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TURERS COUNCIL ON COLOR AND APPEARANCE

NBSIR 80-1827

# COLLABORATIVE REFERENCE PROGRAM COLOR AND APPEARANCE

## COLOR AND COLOR DIFFERENCE

### REPORT NO. 30



U.S. DEPARTMENT OF COMMERCE

National Bureau of Standards

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80-1827  
1980

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

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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 80-1827

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## 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 samples. 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 the laboratory's white calibration sample data (see Explanation of Data For White Sample).

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  $\Delta E$  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  $\Delta E$  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.

$\Delta E$  - 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,

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

$$K_1 = 0.55669 + 0.049434 Y - 0.82575 \cdot 10^{-3} Y^2 + \\ 0.79172 \cdot 10^{-5} Y^3 - 0.30087 \cdot 10^{-7} Y^4,$$

$$K_2 = 0.17548 + 0.027556 Y - 0.57262 \cdot 10^{-3} Y^2 + \\ 0.63893 \cdot 10^{-5} Y^3 - 0.26731 \cdot 10^{-7} Y^4,$$

$$a^2 = 17.3 \cdot 10^{-6} (P^2 + Q^2) / [1 + 2.73 P^2 Q^2 / (P^4 + Q^4)],$$

$$b^2 = 3.098 \cdot 10^{-4} (S^2 + 0.2015 Y^2)$$

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

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

$$S = 0.686 Z,$$

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

\*Friele-MacAdam-Chickering metric

NBS-MCCA COLLABORATIVE REFERENCE PROGRAM

TEST METHOD CODES

FOR PAINT CHIPS AND NEAR WHITE PAPERS

INSTRUMENT CODE		INSTRUMENT	COLOR	DATA
PAINT	PAPER		SPACE	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 <sup>1</sup> YZ, 4V	9016
C70CF	C71CF	COLOR EYE SMALL SPHERE	XYZ, BaS <sup>64</sup>	9017
C70CG	C71CG	COLOR EYE SMALL SPHERE	XX <sup>1</sup> YZ, Ba	9018
C70CH	C71CH	COLOR EYE SMALL SPHERE	XYZ, 3V	9011
C70CL	C71CL	COLOR EYE LARGE SPHERE	XX <sup>1</sup> YZ, 4V	9016
C70CM	C71CM	COLOR EYE LARGE SPHERE	XX <sup>1</sup> YZ, Ba	9018
C70CN	C71CN	COLOR EYE LARGE SPHERE	XYZ, BaS <sup>64</sup>	9017
C70DC	C71DC	DIAN <sup>6</sup> CHROMASCAN SPECTROPHOTOMETER	X Y Z	9014
C70DH	C71DH	DIAN <sup>6</sup> MATCH SCAN SPECTROPHOTOMETER	X Y Z	9014
C70DK	C71DK	DIAN <sup>6</sup> /LSCE AUTOMATE	XYZ, BaS <sup>64</sup>	9017
C70DL	C71DL	DIAN <sup>6</sup> /LSCE AUTOMATE	XYZ, 3V, 4F	9019
C70DM	C71DM	DIAN <sup>6</sup> /LSCE AUTOMATE	XX <sup>1</sup> YZ, 4V	9016
C70DS	C71DS	DIAN <sup>6</sup> /SSCE AUTOMATE	XX <sup>1</sup> YZ, Ba	9018
C70DT	C71DT	DIAN <sup>6</sup> /SSCE AUTOMATE	XYZ, BaS <sup>64</sup>	9017
C70GA	C71GA	GARDNER AUT <sup>6</sup> AC2/AC3	L a b	9013
C70GB	C71GB	GARDNER AUT <sup>6</sup> 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/DIAN <sup>6</sup> /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
C70HP	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 <sup>1</sup> YZ, 4V	9016
C70KD	C71KD	KCS-18	XX <sup>1</sup> 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 <sup>1</sup> 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 ELREPH <sup>6</sup>	X Y Z	9014
C70ZF	C71ZF	ZEISS ELREPH <sup>6</sup>	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 <sup>1</sup> , Y, Z 4 FUNCTION VITROLITE CORRECTION
9017	X, Y, Z, BaS <sup>64</sup> CORRECTION
9018	X, X <sup>1</sup> , Y, Z BaS <sup>64</sup> 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 - Reported insufficient data to be analyzed in this report
- C462A, C543 - Data appears in body of report, but corrections were made too late to be included in the statistical computation
- C480 - Reported extreme values compared to other labs on mean Z for samples D13 and D14
- C496B - Reported extreme values compared to other labs on mean b for all five samples
- C499 - Reported extreme values compared to other labs on mean b for the four colored samples
- C512, C656, C402  
C521A - Data received too late to be analyzed in this report
- C514A, C514B, C662,  
C717A, C717B, C720A,  
C720B, C727A, C727B - Used illuminant D65
- C705, C742 - Apparent reporting or measurement problem on all five samples
- C716 - Data received too late to be included in Grand Mean Statistics
- C721 - Reported extreme values compared to other labs on mean X and Y for samples D15 and D16
- C742 - Used illuminant A

MCCA COLLABORATIVE REFERENCE PROGRAM  
 X, Y, Z SPACE ANALYSIS, NORMAL DATA  
 COLOR \* COLOR DIFFERENCE  
 FOR PAINT CHIPS

LAB CODE	F	SAMPLE D13			SAMPLE D14			DIFFERENCE D14 - D13			ΔE	INST	
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ		CODE	LAB
C157	#	65.01	59.89	25.76	64.93	59.54	25.67	-0.08	-0.35	-0.11	1.92	70GE	C157
C162	#	66.13	61.12*	26.51	65.97	60.64*	25.40	-0.16	-0.48	-0.11	2.20	70DC	C162
C251	#	65.02	58.20	25.33	64.72	57.50	25.04	-0.30	-0.70	-0.35	3.27*	70SA	C251
C253	#	65.17	58.92	25.90	64.93	58.36	25.79	-0.24	-0.56	-0.15	2.46	70GC	C253
C278	#	65.35	59.70	25.73	65.20	59.30	25.85	-0.15	-0.40	0.10 *	1.67	70NE	C278
C407	#	65.26	59.89	26.43	65.14	59.43	26.25	-0.12	-0.45	-0.18	2.44	70BL	C407
C414	#	63.61	57.97	25.24	63.48	57.53	25.11	-0.13	-0.45	-0.13	2.33	70MD	C414
C416A	#	66.13	59.54	25.33	65.75	58.87	25.10	-0.38	-0.67	-0.23	2.42	70IB	C416A
C416B	#	64.85	58.62	25.04	64.50	58.02	25.47	-0.28	-0.59	-0.17	2.40	70GE	C416B
C418	#	63.10	58.69	28.03*	62.91	58.06	27.78*	-0.19	-0.63	-0.25	3.27*	70CE	C418
C422	#	63.27	57.09	25.13	63.00	56.49	24.89	-0.27	-0.61	-0.26	2.71	70SA	C422
C424	#	63.64	58.51	26.03	63.33	57.92	25.80	-0.31	-0.59	-0.24	2.29	70CA	C424
C428	#	64.99	59.08	25.07	64.90	58.65	25.61	-0.09	-0.43	-0.09	2.40	70HC	C428
C437	#	64.31	58.06	25.67	64.00	57.43	25.43	-0.31	-0.63	-0.24	2.55	70GC	C437
C443	#	65.65	60.15	25.31	65.45	59.56	25.61	-0.20	-0.59	-0.20	2.82	70CL	C443
C444	#	64.60	59.11	26.00	64.21	58.43	25.58	-0.38	-0.68	-0.42 *	2.63	70GE	C444
C446	#	64.02	58.45	25.70	63.80	57.92	25.57	-0.22	-0.53	-0.13	2.31	70GE	C446
C451	#	65.03	59.20	25.33	64.86	58.08	25.25	-0.18	-0.52	-0.29	2.72	70AC	C451
C459	#	63.51	57.94	25.10	63.14	57.29	25.07	-0.37	-0.65	-0.11	2.22	70GC	C459
C460	#	64.41	58.97	25.22	64.22	58.48	25.30	-0.19	-0.49	0.09	2.01	70GE	C460
C462A	#	65.25	59.95	25.43	65.13	58.55	25.45	-0.10	-0.40	0.00	2.06	70HB	C462A
C463	#	65.03	59.38	25.73	64.83	58.85	25.69	-0.20	-0.53	-0.11	2.42	70ZD	C463
C469	#	64.53	59.22	26.04	64.43	58.61	25.86	-0.15	-0.61	-0.18	3.30*	70GE	C469
C470	#	66.41*	61.28*	26.33	66.09*	60.69*	26.96	-0.31	-0.59	-0.03	1.56	70DH	C470
C472	#	64.46	59.03	26.02	64.12	58.41	25.87	-0.34	-0.63	-0.15	2.21	70ZD	C472
C473	#	65.13	59.82	25.34	64.93	59.30	25.67	-0.19	-0.51	-0.17	2.43	70DH	C473
C474	#	63.83	58.17	25.74	63.07	57.74	25.71	-0.15	-0.43	-0.03	1.96	70SA	C474
C476	#	64.24	58.57	25.05	64.05	58.09	25.61	-0.19	-0.48	-0.07	2.10	70SA	C476
C480	#	63.78	57.53	17.41X	63.59	57.53	17.45X	-0.19	-0.40	0.04	1.51*	70HB	C480
C481	#	64.90	59.05	25.43	64.65	58.55	25.35	-0.25	-0.50	-0.10	1.90	70HB	C481
C482	#	63.61	57.53	25.10	63.36	56.96	25.01	-0.25	-0.57	-0.17	2.49	70GC	C482
C483	#	64.60	57.50	25.04	64.23	58.75	24.80	-0.35	-0.75 *	-0.24	3.18*	70SL	C483
C495	#	64.73	59.11	25.82	64.05	58.69	25.71	-0.10	-0.43	-0.12	2.33	70KS	C495
C496A	#	65.07	59.44	26.11	65.00	59.12	26.10	-0.01 *	-0.32	-0.01	2.07	70GE	C496A
C499C	X	64.83	58.53	26.34	63.90	57.20	26.40	-0.87 X	-1.33 X	-0.54 X	4.15X	70BL	C499C
C508	#	64.67	59.31	25.73	64.50	58.93	25.83	-0.11	-0.38	0.05	1.81	70GE	C508
C511	#	64.43	58.89	25.71	64.33	58.44	25.61	-0.15	-0.45	-0.10	2.16	70DH	C511
C512	#	65.31	59.62	25.44	65.14	59.17	25.45	-0.18	-0.45	0.01	1.61	70AC	C512
C514B	+	63.53	59.28	24.10	63.22	58.66	24.07	-0.31	-0.62	-0.11	2.28	70SP	C514B
C524	#	65.39	59.59	25.25	65.00	58.94	25.88	-0.32	-0.66	-0.38	2.76	70GE	C524
C526	#	64.84	59.04	25.59	64.07	58.55	25.81	-0.17	-0.49	-0.08	2.23	70KS	C526
C528	#	63.50	58.11	25.44	63.33	57.05	25.30	-0.17	-0.46	-0.14	2.17	70MD	C528
C529	#	62.97	58.33	23.05	62.78	57.81	23.60*	-0.18	-0.53	-0.25	2.63	70DB	C529
C534	#	63.84	58.06	25.33	63.04	57.66	25.40	-0.20	-0.41	0.05	1.48*	70MD	C534
C536	#	62.13*	56.15*	23.10*	61.05*	55.60*	22.98*	-0.28	-0.55	-0.12	2.05	70AC	C536
C540	#	64.63	58.85	26.33	64.40	58.29	26.22	-0.23	-0.57	-0.11	2.45	70GE	C540
C543	#	64.97	59.30	25.33	64.84	58.84	25.79	-0.13	-0.46	-0.06	2.27	70HB	C543
C545	#	61.77*	56.77	24.05	61.01*	55.32	24.72	-0.15	-0.45	-0.13	2.22	70SA	C545
C549	#	65.08	59.61	25.33	64.88	59.09	25.68	-0.20	-0.52	-0.15	2.36	70DB	C549
C552	#	64.21	58.24	25.21	63.82	57.55	25.04	-0.39	-0.69	-0.17	2.41	70BN	C552
C608	#	64.32	57.88	26.72	64.04	57.30	26.61	-0.28	-0.59	-0.11	2.34	70GC	C608
C613	#	65.34	60.07	24.05	65.25	59.65	24.35	-0.08	-0.41	-0.20	2.44	70MD	C613
C627	#	64.23	58.66	26.01	63.95	58.15	25.96	-0.25	-0.51	-0.05	1.95	70SA	C627
C630	#	64.38	58.60	25.73	64.03	58.00	25.69	-0.35	-0.60	-0.06	1.54	70KS	C630
C631	#	65.00	59.15	25.59	64.75	58.60	25.56	-0.25	-0.55	0.17 *	2.08	70AC	C631
C632	#	64.92	59.14	25.31	64.30	58.36	25.37	-0.56 X	-0.78 *	-0.14	1.57	70AC	C632
C638	#	63.80	57.30	25.30	63.55	56.80	25.30	-0.25	-0.50	-0.20	2.06	70GC	C638
C644	#	64.08	58.42	25.33	63.06	57.09	24.98	-0.41	-0.72	-0.37	2.70	70MD	C644
C645	#	63.51	56.43*	24.34	63.27	55.91*	24.55	-0.24	-0.52	-0.29	2.43	70AC	C645
C656	#	63.97	58.12	25.42	63.67	57.53	25.20	-0.30	-0.60	-0.22	2.37	70SA	C656
C657	#	63.18	58.50	23.70*	63.05	58.00	23.48*	-0.13	-0.50	-0.28	2.86	70AC	C657
C660	#	62.49	56.48*	23.41*	62.28	55.98*	23.20*	-0.22	-0.50	-0.21	2.32	70AC	C660
C662	+	62.88	58.04	23.71*	62.62	57.48	23.56*	-0.25	-0.56	-0.15	2.32	70SP	C662
C672	#	65.25	59.15	26.80	65.00	58.55	26.50	-0.25	-0.60	-0.30	2.78	70GC	C672
C675	#	65.93	59.19	25.73	64.72	58.55	25.43	-0.31	-0.65	-0.37	2.75	70AC	C675

MCA COLLABORATIVE REFERENCE PROGRAM  
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 FOR PAINT CHIPS

LAB CODE	F	SAMPLE D13			SAMPLE D14			DIFFERENCE D14 - D13			INST	
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ	ΔE	CODE LAB
C700	†	63.97	58.38	25.40	63.82	57.91	25.26	-0.15	-0.46	-0.14	2.33	70DH C700
C707	†	50.01X	45.28X	20.41X	49.02X	44.70X	20.25X	-0.39	-0.59	-0.16	2.03	70SA C707
C716	#	63.68	57.85	25.34	63.44	57.40	25.28	-0.24	-0.45	-0.06	1.61	70ZE C716
C717A	+	63.10	58.56	23.00	62.07	57.94	23.64	-0.30	-0.62	-0.22	2.52	70SP C717A
C717B	+	63.35	58.76	23.97	63.09	58.19	23.60	-0.26	-0.57	-0.17	2.35	70SP C717B
C718A	†	63.09	59.49	23.40*	63.16	58.24	23.46*	0.07 *	-0.25 *	0.00	2.05	70AC C718A
C718B	†	63.00	58.39	23.52*	63.07	58.04	23.47*	0.01 *	-0.35	-0.06	2.44	70SA C718B
C719C	†	62.14*	56.96	25.60	61.92*	56.42	24.89	-0.22	-0.55	-0.12	2.47	70KC C719C
C720A	+	63.17	58.47	23.00	62.98	57.99	23.68	-0.19	-0.48	0.00	2.03	70SP C720A
C720B	+	63.09	58.40	23.04	62.88	57.89	23.87	-0.22	-0.51	0.03	2.06	70SP C720B
C721	#	63.79	57.30	27.00*	63.73	56.58	27.56*	-0.07	-0.32	-0.02	1.79	70KS C721
C722	†	64.81	58.82	25.04	64.54	58.26	25.55	-0.27	-0.56	-0.06	2.18	70AC C722
C723	†	63.50	58.06	25.00	63.25	57.55	25.64	-0.24	-0.51	-0.03	1.94	70MD C723
C724	†	64.38	58.95	25.70	64.26	58.47	25.61	-0.18	-0.49	-0.14	2.26	70SA C724
C726	†	65.92	60.72	27.00	65.53	60.00	26.55	-0.49	-0.72	-0.48 *	2.87	70SA C726
C727A	+	63.14	58.54	23.94	62.87	57.96	23.73	-0.27	-0.58	-0.21	2.41	70SP C727A
C727B	+	63.32	59.05	24.11	62.99	58.38	23.76	-0.32	-0.67	-0.35	2.77	70SP C727B
C741	†	64.39	58.42	25.70	64.25	57.96	25.63	-0.14	-0.46	-0.07	2.28	70SA C741
GRAND MEANS		64.30	58.69	25.00	64.13	58.16	25.40	-0.22	-0.53	-0.15	2.34	
SD OF MEANS		0.97	1.01	0.07	0.90	1.02	0.87	0.10	0.11	0.12	0.38	
INCLUDED LABS FOR THIS MEAN		67	67	60	67	67	66	67	68	68	68	

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LAB CODE	F	SAMPLE D15			SAMPLE D16			DIFFERENCE D16 - D15			ΔE	INST CODE	LAB
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ			
C157	☺	8.93	12.02	13.73	8.00	11.91	13.08	-0.25 *	-0.11 *	-0.70 *	2.44	70GE	C157
C162	☺	9.27	12.15	13.10	9.10	12.16	13.47	-0.12	0.01	-0.63	2.27	70DC	C162
C251	☺	8.92	11.80	13.11	8.92	12.00	12.64	0.00	0.20	-0.47	2.70	70SA	C251
C253	☺	8.83	11.68	12.70	8.69	11.65	12.12	-0.15	-0.03	-0.64	2.32	70GC	C253
C278	☺	9.40	12.10	14.33*	9.40	12.25	13.95*	0.00	0.15	-0.40	2.07	70NE	C278
C407	☺	9.40	12.30	13.71	9.34	12.35	13.12	-0.06	0.05	-0.59	2.33	70BL	C407
C414	☺	8.73	11.66	12.70	8.83	11.89	12.42	0.10	0.23	-0.34	2.44	70MD	C414
C416A	☺	8.81	11.79	12.47	8.79	11.90	11.98	-0.02	0.11	-0.49	2.35	70IB	C416A
C416B	☺	8.83	11.87	13.00	8.77	11.93	12.45	-0.06	0.06	-0.55	2.31	70GE	C416B
C418	☺	9.05	12.00	14.71*	9.10	12.28	14.40*	0.13	0.28	-0.32	2.51	70CE	C418
C422	☺	8.67	11.51	12.33	8.73	11.66	11.92	0.06	0.15	-0.43	2.53	70SA	C422
C424	☺	9.11	12.05	13.33	9.10	12.23	13.18	0.06	0.18	-0.40	2.35	70CA	C424
C428	☺	8.71	11.69	12.07	8.84	11.94	12.35	0.13	0.25	-0.32	2.55	70HB	C428
C437	☺	8.89	11.80	12.71	8.88	11.91	12.22	-0.01	0.11	-0.49	2.32	70GC	C437
C443	☺	9.29	12.18	13.74	9.27	12.29	13.19	-0.02	0.12	-0.51	2.36	70CL	C443
C444	☺	9.01	11.97	13.33	9.00	12.14	12.90	0.05	0.17	-0.44	2.45	70GE	C444
C446	☺	8.96	11.90	13.04	9.11	12.17	12.77	0.15	0.27	-0.28	2.48	70GE	C446
C451	☺	8.99	11.88	13.11	9.09	12.10	12.85	0.10	0.22	-0.34	2.38	70AC	C451
C459	☺	8.69	11.59	12.07	8.83	11.84	12.58	0.14	0.25	-0.28	2.45	70GE	C459
C460	☺	8.46	11.38	12.08	8.70	11.73	12.53	0.24	0.35	-0.15	2.75	70GE	C460
C462A	#	8.65	11.60	12.00	8.75	11.80	12.20	0.10	0.20	-0.40	2.70	70HB	C462A
C463	☺	8.98	11.95	13.43	9.13	12.24	13.13	0.16	0.29	-0.29	2.68	70ZD	C463
C469	☺	9.24	12.17	13.33	9.10	12.10	13.12	-0.14	-0.01	-0.56	2.06	70GE	C469
C470	☺	9.08	12.04	13.70	9.02	12.11	13.26	-0.05	0.07	-0.50	2.11	70DH	C470
C472	☺	9.12	12.06	13.09	9.14	12.21	13.29	0.02	0.15	-0.40	2.14	70ZD	C472
C473	☺	8.87	11.72	13.34	8.80	11.85	12.91	-0.00	0.13	-0.43	2.13	70DH	C473
C474	☺	9.09	12.00	13.29	9.00	12.04	12.76	-0.09	0.04	-0.53	2.12	70SA	C474
C476	☺	9.04	11.98	13.40	8.87	11.92	12.74	-0.17 *	-0.06 *	-0.67 *	2.21	70SA	C476
C480	☺	8.45	11.37	12.44	8.59	11.64	12.16	0.14	0.27	-0.28	2.53	70HB	C480
C481	☺	8.85	11.75	12.73	8.95	12.05	12.40	0.10	0.30	-0.35	2.75	70HB	C481
C482	☺	8.42	11.24*	12.09	8.45	11.40*	11.69	0.03	0.16	-0.40	2.33	70GC	C482
C483	☺	8.91	11.90	13.33	8.92	12.10	12.64	0.01	0.20	-0.41	2.50	70SL	C483
C495	☺	9.01	11.93	13.33	9.28	12.32	13.48	0.27	0.38	-0.10	2.75	70KS	C495
C496A	☺	9.19	12.18	13.33	9.38	12.49	13.31	0.19	0.31	-0.22	2.54	70GE	C496A
C499C	X	9.56*	12.68*	13.62	9.29	12.56	12.65	-0.27 *	-0.12 *	-0.57 X	3.17X	70BL	C499C
C508	☺	8.67	11.62	12.90	8.72	11.80	12.58	0.05	0.18	-0.38	2.27	70GE	C508
C511	☺	8.88	11.81	13.10	8.90	11.96	12.77	0.02	0.14	-0.41	2.15	70DH	C511
C512	#	8.69	11.54	13.33	8.85	11.83	12.81	0.16	0.29	-0.22	2.35	70AC	C512
C514B	+	8.57	11.91	12.10	8.70	12.23	11.98	0.20	0.32	-0.20	2.57	70SP	C514B
C524	☺	9.27	12.21	13.04	9.30	12.43	13.33	0.10	0.22	-0.30	2.17	70GE	C524
C526	☺	9.00	11.91	13.33	9.03	12.07	13.20	0.02	0.16	-0.39	2.15	70KS	C526
C528	☺	8.77	11.70	12.90	8.75	11.80	12.50	-0.02	0.11	-0.46	2.18	70MD	C528
C529	☺	8.56	11.73	12.23	8.54	11.84	11.80	-0.01	0.11	-0.42	2.12	70DH	C529
C534	☺	8.81	11.67	12.93	8.64	11.86	12.61	0.04	0.19	-0.32	2.10	70MD	C534
C536	☺	8.79	11.98	11.77	8.80	12.10	11.39*	0.01	0.12	-0.38	2.05	70AC	C536
C540	☺	9.59*	12.61*	13.81	9.55*	12.63*	13.30	-0.04	0.07	-0.51	2.15	70GE	C540
C543	#	8.76	11.73	12.73	8.87	11.98	12.40	0.11	0.25	-0.33	2.47	70HB	C543
C545	☺	8.48	11.31	12.79	8.56	11.51*	12.44	0.08	0.20	-0.35	2.38	70SA	C545
C549	☺	8.88	11.78	13.33	8.70	11.78	12.75	-0.13	0.00	-0.58	2.17	70DH	C549
C552	☺	8.51	11.43	12.23	8.52	11.56	11.83	0.01	0.13	-0.45	2.39	70HN	C552
C608	☺	9.69*	12.66*	13.01	9.77X	12.80X	13.26	0.08	0.21	-0.35	2.21	70GC	C608
C613	☺	8.04X	11.57	11.33*	8.23*	11.88	11.14*	0.18	0.31	-0.24	2.74	70MD	C613
C627	☺	8.94	11.92	13.22	9.12	12.22	12.96	0.18	0.30	-0.26	2.65	70SA	C627
C630	☺	8.99	11.95	13.33	9.25	12.32	13.22	0.26	0.38	-0.14	2.83	70KS	C630
C631	☺	9.00	11.90	13.24	9.15	12.16	12.97	0.15	0.26	-0.27	2.51	70AC	C631
C632	☺	8.99	11.86	13.23	9.13	12.13	13.00	0.16	0.27	-0.25	2.44	70AC	C632
C638	☺	8.50	11.50	12.40	8.65	11.70	12.05	0.15	0.20	-0.35	3.01*	70GC	C638
C644	☺	8.69	11.56	12.02	8.78	11.78	12.27	0.10	0.22	-0.35	2.42	70MD	C644
C645	☺	9.14	12.04	12.09	9.24	12.23	12.34	0.10	0.19	-0.35	2.37	70AC	C645
C656	#	8.96	11.90	13.02	9.00	12.11	12.69	0.10	0.21	-0.34	2.36	70SA	C656
C657	☺	8.71	11.96	12.20	8.85	12.21	11.98	0.13	0.25	-0.29	2.45	70AC	C657
C660	☺	9.09	12.33	12.11	9.17	12.49	11.73	0.08	0.16	-0.38	2.41	70AC	C660
C662	+	8.57	11.77	12.13	8.70	12.01	11.84	0.13	0.24	-0.31	2.51	70SP	C662
C672	☺	8.60	11.35	12.33	8.75	11.60	12.00	0.15	0.25	-0.30	2.66	70GC	C672
C675	☺	9.14	12.04	13.37	9.14	12.10	12.90	0.00	0.12	-0.46	2.26	70AC	C675



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LAB CODE	F	SAMPLE D15			SAMPLE D16			DIFFERENCE D16 - D15			INST	
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ	ΔE	CODE LAB
C700	#	8.69	11.61	12.91	8.95	11.97	12.77	0.26	0.37	-0.14	2.80	70DH C700
C707	#	7.92X	10.06X	11.49*	8.07X	10.30X	11.38*	0.15	0.24	-0.11	1.88*	70SA C707
C716	#	13.78X	11.90	13.55	9.37	12.15	12.99	-4.41 X	0.25	-0.36	83.40X	70ZE C716
C717A	*	8.83	12.01	12.54	8.90	12.19	12.21	0.07	0.18	-0.33	2.16	70SP C717A
C717B	*	8.72	11.90	12.49	8.88	12.19	12.26	0.16	0.29	-0.23	2.41	70SP C717B
C718A	#	8.64	11.87	12.17	8.74	12.08	11.85	0.10	0.22	-0.31	2.33	70AC C718A
C718B	#	8.65	11.86	12.21	8.89	12.24	12.08	0.24	0.38	-0.13	2.55	70SA C718B
C719C	#	8.94	11.84	13.24	9.09	12.12	12.97	0.15	0.27	-0.27	2.44	70KC C719C
C720A	*	8.67	11.86	12.33	8.79	12.10	12.03	0.12	0.24	-0.30	2.41	70SP C720A
C720B	*	8.64	11.82	12.29	8.77	12.08	12.02	0.14	0.26	-0.26	2.45	70SP C720B
C721	#	10.12X	13.16X	13.92	10.30X	13.44X	13.65	0.19	0.28	-0.28	2.58	70KS C721
C722	#	9.05	11.94	13.20	9.16	12.17	12.92	0.11	0.23	-0.34	2.45	70AC C722
C723	#	8.52	11.39	12.90	8.74	11.74	12.52	0.22	0.35	-0.16	2.63	70MD C723
C724	#	8.87	11.82	13.11	9.08	12.14	12.89	0.21	0.32	-0.22	2.68	70SA C724
C726	#	9.14	12.05	13.75	9.31	12.37	13.54	0.17	0.32	-0.24	2.50	70SA C726
C727A	*	8.62	11.83	12.32	8.72	12.04	12.00	0.10	0.22	-0.32	2.35	70SP C727A
C727B	*	8.59	11.73	12.40	8.82	11.89	12.08	0.03	0.15	-0.38	2.17	70SP C727B
C741	#	9.00	11.97	13.34	9.03	12.09	12.93	0.02	0.12	-0.41	2.10	70SA C741
GRAND MEANS		8.92	11.86	13.04	8.90	12.03	12.67	0.07	0.19	-0.37	2.40	
SD OF MEANS		0.27	0.28	0.44	0.20	0.26	0.62	0.11	0.11	0.14	0.23	
INCLUDED LABS FOR THIS MEAN		66	67	68	66	66	68	68	68	68	68	

LAH CODE	F	SAMPLE D13			SAMPLE D14			DIFFERENCE D14 - D13			INST CODE	LAB
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB		
C121	θ	76.25	16.55	34.43	75.93	17.50	34.25	-0.30	0.95 *	-0.20	1.02	70HM C121
C148	θ	76.70	16.95	33.70	76.35	17.80	35.00	-0.35	0.85	-0.10 *	0.92	70HF C148
C152	θ	77.20	16.90	33.00	76.80	17.70	35.60	-0.40	0.80	-0.20	0.92	70HA C152
C166	θ	76.95	16.55	33.70	76.00	17.30	33.40	-0.35	0.75	-0.30	0.88	70HA C166
C183	θ	76.95	16.10	33.00	76.45	17.00	33.40	-0.50 *	0.90	-0.20	1.05	70HA C183
C223	θ	76.49	17.01	33.30	76.12	17.79	33.14	-0.37	0.78	-0.24	0.89	70HA C223
C241	θ	77.40	15.90	34.00	76.90	16.85	33.60	-0.50 *	0.95 *	-0.20	1.05*	70HF C241
C256A	θ	76.70	16.33	33.90	76.32	17.15	33.79	-0.38	0.82	-0.18	0.92	70HM C256A
C256B	θ	76.76	16.02	34.10	76.41	16.78	33.94	-0.35	0.75	-0.21	0.86	70HU C256B
C288	θ	76.50	16.70	34.00	76.10	17.50	33.70	-0.40	0.80	-0.30	0.94	70SC C288
C291	θ	76.85	16.60	33.00	76.50	17.35	33.40	-0.35	0.75	-0.20	0.85	70HA C291
C317	θ	76.20	16.70	33.70	75.90	17.50	33.50	-0.30	0.80	-0.20	0.88	70HM C317
C325	θ	76.09	15.46	32.90	75.80	16.25	32.67	-0.30	0.79	-0.27	0.88	70HF C325
C356	θ	76.60	16.80	33.90	76.30	17.50	33.70	-0.30	0.70	-0.20	0.79	70HM C356
C380	θ	77.30	16.80	34.20	76.90	17.55	34.00	-0.40	0.75	-0.20	0.87	70HA C380
C382	θ	76.90	15.60	33.70	76.50	16.40	33.50	-0.40	0.80	-0.20	0.92	70HA C382
C390	θ	76.70	18.45	33.70	76.30	19.35*	33.60	-0.40	0.90	-0.15	1.00	70HF C390
C420A	θ	76.40	17.60	34.20	76.00	18.40	34.00	-0.35	0.80	-0.20	0.92	70HF C420A
C420B	θ	76.65	17.70	34.30	76.00	18.40	34.00	-0.60 X	0.70	-0.30	0.97	70HF C420B
C427	θ	76.95	17.20	34.00	76.00	17.95	33.70	-0.35	0.75	-0.30	0.88	70HA C427
C440	θ	76.78	17.78	34.39	76.50	18.50	34.07	-0.22 *	0.72	-0.33	0.82	70HA C440
C442	θ	76.90	15.70	33.00	76.50	16.50	33.60	-0.35	0.80	-0.20	0.90	70HM C442
C454	θ	76.00	15.80	33.00	75.50	16.70	32.81	-0.44	0.90	-0.19	1.02	70HA C454
C458	θ	76.83	16.57	33.01	76.49	17.35	33.40	-0.34	0.78	-0.21	0.88	70HM C458
C475	θ	76.59	16.98	33.37	76.20	17.87	33.37	-0.40	0.88	-0.20	0.99	70HA C475
C477	θ	76.35	17.87	33.20	75.99	18.63	33.02	-0.36	0.76	-0.24	0.87	70HA C477
C494	θ	77.45	16.95	33.00	77.15	17.60	33.45	-0.30	0.65	-0.15	0.73*	70HA C494
C496B	θ	76.70	15.67	37.07X	76.47	16.40	37.48X	-0.23	0.73	-0.19	0.79	70GP C496B
C499A	θ	76.70	17.20	30.10X	76.45	17.90	29.80X	-0.25	0.70	-0.30	0.80	70HA C499A
C499B	θ	76.70	17.00	33.00	76.25	17.60	33.30	-0.45	0.80	-0.30	0.97	70HA C499B
C506	θ	77.05	17.10	33.70	76.75	17.85	33.50	-0.30	0.75	-0.20	0.83	70HF C506
C514A	+	76.42	17.14	33.70	76.15	17.89	33.46	-0.28	0.75	-0.24	0.83	70SR C514A
C517	θ	77.30	16.00	34.00	77.00	16.80	33.60	-0.30	0.80	-0.20	0.88	70SC C517
C538	θ	77.80*	16.50	32.70*	77.45*	17.20	32.50*	-0.35	0.70	-0.25	0.82	70GX C538
C541	θ	76.70	17.60	33.20	76.35	18.40	33.00	-0.35	0.80	-0.25	0.91	70GP C541
C543	#	77.03	15.55	33.33	76.73	16.33	33.30	-0.30	0.78	-0.23	0.87	70HA C543
C546A	θ	75.90	18.30	33.70	75.00	19.10	33.40	-0.30	0.80	-0.30	0.91	70HQ C546A
C546B	θ	76.10	16.80	33.00	75.70	17.55	33.50	-0.40	0.75	-0.30	0.90	70HM C546B
C547	θ	75.64*	17.88	34.41	75.35*	18.76	34.12	-0.29	0.88	-0.30	0.97	70HQ C547
C574	θ	77.40	15.35	32.70*	77.00	16.05	32.40*	-0.40	0.70	-0.30	0.86	70HQ C574
C600	θ	76.30	19.10*	33.00	76.00	20.00*	32.65	-0.30	0.90	-0.20	0.97	70GD C600
C620	θ	74.65X	15.70	33.30	74.52X	16.38	33.27	-0.33	0.68	-0.23	0.79	70MG C620
C628	θ	77.60	15.41	33.39	77.19	16.09	33.75	-0.41	0.67	-0.24	0.83	70ME C628
C633	θ	77.13	17.58	33.34	76.78	18.24	32.99	-0.35	0.66	-0.35 *	0.82	70HA C633
C655	θ	76.96	16.15	34.15	76.59	16.97	34.01	-0.38	0.82	-0.14	0.91	70HU C655
C677	θ	76.98	17.15	33.33	76.52	17.97	33.80	-0.66 X	0.81	-0.13	1.05*	70SC C677
C690	θ	76.60	16.60	33.00	76.25	17.30	33.40	-0.35	0.70	-0.20	0.81	70HA C690
C705	X	59.31X	65.44X	25.00X	58.80X	65.24X	25.64X	-0.51 *	-0.19 X	-0.16	0.57X	70SC C705
C709	θ	76.43	16.16	33.02	76.10	16.88	33.53	-0.33	0.71	-0.30	0.84	70SC C709
C719A	θ	77.05	15.00	34.00	76.00	15.70*	33.70	-0.40	0.70	-0.30	0.86	70HA C719A
C719B	θ	76.85	17.45	33.30	76.00	16.15	33.60	-0.25	0.70	-0.20	0.77	70HA C719B
C742	+	81.20X	22.55X	37.04X	81.02X	23.36X	37.04X	-0.19 *	0.82	-0.00 X	0.84	70SR C742
GRAND MEANS												
		76.75	16.74	33.75	76.59	17.51	33.50	-0.35	0.78	-0.23	0.89	
SD OF MEANS												
		0.45	0.88	0.41	0.44	0.89	0.42	0.06	0.08	0.06	0.08	
INCLUDED LAHS FOR THIS MEAN												
		47	48	40	47	43	42	46	48	48	48	

MCCA COLLABORATIVE REFERENCE PROGRAM  
 L, a, b SPACE ANALYSIS, NORMAL DATA  
 COLOR \* COLOR DIFFERENCE  
 FOR PAINT CHIPS

LAB CODE	F	SAMPLE D15			SAMPLE D16			DIFFERENCE D16 - D15			INST	
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB	ΔE	CODE LAB
C121	θ	33.80	-14.40	2.10	34.10	-14.90	3.20	0.30	-0.50	1.10	1.24	70HM C121
C148	θ	34.55	-14.55	2.20	34.90	-14.95	3.20	0.35	-0.40	1.00	1.13	70HF C148
C152	θ	34.60	-14.00	1.95	34.45	-14.60	3.00	-0.15 X	-0.60	1.05	1.22	70HA C152
C166	θ	34.30	-14.15	1.00	34.30	-14.75	2.90	0.00 *	-0.60	1.10	1.25	70HA C166
C183	θ	34.35	-15.45X	3.10X	34.15	-14.85	2.10	-0.20 X	0.60 X	-1.00 X	1.18	70HA C183
C223	θ	34.97	-14.43	2.00	35.18	-14.99	3.14	0.21	-0.56	1.11	1.26	70HA C223
C241	θ	34.30	-13.90	1.90	34.35	-14.45	3.00	0.05	-0.55	1.10	1.23	70HF C241
C256A	θ	33.89	-14.10	1.00	34.13	-14.57	2.91	0.24	-0.46	1.11	1.23	70HM C256A
C256B	θ	33.76	-13.58	0.00*	34.02	-14.03	1.71*	0.26	-0.45	1.05	1.17	70HU C256B
C288	θ	34.00	-13.80	1.90	34.20	-14.40	2.90	0.20	-0.60	1.00	1.18	70SC C288
C291	θ	34.50	-14.05	2.20	34.70	-14.55	3.30	0.20	-0.50	1.10	1.22	70HA C291
C317	θ	33.90	-14.00	2.10	34.30	-14.40	3.20	0.40	-0.40	1.10	1.24	70HM C317
C325	θ	34.42	-14.35	1.00	34.71	-15.16	2.80	0.29	-0.81 X	0.59	1.31*	70HR C325
C356	θ	33.80	-13.60	2.10	34.10	-14.00	3.20	0.30	-0.40	1.10	1.21	70HM C356
C380	θ	34.25	-14.00	2.10	34.00	-14.50	3.20	0.35	-0.50	1.10	1.26	70HA C380
C382	θ	34.40	-14.25	1.90	34.60	-14.85	3.00	0.20	-0.60	1.10	1.27	70HA C382
C390	θ	34.55	-14.05	1.00	34.80	-14.45	2.90	0.25	-0.40	1.05	1.15	70HF C390
C420A	θ	34.20	-16.75X	1.10	34.70	-17.10X	2.10	0.50	-0.35	1.00	1.17	70HF C420A
C420B	θ	34.25	-16.75X	1.10	34.05	-17.05X	2.10	0.40	-0.30 *	1.00	1.12	70HF C420B
C427	θ	34.40	-13.90	2.20	34.00	-14.40	3.20	0.20	-0.50	1.00	1.14	70HA C427
C440	θ	34.35	-14.39	2.20	34.72	-14.87	3.28	0.37	-0.48	1.01	1.18	70HA C440
C442	θ	33.95	-13.70	1.30	34.10	-14.20	2.30	0.15	-0.50	1.00	1.13	70HM C442
C454	θ	35.02	-14.22	1.70	35.27	-14.86	2.82	0.25	-0.64	1.09	1.25	70HA C454
C458	θ	33.87	-13.93	1.30	34.10	-14.46	2.37	0.24	-0.53	1.02	1.17	70HM C458
C475	θ	34.56	-14.02	0.90	34.77	-14.59	1.98	0.21	-0.57	1.00	1.17	70HA C475
C477	θ	34.73	-14.36	1.00	35.00	-14.94	2.54	0.27	-0.58	0.98	1.17	70HA C477
C494	θ	34.70	-14.40	1.20	35.00	-14.90	2.30	0.30	-0.50	1.10	1.24	70HA C494
C496B	θ	34.02	-14.83*	4.02X	34.25	-15.37	3.03X	0.22	-0.54	1.02	1.17	70GP C496B
C499A	θ	33.95	-14.45	-7.00X	34.40	-14.85	-0.25X	0.45	-0.40	1.05	1.21	70HA C499A
C499B	θ	34.35	-14.15	2.10	34.05	-14.60	3.10	0.30	-0.45	1.00	1.14	70HA C499B
C506	θ	34.15	-14.20	2.10	34.70	-14.55	3.10	0.55 *	-0.35	1.00	1.15	70HF C506
C514A	θ	34.28	-14.11	1.00	34.00	-14.49	2.07	0.38	-0.38	1.00	1.14	70SF C514A
C517	θ	34.50	-12.95X	0.90	34.00	-13.60*	1.90	0.10	-0.65	1.00	1.20	70SC C517
C538	θ	35.20*	-10.70X	-1.00X	35.40*	-11.20X	-0.30X	0.20	-0.50	1.00	1.14	70CX C538
C541	θ	34.10	-13.60	1.30	34.40	-14.00	2.30	0.30	-0.40	1.00	1.12	70GP C541
C543	θ	34.29	-14.11	1.90	34.01	-14.03	2.95	0.32	-0.51	1.02	1.15	70HA C543
C546A	θ	33.70	-14.10	1.30	34.00	-14.60	2.30	0.35	-0.50	1.00	1.17	70HQ C546A
C546B	θ	33.55	-14.00	2.00	33.90	-14.60	3.05	0.35	-0.60	1.05	1.26	70HM C546B
C547	θ	32.15X	-15.01*	1.30	32.21X	-15.75*	2.40	0.06	-0.75 *	1.06	1.30	70HQ C547
C574	θ	38.20X	-11.70X	1.20	38.50X	-12.15X	2.10	0.30	-0.45	0.90 *	1.05*	70HQ C574
C600	θ	34.70	-14.50	2.10	34.90	-15.00	3.10	0.25	-0.50	1.00	1.15	70GD C600
C620	θ	32.71X	-13.94	1.30	33.07X	-14.40	2.53	0.36	-0.46	0.96	1.13	70MG C620
C628	θ	34.74	-14.47	1.00	35.28	-14.84	2.51	0.54 *	-0.37	0.96	1.16	70ME C628
C633	θ	34.52	-14.13	2.00	34.80	-14.56	3.09	0.34	-0.43	1.06	1.15	70HA C633
C655	θ	34.50	-13.61	1.20	34.05	-14.10	2.25	0.15	-0.49	1.01	1.13	70HU C655
C677	θ	34.93	-12.97X	0.90	34.90	-13.51*	2.03	-0.03 *	-0.54	1.07	1.20	70SC C677
C690	θ	33.70	-14.00	2.00	33.90	-14.60	3.10	0.20	-0.60	1.10	1.27	70HA C690
C705	X	11.71X	8.72X	12.00X	12.04X	8.92X	12.29X	0.33	0.20 X	-0.24 X	0.46X	70SC C705
C709	θ	35.04	-14.17	1.00	35.47*	-14.57	2.53	0.43	-0.40	1.00	1.16	70SC C709
C719A	θ	34.50	-14.20	1.00	34.80	-14.80	2.05	0.35	-0.60	1.05	1.26	70HA C719A
C719B	θ	34.10	-14.30	1.00	34.55	-14.70	2.80	0.45	-0.40	1.00	1.17	70HA C719B
C742	*	32.56X	-13.22*	-2.70X	32.00X	-13.50*	-1.68X	-0.06 *	-0.27 *	1.02	1.05*	70SR C742
GRAND MEANS												
		34.33	-14.14	1.00	34.58	-14.61	2.69	0.28	-0.50	1.04	1.19	
SD OF MEANS												
		0.40	0.32	0.34	0.40	0.41	0.46	0.13	0.09	0.05	0.06	
INCLUDED LABS FOR THIS MEAN												
		45	41	44	40	44	45	46	46	47	48	



## 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 in 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  $\Delta X$ ,  $\Delta Y$ , and  $\Delta Z$ .

LAB CODE	FATIG--(LAB/COMBINED)			INSTR CODE	PERCENT FROM COMBINED		
	X	Y	Z		X	Y	Z
C157	1.0182	1.0166	1.0221	70GE	1.82	1.66	2.51
C162	1.0145	1.0111	1.0192	70DC	1.45	1.11	1.92
C251	1.0027	.9983	1.0028	70SA	.27	.17	.28
C253	1.0122	1.0095	1.0131	70GC	1.32	.95	1.31
C278	1.0237	1.0331	1.0338	70NE	3.37	3.31	3.38
C407	1.0116	1.0095	1.0170	70DL	1.16	.95	1.76
C414	.9890	.9891	.9827	70MD	-1.10	-1.05	-1.73
C416A	1.0465	1.0471	1.0237	70LB	4.85	4.71	2.37
C416B	1.0231	1.0221	1.0235	70GE	2.31	2.21	2.35
C418	.9826	.9790	1.0911	70JE	-1.74	-2.10	9.11
C422	.9895	.9868	.9802	70SA	-1.05	-1.32	-1.38
C424	.9895	.9906	.9975	70CA	-.95	-.94	-.25
C428	1.0081	1.0054	1.0118	70DU	.61	.54	1.18
C437	.9873	.9959	.9920	70GC	-.27	-.41	-.74
C443	1.0148	1.0100	1.0266	70UL	1.48	1.00	2.66
C444	1.0113	1.0115	1.0189	70GE	1.13	1.19	1.89
C446	1.0013	1.0007	1.0053	70GE	.13	.07	.55
C451	1.0129	1.0130	1.0067	70AC	1.29	1.30	.97
C459	.9887	.9993	.9945	70GE	-.13	-.07	-.55
C460	1.0075	1.0081	1.0087	70GE	.75	.81	.87
C462A	1.0014	.9988	1.0096	70AD	.14	-.12	.96
C463	1.0098	1.0082	1.0171	70LD	.98	.82	1.71
C469	.9831	.9616	.9511	70GE	-3.09	-3.84	-4.89
C470	1.0353	1.0349	1.0321	70DD	3.53	3.49	5.21
C472	.9853	.9931	.9987	70LD	-.47	-.69	-.13
C473	1.0055	1.0074	1.0097	70DA	.95	.74	.57
C474	.9911	1.0027	1.0031	70SA	-.89	.27	.81
C476	1.0013	.9954	1.0047	70SA	.13	-.06	.47
C480	1.0082	1.0048	1.0104	70DA	.82	.48	1.64
C481	1.0037	1.0010	1.0067	70AD	.37	.10	.67
C482	.9815	.9895	.9876	70GC	-.85	-1.05	-1.24
C483	.9884	.9961	1.0034	70SL	-.16	-.39	.34
C495	1.0120	1.0117	1.0100	70AS	1.20	1.17	1.00
C496A	1.0219	1.0215	1.0237	70GE	2.19	2.15	2.57
C499C	1.0254	1.0255	1.0391	70DL	2.54	2.55	3.91
C508	1.0086	1.0068	1.0114	70GD	.86	.88	1.14
C511	1.0064	1.0055	1.0067	70DH	.64	.55	.67
C512	1.0153	1.0152	1.0032	70AC	1.53	1.52	.32
C514B	.9868	1.0186	.9913	70SP	-1.52	1.88	-5.87
C524	1.0180	1.0168	1.0209	70GE	1.80	1.68	2.09
C526	1.0118	1.0100	1.0131	70AS	1.18	1.00	1.31
C528	.9851	.9893	.9812	70MD	-1.09	-1.07	-1.88
C529	.9876	.9904	.9223	70DA	-3.24	-.96	-7.75
C534	.9758	.9838	.9837	70MD	-2.02	-1.62	-1.63
C536	.9756	1.0071	.9086	70AC	-2.44	.71	-9.14
C540	1.0174	1.0176	1.0215	70GE	1.74	1.76	2.15
C543	1.0067	1.0040	1.0141	70AD	.67	.40	1.41
C545	.9749	.9759	.9812	70SA	-2.51	-2.41	-1.88
C549	1.0119	1.0068	1.0145	70DH	1.19	.88	1.45
C552	.9836	.9910	1.0033	70BN	-.64	-.90	.33
C608	.9839	.9812	.9928	70GC	-.61	-.88	-.72
C613	1.0244	1.0237	1.0203	70MD	2.44	2.37	2.03
C627	.9878	.9862	.9970	70SA	-.22	-.38	-.24
C630	1.0079	1.0053	1.0145	70AS	.79	.53	1.45
C631	1.0174	1.0156	1.0130	70AC	1.74	1.56	1.30
C632	1.0119	1.0100	1.0090	70AC	1.19	1.00	.90
C638	.9858	.9938	.9960	70GC	-.42	-.62	-.40
C644	.9896	1.0004	.9831	70MD	-.04	.04	-.69
C645	1.0035	1.0093	.9867	70AC	.35	.93	-1.13
C656	.9851	.9938	.9908	70SA	-.49	-.62	-.92
C657	.9820	1.0121	.9300	70AC	-1.80	1.21	-6.94
C660	.9801	1.0114	.9143	70AC	-1.99	1.14	-8.55
C662	.9703	.9932	.9241	70SP	-2.97	-.68	-7.59
C672	.9895	.9889	.9849	70GC	-1.05	-1.11	-1.51
C675	1.0129	1.0113	1.0098	70AC	1.29	1.13	.98
C700	.9880	.9973	.9971	70DH	-.20	-.27	-.29
C707	.9884	.9796	.9784	70SA	-2.016	-2.024	-2.016
C716	.9888	.9949	1.0034	70ZS	.12	-.51	.34
C717A	.9716	.9849	.9277	70SP	-2.04	-.51	-7.23
C717B	.9777	1.0012	.9343	70SP	-2.23	.12	-6.57
C718A	.9779	1.0076	.9203	70AC	-2.21	.76	-7.35
C718B	.9779	1.0068	.9204	70SA	-2.21	.68	-7.36
C719C	.9742	.9705	.9840	70AC	-2.08	-2.91	-1.60
C720A	.9720	.9954	.9204	70SP	-2.06	-.46	-7.36
C720B	.9791	.9932	.9200	70SP	-2.09	-.68	-7.40
C721	1.0100	1.0149	1.0047	70AS	1.00	1.49	.47
C722	1.0158	1.0146	1.0123	70AC	1.58	1.46	1.25
C723	.9885	.9855	.9739	70MD	-1.45	-1.45	-2.11
C724	1.0059	1.0058	1.0079	70SA	.59	.58	.79
C726	1.0130	1.0106	1.0204	70SA	1.30	1.06	2.04
C727A	.9388	.9583	.8757	70SP	-6.12	-4.17	-12.03
C727B	.9743	.9979	.9260	70SP	-2.57	-.21	-7.20
C741	1.0089	1.0072	1.0095	70SA	.89	.72	.95

LAB CODE	RATIOS--(LAB/COMBINED)			INST CODE	PERCENT FROM COMBINED		
	X	Y	Z		X	Y	Z
C121	0.9991	0.9946	1.00025	70HM	-0.09	-0.54	0.25
C148	1.00058	1.00030	1.00111	70HF	0.58	0.30	1.011
C152	1.00083	1.00061	1.00120	70HA	0.83	0.61	1.020
C166	1.00056	1.00040	1.00137	70HA	0.56	0.40	1.037
C183	0.9917	0.9582	0.9403	70HA	-3.083	-4.018	-5.037
C223	1.00188	1.00153	1.00238	70HA	1.088	1.053	2.038
C241	0.9913	0.9572	0.9483	70HF	-3.067	-4.028	-5.017
C256A	0.9997	0.9969	1.00057	70HM	-0.03	-0.31	0.57
C256B	1.00120	1.00106	1.00124	70AU	1.020	1.006	1.024
C288	0.9905	0.9561	0.9400	70BC	-3.095	-4.039	-5.020
C291	1.00046	1.00030	1.00095	70HA	0.46	0.30	0.95
C317	0.9927	0.9893	1.00003	70HM	-0.73	-1.007	0.03
C325	1.00056	1.00038	1.00080	70HA	0.56	0.38	0.86
C356	0.9987	0.9977	1.00088	70HM	-0.13	-0.23	0.88
C380	1.00083	1.00061	1.00143	70HA	0.83	0.61	1.043
C382	1.00079	1.00051	1.00125	70HA	0.79	0.51	1.025
C390	1.00064	1.00030	1.00127	70HF	0.64	0.30	1.027
C420A	1.00053	1.00040	1.00106	70HF	0.93	0.40	1.006
C420B	1.00085	1.00051	1.00101	70HF	0.85	0.51	1.001
C427	1.00091	1.00051	1.00080	70HA	0.91	0.51	0.86
C440	1.00132	1.00094	1.00133	70HA	1.032	0.94	1.033
C442	0.9988	0.9967	1.00002	70HM	-0.12	-0.33	0.62
C454	1.00125	1.00087	1.00207	70HA	1.025	0.87	2.007
C458	1.00006	0.9983	1.00092	70HM	0.06	-0.17	0.92
C475	1.00097	1.00059	1.00172	70HA	0.97	0.59	1.072
C477	1.00151	1.00117	1.00156	70HA	1.051	1.017	1.056
C494	1.00228	1.00199	1.00331	70HA	2.028	1.099	3.031
C496B	1.00243	1.00232	1.00224	70GP	2.043	2.032	2.024
C499A	1.00105	1.00082	1.00180	70HA	1.005	0.82	1.080
C499B	1.00068	1.00040	1.00122	70HA	0.08	0.40	1.022
C506	1.00091	1.00072	1.00131	70HF	0.91	0.72	1.031
C514A	0.9963	0.9944	0.9902	70BC	-0.37	-0.56	-0.38
C517	1.00351	1.00316	1.00340	70BC	3.051	3.016	3.040
C538	0.9826	0.9841	0.9850	70GX	-1.074	-1.059	-1.044
C541	1.00238	1.00210	1.00295	70GP	2.038	2.010	2.095
C543	1.00081	1.00062	1.00157	70HA	0.81	0.62	1.057
C546A	1.00114	1.00082	1.00134	70HQ	1.014	0.82	1.034
C546B	0.9963	0.9935	1.00030	70HM	-0.37	-0.65	0.30
C547	1.00070	1.00045	1.00094	70HQ	0.70	0.45	0.94
C574	1.00263	1.00210	1.00263	70HQ	2.063	2.010	2.063
C600	0.9996	0.9956	0.9989	70GD	-0.04	-0.44	-0.11
C620	0.9501	0.9506	0.9399	70MG	-4.099	-4.094	-6.001
C628	1.00220	1.00232	1.00200	70MG	2.020	2.032	2.066
C633	1.00143	1.00110	1.00233	70HA	1.043	1.010	2.033
C655	1.00123	1.00110	1.00055	70HU	1.023	1.010	0.55
C677	1.00284	1.00254	1.00346	70SC	2.084	2.054	3.046
C690	1.00016	0.9988	1.00021	70HA	0.16	-0.12	0.21
C705	1.04440	0.9215	-0.0080	70SC	44.440	-7.85	*****
C709	1.00052	1.00045	1.00070	70SC	0.52	0.45	0.70
C719A	1.00260	1.00231	1.00304	70HA	2.060	2.031	3.064
C719B	1.00032	0.9998	1.00102	70HA	0.32	-0.02	1.002
C742	1.00005	0.9927	0.9981	70SD	0.05	-0.73	-0.19

LAB CODE	F	SAMPLE D13			SAMPLE D14			DIFFERENCE D14 - D13			ΔE	INST CODE	LAB
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ			
C157	#	63.85	58.91	25.13	63.77	58.57	25.04	-0.08	-0.34	-0.11	1.91	70GE	C157
C162	#	65.19*	60.45*	26.04	65.03*	59.98*	25.91	-0.16	-0.47	-0.10	2.15	70DC	C162
C251	#	64.85	58.30	25.32	64.55	57.60	24.97	-0.30	-0.70	-0.35	3.27*	70SA	C251
C253	#	64.32	58.35	25.04	64.09	57.79	25.46	-0.24	-0.55	-0.19	2.54	70GC	C253
C278	#	63.22	57.79	25.57	63.07	57.40	25.97	-0.15	-0.39	0.10	1.65	70NE	C278
C407	#	64.52	59.33	25.97	64.40	58.88	25.80	-0.12	-0.45	-0.17	2.43	70HL	C407
C414	#	64.32	58.61	25.09	64.19	58.16	25.55	-0.13	-0.45	-0.14	2.34	70MD	C414
C416A	#	63.07*	56.87*	24.75*	62.71*	56.23*	24.52*	-0.36	-0.64	-0.23	2.35	70TB	C416A
C416B	#	63.39	57.35	25.05	63.11	56.77	24.89	-0.28	-0.58	-0.16	2.38	70GE	C416B
C418	#	64.21	59.95*	25.09	64.02	59.31	25.46	-0.19	-0.64	-0.23	3.28*	70CE	C418
C422	#	63.94	57.86	25.00	63.67	57.24	25.24	-0.27	-0.61	-0.26	2.72	70SA	C422
C424	#	64.25	59.07	26.10*	63.94	58.48	25.87	-0.31	-0.60	-0.24	2.29	70CA	C424
C428	#	64.48	58.76	25.40	64.39	58.34	25.31	-0.09	-0.43	-0.08	2.39	70BB	C428
C437	#	64.48	58.30	25.00	64.17	57.67	25.62	-0.31	-0.63	-0.24	2.55	70GC	C437
C443	#	64.69	59.55	25.14	64.49	58.97	24.95	-0.20	-0.58	-0.20	2.81	70CL	C443
C444	#	63.85	58.41	25.02	63.49	57.74	25.11	-0.38	-0.67	-0.41 *	2.62	70GE	C444
C446	#	63.94	58.41	25.05	63.72	57.88	25.43	-0.22	-0.53	-0.13	2.31	70GE	C446
C451	#	64.21	58.44	25.31	64.04	57.93	25.04	-0.17	-0.52	-0.27	2.71	70AC	C451
C455	#	63.59	57.98	25.32	63.23	57.33	25.21	-0.37	-0.65	-0.11	2.23	70GE	C455
C460	#	63.93	58.50	25.00	63.74	58.01	25.09	-0.19	-0.48	0.08	2.01	70GE	C460
C462A	#	65.10*	59.02	25.21	65.06*	58.62	25.21	-0.10	-0.40	0.00	2.06	70HB	C462A
C463	#	64.40	58.90	25.35	64.20	58.37	25.26	-0.20	-0.53	-0.10	2.41	70ZD	C463
C469	#	67.05X	61.59X	27.35X	66.90X	60.95X	27.20X	-0.16	-0.63	-0.18	3.34*	70GE	C469
C470	#	64.15	59.22	25.05	63.84	58.65	25.63	-0.30	-0.57	-0.03	1.94	70DH	C470
C472	#	64.76	59.44	26.05	64.42	58.81	25.91	-0.34	-0.63	-0.15	2.21	70ZD	C472
C473	#	64.52	59.38	25.39	64.34	58.87	25.42	-0.18	-0.51	-0.17	2.42	70DH	C473
C474	#	64.40	58.02	25.05	64.25	57.59	25.50	-0.16	-0.43	-0.03	1.95	70SA	C474
C476	#	64.16	58.60	25.37	63.97	58.12	25.50	-0.19	-0.48	-0.07	2.10	70SA	C476
C490	#	63.27	57.66	17.15X	63.07	57.26	17.17X	-0.19	-0.40	0.03	1.51*	70HB	C480
C481	#	64.66	58.99	25.25	64.41	58.49	25.18	-0.25	-0.50	-0.10	1.85	70HB	C481
C482	#	64.10	58.15	25.00	63.91	57.57	25.32	-0.25	-0.58	-0.18	2.50	70GC	C482
C483	#	64.71	57.73	24.95	64.55	56.97	24.72*	-0.35	-0.75	-0.24	3.18*	70SL	C483
C495	#	64.01	58.43	25.37	63.91	58.01	25.45	-0.10	-0.42	-0.11	2.32	70KS	C455
C496A	#	63.67	58.17	25.45	63.08	57.86	25.45	-0.01 *	-0.31 *	-0.00	2.05	70GE	C496A
C499C	X	63.23	57.08*	25.35	62.35A	55.78X	25.41	-0.85 X	-1.30 X	-0.51 *	4.11X	70HL	C499C
C508	#	64.12	58.79	25.00	64.01	58.41	25.54	-0.11	-0.38	0.04	1.80	70GE	C508
C511	#	64.07	58.57	25.34	63.93	58.13	25.44	-0.14	-0.44	-0.09	2.16	70DH	C511
C512	#	64.33	59.73	25.35	64.16	58.29	25.37	-0.17	-0.44	0.00	1.90	70AC	C512
C514B	*	64.38	58.20	25.59	64.07	57.59	25.58	-0.31	-0.61	-0.12	2.28	70SP	C514B
C524	#	64.23	58.61	25.72	63.91	57.96	25.36	-0.32	-0.64	-0.37	2.75	70GE	C524
C526	#	64.09	58.45	25.00	63.92	57.97	25.48	-0.17	-0.48	-0.08	2.23	70KS	C526
C528	#	64.20	58.75	25.95	64.03	58.28	25.79	-0.17	-0.46	-0.14	2.18	70MD	C528
C529	#	65.08	58.90	25.00	64.89	58.37	25.59	-0.19	-0.53	-0.27	2.67	70DH	C529
C534	#	65.16*	59.02	25.77	64.98*	58.81	25.82	-0.20	-0.41	0.05	1.49*	70MD	C534
C536	#	63.69	55.76X	25.42	63.39	55.22X	25.29	-0.29	-0.54	-0.13	2.10	70AC	C536
C540	#	63.52	57.84	25.70	63.30	57.28	25.67	-0.23	-0.56	-0.11	2.44	70GE	C540
C543	#	64.54	59.07	25.49	64.41	58.61	25.64	-0.13	-0.45	-0.05	2.27	70HB	C543
C545	#	63.36	58.18	25.34	63.20	57.71	25.20	-0.16	-0.46	-0.14	2.24	70SA	C545
C549	#	64.32	59.09	25.40	64.12	58.57	25.31	-0.20	-0.52	-0.15	2.35	70DH	C549
C552	#	64.63	58.77	25.15	64.24	58.07	24.96	-0.39	-0.70	-0.17	2.42	70HN	C552
C608	#	64.72	58.40	25.92X	64.44	57.81	26.80X	-0.28	-0.59	-0.12	2.34	70GC	C608
C613	#	63.78	58.68	24.97X	63.70	58.27	25.87X	-0.08	-0.41	-0.20	2.42	70MD	C613
C627	#	64.37	58.89	26.97*	64.12	58.37	26.02*	-0.25	-0.52	-0.05	1.95	70SA	C627
C630	#	63.88	58.29	25.39	63.53	57.70	25.32	-0.35	-0.60	-0.06	1.94	70KS	C630
C631	#	63.89	58.25	25.05	63.64	57.70	25.24	-0.25	-0.54	0.17 *	2.06	70AC	C631
C632	#	64.16	58.55	25.29	63.81	57.78	25.15	-0.55 X	-0.77 *	-0.14	1.56	70AC	C632
C638	#	64.07	57.66	25.00	63.82	57.15	25.40	-0.25	-0.50	-0.20	2.07	70GC	C638
C644	#	64.11	58.40	25.35	63.89	57.67	25.16	-0.42	-0.72	-0.37	2.73	70MD	C644
C645	#	63.29	55.91X	25.12	63.05	55.40X	24.83	-0.24	-0.52	-0.29	2.43	70AC	C645
C656	#	64.28	58.49	25.00	63.58	57.89	25.43	-0.30	-0.60	-0.22	2.38	70SA	C656
C657	#	64.34	57.80	25.34	64.21	57.31	25.23	-0.13	-0.49	-0.31	2.89	70AC	C657
C660	#	63.77	55.85X	25.05	63.55	55.35X	25.37	-0.22	-0.49	-0.23	2.33	70AC	C660
C662	*	64.81	58.44	25.00	64.54	57.87	25.50	-0.26	-0.56	-0.16	2.34	70SP	C662
C672	#	65.94X	59.82	27.24X	65.69X	59.21	26.51X	-0.25	-0.61	-0.30	2.75	70GC	C672
C675	#	64.21	58.53	25.34	63.90	57.90	25.18	-0.31	-0.64	-0.36	2.78	70AC	C675



MOA COLLABORATIVE REFERENCE PROGRAM  
 X, Y, Z SPACE ANALYSIS, ADJUSTED DATA  
 COLOR + COLOR DIFFERENCE  
 FOR PAINT CHIPS

LAB CODE	F	SAMPLE D13			SAMPLE D14			DIFFERENCE D14 - D13			INST CODE	LAB
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ		
C700	θ	64.11	58.54	25.43	63.95	58.07	25.33	-0.15	-0.47	-0.15	2.34	70DH C700
C707	θ	62.64X	56.78*	25.57	62.15X	50.04*	25.37	-0.49 *	-0.73	-0.20	2.18	70SA C707
C716	#	63.76	58.14	25.23	63.51	57.69	25.19	-0.24	-0.45	-0.06	1.62	70ZE C716
C717A	+	65.01	58.87	25.73	64.71	58.24	25.49	-0.30	-0.62	-0.24	2.55	70SP C717A
C717B	+	64.80	58.69	25.00	64.53	58.12	25.47	-0.27	-0.57	-0.19	2.36	70SP C717B
C718A	θ	64.52	58.06	25.55	64.59	57.81	25.33	0.07 *	-0.25 *	0.00	2.10	70AC C718A
C718B	θ	64.49	58.00	25.39	64.49	57.65	25.33	0.01 *	-0.35	-0.06	2.45	70SA C718B
C719C	θ	63.78	58.67	25.41	63.50	58.11	25.29	-0.22	-0.57	-0.12	2.49	70KC C719C
C720A	+	64.99	58.74	25.70	64.80	58.26	25.78	-0.20	-0.48	0.01	2.03	70SP C720A
C720B	+	65.04	58.80	25.75	64.82	58.28	25.78	-0.22	-0.51	0.03	2.07	70SP C720B
C721	#	63.16*	56.46*	27.45X	63.10	56.15*	27.44X	-0.06	-0.32	-0.01	1.78	70KS C721
C722	θ	63.81	57.98	25.50	63.54	57.42	25.24	-0.27	-0.56	-0.06	2.17	70AC C722
C723	θ	64.43	58.91	25.04	64.19	58.40	25.58	-0.25	-0.52	-0.03	1.95	70MD C723
C724	θ	64.00	58.61	25.50	63.82	58.13	25.42	-0.18	-0.48	-0.14	2.25	70SA C724
C726	θ	65.08	60.09*	26.55X	64.09	59.37	26.02*	-0.39	-0.72	-0.47 *	2.85	70SA C726
C727A	+	67.20X	61.09X	27.22X	66.57A	60.48X	26.98X	-0.29	-0.61	-0.24	2.46	70SP C727A
C727B	+	64.99	59.17	25.50	64.80	58.51	25.61	-0.33	-0.67	-0.37	2.80	70SP C727B
C741	θ	63.83	58.01	25.42	63.09	57.55	25.39	-0.14	-0.46	-0.06	2.28	70SA C741
GRAND MEANS		64.16	58.53	25.50	63.94	57.99	25.37	-0.22	-0.53	-0.15	2.34	
SD OF MEANS		0.47	0.68	0.20	0.48	0.69	0.31	0.10	0.11	0.12	0.32	
INCLUDED LABS FOR THIS MEAN		65	64	62	65	64	63	67	68	68	68	

MCA COLLAGRATIVE REFERENCE PROGRAM  
 X, Y, Z SPACE ANALYSIS, ADJUSTED DATA  
 COLOR \* COLOR DIFFERENCE  
 FOR PAINT CHIPS

IAB CODE	F	SAMPLE D15			SAMPLE D16			DIFFERENCE D16 - D15			ΔE	INST	
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ		CODE	LAB
C157	†	8.77	11.82	13.44	8.52	11.72	12.76	-0.25 *	-0.11 *	-0.68 *	2.43	70GE	C157
C162	†	9.14	12.02	13.34	9.02	12.03	13.22	-0.11	0.01	-0.62	2.25	70DC	C162
C251	†	8.90	11.82	13.07	8.90	12.02	12.60	0.00	0.20	-0.47	2.7C	70SA	C251
C253	†	8.72	11.57	12.00	8.58	11.54	11.97	-0.14	-0.03	-0.63	2.31	70GC	C253
C278	†	9.09	11.71	13.33*	9.09	11.86	13.49	0.00	0.15	-0.39	2.05	70NE	C278
C407	†	9.29	12.18	13.47	9.24	12.23	12.90	-0.06	0.05	-0.57	2.32	70BL	C407
C414	†	9.83	11.79	12.90	8.93	12.02	12.64	0.10	0.23	-0.35	2.46	70MD	C414
C416A	†	9.40*	11.26*	12.10*	8.39*	11.36*	11.71*	-0.01	0.11	-0.47	2.33	70IB	C416A
C416B	†	8.63	11.61	12.71	8.58	11.67	12.17	-0.05	0.06	-0.54	2.30	70GE	C416H
C418	†	9.21	12.26	13.49	9.34	12.54*	13.20	0.14	0.28	-0.29	2.44	70CE	C418
C422	†	8.77	11.66	12.33	8.82	11.82	12.09	0.06	0.15	-0.44	2.55	70SA	C422
C424	†	9.20	12.16	13.04	9.27	12.35	13.21	0.07	0.18	-0.40	2.36	70CA	C424
C428	†	8.64	11.63	12.33	8.77	11.88	12.21	0.13	0.25	-0.32	2.58	70BB	C428
C437	†	9.92	11.85	12.80	8.91	11.96	12.32	-0.01	0.11	-0.49	2.33	70GC	C437
C443	†	9.16	12.06	13.33	9.14	12.17	12.85	-0.02	0.12	-0.50	2.34	70CL	C443
C444	†	8.91	11.83	13.10	8.90	12.00	12.67	0.05	0.17	-0.43	2.44	70GE	C444
C446	†	8.95	11.90	12.97	9.10	12.17	12.70	0.15	0.27	-0.27	2.47	70GE	C446
C451	†	9.88	11.73	13.00	8.98	11.95	12.74	0.10	0.22	-0.34	2.37	70AC	C451
C459	†	8.71	11.60	12.94	8.84	11.85	12.65	0.14	0.25	-0.28	2.46	70GE	C459
C460	†	8.40*	11.29*	12.33	8.64	11.64	12.42	0.23	0.35	-0.15	2.74	70GE	C460
C462A	#	8.64	11.61	12.40	8.74	11.81	12.08	0.10	0.20	-0.40	2.65	70HB	C462A
C463	†	8.90	11.85	13.20	9.00	12.15	12.91	0.16	0.29	-0.29	2.67	7CZD	C463
C469	†	9.59X	12.66X	14.39X	9.43*	12.65*	13.79*	-0.15	-0.02	-0.59	2.05	70GE	C469
C470	†	8.77	11.63	13.00	8.72	11.71	12.60	-0.05	0.07	-0.48	2.08	70DH	C470
C472	†	9.16	12.14	13.71	9.19	12.30	13.31	0.03	0.16	-0.40	2.14	70ZD	C472
C473	†	8.79	11.64	13.22	8.78	11.76	12.79	-0.00	0.12	-0.43	2.12	70DH	C473
C474	†	9.18	11.97	13.40	9.09	12.01	12.66	-0.09	0.03	-0.53	2.12	70SA	C474
C476	†	9.03	11.99	13.34	8.80	11.93	12.68	-0.17 *	-0.07 *	-0.66 *	2.21	70SA	C476
C480	†	8.38*	11.32	12.24*	8.33	11.58	11.97	0.14	0.27	-0.27	2.52	70HB	C480
C481	†	8.82	11.74	12.07	8.92	12.04	12.32	0.10	0.30	-0.35	2.74	70BB	C481
C482	†	8.49	11.36	12.24*	8.53	11.52	11.84*	0.04	0.16	-0.41	2.34	70GC	C482
C483	†	9.92	11.95	13.04	8.93	12.15	12.59	0.01	0.20	-0.41	2.50	70SL	C483
C495	†	8.90	11.80	13.43	9.17	12.15	13.35	0.27	0.38	-0.10	2.74	70KS	C495
C496A	†	8.99	11.92	13.20	9.18	12.22	12.98	0.19	0.30	-0.22	2.52	70GE	C496A
C499C	X	9.33	12.37*	13.41	9.06	12.25	12.17	-0.27 *	-0.12 *	-0.93 X	3.14X	70BL	C499C
C508	†	8.60	11.52	12.01	8.53	11.70	12.44	0.05	0.18	-0.39	2.26	70GE	C508
C511	†	8.82	11.75	13.10	8.84	11.90	12.68	0.02	0.14	-0.41	2.15	70DB	C511
C512	#	8.50	11.37	12.39	8.72	11.66	12.77	0.16	0.29	-0.21	2.35	70AC	C512
C514B	*	8.68	11.69	12.34	8.58	12.01	12.73	0.20	0.32	-0.21	2.64	70SP	C514B
C524	†	9.11	12.01	13.30	9.20	12.23	13.06	0.09	0.22	-0.30	2.15	70GE	C524
C526	†	8.90	11.79	13.42	8.92	11.95	13.03	0.02	0.16	-0.39	2.14	70KS	C526
C528	†	8.87	11.83	13.24	8.83	11.93	12.74	-0.02	0.11	-0.47	2.19	70MD	C528
C529	†	8.85	11.85	13.20	8.83	11.95	12.80	-0.02	0.11	-0.46	2.16	70DH	C529
C534	†	8.99	11.86	13.10	9.03	12.06	12.82	0.04	0.19	-0.33	2.11	70MD	C534
C536	†	9.01	11.90	12.90	9.02	12.02	12.54	0.01	0.12	-0.42	2.11	70AC	C536
C540	†	9.43*	12.39*	13.52	9.39	12.47	13.02	-0.04	0.07	-0.50	2.13	70GE	C540
C543	#	8.71	11.69	12.30	8.82	11.94	12.23	0.11	0.25	-0.32	2.46	70HB	C543
C545	†	8.70	11.59	13.04	8.79	11.80	12.68	0.09	0.21	-0.36	2.40	70SA	C545
C549	†	8.78	11.68	13.14	8.80	11.68	12.57	-0.12	0.00	-0.57	2.16	70DE	C549
C552	†	8.57	11.53	12.20*	8.58	11.67	11.80*	0.01	0.14	-0.45	2.39	70BN	C552
C608	†	9.75X	12.77X	13.74	9.33A	12.98X	13.36	0.08	0.21	-0.35	2.21	70GC	C608
C613	†	7.85X	11.30*	11.15X	8.03A	11.60	10.92X	0.18	0.30	-0.23	2.72	70MD	C613
C627	†	8.96	11.97	13.23	9.10	12.27	12.99	0.18	0.30	-0.26	2.66	70SA	C627
C630	†	8.92	11.89	13.17	9.18	12.26	13.03	0.26	0.37	-0.14	2.81	70KS	C630
C631	†	8.80	11.72	13.07	9.00	11.97	12.80	0.15	0.26	-0.27	2.45	70AC	C631
C632	†	8.88	11.74	13.10	9.04	12.01	12.88	0.16	0.27	-0.25	2.43	70AC	C632
C638	†	8.54	11.57	12.40	8.09	11.77	12.10	0.15	0.20	-0.35	3.01*	70GC	C638
C644	†	8.69	11.56	12.71	8.79	11.78	12.36	0.10	0.21	-0.35	2.43	70MD	C644
C645	†	9.11	11.93	12.30	9.21	12.12	12.48	0.09	0.19	-0.35	2.35	70AC	C645
C656	#	9.01	11.97	13.10	9.11	12.19	12.81	0.10	0.22	-0.34	2.37	70SA	C656
C657	†	8.87	11.82	13.20	9.01	12.06	12.88	0.14	0.24	-0.32	2.57	70AC	C657
C660	†	9.27	12.15	13.24	9.36	12.35	12.83	0.08	0.16	-0.41	2.52	70AC	C660
C662	*	8.84	11.85	13.10	8.97	12.09	12.81	0.13	0.24	-0.34	2.55	70SP	C662
C672	†	8.69	11.48	12.49	8.84	11.73	12.18	0.15	0.25	-0.30	2.68	70GC	C672
C675	†	9.02	11.91	13.24	9.03	12.03	12.78	0.09	0.12	-0.46	2.25	70AC	C675

NCA COLLABORATIVE REFERENCE PROGRAM  
 X, Y, Z SPACE ANALYSIS, ADJUSTED DATA  
 COLOR + COLOR DIFFERENCE  
 FOR PAINT CHIPS

LAB CODE	F	SAMPLE D15			SAMPLE D16			DIFFERENCE D16 - D15			ΔE	INST	
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ		CODE	LAB
C700	#	8.071	11.064	12.990	8.097	12.001	12.061	0.26	0.37	-0.14	2.080	70DH	C700
C707	Ø	9.92X	12.02X	13.00X	10.11A	12.091X	13.26X	0.19	0.29	-0.14	2.006	70SA	C707
C716	#	13.080X	11.096	13.000	9.000	12.021	12.055	-4.42 X	0.25	-0.36	23.039X	70ZE	C716
C717A	+	9.009	12.007	13.000	9.010	12.026	13.016	0.07	0.19	-0.36	2.021	70SP	C717A
C717B	+	8.092	11.089	13.007	9.009	12.018	13.012	0.16	0.29	-0.25	2.047	70SP	C717B
C718A	Ø	8.084	11.078	13.014	8.094	11.099	12.080	0.10	0.21	-0.34	2.040	70AC	C718A
C718B	Ø	8.085	11.078	13.013	9.009	12.016	13.004	0.24	0.38	-0.14	2.066	70SA	C718B
C719C	Ø	9.018	12.020	13.000	9.003	12.048	13.018	0.15	0.28	-0.27	2.045	70KC	C719C
C720A	+	8.092	11.091	13.001	9.000	12.016	12.059	0.12	0.24	-0.32	2.048	70SP	C720A
C720B	+	8.089	11.091	13.007	9.004	12.017	12.059	0.15	0.26	-0.29	2.053	70SP	C720B
C721	#	10.02X	12.097X	13.000	10.020X	13.24X	13.059	0.18	0.28	-0.27	2.058	70KS	C721
C722	Ø	8.091	11.077	13.000	9.002	11.099	12.076	0.11	0.23	-0.34	2.043	70AC	C722
C723	Ø	8.065	11.056	12.000	8.087	11.091	12.079	0.22	0.36	-0.16	2.065	70MD	C723
C724	Ø	8.082	11.075	13.001	9.003	12.007	12.079	0.20	0.32	-0.21	2.067	70SA	C724
C726	#	9.000	11.092	13.001	9.019	12.024	13.027	0.17	0.32	-0.24	2.048	70SA	C726
C727A	+	9.019	12.034*	14.000*	9.029	12.057*	13.064*	0.11	0.22	-0.36	2.047	70SP	C727A
C727B	+	8.080	11.076	13.000	8.085	11.091	13.002	0.03	0.16	-0.41	2.022	70SP	C727B
C741	Ø	8.093	11.089	13.000	8.095	12.000	12.061	0.02	0.11	-0.41	2.010	70SA	C741
GRAND MEANS		8.088	11.079	13.000	8.095	11.099	12.072	0.07	0.19	-0.37	2.040		
SD OF MEANS		0.22	0.24	0.39	0.24	0.26	0.42	0.11	0.11	0.13	0.22		
INCLUDED LABS FOR THIS MEAN		64	65	65	65	66	66	68	68	68	68		

LAB CODE	F	SAMPLE D13		SAMPLE D14			DIFFERENCE D14 - D13			INST CODE	LAB	
		NEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN E	ΔL	ΔA			ΔB
C121	†	76.40	15.91	34.05*	70.10	16.86	34.49*	-0.30	0.95 *	-0.20	1.02	70HM C121
C148	†	76.59	16.50	33.84	76.24	17.35	33.71	-0.35	0.85	-0.10 *	0.92	70HF C148
C152	†	76.96	16.52	33.81	76.57	17.31	33.61	-0.40	0.80	-0.20	0.91	70HA C152
C166	†	76.80	16.28	33.33	76.43	17.02	33.53	-0.35	0.75	-0.30	0.88	70HA C166
C183	†	78.61X	15.88	34.60	78.10X	16.86	33.86	-0.51 *	0.92	-0.20	1.07*	70HA C183
C223	†	75.92	16.37	33.27	75.55	17.14	33.66	-0.37	0.77	-0.23	0.89	70HA C223
C241	†	79.11X	15.59	34.00	78.00X	16.56	34.36	-0.51 *	0.97 *	-0.20	1.02*	70HF C241
C256A	†	76.82	15.94	34.21	76.44	16.76	34.02	-0.38	0.82	-0.19	0.92	70HU C256A
C256H	†	76.30	15.73	34.01	76.01	16.48	33.80	-0.35	0.75	-0.21	0.85	70HU C256H
C288	†	78.23X	16.37	34.00	77.83X	17.19	34.29	-0.41	0.82	-0.31	0.96	70SC C288
C291	†	76.74	16.33	33.00	76.39	17.08	33.48	-0.35	0.75	-0.20	0.85	70HA C291
C317	†	76.61	16.28	34.10	76.31	17.08	33.90	-0.30	0.80	-0.20	0.88	70HM C317
C325	†	75.90	15.17	32.37*	75.80	15.96	32.70*	-0.30	0.79	-0.26	0.88	70HR C325
C356	†	76.69	16.67	34.10	76.39	17.37	33.96	-0.30	0.70	-0.20	0.79	70HM C356
C380	†	77.06	16.42	34.20	76.67	17.16	34.06	-0.40	0.75	-0.20	0.87	70HA C380
C382	†	76.71	15.14	33.70	76.31	15.94	33.56	-0.40	0.80	-0.20	0.91	70HA C382
C390	†	76.59	17.91	33.00	76.19	18.80*	33.74	-0.40	0.90	-0.15	0.89	70HF C390
C420A	†	76.20	16.78	34.20	75.50	17.58	34.06	-0.35	0.80	-0.20	0.89	70HF C420A
C420H	†	76.40	17.14	34.31	76.00	17.84	34.01	-0.60 X	0.70	-0.30	0.87	70HF C420B
C427	†	76.70	16.55	33.30	76.41	17.30	33.68	-0.35	0.75	-0.30	0.88	70HA C427
C440	†	76.42	17.12	34.31	76.20	17.84	33.99	-0.22 *	0.72	-0.32	0.81	70HA C440
C442	†	77.03	15.40	34.00	76.88	16.20	33.85	-0.35	0.80	-0.20	0.90	70HM C442
C454	†	75.67	15.18	33.00	75.23*	16.07	32.90	-0.44	0.90	-0.19	1.02	70HA C454
C458	†	76.89	16.24	33.00	76.35	17.02	33.65	-0.34	0.78	-0.21	0.88	70HM C458
C475	†	76.37	16.37	33.70	75.97	17.26	33.50	-0.40	0.88	-0.20	0.95	70HA C475
C477	†	75.91	17.28	33.10	75.55	18.03	32.91	-0.36	0.76	-0.24	0.87	70HA C477
C494	†	76.69	16.36	33.00	76.39	17.00	33.38	-0.30	0.64	-0.15	0.72*	70HA C494
C496B	†	75.83	15.33	37.23X	75.60	16.06	37.05X	-0.23	0.72	-0.18	0.78	70GP C496B
C499A	†	76.39	16.80	30.20X	76.14	17.49	29.91X	-0.25	0.70	-0.30	0.80	70HA C499A
C499H	†	76.55	16.54	33.00	76.10	17.34	33.39	-0.45	0.80	-0.30	0.96	70HA C499H
C506	†	76.77	16.75	33.70	76.43	17.50	33.50	-0.30	0.75	-0.20	0.83	70HF C506
C514A	*	76.64	16.90	33.00	76.35	17.65	33.59	-0.29	0.75	-0.24	0.83	70SR C514A
C517	†	76.11	15.24	33.00	75.81	16.03	33.32	-0.30	0.79	-0.20	0.86	70SC C517
C538	†	78.43X	16.86	33.00	78.07X	17.57	32.80	-0.35	0.71	-0.25	0.83	70GX C538
C541	†	75.91	17.00	33.07	75.56	17.79	32.83	-0.35	0.79	-0.25	0.90	70GP C541
C543	#	76.79	15.22	33.00	76.49	16.00	33.39	-0.30	0.78	-0.23	0.86	70HA C543
C546A	†	75.59*	17.76	33.00	75.29	16.55	33.36	-0.30	0.80	-0.30	0.90	70HQ C546A
C546H	†	76.35	16.44	34.00	75.95	17.19	33.79	-0.40	0.75	-0.30	0.90	70HM C546H
C547	†	75.47*	17.48	34.42	75.18*	18.35	34.13	-0.29	0.87	-0.29	0.86	70HQ C547
C574	†	76.60	14.42*	32.47X	76.21	15.11*	32.18X	-0.40	0.69	-0.30	0.85	70HQ C574
C600	†	76.47	18.53*	33.10	76.17	19.43*	32.99	-0.30	0.90	-0.20	0.87	70GD C600
C620	†	76.57	16.18	34.10	76.23	16.88	33.90	-0.34	0.70	-0.24	0.81	70MG C620
C628	†	76.72	15.41	33.00	76.32	16.07	33.43	-0.41	0.67	-0.24	0.82	70ME C628
C633	†	76.71	17.00	33.41	76.30	17.66	33.06	-0.35	0.66	-0.35 *	0.82	70HA C633
C655	†	76.54	15.87	33.00	76.17	16.09	33.71	-0.37	0.82	-0.14	0.91	70HU C655
C677	†	76.02	16.50	33.00	75.37	17.31	33.55	-0.65 X	0.81	-0.14	1.04	70SC C677
C690	†	76.65	16.19	33.00	76.30	16.89	33.49	-0.35	0.70	-0.20	0.81	70HA C690
C705	†	61.78X	4.38X	08.00X	61.25X	4.59X	67.35X	-0.54 *	0.21 X	-0.68 X	0.89	70SC C705
C709	†	76.20	16.02	33.00	75.90	16.74	33.50	-0.33	0.71	-0.30	0.84	70SC C709
C719A	†	76.18	14.41*	33.00	75.78	15.10*	33.57	-0.40	0.69	-0.30	0.85	70HA C719A
C719B	†	76.80	16.94	34.00	76.01	17.64	33.81	-0.25	0.70	-0.20	0.77	70HA C719B
C742	*	81.50X	21.35X	37.00X	81.31X	22.16X	37.88X	-0.19 *	0.81	-0.01 X	0.84	70SR C742

GRAND MEANS

76.44 16.31 33.00 76.08 17.09 33.00 -0.36 0.78 -0.23 0.89

SD OF MEANS

0.39 0.83 0.42 0.40 0.84 0.42 0.07 0.08 0.06 0.08

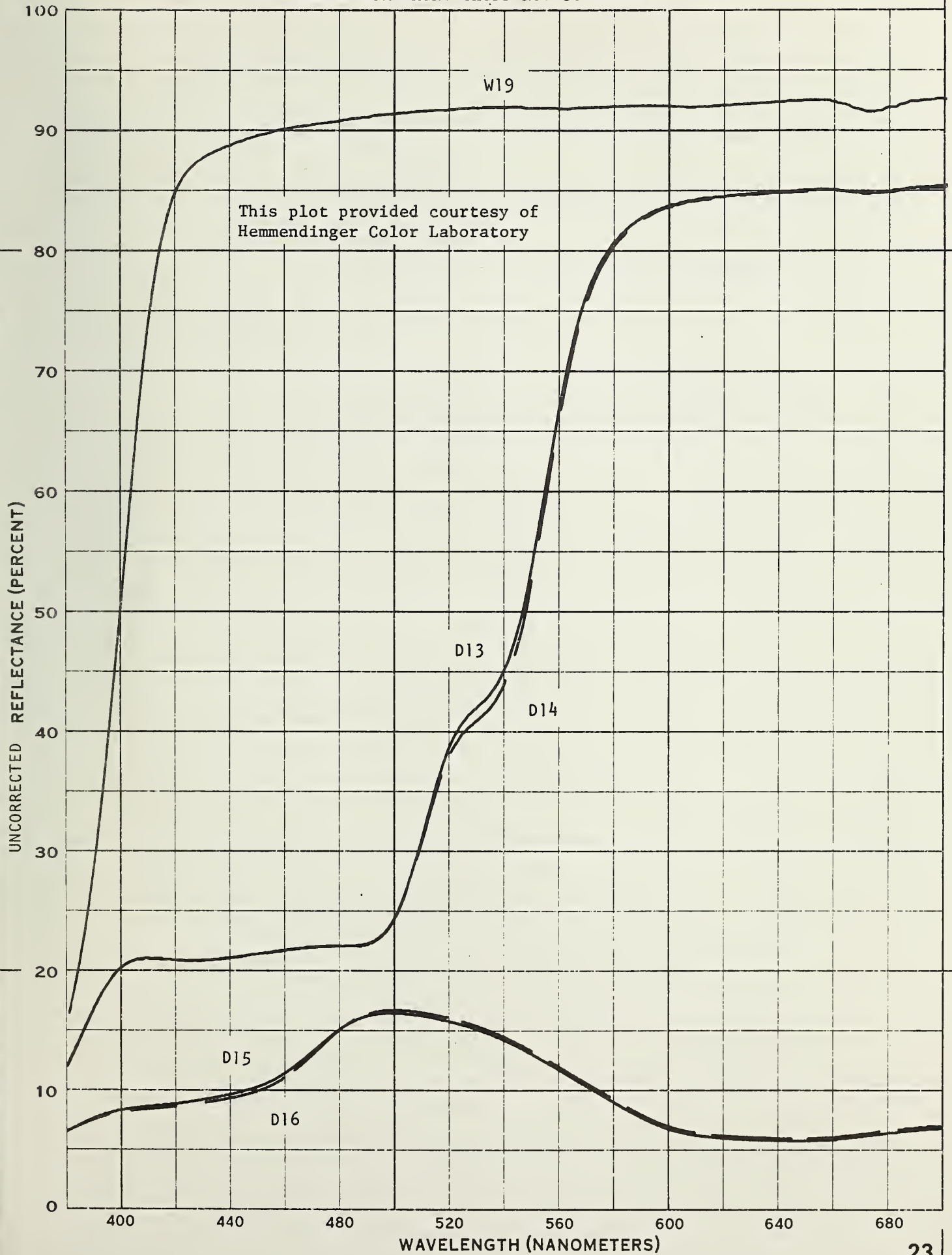
INCLUDED LABS FOR THIS MEAN

44 48 40 44 48 45 47 48 48 49

LAB CODE	F	SAMPLE D15			SAMPLE D16			DIFFERENCE D16 - D15			INST CODE	LAB
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔI	ΔA	ΔB		
C121	♂	33.89	-14.65	2.26	34.19	-15.15	3.37	.30	-.50	1.10	1.24	70HM C121
C148	♂	34.50	-14.66	2.37	34.35	-15.06	3.37	.35	-.40	.99	1.13	70HF C148
C152	♂	34.49	-14.06	2.07	34.34	-14.66	3.11	-.15 X	-.60	1.04	1.21	70HA C152
C166	♂	34.23	-14.19	2.04	34.23	-14.79	3.10	.00 *	-.60	1.09	1.24	70HA C166
C183	♂	35.09	-15.95X	2.90*	34.89	-15.34	1.87	-.20 X	.61 X	-1.03 X	1.22	70HA C183
C223	♂	34.71	-14.48	2.19	34.91	-15.04	3.29	.20	-.55	1.10	1.25	70BA C223
C241	♂	35.06	-14.41	1.73	35.11	-14.97	2.87	.05	-.56	1.13 *	1.27	70HF C241
C256A	♂	33.94	-14.25	2.00	34.18	-14.72	3.10	.24	-.47	1.10	1.22	70HM C256A
C256B	♂	33.59	-13.57*	.09*	33.84	-14.02	1.74*	.25	-.45	1.04	1.16	70HU C256B
C288	♂	34.77	-14.33	1.70	34.98	-14.94	2.73	.20	-.61	1.03	1.22	70SC C288
C291	♂	34.45	-14.10	2.34	34.05	-14.60	3.43	.20	-.50	1.09	1.22	70HA C291
C317	♂	34.08	-14.23	2.33	34.40	-14.63	3.45	.40	-.40	1.10	1.24	70HM C317
C325	♂	34.36	-14.41	1.94	34.05	-15.21	2.89	.29	-.80 X	.98	1.30*	70HR C325
C356	♂	33.84	-13.66	2.34	34.14	-14.06	3.43	.30	-.40	1.09	1.20	70HM C356
C380	♂	34.15	-14.06	2.27	34.49	-14.56	3.36	.35	-.50	1.09	1.25	70HA C380
C382	♂	34.31	-14.34	2.00	34.51	-14.94	3.15	.20	-.60	1.09	1.26	70HA C382
C390	♂	34.50	-14.19	2.00	34.75	-14.59	3.10	.25	-.40	1.04	1.14	70HF C390
C420A	♂	34.13	-16.94X	1.23	34.03	-17.29X	2.24	.50	-.35	.99	1.17	70HF C420A
C420B	♂	34.16	-16.85X	1.24	34.50	-17.15X	2.21	.40	-.30 *	.99	1.11	70HF C420B
C427	♂	34.31	-14.05	2.27	34.51	-14.55	3.26	.20	-.50	.99	1.13	70HA C427
C440	♂	34.18	-14.50	2.34	34.55	-14.98	3.35	.37	-.48	1.01	1.18	70BA C440
C442	♂	34.01	-13.82	1.32	34.16	-14.32	2.51	.15	-.50	.99	1.12	70HM C442
C454	♂	34.87	-14.33	1.97	35.12	-14.97	3.06	.25	-.64	1.07	1.27	70HA C454
C458	♂	33.90	-14.04	1.39	34.13	-14.58	2.60	.24	-.53	1.01	1.17	70BM C458
C475	♂	34.43	-14.15	1.23	34.66	-14.72	2.22	.21	-.57	.99	1.16	70HA C475
C477	♂	34.57	-14.43	1.64	34.84	-15.00	2.61	.27	-.58	.97	1.16	70BA C477
C494	♂	34.36	-14.39	1.48	34.66	-14.88	2.56	.30	-.49	1.08	1.22	70HA C494
C496B	♂	33.64	-14.71	3.93X	33.83	-15.24	4.96X	.22	-.53	1.01	1.16	70GP C496B
C499A	♂	33.81	-14.49	-0.97X	34.26	-14.89	-5.93X	.45	-.40	1.04	1.20	70HA C499A
C499B	♂	34.28	-14.25	2.27	34.58	-14.70	3.26	.30	-.45	.99	1.13	70HA C499B
C506	♂	34.03	-14.24	2.22	34.58	-14.59	3.21	.55 *	-.35	.99	1.19	70HF C506
C514A	+	34.38	-14.24	1.42	34.76	-14.63	2.12	.39	-.39	1.00	1.14	70SR C514A
C517	♂	33.97	-12.91X	.94	34.07	-13.55*	1.92	.10	-.64	.98	1.18	70SC C517
C538	♂	35.48*	-10.71X	-1.27X	35.08*	-11.21X	-2.26X	.20	-.50	1.01	1.14	70GX C538
C541	♂	33.75	-13.59*	1.47	34.03	-13.98	2.45	.30	-.40	.98	1.10	70GP C541
C543	#	34.18	-14.16	2.12	34.50	-14.67	3.14	.32	-.51	1.01	1.18	70HA C543
C546A	♂	33.56	-14.18	1.44	33.91	-14.68	2.40	.35	-.50	.99	1.16	70HQ C546A
C546B	♂	33.66	-14.17	2.24	34.01	-14.77	3.26	.35	-.60	1.05	1.26	70HM C546B
C547	♂	32.08X	-15.07*	1.44	32.14A	-15.81*	2.49	.06	-.74 *	1.05	1.29	70HQ C547
C574	♂	37.81X	-11.86X	1.32	38.10A	-12.31X	2.21	.30	-.45	.89 *	1.04*	70HQ C574
C600	♂	34.78	-14.72	2.18	35.03	-15.22	3.18	.25	-.50	1.00	1.15	70GD C600
C620	♂	33.55	-14.27	1.33	33.92	-14.75	2.35	.37	-.48	.99	1.16	70MG C620
C628	♂	34.34	-14.25	1.33	34.87	-14.61	2.56	.53	-.36	.95	1.15	70ME C628
C633	♂	34.33	-14.20	2.20	34.07	-14.63	3.32	.34	-.43	1.04	1.18	70BA C633
C655	♂	34.31	-13.60*	1.44	34.40	-14.69	2.12	.14	-.49	1.01	1.13	70HU C655
C677	♂	34.49	-12.95X	1.13	34.47	-13.48*	2.20	-.02 *	-.53	1.05	1.17	70SC C677
C690	♂	33.72	-14.13	2.37	33.92	-14.73	3.17	.20	-.69	1.10	1.27	70HA C690
C705	♂	12.20X	-1.93X	1.73	12.54A	-2.01X	2.68	.34	-.68 X	.98	1.05*	70SC C705
C709	♂	34.90	-14.17	1.39	35.39*	-14.57	2.58	.43	-.40	.99	1.15	70SC C709
C719A	♂	34.11	-14.17	1.20	34.45	-14.76	2.31	.35	-.59	1.03	1.24	70HA C719A
C719B	♂	34.10	-14.46	2.33	34.55	-14.86	3.02	.45	-.40	.99	1.16	70HA C719B
C742	+	32.63X	-13.62	-2.37X	32.02A	-13.88	-1.55X	-.06 *	-.27 *	1.01	1.05*	70SR C742
GRAND MEANS												
		34.26	-14.24	1.01	34.52	-14.71	2.80	.28	-.50	1.03	1.19	
SD OF MEANS												
		.44	.31	.40	.41	.44	.49	.13	.09	.05	.06	
INCLUDED LABS FOR THIS MEAN												
		46	41	40	46	44	46	47	46	49	49	



SPECTROPHOTOMETRIC CURVES OF COLOR AND COLOR  
DIFFERENCE FOR PAINT CHIPS NO. 30 SAMPLES







Notes on Specific Laboratory Results for Near White Papers

- C162 - Reporting or measurement problem on mean Z for both samples
- C222 - Reporting or measurement problem on mean a for both samples
- C226 - Reported insufficient data to be analyzed in this report
- C662, C717A, C717B, C720A, C720B, C727A, C727B - Used illuminant D65
- C716 - Data received too late to be included in Grand Mean Statistics

MCCA COLLABORATIVE REFERENCE PROGRAM  
 X, Y, Z SPACE ANALYSIS, NORMAL DATA  
 COLOR \* COLOR DIFFERENCE  
 FOR NEAR WHITE PAPERS

LAB CODE	F	SAMPLE P03			SAMPLE P04			DIFFERENCE P04 - P03			ΔE	INST	
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ		CODE	LAB
C162	#	80.30*	81.98X	60.10X	77.90*	79.44X	75.70X	-2.41	-2.55	-4.44	4.49	71DC	C162
C244	#	77.74	78.69	73.33	75.02	76.13	70.70	-2.72	-2.56	-4.69	4.32	71ZE	C244
C250	#	77.87	79.24	73.31	75.30	76.37	70.77	-2.57	-2.86	-4.74	5.47	71ZF	C250
C313	#	77.65	78.51	73.33	74.80	75.50	71.29	-2.79	-3.01	-4.70	5.12	71SA	C313
C446	#	76.91	78.42	75.13	74.30	75.68	70.57	-2.61	-2.74	-4.57	4.76	71GE	C446
C662	+	75.63	79.02	69.37X	73.15	76.28	65.57X	-2.48	-2.74	-4.30	4.92	71SP	C662
C716	#	76.33	77.77	74.33	73.47	74.77	69.76	-2.87	-3.00	-4.77	4.95	71ZE	C716
C717A	+	75.70	79.19	70.33X	73.00	76.26	65.96X	-2.70	-2.93	-4.37	4.81	71SP	C717A
C717B	+	75.98	78.91	70.33X	73.01	77.04	66.61X	-2.17	-1.86 *	-3.88 *	3.63	71SP	C717B
C720A	+	75.61	79.04	69.33X	72.92	76.10	65.48X	-2.69	-2.93	-4.45	4.96	71SP	C720A
C720B	+	75.36	78.80	69.70X	72.72	75.89	65.42X	-2.66	-2.90	-4.36	4.87	71SP	C720B
C727A	+	75.85	79.28	70.20X	73.60	76.48	65.91X	-2.58	-2.81	-4.32	4.77	71SP	C727A
C727B	+	75.81	79.24	70.33X	73.67	76.48	66.25X	-2.54	-2.77	-4.25	4.69	71SP	C727B
GRAND MEANS		78.11	78.72	73.31	75.43	76.92	70.63	-2.62	-2.74	-4.63	4.83		
SD OF MEANS		1.31	.37	.33	1.42	.40	.32	.15	.20	.12	.47		
INCLUDED LABS FOR THIS MEAN		5	4	4	5	4	4	5	5	5	5		

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

LAB CODE	F	SAMPLE P03			SAMPLE P04			DIFFERENCE P04 - P03			ΔE	INST	
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB		CODE	LAB
C105	θ	89.00	-0.40	12.17	87.34	-0.14	13.49	-1.066	0.26	1.33	2.14	71HM	C105
C122	θ	88.60	0.20	11.37	86.93	0.54	13.35	-1.073	0.34	1.38	2.25	71SC	C122
C128	θ	88.60	0.01	12.67	80.81	0.26	13.29	-1.079	0.25	1.22	2.19	71HM	C128
C148	θ	90.13	-0.64	12.22	88.41	-0.42	13.58	-1.072	0.22	1.36	2.21	71HF	C148
C150	θ	89.53	-0.16	11.33	87.95	0.10	13.25	-1.060	0.26	1.26	2.06	71HA	C150
C213	θ	88.19	-0.24	11.33	80.02	0.22	13.04	-1.057	0.26	1.15	1.97	71SC	C213
C222	X	89.53	-1.40*	11.31	89.13	-1.05*	12.32*	-0.39 X	0.35	0.41 X	0.67X	71HA	C222
C230	θ	90.42	-0.40	11.33	89.11	0.24	13.20	-1.031	0.64 X	1.27	1.93	71HA	C230
C262	θ	88.03	-0.20	11.31	80.19	0.69	12.90	-1.083	0.29	1.29	2.26	71HR	C262
C285	θ	89.34	-0.84	12.47	87.72	-0.59	13.78	-1.062	0.24	1.31	2.10	71MG	C285
C301	θ	88.84	-0.00	12.13	87.11	0.18	13.47	-1.072	0.18	1.28	2.16	71HM	C301
C320	θ	90.09	-0.89	11.33	88.01	-0.72	12.97	-1.048	0.17	1.10	1.85	71HA	C320
C324	θ	90.49	0.33	11.37	89.39	0.04	12.77	-1.10 *	0.31	1.10	1.59*	71HA	C324
C352	θ	90.18	-0.45	11.33	88.01	-0.22	12.94	-1.036	0.24	1.11	1.77	71HA	C352
C442	θ	89.02	-0.48	11.33	87.37	-0.27	13.10	-1.065	0.21	1.23	2.07	71HM	C442
C456	θ	87.72	-0.15	12.10	80.07	0.11	13.31	-1.065	0.26	1.20	2.06	71HA	C456
C571	θ	88.40	0.36	12.47	80.37	0.77	13.75	-1.084	0.40	1.28	2.28	71HA	C571
C585	θ	86.79*	0.05	11.34	84.73*	0.31	13.07	-2.004	0.26	1.23	2.40	71HA	C585
C670	θ	89.13	-0.78	12.73	87.71	-0.64	14.06	-1.043	0.14	1.26	1.91	71ME	C670
C702	θ	88.07	0.03	12.13	85.82	0.40	13.37	-2.025 *	0.37	1.18	2.57*	71HA	C702
C713	θ	90.91	0.24	12.97*	89.10	0.30	14.22*	-1.080	0.06 *	1.26	2.20	71HA	C713
GRAND MEANS													
		89.08	-0.22	12.10	87.42	0.05	13.35	-1.066	0.25	1.24	2.10		
SD OF MEANS													
		1.07	0.38	0.33	1.23	0.42	0.39	0.26	0.08	0.08	0.22		
INCLUDED LABS FOR THIS MEAN													
		20	20	20	20	20	20	20	19	20	20		

## 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 in 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  $\Delta X$ ,  $\Delta Y$ , and  $\Delta Z$ .

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

LAB CODE	FATIG--(LAB/COMBINED)			INST CODE	PERCENT FROM COMBINED		
	X	Y	Z		X	Y	Z
C162	1.0129	1.0090	1.0162	7100	1.29	.90	1.82
C244	1.0024	.9977	1.0090	712E	.24	-.23	.96
C250	1.0106	1.0043	1.0114	712F	1.06	.43	1.14
C313	1.0086	1.0038	1.0125	715A	.86	.38	1.25
C446	1.0004	.9958	1.0051	71GE	.04	-.02	.51
C662	.9713	.9944	.9254	713P	-2.57	-.56	-7.46
C716	.9979	.9955	1.0034	712E	-.21	-.45	.34
C717A	.9771	1.0004	.9345	713P	-2.29	.04	-6.55
C717B	.9806	1.0042	.9355	713P	-1.94	.42	-6.35
C720A	.9726	.9959	.9275	713P	-2.74	-.41	-7.25
C720B	.9930	.9935	.9264	713P	-.70	-.65	-7.36
C727A	.9775	1.0012	.9350	713P	-2.25	.12	-6.64
C727B	.9754	.9988	.9325	713P	-2.46	-.12	-6.75

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

LAB CODE	FATIG--(LAB/COMBINED)			INST CODE	PERCENT FROM COMBINED		
	X	Y	Z		X	Y	Z
C105	1.0011	.9977	1.0088	711M	.11	-.23	.88
C122	.9994	.9967	1.0062	7130	-.96	-.33	.62
C128	.9984	.9956	1.0030	711M	-.16	-.44	.36
C148	1.0068	1.0040	1.0160	711F	.68	.40	1.06
C150	1.0037	1.0015	1.0127	711A	.37	.15	1.27
C213	.9900	.9872	.9900	7130	-1.00	-1.28	-.34
C222	.9939	.9896	.9954	711A	-.61	-1.04	-.66
C230	1.0012	.9989	1.0077	711A	.12	-.11	.77
C262	1.0108	1.0078	1.0203	711A	1.08	.78	2.03
C285	.9963	.9877	.9800	711G	-1.37	-1.23	-1.94
C301	.9984	.9956	1.0067	711M	-.16	-.44	.67
C320	1.0146	1.0114	1.0150	711A	1.46	1.14	1.50
C324	1.0061	1.0030	1.0142	711A	.61	.30	1.42
C352	1.0100	1.0072	1.0165	711A	1.00	.72	1.65
C442	.9978	.9956	1.0030	711M	-.22	-.44	.36
C456	1.0061	1.0031	1.0137	711A	.61	.31	1.37
C571	.9855	.9816	.9792	711A	-1.45	-1.84	-2.08
C585	1.0088	1.0055	1.0178	711A	.88	.55	1.78
C670	.9905	.9915	.9854	711E	-.95	-.85	-1.46
C702	1.0000	.9967	1.0070	711A	.00	-.33	.70
C713	1.00610	1.00552	1.00637	711A	6.10	5.52	6.37

MCA COLLABORATIVE REFERENCE PROGRAM  
 X, Y, Z SPACE ANALYSIS, ADJUSTED DATA  
 COLOR + COLOR DIFFERENCE  
 FOR NEAR WHITE PAPERS

LAB CODE	F	SAMPLE P03			SAMPLE P04			DIFFERENCE P04 - P03			INST ΔE	CODE	LAB
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ			
C162	#	76.34*	81.25*	73.71X	70.90Δ	73.73*	74.35X	-2.38	-2.52	-4.37	4.47	71DC	C162
C244	#	77.55	73.88	74.57	74.04	76.31	70.02	-2.71	-2.57	-4.65	4.31	71ZE	C244
C250	#	77.05	78.90	74.55	74.51	76.04	69.98	-2.54	-2.85	-4.69	5.45	71ZF	C250
C313	#	76.99	78.22	73.55	74.22	73.22	70.41	-2.77	-3.00	-4.64	5.10	71SA	C313
C446	#	76.88	78.43	74.73	74.27	73.69	70.21	-2.61	-2.74	-4.54	4.75	71GE	C446
C662	+	77.87	79.47	75.51	73.52	76.71	70.85	-2.55	-2.75	-4.65	5.06	71SP	C662
C716	#	76.49	78.13	74.25	73.02	73.11	69.53	-2.87	-3.01	-4.75	4.94	71ZE	C716
C717A	+	77.54	79.17	75.27	74.73	76.24	70.59	-2.76	-2.93	-4.68	4.91	71SP	C717A
C717B	+	77.49	78.58	75.25	75.27	76.72	71.13	-2.21	-1.86 *	-4.14	3.69	71SP	C717B
C720A	+	77.74	79.37	73.45	74.57	76.42	70.60	-2.77	-2.95	-4.80	5.08	71SP	C720A
C720B	+	75.92	79.32	73.55	73.23	76.39	70.62	-2.68	-2.92	-4.71	4.98	71SP	C720B
C727A	+	77.59	79.19	75.25	74.95	76.38	70.61	-2.64	-2.80	-4.62	4.88	71SP	C727A
C727B	+	77.73	79.34	73.55	75.12	76.57	71.05	-2.61	-2.77	-4.56	4.80	71SP	C727B
GRAND MEANS		77.50	79.14	74.77	74.40	76.40	70.15	-2.60	-2.74	-4.58	4.81		
SD OF MEANS		1.03	1.22	0.10	0.20	1.36	0.20	0.15	0.20	0.13	0.47		
INCLUDED LABS FOR THIS MEAN		5	5	4	4	5	4	5	5	5	5		

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

LAB CODE	F	SAMPLE P03			SAMPLE P04			DIFFERENCE P04 - P03			INST CODE	LAB
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB		
C105	#	89.10	-0.93	12.75	87.44	-0.06	14.03	-1.66	0.27	1.30	2.13	71HM C105
C122	#	88.81	-0.23	12.44	87.05	0.11	13.82	-1.74	0.35	1.36	2.24	71SC C122
C128	#	88.80	-0.42	12.43	87.38	-0.16	13.70	-1.80	0.26	1.21	2.18	71HM C128
C148	#	89.95	-1.08	12.52	88.23	-0.85	13.86	-1.72	0.22	1.34	2.19	71HF C148
C150	#	89.48	-0.51	12.54	87.88	-0.24	13.78	-1.60	0.27	1.24	2.04	71HA C150
C213	#	88.76	-0.67	12.44	87.17	-0.40	13.57	-1.59	0.27	1.14	1.97	71SC C213
C222	X	89.99	-2.08X	12.10	89.00	-1.72X	12.57X	-0.39 X	0.36	0.41 X	0.67X	71HA C222
C230	#	90.47	-0.78	12.33	89.10	-0.14	13.84	-1.31	0.64 X	1.25	1.92	71HA C230
C262	#	87.69	-0.65	12.10	88.80	-0.36	13.43	-1.83	0.30	1.26	2.24	71HR C262
C285	#	89.90	-0.62	12.19	88.27	-0.38	13.53	-1.64	0.24	1.34	2.13	71MG C285
C301	#	89.04	-0.43	12.77	87.31	-0.25	14.03	-1.73	0.19	1.26	2.15	71HM C301
C320	#	89.58	-1.38*	11.38*	88.11	-1.21*	13.07*	-1.47	0.17	1.09	1.84	71HA C320
C324	#	90.30	-0.17	12.20	89.20	0.15	13.31	-1.10 *	0.32	1.08	1.57*	71HA C324
C352	#	89.85	-0.89	12.30	88.90	-0.65	13.44	-1.36	0.24	1.09	1.75	71HA C352
C442	#	89.21	-0.82	12.30	87.90	-0.60	13.52	-1.65	0.22	1.21	2.06	71HM C442
C456	#	87.59	-0.61	12.00	89.94	-0.34	13.78	-1.65	0.27	1.19	2.04	71HA C456
C571	#	89.23	-0.25	12.47	87.37	0.17	13.76	-1.86	0.42	1.30	2.30	71HA C571
C585	#	86.50*	-0.45	12.40	84.91*	-0.18	13.59	-2.04	0.27	1.19	2.38	71HA C585
C670	#	89.52	-0.63	12.54	88.08	-0.49	13.82	-1.44	0.14	1.28	1.93	71ME C670
C702	#	88.21	-0.49	12.72	89.30	-0.11	13.88	-2.25 *	0.38	1.16	2.56*	71HA C702
C713	#	88.49	-0.62	13.01*	89.74	-0.54	14.22	-1.76	0.07 *	1.21	2.13	71HA C713
GRAND MEANS		89.03	-0.63	12.46	87.37	-0.35	13.69	-1.66	0.26	1.22	2.09	
SD OF MEANS		0.98	0.29	0.24	1.17	0.34	0.27	0.25	0.08	0.09	0.22	
INCLUDED LABS FOR THIS MEAN		20	20	20	20	20	20	20	19	20	20	

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