NBSIR 79-1368

MCCA

MANUFACTURERS COUNCIL ON COLOR AND APPEARANCE

COLLABORATIVE REFERENCE PROGRAM

COLOR AND APPEARANCE

COLOR AND COLOR DIFFERENCE

REPORT NO. 25

U.S. DEPARTMENT OF COMMERCE

National Bureau of Standards

NBS COLLABORATIVE REFERENCE PROGRAMS

TAPPI Paper and Board (6 times per year)

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

FKBG-API Containerboard (48 times per year)

- Mullen burst of linerboard
- Concora test of medium

MCCA Color and Appearance (4 times per year)

- Gloss at 60°
- Color and color difference
- Retroreflectivity

Rubber (4 times per year)

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

ASTM Textiles (3 times per year)

- Flammability (FF3-71 and FF5-74)

ASTM Cement (2 times per year)

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

AASHTO Bituminous

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

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

Rev. 4/77

MANUFACTURERS COUNCIL ON
COLOR AND APPEARANCE

COLLABORATIVE REFERENCE PROGRAM FOR COLOR AND APPEARANCE

COLOR AND COLOR DIFFERENCE

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

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

U. S. DEPARTMENT OF COMMERCE
National Bureau of Standards

NBSIR 79-1368

INTRODUCTION

This Collaborative Reference Program is sponsored by the Manufacturers Council on Color and Appearance and the National Bureau of Standards. Four times per year, color chip samples are distributed to each participating laboratory. After the data has been returned to and analyzed by NBS, a report (as illustrated by this report) showing the data from all participants is prepared.

Reflectance values for 40 wavelengths and colorimetric data for 45/0 reflectance factor have been provided by NBS. For further explanation, see page vi. A plot of the spectrophotometric curves of the samples was provided by Hemmendinger Color Laboratory, Belvedere, New Jersey. The NBS Reflectance values have succeeded the tentative values which were given in previous reports.

If there are any questions on the notes, the analyses, or the report in general, contact J. Horlick on 301-921-2946.

April 20, 1979

TABLE OF CONTENTS

Page	
i	Introduction
ii	Table of Contents
iii	Explanation of WHITE Sample Data
iv	ΔE Calculations
v	Special Instrument Identification
vi	Notes on NBS Reflectance Values
1	Key to Tables
3	Analysis of laboratories in X, Y, Z space, normal data, samples C91-C92
5	Analysis of laboratories in X, Y, Z space, normal data, samples C93-C94
7	Analysis of laboratories in L, a, b space, normal data, samples C91-C92
8	Analysis of laboratories in L, a, b space, normal data, samples C93-C94
9	Ratios of laboratories in X, Y, Z space, WHITE sample
10	Ratios of laboratories in L, a, b space, WHITE sample (results according to values converted to X, Y, Z space)
11	Analysis of laboratories in X, Y, Z space, adjusted data, samples C91-C92
13	Analysis of laboratories in X, Y, Z space, adjusted data, samples C93-C94
15	Analysis of laboratories in L, a, b space, adjusted data, samples C91-C92
16	Analysis of laboratories in L, a, b space, adjusted data, samples C93-C94
17	Reflectance at 40 wavelengths, 45/0 Reflectance factor, C92, C94, W14
18	Spectrophotometric curves of samples C91, C92, C93, C94, W14

EXPLANATION OF DATA FOR WHITE SAMPLE

Specimens of a white sample 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 specimen, 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 ΔX, ΔY, and ΔZ.

ΔE Calculation

ΔE is calculated in the Color and Color Difference Collaborative Reference Program by the FMC2* equations 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

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

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

INSTRUMENT IDENTIFICATION
FOR INSTRUMENTS LABELED SA, SB, SC IN DATA TABLES

XYZ ANALYSIS

C244	not specified
C407	RIE-LEE
C414	Macbeth MS2000
C416A	Diano Hardy II Poly
C416B	Diano Hardy Monochromatic II
C422	Gardner SL-31
C453	Hunterlab D54
C476	not specified
C479A	AC-3
C479B	not specified
C511	Diano Match-Scan
C521B	Xerox
C522	Color Guard Sensor w/Gardner PG 5500
C528	Hunter D54P5
C534	Macbeth MS2000
C545	Diano-Hardy Automate
C548	Gardner SL-20
C613	Macbeth MS2000
C627	Zeiss RFL3
C631A	ACS Spectra-Sensor
C631B	ACS 500 Spectra-Sensor
C632	ACS Spectra-Sensor
C638	Gardner SL-20
C639	Diano Match-Scan
C644	Macbeth MS2000
C645	ACS Spectra-Sensor
C657	ACS Spectra-Sensor
C660	ACS 500 w/Spectra Sensor
C661	not specified
C671A	Diano Match-Scan
C671B	Diano Match-Scan
C672	Gardner XL-20
C675	ACS Spectra-Sensor

Lab ANALYSIS

C230	Hunterlab D25-3
C475	Hunterlab D25-A, nonstandard conditions
C517	Hunterlab D25D2
C567	Hunterlab D25
C600	Gardner SL-20
C648	not specified
C655	Hunterlab D54 P-5
C677	Hunterlab D38

NOTES ON NBS REFLECTANCE VALUES

The tables on page 17 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.

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 first table.
F -	Flag, is based on ΔE Column with following meaning:
# -	Excluded because data were not understood; because of a non-coded variation reported by the laboratory or data received late.
M -	Excluded because data for one sample are missing
X -	Excluded from all calculations because ΔE is beyond (3) standard deviation units.
* -	Included in grand means but results are between two and three standard deviation units. The participant should take this as a warning to reexamine his testing procedure.
0 -	Included in grand mean analysis.

Note: In addition to flag (F) based on delta E column it is also possible to have either a 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 that 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.

ANALYSIS C70-1 TABLE 1
COLOR & COLOR DIFFERENCE

INSTRUMENT IDENTIFICATION

INST CODE	INSTRUMENT	COLOR SPACE	DATA CODE
C70BA	BECKMAN AUTO-PRO 54	X Y Z	9014
C70BB	BECKMAN DB-G	X Y Z	9014
C70BL	B+L 503 SPECTROPHOTOMETER	X Y Z	9014
C70CA	CARY 14	X Y Z	9014
C70CD	COLOR EYE SMALL SPHERE	X Y Z	9014
C70CE	COLOR EYE SMALL SPHERE	XX'YZ,4V	9016
C70CF	COLOR EYE SMALL SPHERE	XYZ,BaS04	9017
C70CG	COLOR EYE SMALL SPHERE	XX'YZ,Ba	9018
C70CH	COLOR EYE SMALL SPHERE	XYZ,3V	9011
C70CL	COLOR EYE LARGE SPHERE	XX'YZ,4V	9016
C70CM	COLOR EYE LARGE SPHERE	XX'YZ,Ba	9018
C70CN	COLOR EYE LARGE SPHERE	XYZ,BaS04	9017
C70DC	DIANO CHROMASCAN	X Y Z	9014
C70DX	DIANO/LSCE AUTOMATE	XYZ,BaS04	9017
C70DL	DIANO/LSCE AUTOMATE	XYZ,3V,4P	9019
C70DM	DIANO/LSCE AUTOMATE	XX'YZ,4V	9016
C70DT	DIANO/SSCE AUTOMATE	XYZ,BaS04	9017
C70GA	GARDNER AUTO. COLOR DIFF. METER, AC-2A	L a b	9013
C70GE	GARDNER AUTO. COLOR DIFF. METER, AC-2A	X Y Z	9014
C70GC	GARDNER XL-23	X Y Z	9014
C70GD	GARDNER XL-23	L a b	9013
C70GE	DIANO/HARDY/GE SPECTROPHOTOMETER	X Y Z	9014
C70GG	GARDNER XL-30	X Y Z	9014
C70GX	GARDNER XL-70	X Y Z	9014
C70GL	GARDNER XL-70	L a b	9013
C70GM	GARDNER MULTIPURPOSE REFLECTOMETER	X Y Z	9014
C70GP	GARDNER XL-200	L a b	9013
C70GX	GARDNER XL-10	L a b	9013
C70GY	GARDNER XL-10	X Y Z	9014
C70HA	HUNTER D25A (DA,D1A,D2A)	L a b	9013
C70HE	HUNTER D25A (DA,D1A,D2A)	X Y Z	9014
C70HM	HUNTER D25M (DM,D1M,D2M)	L a b	9013
C70HN	HUNTER D25M (DM,D1M,D2M)	X Y Z	9014
C70HP	HUNTER D25P (DP,D1P,D2P)	X Y Z	9014
C70HQ	HUNTER D25P (DP,D1P,D2P)	L a b	9013
C70HR	HUNTER D25A (DA,D1A,D2A)	Rd a b	9012
C70XC	XCS-18	XX'YZ,4V	9016
C70XD	XCS-18	XX'YZ,Ba	9018
C70XS	XCS-18	X Y Z	9014
C70XT	XCS-40	X Y Z	9014
C70LS	LERES TRILAC	X Y Z	9014
C70LT	LERES TRILAC	XYZ,3V	9011
C70MC	MECCO COLORMASTER V	R G B	9015
C70MS	MARTIN SWEETS	X Y Z	9014
C70MT	MARTIN SWEETS	XX'YZ,Ba	9018
C70ND	NEOTEC 220 DU COLOR	R G B	9015
C70NE	NEOTEC 220 DU COLOR	X Y Z	9014
C70PM	PHOTOVOLT MODEL 501A	R G B	9015
C70PV	PHOTOVOLT MODEL 610	X Y Z	9014
C70SA	SPECIAL INSTRUMENT	X Y Z	9014
C70SB	SPECIAL INSTRUMENT	Rd a b	9012
C70SC	SPECIAL INSTRUMENT	L a b	9013
C70SL	SPECIAL INSTRUMENT	R G B	9015
C70ZD	ZEISS DMC25	X Y Z	9014
C70ZE	ZEISS ELREPHO	X Y Z	9014
C70ZF	ZEISS ELREPHO	R G B	9015
C70XX	GIVE INSTRUMENT MAKE+MODEL,	NOT SPECIFIED	9020

FORMAT OF COLORMETRIC (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)

X, Y, Z SPACE ANALYSIS, NORMAL DATA

COLOR + COLOR DIFFERENCE

LAB CODE	F	SAMPLE C91 MEAN X	MEAN Y	MEAN Z	SAMPLE C92 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C92 - C91 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C162	G	14.54*	13.06*	6.56	14.62*	12.98*	6.37	.08	-.08	-.19	3.47	70DC	C162
C232	G	17.31X	15.75X	7.97X	17.33X	15.65X	7.91X	.02	-.10	-.06	2.00	70CM	C232
C244	X	13.55	12.17	5.96	13.61	12.00	5.76	.07	-.17	-.20	5.05X	70SA	C244
C250	G	14.68*	13.00	6.73	14.66*	12.80	6.61	-.02	-.20	-.12	3.55	70ZF	C250
C251	G	13.74	11.80	5.91	13.91	11.90	6.02	.17	.10	.11	.89*	70ZE	C251
C278A	G	13.70	12.03	5.94	13.97	12.27	6.08	.27	.25 *	.14	.91*	70BL	C278A
C278B	G	13.60	12.25	6.25	13.80	12.35	6.25	.20	.10	.00	1.82	70BL	C278B
C314	G	13.43	12.12	6.19	13.49	11.99	6.04	.05	-.13	-.15	3.79	70CE	C314
C372	X	14.11	12.70	7.39X	14.28	12.80	6.38	.18	.10	-1.01 X	7.56X	70ZE	C372
C407	G	13.46	11.84	5.96	13.48	11.73	5.93	.02	-.11	-.03	2.49	70SA	C407
C412	G	14.29	12.81	6.67	14.23	12.60	6.46	-.06	-.21	-.22	3.53	70GE	C412
C414	G	13.74	12.23	6.11	13.76	12.10	5.96	.01	-.13	-.15	3.17	70SA	C414
C416A	G	13.42	11.86	5.52	13.49	11.79	5.46	.07	-.07	-.06	2.82	70SA	C416A
C416B	G	13.42	11.86	5.49	13.47	11.78	5.43	.05	-.09	-.06	2.77	70SA	C416B
C418	G	13.90	12.59	6.56	13.86	12.40	6.28	-.04	-.19	-.28	3.71	70CE	C418
C422	G	13.56	11.96	6.03	13.48	11.73	5.75	-.08	-.23	-.28	3.84	70SA	C422
C424	G	14.27	12.76	6.69	14.25	12.59	6.53	-.02	-.16	-.16	3.17	70CA	C424
C428	G	14.00	12.46	6.34	13.96	12.28	6.18	-.03	-.18	-.16	3.19	70HB	C428
C437	G	14.34	12.94	6.49	14.42	12.87	6.39	.07	-.08	-.10	2.90	70CE	C437
C443	G	16.67X	12.57	5.29*	16.72X	12.47	5.17*	.05	-.10	-.12	2.99	70HB	C443
C444	G	13.86	12.41	6.31	14.06	12.46	6.30	.20	.05	-.01	2.65	70GE	C444
C445	G	13.98	12.48	6.71	14.16	12.51	6.67	.17	.02	-.04	2.76	70LS	C445
C446A	G	13.81	12.27	6.23	14.12	12.46	6.51	.31	.19	.27	1.76	70GE	C446A
C453	G	13.92	12.47	6.31	13.91	12.31	6.07	-.01	-.16	-.23	3.61	70SA	C453
C455	G	13.79	12.31	6.28	14.07	12.44	6.34	.29	.13	.06	2.49	70KS	C455
C459	G	13.81	12.33	6.43	13.84	12.21	6.32	.03	-.11	-.11	2.92	70GE	C459
C460	G	13.72	12.27	6.22	14.02	12.42	6.45	.29	.15	.23	1.91	70GE	C460
C462A	G	13.80	12.20	6.05	13.90	12.15	6.05	.10	-.05	.00	2.63	70HB	C462A
C463	G	13.87	12.39	6.33	14.25	12.62	6.62	.38 *	.23 *	.29 *	2.09	70ZD	C463
C467A	G	13.84	12.31	6.64	14.14	12.48	6.93	.30	.17	.29 *	1.76	70GE	C467A
C467B	G	13.59	12.03	5.96	13.76	12.05	6.02	.17	.02	.06	2.35	70HN	C467B
C469	G	13.84	12.53	5.79	13.88	12.43	5.71	.04	-.10	-.08	2.74	70GE	C469
C470	G	13.88	12.48	6.19	13.96	12.42	6.10	.08	-.06	-.09	2.78	70GE	C470
C472	G	13.72	12.29	5.73	13.75	12.19	5.76	.03	-.10	.03	2.25	70ZD	C472
C473	G	13.76	12.48	5.87	13.92	12.50	5.93	.17	.02	.06	2.32	70GE	C473
C476	G	13.52	12.00	6.54	13.74	12.08	6.72	.22	.07	.19	2.07	70SA	C476
C479A	G	13.85	12.35	6.65	13.75	12.30	6.45	-.10	-.05	-.20	1.00*	70SA	C479A
C479B	G	14.35	12.83	6.85	14.66*	12.99*	7.00*	.31	.15	.15	2.21	70SA	C479B
C480	G	13.95	12.48	6.48	14.16	12.55	6.59	.21	.07	.11	2.10	70HB	C480
C481	G	14.05	12.58	6.44	14.02	12.43	6.41	-.03	-.15	-.02	2.25	70KS	C481
C483	X	14.11	12.30	6.61	14.05	12.00	6.26	-.06	-.30	-.35	5.75X	70ZF	C483
C496A	G	13.82	12.31	6.30	14.04	12.39	6.37	.22	.08	.07	2.20	70GE	C496A
C499C	G	14.00	12.34	6.49	14.49	12.71	7.00*	.50 X	.37 X	.51 X	2.26	70BL	C499C
C503	G	13.78	12.33	6.36	14.09	12.49	6.59	.31	.16	.23	1.98	70GE	C503
C508	G	13.65	12.12	6.18	13.70	12.03	6.08	.04	-.10	-.09	2.85	70GE	C508
C511	G	13.94	12.46	6.42	13.87	12.24	6.13	-.07	-.22	-.29	3.87	70SA	C511
C521A	G	14.02	12.46	6.32	13.98	12.27	6.19	-.04	-.19	-.13	3.17	70CA	C521A
C521B	G	13.54	11.99	6.40	13.14*	11.50*	5.85	-.40 X	-.49 X	-.56 X	4.45*	70SA	C521B
C522	G	14.49*	13.25*	6.98*	14.59	13.23*	6.76	.10	-.02	-.22	3.08	70SA	C522
C524	G	14.10	12.62	6.47	14.16	12.53	6.38	.06	-.09	-.10	2.87	70GE	C524
C528	G	13.99	12.49	6.36	14.23	12.59	6.59	.25	.10	.23	1.92	70SA	C528
C531	G	14.07	12.61	6.54	14.02	12.40	6.25	-.05	-.20	-.29	3.91	70GE	C531
C532	G	14.09	12.58	6.46	14.09	12.44	6.32	-.00	-.14	-.14	3.01	70GE	C532
C534	G	13.56	12.10	6.03	13.82	12.21	6.15	.26	.11	.12	2.34	70SA	C534
C536	G	14.32	12.82	6.77	14.27	12.64	6.54	-.05	-.19	-.23	3.34	70KS	C536
C540	G	14.61*	13.12*	7.09*	14.60*	12.98*	7.02*	-.01	-.14	-.07	2.49	70GE	C540
C545	G	12.99*	11.56*	5.70	13.10*	11.54*	5.71	.11	-.02	.01	2.32	70SA	C545
C548	G	13.31	11.55*	5.89	13.10*	11.25X	5.75	-.22 *	-.30 *	-.14	2.45	70SB	C548
C549	G	13.39	11.85	5.74	13.54	11.86	5.93	.14	.01	.19	1.94	70GE	C549
C552	G	13.55	12.08	6.13	13.75	12.13	6.13	.20	.05	.00	2.54	70HN	C552
C612	G	13.66	12.16	6.23	13.69	12.05	6.13	.03	-.11	-.10	2.87	70GE	C612
C613	G	13.92	12.47	6.12	14.01	12.42	6.10	.09	-.04	-.02	2.42	70SA	C613
C627	G	13.58	12.15	5.71	13.68	12.12	5.69	.10	-.03	-.02	2.34	70SA	C627
C629	G	13.74	12.22	6.22	13.74	12.09	6.10	.00	-.13	-.13	2.89	70HN	C629
C630	G	13.83	12.34	6.33	14.02	12.42	6.58	.19	.08	.25	1.60	70KS	C630

X, Y, Z SPACE ANALYSIS, NORMAL DATA

COLOR • COLOR DIFFERENCE

LAB CODE	F	SAMPLE C91 MEAN X	MEAN Y	MEAN Z	SAMPLE C92 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C92 - C91 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C631A	♂	13.41	12.17	5.74	13.64	12.25	5.83	.23	.08	.08	2.39	70SA	C631A
C631B	♂	14.11	12.64	6.44	14.07	12.46	6.28	-.04	-.18	-.16	3.08	70SA	C631B
C632	♂	13.85	12.38	6.26	13.97	12.36	6.19	.12	-.02	-.06	2.69	70SA	C632
C634	♂	13.49	12.12	6.24	13.55	12.05	6.22	.06	-.07	-.02	2.40	70CE	C634
C638	♂	13.50	11.80	6.00	13.60	11.80	6.20	.10	.00	.20	1.57	70SA	C638
C639	♂	13.78	12.33	6.28	14.07	12.48	6.53	.29	.15	.25	1.84	70SA	C639
C644	♂	13.73	12.27	6.03	13.86	12.27	6.09	.13	.00	.06	2.08	70SA	C644
C645	♂	14.01	12.53	6.36	14.04	12.42	6.22	.03	-.11	-.14	2.99	70SA	C645
C646	♂	13.68	13.33*	5.68	13.84	13.49X	5.84	.16	.16	.15	.80*	70CE	C646
C657	♂	13.49	12.25	5.75	13.70	12.33	5.85	.21	.08	.10	2.08	70SA	C657
C660	♂	13.62	12.43	5.84	13.71	12.38	5.77	.09	-.05	-.06	2.79	70SA	C660
C661	♂	18.80X	14.64X	2.05X	18.95X	14.63X	2.01X	.15	-.01	-.04	2.33	70SA	C661
C664	♂	13.36	11.90	6.20	13.23	11.64	5.95	-.13	-.26	-.25	3.59	70KC	C664
C671A	♂	13.56	12.27	5.94	13.61	12.15	5.74	.04	-.12	-.19	3.72	70SA	C671A
C671B	♂	13.53	12.28	5.88	13.57	12.19	5.82	.04	-.09	-.06	2.61	70SA	C671B
C671C	♂	13.67	12.12	6.11	13.60	11.90	5.92	-.07	-.21	-.19	3.43	70GC	C671C
C671D	♂	14.26	12.17	5.23*	14.44	12.20	5.28*	.18	.03	.04	2.24	70HB	C671D
C672	♂	13.50	12.00	6.05	13.60	12.00	6.00	.10	.00	-.05	1.97	70SA	C672
C675	♂	13.96	12.49	6.45	13.85	12.24	6.13	-.12	-.25	-.32	3.76	70SA	C675
GRAND MEANS		13.82	12.34	6.21	13.91	12.30	6.18	.09	-.04	-.03	2.61		
SD OF MEANS		.32	.35	.37	.34	.33	.38	.12	.13	.16	.74		
INCLUDED LABS FOR THIS MEAN		78	79	79	78	77	79	79	79	79	81		

X, Y, Z SPACE ANALYSIS, NORMAL DATA
COLOR • COLOR DIFFERENCE

LAB CODE	F	SAMPLE C93 MEAN X	MEAN Y	MEAN Z	SAMPLE C94 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C94 - C93 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C162	d	50.66	51.58	60.11	50.20	51.07	58.42	-.45	-.51	-1.70	2.61	70DC	C162
C232	d	57.86I	58.55I	69.09I	57.44I	58.20I	67.08I	-.42	-.35	-2.01 *	2.63	70CN	C232
C244	X	49.13	50.07	58.31	48.98	49.95	57.04	-.15	-.13	-1.27	2.18I	70SA	C244
C250	d	50.23	51.30	60.11	49.84	50.80	58.46	-.39	-.50	-1.65	2.85*	70ZF	C250
C251	d	49.78	50.80	59.05	49.07	50.00	57.17	-.71 *	-.80 *	-1.88	2.68	70ZE	C251
C278A	X	49.83	51.10	60.21	49.51	50.70	58.94	-.32	-.40	-1.27	2.14I	70BL	C278A
C278B	d	50.85	52.05*	60.35	50.50	51.60*	58.80	-.35	-.45	-1.55	2.68	70BL	C278B
C314	X	48.10	48.93I	57.40*	47.67*	48.40I	55.64	-.42	-.53	-1.77	3.10I	70CE	C314
C372	X	50.17	51.20	59.99	49.84	50.90	58.46	-.34	-.30	-1.53	2.23I	70ZE	C372
C407	d	49.79	50.94	59.13	49.61	50.70	57.68	-.17	-.24	-1.46	2.77	70SA	C407
C412	d	49.74	50.86	59.37	49.34	50.40	57.74	-.40	-.46	-1.63	2.59	70GE	C412
C414	d	49.35	50.43	58.37	49.12	50.15	56.94	-.22	-.28	-1.43	2.60	70SA	C414
C416A	d	50.07	51.19	59.62	49.83	50.90	58.18	-.25	-.30	-1.44	2.52	70SA	C416A
C416B	d	50.08	51.22	59.73	49.83	50.92	58.26	-.25	-.30	-1.48	2.57	70SA	C416B
C418	d	48.52	49.39*	58.37	48.25	49.11*	56.90	-.27	-.28	-1.48	2.44	70CE	C418
C422	d	48.76	49.65*	57.63*	48.42	49.27*	56.05	-.34	-.38	-1.58	2.63	70SA	C422
C424	d	49.97	51.05	59.72	49.74	50.76	58.17	-.23	-.29	-1.55	2.77	70CA	C424
C428	d	49.92	50.92	59.48	49.51	50.45	57.80	-.41	-.46	-1.67	2.67	70HB	C428
C437	d	50.63	51.47	61.13*	50.20	50.97	59.45	-.43	-.51	-1.67	2.65	70CE	C437
C443	X	51.50*	50.85	50.51I	51.47*	50.51	49.22I	-.03	-.35	-1.29	4.13I	70HB	C443
C444	d	50.03	51.11	59.88	49.71	50.74	58.33	-.32	-.37	-1.55	2.56	70GE	C444
C445	d	50.20	51.28	60.13	49.95	50.97	58.60	-.25	-.31	-1.53	2.69	70LS	C445
C446A	d	49.40	50.48	59.00	48.93	49.96	57.32	-.47	-.53	-1.68	2.54	70GE	C446A
C453	d	49.95	51.04	59.50	49.69	50.72	58.04	-.26	-.32	-1.46	2.55	70SA	C453
C455	d	49.76	50.93	59.50	49.47	50.59	57.96	-.29	-.34	-1.54	2.64	70KS	C455
C459	d	49.23	50.33	58.64	48.57	49.61	56.74	-.66	-.72	-1.90	2.70	70GE	C459
C460	d	49.21	50.31	58.76	49.16	50.20	57.54	-.05	-.11	-1.22	2.55	70GE	C460
C462A	d	49.90	50.90	59.50	49.40	50.40	57.80	-.50	-.50	-1.70	2.35*	70HB	C462A
C463	d	50.33	51.46	60.18	49.94	51.01	58.55	-.39	-.45	-1.63	2.66	70ZD	C463
C467A	d	50.16	51.33	60.13	49.98	51.10	58.65	-.18	-.23	-1.47	2.70	70GE	C467A
C467B	d	49.22	50.23	58.81	49.09	50.04	57.41	-.13	-.19	-1.40	2.81*	70HN	C467B
C469	d	50.25	51.18	60.63	49.75	50.64	58.86	-.49	-.54	-1.77	2.62	70GE	C469
C470	d	49.74	50.76	59.83	49.45	50.42	58.27	-.29	-.34	-1.56	2.67	70GE	C470
C472	d	49.56	50.56	59.28	49.44	50.41	57.97	-.12	-.15	-1.31	2.51	70ZD	C472
C473	d	48.65	50.93	55.33I	48.31	50.52	53.87*	-.34	-.41	-1.46	2.51	70GE	C473
C476	d	49.66	50.72	59.29	49.43	50.43	57.84	-.23	-.29	-1.45	2.61	70SA	C476
C479A	X	49.45	50.35	62.60I	49.00	49.95	61.10*	-.45	-.40	-1.50	1.82I	70SA	C479A
C479B	d	51.22	51.89	60.16	49.97	51.05	58.43	-1.24 I	-.84 *	-1.73	2.69	70SA	C479B
C480	d	50.17	51.17	59.88	49.72	50.70	58.15	-.45	-.47	-1.72	2.53	70HB	C480
C481	d	50.75	51.67	61.42*	50.49	51.36	59.90	-.26	-.31	-1.52	2.58	70KS	C481
C483	X	49.27	50.40	58.81	48.84	49.80	57.16	-.43	-.60	-1.65	3.08I	70ZF	C483
C496A	d	49.91	51.05	59.70	50.00	51.09	58.54	.09 *	.04 *	-1.16 *	2.74	70GE	C496A
C499C	X	51.26	52.59I	61.14*	50.96*	52.04*	59.43	-.30	-.55	-1.70	3.68I	70BL	C499C
C503	d	49.73	50.76	59.65	49.35	50.33	58.01	-.38	-.43	-1.63	2.63	70GE	C503
C508	d	49.37	50.49	59.00	49.45	50.52	57.82	.08 *	.03 *	-1.19	2.77	70GE	C508
C511	d	49.74	50.84	59.33	49.38	50.44	57.72	-.36	-.41	-1.61	2.60	70SA	C511
C521A	X	50.91	52.14*	60.87	49.93	51.09	58.47	-.97 I	-1.05 I	-2.39 I	3.07I	70CA	C521A
C521B	X	51.54*	52.69I	61.12*	51.79I	52.89I	59.90	.25 I	.20 I	-1.22	3.19I	70SA	C521B
C522	d	49.72	51.23	59.63	48.94	50.45	57.64	-.78 *	-.78 *	-1.99 *	2.40*	70SA	C522
C524	d	50.33	51.43	60.03	50.10	51.16	58.53	-.23	-.27	-1.50	2.62	70GE	C524
C528	d	50.30	51.40	59.97	50.02	51.15	58.34	-.28	-.25	-1.63	2.56	70SA	C528
C531	d	50.13	51.14	60.15	49.85	50.82	58.63	-.28	-.32	-1.52	2.57	70GE	C531
C532	d	50.26	51.36	60.26	49.71	50.76	58.41	-.55	-.60	-1.85	2.69	70GE	C532
C534	d	48.94	50.10	58.04	48.88	49.99	56.79	-.06	-.11	-1.25	2.63	70SA	C534
C536	d	50.31	51.39	60.03	50.09	51.12	58.57	-.22	-.27	-1.46	2.59	70KS	C536
C540	d	50.11	51.23	59.71	49.79	50.85	58.17	-.32	-.38	-1.55	2.60	70GE	C540
C545	d	47.55*	48.65I	56.90I	47.13*	48.19I	55.29	-.42	-.46	-1.61	2.56	70SA	C545
C548	d	48.28	49.25I	57.23*	48.14	49.00*	55.90	-.15	-.25	-1.34	2.80	70SB	C548
C549	d	49.68	50.77	59.51	49.26	50.30	57.80	-.43	-.48	-1.71	2.68	70GE	C549
C552	d	49.48	50.47	58.99	49.25	50.20	57.51	-.23	-.27	-1.49	2.63	70HN	C552
C612	d	49.59	50.72	59.21	49.50	50.60	57.86	-.09	-.12	-1.35	2.65	70GE	C612
C613	d	50.15	51.28	59.62	49.92	50.99	58.18	-.23	-.29	-1.43	2.57	70SA	C613
C627	d	48.05	50.85	53.44I	47.67*	50.35	51.98I	-.39	-.51	-1.46	2.64	70SA	C627
C629	d	49.43	50.44	58.85	49.02	49.98	57.16	-.41	-.46	-1.69	2.72	70HN	C629
C630	d	49.32	50.37	58.99	49.15	50.15	57.58	-.16	-.21	-1.40	2.64	70KS	C630

MCCA COLLABORATIVE REFERENCE PROGRAM
X, Y, Z SPACE ANALYSIS, NORMAL DATA
COLOR • COLOR DIFFERENCE

LAB CODE	F	SAMPLE C93 MEAN X	MEAN Y	MEAN Z	SAMPLE C94 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C94 - C93 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C631A	G	48.36	50.99	54.47X	47.97	50.52	52.96*	-.39	-.47	-1.51	2.58	70SA	C631A
C631B	G	50.21	51.30	59.61	49.84	50.83	58.14	-.37	-.47	-1.47	2.55	70SA	C631B
C632	G	49.93	51.05	59.28	49.53	50.59	57.69	-.40	-.46	-1.59	2.55	70SA	C632
C634	X	47.74*	48.51X	56.41X	46.74X	47.44X	54.16	-.99 X	-1.07 X	-2.26 X	3.03X	70CE	C634
C638	X	49.10	50.00	58.30	48.90	49.60	56.80	-.20	-.40	-1.50	3.43X	70SA	C638
C639	G	49.48	50.53	59.01	49.02	50.02	57.31	-.46	-.51	-1.70	2.57	70SA	C639
C644	G	49.36	50.55	58.30	49.24	50.36	57.00	-.13	-.20	-1.30	2.61	70SA	C644
C645	G	50.02	51.09	59.20	49.56	50.56	57.49	-.46	-.53	-1.72	2.71	70SA	C645
C646	X	45.79X	47.49X	54.99X	46.37X	47.33X	53.50*	.58 X	-.16	-1.49	8.14X	70CE	C646
C657	G	48.29	50.91	54.46X	48.16	50.69	53.17*	-.14	-.21	-1.29	2.65	70SA	C657
C660	G	48.31	50.92	54.61X	47.90	50.44	53.07*	-.41	-.48	-1.54	2.56	70SA	C660
C661	X	56.23X	50.91	18.17X	56.55X	51.09	17.82X	.32 X	.19 *	-.35 X	1.84X	70SA	C661
C664	X	47.86*	48.57X	57.01*	47.70*	48.01X	55.31	-.16	-.56	-1.69	4.96X	70KC	C664
C671A	G	47.82*	50.13	54.29X	47.78	50.02	53.11*	-.05	-.11	-1.18	2.59	70SA	C671A
C671B	G	47.39*	49.63*	54.01X	47.38*	49.56	52.89*	-.01	-.07	-1.12 *	2.53	70SA	C671B
C671C	G	49.33	50.24	58.32	48.80	49.64	56.56	-.53	-.61	-1.76	2.70	70GC	C671C
C671D	G	51.54*	51.35	50.69X	50.83*	50.60	49.05X	-.71 *	-.75 *	-1.64	2.48	70HB	C671D
C672	G	49.20	50.10	58.05	48.85	49.75	56.50	-.35	-.35	-1.55	2.39*	70SA	C672
C675	G	49.70	50.80	59.05	49.23	50.28	57.32	-.47	-.52	-1.73	2.64	70SA	C675
GRAND MEANS		49.64	50.88	59.42	49.31	50.48	57.39	-.32	-.38	-1.55	2.62		
SD OF MEANS		.81	.52	.78	.76	.52	1.56	.18	.18	.19	.09		
INCLUDED LABS FOR THIS MEAN		68	66	59	68	67	66	68	69	69	69		

L, a, b SPACE ANALYSIS, NORMAL DATA
COLOR • COLOR DIFFERENCE

LAB CODE	F	SAMPLE C91 MEAN L	MEAN A	MEAN B	SAMPLE C92 MEAN L	MEAN A	MEAN B	DIFFERENCE C92 - C91 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C105	6	34.90	8.80	14.10	34.80	9.50	14.15	-.10	.70	.05	.71	70HM	C105
C121	6	34.80	9.20	14.20	34.70	9.90	14.00	-.10	.70	-.20	.73	70HM	C121
C122	6	35.20	9.30	13.95	35.10	10.00	13.90	-.10	.70	-.05	.71	70HM	C122
C148	6	35.45	9.20	14.00	35.35	9.95	14.10	-.10	.75	.10	.76	70HA	C148
C150	6	35.25	8.80	13.86	35.15	9.61	13.86	-.10	.80	.01	.81	70HA	C150
C152	6	35.20	8.80	14.00	35.05	9.55	13.95	-.15	.75	-.05	.77	70HA	C152
C166	6	35.25	8.70	13.95	35.20	9.55	13.85	-.05	.85 •	-.10	.86	70HA	C166
C183	6	35.15	8.71	14.18	35.06	9.47	14.17	-.10	.76	-.01	.77	70HA	C183
C213	6	34.80	8.60	13.20X	34.60	9.30	13.20X	-.20	.70	.00	.73	70HM	C213
C223	6	35.22	8.66	13.84	35.13	9.40	13.78	-.09	.74	-.05	.75	70HA	C223
C230	6	35.26	8.85	14.07	35.32	9.45	13.78	.06	.60	-.29 •	.67	70SC	C230
C241	6	35.35	9.10	14.15	35.25	9.90	14.20	-.10	.80	.05	.81	70HA	C241
C256	X	34.87	9.58	13.67	34.39•	10.42•	13.82	-.48 •	.85	.15	.98X	70HM	C256
C259	6	35.15	10.30X	13.70	35.00	11.10X	13.80	-.15	.80	.10	.82	70HA	C259
C262	6	35.29	8.81	13.92	35.19	9.48	13.91	-.11	.66	-.01	.67	70ZR	C262
C285	6	35.25	8.70	13.90	35.05	9.50	14.10	-.20	.80	.20 •	.85	70HA	C285
C291	6	34.95	8.95	14.10	35.25	9.55	13.85	.30 •	.60	-.25 •	.72	70HA	C291
C317	6	34.80	9.10	13.80	34.85	9.80	13.70	.05	.70	-.10	.71	70HM	C317
C320	6	34.95	8.30	13.70	34.65	9.15	13.80	-.30	.85 •	.10	.91•	70HA	C320
C325	6	34.93	8.46	13.68	34.71	9.19	13.82	-.22	.73	.15	.77	70HR	C325
C340	6	35.45	8.43	13.80	35.51	9.05	13.68	.06	.61	-.12	.63	70HA	C340
C352	6	35.25	8.90	14.00	34.95	9.70	14.10	-.30	.80	.10	.86	70HA	C352
C356	6	34.80	9.30	13.80	34.60	10.00	13.80	-.20	.70	.00	.73	70HM	C356
C380	6	35.20	9.00	14.05	35.25	9.65	14.00	.05	.65	-.05	.65	70HA	C380
C382	6	35.45	8.15•	13.80	35.15	8.95•	13.90	-.30	.80	.10	.86	70HA	C382
C402	6	35.11	8.73	13.91	35.15	9.46	13.93	.04	.73	.02	.73	70HA	C402
C417A	6	35.11	8.78	13.88	35.06	9.55	13.99	-.05	.77	.11	.78	70GE	C417A
C417B	X	35.02	9.10	14.05	34.55	9.91	14.10	-.47 •	.81	.06	.94X	70HN	C417B
C420	6	35.50	9.10	13.80	35.35	9.80	13.85	-.15	.70	.05	.72	70HA	C420
C427	6	34.90	9.45	14.00	35.15	10.15	13.85	.25 •	.70	-.15	.76	70HA	C427
C440	6	35.40	8.80	14.04	35.28	9.52	13.96	-.12	.72	-.08	.74	70HA	C440
C442	6	34.80	9.10	13.90	34.50	9.80	13.90	-.30	.70	.00	.76	70HM	C442
C454	6	34.87	9.22	13.73	34.66	9.95	13.77	-.21	.73	.04	.76	70HA	C454
C456	6	35.23	8.95	13.79	35.15	9.70	13.85	-.08	.75	.07	.76	70HA	C456
C458	6	35.07	9.21	13.85	34.96	9.94	13.79	-.10	.73	-.06	.74	70HM	C458
C475	6	34.85	8.94	13.27X	35.02	9.63	13.28X	.16	.69	.01	.71	70SC	C475
C477	6	35.16	9.41	13.68	35.04	10.11	13.64	-.13	.71	-.04	.72	70HA	C477
C494	6	35.70•	9.10	13.90	35.65	9.70	13.70	-.05	.60	-.20	.63	70HA	C494
C496B	X	34.11X	.08X	.14X	34.23•	.09X	.14X	.12	.01 X	-.00	.12X	70GP	C496B
C499A	6	35.05	8.80	13.65	34.95	9.50	13.75	-.10	.70	.10	.71	70HA	C499A
C499B	X	35.10	4.55X	13.85	35.05	9.75	13.85	-.05	5.20 X	-.00	5.20X	70HA	C499B
C506	6	35.25	9.30	13.90	35.05	10.00	13.80	-.20	.70	-.10	.73	70HA	C506
C517	6	34.95	8.70	13.60	34.80	9.40	13.60	-.15	.70	.00	.72	70SC	C517
C538	6	36.20X	10.30X	14.30•	36.20X	10.90X	14.30•	.00	.60	.00	.60•	70GX	C538
C542	X	33.96X	9.28	13.63	33.55X	10.17	13.77	-.41 •	.89 •	.13	.99X	70GP	C542
C543	6	35.45	8.75	14.07	35.20	9.57	14.13	-.25	.82	.06	.86	70HA	C543
C546A	6	33.50X	9.60	13.90	33.40X	10.35	14.00	-.10	.75	.10	.76	70HQ	C546A
C546B	6	34.50•	9.20	13.80	34.60	9.90	13.70	.10	.70	-.10	.71	70HM	C546B
C567	6	35.35	8.99	14.22	35.30	9.76	14.16	-.04	.77	-.06	.77	70SC	C567
C576	6	36.63X	9.15	14.12	36.59X	9.80	14.02	-.04	.65	-.09	.65	70HM	C576
C585	6	35.22	9.22	13.74	35.04	9.92	13.68	-.19	.71	-.06	.73	70HA	C585
C600	6	34.80	9.70•	7.70X	34.80	10.50•	7.70X	.00	.80	.00	.80	70SC	C600
C620	6	35.32	8.18•	13.58	35.62	8.78•	13.49•	.31 •	.60	-.09	.68	70HA	C620
C633	6	34.92	9.25	13.93	34.99	9.99	13.95	.07	.73	.01	.74	70HA	C633
C647	6	35.25	8.95	16.99X	35.26	9.67	16.93X	.01	.73	-.06	.73	70HQ	C647
C648	6	34.15X	9.43	13.65	34.19•	10.14	13.59	.04	.71	-.06	.71	70SC	C648
C655	6	34.84	8.64	14.07	34.63	9.41	14.11	-.20	.77	.05	.79	70SC	C655
C662	6	35.60	6.95X	13.80	35.65	7.60X	13.70	.05	.65	-.10	.66	70GX	C662
C674	6	35.40	9.10	13.65	35.45	9.80	13.45•	.05	.70	-.20	.73	70HA	C674
C677	6	35.30	9.40	13.88	35.30	10.06	13.76	-.01	.65	-.12	.66	70SC	C677
GRAND MEANS		35.14	8.96	13.90	35.05	9.68	13.88	-.07	.72	-.02	.74		
SD OF MEANS		.25	.34	.17	.31	.34	.19	.14	.06	.10	.06		
INCLUDED LABS FOR THIS MEAN		51	52	51	52	52	51	55	55	55	55		

NCCA COLLABORATIVE REFERENCE PROGRAM

L, a, b SPACE ANALYSIS, NORMAL DATA
COLOR • COLOR DIFFERENCE

LAB CODE	F	SAMPLE C93 MEAN L	MEAN A	MEAN B	SAMPLE C94 MEAN L	MEAN A	MEAN B	DIFFERENCE C94 - C93 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C105	G	71.20	-.00	.50	70.90	.10	1.40	-.30	.10	.90	.95	70HM	C105
C121	G	71.05	-.10	.50	70.60	-.00	1.50	-.45	.10	1.00	1.10*	70HM	C121
C122	G	71.15	.20	.30	71.05	.30	1.30	-.10	.10	1.00	1.01	70HM	C122
C148	G	71.45	.50*	.50	71.40	.60*	1.50	-.05	.10	1.00	1.01	70HA	C148
C150	G	71.49	-.36*	1.05*	71.32	-.31*	2.02*	-.17	.05	.97	.99	70HA	C150
C152	G	71.55	-.00	.60	71.40	-.00	1.60	-.15	-.00	1.00	1.01	70HA	C152
C166	G	71.20	-.00	.40	71.00	.05	1.40	-.20	.05	1.00	1.02	70HA	C166
C183	G	71.46	.25	.34	71.19	.34	1.28	-.27	.09	.95	.99	70HA	C183
C213	G	70.60	-.00	.40	70.30*	.10	1.30	-.30	.10	.90	.95	70HM	C213
C223	G	71.62	.08	.39	71.39	.20	1.34	-.23	.12	.94	.98	70HA	C223
C230	G	71.17	-.31	.57	70.80	-.19	1.51	-.37	.12	.94	1.01	70SC	C230
C241	G	71.20	-.00	.60	71.10	.20	1.60	-.10	.20	1.00	1.02	70HA	C241
C256	G	70.97	.14	.35	70.59	.27	1.27	-.38	.14	.92	1.00	70HM	C256
C259	G	71.15	.30	.50	71.00	.40	1.50	-.15	.10	1.00	1.02	70HA	C259
C262	G	71.69	.12	.32	71.43	.21	1.19	-.26	.09	.88	.92	70HR	C262
C285	G	71.50	.30	.50	71.60	-.15	1.50	.10 *	-.45 X	1.00	1.10*	70HA	C285
C291	G	71.25	-.05	.65	71.10	-.00	1.60	-.15	.05	.95	.96	70HA	C291
C317	G	70.90	-.00	.50	70.70	.20	1.40	-.20	.20	.90	.94	70HM	C317
C320	G	71.60	-.10	.60	71.30	.20	1.50	-.30	.30 X	.90	.99	70HA	C320
C325	G	71.48	.05	.44	71.17	.15	1.33	-.32	.10	.89	.95	70HR	C325
C340	G	71.62	-.20	.29	71.26	-.08	1.16	-.36	.12	.87	.95	70HA	C340
C352	G	71.70	-.00	.30	71.20	-.00	1.25	-.50	-.00	.95	1.07	70HA	C352
C356	G	71.00	-.00	.40	70.70	-.00	1.30	-.30	.00	.90	.95	70HM	C356
C380	G	71.65	-.00	.60	71.30	.20	1.50	-.35	.20	.90	.99	70HA	C380
C382	G	71.20	-.10	.60	71.15	-.10	1.60	-.05	-.00	1.00	1.00	70HA	C382
C402	G	71.34	-.12	.79	70.99	.01	1.72	-.35	.14	.93	1.00	70HA	C402
C417A	G	71.46	-.22	.36	70.84	-.07	1.20	-.61 *	.16	.84 *	1.05	70GE	C417A
C417B	G	70.93	.00	.45	70.77	.13	1.43	-.15	.13	.98	1.00	70HN	C417B
C420	G	71.55	-.00	.50	71.25	.20	1.40	-.30	.20	.90	.97	70HA	C420
C427	G	71.30	.10	.00*	71.10	.25	1.00	-.20	.15	1.00	1.03	70HA	C427
C440	G	71.69	.16	.69	71.18	.25	1.58	-.51	.09	.89	1.02	70HA	C440
C442	G	70.80	-.00	.40	70.60	-.00	1.30	-.20	.00	.90	.92	70HM	C442
C454	G	71.63	.20	.25	71.34	.28	1.14	-.29	.08	.89	.94	70HA	C454
C456	G	71.33	.01	.06	71.14	.13	1.03	-.20	.12	.97	1.00	70HA	C456
C458	G	71.16	.01	.27	70.83	.15	1.20	-.34	.14	.93	1.00	70HM	C458
C475	G	71.58	.23	.15	71.38	.36	1.12	-.20	.13	.97	1.00	70SC	C475
C477	G	71.59	.29	.65	71.20	.45	1.55	-.39	.15	.90	1.00	70HA	C477
C494	G	71.65	-.05	.10	71.50	.15	1.10	-.15	.20	1.00	1.03	70HA	C494
C496B	X	69.99X	.00	.00	69.79X	.00	.01X	-.19	.00	.01 X	.20X	70GP	C496B
C499A	G	70.75	-.10	.50	70.65	-.00	1.50	-.10	.10	1.00	1.01	70HA	C499A
C499B	G	71.05	.10	.50	71.15	.20	1.50	.10 *	.10	1.00	1.01	70HA	C499B
C506	G	71.30	-.00	.50	70.95	.10	1.50	-.35	.10	1.00	1.06	70HA	C506
C517	G	71.40	.40	.40	71.00	.65*	1.40	-.40	.25 *	1.00	1.11*	70SC	C517
C538	G	72.10*	1.70X	.00*	71.70	1.80X	.85*	-.40	.10	.85	.94	70GX	C538
C542	G	70.28*	.50*	.37	69.88X	.65*	1.28	-.40	.16	.91	1.01	70GP	C542
C543	G	71.62	-.11	.51	71.27	.08	1.45	-.35	.19	.94	1.03	70HA	C543
C546A	G	70.40*	-.00	.30	70.05X	-.00	1.20	-.35	-.00	.90	.97	70HQ	C546A
C546B	G	70.50*	.10	.40	70.30*	.20	1.30	-.20	.10	.90	.93	70HM	C546B
C567	G	71.37	.03	.45	71.00	.02	1.43	-.37	-.01 *	.97	1.04	70SC	C567
C576	G	71.46	.33	.60	71.15	.43	1.53	-.31	.10	.93	.98	70HM	C576
C585	G	71.29	.02	.24	71.10	.14	1.21	-.20	.12	.98	1.01	70HA	C585
C600	X	70.70	.20	-6.70X	70.40*	.40	-6.10X	-.30	.20	.60 X	.70X	70SC	C600
C620	G	71.68	-.10	.52	71.28	.02	1.40	-.40	.12	.88	.97	70HA	C620
C633	G	71.24	.06	.43	71.05	.20	1.40	-.19	.15	.97	1.00	70HA	C633
C647	G	71.74	.37	.85	71.59	.49	1.86*	-.15	.12	1.02	1.04	70HQ	C647
C648	G	71.23	.22	.41	70.89	.33	1.27	-.35	.11	.86	.93	70SC	C648
C655	G	71.19	-.18	.70	70.80	-.07	1.62	-.39	.11	.92	1.00	70SC	C655
C662	G	71.90	-1.80X	1.00*	71.70	-1.60X	1.90*	-.20	.20	.90	.94	70GX	C662
C674	G	71.50	-.00	.50	71.15	.10	1.40	-.35	.10	.90	.97	70HA	C674
C677	G	72.53X	-.05	-.12*	72.34X	.12	.85*	-.18	.17	.97	1.01	70SC	C677
GRAND MEANS		71.31	.05	.45	71.09	.15	1.39	-.26	.11	.94	1.00		
SD OF MEANS		.36	.18	.22	.31	.20	.22	.14	.06	.05	.04		
INCLUDED LABS FOR THIS MEAN		57	56	58	55	56	58	58	56	58	58		

WHITE SAMPLE ANALYSIS
X, Y, Z LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C162	1.0135	1.0107	1.0128	70DC	1.35	1.07	1.28
C232	1.1605	1.1528	1.1517	70CM	16.05	15.28	15.17
C244	.9956	.9946	.9942	70SA	-.44	-.54	-.58
C250	.9964	.9965	1.0003	70ZF	-.36	-.35	.03
C251	1.0080	1.0064	1.0059	70ZE	.80	.64	.59
C278A	1.0163	1.0155	1.0377	70BL	1.63	1.55	3.77
C278B	1.0268	1.0271	1.0236	70BL	2.68	2.71	2.36
C314	.9736	.9692	.9711	70CE	-2.64	-3.08	-2.89
C372	.9953	1.0075	1.0115	70ZE	-.47	.75	1.15
C407	1.0123	1.0124	1.0105	70SA	1.23	1.24	1.05
C412	1.0057	1.0059	1.0065	70GE	.57	.59	.65
C414	.9902	.9900	.9828	70SA	-.98	-1.00	-1.72
C416A	1.0217	1.0214	1.0188	70SA	2.17	2.14	1.88
C416B	1.0241	1.0251	1.0233	70SA	2.41	2.51	2.33
C418	.9835	.9799	.9957	70CB	-1.65	-2.01	-.43
C422	.9906	.9888	.9849	70SA	-.94	-1.12	-1.51
C424	1.0086	1.0088	1.0097	70CA	.86	.88	.97
C428	1.0085	1.0066	1.0106	70HB	.85	.66	1.06
C437	1.0126	1.0089	1.0249	70CB	1.26	.89	2.49
C443	1.0442	1.0056	.8528	70HB	4.42	.56	-14.72
C444	1.0086	1.0089	1.0125	70GE	.86	.89	1.25
C445	1.0109	1.0101	1.0137	70LS	1.09	1.01	1.37
C446A	1.0028	1.0024	1.0043	70GE	.28	.24	.43
C453	1.0092	1.0085	1.0045	70SA	.92	.85	.45
C455	1.0062	1.0083	1.0025	70KS	.62	.83	.25
C459	.9972	.9976	.9957	70GE	-.28	-.24	-.43
C460	1.0074	1.0085	1.0055	70GE	.74	.85	.55
C462A	1.0050	1.0036	1.0089	70HB	.50	.36	.89
C463	1.0128	1.0117	1.0147	70ZD	1.28	1.17	1.47
C467A	1.0188	1.0200	1.0240	70GE	1.88	2.00	2.40
C467B	1.0012	.9997	1.0057	70BN	.12	-.03	.57
C469	1.0179	1.0161	1.0278	70GE	1.79	1.61	2.78
C470	1.0101	1.0093	1.0142	70GB	1.01	.93	1.42
C472	1.0035	1.0031	1.0058	70ZD	.35	.31	.58
C473	.9866	1.0110	.9365	70GE	-1.34	1.10	-6.35
C476	1.0046	1.0041	1.0039	70SA	.46	.41	.39
C479A	.9994	1.0009	.9880	70SA	-.06	.09	-1.20
C479B	1.0117	1.0119	1.0130	70SA	1.17	1.19	1.30
C480	1.0103	1.0081	1.0148	70HB	1.03	.81	1.48
C481	1.0189	1.0163	1.0351	70KS	1.89	1.63	3.51
C483	.9942	.9922	.9936	70ZF	-.58	-.78	-.64
C496A	1.0174	1.0177	1.0166	70GE	1.74	1.77	1.66
C499C	1.0277	1.0280	1.0299	70BL	2.77	2.80	2.99
C503	1.0179	1.0181	1.0215	70GE	1.79	1.81	2.15
C508	1.0067	1.0073	1.0070	70GB	.67	.73	.70
C511	1.0033	1.0032	1.0012	70SA	.33	.32	.12
C521A	1.0217	1.0227	1.0242	70CA	2.17	2.27	2.42
C521B	1.0223	1.0226	1.0236	70SA	2.23	2.26	2.36
C522	.9984	.9976	.9920	70SA	-.16	-.24	-.80
C524	1.0184	1.0192	1.0189	70GE	1.84	1.92	1.89
C528	1.0112	1.0107	1.0057	70SA	1.12	1.07	.57
C531	1.0185	1.0171	1.0231	70GB	1.85	1.71	2.31
C532	1.0206	1.0212	1.0243	70GE	2.06	2.12	2.43
C534	.9814	.9822	.9721	70SA	-1.86	-1.78	-2.79
C536	1.0110	1.0104	1.0116	70KS	1.10	1.04	1.16
C540	1.0138	1.0135	1.0126	70GE	1.38	1.35	1.26
C545	.9703	.9709	.9738	70SA	-2.97	-2.91	-2.62
C548	.9857	.9851	.9811	70SB	-1.43	-1.49	-1.89
C549	1.0092	1.0101	1.0113	70GB	.92	1.01	1.13
C552	1.0027	1.0008	1.0071	70BN	.27	.08	.71
C612	1.0108	1.0118	1.0096	70GE	1.08	1.18	.96
C613	1.0077	1.0081	1.0008	70SA	.77	.81	.08
C627	.9632	.9963	.8956	70SA	-3.68	-.37	-10.44
C629	1.0000	.9988	1.0031	70BN	-.00	-.12	.31
C630	1.0002	.9995	1.0021	70KS	.02	-.05	.21
C631A	.9830	1.0140	.9251	70SA	-1.70	1.40	-7.49
C631B	1.0154	1.0145	1.0096	70SA	1.54	1.45	.96
C632	1.0121	1.0006	1.0035	70SA	1.21	.06	.35
C634	.9688	.9642	.9629	70CB	-3.12	-3.58	-3.71
C638	1.0011	.9987	.9980	70SA	.11	-.13	-.20
C639	.9974	.9966	.9945	70SA	-.26	-.34	-.55
C644	.9933	.9954	.9852	70SA	-.67	-.46	-1.48
C645	1.0104	1.0095	1.0016	70SA	1.04	.95	.16
C646	.8976	.9038	.8988	70CE	-10.24	-9.62	-10.12
C657	.9811	1.0123	.9244	70SA	-1.89	1.23	-7.56
C660	.9828	1.0132	.9279	70SA	-1.72	1.32	-7.21
C661	1.1350	1.0126	.3076	70SA	13.90	1.26	-69.24
C664	.9638	.9565	.9621	70KC	-3.62	-4.35	-3.79
C671A	.9678	.9920	.9176	70SA	-3.22	-.80	-8.24
C671B	.9598	.9832	.9138	70SA	-4.02	-1.68	-8.62
C671C	.9950	.9942	.9902	70GC	-.50	-.59	-.98
C671D	1.0330	1.0094	.8555	70BB	3.30	.94	-14.45
C672	.9983	.9971	.9899	70SA	-.17	-.29	-1.01
C675	1.0101	1.0094	1.0036	70SA	1.01	.94	.36

WHITE SAMPLE ANALYSIS
L, a, b LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C105	.9858	.9826	.9939	70HM	-1.02	-1.74	-.61
C121	.9890	.9847	.9975	70HM	-1.10	-1.53	-.25
C122	.9903	.9877	1.0007	70HM	-.97	-1.23	.07
C148	.9977	.9939	1.0009	70HA	-.23	-.61	.09
C150	.9908	.9902	.9977	70HA	-.92	-.98	-.23
C152	.9975	.9970	1.0033	70HA	-.25	-.30	.33
C166	.9901	.9888	.9995	70HA	-.99	-1.12	-.05
C183	1.0108	1.0089	1.0153	70HA	1.08	.89	1.53
C213	.9759	.9734	.9830	70HM	-2.41	-2.66	-1.70
C223	.9979	.9947	1.0064	70HA	-.21	-.53	.64
C230	.9879	.9863	.9968	70SC	-1.21	-1.37	-.32
C241	.9866	.9847	.9922	70HA	-1.34	-1.53	-.78
C256	.9821	.9797	.9892	70HM	-1.79	-2.03	-1.08
C259	.9856	.9836	.9942	70HA	-1.44	-1.64	-.58
C262	.9966	.9940	1.0069	70HR	-.34	-.60	.69
C285	.9916	.9908	1.0008	70HA	-.84	-.92	.08
C291	.9864	.9857	.9940	70HA	-1.36	-1.43	-.60
C317	.9831	.9806	.9888	70HM	-1.69	-1.94	-1.12
C320	.9959	.9939	1.0009	70HA	-.41	-.61	.09
C325	.9928	.9915	.9994	70HR	-.72	-.81	-.06
C340	.9876	.9872	.9991	70HA	-1.24	-1.28	-.09
C352	.9944	.9919	1.0057	70HA	-.56	-.81	.57
C356	.9839	.9826	.9939	70HM	-1.61	-1.74	-.61
C380	.9924	.9898	.9982	70HA	-.76	-1.02	-.18
C382	.9912	.9898	.9967	70HA	-.88	-1.02	-.33
C402	.9875	.9858	.9907	70HA	-1.25	-1.42	-.93
C417A	.9932	.9931	1.0029	70GE	-.68	-.69	.29
C417B	.9850	.9831	.9921	70HN	-1.50	-1.69	-.79
C420	.9928	.9908	.9985	70HA	-.72	-.92	-.15
C427	.9878	.9847	1.0059	70HA	-1.22	-1.53	.59
C440	.9945	.9913	.9971	70HA	-.55	-.87	-.29
C442	.9813	.9806	.9873	70HM	-1.87	-1.94	-1.27
C454	.9994	.9958	1.0077	70HA	-.06	-.42	.77
C456	.9894	.9873	1.0062	70HA	-1.06	-1.27	.62
C458	.9863	.9843	.9965	70HM	-1.37	-1.57	-.35
C475	.9949	.9915	1.0039	70SC	-.51	-.85	.39
C477	.9974	.9940	.9990	70HA	-.26	-.60	-.10
C494	1.0012	1.0001	1.0164	70HA	.12	.01	1.64
C496B	.9947	.9898	1.0207	70GP	-.53	-1.02	2.07
C499A	.9794	.9775	.9887	70HA	-2.06	-2.25	-1.13
C499B	.9860	.9836	.9946	70HA	-1.40	-1.64	-.54
C506	.9897	.9877	.9977	70HA	-1.03	-1.23	-.23
C517	1.0131	1.0105	1.0148	70SC	1.31	1.05	1.48
C538	.9661	.9703	.9678	70GX	-3.39	-2.97	-3.22
C542	1.0023	.9996	1.0021	70GP	.23	-.04	.21
C543	.9911	.9888	1.0002	70HA	-.89	-1.12	.02
C546A	.9938	.9919	.9988	70HQ	-.62	-.81	-.12
C546B	.9748	.9724	.9842	70HM	-2.52	-2.76	-1.58
C567	.9877	.9857	.9979	70SC	-1.23	-1.43	-.21
C576	.9808	.9788	.9906	70HM	-1.92	-2.12	-.94
C585	.9886	.9850	1.0021	70HA	-1.14	-1.40	.21
C600	.9851	.9826	.9969	70SC	-1.49	-1.74	-.31
C620	.9898	.9876	.9929	70HA	-1.02	-1.24	-.71
C633	.9859	.9836	.9971	70HA	-1.41	-1.64	-.29
C647	1.0114	1.0092	1.0214	70HQ	1.14	.92	2.14
C648	.9882	.9843	.9957	70SC	-1.18	-1.57	-.43
C655	.9958	.9952	.9920	70SC	-.42	-.48	-.80
C662	.9881	.9867	.9981	70GX	-1.19	-1.33	-.19
C674	.9922	.9908	1.0000	70HA	-.78	-.92	.00
C677	1.0224	1.0194	1.0304	70SC	2.24	1.94	3.04

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA
COLOR • COLOR DIFFERENCE

LAB CODE	F	SAMPLE C91 MEAN X	MEAN Y	MEAN Z	SAMPLE C92 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C92 - C91 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C162	G	14.35*	12.93*	6.48	14.43	12.85*	6.29	.08	-.08	-.19	3.46	70DC	C162
C232	G	14.91X	13.66X	6.92*	14.93X	13.58X	6.87*	.02	-.09	-.05	1.89	70CM	C232
C244	X	13.61	12.24	5.99	13.68	12.06	5.79	.07	-.18	-.20	5.06X	70SA	C244
C250	G	14.73X	13.05*	6.73	14.71*	12.84*	6.61	-.02	-.20	-.12	3.55	70ZF	C250
C251	G	13.63	11.73	5.88	13.80	11.82	5.98	.17	.10	.11	.89*	70ZE	C251
C278A	G	13.49	11.85	5.72*	13.75	12.09	5.86	.27	.24 *	.13	.90*	70BL	C278A
C278B	G	13.24	11.93	6.11	13.44	12.02	6.11	.19	.10	.00	1.80	70BL	C278B
C314	G	13.80	12.50	6.38	13.85	12.37	6.22	.05	-.13	-.16	3.83	70CE	C314
C372	X	14.18	12.61	7.31X	14.35	12.71	6.30	.18	.10	-1.00 X	7.51X	70ZE	C372
C407	G	13.30	11.70	5.90	13.32	11.59*	5.87	.02	-.11	-.03	2.48	70SA	C407
C412	G	14.21	12.74	6.63	14.15	12.53	6.42	-.06	-.21	-.21	3.52	70GE	C412
C414	G	13.88	12.35	6.22	13.90	12.22	6.06	.02	-.13	-.15	3.19	70SA	C414
C416A	G	13.14*	11.62*	5.42X	13.21*	11.55*	5.36X	.07	-.07	-.06	2.80	70SA	C416A
C416B	G	13.10*	11.57*	5.37X	13.16*	11.49*	5.31X	.05	-.08	-.06	2.74	70SA	C416B
C418	G	14.14	12.84	6.59	14.09	12.65	6.31	-.04	-.19	-.28	3.72	70CE	C418
C422	G	13.69	12.10	6.12	13.61	11.87	5.84	-.08	-.23	-.28	3.86	70SA	C422
C424	G	14.15	12.65	6.63	14.13	12.48	6.47	-.02	-.16	-.16	3.16	70CA	C424
C428	G	13.88	12.38	6.27	13.85	12.20	6.12	-.03	-.18	-.16	3.18	70HB	C428
C437	G	14.17	12.83	6.34	14.24	12.75	6.24	.07	-.08	-.10	2.88	70CE	C437
C443	G	15.96X	12.50	6.20	16.01X	12.40	6.07	.05	-.10	-.13	3.09	70HB	C443
C444	G	13.75	12.30	6.24	13.94	12.35	6.23	.20	.05	-.01	2.64	70GE	C444
C445	G	13.83	12.36	6.62	14.01	12.38	6.59	.17	.02	-.04	2.74	70LS	C445
C446A	G	13.77	12.25	6.21	14.09	12.43	6.48	.31	.18	.27	1.76	70GE	C446A
C453	G	13.79	12.37	6.28	13.78	12.21	6.05	-.01	-.16	-.23	3.60	70SA	C453
C455	G	13.71	12.21	6.26	13.99	12.34	6.33	.28	.13	.06	2.49	70KS	C455
C459	G	13.85	12.36	6.46	13.88	12.24	6.35	.03	-.11	-.11	2.92	70GE	C459
C460	G	13.62	12.17	6.19	13.92	12.32	6.42	.29	.15	.23	1.91	70GE	C460
C462A	G	13.73	12.16	6.00	13.83	12.11	6.00	.10	-.05	.00	2.63	70HB	C462A
C463	G	13.69	12.25	6.24	14.07	12.47	6.52	.38 *	.22 *	.29 *	2.08	70ZD	C463
C467A	G	13.59	12.07	6.48	13.88	12.24	6.77	.29	.17	.28 *	1.75	70GE	C467A
C467B	G	13.57	12.03	5.93	13.74	12.06	5.99	.17	.03	.05	2.35	70HN	C467B
C469	G	13.60	12.33	5.64*	13.64	12.24	5.56*	.04	-.09	-.08	2.72	70GE	C469
C470	G	13.74	12.37	6.11	13.82	12.31	6.02	.08	-.06	-.09	2.77	70GE	C470
C472	G	13.67	12.25	5.70*	13.70	12.15	5.73	.03	-.10	.03	2.25	70ZD	C472
C473	G	13.95	12.35	6.27	14.11	12.37	6.34	.17	.02	.07	2.32	70GE	C473
C476	G	13.46	11.96	6.51	13.68	12.03	6.70	.22	.07	.18	2.07	70SA	C476
C479A	G	13.86	12.34	6.73	13.76	12.29	6.53	-.10	-.05	-.20	1.01*	70SA	C479A
C479B	G	14.18	12.68	6.76	14.49*	12.84*	6.92*	.31	.15	.15	2.20	70SA	C479B
C480	G	13.81	12.39	6.39	14.02	12.45	6.49	.21	.07	.10	2.09	70HB	C480
C481	G	13.79	12.38	6.22	13.76	12.24	6.20	-.03	-.15	-.02	2.23	70KS	C481
C483	X	14.19	12.40	6.66	14.14	12.09	6.30	-.06	-.30	-.36	5.77X	70ZF	C483
C496A	G	13.58	12.10	6.20	13.80	12.17	6.27	.22	.08	.07	2.18	70GE	C496A
C499C	G	13.62	12.00	6.30	14.10	12.36	6.80	.48 X	.36 X	.50 X	2.23	70BL	C499C
C503	G	13.54	12.11	6.23	13.84	12.27	6.45	.30	.16	.23	1.97	70GE	C503
C508	G	13.56	12.04	6.14	13.61	11.94	6.04	.04	-.09	-.09	2.84	70GE	C508
C511	G	13.90	12.43	6.42	13.83	12.21	6.13	-.07	-.22	-.29	3.86	70SA	C511
C521A	G	13.72	12.18	6.17	13.68	12.00	6.04	-.04	-.19	-.13	3.14	70CA	C521A
C521B	G	13.24	11.73	6.26	12.85X	11.25X	5.71	-.39 X	-.48 X	-.54 X	4.41*	70SA	C521B
C522	G	14.51*	13.29X	7.04*	14.61*	13.26X	6.81	.10	-.03	-.22	3.09	70SA	C522
C524	G	13.85	12.38	6.35	13.91	12.30	6.26	.06	-.08	-.09	2.85	70GE	C524
C528	G	13.84	12.36	6.32	14.08	12.46	6.55	.24	.10	.23	1.91	70SA	C528
C531	G	13.81	12.39	6.39	13.77	12.20	6.11	-.05	-.20	-.28	3.88	70GE	C531
C532	G	13.81	12.32	6.31	13.81	12.18	6.17	-.00	-.14	-.14	2.98	70GE	C532
C534	G	13.82	12.32	6.21	14.08	12.43	6.33	.26	.11	.12	2.36	70SA	C534
C536	G	14.16	12.69	6.70	14.12	12.51	6.47	-.04	-.18	-.23	3.33	70KS	C536
C540	G	14.42*	12.95*	7.01*	14.41	12.81	6.93*	-.01	-.14	-.07	2.48	70GE	C540
C545	G	13.39	11.91	5.85	13.51	11.89	5.86	.11	-.02	.01	2.34	70SA	C545
C548	G	13.51	11.73	6.00	13.29*	11.42*	5.86	-.22 *	-.30 *	-.14	2.46	70BB	C548
C549	G	13.27	11.73	5.68*	13.42	11.75	5.87	.14	.01	.19	1.94	70GE	C549
C552	G	13.52	12.08	6.09	13.71	12.13	6.09	.19	.05	.00	2.53	70HN	C552
C612	G	13.52	12.02	6.18	13.55	11.91	6.08	.03	-.11	-.10	2.86	70GE	C612
C613	G	13.81	12.37	6.12	13.90	12.33	6.10	.09	-.04	-.02	2.41	70SA	C613
C627	G	14.10	12.20	6.38	14.20	12.16	6.36	.10	-.04	-.02	2.38	70SA	C627
C629	G	13.74	12.24	6.21	13.74	12.10	6.08	.00	-.14	-.12	2.89	70HN	C629
C630	G	13.83	12.35	6.32	14.02	12.43	6.57	.19	.08	.25	1.60	70KS	C630

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA

COLOR • COLOR DIFFERENCE

LAB CODE	F	SAMPLE C91 MEAN X	MEAN Y	MEAN Z	SAMPLE C92 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C92 - C91 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C631A	6	13.64	12.00	6.21	13.88	12.08	6.30	.23	.08	.09	2.39	70SA	C631A
C631B	6	13.90	12.46	6.38	13.86	12.28	6.22	-.04	-.18	-.16	3.06	70SA	C631B
C632	6	13.68	12.37	6.24	13.80	12.35	6.17	.12	-.02	-.06	2.68	70SA	C632
C634	6	13.93	12.57	6.49	13.99	12.50	6.46	.06	-.07	-.02	2.43	70CE	C634
C638	6	13.49	11.82	6.01	13.59	11.82	6.21	.10	.00	.20	1.57	70SA	C638
C639	6	13.82	12.38	6.31	14.11	12.53	6.57	.29	.15	.25	1.84	70SA	C639
C644	6	13.83	12.33	6.12	13.96	12.33	6.18	.13	.00	.06	2.09	70SA	C644
C645	6	13.87	12.41	6.35	13.90	12.30	6.21	.03	-.11	-.14	2.98	70SA	C645
C646	6	15.24X	14.75X	6.32	15.41X	14.92X	6.50	.18	.17	.17	.84*	70CE	C646
C657	6	13.75	12.11	6.22	13.97	12.18	6.33	.21	.07	.11	2.08	70SA	C657
C660	6	13.86	12.27	6.29	13.96	12.22	6.22	.10	-.05	-.07	2.82	70SA	C660
C661	6	16.51X	14.46X	6.67	16.64X	14.45X	6.54	.13	-.01	-.13	2.78	70SA	C661
C664	6	13.86	12.44	6.45	13.73	12.17	6.19	-.13	-.28	-.26	3.64	70KC	C664
C671A	6	14.02	12.37	6.47	14.06	12.25	6.26	.05	-.12	-.21	3.80	70SA	C671A
C671B	6	14.10	12.50	6.44	14.14	12.40	6.37	.05	-.09	-.07	2.66	70SA	C671B
C671C	6	13.74	12.19	6.18	13.67	11.97	5.98	-.07	-.22	-.20	3.44	70GC	C671C
C671D	6	13.81	12.06	6.12	13.98	12.09	6.17	.17	.03	.05	2.23	70HB	C671D
C672	6	13.52	12.04	6.11	13.62	12.04	6.06	.10	.00	-.05	1.97	70SA	C672
C675	6	13.82	12.38	6.43	13.71	12.13	6.11	-.11	-.25	-.32	3.76	70SA	C675
GRAND MEANS		13.76	12.26	6.29	13.88	12.23	6.26	.09	-.04	-.03	2.61		
SD OF MEANS		.27	.31	.28	.29	.29	.29	.12	.13	.16	.74		
INCLUDED LABS FOR THIS MEAN		76	77	79	76	76	79	79	79	79	81		

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA
COLOR • COLOR DIFFERENCE

LAB CODE	P	SAMPLE C93 MEAN X	MEAN Y	MEAN Z	SAMPLE C94 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C94 - C93 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C162	G	49.99	51.04	59.36	49.54	50.53	57.68	-.45	-.50	-1.67	2.59	70DC	C162
C232	G	49.86	50.79	59.99*	49.49	50.49	58.24	-.36	-.30	-1.74	2.51	70CK	C232
C244	X	49.35	50.35	58.65	49.20	50.22	57.37	-.15	-.13	-1.28	2.18X	70SA	C244
C250	G	50.42X	51.48*	60.09*	50.02X	50.98*	58.44*	-.39	-.50	-1.65	2.85*	70ZF	C250
C251	G	49.38	50.48	58.70	48.68	49.68	56.84	-.70 *	-.79 *	-1.87	2.68	70ZE	C251
C278A	X	49.03	50.33	58.02*	48.72	49.93	56.80	-.31	-.40	-1.22	2.11X	70BL	C278A
C278B	G	49.52	50.68	58.96	49.18	50.24	57.44	-.34	-.44	-1.51	2.67	70BL	C278B
C314	X	49.40	50.49	59.11	48.97	49.94	57.29	-.44	-.55	-1.82	3.12X	70CE	C314
C372	X	50.41X	50.82	59.31	50.08X	50.52	57.79	-.34	-.30	-1.52	2.22X	70ZE	C372
C407	G	49.18	50.31	58.52	49.01	50.08	57.08	-.17	-.24	-1.44	2.76	70SA	C407
C412	G	49.47	50.56	58.98	49.06	50.10	57.36	-.40	-.46	-1.62	2.58	70GE	C412
C414	G	49.84	50.95	59.40	49.61	50.66	57.94	-.23	-.28	-1.46	2.62	70SA	C414
C416A	G	49.01	50.12	58.53	48.77	49.83	57.11	-.24	-.29	-1.41	2.50	70SA	C416A
C416B	G	48.91	49.97	58.37	48.66	49.68	56.93	-.24	-.29	-1.44	2.55	70SA	C416B
C418	G	49.34	50.40	58.63	49.06	50.12	57.14	-.27	-.28	-1.48	2.43	70CE	C418
C422	G	49.23	50.22	58.51	48.88	49.83	56.91	-.34	-.38	-1.60	2.64	70SA	C422
C424	G	49.54	50.61	59.15	49.31	50.32	57.62	-.23	-.29	-1.53	2.76	70CA	C424
C428	G	49.50	50.59	58.85	49.10	50.12	57.20	-.41	-.46	-1.66	2.66	70HB	C428
C437	G	50.00*	51.01	59.64	49.57	50.51	58.01	-.43	-.50	-1.63	2.62	70CE	C437
C443	X	49.32	50.57	59.23	49.29	50.23	57.72	-.03	-.34	-1.51	4.28X	70HB	C443
C444	G	49.61	50.66	59.14	49.29	50.30	57.61	-.32	-.36	-1.54	2.55	70GE	C444
C445	G	49.66	50.77	59.32	49.41	50.46	57.81	-.25	-.30	-1.51	2.68	70LS	C445
C446A	G	49.27	50.36	58.75	48.79	49.84	57.08	-.47	-.52	-1.67	2.54	70GE	C446A
C453	G	49.50	50.61	59.23	49.24	50.30	57.78	-.26	-.31	-1.45	2.54	70SA	C453
C455	G	49.46	50.52	59.35	49.17	50.17	57.81	-.29	-.34	-1.54	2.64	70KS	C455
C459	G	49.37	50.45	58.89	48.71	49.73	56.99	-.66	-.72	-1.90	2.70	70GE	C459
C460	G	48.85*	49.89	58.45	48.80	49.78	57.23	-.05	-.11	-1.21	2.55	70GE	C460
C462A	G	49.65	50.72	58.97	49.16	50.22	57.29	-.50	-.50	-1.68	2.34*	70HB	C462A
C463	G	49.69	50.87	59.32	49.31	50.42	57.71	-.38	-.45	-1.61	2.64	70ZD	C463
C467A	G	49.24	50.33	58.72	49.06	50.10	57.28	-.18	-.23	-1.44	2.68	70GE	C467A
C467B	G	49.16	50.25	58.48	49.03	50.06	57.09	-.12	-.20	-1.39	2.80	70HN	C467B
C469	G	49.37	50.37	58.99	48.88	49.84	57.27	-.49	-.53	-1.72	2.59	70GE	C469
C470	G	49.24	50.29	58.99	48.96	49.96	57.45	-.28	-.33	-1.54	2.65	70GE	C470
C472	G	49.39	50.41	58.94	49.27	50.26	57.64	-.11	-.15	-1.30	2.50	70ZD	C472
C473	G	49.31	50.38	59.09	48.97	49.97	57.53	-.34	-.40	-1.56	2.61	70GE	C473
C476	G	49.43	50.52	59.06	49.20	50.23	57.62	-.23	-.29	-1.44	2.60	70SA	C476
C479A	X	49.48	50.30	63.36X	49.03	49.90	61.84X	-.45	-.40	-1.52	1.83X	70SA	C479A
C479B	G	50.63X	51.28*	59.39	49.40	50.45	57.68	-1.23 X	-.83 *	-1.71	2.68	70SA	C479B
C480	G	49.66	50.76	59.01	49.21	50.30	57.31	-.45	-.46	-1.70	2.52	70HB	C480
C481	G	49.81	50.84	59.34	49.56	50.54	57.87	-.26	-.30	-1.47	2.54	70KS	C481
C483	X	49.56	50.80	59.19	49.13	50.19	57.53	-.43	-.60	-1.66	3.08X	70ZF	C483
C496A	G	49.06	50.16	58.72	49.14	50.20	57.58	.09 *	.04 *	-1.14 *	2.72	70GE	C496A
C499C	X	49.88	51.16	59.37	49.59	50.63	57.71	-.29	-.53	-1.66	3.65X	70BL	C499C
C503	G	48.85*	49.86*	58.39	48.49*	49.44*	56.79	-.37	-.42	-1.60	2.61	70GE	C503
C508	G	49.05	50.12	58.59	49.13	50.16	57.42	.08 *	.03 *	-1.18 *	2.76	70GE	C508
C511	G	49.58	50.68	59.27	49.22	50.28	57.66	-.36	-.40	-1.61	2.60	70SA	C511
C521A	X	49.83	50.99	59.43	48.87	49.96	57.09	-.95 X	-1.03 X	-2.34 X	3.05X	70CA	C521A
C521B	X	50.42X	51.53*	59.71	50.66X	51.73X	58.52*	.24 X	.20 X	-1.19	3.17X	70SA	C521B
C522	G	49.81	51.35*	60.11*	49.02	50.57	58.10	-.78 *	-.78 *	-2.01 *	2.41*	70SA	C522
C524	G	49.42	50.46	58.92	49.19	50.20	57.45	-.23	-.26	-1.47	2.61	70GE	C524
C528	G	49.75	50.86	59.63	49.47	50.61	58.01	-.28	-.25	-1.62	2.56	70SA	C528
C531	G	49.22	50.28	58.79	48.94	49.97	57.31	-.27	-.32	-1.49	2.55	70GE	C531
C532	G	49.25	50.29	58.84	48.71	49.70	57.03	-.54	-.59	-1.81	2.67	70GE	C532
C534	G	49.87	51.01	59.71	49.81*	50.90*	58.42*	-.06	-.11	-1.29	2.66	70SA	C534
C536	G	49.77	50.86	59.34	49.55	50.60	57.90	-.22	-.27	-1.44	2.58	70KS	C536
C540	G	49.43	50.55	58.97	49.11	50.18	57.44	-.32	-.37	-1.53	2.59	70GE	C540
C545	G	49.01	50.11	58.44	48.58	49.63	56.78	-.43	-.47	-1.65	2.58	70SA	C545
C548	G	48.99	50.00	58.34	48.84	49.74	56.97	-.15	-.25	-1.36	2.82	70SB	C548
C549	G	49.23	50.27	58.84	48.81	49.80	57.15	-.42	-.47	-1.69	2.67	70GE	C549
C552	G	49.34	50.43	58.58	49.12	50.16	57.11	-.23	-.27	-1.47	2.62	70HN	C552
C612	G	49.06	50.13	58.65	48.98	50.02	57.32	-.08	-.12	-1.33	2.64	70GE	C612
C613	G	49.77	50.87	59.58	49.54	50.59	58.14	-.23	-.29	-1.43	2.58	70SA	C613
C627	G	49.89	51.04	59.67	49.49	50.54	58.04	-.40	-.51	-1.63	2.79	70SA	C627
C629	G	49.44	50.51	58.67	49.03	50.04	56.98	-.41	-.47	-1.69	2.72	70HN	C629
C630	G	49.31	50.40	58.86	49.14	50.18	57.46	-.16	-.22	-1.40	2.64	70KS	C630

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA
COLOR • COLOR DIFFERENCE

LAB CODE	P	SAMPLE C93 MEAN X	MEAN Y	MEAN Z	SAMPLE C94 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C94 - C93 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C631A	G	49.19	50.29	58.89	48.80	49.82	57.25	-.40	-.47	-1.64	2.70	70SA	C631A
C631B	G	49.45	50.57	59.05	49.09	50.10	57.59	-.36	-.47	-1.46	2.54	70SA	C631B
C632	G	49.33	51.02	59.08	48.94	50.56	57.49	-.40	-.46	-1.59	2.54	70SA	C632
C634	X	49.27	50.32	58.59	48.25*	49.21*	56.25*	-1.02 X	-1.11 X	-2.35 X	3.06X	70CE	C634
C638	X	49.05	50.06	58.42	48.85	49.66	56.91	-.20	-.40	-1.50	3.42X	70SA	C638
C639	G	49.61	50.71	59.33	49.15	50.19	57.63	-.47	-.51	-1.70	2.58	70SA	C639
C644	G	49.70	50.79	59.18	49.57	50.59	57.86	-.13	-.20	-1.32	2.63	70SA	C644
C645	G	49.51	50.61	59.11	49.05	50.08	57.40	-.46	-.53	-1.71	2.71	70SA	C645
C646	X	51.01X	52.54X	61.18X	51.66X	52.37X	59.52X	.65 X	-.17	-1.66	8.45X	70CE	C646
C657	G	49.22	50.29	58.91	49.09	50.08	57.52	-.14	-.21	-1.40	2.78	70SA	C657
C660	G	49.16	50.26	58.86	48.75	49.79	57.20	-.41	-.47	-1.66	2.67	70SA	C660
C661	X	49.37	50.28	59.08	49.65	50.46	57.94	.29 X	.18 *	-1.14 *	3.41X	70SA	C661
C664	X	49.66	50.78	59.25	49.49	50.19	57.49	-.17	-.58	-1.76	5.00X	70KC	C664
C671A	G	49.42	50.53	59.17	49.37	50.43	57.88	-.05	-.11	-1.29	2.72	70SA	C671A
C671B	G	49.37	50.48	59.11	49.36	50.41	57.89	-.01	-.07	-1.22	2.65	70SA	C671B
C671C	G	49.58	50.54	58.90	49.04	49.93	57.13	-.54	-.61	-1.78	2.71	70GC	C671C
C671D	G	49.90	50.87	59.26	49.21	50.13	57.34	-.69 *	-.74 *	-1.92 *	2.65	70HB	C671D
C672	G	49.29	50.25	58.64	48.94	49.90	57.07	-.35	-.35	-1.57	2.41*	70SA	C672
C675	G	49.21	50.33	58.84	48.74	49.81	57.12	-.47	-.52	-1.72	2.64	70SA	C675
GRAND MEANS		49.42	50.54	59.02	49.11	50.17	57.47	-.32	-.37	-1.55	2.62		
SD OF MEANS		.28	.34	.40	.28	.32	.39	.17	.18	.18	.10		
INCLUDED LABS FOR THIS MEAN		67	69	69	68	69	69	68	69	69	69		

L, a, b SPACE ANALYSIS, ADJUSTED DATA
COLOR * COLOR DIFFERENCE

LAB CODE	F	SAMPLE C91 MEAN L	MEAN A	MEAN B	SAMPLE C92 MEAN L	MEAN A	MEAN B	DIFFERENCE C92 - C91 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C105	6	35.21	8.36	14.34	35.11	9.06	14.39	-.10	.70	.05	.71	70HM	C105
C121	6	35.07	8.96	14.44	34.97	9.67	14.24	-.10	.70	-.20	.74	70HM	C121
C122	6	35.42	9.17	14.18	35.32	9.88	14.12	-.10	.70	-.05	.71	70HM	C122
C148	6	35.56	8.96	14.12	35.46	9.71	14.22	-.10	.75	.10	.76	70HA	C148
C150	6	35.42	8.80	14.00	35.32	9.61	14.01	-.11	.81	.01	.82	70HA	C150
C152	6	35.25	8.78	14.09	35.10	9.53	14.04	-.15	.75	-.05	.77	70HA	C152
C166	6	35.45	8.65	14.14	35.40	9.51	14.04	-.05	.85 *	-.10	.86	70HA	C166
C183	6	35.00	8.54	14.18	34.90	9.30	14.17	-.10	.76	-.01	.76	70HA	C183
C213	6	35.27	8.54	13.49*	35.07	9.25	13.49*	-.20	.71	-.00	.74	70HM	C213
C223	6	35.31	8.46	14.00	35.22	9.20	13.95	-.10	.74	-.06	.75	70HA	C223
C230	6	35.50	8.80	14.28	35.56	9.40	13.99	.06	.60	-.29 *	.67	70SC	C230
C241	6	35.62	9.03	14.34	35.52	9.84	14.39	-.10	.80	.05	.81	70HA	C241
C256	X	35.22	9.51	13.91	34.74	10.36*	14.06	-.48 *	.85	.14	.99X	70HM	C256
C259	6	35.44	10.24X	13.93	35.29	11.05X	14.03	-.15	.81	.10	.83	70HA	C259
C262	6	35.40	8.65	14.10	35.29	9.32	14.09	-.11	.66	-.01	.67	70HR	C262
C285	6	35.41	8.69	14.07	35.21	9.49	14.27	-.20	.80	.20 *	.85	70HA	C285
C291	6	35.20	8.96	14.29	35.50	9.56	14.04	.30 *	.60	-.25 *	.72	70HA	C291
C317	6	35.14	9.01	14.03	35.19	9.71	13.93	.05	.70	-.10	.71	70HM	C317
C320	6	35.06	8.19	13.82	34.76	9.04	13.92	-.30	.85 *	.10	.91*	70HA	C320
C325	6	35.07	8.43	13.81	34.85	9.16	13.96	-.22	.73	.15	.78	70HR	C325
C340	6	35.67	8.47	14.03	35.73	9.09	13.91	.06	.62	-.12	.63	70HA	C340
C352	6	35.39	8.75	14.20	35.09	9.56	14.30	-.30	.80	.10	.86	70HA	C352
C356	6	35.11	9.29	14.04	34.90	9.99	14.04	-.20	.71	-.00	.73	70HM	C356
C380	6	35.38	8.86	14.21	35.43	9.52	14.16	.05	.65	-.05	.66	70HA	C380
C382	6	35.63	8.09*	13.95	35.33	8.90*	14.05	-.30	.80	.10	.86	70HA	C382
C402	6	35.36	8.68	14.07	35.41	9.41	14.08	.05	.73	.02	.74	70HA	C402
C417A	6	35.24	8.80	14.03	35.19	9.57	14.14	-.05	.78	.11	.78	70GE	C417A
C417B	X	35.32	9.05	14.26	34.84	9.87	14.32	-.48 *	.82	.05	.95X	70HN	C417B
C420	6	35.66	9.00	13.95	35.51	9.70	14.00	-.15	.70	.05	.72	70HA	C420
C427	6	35.17	9.30	14.33	35.42	10.00	14.19	.25 *	.70	-.14	.76	70HA	C427
C440	6	35.56	8.61	14.17	35.44	9.33	14.08	-.12	.73	-.08	.74	70HA	C440
C442	6	35.14	9.14	14.11	34.84	9.84	14.11	-.30	.71	-.00	.77	70HM	C442
C454	6	34.94	8.98	13.89	34.73	9.71	13.92	-.21	.73	.04	.76	70HA	C454
C456	6	35.45	8.86	14.08	35.37	9.62	14.14	-.08	.76	.06	.77	70HA	C456
C458	6	35.34	9.14	14.09	35.24	9.87	14.03	-.11	.73	-.06	.74	70HM	C458
C475	6	35.00	8.74	13.47*	35.17	9.43	13.48*	.17	.69	.01	.71	70SC	C475
C477	6	35.27	9.19	13.78	35.14	9.90	13.73	-.13	.71	-.05	.72	70HA	C477
C494	6	35.70	9.02	14.08	35.65	9.62	13.88	-.05	.60	-.20	.63	70HA	C494
C496B	X	34.29X	-.21X	.86X	34.41*	-.21X	.86X	.12	.00 X	.00	.12X	70GP	C496B
C499A	6	35.45	8.76	13.93	35.35	9.47	14.03	-.10	.71	.10	.72	70HA	C499A
C499B	X	35.39	4.43X	14.08	35.34	9.66	14.08	-.05	5.23 X	-.00	5.23X	70HA	C499B
C506	6	35.47	9.22	14.09	35.27	9.92	13.99	-.20	.70	-.10	.74	70HA	C506
C517	6	34.77*	8.47	13.57*	34.62*	9.17	13.57*	-.15	.70	-.00	.71	70SC	C517
C538	6	36.75X	10.79X	14.49	36.75X	11.40X	14.49*	.00	.61	.00	.61*	70GX	C538
C542	X	33.97X	9.10	13.66	33.56X	9.99	13.79	-.41 *	.89 *	.13	.99X	70GP	C542
C543	6	35.65	8.63	14.27	35.40	9.45	14.34	-.25	.82	.06	.86	70HA	C543
C546A	6	33.64X	9.50	14.02	33.54X	10.26*	14.12	-.10	.75	.10	.77	70HQ	C546A
C546B	6	34.99	9.15	14.12	35.09	9.86	14.02	.10	.71	-.10	.72	70HM	C546B
C567	6	35.60	8.91	14.45	35.56	9.68	14.39	-.05	.77	-.06	.78	70SC	C567
C576	6	37.03X	9.10	14.41	36.99X	9.75	14.32	-.04	.65	-.09	.66	70HM	C576
C585	6	35.47	9.10	14.01	35.28	9.81	13.95	-.19	.71	-.06	.74	70HA	C585
C600	6	35.11	9.60*	8.01X	35.11	10.41*	8.01X	.00	.80	.00	.80	70SC	C600
C620	6	35.54	8.08*	13.72	35.84*	8.69*	13.64	.31 *	.61	-.09	.69	70HA	C620
C633	6	35.20	9.17	14.19	35.27	9.91	14.21	.07	.74	.02	.74	70HA	C633
C647	6	35.08	8.75	17.01X	35.10	9.47	16.95X	.01	.72	-.06	.72	70HQ	C647
C648	6	34.42X	9.23	13.87	34.46*	9.94	13.82	.04	.71	-.05	.72	70SC	C648
C655	6	34.92	8.63	14.07	34.72	9.39	14.12	-.20	.77	.05	.79	70SC	C655
C662	6	35.84*	6.90X	14.02	35.89*	7.55X	13.92	.05	.65	-.10	.66	70GX	C662
C674	6	35.56	9.04	13.82	35.61	9.75	13.62	.05	.70	-.20	.73	70HA	C674
C677	6	34.96	9.11	13.86	34.96	9.75	13.74	-.00	.64	-.12	.65	70SC	C677
GRAND MEANS		35.32	8.85	14.06	35.23	9.58	14.03	-.07	.72	-.02	.75		
SD OF MEANS		.24	.33	.22	.30	.33	.22	.14	.06	.10	.06		
INCLUDED LABS FOR THIS MEAN		51	52	53	52	52	53	55	55	55	55		

NCCA COLLABORATIVE REFERENCE PROGRAM
L, a, b SPACE ANALYSIS, ADJUSTED DATA
COLOR • COLOR DIFFERENCE

LAB CODE	F	SAMPLE C93 MEAN L	MEAN A	MEAN B	SAMPLE C94 MEAN L	MEAN A	MEAN B	DIFFERENCE C94 - C93 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C105	6	71.83	-.92X	1.07	71.52	-.81X	1.97	-.30	.10	.90	.95	70HM	C105
C121	6	71.60	-.64*	1.14	71.15	-.54*	2.13	-.45	.10	.99	1.09*	70HM	C121
C122	6	71.59	-.12	.95	71.49	-.02	1.94	-.10	.10	.99	1.00	70HM	C122
C148	6	71.67	.03	.85	71.62	.13	1.84	-.05	.10	1.00	1.00	70HA	C148
C150	6	71.84	-.45	1.42*	71.67	-.39	2.38*	-.17	.06	.97	.98	70HA	C150
C152	6	71.66	-.06	.91	71.51	-.06	1.91	-.15	.00	.99	1.01	70HA	C152
C166	6	71.60	-.17	.93	71.40	-.12	1.93	-.20	.05	.99	1.01	70HA	C166
C183	6	71.15X	.01	.65	70.88X	.10	1.58	-.27	.09	.93	.98	70HA	C183
C213	6	71.56	-.32	.89	71.25	-.22	1.79	-.30	.10	.90	.96	70HN	C213
C223	6	71.81	-.33	.97	71.58	-.21	1.91	-.24	.13	.93	.97	70HA	C223
C230	6	71.66	-.52	1.10	71.29	-.39	2.02	-.37	.12	.93	1.01	70SC	C230
C241	6	71.75	-.25	.98	71.65	-.04	1.98	-.10	.20	1.00	1.02	70HA	C241
C256	6	71.70	-.16	.83	71.32	-.02	1.75	-.38	.14	.92	1.00	70HM	C256
C259	6	71.74	.06	1.03	71.59	.16	2.03	-.15	.10	1.00	1.01	70HA	C259
C262	6	71.90	-.21	.96	71.64	-.12	1.83	-.26	.09	.87	.91*	70HR	C262
C285	6	71.83	.20*	1.00	71.93*	-.25	1.99	.10 *	-.45 X	1.00	1.10*	70BA	C285
C291	6	71.77	-.15	1.07	71.61	-.10	2.02	-.15	.05	.95	.96	70HA	C291
C317	6	71.60	-.32	.92	71.40	-.12	1.82	-.20	.20	.90	.94	70HM	C317
C320	6	71.82	-.35	.95	71.52	-.05	1.84	-.30	.30 X	.89	.99	70HA	C320
C325	6	71.78	-.07	.82	71.46	.03	1.70	-.32	.10	.88	.94	70HR	C325
C340	6	72.08	-.24	.88	71.72	-.12	1.74	-.36	.12	.86	.94	70HA	C340
C352	6	71.99	-.32	.99	71.49	-.32	1.92	-.50	.00	.94	1.06	70HA	C352
C356	6	71.63	-.17	.97	71.32	-.17	1.86	-.30	.00	.90	.94	70HN	C356
C380	6	72.02	-.32	1.02	71.67	-.12	1.92	-.35	.20	.89	.98	70HA	C380
C382	6	71.57	-.27	.95	71.52	-.27	1.94	-.05	.00	1.00	1.00	70HA	C382
C402	6	71.85	-.34	1.05	71.50	-.20	1.98	-.35	.14	.93	1.00	70HA	C402
C417A	6	71.71	-.24	.85	71.09*	-.08	1.68	-.62 *	.16	.83 *	1.04	70GE	C417A
C417B	6	71.53	-.23	.90	71.38	-.10	1.88	-.15	.13	.98	1.00	70HN	C417B
C420	6	71.88	-.25	.89	71.58	-.05	1.78	-.30	.20	.90	.97	70HA	C420
C427	6	71.85	-.30	1.06	71.65	-.14	2.04	-.20	.15	.98	1.02	70HA	C427
C440	6	72.01	-.25	.99	71.49	-.16	1.87	-.51	.09	.88	1.02	70HA	C440
C442	6	71.50	-.09	.74	71.30	-.09	1.64	-.20	.00	.90	.92	70HN	C442
C454	6	71.78	-.26	.84	71.49	-.18	1.72	-.29	.08	.88	.93	70HA	C454
C456	6	71.79	-.25	1.00	71.59	-.13	1.96	-.20	.12	.96	.99	70HA	C456
C458	6	71.73	-.24	.88	71.39	-.10	1.81	-.34	.14	.93	1.00	70HN	C458
C475	6	71.89	-.20	.77	71.69	-.06	1.74	-.20	.13	.96	.99	70SC	C475
C477	6	71.80	-.13	.90	71.41	.03	1.80	-.39	.16	.90	1.00	70HA	C477
C494	6	71.65	-.19	.90	71.50	.01	1.88	-.15	.20	.98	1.01	70HA	C494
C496B	X	70.34X	-.60*	1.49*	70.15X	-.60*	1.50	-.20	.00	.01 X	.20X	70GP	C496B
C499A	6	71.56	-.35	1.07	71.46	-.24	2.07	-.10	.10	1.00	1.01	70HA	C499A
C499B	6	71.64	-.20	1.05	71.74	-.10	2.05	.10 *	.10	1.00	1.01	70HA	C499B
C506	6	71.74	-.25	1.00	71.39	-.15	1.99	-.35	.10	.99	1.06	70HA	C506
C517	6	71.03X	.08	.60	70.63X	.33*	1.59	-.40	.25 *	.99	1.10*	70SC	C517
C538	6	73.19X	2.30X	-.13X	72.79X	2.40X	.73X	-.41	.10	.87	.96	70GX	C538
C542	6	70.29X	.17*	.49*	69.89X	.33*	1.40*	-.40	.16	.91	1.00	70GP	C542
C543	6	72.03	-.41	1.08	71.67	-.22	2.02	-.36	.19	.94	1.02	70HA	C543
C546A	6	70.69X	-.24	.64	70.34X	-.24	1.54	-.35	.00	.90	.96	70HQ	C546A
C546B	6	71.49	-.22	1.00	71.29	-.11	1.90	-.20	.10	.90	.93	70HM	C546B
C567	6	71.88	-.22	1.06	71.51	-.23	2.03	-.37	-.01 *	.97	1.03	70SC	C567
C576	6	72.23*	.07	1.20	71.92*	.17	2.13	-.31	.10	.93	.98	70HM	C576
C585	6	71.80	-.31	1.04	71.60	-.18	2.01	-.20	.13	.97	1.00	70HA	C585
C600	X	71.32*	-.12	-5.94X	71.02*	.08	-5.35X	-.30	.20	.59 X	.70X	70SC	C600
C620	6	72.13*	-.37	.79	71.72	-.25	1.66	-.41	.12	.87	.97	70HA	C620
C633	6	71.83	-.23	1.11	71.64	-.08	2.07	-.19	.15	.96	.99	70HA	C633
C647	6	71.41	.09	1.43*	71.26	.21	2.43*	-.15	.12	1.00	1.02	70HQ	C647
C648	6	71.80	-.28	.99	71.45	-.17	1.84	-.35	.11	.85	.93	70SC	C648
C655	6	71.37*	-.25	.54*	70.98*	-.14	1.46	-.39	.12	.92	1.01	70SC	C655
C662	6	72.38X	-1.98X	1.57X	72.18X	-1.78X	2.47*	-.20	.20	.89	.94	70GX	C662
C674	6	71.83	-.17	.96	71.48	-.07	1.85	-.35	.10	.89	.97	70HA	C674
C677	6	71.84	-.42	.42*	71.65	-.26	1.37*	-.18	.16	.95	.99	70SC	C677
GRAND MEANS		71.76	-.21	.94	71.50	-.11	1.88	-.27	.11	.93	.99		
SD OF MEANS		.18	.16	.19	.19	.16	.22	.14	.06	.05	.04		
INCLUDED LABS FOR THIS MEAN		52	55	56	52	55	57	58	56	58	58		

NBS VALUES FOR SPECTRAL REFLECTANCE

45/0 REFLECTANCE FACTOR

SAMPLES C92, C94, W14

WAVELENGTH (nm)	C92	C94	W14
380	.0427	.1167	.1329
390	.0452	.1899	.2255
400	.0472	.3202	.4389
410	.0481	.4143	.7091
420	.0487	.4430	.8584
430	.0492	.4607	.8974
440	.0498	.4845	.9058
450	.0504	.5020	.9107
460	.0510	.5056	.9144
470	.0517	.5055	.9178
480	.0528	.5047	.9224
490	.0546	.5053	.9256
500	.0584	.5095	.9283
510	.0673	.5135	.9306
520	.0780	.5116	.9322
530	.0841	.5062	.9335
540	.0887	.5062	.9339
550	.0978	.5085	.9340
560	.1167	.5029	.9343
570	.1437	.5014	.9350
580	.1671	.5105	.9362
590	.1818	.5177	.9368
600	.1888	.5184	.9368
610	.1912	.5169	.9363
620	.1917	.5162	.9366
630	.1911	.5174	.9370
640	.1905	.5206	.9372
650	.1896	.5279	.9372
660	.1887	.5382	.9428
670	.1882	.5537	.9305
680	.1873	.5746	.9338
690	.1870	.6016	.9367
700	.1864	.6313	.9365
710	.1856	.6632	.9371
720	.1849	.6943	.9368
730	.1843	.7223	.9378
740	.1835	.7430	.9375
750	.1826	.7576	.9381
760	.1819	.7680	.9393
770	.1813	.7731	.9406

NBS TRISTIMULUS VALUES

45/0 REFLECTANCE FACTOR

SAMPLES C92, C94, W14

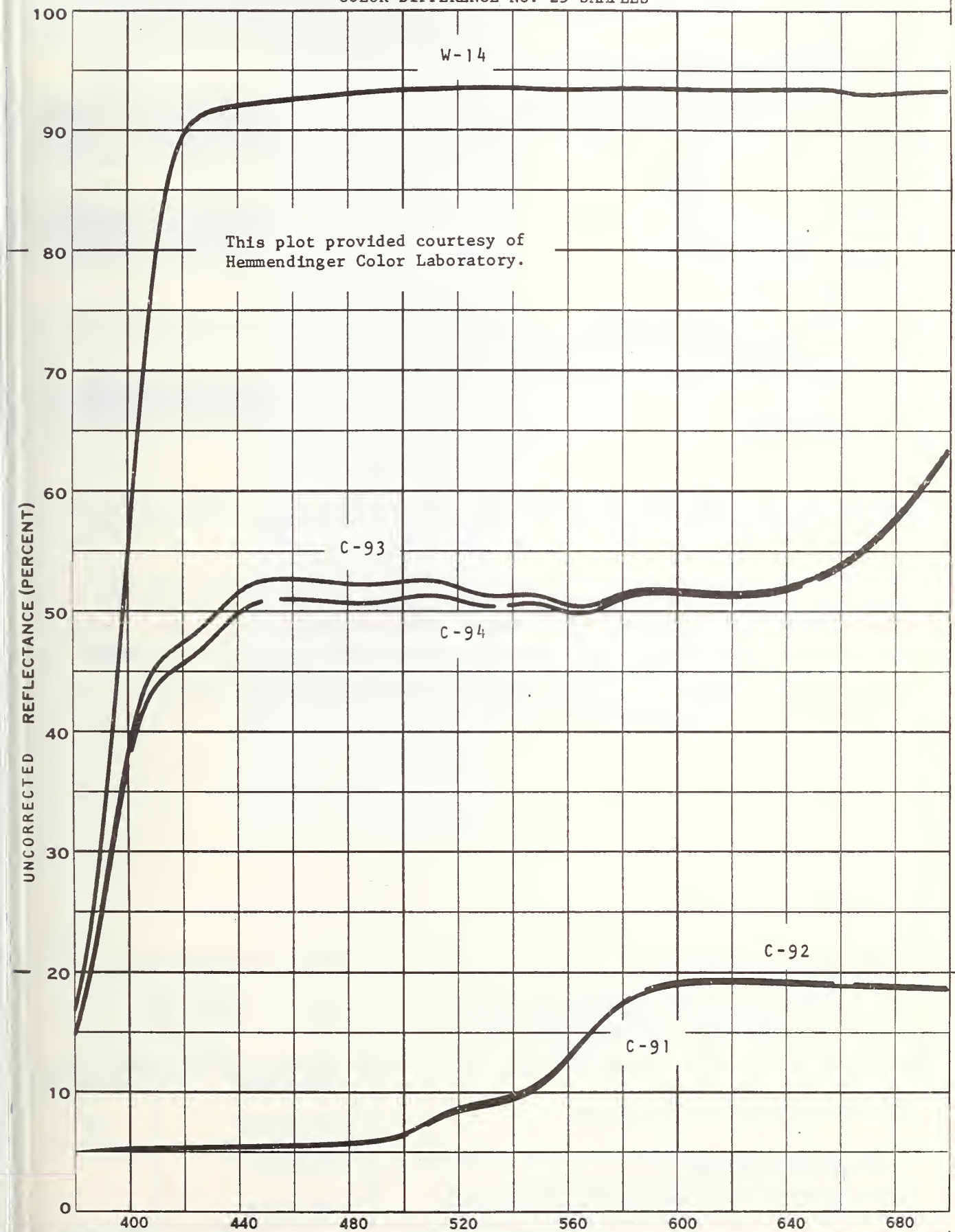
X, Y, Z SPACE

	C92	C94	W14
X	13.91	49.90	90.93
Y	12.26	50.97	93.21
Z	6.04	57.92	106.71

L, a, b SPACE

	C92	C94	W14
L	35.01	71.39	96.54
a	9.68	-0.18	-0.83
b	14.27	1.89	2.07

SPECTROPHOTOMETRIC CURVES OF COLOR AND
COLOR DIFFERENCE NO. 25 SAMPLES



NBS-114A (REV. 9-78)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. MCCA CRP Color 25	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 Report No. 25 , Color and Color Difference

5. Publication Date

April 23, 1979

6. Performing Organization Code

7. AUTHOR(S)

J. Horlick, T. L. Cummings

8. Performing Organ. Report No.

NBSIR 79-1368

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 important by-product of the programs is the provision of realistic pictures of the state of the testing art. This is one of the periodic reports showing averages for each participant, within and between laboratory variability, and other information for participants and standards committees.

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

Collaborative reference program; Color; Laboratory evaluation; Precision; Reference samples: Testing calibration

18. AVAILABILITY

☐ Unlimited

☒ For Official Distribution. Do Not Release to NTIS

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

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

19. SECURITY CLASS (THIS REPORT)	21. NO. OF PRINTED PAGES
UNCLASSIFIED	23
20. SECURITY CLASS (THIS PAGE)	**22. Price**
UNCLASSIFIED	

USCOMM-DC