.41	13.65	29.72	12.25	13.22	29.45	-.15	-.42	-.27	2.62	70SA	C479B
C481	X	11.73	13.07	28.91	11.73	12.77	28.81	.00	-.30	-.10	3.16X	70HB	C481
C482	6	11.59*	12.89*	28.50*	11.57	12.65	28.49	-.01	-.24	-.08	2.31	70GC	C482
C483	X	12.17	13.85	29.84	11.99	13.55	29.49	-.18	-.30	-.36	1.22X	70ZF	C483
C495	6	12.40	13.65	30.02	12.26	13.29	29.77	-.14	-.36	-.25	2.15	70KS	C495
C496A	6	12.34	13.62	29.68	12.13	13.17	29.47	-.21	-.45	-.41	2.36	70GE	C496A
C499B	6	12.29	14.00	29.43	12.22	13.68	29.47	-.07	-.32	.03 *	2.08	70HL	C499B
C503	6	12.04	13.23	29.22	11.98	12.94	29.00	-.06	-.29	-.21	2.41	70GE	C503
C508	6	12.08	13.27	29.52	12.00	12.96	29.27	-.08	-.31	-.24	2.45	70GE	C508
C511	6	12.26	13.49	29.62	12.16	13.18	29.43	-.09	-.31	-.19	2.11	70DH	C511
C512	6	12.06	13.26	29.30	11.89	12.90	29.03	-.16	-.36	-.27	1.91	70AC	C512
C524	#	12.18	13.31	29.45	11.91	12.84	29.07	-.27	-.48	-.39	2.10	70GE	C524
C528	6	12.57	13.82	30.40	12.32	13.35	29.91	-.25	-.48	-.49	2.22	70HT	C528
C529	6	12.15	13.59	29.72	11.94	13.15	29.33	-.21	-.44	-.39	2.20	70DH	C529
C532	6	11.90	13.15	29.22	11.80	12.83	29.03	-.10	-.33	-.18	2.20	70GE	C532
C534	#	17.87X	18.97X	34.49X	17.90X	18.81X	34.47X	.03 *	-.16 *	-.02	1.98	70MD	C534
C536	6	12.25	14.39*	29.81	12.04	13.95*	29.44	-.21	-.44	-.36	1.99	70AC	C536
C540	6	12.88*	14.24*	30.27	12.64*	13.77*	29.84	-.24	-.48	-.44	2.31	70GE	C540
C545	6	11.90	13.05	29.25	11.91	12.85	29.31	.02	-.20 *	.06 *	2.13	70SA	C545
C549	6	12.25	13.42	29.68	12.13	13.08	29.42	-.12	-.35	-.26	2.23	70DH	C549
C552	X	13.11*	11.88X	29.27	11.82	12.88	29.02	-1.29 X	1.00 X	-.25	35.41X	70HN	C552
C567	#	11.82	13.17	29.41	11.68	12.80	29.16	-.14	-.37	-.25	2.18	70HB	C567
C613	6	11.61*	13.24	28.48*	11.59	12.98	28.29*	-.02	-.26	-.19	2.55	70MD	C613
C627	6	12.40	13.73	30.40	12.30	13.40	30.18*	-.11	-.33	-.22	2.17	70SA	C627
C630	6	12.47	13.71	30.02	12.31	13.31	29.66	-.16	-.40	-.37	2.44	70KS	C630
C631A	6	12.33	13.57	29.64	12.17	13.19	29.32	-.16	-.38	-.32	2.15	70AC	C631A
C632	6	12.28	13.53	29.60	12.05	13.08	29.17	-.23	-.45	-.43	2.22	70AC	C632
C638	6	11.65	13.09	28.79	11.55	12.78	28.69	-.10	-.30	-.10	1.82*	70GC	C638
C639	6	12.25	13.31	29.57	12.11	12.94	29.23	-.15	-.37	-.34	2.36	70DH	C639
C644	6	12.10	13.46	29.02	12.11	13.26	29.02	.01	-.21 *	-.01 *	2.19	70MD	C644
C645	6	12.14	13.49	29.32	12.12	13.23	29.24	-.02	-.25	-.08	2.30	70AC	C645
C656	6	12.26	13.62	29.72	12.13	13.27	29.56	-.13	-.35	-.16	2.03	70SA	C656
C657	6	11.94	13.42	29.25	11.83	13.10	29.06	-.11	-.33	-.18	1.99	70AC	C657
C660	6	12.40	14.55X	29.85	12.19	14.11X	29.55	-.21	-.44	-.30	1.96	70AC	C660
C662	•	12.13	13.62	29.81	11.94	13.20	29.50	-.19	-.41	-.31	2.10	70SP	C662
C672	6	11.64	12.86*	28.51*	11.49*	12.51*	28.26*	-.15	-.35	-.25	1.95	70GC	C672

X,Y,Z SPACE ANALYSIS, ADJUSTED DATA

COLOR * COLOR DIFFERENCE

FOR PAINT CHIPS

LAB CODE	F	SAMPLE D11 MEAN X	MEAN Y	MEAN Z	SAMPLE D12 MEAN X	MEAN Y	MEAN Z	DIFFERENCE D12 - D11 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C675	d	12.32	13.61	29.52	12.10	13.16	29.14	-.22	-.45	-.38	2.21	70AC	C675
C683	d	10.70X	12.26X	27.20X	10.60X	11.96X	27.03X	-.09	-.30	-.17	1.97	70GC	C683
C691	d	12.25	13.64	28.85	12.02	13.18	28.41	-.23	-.46	-.44	2.27	70SA	C691
C699	d	12.87*	14.32*	30.24	12.66*	13.84*	29.88	-.21	-.48	-.36	2.53	70BL	C699
C700	d	12.27	13.51	29.61	12.02	13.04	29.16	-.25	-.46	-.45	2.12	70DH	C700
C705	#	12.43	58.91X	74.88X	12.10	58.91X	73.78X	-.33 *	.00 X	-1.10 X	1.55X	70HP	C705
C707	#	11.78	13.04	28.34*	11.58	12.60	27.82X	-.20	-.44	-.51	2.64	70SA	C707
C716	#	8.99X	13.61	29.63	8.90X	13.21	29.28	-.10	-.40	-.35	1.89	70ZE	C716
C717A	*	12.11	13.58	29.59	11.87	13.10	29.16	-.24	-.48	-.43	2.33	70SP	C717A
C717B	*	12.13	13.58	29.76	12.05	13.26	29.57	-.08	-.32	-.19	2.34	70SP	C717B
C718A	d	12.05	13.56	29.42	12.03	13.31	29.28	-.02	-.25	-.13	2.40	70AC	C718A
C718B	d	11.93	13.42	29.40	11.93	13.19	29.32	.01	-.23	-.08	2.48	70AC	C718B
C719C	d	12.51	13.67	29.91	12.24	13.17	29.49	-.27	-.50	-.43	2.31	70KC	C719C
C720	*	12.21	13.67	29.77	12.06	13.29	29.46	-.14	-.38	-.30	2.23	70SP	C720
C721	d	13.34X	15.14X	30.15	13.11X	14.73X	29.79	-.23	-.41	-.36	1.70*	70KS	C721
C722	d	12.22	13.49	29.60	12.11	13.15	29.39	-.11	-.33	-.20	2.09	70AC	C722
C723	d	12.20	13.44	29.97	12.00	13.03	29.62	-.20	-.41	-.35	2.01	70MD	C723
C724	d	12.31	13.58	29.09	12.15	13.18	29.37	-.16	-.40	-.32	2.28	70SA	C724
C725	d	12.62	13.70	30.19	12.38	13.31	29.38	-.25	-.39	-.81 X	2.17	70KS	C725
C726	#	12.66	13.74	30.73*	12.52	13.37	30.41*	-.14	-.37	-.32	2.30	70SA	C726
C727A	*	12.07	13.50	29.51	11.97	13.17	29.24	-.10	-.33	-.27	2.29	70SP	C727A
C727B	*	12.02	13.50	29.34	11.94	13.18	29.10	-.08	-.32	-.24	2.40	70SP	C727B
GRAND MEANS		12.21	13.51	29.52	12.08	13.15	29.25	-.14	-.36	-.27	2.24		
SD OF MEANS		.30	.31	.48	.27	.28	.42	.08	.08	.13	.19		
INCLUDED LABS FOR THIS MEAN		64	63	63	64	63	63	66	66	65	66		

L, a, b SPACE ANALYSIS, ADJUSTED DATA
COLOR - COLOR DIFFERENCE
FOR PAINT CHIPS

LAB		SAMPLE D09			SAMPLE D10			DIFFERENCE D10 - D09				INST	
CODE	F	MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	Δa	Δb	ΔE	CODE	LAB
C121	G	76.90	4.20	43.36*	76.40	5.71	42.73*	-.50	1.51	-.65	1.72	70HM	C121
C148	G	77.20	5.17	42.46	76.65	6.63	41.86	-.55	1.45	-.60	1.67	70SC	C148
C152	G	77.44	5.55	42.09	76.79	7.10	41.48	-.65	1.56	-.60	1.79	70HA	C152
C166	X	78.76X	5.72	42.07	76.73	7.19	41.51	-2.03 X	1.47	-.55	2.56X	70HA	C166
C183	G	77.75	4.29	42.10	77.19	5.86	41.54	-.56	1.56	-.55	1.75	70HA	C183
C223	G	76.58	5.39	41.75	75.98	6.84	41.19	-.60	1.45	-.56	1.66	70HA	C223
C233	#	74.82X	14.16X	40.24X	74.27X	14.57X	39.77X	-.55	.41 X	-.47	.83X	70SC	C233
C241	G	78.04*	4.19	42.65	77.39	5.65	42.00	-.65	1.46	-.65	1.73	70HA	C241
C256A	G	77.21	5.18	42.52	76.59	6.78	41.96	-.62	1.60	-.56	1.80	70HM	C256A
C256B	G	76.78	4.81	42.16	76.16	6.25	41.56	-.62	1.45	-.60	1.69	70HU	C256B
C259	G	77.54	5.16	42.22	76.89	6.72	41.66	-.66	1.56	-.56	1.79	70HA	C259
C288	G	77.03	4.84	42.63	76.42	6.50	42.13	-.60	1.66	-.55	1.85	70HM	C288
C291	G	77.36	4.99	41.93	76.65	6.65	41.48	-.70	1.66	-.45	1.86	70HA	C291
C317	G	77.11	4.45	42.01	76.40	5.86	41.40	-.71	1.41	-.60	1.69	70HM	C317
C320	#	76.67	4.83	42.00	75.97	6.14	41.35	-.70	1.30 *	-.65	1.62	70HA	C320
C325	G	76.62	3.65	41.38	76.02	5.25	40.84	-.60	1.59	-.54	1.79	70HR	C325
C356	G	77.36	5.88	42.45	76.70	7.54	41.90	-.66	1.66	-.55	1.87	70HM	C356
C380	G	77.30	5.55	42.28	76.70	7.46	41.88	-.60	1.51	-.40 *	1.67	70HA	C380
C382	G	77.23	4.01	42.03	76.57	5.57	41.48	-.65	1.56	-.55	1.78	70HA	C382
C390	G	76.89	5.62	42.31	76.29	6.98	41.66	-.60	1.36	-.65	1.62	70HF	C390
C402	G	79.05X	4.52	43.14	78.46X	6.06	42.51	-.59	1.54	-.63	1.77	70HA	C402
C420A	G	77.25	2.64*	40.78*	76.74	4.14*	40.23*	-.50	1.50	-.55	1.68	70HA	C420A
C420B	G	77.37	2.69*	40.90*	76.76	4.20*	40.24*	-.60	1.50	-.65	1.74	70HA	C420B
C427	G	77.49	5.88	42.30	76.74	7.29	41.70	-.75	1.41	-.60	1.71	70HA	C427
C440	G	77.10	5.71	42.83	76.52	7.19	42.21	-.58	1.48	-.63	1.71	70HA	C440
C442	X	77.53	5.02	42.35	77.53*	5.02	42.25	.00 X	.00 X	-.10 X	.10X	70HM	C442
C454	G	76.49	3.93	41.77	75.86	5.50	41.18	-.63	1.58	-.59	1.80	70HA	C454
C458	G	77.54	5.29	42.34	77.01	6.94	42.00	-.53	1.65	-.54	1.81	70HM	C458
C475	G	76.91	5.58	42.12	76.13	7.05	41.48	-.78 *	1.47	-.64	1.79	70HA	C475
C494	G	77.53	5.57	41.89	76.83	7.27	41.44	-.70	1.70	-.45	1.89	70HA	C494
C496B	G	76.67	4.25	44.27X	75.97	5.92	43.67X	-.70	1.67	-.60	1.90	70GP	C496B
C499A	G	77.50	5.83	40.53X	76.79	7.09	39.82X	-.70	1.26 *	-.70 *	1.61	70HA	C499A
C499C	G	77.48	7.29*	42.28	76.77	8.90*	41.73	-.71	1.61	-.55	1.84	70HA	C499C
C506	G	77.58	5.78	42.09	76.87	7.28	41.54	-.70	1.51	-.55	1.75	70HA	C506
C514A	*	77.18	6.14	42.07	76.61	7.68	41.50	-.57	1.54	-.58	1.74	70SR	C514A
C517	G	76.90	4.85	41.81	76.35	6.29	41.31	-.55	1.44	-.50	1.62	70HQ	C517
C538	G	78.65X	6.54	42.21	78.40X	7.86	41.60	-.26 X	1.32	-.61	1.48*	70GX	C538
C541	G	76.55	5.26	41.35	76.00	6.91	40.85	-.55	1.65	-.50	1.81	70GP	C541
C543	G	77.60	5.79	42.12	77.09	7.30	41.49	-.51	1.50	-.63	1.71	70HA	C543
C547	G	75.58X	5.37	45.60X	74.98X	7.22	45.14X	-.60	1.86 X	-.52	2.02*	70HQ	C547
C574	G	76.71	4.89	42.36	76.17	6.48	41.86	-.55	1.59	-.50	1.75	70HQ	C574
C576	G	77.24	6.49	42.09	76.59	8.12	41.59	-.65	1.64	-.50	1.83	70SB	C576
C600	G	76.91	6.90	41.43	76.35	8.41	40.93	-.56	1.51	-.50	1.69	70GD	C600
C619	G	76.44	5.28	41.84	75.84	6.99	41.34	-.60	1.70	-.50	1.87	70SC	C619
C620	G	77.00	4.85	42.40	76.37	6.45	41.90	-.63	1.60	-.50	1.79	70MG	C620
C628	G	77.04	4.81	42.04	76.07	6.29	41.54	-.97 X	1.48	-.50	1.84	70ME	C628
C655	G	77.96	3.64	42.86	77.34	5.19	42.24	-.62	1.55	-.62	1.78	70HU	C655
C677	G	76.18*	6.72	42.49	75.40*	8.21	41.94	-.78 *	1.50	-.55	1.77	70SC	C677
C690	G	77.47	4.88	42.30	76.87	6.39	41.75	-.61	1.52	-.56	1.72	70HM	C690
C709	#	77.02	4.85	41.91	76.26	6.31	41.27	-.76	1.46	-.64	1.76	70SC	C709
C719A	G	76.63	4.55	42.21	75.93	6.04	41.71	-.70	1.49	-.50	1.72	70HA	C719A
C719B	G	77.66	6.50	42.49	77.16	7.86	41.94	-.50	1.36	-.55	1.55*	70HA	C719B
GRAND MEANS		77.15	5.12	42.16	76.52	6.66	41.60	-.62	1.53	-.56	1.75		
SD OF MEANS		.43	1.00	.51	.44	.99	.49	.07	.10	.06	.10		
INCLUDED LABS FOR THIS MEAN		43	46	43	43	46	43	44	45	46	46		

MCCA COLLABORATIVE REFERENCE PROGRAM

L, a, b SPACE ANALYSIS, ADJUSTED DATA

COLOR • COLOR DIFFERENCE

FOR PAINT CHIPS

LAB CODE	F	SAMPLE D11 MEAN L	MEAN A	MEAN B	SAMPLE D12 MEAN L	MEAN A	MEAN B	DIFFERENCE D12 - D11 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C121	6	36.29	-4.73	-22.98	35.73	-3.62	-23.64	-.55	1.11	-.65	1.40	70HM	C121
C148	6	36.90	-5.44	-21.89	36.24	-4.43	-22.65	-.65	1.00	-.75	1.41	70SC	C148
C152	6	37.06	-5.25	-21.81	36.41	-4.29	-22.61	-.65	.95	-.80 *	1.41	70HA	C152
C166	6	36.48	-5.70	-22.39	36.12	-4.60	-22.94	-.35	1.11	-.55	1.29	70HA	C166
C183	6	36.68	-5.05	-22.21	36.17	-4.04	-22.82	-.51	1.01	-.60	1.28	70HA	C183
C223	6	37.30	-5.15	-21.17*	36.80	-4.10	-21.76*	-.50	1.05	-.59	1.30	70HA	C223
C233	#	38.25X	-9.04X	-20.24X	37.58X	-7.54X	-20.89X	-.67	1.50 X	-.65	1.76X	70SC	C233
C241	6	36.53	-5.05	-22.61	35.92	-4.05	-23.17	-.60	1.01	-.55	1.30	70HA	C241
C256A	6	36.40	-5.22	-22.59	35.92	-4.12	-23.20	-.48	1.10	-.61	1.34	70HM	C256A
C256B	6	36.19	-4.35	-22.81	35.72	-3.32	-23.32	-.47	1.03	-.52	1.25	70HU	C256B
C259	6	36.68	-5.17	-22.49	36.27	-4.11	-23.09	-.40	1.06	-.60	1.28	70HA	C259
C288	6	36.19	-4.79	-22.31	35.89	-3.68	-22.81	-.30	1.11	-.50	1.25	70HM	C288
C291	6	36.34	-5.24	-22.31	35.99	-4.19	-23.01	-.35	1.06	-.70	1.32	70HA	C291
C317	6	36.33	-4.91	-21.91	35.93	-3.80	-22.52	-.40	1.11	-.60	1.33	70HM	C317
C320	#	37.21	4.12X	21.49X	36.71	3.08X	22.04X	-.50	-1.04 X	.55 X	1.28	70HA	C320
C325	6	36.96	-4.37	-21.50	36.41	-3.35	-22.09	-.55	1.02	-.59	1.30	70HR	C325
C356	6	36.33	-5.34	-22.65	35.83	-4.33	-23.35	-.50	1.01	-.70	1.33	70HM	C356
C380	6	36.49	-5.53	-22.32	35.94	-4.48	-22.97	-.55	1.05	-.65	1.36	70HA	C380
C382	6	36.60	-4.71	-21.83	36.15	-3.70	-22.49	-.45	1.00	-.65	1.28	70HA	C382
C390	6	36.71	-5.22	-22.09	36.31	-4.22	-22.74	-.40	1.00	-.65	1.26	70HF	C390
C402	6	37.49*	-5.46	-23.04	37.09*	-4.38	-23.63	-.41	1.08	-.60	1.30	70HA	C402
C420A	6	37.16	-5.47	-26.54X	36.76	-4.47	-27.14X	-.40	1.00	-.60	1.24	70HA	C420A
C420B	6	37.22	-5.40	-26.37X	36.72	-4.25	-27.07X	-.50	1.15 *	-.70	1.44	70HA	C420B
C427	6	36.71	-5.46	-22.56	36.26	-4.45	-23.21	-.45	1.00	-.65	1.28	70HA	C427
C440	6	36.92	-5.25	-22.30	36.47	-4.22	-22.93	-.45	1.03	-.63	1.29	70HA	C440
C442	6	36.19	-5.24	-22.56	35.79	-4.23	-23.17	-.40	1.01	-.60	1.24	70HM	C442
C454	X	37.64*	-4.59	-21.52	36.91	-3.45	-22.34	-.73 *	1.15	-.82 *	1.59X	70HA	C454
C458	6	36.41	-5.48	-22.35	35.96	-4.37	-22.88	-.45	1.11	-.52	1.30	70HM	C458
C475	6	36.89	-5.15	-22.22	36.36	-4.07	-22.82	-.53	1.08	-.60	1.35	70HA	C475
C494	6	36.94	-5.40	-22.19	36.29	-4.20	-22.59	-.65	1.20 X	-.40 X	1.42	70HA	C494
C496B	6	36.37	-4.77	-23.00	35.68	-3.78	-23.63	-.69	.99	-.63	1.36	70GP	C496B
C499A	6	36.56	-5.72	-25.35X	36.06	-4.71	-26.05X	-.50	1.01	-.70	1.33	70HA	C499A
C499C	6	36.70	-6.58X	-22.39	36.19	-5.53*	-23.04	-.50	1.06	-.65	1.34	70HA	C499C
C506	6	36.40	-5.43	-22.54	36.15	-4.37	-23.09	-.25 *	1.05	-.55	1.22	70HA	C506
C514A	•	36.98	-5.60	-22.47	36.51	-4.54	-23.03	-.47	1.06	-.56	1.28	70SR	C514A
C517	6	36.36	-3.99*	-22.33	35.86	-3.00*	-22.98	-.50	1.00	-.65	1.29	70HQ	C517
C538	6	37.57*	-1.74X	-26.37X	37.11*	-.72X	-26.98X	-.46	1.02	-.61	1.27	70GX	C538
C541	6	36.20	-4.94	-22.09	35.55	-3.89	-22.74	-.65	1.05	-.65	1.39	70GP	C541
C543	6	36.52	-5.91	-22.46	36.13	-4.82	-23.07	-.38	1.10	-.61	1.31	70HA	C543
C547	X	29.76X	-6.76X	-27.71X	29.09X	-5.40*	-28.67X	-.66	1.36 X	-.96 X	1.79X	70HQ	C547
C574	6	36.62	-4.61	-22.10	36.03	-3.62	-22.75	-.60	.99	-.65	1.33	70HQ	C574
C576	X	36.45	-5.53	-22.49	35.80	-5.02	-22.77	-.65	.51 X	-.27 X	.87X	70SB	C576
C600	6	37.14	-6.80X	-21.51	36.54	-5.69*	-22.16	-.61	1.11	-.66	1.42	70GD	C600
C619	6	36.27	-4.90	-21.80	35.67	-3.80	-22.40	-.60	1.10	-.60	1.39	70SC	C619
C620	6	36.34	-5.25	-22.94	35.84	-4.19	-23.53	-.50	1.06	-.59	1.31	70MG	C620
C628	6	37.33	-5.01	-22.07	36.77	-3.92	-22.56	-.57	1.09	-.49 *	1.33	70ME	C628
C655	6	37.04	-4.67	-22.08	36.58	-3.71	-22.65	-.46	.96	-.57	1.21	70HU	C655
C677	6	37.10	-5.66	-22.31	36.23	-4.78	-23.07	-.88 X	.87 X	-.75 *	1.45*	70SC	C677
C690	6	36.21	-5.16	-22.01	35.60	-4.14	-23.26	-.61	1.01	-.66	1.35	70HM	C690
C709	#	37.06	-4.20*	-21.93	36.71	-3.11	-22.43	-.35	1.09	-.50	1.25	70SC	C709
C719A	6	36.54	-5.17	-21.77	35.95	-4.17	-22.37	-.60	1.00	-.60	1.31	70HA	C719A
C719B	6	36.54	-6.31*	-22.59	35.98	-5.35*	-23.19	-.55	.96	-.60	1.26	70HA	C719B
GRAND MEANS		36.67	-5.17	-22.29	36.16	-4.19	-22.90	-.50	1.04	-.62	1.32		
SD OF MEANS		.38	.43	.42	.38	.53	.42	.10	.05	.06	.06		
INCLUDED LABS FOR THIS MEAN		45	42	41	45	44	41	44	43	44	45		

NOTES ON NBS REFLECTANCE VALUES

The tables on page 23 of this report contain absolute reflectance values measured at 40 wavelengths (380-770 nm) and tristimulus values for three of the five samples covered by this report. The measurements were performed by the Radiometric Physics Division of the National Bureau of Standards.

These values represent state-of-the-art color measurements on a single specimen of each sample. Thus the results give an accurate picture of the values for single specimens and are not an accurate measure of the whole sample population. Participants should be aware of this concept when comparing their measurements to these NBS values.

NBS VALUES FOR SPECTRAL REFLECTANCE

45/0 REFLECTANCE FACTOR

Samples D09, D11, W18

WAVELENGTH (nm)	D09	D11	W18
380	.0767	.0938	.1270
390	.0969	.1377	.2295
400	.1128	.1945	.4518
410	.1165	.2263	.7025
420	.1160	.2361	.8171
430	.1160	.2425	.8447
440	.1175	.2505	.8552
450	.1199	.2581	.8635
460	.1224	.2603	.8706
470	.1245	.2595	.8776
480	.1267	.2561	.8833
490	.1305	.2497	.8888
500	.1443	.2398	.8936
510	.2021	.2250	.8974
520	.3356	.2044	.9010
530	.4974	.1790	.9038
540	.6158	.1526	.9059
550	.6826	.1264	.9069
560	.7174	.1040	.9074
570	.7380	.0905	.9090
580	.7519	.0849	.9113
590	.7598	.0823	.9133
600	.7648	.0800	.9136
610	.7676	.0788	.9143
620	.7693	.0803	.9160
630	.7708	.0849	.9183
640	.7717	.0911	.9203
650	.7726	.0966	.9225
660	.7727	.0996	.9213
670	.7732	.0976	.9149
680	.7736	.0912	.9178
690	.7742	.0863	.9235
700	.7748	.0856	.9254
710	.7757	.0883	.9267
720	.7765	.0929	.9280
730	.7773	.0995	.9290
740	.7780	.1110	.9315
750	.7785	.1289	.9327
760	.7797	.1495	.9352
770	.7807	.1681	.9366

NBS TRISTIMULUS VALUES

45/0 REFLECTANCE FACTOR

SAMPLES D09, D11, W18

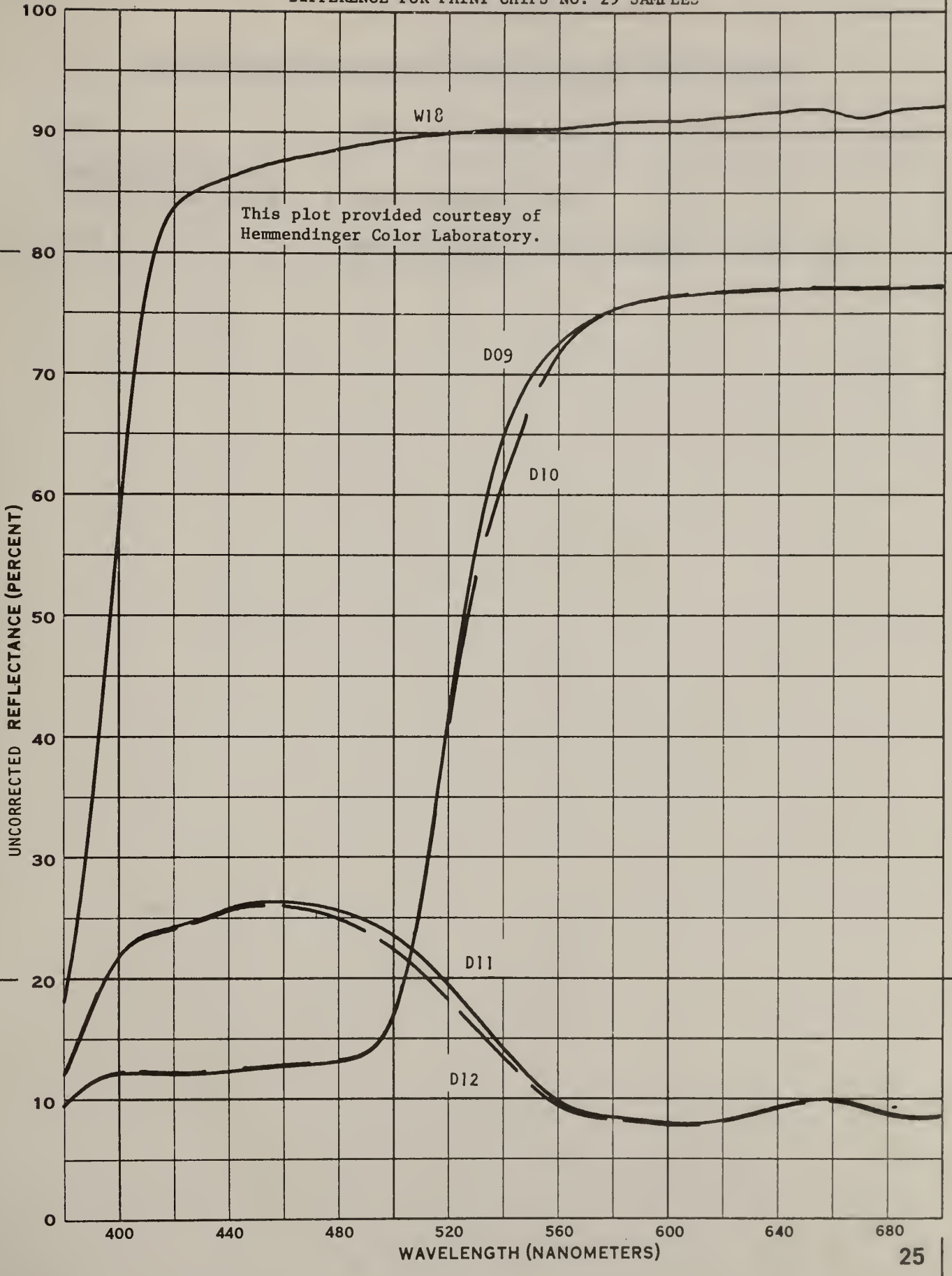
X, Y, Z SPACE

	D09	D11	W18
X	60.26	12.18	88.34
Y	59.52	13.44	90.58
Z	14.86	29.55	101.66

L, a, b SPACE

	D09	D11	W18
L	77.15	36.65	95.17
a	4.41	-4.83	-0.87
b	42.58	-22.14	3.29

SPECTROPHOTOMETRIC CURVES OF COLOR AND COLOR DIFFERENCE FOR PAINT CHIPS NO. 29 SAMPLES



Notes on Specific Laboratory Results for Near White Papers

C446	- Data received too late to be included in this report
C662, C717A, C717B C720, C727A, C727B	- Used illuminant D 65
C713	- Reported extreme values compared to other labs on all samples

REPORT NO. 29 — MCCA COLLABORATIVE REFERENCE PROGRAM — 1979-1980

X, Y, Z SPACE ANALYSIS, NORMAL DATA

COLOR • COLOR DIFFERENCE

FOR NEAR WHITE PAPERS

LAB CODE	P	SAMPLE X52 MEAN X	MEAN Y	MEAN Z	SAMPLE X56 MEAN X	MEAN Y	MEAN Z	DIFFERENCE X56 - X52 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C162	G	84.25	85.73	97.72	84.57	86.14	97.40	.32	.40	-.32	.98	71DE	C162
C244	G	81.81	83.42	94.85	82.17	83.84	94.57	.36	.42	-.27	1.02	71ZE	C244
C313	G	82.21	83.65	95.23	82.30	84.00	95.14	.09	.35	-.09	1.07	71ZE	C313
C662	•	79.43	83.18	87.43	79.75	83.61	87.04	.32	.43	-.40	1.11	71SP	C662
C716	X	83.55	83.11	79.98	84.04	83.50	79.64	.49	.38	-.34	1.59X	71ZE	C716
C717A	•	79.65	83.48	87.77	79.95	83.85	87.58	.31	.37	-.19	.81	71SP	C717A
C717B	•	79.63	83.41	87.77	79.90	83.77	87.33	.27	.35	-.45	1.07	71SP	C717B
C720	•	79.64	83.45	87.87	79.95	83.84	87.49	.31	.39	-.38	1.06	71SP	C720
C727A	•	79.58	83.39	87.67	79.95	83.82	87.58	.37	.44	-.10	.83	71SP	C727A
C727B	•	79.55	83.36	87.76	79.88	83.78	87.43	.33	.42	-.33	1.04	71SP	C727B
GRAND MEANS		82.76	84.27	95.94	83.02	84.66	95.71	.26	.39	-.23	1.03		
SD OF MEANS		1.31	1.28	1.36	1.35	1.28	1.50	.15	.04	.12	.05		
INCLUDED LABS FOR THIS MEAN		3	3	3	3	3	3	3	3	3	3		

L, a, b SPACE ANALYSIS, NORMAL DATA
COLOR * COLOR DIFFERENCE
FOR NEAR WHITE PAPERS

LAB CODE	F	SAMPLE X52 MEAN L	MEAN A	MEAN B	SAMPLE X56 MEAN L	MEAN A	MEAN B	DIFFERENCE X56 - X52 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C105	6	91.50	-.38	2.25	91.73	-.47	2.82	.23	-.08	.57	.62	71HM	C105
C122	6	91.48	-.20	2.20	91.70	-.33	2.70	.22	-.12	.50	.56	71HM	C122
C128	6	91.26	-.20	2.30	91.49	-.28	2.64	.23	-.08	.34 *	.42	71HM	C128
C148	6	92.22	-.56	2.60	92.49	-.63	3.15	.27	-.07	.55	.62	71SC	C148
C150	6	91.95	-.76	2.45	92.17	-.98*	3.03	.22	-.23 *	.57	.66	71HA	C150
C213	6	90.76*	-.20	2.28	90.96*	-.35	2.79	.21	-.15	.51	.58	71SC	C213
C222	6	92.32	-.24	2.13	92.57	-.38	2.67	.25	-.14	.54	.61	71HA	C222
C226	6	92.00	-.24	2.20	92.22	-.30	2.60	.22	-.06	.40	.46	71HA	C226
C230	6	91.96	-.41	2.34	92.17	-.57	2.98	.20	-.16	.65	.70	71HA	C230
C262	6	91.63	-.37	2.07	91.86	-.44	2.64	.23	-.08	.57	.62	71SB	C262
C285	6	91.47	-.66	3.07*	91.72	-.81	3.42	.25	-.15	.35	.45	71MC	C285
C324	6	91.96	-.09	2.34	92.20	-.23	2.88	.25	-.14	.54	.60	71HA	C324
C328	6	92.09	-.53	2.09	92.35	-.68	2.62	.26	-.15	.53	.61	71HA	C328
C340	6	92.05	-.64	2.18	92.27	-.77	2.67	.23	-.13	.50	.56	71HA	C340
C352	6	92.02	-.30	2.13	92.28	-.48	2.75	.26	-.18	.61	.69	71HA	C352
C442	6	91.30	-.42	2.28	91.56	-.59	2.89	.27	-.17	.62	.69	71HM	C442
C456	6	91.43	-.34	2.32	91.63	-.47	2.87	.20	-.13	.55	.60	71SC	C456
C571	6	91.51	-.56	2.52	91.72	-.62	3.14	.22	-.06	.62	.65	71HQ	C571
C585	6	91.85	-.27	1.98	92.02	-.37	2.44	.17 *	-.10	.46	.51	71HA	C585
C670	6	91.30	-.66	3.06*	91.50	-.79	3.59*	.21	-.13	.53	.58	71ME	C670
C702	6	91.84	-.66	2.65	91.98	-.50	3.01	.14 X	.16 X	.36	.42	71HA	C702
C713	6	93.99X	.33X	2.37	94.23X	-.03*	2.87	.24	-.35 X	.49	.65	71HA	C713
GRAND MEANS		91.71	-.41	2.35	91.93	-.50	2.87	.23	-.13	.52	.58		
SD OF MEANS		.39	.19	.28	.40	.22	.27	.03	.05	.09	.09		
INCLUDED LABS FOR THIS MEAN		21	21	22	21	22	22	21	20	22	22		

EXPLANATION OF DATA FOR WHITE SAMPLE FOR NEAR WHITE PAPERS

Specimens of a white calibration sample (Paint Chips) were distributed to the participants along with the two sets of eight near white paper, and each participant was asked to return measurement data for the white calibration sample (Paint Chips), reporting results in the same manner as for the near white papers.

As a first step, three laboratories were selected to serve as "reference" laboratories for the purposes of this analysis and the average of their X, Y, Z values for the white sample were computed. Next, the ratios of the participants data to the combined reference laboratory values were calculated for each participant (transformed to X, Y, Z space if necessary). These ratios are shown in the White Sample Analysis table.

Two observations can be made about the data in the White Sample Analysis tables. First, the participants as a whole tend to be high compared with the combined average values obtained by the selected reference laboratories. Second , a few participants had noticeably extreme values for one or more of the components and these participants especially should look to the cause.

Next, the ratios in the White Sample Analysis tables were used to "adjust" the data of the normal data tables to obtain the adjusted data table values. The adjustment consisted of dividing the X, Y, Z values of the normal data tables by the respective ratios in the White Sample Analysis tables.

The significant change is the adjusted data tables is in the SD OF MEANS. Comparison of these among-laboratory standard deviations with those in the normal data tables, shows considerable reduction for X, Y. Z. Thus part, at least, of the disagreement among participants is due to errors in standardization that could be corrected through use of an agreed-upon white standard. There is no similar significant change for ΔX, ΔY, and ΔZ.

REPORT NO. 29

MCCA COLLABORATIVE REFERENCE PROGRAM
WHITE SAMPLE ANALYSIS FOR NEAR WHITE PAPERS
X, Y, Z LABORATORIES

1979-1980

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C162	.9962	.9915	1.0003	71DH	-.38	-.85	.03
C244	.9887	.9850	.9941	71ZE	-1.13	-1.50	-.59
C313	.9881	.9826	.9877	71ZE	-1.19	-1.74	-1.23
C662	.9514	.9731	.9036	71SP	-4.86	-2.69	-9.64
C716	1.0143	.9815	.8413	71ZE	1.43	-1.85	-15.87
C717A	.9550	.9774	.9126	71SP	-4.50	-2.26	-8.74
C717B	.9553	.9775	.9135	71SP	-4.47	-2.25	-8.65
C720	.9566	.9787	.9144	71SP	-4.34	-2.13	-8.56
C727A	.9579	.9804	.9177	71SP	-4.21	-1.96	-8.23
C727B	.9586	.9811	.9176	71SP	-4.14	-1.89	-8.24

WHITE SAMPLE ANALYSIS FOR NEAR WHITE PAPERS
L, a, b LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C105	.9848	.9817	.9935	71HM	-1.52	-1.83	-.65
C122	.9845	.9817	.9919	71HM	-1.55	-1.83	-.81
C128	.9803	.9776	.9822	71HM	-1.97	-2.24	-1.78
C148	.9965	.9943	1.0025	71SC	-.35	-.57	.25
C150	.9879	.9862	.9937	71HA	-1.21	-1.38	-.63
C213	.9741	.9713	.9797	71SC	-2.59	-2.87	-2.03
C222	1.0021	.9982	1.0082	71HA	.21	-.18	.82
C226	.9872	.9838	.9949	71HA	-1.28	-1.62	-.51
C230	.9883	.9857	.9961	71HA	-1.17	-1.43	-.39
C262	.9960	.9930	1.0065	71SB	-.40	-.70	.65
C285	.9719	.9728	.9600	71MG	-2.81	-2.72	-4.00
C324	.9896	.9859	.9947	71HA	-1.04	-1.41	-.53
C328	.9911	.9897	.9974	71HA	-.89	-1.03	-.26
C340	.9862	.9844	.9895	71HA	-1.38	-1.56	-1.05
C352	.9896	.9859	.9939	71HA	-1.04	-1.41	-.61
C442	.9787	.9765	.9803	71HM	-2.13	-2.35	-1.97
C456	.9894	.9868	.9910	71SC	-1.06	-1.32	-.90
C571	.9878	.9851	.9932	71HQ	-1.22	-1.49	-.68
C585	.9871	.9838	.9978	71HA	-1.29	-1.62	-.22
C670	.9695	.9700	.9590	71ME	-3.05	-3.00	-4.10
C702	.9854	.9838	.9886	71HA	-1.46	-1.62	-1.14
C713	1.0414	1.0366	1.0445	71HA	4.14	3.66	4.45

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA

COLOR • COLOR DIFFERENCE

FOR NEAR WHITE PAPERS

LAB CODE	F	SAMPLE X52 MEAN X	MEAN Y	MEAN Z	SAMPLE X56 MEAN X	MEAN Y	MEAN Z	DIFFERENCE X56 - X52 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C162	G	84.58	86.47	97.70	84.90	86.88	97.38	.33	.41	-.32	.98	71DE	C162
C244	G	82.75	84.69	95.41	83.12	85.12	95.13	.36	.43	-.28	1.02	71ZE	C244
C313	G	83.20	85.14	96.42	83.29	85.49	96.33	.09	.36	-.09	1.08	71ZE	C313
C662	•	83.49	85.48	96.77	83.83	85.92	96.33	.34	.44	-.44	1.16	71SP	C662
C716	X	82.38	84.69	95.06	82.86	85.08	94.66	.48	.39	-.40	1.70X	71ZE	C716
C717A	•	83.40	85.41	96.18	83.72	85.79	95.98	.32	.38	-.20	.84	71SP	C717A
C717B	•	83.36	85.34	96.09	83.64	85.70	95.60	.28	.36	-.49	1.11	71SP	C717B
C720	•	83.26	85.27	96.09	83.58	85.66	95.68	.32	.39	-.41	1.09	71SP	C720
C727A	•	83.07	85.06	95.54	83.46	85.50	95.44	.39	.44	-.10	.86	71SP	C727A
C727B	•	82.98	84.97	95.64	83.33	85.40	95.28	.34	.43	-.36	1.08	71SP	C727B
GRAND MEANS		83.51	85.43	96.51	83.77	85.83	96.28	.26	.40	-.23	1.03		
SD OF MEANS		.95	.93	1.15	.98	.93	1.12	.15	.04	.12	.05		
INCLUDED LABS FOR THIS MEAN		3	3	3	3	3	3	3	3	3	3		

MCCA COLLABORATIVE REFERENCE PROGRAM
L, a, b SPACE ANALYSIS, ADJUSTED DATA
COLOR • COLOR DIFFERENCE
FOR NEAR WHITE PAPERS

LAB CODE	F	SAMPLE X52 MEAN L	MEAN A	MEAN B	SAMPLE X56 MEAN L	MEAN A	MEAN B	DIFFERENCE X56 - X52 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C105	6	92.35	-0.89	3.01	92.58	-0.97	3.57	0.23	-0.09	0.57	0.62	71HM	C105
C122	6	92.33	-0.66	2.86	92.55	-0.78	3.36	0.22	-0.13	0.50	0.56	71HM	C122
C128	6	92.30	-0.66	2.82	92.53	-0.73	2.96	0.24	-0.08	0.34	0.42	71HM	C128
C148	6	92.48	-0.93	3.12	92.76	-0.99	3.67	0.28	-0.07	0.55	0.62	71SC	C148
C150	6	92.60	-1.03	2.94	92.82	-1.26*	3.52	0.22	-0.23 *	0.58	0.66	71HA	C150
C213	6	92.08	-0.65	2.84	92.30	-0.81	3.35	0.21	-0.15	0.52	0.58	71SC	C213
C222	6	92.40	-0.86	2.75	92.65	-1.00	3.29	0.25	-0.15	0.54	0.61	71HA	C222
C226	6	92.75	-0.80	2.91	92.97	-0.86	3.31	0.22	-0.06	0.40	0.46	71HA	C226
C230	6	92.63	-0.84	3.00	92.84	-1.01	3.65	0.21	-0.17	0.65	0.70	71HA	C230
C262	6	91.95*	-0.85	2.91	92.18*	-0.93	3.48	0.23	-0.08	0.57	0.62	71SB	C262
C285	6	92.75	-0.52	2.28*	92.99	-0.67	2.64*	0.25	-0.15	0.36	0.46	71MG	C285
C324	6	92.61	-0.69	2.91	92.86	-0.84	3.44	0.25	-0.14	0.54	0.61	71HA	C324
C328	6	92.57	-0.76	2.89	92.83	-0.91	3.12	0.26	-0.15	0.53	0.61	71HA	C328
C340	6	92.77	-0.92	2.82	93.00	-1.06	3.01	0.23	-0.13	0.50	0.56	71HA	C340
C352	6	92.67	-0.91	2.86	92.94	-1.08	3.27	0.27	-0.18	0.61	0.69	71HA	C352
C442	6	92.39	-0.77	2.54	92.66	-0.95	3.16	0.27	-0.18	0.62	0.70	71HM	C442
C456	6	92.04	-0.76	2.60	92.24	-0.88	3.15	0.20	-0.13	0.56	0.61	71SC	C456
C571	6	92.20	-1.01	3.05	92.42	-1.07	3.67	0.22	-0.06	0.62	0.66	71HQ	C571
C585	6	92.60	-0.81	2.88	92.77	-0.91	3.34	0.17 *	-0.10	0.46	0.50	71HA	C585
C670	6	92.70	-0.57	2.40	92.91	-0.71	2.93	0.21	-0.13	0.54	0.59	71ME	C670
C702	6	92.59	-0.93	2.98	92.73	-0.76	3.34	0.14 X	0.17 X	0.36	0.42	71HA	C702
C713	6	92.32	-0.43*	2.80	92.55	-0.78	3.28	0.24	-0.35 X	0.48	0.64	71HA	C713
GRAND MEANS		92.46	-0.78	2.78	92.69	-0.91	3.30	0.23	-0.13	0.52	0.59		
SD OF MEANS		0.24	0.16	0.22	0.24	0.14	0.26	0.03	0.05	0.09	0.08		
INCLUDED LABS FOR THIS MEAN		22	22	22	22	22	22	21	20	22	22		

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. MCCA CRP Color 29	2. Gov't. Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE

Manufacturers Council on Color and Appearance
COLLABORATIVE REFERENCE PROGRAM, COLOR AND APPEARANCE
Color and Color Difference, Report No. 29

5. Publication Date: December 28, 1979

6. Performing Organization Code:

7. AUTHOR(S): T.L. Cummings, J. Horlick

8. Performing Organ. Report No.: NBSIR 79-1818

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
and Manufacturers Council on Color and Appearance.

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 inmportant by-product of the programs is the provision of realistice 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; Color; Laboratory evaluation; Precision; Reference samples; Testing calibration

18. AVAILABILITY

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

19. SECURITY CLASS (THIS REPORT)	21. NO. OF PRINTED PAGES
UNCLASSIFIED	34
20. SECURITY CLASS (THIS PAGE)	**22. Price**
UNCLASSIFIED	

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