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A survey of snellen acuity sizes and linance contrasts of letters on signs visible from the front of the college of optometry building at PU

Randy H. Pinkerton
Pacific University

Ray L. Sexton
Pacific University

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A survey of snellen acuity sizes and linance contrasts of letters on signs visible from the front of the college of optometry building at PU

Abstract

A survey of snellen acuity sizes and linance contrasts of letters on signs visible from the front of the college of optometry building at PU

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Niles Roth

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A SURVEY OF SNELLEN ACUITY SIZES AND LUMINANCE CONTRASTS
OF LETTERS ON SIGNS VISIBLE FROM THE FRONT OF THE COLLEGE
OF OPTOMETRY BUILDING AT P.U.

A Dissertation
Presented to
the Faculty of the College of Optometry
Pacific University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Optometry

by
Randy H. Pinkerton and Ray L. Sexton, III
May 1973

APPROVED

Niles Roth

Advisor

TABLE OF CONTENTS

Title and Purpose.....	1
Section I - Snellen Acuity Sizes	
Method.....	1
Results.....	2
Discussion.....	2
Summary of Section I.....	3
Section II - Luminance Contrasts	
Method.....	4
Results.....	4
Discussion.....	4
Summary of Section II.....	5
Section III - Photographs and Pertinent Data.....	6 thru 21
Section IV - Miscellaneous Data	
Construction of Optotypes.....	22
Irradiation.....	22
Ambient Lighting.....	23
Munsell Colors.....	23
Information Handout Form.....	23
Definitions.....	24
Data Sheets	
Information Handout Form.....	26
Computation of Snellen Acuity Sizes.....	27
Overall Height to Smallest Letter Detail Ratios.....	28
Overall Height to Overall Width Characteristics.....	29
Computation of Luminance Contrasts.....	30
Averages of Brightness Meter Readings.....	31
References.....	33

A SURVEY OF SNELLEN ACUITY SIZES AND LUMINANCE CONTRASTS
OF LETTERS ON SIGNS VISIBLE FROM THE FRONT OF THE COLLEGE
OF OPTOMETRY BUILDING AT P.U.

This thesis project was designed to determine the characteristics (acuity size and contrast values) of selected letters in various signs in front of the optometry clinic. This quantitative data will be made available to clinicians to enable evaluation of a patient's refractive status in an environment that is more natural than that usually encountered in a clinical examining room.

Section I

This section reports Snellen acuity sizes of selected letters in various signs viewed from the front of the optometry clinic relative to a fixed reference point.

Method:

The second pillar east of the entrance of the optometry clinic was selected as the reference point. This point was chosen because a maximum number of signs are viewable from this position. See the photographs on page 6, Section III.

Distances were measured from this reference point directly to the selected letters. These letters were then measured for height, width, and smallest letter detail (gap or stroke).

A one hundred foot metal tape was used to measure distances from reference point to individual letters. A twelve foot metal tape was used to measure dimensions of the individual letters.

Snellen acuity corresponding to the smallest detail of each letter was calculated as follows:

detail size / viewing distance = θ , angle in radians

$\theta \times 180 / \pi \times 60 =$ angle in arcminutes = θ'

Snellen acuity = $20 / 20 \times \theta'$

Sample calculation:

1.37 inches / 6420 inches $\times 180 / \pi \times 60 = 0.734$ Snellen denominator

Snellen acuity = $20 / (20 \times 0.734) = 20/14.7$

Rounding off denominator of Snellen fraction to nearest multiple of 5 yields 20/15 approximate Snellen equivalent.

Results:

Data and the results of the computations are given for each of the selected signs and letters on pages 7 through 21, Section III. Summarized field measurements and computations are given on pages 27, 28, and 29.

Discussion:

The basic limitation of this section was the signs available and their design. Most important in this respect is the fact that the smallest letter details (gap or stroke), used as criteria to determine acuity sizes, are not necessarily in a 1 to 5 ratio to the overall heights of the letters as are

Snellen optotypes used to determine acuity sizes. Tolerance for the 1 to 5 ratio (smallest letter detail to overall height) was set at 1 x 3 to 1 x 8. Therefore, it became necessary to select signs, individual letters, and gap or stroke. All of the signs selected in this project contained certain letters which fell within this ratio range of smallest letter detail to overall height. With exception of four letters ("F", "R", "S", and "U"), these letters were "E" and "P".

Letter width was measured to give further information on optotype construction as will be explained later in Section IV.

Summary of Section I

This section shows that the approximate Snellen acuity sizes of selected letters of selected signs viewed from the front of the optometry clinic (at the chosen reference point) range from 20/10 to 20/165.

Section II - Luminance Contrasts of Selected Letters and Signs

Method:

A G.E. Luckiesh-Taylor Brightness Meter was used on a tripod to obtain readings of the selected signs. The distances at which the signs were measured allowed the standard field of the instrument to be completely surrounded by the letter or the background being measured. Several luminance readings were taken of the various letters and adjacent backgrounds to determine their average luminance values. These averaged luminance values were then used to calculate individual luminance contrasts for each sign with the following formula:¹

$$C_L = 1 - \text{Luminance (smallest value)} / \text{Luminance (larger value)}$$

Results:

Letter luminance, background luminance, and luminance contrast are given for each individual sign under their respective photographs on pages 7 through 21, Section III.

A summary of the luminance contrast computations for the individual signs is given on page 30.

Discussion:

Luminance contrast values of 0.70 to 0.90 can be considered to be the range for optimal viewing conditions as stated by Dr. O.W. Richards.² It was found in this survey that only two of the selected signs did not fall within this range. Because these two extreme values of 0.68 and 0.92 vary by less than 3% from the above stated range they may be considered acceptable.

As can be seen in the following proof, when detail and surround areas have different reflectances and illuminance is the same for both, contrast depends only on reflectance ratio, and, therefore, is independent of illuminance level:

r_2 = reflectance of detail area

r_1 = reflectance of surround area

L_2 = luminance on detail area

L_1 = luminance on surround area

E_2 = illuminance on detail area

E_1 = illuminance on surround area

$$C = 1 - L_2 / L_1 ; C = 1 - E_2 r_2 / E_1 r_1$$

But, $E_2 = E_1$; therefore, $C = 1 - r_2 / r_1$ proven.

Summary of Section II

The data in this section shows that the luminance contrasts of various signs in front of the optometry clinic range from 0.68 to 0.92.

Section III - Photographs of the Signs, and Pertinent Data



The two photographs above show the reference point used for this thesis project as mentioned in Section I (second pillar east of the entrance).



RESTAURANT

"E" of RESTAURANT

Distance: 6,420 inches

Construction of Optotype:

Letter height: 7.75 inches

Letter width: 5.75 inches

Smallest letter detail: 1.37 inches

Angular Subtense: 44.8"

Snellen Acuity Size: 20/15

Letter Luminance: 90.8 fL

Background Luminance: 640.0 fL

Luminance Contrast: $C_L = 1 - 90.8/640.0 = 0.86$

Munsell Colors:

Letter color: 2 Black

Background color: 9 White



COMPLETE MEALS

First "E" of Complete

Distance: 6,420 inches

Construction of Optotype:

Letter height: 5.50 inches

Letter width: 5.00 inches

Smallest letter detail: 0.75 inches

Angular Subtense: 24"

Snellen Acuity Size: 20/10

Letter Luminance: 64.0 fL

Background Luminance: 640.0 fL

Luminance Contrast: $C_L = 1 - 64.0/640.0 = 0.90$

Munsell Colors:

Letter color: 1 Black

Background color: 9 White



(east) CHAMPION

"P" of CHAMPION

Distance: 3,668 inches

Construction of Optotype:
Letter height: 18.50 inches
Letter width: 17.25 inches
Smallest letter detail: 4.50 inches

Angular Subtense: 4' 13"

Snellen Acuity Size: 20/85

Letter Luminance: 107.8 fL

Background Luminance: 1,040.0 fL

Luminance Contrast: $C_L = 1 - 107.8/1040.0 = 0.90$

Munsell Colors:
Letter color: 1 Black
Background color: 9 White



(east) AMERICA'S FAVORITE

SPARK PLUGS

"P" of PLUGS

Distance: 3,668 inches

Construction of Optotype:

Letter height: 6.00 inches

Letter width: 5.00 inches

Smallest letter detail: 1.25 inches

Angular Subtense: 1' 10"

Snellen Acuity Size: 20/25

Letter Luminance:

AMERICA'S - SPARK: 873.3 fL

FAVORITE - PLUGS: 925.0 fL

Background Luminance:

AMERICA'S - SPARK: 192.0 fL

FAVORITE - PLUGS: 72.5 fL

Luminance Contrast:

AMERICA'S - SPARK:

$$C_L = 1 - 192.0/873.3 = 0.78$$

FAVORITE - PLUGS:

$$C_L = 1 - 72.5/925.0 = 0.92$$

Munsell Colors:

Letter color:

AMERICA'S - SPARK: 9 White

FAVORITE - PLUGS: 9 White

Background color:

AMERICA'S - SPARK: 5 R 4/12 (strong red)

FAVORITE - PLUGS: 1 Black



(large) LUKES AUTO PARTS

Distance:

"E" of LUKES: 3,583 inches
"R" of PARTS: 3,280 inches

Construction of Optotypes:

Letter heights: 27.50 inches
Letter widths: 23.00 inches
Smallest letter detail: 5.25 inches

Angular Subtense:

"E" of LUKES: 5' 2"
"R" of PARTS: 5' 30"

Snellen Acuity Size:

"E" of LUKES: 20/100
"R" of PARTS: 20/110

Letter Luminance: 96.3 fL

Background Luminance: 943.3 fL

Luminance Contrast: $C_L = 1 - 96.3/943.3 = 0.90$

Munsell Colors:

Letter color: 1 Black
Background color: 5 Y 9/9 (brilliant yellow)



(small) LUKES AUTO PARTS

"U" of AUTO

Distance: 3,583 inches

Construction of Optotype:

Letter height: 8.00 inches

Letter width: 3.25 inches

Smallest letter detail: 1.25 inches (horizontal)

Angular Subtense: 1' 12"

Snellen Acuity Size: 20/25

Letter Luminance: 81.7 fL

Background Luminance: 733.3 fL

Luminance Contrast: $C_L = 1 - 81.7/733.3 = 0.89$

Munsell Colors:

Letter color: 1 Black

Background color: 10 White



(west) CHAMPION

"P" of CHAMPION

Distance: 3,201 inches

Construction of Optotype:

Letter height: 18.50 inches

Letter width: 17.50 inches

Smallest letter detail: 4.50 inches

Angular Subtense: 4' 50"

Snellen Acuity Size: 20/95

Letter Luminance: 107.8 fL

Background Luminance: 1040.0 fL

Luminance Contrast: $C_L = 1 - 107.8/1040.0 = 0.90$

Munsell Colors:

Letter color: 1 Black

Background color: 9 White



(west) AMERICA'S FAVORITE

SPARK PLUGS

"P" of PLUGS

Distance: 3,201 inches

Construction of Optotype:

Letter height: 6.00 inches

Letter width: 5.00 inches

Smallest letter detail: 1.25 inches

Angular Subtense: 1' 20"

Snellen Acuity Size: 20/25

Letter Luminance:

AMERICA'S - SPARK: 873.3 fL

FAVORITE - PLUGS: 925.0 fL

Background Luminance:

AMERICA'S - SPARK: 192.0 fL

FAVORITE - PLUGS: 72.5 fL

Luminance Contrast:

AMERICA'S - SPARK:

$$C_L = 1 - 192.0/873.3 = 0.78$$

FAVORITE - PLUGS:

$$C_L = 1 - 72.5/925.0 = 0.92$$

Munsell Colors:

Letter color:

AMERICA'S - SPARK: 9 White

FAVORITE - PLUGS: 9 White

Background color:

AMERICA'S - SPARK: 5 R 4/12 (strong red)

FAVORITE - PLUGS: 1 Black



STATE FARM

"F" of FARM

Distance: 3,110 inches

Construction of Optotype:

Letter height: 9.00 inches

Letter width: 5.25 inches

Smallest letter detail: 1.37 inches

Angular Subtense: 1' 30"

Snellen Acuity Size: 20/30

Letter Luminance: 822.5 fL

Background Luminance: 145.0 fL

Luminance Contrast: $C_L = 1 - 145.0/822.5 = 0.82$

Munsell Colors:

Letter color: 9 White

Background color: 7.5 R 5/13 (strong reddish orange)



RAILROAD CROSSING

First "S" of CROSSING

Distance: 2,388 inches

Construction of Optotype:

Letter height: 6.00 inches

Letter width: 4.75 inches

Smallest letter detail: 1.00 inches

Angular Subtense: 1' 26"

Snellen Acuity Size: 20/30

Letter Luminance: 188.3 fL

Background Luminance: 733.3 fL

Luminance Contrast: $C = 1 - 188.3/733.3 = 0.74$

Munsell Colors:

Letter color: 3 Black

Background color: 9 White



PACIFIC AVENUE

First "E" of AVENUE

Distance: 3,587 inches

Construction of Optotype:

Letter height: 4.00 inches

Letter width: 1.75 inches

Smallest letter detail: 0.50 inches (horizontal)

Angular Subtense: 29"

Snellen Acuity Size: 20/10

Letter Luminance: 69.7 fL

Background Luminance: 456.7 fL

Luminance Contrast: $C_L = 1 - 69.7/456.7 = 0.85$

Munsell Colors:

Letter Color: 2 Black

Background Color: 7 White



USED CARS

"E" of USED

Distance: 2,644 inches

Construction of Optotype:

Letter height: 13.00 inches

Letter width: 11.00 inches

Smallest letter detail: 2.00 inches

Angular Subtense: 2' 36"

Snellen Acuity Size: 20/50

Letter Luminance: 360.0 fL

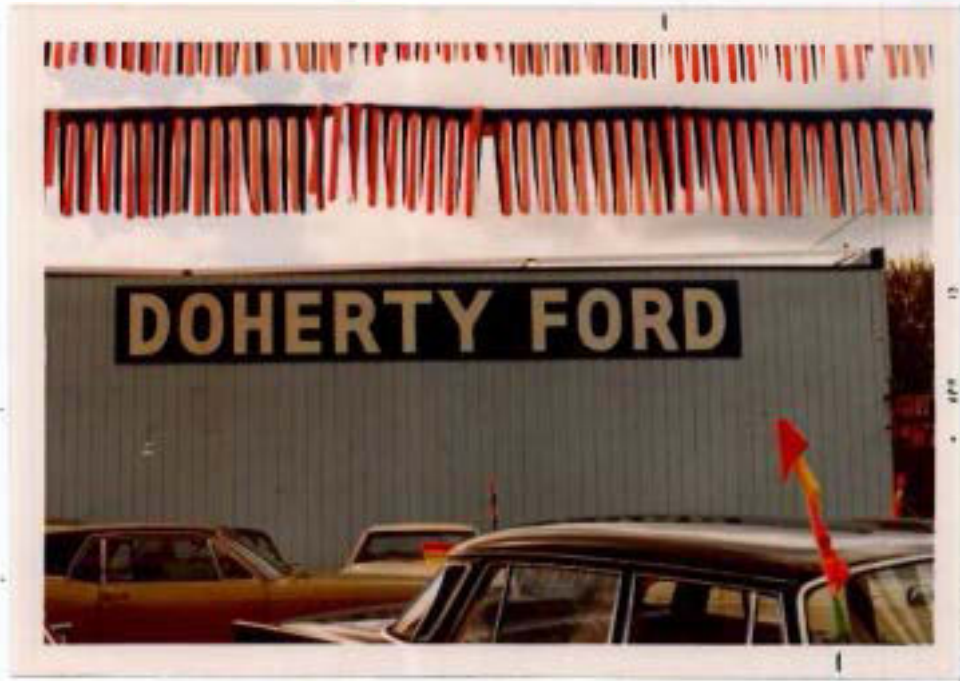
Background Luminance: 1,125.0 fL

Luminance Contrast: $C_L = 1 - 360.0/1125.0 = 0.68$

Munsell Colors:

Letter color: 10 B 5/7 (moderate blue)

Background color: 10 White



DOHERTY FORD

"E" of DOHERTY

Distance: 3,140 inches

Construction of Optotype:

Letter height: 38.00 inches

Letter width: 21.50 inches

Smallest letter detail: 7.50 inches

Angular Subtense: 8' 12"

Snellen Acuity Size: 20/165

Letter Luminance: 810.0 fL

Background Luminance: 107.5 fL

Luminance Contrast: $C_L = 1 - 207.5/810.0 = 0.74$

Munsell Colors:

Letter color: 9 White

Background color: 5 PB 5/10 (strong blue)

Section IV - Miscellaneous Data to Clarify Sections I & II

Construction of Optotypes:

All of the selected letters in this project are of non-serif type.

As shown on page 29, the range of height to width ratios of these selected letters is 5 : 2 to 5 : 4.6. Therefore, all but one sign (5 : 2) fell well within overall height to overall width ranges mentioned in Borish's historical review of optotype constructions.³

Page 28 shows the ratios of overall height to smallest letter detail which were explained previously in Section I.

Irradiation:

It should be noted that the spread of light by irradiation is partly responsible for the apparent difference in size between white and black letters of equal size. A white letter on a black background seems larger than a black letter of the same size on a white background. The white letter appears spread out by irradiation on the surrounding cones in the retina and therefore involves a larger area of the retina than its actual visual angle. For this same reason, the white area surrounding a black letter causes a similar spread of illumination inward and leaves a smaller area of retina unstimulated than that measured by the visual angle of the black letter. Hence, the black letter on a white surround appears to be smaller than the white letter on a black surround.⁴

Ambient Lighting:

Ambient light readings were recorded over a three month period to determine an illumination range during clinic hours. These readings were taken from the standing reference point stated in Section I. A G.E. Type 213 Light Meter was used to record the illumination in footcandles (fc). Time of day at which readings were taken ranged from 8 a.m. to 5:30 p.m. on cloudy and sunny days. Horizontal readings (light meter directed upward) ranged from 380 fc to greater than 5,000 fc. Viewing angle readings (light meter directed from patient towards target) ranged from 240 fc to greater than 5,000 fc. These findings were accumulated to designate an approximate range under various weather conditions of outdoor illumination in which the patient and clinician may be working.

Munsell Color:

Many of the signs were painted in different colors. Irradiation consequences of different letter and background colors have been mentioned in this section under irradiation. The different colors of the signs are given in Munsell color notations for each individual sign under their respective photographs on pages 7 through 21, Section III. These colors were determined with a Nickerson Color Fan.

Information Handout Form:

An information handout form, page 26, was compiled to summarize and make available to optometry clinicians the data of this thesis project. This data should enable more accurate

evaluation of patients' refractive status.

DEFINITIONS

ambient light: All light in the vicinity of the patient.

footcandle (fc): A unit of illuminance equal to uniformly distributed luminous flux of 1 lumen per square foot.

footlambert (fL): A unit of luminance equal to 1 lumen per square foot coming off a diffusing surface.

gap: The perpendicular distance between strokes of a letter.

illuminance: The photometric term for the intensive property of the luminous flux falling on a surface.

irradiation (ocular): A phenomenon in which bright areas or objects appear enlarged against a dark background.

Luckiesh-Taylor Brightness Meter: A small portable, self-contained visual photometer for measuring luminance or illuminance.

luminance: The photometric term for the intensive property of diffusely emitting or reflecting surface.

luminance contrast (C_L): The ratio or other numerical representation of the difference in luminance between two stimulus fields or surfaces.

Munsell color: A series of about one thousand standard color samples, each designated by a letter-number system.

optotype: Test type used for determining visual acuity.

serif: Any of the short lines stemming from, and at any angle to the upper and lower ends of the strokes of a letter.

stroke: A single line that is part of a letter.

visual acuity: In the present context this term refers to the reciprocal of the angular subtense of detail, expressed as a Snellen fraction.

QUANTITATIVE DATA OF SIGNS IN FRONT OF P.U. OPT. CLINIC
Standing Reference Point; Second Pillar East of Clinic Entrance
Excerpt from Graduate Thesis 1973; R. Pinkerton & R. Sexton

RESTAURANT
COMPLETE MEALS

"E" of RESTAURANT
Snellen Acuity Size: 20/15
Luminance Contrast: 0.86

First "E" of COMPLETE
Snellen Acuity Size: 20/10
Luminance Contrast: 0.90



"E" of USED
Snellen Acuity Size: 20/50
Luminance Contrast: 0.68

DOHERTY FORD

"E" of DOHERTY
Snellen Acuity Size: 20/165
Luminance Contrast: 0.74

STATE FARM

"F" of FARM
Snellen Acuity Size: 20/30
Luminance Contrast: 0.82



First "S" of CROSSING
Snellen Acuity Size: 20/30
Luminance Contrast: 0.74

LUKES AUTO PARTS

"E" of LUKES
Snellen Acuity Size: 20/100
Luminance Contrast: 0.90

"R" of PARTS
Snellen Acuity Size: 20/110
Luminance Contrast: 0.90

PACIFIC AVENUE

"E" of AVENUE
Snellen Acuity Size: 20/10
Luminance Contrast: 0.85



LUKES
AUTO PARTS

"U" of AUTO
Snellen Acuity Size: 20/25
Luminance Contrast: 0.89



"P" of CHAMPION
Snellen Acuity Size: (east) 20/85 (west) 20/95
Luminance Contrast : 0.90

"P" of SPARK
Snellen Acuity Size: (east) 20/25; (west) 20/25
Luminance Contrast: 0.78

"P" of PLUGS
Snellen Acuity Size: (east) 20/25; (west) 20/25
Luminance Contrast: 0.92

Computation of Snellen Acuity Sizes

<u>Sign</u>	<u>θ, angle in radians</u>	<u>$\theta' = *$</u>	<u>Snellen Acuity Size</u>	<u>20/ **</u>
R"E"STAURANT	1.37/6420=.0002133	44.8"	20/15	(14.7)
COMPL"E"TE	0.75/6420=.0001168	24"	20/10	(8.0)
CHAM"P"ION (east)	4.50/3668=.0012202	4' 13"	20/85	(84.3)
"P"LUGS (east)	1.25/3668=.0003407	1' 10"	20/25	(23.4)
A"U"TO (small)	1.25/3583=.0003489	1' 12"	20/25	(24.0)
LUK"E"S (large)	5.25/3583=.0014652	5' 2"	20/100	(100.7)
PA"R"TS (large)	5.25/3280=.0016006	5' 30"	20/110	(110.0)
CHAM"P"ION (west)	4.50/3201=.0014058	4' 50"	20/95	(96.7)
"P"LUGS (west)	1.25/3201=.0003905	1' 20"	20/25	(26.8)
"F"ARM	1.37/3110=.0004405	1' 30"	20/30	(30.3)
CRO"S"SING	1.00/2388=.0004187	1' 26"	20/30	(28.8)
AV"E"NUÉ	0.50/3587=.0001393	29"	20/10	(9.6)
US"E"D	2.00/2644=.0007564	2' 36"	20/50	(52.0)
DOH"E"RTY	7.50/3140=.0023885	8' 12"	20/165	(164.2)

*Angular Subtense

** The numbers in the parenthesis show the actual calculated Snellen denominators, while the previous column contains the actual values rounded off to the nearest multiple of 5.

Overall Height to Smallest Letter Detail Ratios

<u>Sign</u>	<u>Ratio</u>
R"E"STaurant	5.66 : 1
COMPL"E"TE	7.33 : 1
CHAM" P" ION	4.11 : 1
"P" LUGS	4.80 : 1
LUK"E" S AUTO PA"R" TS (large)	4.24 : 1
A"U" TO (small)	3.00 : 1 (horizontal)
"F" ARM	6.57 : 1
CRO" S" SING	6.00 : 1
AV" E" NUE	3.50 : 1 (horizontal)
US" E" D	6.50 : 1
DOH" E" RTY	5.07 : 1

Overall Height to Overall Width Characteristics
of Optotypes

Height x Width = 5 x X:

$X = 5 \times \text{Letter Width} / \text{Letter Height}$

<u>Signs</u>	<u>Height x Width</u>
R"E"STAURANT	5 x 3.7
COMPL"E"TE	5 x 4.5
CHAM"P"ION	5 x 4.6
"P"LUGS	5 x 4
LUK"E"S AUTO PA"R"TS (large)	5 x 4
A"U"TO (small)	5 x 2
"F"ARM	5 x 3
CRO"S"SING	5 x 4
AV"E"NUE	5 x 3
US"E"D	5 x 4.25
DOH"E"RTY	5 x 3

Computation of Luminance Contrasts (C_L)

<u>Signs</u>	<u>$C_L = 1 - \text{Luminance (smaller)}/\text{Luminance (larger)}$</u>
R"E"STAURANT	$C_L = 1 - 90.8/640 = 0.86$
COMPL"E"TE	$C_L = 1 - 64.0/640 = 0.90$
CHAM"P"ION	$C_L = 1 - 107.8/1040.0 = 0.90$
S"P"ARK	$C_L = 1 - 192.0/873.3 = 0.78$
"P"LUGS	$C_L = 1 - 72.5/925.0 = 0.92$
LUK"E"S (large)	$C_L = 1 - 96.3/943.3 = 0.90$
A"U"TO (small)	$C_L = 1 - 81.7/733.3 = 0.89$
"F"ARM	$C_L = 1 - 145.0/822.5 = 0.82$
CRO"S"SING	$C_L = 1 - 188.3/733.3 = 0.74$
AV"E"NUE	$C_L = 1 - 69.7/456.7 = 0.85$
US"E"D	$C_L = 1 - 360.0/1125.0 = 0.68$
DOH"E"RTY	$C_L = 1 - 207.5/810.0 = 0.74$

Averages of G.E. Luckiesh-Taylor Brightness Meter Readings

R"E"STaurant

8.6 x 10
10.0 x 10
8.2 x 10
9.5 x 10
90.8 fL

Adjacent White Surround

6.9 x 100
6.1 x 100
6.2 x 100
640.0 fL

COMPL"E"TE

6.9 x 10
5.0 x 10
6.6 x 10
7.1 x 10
64.0 fL

Adjacent White Surround

6.9 x 100
6.1 x 100
6.2 x 100
640.0 fL

CHAM" P" ION

10.5 x 10
11.6 x 10
10.8 x 10
107.8 fL

Adjacent White Surround

10.0 x 100
11.0 x 100
10.2 x 100
1040.0 fL

S" P" ARK

8.9 x 100
8.9 x 100
8.4 x 100
873.3 fL

Adjacent Red Surround

21.0 x 10
20.0 x 10
18.0 x 10
18.0 x 10
19.0 x 10
192.0 fL

" P" LUGS

9.2 x 100
9.4 x 100
9.6 x 100
8.8 x 100
925.0 fL

Adjacent Black Surround

6.7 x 10
7.4 x 10
7.3 x 10
7.6 x 10
72.5 fL

LUK"E"S (large)

9.5 x 10
10.2 x 10
9.6 x 10
96.3 fL

Adjacent Yellow Surround

9.4 x 100
9.6 x 100
9.3 x 100
943.3 fL

A"U"TO (small)

8.2 x 10
7.8 x 10 81.7 fL
8.5 x 10

Adjacent White Surround

7.1 x 100
7.5 x 100 733.3 fL
7.4 x 100

"F"ARM

8.1 x 100
8.3 x 100 822.5 fL
8.5 x 100
8.0 x 100

Adjacent Red Surround

16.2 x 10
14.0 x 10 145.0 fL
13.0 x 10
15.0 x 10

CRO"S"SING

15.5 x 10
22.0 x 10 188.3 fL
19.0 x 10

Adjacent White Surround

7.5 x 100
7.0 x 100 733.3 fL
7.5 x 100

AV"E"NUe

6.9 x 10
7.2 x 10 69.7 fL
6.8 x 10

Adjacent White Surround

4.4 x 100
4.6 x 100 456.7 fL
4.7 x 100

US"E"D

33.0 x 10
35.0 x 10 360.0 fL
40.0 x 10

Adjacent White Surround

10.5 x 100
12.0 x 100 1125.0 fL
11.5 x 100
11.0 x 100

DOH"E"RTY

8.0 x 100
8.2 x 100 810.0 fL
8.1 x 100

Adjacent Blue Surround

23.0 x 10
21.0 x 10
18.0 x 10 207.5 fL
21.0 x 10

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