

NBSIR 78-1333

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MANUFACTURERS COUNCIL ON COLOR AND APPEARANCE

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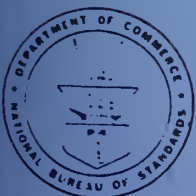
**COLLABORATIVE REFERENCE PROGRAM**  
**COLOR AND APPEARANCE**

**COLOR AND COLOR DIFFERENCE**

**REPORT NO. 22**

**U.S. DEPARTMENT OF COMMERCE**

**National Bureau of Standards**



NBS COLLABORATIVE REFERENCE PROGRAMS

TAPPI Paper and Board (6 times per year)

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

FKBG-API Containerboard (48 times per year)

Mullen burst of linerboard  
Concora test of medium

MCCA Color and Appearance (4 times per year)

Gloss at 60°  
Color and color difference  
Retroreflectivity

Rubber (4 times per year)

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

ASTM Textiles (3 times per year)

Flammability (FF3-71 and FF5-74)

ASTM Cement (2 times per year)

Chemical (11 chemical components)  
Physical (8 characteristics)

AASHTO Bituminous

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



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

MANUFACTURERS COUNCIL ON  
COLOR AND APPEARANCE

COLLABORATIVE REFERENCE PROGRAM  
FOR  
COLOR AND APPEARANCE

COLOR AND COLOR DIFFERENCE

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U. S. DEPARTMENT OF COMMERCE  
National Bureau of Standards



## 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.

NBS and NRC (National Research Council of Canada) are currently developing methods for absolute reflectance determinations. As an interim step, this report gives tentative values which are a composite based on the results reported by NBS and NRC. These tentative values may be used as guides to detect serious errors in testing. CAUTION: These values are based on results from G. E. Spectrophotometers relative to the present state of the art for absolute reflectance measurements, and are not necessarily applicable to all instruments and standards.

Reflectance values for 40 wavelengths using a 45/0 geometry instrument and colorimetric data have been provided by NBS.

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

March 20, 1978

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

## 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

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

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



## Notes on Specific Laboratory Results

- C241 - Apparent measurement or reporting error on samples C79-C80, a-value.
- C262, C325 - Apparent measurement or reporting error on all samples, L-value, and on samples C81-C82, a-value.
- C479A - Apparent measurement or reporting error on all samples, Z-value.
- C479B - Apparent measurement or reporting error on samples C79-C80, X-value.
- C499B - Apparent measurement or reporting error on samples C79-C80, b-value.
- C514B - Apparent measurement or reporting error on samples C81-C82, a, b-values.
- C519 - Apparent measurement or reporting error on samples C79-C80, Z-value.
- C524 - Apparent measurement or reporting error on samples C79-C80, Y-value.
- C538 - Apparent measurement or reporting error on all samples.
- C541 - Apparent measurement or reporting error on all samples, a-value.
- C262, C325, C495, C519 - All have some problem regarding measurement of the white sample, and should check their measurement process regarding this.



## 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 $\Delta E$ 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 $\Delta E$ 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.

$\Delta E$  - 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.

ANALYSIS C70-1 TABLE 1  
 CØLØR & CØLØR DIFFERENCE

INSTRUMENT IDENTIFICATION

INST CØDE	INSTRUMENT	CØLØR SPACE	DATA CØDE
C70BA	BECKMAN AUTC-PRØ 54	X Y Z	9014
C70BB	BECKMAN EE-G	X Y Z	9014
C70BL	E+L 505 SPECTRØPHØTØMETER	X Y Z	9014
C70CA	CARY 14	X Y Z	9014
C70CD	CØLØR EYE SMALL SPHERE	X Y Z	9014
C70CE	CØLØR EYE SMALL SPHERE	XX <sup>1</sup> YZ,4V	9016
C70CF	CØLØR EYE SMALL SPHERE	XYZ,BaSØ4	9017
C70CG	CØLØR EYE SMALL SPHERE	XX <sup>1</sup> YZ,Ba	9018
C70CH	CØLØR EYE SMALL SPHERE	XYZ,3V	9011
C70CL	CØLØR EYE LARGE SPHERE	XX <sup>1</sup> YZ,4V	9016
C70CM	CØLØR EYE LARGE SPHERE	XX <sup>1</sup> YZ,Ba	9018
C70CN	CØLØR EYE LARGE SPHERE	XYZ,BaSØ4	9017
C70DC	DIANE CBRØMASCAN	X Y Z	9014
C70DK	DIANE/LSCØ AUTØMATE	XYZ,BaSØ4	9017
C70DL	DIANE/LSCØ AUTØMATE	XYZ,3V,4F	9019
C70DM	DIANE/LSCØ AUTØMATE	XX <sup>1</sup> YZ,4V	9016
C70DT	DIANE/SSCE AUTØMATE	XYZ,BaSØ4	9017
C70GA	GARDNER AUTØ. CØLØR DIFF. METEF. AC-2A	L a b	9013
C70GB	GARDNER AUTØ. CØLØR 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	DIANE/BARDY/GE SPECTRØPHØTØMETER	X Y Z	9014
C70GG	GARDNER XL-30	X Y Z	9014
C70GK	GARDNER XL-70	X Y Z	9014
C70GL	GARDNER XL-70	L a b	9013
C70GM	GARDNER MULTIPURPOSE REFLECTØMETER	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
C70HB	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
C70KC	KCS-18	XX <sup>1</sup> YZ,4V	9016
C70KD	KCS-18	XX <sup>1</sup> YZ,Ba	9018
C70KS	KCS-18	X Y Z	9014
C70KT	KCS-40	X Y Z	9014
C70LS	LERES TRILAC	X Y Z	9014
C70LT	LERES TRILAC	XYZ,3V	9011
C70MC	MECCØ CØLØRMÄSTER V	R G B	9015
C70MS	MARTIN SWEETS	X Y Z	9014
C70MT	MARTIN SWEETS	XX <sup>1</sup> YZ,Ba	9018
C70ND	NEØTEC 220 DU CØLØR	R G B	9015
C70NE	NEØTEC 220 DU CØLØR	X Y Z	9014
C70PM	FHØTEVØLI MØDEL 501A	R G B	9015
C70PV	FHØTEVØLT MØDEL 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 ELREPHØ	X Y Z	9014
C70ZF	ZEISS ELREPHØ	R G B	9015
C70XX	GIVE INSTRUMENT MAKE+MØDEL.	NOT SPECIFIED	9020

FORMAT OF CØLØRMETRIC (INPUT) DATA

DATA CØDE	CØLØR SCALE
9011	X,Y,Z 3 FUNCTION VITRØLITE CØRRECTION
9012	Rd,a,b
9013	L,a,b HUNTER
9014	X,Y,Z
9015	k,G,B
9016	X,X <sup>1</sup> ,Y,Z 4 FUNCTION VITRØLITE CØRRECTION
9017	X,Y,Z, BaSØ4 CØRRECTION
9018	X,X <sup>1</sup> ,Y,Z BaSØ4 CØRRECTION
9019	X,Y,Z 4 FUNCTION VITRØLITE CØRRECTION
9020	(NON-STD. INST. SCALE SPECIFIED WITH DATA)

LAB CODE	F	SAMPLE C79			SAMPLE C80			DIFFERENCE C80 - C79			ΔE	INST CODE	LAB
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ			
C122	⊗	48.50	44.10	16.80	48.00	43.35	16.95	-.50	-.75	.15	2.45	70SA C122	
C162	⊗	45.45	44.73	17.55	45.23	44.17	17.83	-.22	-.56	.24	2.76	70DC C162	
C200	⊗	48.77	43.92	17.66	48.41	43.24	17.92	-.36	-.68	.26	2.86	70GE C200	
C244	⊗	48.26	42.30	15.94X	47.92	41.60	16.24*	-.34	-.70	.30	3.30	70SA C244	
C250	⊗	45.33	44.30	17.12	45.00	43.60	17.48	-.33	-.70	.35 *	3.19	70ZF C250	
C251	X	48.46	42.60	16.65	48.28	42.20	17.01	-.18	-.40 *	.36 *	2.07X	70ZE C251	
C314	⊗	48.66	44.20	18.16*	48.24	43.35	18.22	-.42	-.81	.06	3.43*	70CE C314	
C407	⊗	49.10	43.84	17.19	48.70	43.16	17.43	-.40	-.68	.24	2.65	70SA C407	
C412A	⊗	48.33	43.29	17.50	48.08	42.74	17.76	-.25	-.55	.27	2.65	70GE C412A	
C412B	⊗	48.10	43.10	17.37	47.84	42.53	17.63	-.26	-.57	.26	2.68	70GE C412B	
C414	X	45.75	45.12	18.12	45.35	44.21	18.26	-.37	-.91	.14	4.50X	70SA C414	
C416A	⊗	48.74	43.36	17.19	48.36	42.66	17.38	-.38	-.70	.19	2.95	70SA C416A	
C416B	⊗	48.72	43.55	17.25	48.35	42.90	17.45	-.38	-.69	.15	2.91	70SA C416B	
C417B	⊗	48.45	42.85	16.79	48.14	42.21	16.95	-.31	-.63	.16	2.94	70HN C417B	
C418	⊗	45.24	44.54	18.07	48.94	44.30	18.25	-.25	-.64	.18	2.94	70CE C418	
C422	⊗	47.48	42.07	16.77	47.02	41.27	16.90	-.46	-.81	.13	3.33	70SA C422	
C423	⊗	50.32*	44.76	18.22*	45.80*	43.56	18.42*	-.52	-.81	.20	2.82	70GE C423	
C428	⊗	45.23	43.73	17.21	48.97	43.17	17.45	-.26	-.57	.28	2.67	70HF C428	
C437	X	48.66	44.55	18.10	48.48	43.86	18.25	-.17	-.69	.15	4.11X	70CE C437	
C443	⊗	49.18	43.72	17.03	48.68	42.56	17.17	-.45	-.76	.14	2.73	70CN C443	
C444	⊗	48.61	43.67	17.30	48.10	42.84	17.43	-.50	-.83	.13	3.11	70GE C444	
C445	⊗	45.19	44.01	18.20*	48.77	43.27	18.37*	-.41	-.74	.17	2.94	70LS C445	
C446A	⊗	48.03	42.81	17.22	47.57	42.05	17.34	-.46	-.77	.12	2.96	70GE C446A	
C446B	⊗	48.40	43.28	17.29	47.87	42.46	17.42	-.52	-.82	.13	2.94	70CA C446B	
C451	⊗	48.71	43.80	17.56	48.12	42.92	17.70	-.59	-.89	.14	2.95	70GE C451	
C455	⊗	47.57	42.85	16.89	47.05	41.73	16.98	-.52	-.81	.05	2.94	70GE C455	
C460	⊗	48.56	43.54	17.20	48.05	42.74	17.37	-.51	-.81	.17	2.87	70GE C460	
C463	⊗	48.81	43.58	17.23	48.28	42.73	17.35	-.53	-.85	.12	3.13	70ZD C463	
C467A	⊗	48.31	43.23	17.18	47.98	42.62	17.45	-.33	-.61	.27	2.54	70GE C467A	
C467B	⊗	48.86	43.10	16.95	48.62	42.51	17.15	-.24	-.59	.24	3.02	70HF C467B	
C469	⊗	48.71	43.88	17.22	48.32	43.17	17.36	-.39	-.71	.14	2.90	70GE C469	
C470	⊗	45.23	44.14	18.05	45.03	43.65	18.35*	-.20	-.45	.34	2.44	70GE C470	
C472	⊗	48.82	43.73	17.68	48.46	43.04	17.86	-.36	-.70	.18	3.00	70ZD C472	
C473	⊗	48.06	42.71	17.13	47.64	42.00	17.33	-.43	-.72	.20	2.81	70GE C473	
C474	⊗	48.40	43.26	17.21	48.13	42.67	17.45	-.27	-.58	.24	2.75	70GE C474	
C476	⊗	48.44	43.21	17.51	48.14	42.58	17.73	-.30	-.63	.22	2.88	70SA C476	
C475A	⊗	48.50	43.15	25.00X	48.35	42.70	25.30X	-.15 *	-.45 *	.30	2.45	70SA C475A	
C479B	X	45.27	44.04	18.05	45.90*	43.48	18.06	.63 X	-.56	.01 *	5.45X	70SA C479B	
C480	⊗	47.53	42.08	13.50X	47.10	41.36	13.63X	-.42	-.72	.13	2.91	70HB C480	
C481	⊗	49.26	44.40	17.64	48.90	43.64	17.86	-.36	-.76	.22	3.44*	70KS C481	
C495	⊗	55.18X	45.15X	16.82X	54.72X	48.35X	20.13X	-.46	-.80	.31	2.93	70KS C495	
C495A	⊗	48.33	43.26	17.21	48.05	42.67	17.45	-.27	-.59	.24	2.76	70GF C495A	
C503	⊗	48.08	42.98	17.03	47.70	42.30	17.20	-.38	-.68	.17	2.80	70GE C503	
C508	⊗	48.17	43.09	17.15	47.50	42.13	17.20	-.68 *	-.97 *	.01 *	3.14	70GE C508	
C511	⊗	45.04	44.08	17.88	48.66	43.43	18.18	-.38	-.66	.30	2.55	70BA C511	
C516	⊗	48.93	44.43	17.20	48.65	43.83	17.39	-.24	-.60	.19	2.95	70RI C516	
C519	⊗	46.71*	42.13	15.83X	46.39*	41.46	16.01X	-.32	-.67	.18	3.13	70KS C519	
C521A	⊗	45.01	43.69	17.36	48.66	43.03	17.54	-.35	-.67	.17	2.88	70CA C521A	
C521B	⊗	50.12*	44.55	17.32	45.54	43.65	17.61	-.58	-.89	.30	3.17	70SA C521B	
C522	X	47.57	42.35	16.07*	47.39	41.74	16.30*	-.18	-.65	.23	3.94X	70SA C522	
C524	⊗	46.52*	40.75X	16.79	46.44*	40.00X	16.98	-.48	-.74	.15	2.50	70SA C524	
C526	⊗	48.31	43.71	17.32	47.96	43.04	17.56	-.35	-.67	.23	2.84	70KS C526	
C528	⊗	47.66	42.53	17.17	47.28	41.83	17.31	-.38	-.70	.13	2.95	70SA C528	
C531	⊗	48.80	44.00	17.48	48.51	43.41	17.75	-.29	-.59	.27	2.61	70GE C531	
C532	⊗	48.52	43.63	17.70	48.15	43.02	17.57	-.33	-.61	.27	2.52	70SA C532	
C534	⊗	48.47	43.80	16.64	48.16	43.17	16.82	-.31	-.63	.18	2.80	70GE C534	
C536	⊗	48.13	43.00	17.15	47.86	42.43	17.38	-.27	-.57	.23	2.61	70KS C536	
C537	⊗	50.25*	45.82*	17.14	45.79*	45.08*	17.35	-.46	-.75	.21	2.62	70DM C537	
C540	⊗	48.46	43.33	17.70	48.18	42.75	17.93	-.28	-.59	.23	2.65	70GE C540	
C545	⊗	47.53	42.82	16.82	47.54	42.11	17.02	-.39	-.71	.21	2.97	70SA C545	
C548	⊗	47.95	41.60*	16.80	47.50	40.50*	17.00	-.45	-.70	.20	2.67	70SA C548	
C549	⊗	46.26X	41.41*	16.23*	46.13*	41.00*	16.62	-.13 *	-.41 *	.39 *	2.48	70GE C549	
C552	⊗	48.20	42.74	16.92	47.83	42.11	17.17	-.36	-.63	.25	2.56	70HN C552	

GRAND MEANS

48.57 43.46 17.25 48.16 42.77 17.47 -.38 -.69 .21 2.86

SD OF MEANS

.69 .83 .41 .75 .82 .45 .11 .11 .07 .24

INCLUDED LABS FOR THIS MEAN

⊕6      ⊕6      ⊕3      ⊕7      ⊕6      ⊕4      ⊕8      ⊕8      ⊕8      ⊕8

Tentative values:  
(absolute reflectance)    C79                    C80  
                                 X=48.12                    X=47.68  
                                 Y=43.09                    Y=42.34  
                                 Z=17.26                    Z=17.41

LAB CODE	F	SAMPLE C81			SAMPLE C82			DIFFERENCE C82 - C81			INST CODE	LAB
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	$\Delta$ X	$\Delta$ Y	$\Delta$ Z		
C122	X	9.20	12.30	13.20	8.60	11.60	12.70	-.60	-.70	-.50	3.41X	70SA C122
C162	$\emptyset$	9.63	12.65	13.86	9.14	12.00	13.32	-.50	-.65	-.54	2.36	70DC C162
C200	$\emptyset$	9.49	12.46	13.73	8.96	11.79	13.29	-.53	-.67	-.44	2.84	70GE C200
C244	$\emptyset$	8.76	11.77	12.93	8.16*	11.15	12.19	-.60	-.63	-.74 *	3.15*	70SA C244
C250	$\emptyset$	9.25	12.50	13.70	8.88	11.90	13.35	-.37	-.60	-.35	2.32	70ZF C250
C251	$\emptyset$	9.24	12.20	13.11	8.87	11.60	12.75	-.37	-.60	-.36	2.40	70ZE C251
C314	$\emptyset$	10.06	12.94	14.37	9.56	12.32	13.60	-.50	-.61	-.57	2.23	70GE C314
C407	$\emptyset$	9.64	12.50	13.41	9.33	12.06	13.17	-.31 *	-.43 *	-.25 *	1.71	70SA C407
C412A	$\emptyset$	9.53	12.52	13.77	9.09	11.56	13.12	-.43	-.56	-.45	2.11	70GE C412A
C4128	$\emptyset$	9.48	12.46	13.48	9.05	11.90	13.05	-.43	-.56	-.43	2.12	70GE C4128
C414	$\emptyset$	10.00	12.92	14.32	9.53	12.31	13.78	-.48	-.61	-.54	2.18	70SA C414
C416A	$\emptyset$	9.33	12.36	13.34	8.92	11.80	12.92	-.41	-.56	-.42	2.09	70SA C416A
C4168	$\emptyset$	9.37	12.38	13.41	8.83	11.70	12.83	-.54	-.68	-.58	2.60	70SA C4168
C4178	$\emptyset$	9.07	12.03	12.75	8.59	11.42	12.26	-.48	-.61	-.49	2.39	70HN C4178
C418	$\emptyset$	9.83	12.95	14.25	9.31	12.29	13.68	-.52	-.70	-.57	2.45	70CE C418
C422	$\emptyset$	9.04	11.88	12.49	8.61	11.33	12.08	-.43	-.55	-.41	2.17	70SA C422
C423	$\emptyset$	9.94	13.06	14.65	9.47	12.47	13.54	-.47	-.60	-.51	2.17	70GE C423
C428	$\emptyset$	9.24	12.20	13.05	8.70	11.52	12.47	-.54	-.68	-.58	2.66	70HB C428
C437	$\emptyset$	9.55	12.81	14.67*	9.39	12.17	14.12*	-.56	-.64	-.55	2.81	70CE C437
C443	$\emptyset$	9.54	12.42	13.48	9.03	11.82	12.99	-.50	-.60	-.49	2.55	70CN C443
C444	$\emptyset$	9.25	12.25	13.54	8.83	11.66	13.07	-.45	-.59	-.47	2.27	70GE C444
C445	$\emptyset$	9.65	12.86	14.18	9.32	12.21	13.62	-.52	-.64	-.56	2.48	70LS C445
C446A	$\emptyset$	9.46	12.43	13.24	8.96	11.80	12.81	-.50	-.63	-.53	2.35	70GE C446A
C4468	$\emptyset$	9.51	12.45	13.58	9.05	11.90	13.02	-.46	-.59	-.55	2.10	70CA C4468
C451	$\emptyset$	9.32	12.25	13.46	8.81	11.63	12.67	-.51	-.65	-.59	2.42	70GE C451
C459	$\emptyset$	9.25	12.14	13.23	8.72	11.49	12.66	-.53	-.65	-.57	2.63	70GE C459
C460	$\emptyset$	9.31	12.28	13.45	8.83	11.66	12.93	-.49	-.62	-.52	2.36	70GE C460
C463	$\emptyset$	9.44	12.44	13.61	8.90	11.77	13.01	-.55	-.67	-.59	2.61	70ZD C463
C467A	$\emptyset$	9.04	12.00	13.18	8.65	11.49	12.78	-.40	-.52	-.40	2.01	70GE C467A
C4678	$\emptyset$	9.17	12.23	12.89	8.75	11.67	12.47	-.42	-.56	-.42	2.14	70bE C4678
C469	$\emptyset$	8.94	11.90	13.34	8.40	11.23	12.76	-.54	-.67	-.58	2.73	70GE C469
C470	$\emptyset$	9.57	12.58	14.32	9.50	12.37	13.82	-.47	-.61	-.50	2.22	70GF C470
C472	$\emptyset$	9.68	12.87	14.30	9.32	12.20	13.71	-.56	-.67	-.59	2.67	70ZD C472
C473	$\emptyset$	9.36	12.39	13.20	8.88	11.77	12.80	-.48	-.61	-.50	2.34	70GE C473
C474	$\emptyset$	9.43	12.40	13.24	8.99	11.85	12.92	-.44	-.55	-.42	2.22	70GE C474
C476	$\emptyset$	9.65	12.61	13.66	9.28	12.10	13.51	-.38	-.50	-.35	1.92	70SA C476
C479A	$\emptyset$	9.20	12.00	21.75X	8.90	11.50	21.50X	-.30 *	-.50	-.25 *	2.30	70SA C479A
C4798	$\emptyset$	9.89	12.84	14.12	9.51	12.40	13.63	-.38	-.45 *	-.49	1.66*	70SA C4798
C480	$\emptyset$	8.90	11.80	12.70	8.41	11.19	12.17	-.49	-.61	-.53	2.43	70HE C480
C481	$\emptyset$	9.80	12.70	14.27	9.30	12.04	13.70	-.50	-.66	-.57	2.37	70KS C481
C495	$\emptyset$	11.07X	14.33X	15.93X	10.40X	13.59X	15.21X	-.67 *	-.80 *	-.72 *	2.97*	70KS C495
C496A	$\emptyset$	9.23	12.21	13.33	8.80	11.66	12.90	-.43	-.55	-.43	2.16	70GE C496A
C503	$\emptyset$	9.26	12.18	13.26	8.72	11.50	12.68	-.54	-.68	-.58	2.63	70GE C503
C508	$\emptyset$	9.24	12.21	13.24	8.75	11.58	12.71	-.50	-.63	-.52	2.42	70GE C508
C511	$\emptyset$	9.71	12.77	14.03	9.17	12.09	13.46	-.54	-.68	-.57	2.58	70EA C511
C516	$\emptyset$	9.13	11.89	13.26	8.69	11.33	12.90	-.44	-.56	-.46	2.20	70KT C516
C519	$\emptyset$	9.30	12.63	12.62	8.93	12.11	12.25	-.37	-.51	-.37	1.86	70KS C519
C521A	$\emptyset$	9.58	12.61	13.53	9.14	12.00	13.00	-.44	-.61	-.53	2.13	70CA C521A
C5218	$\emptyset$	9.51	12.62	13.78	9.22	12.30	13.51	-.29 *	-.32 X	-.27 *	1.66*	70SA C5218
C522	$\emptyset$	8.92	12.29	12.62	8.51	11.71	12.18	-.42	-.58	-.44	2.12	70SA C522
C524	$\emptyset$	9.55	12.61	12.75	9.12	12.07	12.34	-.43	-.54	-.41	2.08	70SA C524
C526	$\emptyset$	9.61	12.38	13.95	9.11	11.76	13.41	-.50	-.62	-.54	2.35	70KS C526
C528	$\emptyset$	9.38	12.26	13.39	8.90	11.66	12.87	-.48	-.61	-.51	2.31	70SA C528
C531	$\emptyset$	9.63	12.55	14.08	9.35	12.14	13.83	-.27 *	-.41 *	-.25 *	1.58*	70GE C531
C532	$\emptyset$	9.40	12.36	13.52	8.94	11.79	13.05	-.45	-.58	-.47	2.23	70SA C532
C534	$\emptyset$	8.83	11.50*	12.95	8.36	10.90*	12.42	-.47	-.61	-.53	2.33	70GE C534
C536	$\emptyset$	9.46	12.42	13.57	9.04	11.87	13.13	-.42	-.55	-.44	2.05	70KS C536
C537	$\emptyset$	10.27*	13.45*	13.53	9.80*	12.83*	13.02	-.47	-.63	-.51	2.13	70DM C537
C540	$\emptyset$	9.92	12.91	13.92	9.58	12.42	13.60	-.35	-.49	-.32	1.81	70GE C540
C545	$\emptyset$	9.05	12.00	13.03	8.56	11.38	12.52	-.49	-.62	-.52	2.44	70SA C545
C548	$\emptyset$	9.05	12.05	12.50	8.50	11.40	12.00	-.55	-.65	-.50	2.94	70SA C548
C549	$\emptyset$	8.56*	11.40*	12.65	8.05*	10.76*	12.09	-.51	-.64	-.56	2.60	70GE C549
C552	$\emptyset$	9.21	12.15	12.78	8.69	11.51	12.23	-.52	-.64	-.55	2.52	70HN C552

GRAND MEANS

9.43 12.40 13.48 8.56 11.81 12.99 -.47 -.60 -.49 2.32

SD OF MEANS

.35 .39 .53 .36 .40 .53 .08 .07 .10 .32

INCLUDED LABS FOR THIS MEAN

61 61 60 61 60 62 61 62 62

Tentative values:  
(absolute reflectance) C81 X= 9.40  
Y=12.34  
Z=13.43  
C82 X= 8.88  
Y=11.69  
Z=12.92

LAB CODE	F	SAMPLE C79			SAMPLE C80			DIFFERENCE C80 - C79			INST CODE	LAB
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB		
C105	θ	65.55	17.00	30.40	65.00	18.00	29.70	-0.55	1.00	-0.70	1.34	70HM C105
C121A	θ	65.10	17.80	29.80	64.70	18.70	29.10	-0.40	.90	-0.70	1.21	70HM C121A
C14B	θ	65.70	17.20	30.20	65.25	18.00	29.50	-0.45	.80	-0.70	1.15	70HA C14B
C150	θ	65.67	17.40	30.50	65.08	18.39	29.82	-0.59	1.00	-0.68	1.34	70HA C150
C152	θ	66.30	16.70	30.50	65.80	17.60	29.80	-0.50	.90	-0.70	1.24	70HA C152
C213	θ	65.00	17.20	29.50*	64.50	18.00	28.60*	-0.50	.80	-0.90 X	1.30	70HM C213
C241	θ	66.55	22.10X	30.15	65.90	23.10X	29.95	-0.65	1.00	-0.20 X	1.21	70HA C241
C253	θ	65.78	17.77	30.38	65.16	18.80	29.72	-0.62	1.03	-0.67	1.38	70GC C253
C256	θ	65.59	17.33	30.24	65.08	18.30	29.58	-0.51	.97	-0.65	1.27	70FM C256
C259	θ	65.75	17.45	30.10	65.15	18.40	29.40	-0.60	.95	-0.70	1.32	70HA C259
C262	θ	42.99X	17.27	30.89	42.32X	18.24	30.30	-0.67	.97	-0.59	1.32	70HA C262
C285	θ	66.60	15.00	30.50	66.10	16.00	29.90	-0.50	1.00	-0.60	1.27	70HA C285
C288	θ	66.30	16.70	30.50	65.90	17.75	29.90	-0.40	1.05	-0.60	1.27	70HA C288
C291	θ	65.75	16.90	30.20	65.25	17.85	29.65	-0.50	.95	-0.65	1.25	70HA C291
C317	θ	65.30	17.80	29.70	64.70	18.70	29.00	-0.60	.90	-0.70	1.29	70HM C317
C325	θ	42.10X	17.45	30.30	41.50X	18.45	29.70	-0.60	1.00	-0.60	1.31	70HA C325
C352	θ	65.90	16.25	30.50	65.45	17.20	29.90	-0.45	.95	-0.60	1.21	70HA C352
C356	θ	65.50	17.30	30.20	64.90	18.20	29.50	-0.60	.90	-0.70	1.29	70HM C356
C382	θ	65.70	16.30	30.25	65.15	17.30	29.60	-0.55	1.00	-0.65	1.31	70HA C382
C417A	θ	65.31	16.65	30.08	64.68	17.80	29.40	-0.63	.95	-0.68	1.32	70GE C417A
C420	θ	65.70	19.50	30.60	65.25	20.40	29.90	-0.45	.90	-0.70	1.23	70HA C420
C424	θ	66.03	16.22	30.11	65.45	17.22	29.42	-0.57	1.01	-0.68	1.35	70CA C424
C440	θ	65.87	18.06	30.64	65.39	19.02	30.20	-0.48	.96	-0.64	1.25	70HA C440
C442	θ	65.70	16.80	30.40	65.20	17.70	29.70	-0.50	.90	-0.70	1.24	70HM C442
C454	θ	64.82	18.18	29.48*	64.24	19.23	28.80*	-0.58	1.05	-0.68	1.38	70HA C454
C456	θ	65.99	17.06	30.55	65.57	17.97	29.91	-0.42	.91	-0.65	1.19	70HA C456
C458	θ	65.63	17.35	30.11	65.10	18.29	29.44	-0.52	.94	-0.66	1.27	70HM C458
C475	θ	65.39	19.18	29.93	64.75	20.16	29.22	-0.63	.98	-0.70	1.36	70HA C475
C477	θ	65.42	18.26	29.56	64.90	19.27	29.34	-0.52	1.00	-0.62	1.29	70HA C477
C483	θ	64.77	20.51*	29.78	64.27	21.29*	29.19	-0.50	.79	-0.58	1.10*	707F C483
C494	θ	66.20	17.30	30.20	65.70	18.05	29.60	-0.50	.75 *	-0.60	1.08*	70HA C494
C498	θ	65.35	16.50	30.60	64.80	17.50	30.00	-0.55	1.00	-0.60	1.29	70HQ C498
C499A	θ	65.80	17.40	30.30	65.25	18.25	29.60	-0.55	.85	-0.70	1.23	70SC C499A
C499B	X	65.00	20.50*	25.60X	65.10	21.30*	25.00X	.10 X	.80	-0.60	1.00X	70SC C499B
C506	θ	65.95	17.53	30.30	65.50	18.40	29.70	-0.45	.90	-0.60	1.17	70HA C506
C514A	θ	65.40	20.80*	30.03	64.88	21.74*	29.33	-0.52	.94	-0.70	1.29	70GD C514A
C514B	θ	66.00	19.70	30.30	65.60	20.60	29.70	-0.40	.90	-0.60	1.15	70GX C514B
C538	θ	67.35X	16.30	31.10*	66.80X	17.20	30.40*	-0.55	.90	-0.70	1.27	70CX C538
C541	θ	66.50	9.40X	30.40	66.05	10.20X	29.65	-0.45	.80	-0.75	1.19	70GP C541
C543	θ	66.45	15.40	30.40	65.90	16.50	29.60	-0.55	1.10 *	-0.80 *	1.47*	70SC C543
C544	θ	65.70	17.80	30.10	65.10	18.70	29.45	-0.60	.90	-0.65	1.26	70HA C544
C546A	θ	64.65	18.40	29.90	64.10	19.40	29.20	-0.55	1.00	-0.70	1.34	70HQ C546A
C546B	θ	64.80	17.40	30.00	64.10	18.25	29.30	-0.70 *	.85	-0.70	1.30	70RM C546B
C547	θ	64.99	17.75	30.13	64.45	18.70	29.47	-0.54	.95	-0.66	1.28	70HQ C547
C550	θ	65.60	16.10	30.45	65.25	16.95	29.80	-0.35 *	.85	-0.65	1.13	70HA C550
C576	θ	65.05	15.17	30.45	64.47	16.10	29.75	-0.57	.92	-0.69	1.29	70HM C576
GRAND MEANS		65.65	17.40	30.25	65.12	18.34	29.59	-0.53	.94	-0.67	1.27	
SD OF MEANS		.50	1.22	.33	.52	1.20	.36	.08	.08	.05	.08	
INCLUDED LABS FOR THIS MEAN		42	43	45	42	43	45	45	45	43	45	

LAB CODE	F	SAMPLE C81			SAMPLE C82			DIFFERENCE C82 - C81			INST	
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB	ΔF	C8DF LAB
C105	θ	34.80	-13.70	2.40	33.80	-13.50	2.10	-1.00	.20	-.30	1.06	70HM C105
C121A	θ	34.80	-13.80	2.55	33.80	-13.60	2.30	-1.00	.20	-.25	1.05	70HM C121A
C148	θ	35.00	-14.10	2.50	34.10	-13.85	2.20	-.90	.25	-.30	.98	70HA C148
C150	θ	35.19	-13.95	2.51	34.19	-13.70	2.17	-.99	.25	-.34	1.07	70HA C150
C152	θ	35.40	-14.20	2.70	34.50	-14.00	2.30	-.90	.20	-.40	1.00	70BA C152
C213	θ	34.70	-13.60	2.50	34.30	-12.50X	2.20	-.40 X	1.10 X	-.30	1.21*	70HM C213
C241	θ	35.00	-13.70	2.50	34.20	-13.75	2.05	-.80	-.05 X	-.45 *	.92	70HA C241
C253	θ	35.08	-13.81	2.72	34.13	-13.58	2.41	-.95	.23	-.30	1.07	70GC C253
C256	θ	34.96	-13.96	2.68	33.96	-13.76	2.36	-1.00	.20	-.31	1.07	70BM C256
C259	θ	34.80	-13.80	2.70	34.05	-13.50	2.30	-.75	.30	-.40	.90	70HA C259
C262	X	12.51X	-16.90X	2.66	11.97X	-16.78X	2.26	-.54 X	.13	-.40	.69X	70HA C262
C285	θ	36.50X	-13.50	3.50*	35.70X	-13.10*	3.20*	-.80	.40 *	-.30	.94	70HA C285
C288	θ	35.30	-14.00	2.20	34.50	-13.65	1.85	-.80	.35	-.35	.94	70HA C288
C291	θ	35.00	-13.80	2.70	34.10	-13.60	2.30	-.50	.20	-.40	1.60	70HA C291
C317	θ	34.70	-13.75	2.40	33.70	-13.50	2.00	-1.00	.25	-.40	1.11	70BM C317
C325	θ	12.60X	-17.20X	3.15	12.00X	-17.00X	2.75	-.60 X	.20	-.40	.75*	70HA C325
C352	θ	35.10	-14.00	2.40	34.30	-13.70	2.10	-.80	.30	-.30	.91	70HA C352
C356	θ	34.70	-13.60	2.30	33.80	-13.40	1.90	-.90	.20	-.40	1.00	70HM C356
C382	θ	35.05	-14.00	2.40	34.05	-13.70	2.10	-1.00	.30	-.30	1.09	70HA C382
C417A	θ	34.94	-14.02	1.85	34.07	-13.71	1.44	-.86	.37	-.41	1.02	70GE C417A
C420	θ	35.50	-14.20	1.70	34.70	-14.00	1.40	-.80	.20	-.30	.68	70HA C420
C424	θ	35.76*	-13.81	1.80	34.75	-13.56	1.50	-1.01	.25	-.30	1.05	70CA C424
C440	θ	35.30	-14.14	2.76	34.46	-13.89	2.42	-.84	.25	-.33	.93	70HA C440
C442	θ	34.80	-13.90	2.00	33.90	-13.60	1.60	-.90	.30	-.40	1.03	70HM C442
C454	θ	34.89	-13.42*	1.80	34.10	-13.12*	1.46	-.79	.30	-.32	.90	70HA C454
C456	θ	35.24	-14.05	2.36	34.41	-13.79	2.03	-.83	.26	-.33	.93	70HA C456
C458	θ	34.65	-13.74	2.08	33.92	-13.56	1.78	-.93	.18	-.70	.69	70HM C458
C475	θ	35.30	-13.79	1.58	34.44	-13.60	1.25	-.86	.19	-.33	.94	70HA C475
C477	θ	35.37	-13.82	1.91	34.58	-13.60	1.59	-.78	.22	-.31	.87	70HA C477
C483	θ	35.50	-14.22	2.37	34.64	-14.27*	2.22	-.86	-.05 X	-.14 X	.87	70ZF C483
C494	θ	35.30	-14.10	1.80	34.45	-13.85	1.45	-.85	.25	-.35	.95	70HA C494
C498	θ	34.40	-13.40*	1.60	33.40	-13.30	1.30	-1.00	.10 *	-.30	1.05	70HQ C498
C499A	θ	34.70	-14.05	2.30	33.90	-13.80	2.00	-.80	.25	-.30	.89	70SC C499A
C499B	θ	34.30	-14.40*	2.40	33.30*	-14.25*	2.30	-1.00	.15	-.10 X	1.02	70SC C499B
C506	θ	35.10	-13.90	2.65	34.10	-13.70	2.30	-1.00	.20	-.25	1.08	70HA C506
C514A	θ	35.23	-14.33	2.77	34.34	-14.03	2.44	-.89	.30	-.72	.99	70GD C514A
C514B	θ	35.25	-11.95X	.10X	34.35	-11.70X	-.20X	-.90	.25	-.30	.98	70GX C514B
C538	θ	35.20X	-13.00X	1.00*	35.30X	-12.80X	.65X	-.90	.20	-.35	.99	70GX C538
C541	θ	34.50	-15.60X	3.20	33.60	-15.20X	2.70	-.90	.40 *	-.50 X	1.10	70GP C541
C543	θ	35.35	-14.00	2.40	34.45	-13.80	2.10	-.90	.20	-.70	.97	70SC C543
C544	θ	35.00	-14.10	2.65	34.20	-13.90	2.35	-.80	.20	-.30	.88	70HA C544
C546A	θ	34.20*	-13.65	1.70	33.40	-13.40	1.40	-.80	.25	-.30	.89	70HQ C546A
C546B	θ	34.55	-13.75	2.60	33.60	-13.50	2.30	-.95	.25	-.30	1.03	70HM C546B
C547	θ	34.67	-13.70	1.80	33.82	-13.41	1.47	-.85	.29	-.33	.96	70HQ C547
C550	θ	34.90	-14.00	2.60	34.10	-13.70	2.30	-.80	.30	-.30	.91	70HA C550
C576	θ	34.54	-13.83	2.57	33.68	-13.58	2.25	-.86	.25	-.32	.95	70HM C576
GRAND MEANS		34.99	-13.89	2.34	34.10	-13.67	2.05	-.89	.25	-.33	.98	
SD OF MEANS		.35	.23	.48	.36	.25	.43	.08	.06	.04	.08	
INCLUDED LABS PER THIS MEAN		42	41	44	42	40	43	43	42	42	45	



LAB CODE	RATIO--(LAB/COMBINED)			INST CODE	PERCENT FROM COMBINED		
	X	Y	Z		X	Y	Z
C122	.9588	.9559	1.0020	70SA	-.12	-.41	.20
C162	1.0132	1.0114	1.0130	70DC	1.32	1.14	1.30
C200	1.0077	1.0073	1.0091	70GE	.77	.73	.91
C244	.9543	.9888	.9570	70SA	-.57	-1.12	-.30
C250	.9588	.9980	1.0006	70ZF	-.12	-.20	.06
C251	1.0013	1.0002	1.0006	70ZE	.13	.02	.06
C314	1.0125	1.0092	1.0134	70CE	1.25	.98	1.34
C407	1.0154	1.0130	1.0137	70SA	1.54	1.30	1.37
C412A	1.0075	1.0076	1.0085	70GE	.75	.76	.85
C412B	1.0019	1.0024	1.0010	70GE	.15	.24	.10
C414	1.0177	1.0140	1.0231	70SA	1.77	1.40	2.31
C416A	1.0174	1.0168	1.0160	70SA	1.74	1.68	1.60
C416B	1.0201	1.0203	1.0176	70SA	2.01	2.03	1.76
C417B	.9975	.9565	1.0005	70BN	-.25	-.35	.05
C418	1.0276	1.0252	1.0052	70CE	2.76	2.52	3.92
C422	.9842	.9830	.9807	70SA	-1.58	-1.70	-1.93
C423	1.0521	1.0526	1.0544	70GE	5.21	5.26	5.44
C428	1.0056	1.0034	1.0109	70BB	.56	.34	1.09
C437	1.0055	1.0078	1.0224	70CE	.99	.78	2.24
C443	1.0108	.9590	1.0066	70CN	1.08	-.10	.66
C444	1.0052	1.0098	1.0120	70GE	.92	.98	1.20
C445	1.0260	1.0253	1.0327	70LS	2.60	2.57	3.27
C446A	.9978	.9974	.9595	70GE	-.22	-.26	-.01
C446B	1.0009	1.0005	1.0036	70CA	.05	.05	.36
C451	1.0105	1.0127	1.0104	70GE	1.09	1.27	1.04
C455	.9546	.9953	.9911	70GE	-.54	-.47	-.89
C460	1.0150	1.0163	1.0161	70GE	1.50	1.63	1.61
C463	1.0110	1.0101	1.0125	70ZD	1.10	1.01	1.25
C467A	1.0129	1.0144	1.0149	70GE	1.25	1.44	1.49
C467B	1.0077	1.0057	1.0055	70BB	.77	.57	.95
C469	1.0182	1.0170	1.0266	70GE	1.82	1.70	2.66
C470	1.0232	1.0222	1.0323	70GE	2.32	2.22	3.23
C472	1.0086	1.0075	1.0109	70ZD	.86	.79	1.09
C473	1.0072	1.0077	1.0102	70GE	.72	.77	1.02
C474	1.0103	1.0105	1.0084	70GE	1.03	1.05	.84
C476	1.0043	1.0030	1.0060	70SA	.43	.30	.60
C479A	.9960	.9575	.9865	70SA	-.40	-.25	-1.31
C479B	1.0228	1.0225	1.0275	70SA	2.28	2.25	2.75
C480	1.0052	1.0024	1.0117	70BB	.52	.24	1.17
C481	1.0240	1.0210	1.0324	70ES	2.40	2.10	3.24
C495	1.1441	1.1388	1.1493	70ES	14.41	13.88	14.93
C496A	1.0120	1.0127	1.0057	70GE	1.20	1.27	.97
C503	1.0110	1.0113	1.0076	70GE	1.10	1.13	.76
C508	1.0079	1.0082	1.0071	70GE	.79	.82	.71
C511	1.0048	1.0047	1.0043	70BA	.48	.47	.43
C516	1.0050	1.0048	1.0047	70ET	.50	.48	.47
C519	.9575	.9576	.9203	70ES	-3.25	-.24	-7.97
C521A	1.0183	1.0186	1.0202	70CA	1.83	1.86	2.02
C521B	1.0603	1.0608	1.0592	70SA	6.03	6.08	5.92
C522	.9542	.9939	.9888	70SA	-.58	-.61	-1.12
C524	.9754	.9817	.9708	70SA	-2.46	-1.83	-2.92
C526	1.0037	1.0028	1.0097	70ES	.37	.28	.97
C528	.9846	.9832	.9844	70SA	-1.54	-1.68	-1.56
C531	1.0126	1.0126	1.0189	70GE	1.26	1.26	1.89
C532	1.0056	1.0095	1.0142	70SA	.56	.95	1.42
C534	1.0424	1.0423	1.0423	70GE	4.24	4.23	4.23
C536	1.0055	1.0050	1.0066	70ES	.55	.50	.66
C537	1.0088	1.0424	.9627	70DM	.88	4.24	-3.73
C540	1.0086	1.0085	1.0089	70GE	.86	.85	.89
C545	1.0016	1.0030	1.0066	70SA	.16	.30	.66
C548	.9954	.9937	.9902	70SA	-.46	-.63	-.98
C549	.9729	.9727	.9841	70GE	-2.71	-2.73	-1.59
C552	.9586	.9967	1.0036	70BN	-.14	-.33	.36

WHITE SAMPLE ANALYSIS  
L, a, b LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED)			INST CODE	PERCENT FROM COMBINED		
	X	Y	Z		X	Y	Z
C105	.9976	.9957	1.0037	70BM	-.24	-.43	.37
C121A	1.0011	.9988	1.0054	70BM	.11	-.12	.54
C148	1.0071	1.0051	1.0117	70BA	.71	.51	1.17
C150	1.0033	1.0026	1.0092	70BA	.33	.26	.92
C152	1.0194	1.0177	1.0268	70BA	1.94	1.77	2.68
C213	.9929	.9895	.9944	70BM	-.71	-1.05	-.56
C241	1.0149	1.0135	1.0203	70BA	1.49	1.35	2.03
C253	1.0197	1.0169	1.0142	70GC	1.97	1.69	1.42
C256	1.0010	.9988	1.0057	70BM	.10	-.12	.57
C259	1.0005	.9988	1.0039	70BA	.05	-.12	.39
C262	.9337	.9314	.9405	70BA	-6.63	-6.86	-5.95
C285	1.0310	1.0293	1.0456	70BA	3.10	2.93	4.56
C288	1.0188	1.0177	1.0259	70BA	1.88	1.77	2.59
C291	1.0056	1.0051	1.0079	70BA	.56	.51	.79
C317	1.0000	.9978	1.0043	70BM	.00	-.22	.43
C325	.9317	.9282	.9322	70BA	-6.83	-7.18	-6.78
C352	1.0092	1.0072	1.0154	70BA	.92	.72	1.54
C356	.9973	.9957	1.0037	70BM	-.27	-.43	.37
C382	1.0055	1.0030	1.0066	70BA	.59	.30	.66
C417A	1.0129	1.0141	1.0149	70GE	1.29	1.41	1.49
C420	1.0122	1.0093	1.0137	70BA	1.22	.93	1.37
C424	1.0116	1.0103	1.0212	70CA	1.16	1.03	2.12
C440	1.0148	1.0114	1.0153	70BA	1.48	1.14	1.53
C442	.9988	.9978	1.0043	70BM	-.12	-.22	.43
C454	1.0147	1.0107	1.0209	70BA	1.47	1.07	2.09
C456	1.0144	1.0142	1.0244	70BA	1.44	1.42	2.44
C458	1.0003	.9984	1.0063	70BM	.03	-.16	.63
C475	1.0073	1.0039	1.0113	70BA	.73	.39	1.13
C477	1.0092	1.0070	1.0091	70BA	.98	.70	.91
C483	.9956	.9937	.9978	70ZF	-.44	-.63	-.22
C494	1.0194	1.0177	1.0276	70BA	1.94	1.77	2.76
C498	1.0078	1.0061	1.0067	70BQ	.78	.61	.67
C499A	1.0005	.9988	1.0031	70SC	.05	-.12	.31
C499B	1.0218	.9957	1.0037	70SC	2.18	-.43	.37
C506	1.0057	1.0040	1.0092	70BA	.57	.40	.92
C514A	1.0021	1.0007	1.0031	70GD	.21	.07	.31
C514B	.9890	.9915	.9843	70GX	-1.10	-.85	-1.57
C538	.9840	.9853	.9826	70GX	-1.60	-1.47	-1.74
C541	1.0180	1.0580	1.0632	70GP	1.80	5.80	6.32
C543	1.0216	1.0208	1.0331	70SC	2.16	2.08	3.31
C544	1.0036	1.0020	1.0101	70BA	.36	.20	1.01
C546A	1.0075	1.0061	1.0067	70HQ	.75	.61	.67
C546B	.9832	.9822	.9885	70BM	-1.68	-1.78	-1.15
C547	1.0079	1.0062	1.0067	70HQ	.79	.62	.67
C550	1.0095	1.0072	1.0131	70BA	.95	.72	1.31
C576	.9998	.9938	1.0022	70BM	-.42	-.62	.22

LAB CODE	F	SAMPLE C75			SAMPLE C80			DIFFERENCE C80 - C79			INST CODE	LAP
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	$\Delta X$	$\Delta Y$	$\Delta Z$		
C122	F	48.56	44.28*	16.77	48.06	43.53	16.92	-.50	-.75	.15	2.49	70SA C122
C162	E	48.81	44.23	17.36	48.59*	43.67*	17.60	-.22	-.55	.24	2.75	70DC C162
C200	E	48.40	43.60	17.50	48.04	42.93	17.76	-.36	-.67	.26	2.85	70GE C200
C244	E	48.54	42.78	15.99X	48.19	42.07	16.29X	-.34	-.71	.30	3.31	70SA C244
C250	E	45.35X	44.35*	17.11	45.06X	43.69*	17.47	-.33	-.70	.35	3.19	70ZF C250
C251	X	48.40	42.55	16.64	48.22	42.19	17.00	-.18	-.40 *	.36 *	2.07X	70ZE C251
C314	E	48.06	43.77	17.52*	47.65	42.97	17.98*	-.42	-.80	.06 *	3.42*	70CE C314
C407	E	48.36	42.28	16.56	47.96	42.61	17.20	-.39	-.68	.24	2.68	70SA C407
C412A	E	47.97	42.57	17.35	47.73	42.42	17.61	-.25	-.55	.26	2.64	70GE C412A
C412B	E	48.01	43.00	17.35	47.75	42.43	17.61	-.26	-.57	.26	2.67	70GE C412B
C414	X	48.85	44.50*	17.71	48.53	43.61	17.85	-.36	-.89	.14	4.47X	70SA C414
C416A	E	47.91	42.64	16.92	47.54	41.96	17.11	-.37	-.69	.19	2.97	70SA C416A
C416B	E	47.77	42.73	17.00	47.40	42.05	17.15	-.37	-.68	.15	2.90	70SA C416B
C417B	E	46.57	43.00	16.78	48.26	42.36	16.94	-.31	-.64	.16	2.94	70RN C417B
C418	F	47.51	43.84	17.39	47.63	43.21	17.56	-.29	-.63	.17	2.91	70CF C418
C422	E	48.25	42.80	17.10	47.78	41.98	17.23	-.47	-.82	.13	3.35*	70SA C422
C423	E	47.83	42.53	17.28	47.33	41.76	17.47	-.49	-.76	.19	2.77	70GE C423
C428	E	48.95*	43.55	17.03	48.70*	43.02	17.30	-.26	-.56	.28	2.66	70HF C428
C437	X	48.18	44.20	17.71	48.01	43.52	17.85	-.17	-.68	.15	4.10X	70CE C437
C443	F	48.65	43.77	16.92	48.17	43.00	17.06	-.49	-.77	.14	2.72	70CN C443
C444	E	48.17	43.25	17.10	47.67	42.43	17.23	-.50	-.82	.13	3.10	70GE C444
C445	E	47.54	42.92	17.63	47.54	42.21	17.75	-.40	-.72	.16	2.92	70LS C445
C446A	E	48.14	42.93	17.23	47.68	42.16	17.34	-.46	-.77	.12	2.57	70GE C446A
C446B	E	48.36	42.26	17.23	47.83	42.44	17.36	-.52	-.82	.12	2.54	70CA C446B
C451	F	48.18	43.26	17.38	47.60	42.38	17.52	-.53	-.87	.14	2.58	70CF C451
C459	E	47.83	42.75	17.04	47.31	41.53	17.14	-.53	-.82	.10	2.55	70GE C459
C460	E	47.85	42.85	16.93	47.34	42.06	17.10	-.51	-.75	.17	2.85	70GE C460
C463	E	48.28	42.15	17.02	47.76	42.30	17.13	-.52	-.84	.12	3.12	70ZF C463
C467A	E	47.70	42.62	16.93	47.78	42.02	17.15	-.33	-.60	.26	2.53	70GE C467A
C467B	E	46.45	42.86	16.80	48.25	42.28	17.03	-.24	-.59	.24	3.02	70HB C467B
C469	F	47.85	43.15	16.77	47.40	42.45	16.91	-.38	-.70	.14	2.89	70GF C469
C470	E	48.12	42.18	17.48	47.92	42.70	17.82	-.20	-.48	.33	2.42	70GE C470
C472	E	48.40	43.35	17.50	48.05	42.70	17.67	-.36	-.69	.17	2.55	70ZF C472
C473	E	47.72	42.39	16.56	47.30	41.68	17.15	-.42	-.71	.19	2.81	70GE C473
C474	E	47.91	42.81	17.07	47.64	42.23	17.30	-.27	-.58	.23	2.75	70GE C474
C476	F	48.24	43.08	17.40	47.94	42.46	17.62	-.30	-.62	.22	2.87	70SA C476
C475A	E	48.70	42.26	25.35X	48.54	42.81	25.64X	-.15 *	-.45 *	.30	2.45	70SA C475A
C475B	X	48.17	43.08	17.57	48.75*	42.53	17.58	.62 X	-.55	.00 *	9.38X	70SA C475B
C480	E	47.29*	41.98	13.35X	46.86*	41.26	13.47X	-.42	-.72	.12	2.91	70HB C480
C481	F	48.11	43.49	17.09	47.75	42.75	17.30	-.35	-.74	.21	3.41*	70KS C481
C495	E	48.24	43.16	17.25	47.83	42.46	17.51	-.41	-.70	.27	2.81	70KS C495
C496A	F	47.76	42.72	17.04	47.49	42.14	17.28	-.27	-.58	.24	2.75	70GE C496A
C503	E	47.56	42.50	16.90	47.18	41.83	17.07	-.38	-.67	.17	2.79	70GE C503
C508	F	47.80	42.74	17.07	47.13	41.79	17.08	-.67 *	-.96 *	.01 *	3.13	70GE C508
C511	F	46.81	43.88	17.80*	48.43	43.23	18.10*	-.38	-.65	.30	2.58	70BA C511
C516	E	48.69	44.22	17.12	48.45	43.62	17.31	-.24	-.60	.19	2.55	70RT C516
C515	E	46.25	42.24	17.21	47.96	41.57	17.40	-.33	-.67	.19	3.14	70XE C515
C521A	F	48.13	42.50	17.02	47.79	42.24	17.19	-.34	-.65	.17	2.86	70CA C521A
C521B	E	47.27*	42.00	16.35*	46.73*	41.15	16.63*	-.55	-.84	.28	3.11	70SA C521B
C522	X	47.85	42.85	16.26*	47.67	42.00	16.45*	-.18	-.65	.23	3.55X	70SA C522
C524	E	48.10	41.51*	17.30	47.62	40.75*	17.50	-.49	-.76	.20	2.52	70SA C524
C526	E	48.14	43.59	17.16	47.75	42.92	17.39	-.35	-.67	.23	2.84	70KS C526
C528	E	46.41	43.26	17.45	48.02	42.55	17.58	-.39	-.71	.14	2.56	70SA C528
C531	F	48.19	42.45	17.15	47.91	42.87	17.42	-.29	-.58	.26	2.60	70PF C531
C532	F	48.06	43.22	17.46	47.73	42.62	17.72	-.33	-.60	.26	2.51	70BA C532
C534	F	46.50X	42.02	15.97X	46.21X	41.42	16.14X	-.30	-.60	.17	2.76	70GE C534
C536	E	47.87	42.79	17.04	47.60	42.22	17.27	-.27	-.56	.23	2.61	70KS C536
C537	E	45.81X	43.56	17.80*	45.35X	43.24	18.02*	-.46	-.72	.22	2.60	70DM C537
C540	E	48.05	42.97	17.55	47.77	42.39	17.77	-.28	-.58	.22	2.65	70GE C540
C545	E	47.86	42.70	16.71	47.47	41.99	16.91	-.39	-.71	.20	2.97	70SA C545
C548	E	48.17	41.86	16.97	47.72	41.16	17.17	-.45	-.70	.20	2.68	70SA C548
C549	E	47.56	42.58	16.50*	47.42	42.15	16.89	-.13 *	-.43 *	.40 *	2.50	70GE C549
C552	E	48.27	42.88	16.86	47.90	42.25	17.11	-.37	-.63	.24	2.56	70RN C552

GRAND MEANS												
		48.13	43.05	17.15	47.75	42.37	17.35	-.37	-.68	.20	2.85	
SD OF MEANS												
		.36	.61	.31	.40	.63	.31	.11	.11	.07	.24	

INCLUDED LABS FOR THIS MEAN  
 55       58       54       55       58       54       58       58       58       58

LAB CODE	F	SAMPLE C81			SAMPLE C82			DIFFERENCE C82 - C81			ΔE	INST CODE	LAB
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ			
C122	X	9.21	12.35	13.17	8.61	11.65	12.67	-0.60	-0.70	-0.50	3.41X	70SA C122	
C162	0	9.51	12.51	13.69	9.02	11.87	13.15	-0.49	-0.64	-0.54	2.34	70DC C162	
C200	0	9.41	12.37	13.61	8.89	11.70	13.17	-0.52	-0.67	-0.44	2.83	70GE C200	
C244	0	8.81	11.91	12.97	8.21*	11.28	12.23	-0.60	-0.63	-0.74 *	3.15*	70SA C244	
C250	0	9.26	12.52	13.65	8.89	11.52	13.34	-0.37	-0.60	-0.35	2.32	70ZF C250	
C251	0	9.23	12.20	13.10	8.86	11.50	12.74	-0.37	-0.60	-0.36	2.40	70ZE C251	
C314	0	9.94	12.81	14.18	9.45	12.20	13.61	-0.45	-0.61	-0.57	2.22	70CF C314	
C407	0	9.49	12.34	13.23	9.19	11.91	12.99	-0.31 *	-0.43 *	-0.24 *	1.70	70SA C407	
C412A	0	9.46	12.43	13.46	9.03	11.88	13.01	-0.43	-0.56	-0.45	2.10	70GF C412A	
C412B	0	9.46	12.43	13.47	9.03	11.88	13.04	-0.43	-0.55	-0.43	2.12	70GE C412B	
C414	0	9.83	12.74	14.00	9.36	12.14	13.47	-0.47	-0.60	-0.52	2.15	70SA C414	
C416A	0	9.18	12.16	13.13	8.77	11.61	12.72	-0.41	-0.55	-0.41	2.07	70SA C416A	
C416B	0	9.19	12.14	13.18	8.66	11.47	12.61	-0.53	-0.57	-0.57	2.59	70SA C416B	
C417B	0	9.10	12.07	12.75	8.62	11.47	12.26	-0.48	-0.61	-0.49	2.39	70HN C417B	
C418	0	9.57	12.67	13.71	9.06	11.99	13.17	-0.51	-0.68	-0.54	2.46	70CE C418	
C422	0	9.19	12.05	12.74	8.75	11.53	12.32	-0.43	-0.56	-0.42	2.18	70SA C422	
C423	0	9.45	12.41	13.32	9.01	11.85	12.84	-0.45	-0.57	-0.48	2.12	70GF C423	
C428	0	9.19	12.16	12.91	8.65	11.49	12.34	-0.54	-0.57	-0.57	2.65	70PF C428	
C437	0	9.65	12.71	14.35*	9.30	12.07	13.81*	-0.55	-0.64	-0.54	2.79	70CE C437	
C443	0	9.44	12.42	13.35	8.94	11.84	12.90	-0.50	-0.60	-0.49	2.53	70CN C443	
C444	0	9.21	12.13	13.38	8.75	11.55	12.92	-0.45	-0.58	-0.46	2.26	70GF C444	
C445	0	9.60	12.54	13.74	9.09	11.91	13.19	-0.51	-0.63	-0.54	2.45	70LS C445	
C446A	0	9.45	12.46	13.35	8.99	11.83	12.81	-0.50	-0.63	-0.54	2.39	70GF C446A	
C446B	0	9.51	12.48	13.53	9.05	11.90	12.98	-0.46	-0.58	-0.55	2.10	70CA C446B	
C451	0	9.22	12.14	13.32	8.72	11.49	12.74	-0.50	-0.65	-0.58	2.40	70GF C451	
C459	0	9.31	12.20	13.35	8.77	11.64	12.78	-0.54	-0.65	-0.57	2.63	70GE C459	
C460	0	9.18	12.08	13.24	8.70	11.47	12.73	-0.48	-0.61	-0.51	2.34	70CF C460	
C463	0	9.34	12.32	13.44	8.80	11.65	12.85	-0.54	-0.66	-0.59	2.60	70TF C463	
C467A	0	8.93	11.83	12.99	8.54	11.33	12.60	-0.39	-0.51	-0.39	2.00	70G1 C467A	
C467B	0	9.11	12.18	12.77	8.58	11.60	12.35	-0.42	-0.55	-0.42	2.14	70CH C467B	
C469	0	8.79	11.70*	12.99	8.26	11.04*	12.43	-0.53	-0.66	-0.56	2.71	70GE C469	
C470	0	9.74	12.70	13.87	9.28	12.11	13.39	-0.46	-0.60	-0.48	2.20	70GF C470	
C472	0	9.80	12.77	14.15	9.25	12.10	13.57	-0.56	-0.67	-0.58	2.66	70TF C472	
C473	0	9.29	12.29	13.17	8.82	11.68	12.68	-0.48	-0.61	-0.49	2.33	70GF C473	
C474	0	9.34	12.27	13.23	8.90	11.73	12.82	-0.44	-0.54	-0.42	2.21	70GF C474	
C476	0	9.61	12.57	13.78	9.24	12.07	13.43	-0.37	-0.50	-0.35	1.92	70SA C476	
C479A	0	9.24	12.03	22.04X	8.54	11.53	21.79X	-0.30 *	-0.50	-0.25 *	2.30	70SA C479A	
C479B	0	9.67	12.56	13.75	9.30	12.13	13.27	-0.37 *	-0.44 *	-0.48	1.65*	70SA C479B	
C480	0	8.65	11.77	12.55	8.37	11.17	12.03	-0.49	-0.60	-0.52	2.42	70HP C480	
C481	0	9.58	12.44	13.83	9.08	11.80	13.27	-0.49	-0.65	-0.55	2.35	70KS C481	
C495	0	9.68	12.63	13.86	9.09	11.93	13.23	-0.55	-0.70	-0.63	2.80	70FS C495	
C496A	0	9.13	12.06	13.21	8.70	11.51	12.78	-0.42	-0.54	-0.43	2.14	70GF C496A	
C503	0	9.16	12.05	13.16	8.63	11.37	12.58	-0.54	-0.68	-0.59	2.62	70CE C503	
C508	0	9.17	12.11	13.15	8.68	11.49	12.63	-0.49	-0.62	-0.52	2.41	70GF C508	
C511	0	9.66	12.71	13.98	9.12	12.03	13.41	-0.54	-0.68	-0.57	2.58	70HA C511	
C516	0	9.08	11.84	13.30	8.65	11.28	12.84	-0.44	-0.56	-0.46	2.20	70TK C516	
C519	0	9.61	12.66	13.72	9.23	12.14	13.32	-0.38	-0.52	-0.40	1.87	70KS C519	
C521A	0	9.41	12.38	13.25	8.98	11.79	12.74	-0.44	-0.60	-0.52	2.12	70CA C521A	
C521B	0	9.57	11.90	13.02	8.70	11.60	12.76	-0.27 *	-0.30 X	-0.25 *	1.57*	70SA C521B	
C522	0	8.98	12.37	12.76	8.56	11.78	12.32	-0.42	-0.59	-0.44	2.13	70SA C522	
C524	0	9.79	12.85	13.14	9.35	12.29	12.71	-0.44	-0.56	-0.43	2.11	70SA C524	
C526	0	9.57	12.35	13.82	9.08	11.73	13.29	-0.49	-0.62	-0.53	2.35	70KS C526	
C528	0	9.53	12.47	13.60	9.04	11.86	13.08	-0.45	-0.62	-0.52	2.33	70SA C528	
C531	0	9.51	12.40	13.82	9.24	11.99	13.57	-0.27 *	-0.40 X	-0.24 *	1.57*	70GF C531	
C532	0	9.31	12.25	13.34	8.86	11.68	12.87	-0.45	-0.57	-0.46	2.22	70SA C532	
C534	0	8.47*	11.04X	12.42*	8.02*	10.46X	11.92*	-0.45	-0.58	-0.51	2.25	70GE C534	
C536	0	9.41	12.36	13.48	9.00	11.81	13.04	-0.42	-0.55	-0.44	2.05	70KS C536	
C537	0	10.18*	12.51	14.06	9.72*	12.31	13.83	-0.46	-0.60	-0.53	2.10	70DN C537	
C540	0	9.84	12.80	13.80	9.50	12.31	13.48	-0.34	-0.49	-0.32	1.80	70GF C540	
C545	0	9.04	11.97	12.95	8.55	11.35	12.44	-0.49	-0.62	-0.51	2.44	70SA C545	
C548	0	9.09	12.13	12.62	8.54	11.47	12.12	-0.55	-0.65	-0.50	2.95	70SA C548	
C549	0	8.80	11.72*	12.85	8.27	11.06*	12.29	-0.52	-0.66	-0.57	2.63	70CE C549	
C552	0	9.22	12.19	12.73	8.70	11.55	12.15	-0.52	-0.64	-0.55	2.52	70HN C552	

GRAND MEANS

9.35 12.32 13.37 8.89 11.73 12.86 -0.46 -0.60 -0.48 2.31

SD OF MEANS

.32 .30 .44 .33 .31 .44 .07 .06 .10 .32

INCLUDED LABS FOR THIS MEAN

62 61 61 61 62 60 62 62

LAB CODE	F	SAMPLE C75			SAMPLE C80			DIFFERENCE C80 - C75			INST CODE	LAB
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB		
C105	0	65.69	16.78	30.59	65.14	17.78	29.89	-.55	1.00	-.70	1.34	70HM C105
C121A	0	65.14	17.51	29.92	64.74	18.41	29.22	-.40	.90	-.70	1.21	70HM C121A
C148	0	65.53	16.90	30.23	65.08	17.70	29.53	-.45	.80	-.70	1.15	70HA C148
C150	0	65.59	17.28	30.57	65.00	18.28	29.89	-.59	.99	-.68	1.34	70HA C150
C152	0	65.72	16.33	30.37	65.23	17.23	29.68	-.50	.89	-.69	1.23	70HA C152
C213	0	65.34	16.84	29.74	64.84	17.64	28.83*	-.50	.80	-.90 X	1.31	70HM C213
C241	0	66.11	21.76X	30.06	65.46	22.76X	29.86	-.65	.99	-.20 X	1.20	70HA C241
C253	0	65.23	17.26	30.09	64.62	18.28	29.43	-.62	1.02	-.66	1.36	70GC C253
C256	0	65.63	17.06	30.36	65.12	18.03	29.71	-.51	.97	-.65	1.27	70HM C256
C259	0	65.75	17.24	30.20	65.15	18.19	29.50	-.60	.95	-.70	1.32	70HA C259
C262	0	44.64X	17.66	32.00X	43.84X	18.67	31.39X	-.70 *	1.01	-.61	1.37	70HA C262
C285	0	65.65	14.57	30.31	65.15	15.55	29.72	-.49	.99	-.59	1.25	70HA C285
C288	0	65.72	16.41	30.42	65.33	17.45	29.83	-.40	1.04	-.59	1.26	70HA C288
C291	0	65.58	16.80	30.17	65.08	17.74	29.52	-.50	.95	-.65	1.25	70HA C291
C317	0	65.37	17.52	29.84	64.77	18.42	29.14	-.60	.90	-.70	1.25	70HM C317
C325	0	43.70X	17.76	31.45X	43.07X	18.80	30.82X	-.62	1.04	-.62	1.36	70HA C325
C352	0	65.66	15.93	30.52	65.22	16.88	29.92	-.45	.95	-.60	1.20	70HA C352
C356	0	65.64	17.12	30.39	65.04	18.02	29.69	-.60	.90	-.70	1.29	70HM C356
C382	0	65.60	15.90	30.26	65.05	16.90	29.61	-.55	1.00	-.65	1.31	70HA C382
C417A	0	64.86	16.88	29.88	64.23	17.82	29.21	-.63	.94	-.67	1.32	70GE C417A
C420	0	65.40	15.03	30.53	64.95	19.92	29.83	-.45	.90	-.70	1.22	70HA C420
C424	0	65.65	15.96	30.12	65.12	16.97	29.44	-.57	1.00	-.68	1.34	70CA C424
C440	0	65.50	17.51	30.73	65.02	18.46	30.09	-.48	.95	-.64	1.24	70FA C440
C442	0	65.77	16.68	30.54	65.27	17.58	29.84	-.50	.90	-.70	1.25	70HM C442
C454	0	64.47*	17.58	29.48*	63.90*	18.62	28.81*	-.58	1.04	-.67	1.37	70HA C454
C456	0	65.53	16.52	30.45	65.11	17.82	29.86	-.42	.90	-.64	1.18	70HA C456
C458	0	65.68	17.12	30.25	65.15	18.06	29.59	-.53	.95	-.66	1.27	70HM C458
C475	0	65.26	18.70	29.99	64.62	19.68	29.29	-.63	.98	-.70	1.36	70HA C475
C477	0	65.19	17.83	29.89	64.67	18.83	29.28	-.52	1.00	-.62	1.25	70HA C477
C483	0	64.97	20.31*	29.53	64.47	21.10*	29.35	-.51	.79	-.58	1.11*	70ZF C483
C494	0	65.62	16.93	30.09	65.13	17.67	29.50	-.50	.74 *	-.55	1.07*	70HA C494
C498	0	65.15	16.23	30.51	64.60	17.23	29.92	-.55	1.00	-.60	1.29	70HQ C498
C499A	0	65.84	17.19	30.38	65.29	18.04	29.60	-.55	.85	-.70	1.23	70SC C499A
C499B	X	65.14	17.10	29.81X	65.24	17.88	29.22X	.10 X	.78	-.59	.98X	70SC C499B
C506	0	65.82	17.24	30.32	65.37	18.14	29.72	-.45	.90	-.60	1.17	70HA C506
C514A	0	65.38	20.61*	30.06	64.86	21.55*	29.35	-.52	.94	-.70	1.29	70GF C514A
C514B	0	66.28*	20.13*	30.31	65.88*	21.04*	29.71	-.40	.90	-.60	1.16	70GX C514B
C538	0	67.85X	16.61	31.29X	67.30X	17.51	30.58X	-.55	.91	-.71	1.28	70GX C538
C541	0	64.65*	13.95*	29.63*	64.21	14.72*	28.50*	-.44	.78 *	-.73	1.15	70GF C541
C543	0	65.77	15.14	30.28	65.22	16.23	29.45	-.54	1.05	-.79 *	1.45*	70SC C543
C544	0	65.64	17.56	30.20	65.04	18.46	29.55	-.60	.90	-.65	1.26	70HA C544
C546A	0	64.45*	18.16	29.82	63.90*	19.16	29.12	-.55	1.00	-.70	1.33	70HQ C546A
C546B	0	65.38	17.42	30.37	64.68	18.28	29.66	-.71 *	.86	-.70	1.32	70HM C546B
C547	0	64.79	17.48	30.04	64.25	18.44	29.38	-.54	.95	-.66	1.28	70HQ C547
C550	0	65.37	15.75	30.43	65.02	16.59	29.75	-.35 *	.85	-.65	1.12	70HA C550
C576	0	65.25	14.97	30.67	64.67	15.90	29.58	-.58	.93	-.69	1.29	70HM C576
GRAND MEANS												
		65.45	17.11	30.21	64.92	18.04	29.56	-.53	.93	-.66	1.27	
SD OF MEANS												
		.39	1.32	.29	.41	1.32	.31	.08	.09	.05	.08	
INCLUDED LABS FOR THIS MEAN												
		42	44	42	42	44	42	45	45	43	45	

LAB CODE	F	SAMPLE C81			SAMPLE C82			DIFFERENCE C82 - C81			INST CODE	LAB
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB		
C105	θ	34.87	-13.82	2.58	33.87	-13.62	2.28	-1.00	.20	-.30	1.07	70HM C105
C121A	θ	34.82	-13.91	2.69	33.82	-13.71	2.44	-1.00	.20	-.25	1.05	70HM C121A
C148	θ	34.91	-14.16	2.64	34.01	-13.90	2.34	-.90	.25	-.30	.98	70HA C148
C150	θ	35.14	-13.97	2.65	34.15	-13.71	2.31	-.99	.35	-.34	1.07	70HA C150
C152	θ	35.09	-14.16	2.67	34.20	-13.96	2.47	-.86	.20	-.40	1.00	70HA C152
C213	θ	34.88	-13.83	2.62	34.48	-12.73X	2.32	-.40 X	1.10 X	-.30	1.21*	70HM C213
C241	θ	34.77	-13.67	2.63	33.97	-13.72	2.18	-.79	-.05 X	-.45 *	.91	70HA C241
C253	θ	34.79	-13.82	2.63	33.95	-13.59	2.23	-.94	.23	-.30	1.01	70GC C253
C256	θ	34.99	-14.07	2.84	33.98	-13.87	2.10	-1.01	.20	-.31	1.07	70HM C256
C259	θ	34.82	-13.89	2.81	34.07	-13.58	2.41	-.75	.30	-.40	.90	70HA C259
C262	X	12.96X	-17.53X	2.82	12.40X	-17.40X	2.40	-.56 X	.13	-.42	.71X	70HA C262
C285	θ	35.98X	-13.39*	3.79X	35.19X	-12.99*	3.49X	-.79	.40 *	-.30	.93	70HA C285
C288	θ	34.99	-13.93	2.45	34.20	-13.58	2.10	-.79	.35	-.35	.93	70HA C288
C291	θ	34.91	-13.79	2.75	34.01	-13.59	2.35	-.90	.20	-.40	1.00	70HA C291
C317	θ	34.74	-13.87	2.55	33.74	-13.62	2.14	-1.00	.25	-.40	1.11	70HM C317
C325	θ	13.08X	-17.87X	3.29*	12.46X	-17.66X	2.88	-.62 X	.21	-.42	.78*	70HA C325
C352	θ	34.97	-14.04	2.57	34.18	-13.74	2.27	-.80	.30	-.30	.90	70HA C352
C356	θ	34.77	-13.71	2.48	33.87	-13.50	2.08	-.90	.20	-.40	1.01	70HM C356
C382	θ	35.00	-14.11	2.47	34.00	-13.81	2.17	-1.00	.30	-.30	1.09	70HA C382
C417A	θ	34.69	-13.93	1.85	33.84	-13.56	1.45	-.86	.36 *	-.41	1.02	70GF C417A
C420	θ	35.34	-14.27	1.79	34.54	-14.07	1.49	-.80	.20	-.30	.87	70HA C420
C424	θ	35.56*	-13.80	2.03	34.57	-13.56	1.73	-1.01	.25	-.31	1.08	70CA C424
C440	θ	35.10	-14.22	2.82	34.27	-13.97	2.49	-.93	.25	-.33	.93	70HA C440
C442	θ	34.84	-13.96	2.15	33.94	-13.66	1.75	-.90	.30	-.40	1.03	70HM C442
C454	θ	34.70	-13.53	2.01	33.92	-13.23	1.69	-.79	.30	-.32	.90	70HA C454
C456	θ	35.00	-13.96	2.56	34.17	-13.70	2.23	-.82	.26	-.33	.92	70HA C456
C458	θ	34.86	-13.84	2.26	33.95	-13.66	1.95	-.93	.18	-.30	1.00	70HM C458
C475	θ	35.23	-13.92	1.75	34.38	-13.72	1.41	-.85	.19	-.33	.94	70HA C475
C477	θ	35.25	-13.91	1.95	34.47	-13.68	1.64	-.78	.23	-.31	.97	70HA C477
C483	θ	35.61*	-14.36	2.47	34.75*	-14.40*	2.32	-.86	-.04 X	-.15 X	.87	70ZF C483
C494	θ	34.99	-14.06	2.00	34.15	-13.81	1.65	-.84	.25	-.35	.95	70HA C494
C498	θ	34.29*	-13.44*	1.61*	33.30*	-13.33	1.31*	-1.00	.10 *	-.30	1.05	70HQ C498
C499A	θ	34.72	-14.14	2.39	33.92	-13.88	2.09	-.80	.25	-.30	.86	70SC C499A
C499B	θ	34.37	-15.60X	2.58	33.37*	-15.41X	2.47	-1.00	.19	-.11 X	1.03	70SC C499B
C506	θ	35.03	-13.95	2.76	34.03	-13.75	2.40	-1.00	.20	-.75	1.04	70HA C506
C514A	θ	35.21	-14.39*	2.82	34.32	-14.09	2.50	-.89	.30	-.33	.99	70GD C514A
C514B	θ	35.40	-11.87X	-.08X	34.50	-11.62X	-.38X	-.90	.25	-.30	.98	70GX C514B
C538	θ	36.47X	-13.03X	.94X	35.56X	-12.83X	.59X	-.91	.20	-.35	.95	70GY C538
C541	θ	33.54X	-13.45*	3.21	32.67X	-13.11*	2.72	-.87	.34	-.49 X	1.06	70GP C541
C543	θ	34.99	-13.89	2.64	34.10	-13.70	2.34	-.89	.20	-.30	.96	70SC C543
C544	θ	34.97	-14.16	2.82	34.17	-13.96	2.52	-.80	.20	-.30	.98	70HA C544
C546A	θ	34.10*	-13.67	1.71	33.30*	-13.42	1.41	-.80	.25	-.30	.85	70HQ C546A
C546B	θ	34.86	-13.92	2.76	33.90	-13.67	2.46	-.96	.25	-.31	1.04	70RM C546B
C547	θ	34.56	-13.73	1.80	33.71	-13.44	1.48	-.85	.29	-.33	.95	70HQ C547
C550	θ	34.78	-14.06	2.72	33.98	-13.75	2.42	-.80	.30	-.30	.90	70HA C550
C576	θ	34.65	-13.97	2.76	33.79	-13.71	2.44	-.86	.26	-.32	.95	70HM C576
GRAND MEANS												
		34.92	-13.92	2.47	34.04	-13.68	2.14	-.88	.25	-.33	.98	
SD OF MEANS												
		.30	.23	.41	.32	.26	.40	.08	.06	.04	.09	
INCLUDED LABS FOR THIS MFAN												
		41	41	42	41	40	42	43	42	42	45	

NBS VALUES FOR SPECTRAL REFLECTANCE

45% REFLECTANCE FACTOR

SAMPLES C79, C80, C81, C82, W11

WAVELENGTH (NM)	C79	C80	C81	C82	W11
380	.0838	.0850	.0580	.0570	.1312
390	.1114	.1134	.0711	.0689	.2256
400	.1343	.1368	.0817	.0786	.4415
410	.1395	.1420	.0859	.0825	.7123
420	.1379	.1402	.0881	.0847	.8607
430	.1367	.1389	.0910	.0874	.8999
440	.1376	.1396	.0950	.0914	.9028
450	.1391	.1411	.1002	.0966	.9122
460	.1411	.1429	.1092	.1055	.9161
470	.1436	.1456	.1260	.1254	.9195
480	.1452	.1468	.1464	.1410	.9232
490	.1459	.1471	.1606	.1545	.9259
500	.1558	.1563	.1653	.1588	.9285
510	.1965	.1949	.1646	.1579	.9302
520	.2497	.2427	.1615	.1545	.9320
530	.2678	.2565	.1564	.1494	.9331
540	.2868	.2736	.1493	.1421	.9340
550	.3644	.3497	.1395	.1322	.9342
560	.4957	.4836	.1273	.1201	.9343
570	.5907	.5833	.1140	.1072	.9354
580	.6263	.6222	.1005	.0942	.9358
590	.6382	.6350	.0866	.0812	.9364
600	.6423	.6394	.0750	.0705	.9362
610	.6431	.6403	.0681	.0644	.9361
620	.6424	.6401	.0649	.0616	.9359
630	.6418	.6393	.0633	.0603	.9358
640	.6409	.6385	.0623	.0594	.9366
650	.6402	.6375	.0617	.0590	.9368
660	.6390	.6365	.0626	.0599	.9358
670	.6380	.6351	.0650	.0621	.9342
680	.6369	.6345	.0679	.0647	.9344
690	.6360	.6335	.0707	.0672	.9353
700	.6350	.6322	.0727	.0691	.9358
710	.6338	.6310	.0729	.0692	.9352
720	.6329	.6303	.0712	.0677	.9355
730	.6322	.6286	.0708	.0674	.9356
740	.6316	.6280	.0738	.0704	.9355
750	.6306	.6272	.0794	.0755	.9357
760	.6297	.6269	.0841	.0800	.9367
770	.6289	.6258	.0859	.0816	.9365

NBS TRISTIMULUS VALUES

45/O REFLECTANCE FACTOR

SAMPLES C79, C80, C81, C82, W11

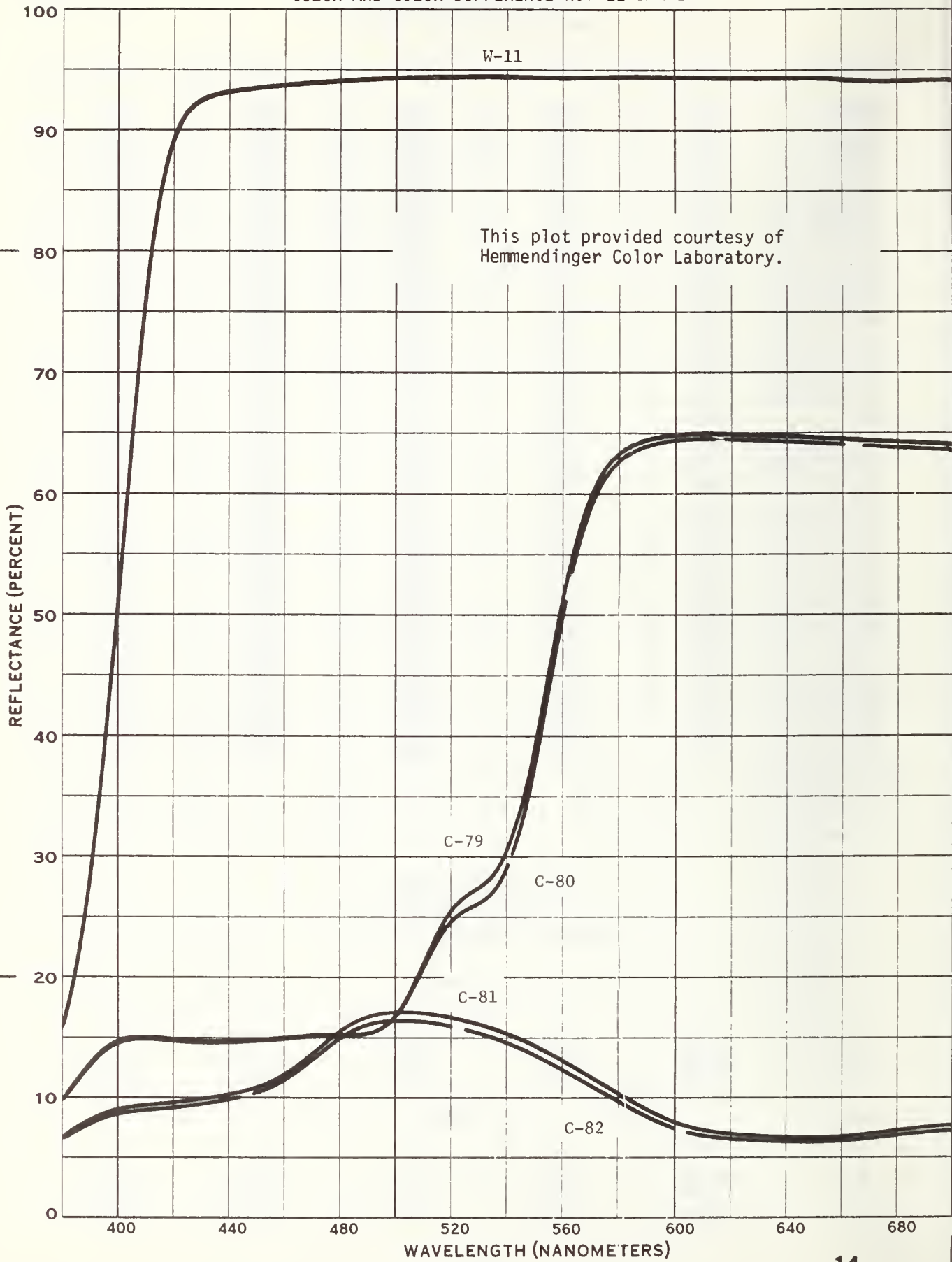
X, Y, Z SPACE

	C79	C80	C81	C82	W11
X	48.608	48.258	9.230	8.765	91.174
Y	43.549	42.897	12.201	11.600	93.440
Z	16.935	17.149	13.180	12.679	107.078

L, a, b SPACE

	C79	C80	C81	C82	W11
X	65.992	65.496	34.930	34.059	96.664
Y	15.994	16.903	-13.960	-13.666	-.801
Z	30.984	30.328	2.087	1.777	2.011

SPECTROPHOTOMETRIC CURVES OF  
COLOR AND COLOR DIFFERENCE NO. 22 SAMPLES





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15. SUPPLEMENTARY NOTES			
<p>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.)</p> <p>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.</p>			
<p>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)</p> <p>Collaborative reference program; Color; Laboratory evaluation; Precision; Reference samples; Testing calibration.</p>			
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