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COEFFICIENTS OF UTILIZATION.*

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Synopsis: A method is presented for the direct determination of Coefficients of Utilization applying to installations of all ordinary types of lighting units in rooms of varied proportions and different ceiling and wall colors. As a basis for the method, Coefficient of Utilization data are tabulated from a series of several hundred illumination tests made in an experimental room with reflectors having three fundamental forms of light distribution. Illustrating the application of the data presented, typical Coefficient of Utilization Tables, as determined for a number of reflector types in common use, are included.

The variation in the percentage of light reaching the plane of illumination for three general types of lighting units, as found from an extended series of illumination tests in an experimental room whose size, ceiling height, outlet arrangement and interior color could be changed over a wide range, was reported by the authors before the Society in 1915.¹ From these data and the results of other subsequent similar tests, coefficient of utilization tables for candlepower distribution curves of three component types, called indirect, horizontal and direct, have been computed and are shown in Table 5 of this paper. The indirect component curve is similar in shape to that given by a standard type of totally indirect fixture. The direct component curve corresponds to the curve of an opaque direct reflector with a medium cut-off. The horizontal is a circular curve with the maximum candlepower at 90°; a distribution similar to that given by a standard vacuum tungsten lamp. Values are listed applying to rooms having ceiling and wall reflection factors from 0 per cent. to 80 per cent., and for varying proportions of room width to height from 0.5 to 5.0.

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¹ Illumination Efficiencies as Determined in an Experimental Room, I. E. S. TRANSACTIONS, Vol. XI, p. 67.

The plan of the Three-Curve Calculation Method for the determination of coefficients of utilization of all ordinary interior fixtures, as presented in this paper, consists simply in separating the curve of the test reflector into the three component curves; then the proportion of useful light flux is computed separately for the lumens in the indirect, horizontal and direct component curves by reference to the tables of coefficients of utilization for these component curves. This division of the test candlepower curve into the three components is shown graphically by the dotted candlepower curves in Fig. 1.

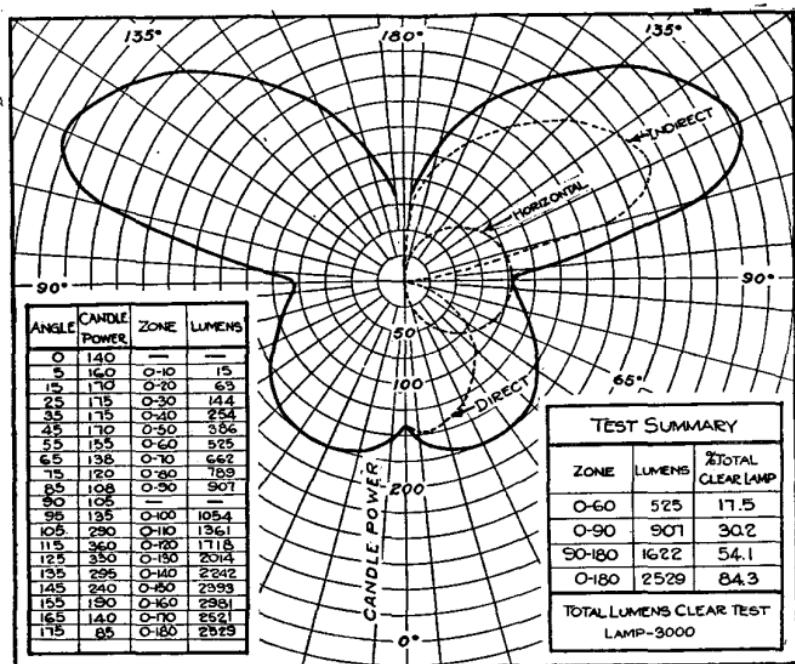


Fig. 1.—Separation of Test Candlepower Distribution Curve into Three Component Curves

The size of the horizontal component is determined by making its 90° angle candlepower equal to the candlepower at the 90° angle of the test distribution curve, which for the test curve of the light opal semi-indirect bowl in Fig. 1 is 105 candlepower. The total lumens represented by a circular curve, such as the horizontal component, equals very closely 10 times 90° candlepower,² or in this case, $10 \times 105 = 1050$, (lumens horizontal component).

² Mathematically, the total lumens in a symmetrical circular curve with the maximum at the horizontal or 90° axis = $\pi^2 \times (\text{maximum candlepower})$, or $9.87 \times 90^\circ$ candlepower. Hence, for simplicity in determining the lumens to be placed in the horizontal component, $10 \times 90^\circ$ candlepower may be used with negligible error.

Subtracting the candlepower values of the horizontal component curve, indirect and direct components remain as shown by the dotted curves. The actual number of lumens represented in the indirect component is found by subtracting the lumens of the horizontal component in the 90° - 180° zone from the total 90° - 180° lumens for the test curve; in this instance,

$$1622 - \frac{1050}{2} = 1097 \text{ (lumens indirect component).}$$

Similarly, the direct component is found by subtracting the lumens of the horizontal component in the 0° - 90° zone from the test curve total for this zone, or

$$907 - \frac{1050}{2} = 382 \text{ (lumens direct component).}$$

The lumens in the three component curves whose algebraic sum equals the original test curve are then:

Indirect	1097
Horizontal	1050
Direct	382
Total	2529

Suppose the ceiling has a 60 per cent. reflection factor, the walls 40 per cent. and the room dimensions such that the room ratio is 1.25, then by finding the coefficient of utilization values for the component curves in Table 5 applying under these conditions, and multiplying the lumens in each component curve by the respective coefficient, the useful lumens are found to be:

Indirect	$1097 \times .25 = 274$
Horizontal	$1050 \times .30 = 315$
Direct	$382 \times .65 = 248$
Total useful lumens	837

But reference to the data on the candlepower distribution curve sheet shows that the clear lamp used in making the test emitted 3,000 lumens,³ hence the coefficient of utilization of the lighting system under the assumed conditions of the installation is:

* Where the output efficiency of the reflector instead of the lumen output of the test lamp is shown on the test curve sheet, the coefficient of utilization may be found from the useful lumens by: Coefficient of utilization = useful lumens \times reflector output efficiency divided by total lumens (0° - 180°) of test curve.

$$\frac{\text{Useful lumens}}{\text{Lumens clear lamp}} = \frac{837}{3000} = 0.279.$$

Obviously, in case the candlepower at 90° is zero the horizontal component will have a zero value, and the lumen quantities for the direct and indirect components will be the same respectively as the 0° - 90° and 90° - 180° lumen values of the test curve.

In some instances the subtraction of the horizontal component will leave a negative direct or indirect component, as in the distribution curve of the diffusing globe with reflector shown in Fig. 2.

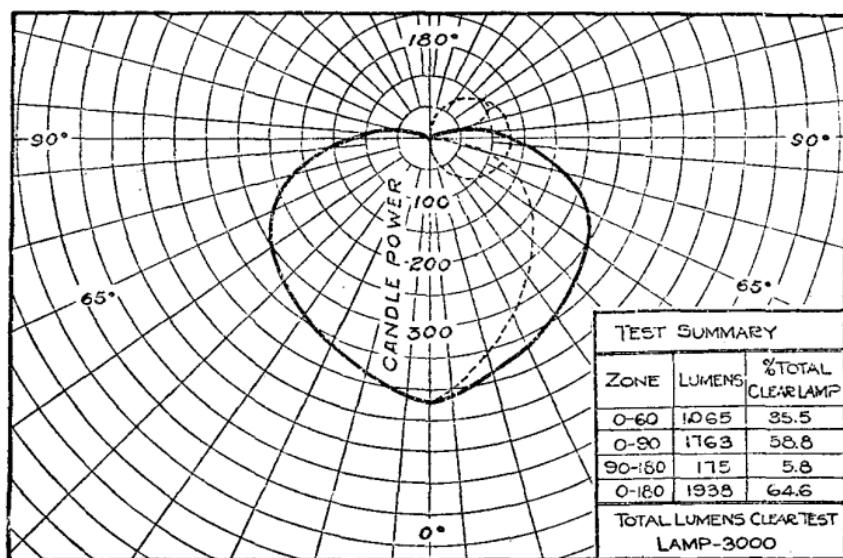


Fig. 2.—Test Candlepower Distribution Curve Showing Negative Indirect Component Curve.

2. In these instances the calculation is carried through precisely as before, except that the useful lumens for the negative components are added algebraically, that is, subtracted in obtaining the sum of useful lumens for the three components. Thus, a calculation of the coefficient of utilization for the reflector curve of Fig. 2 under the same installation conditions as those assumed in the previous example is as follows:

The horizontal component is $10 \times 130 = 1300$ lumens.

Then the indirect is $175 - \frac{1300}{2} = -475$ (negative).

And the direct is $1762 - \frac{1300}{2} = 1112$.

Calculating the useful lumens for the component curves as in the previous example,

Indirect	$-475 \times .25 = -119$	(negative)
Horizontal	$1300 \times .30 = 390$	
Direct	$1112 \times .65 = 723$	
Total useful lumens	994	

$$\text{Coefficient of utilization} = \frac{994}{3000} = 0.331.$$

Classification of Direct Component Curves.—The shapes of the direct and indirect component curves remaining after the subtraction of the horizontal curve are subject to variation, depending upon the distribution of light flux in the original test curves. This difference in curve shape is of less importance in the case of the indirect component since for reflector systems of semi-indirect and indirect types in which the indirect component represents a large part of the flux, the hanging height of the reflectors is commonly adjusted so as to secure a fairly even distribution of light on the ceiling with but little direct light against the side walls, and under this condition the proportion of useful flux is not greatly affected.

For the direct component it is obvious that a broad or narrow shape of distribution curve may influence the proportion of useful light flux to a very considerable extent. Especially in the case of small rooms with dark walls a fairly broad direct component curve may have a coefficient of utilization several per cent. lower than that which applies to a medium curve; and similarly, a rather narrow curve may have a coefficient of utilization several per cent. higher than the value for a medium curve.

In order to provide for a more precise calculation of the coefficient for these exceptional curves, broad and narrow classes of direct component curves were established from an analysis of a

large number of reflector distribution curves. The typical⁴ curves chosen for the broad and narrow classes, are shown on the left hand side of Fig. 3 above and below the medium curve. Coefficient of utilization values computed for these broad and narrow classes in comparison with the medium curve used in the test series, are shown in light face type in Table 5. The first or lesser light face value in each column applies to the broad, and the last and higher light face figure to the narrow direct component class. The distribution curves shown on the right hand side of Fig. 3 are pointed shapes, all three of which at first glance might appear to fall in the narrow class, but which are better placed in the classes as shown. This classification of the direct component curves into broad, medium and narrow will be found to apply to practically all common types except distribution curves with the light flux concentrated in very narrow zones, as in the case of special units of projector types.

Actual experience indicates that the coefficient of utilization values for the medium direct component, shown in bold face type in Table 5, may be applied, in the computations for the large majority of practical installations, without serious error; for example, a comparison of the direct component of the test curve in Fig. 1, with the typical curves of Fig. 3, shows that it really falls in the narrow class, though the medium direct component coefficient value was used in working out the example. Referring to Table 5, a coefficient of .69 is found to apply to the narrow direct component under the room conditions assumed, instead of .65, the value for the medium curve. Recalculating the useful lumens for the direct component in Fig. 1 gives a result of

⁴ The classification of the direct component curves as broad, medium and narrow is an arbitrary one based on the percentage of flux in the 0° - 40° zone, considering the 0° - 90° flux as 100 per cent. The flux in the 0° - 40° zone is practically the amount that becomes useful in a black-walled room with a single outlet where the width of the room is 1.5 times the height of the lamp above the reference plane.

For the typical component curve classes selected, the

$\frac{\text{lumens in } 0^\circ - 40^\circ \text{ zone}}{\text{lumens in } 0^\circ - 90^\circ \text{ zone}}$	are	Broad = 35% - 40%
		Medium = 40% - 45%
		Narrow = 45% - 50%

Hence, although it is usually evident from inspection whether the direct component is broad, medium, or narrow, the classification may be determined by calculation from the following equation :

$$\text{Per cent. of flux in } 0^\circ - 40^\circ \text{ zone} = \frac{(\text{Total lumens in } 0^\circ - 40^\circ \text{ zone} - 0.65 (\text{cp @ } 90^\circ))}{(\text{Total lumens in } 0^\circ - 90^\circ \text{ zone} - 5.0 (\text{cp @ } 90^\circ))}.$$

The last terms in the numerator and denominator of this expression are simply the number of lumens in the 0° - 40° and the 0° - 90° zones for the horizontal component curve, and it is noted that these terms disappear when there is no horizontal component.

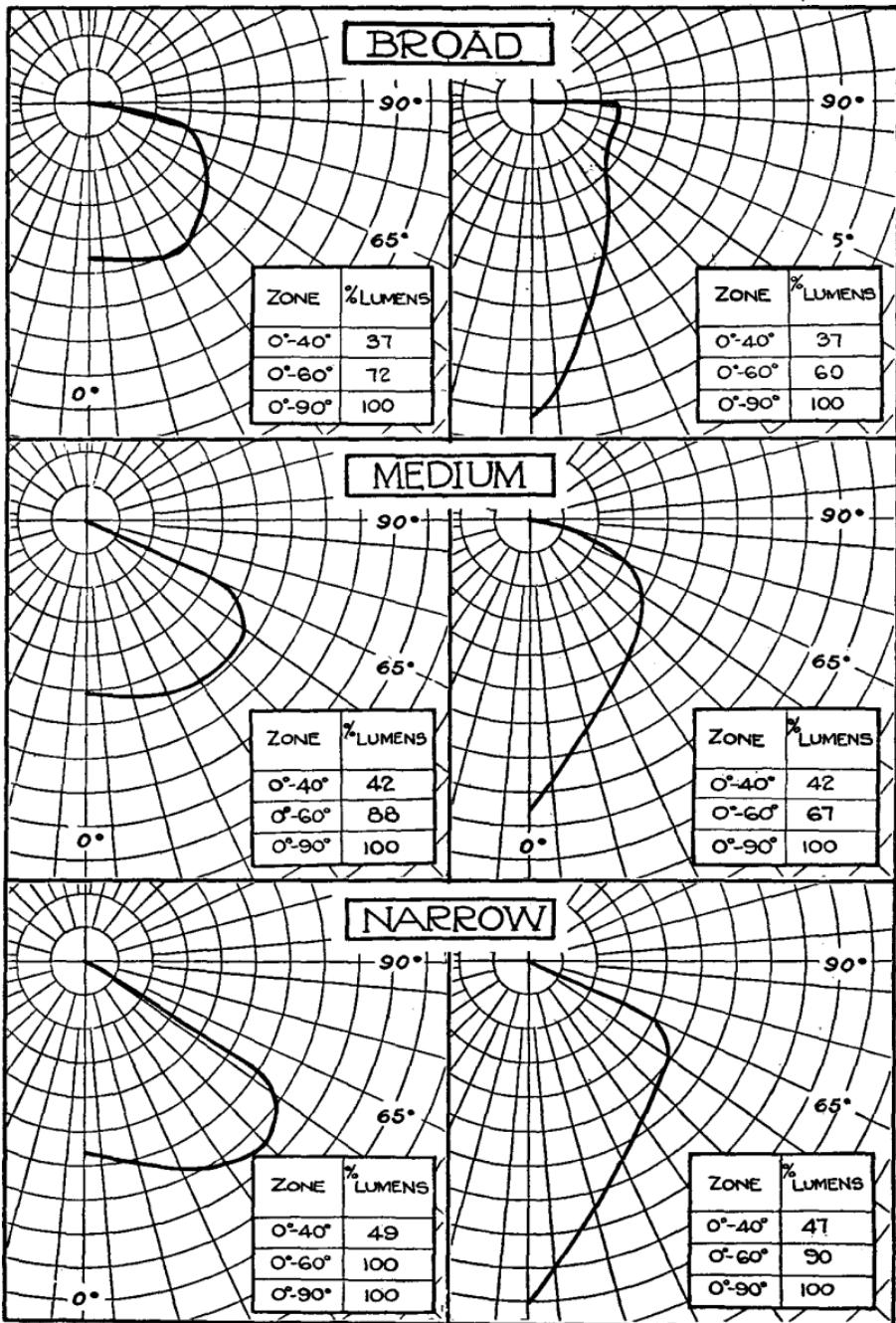


Fig. 3.—Types of Candlepower Distribution Curves Falling in Broad, Medium and Narrow Direct Component Classes.

$$382 \times .69 = 264,$$

and using this in obtaining the sum of useful lumens, the coefficient of utilization is determined to be 0.284, a difference of only 0.005 from the value 0.279 found in the previous calculation.

Room Ratio.—It has been shown that the proportion of light which reaches the useful plane is the same for rooms of similar proportions, but that the amount may vary greatly, according to the width of the room compared with the height of the light sources. This variation resultant from the difference in room proportions is taken account of in Table 5 by showing coefficients of utilization applying to a series of room ratios ranging from 0.5 to 5.0.⁵ These room ratios represent approximately the room width divided by the ceiling height. However, in order to take account of the wide difference in the proportionate height of the plane of work above the floor, and the variation of hanging height for lighting fixtures in high rooms, the following expressions were used in classifying the proportions of the installation.

1. For reflector systems of direct types in which the lighting unit is the principal source of light,

$$\text{Room ratio} = \frac{\text{Room width}}{2 \text{ (height from plane of work to lamps)}}.$$

2. For indirect and semi-indirect systems where the ceiling becomes the principal source of light,

$$\text{Room ratio} = \frac{\text{Room width}}{1 \frac{1}{3} \text{ (height from plane of work to ceiling)}}.$$

It will be noted that the room ratios found by these different methods are exactly the same for an ordinary ceiling height of 12 ft., with lamps mounted 9 ft. from the floor and with a plane of work 3 ft. from the floor.

Rectangular Rooms.—The coefficient of utilization values in Table 5 apply directly to square rooms. However, the floor areas in most rooms are rectangular in shape rather than square. Tests reported in Table 1 were performed to indicate differences in the coefficients of utilization for rooms of fixed ceiling height but varied in proportion from a square to a rectangle whose length is six times its width. Quite commonly, for the purpose of de-

⁵ The proportions of the rooms in which the tests from which the tables were calculated were varied from a minimum room ratio of 0.8 to a maximum of 4.15, and the test curves were extrapolated to obtain the values for room ratios outside of this range.

termining the coefficient of utilization for a rectangular room, the room has been considered as equivalent to a square room whose side equaled the average of the width and length of the rectangle. Another plan has been to consider the coefficient of utilization for the rectangular room to be the average of the coefficients applying to two square rooms whose sides were equal respectively to the long and narrow dimensions of the rectangular room. A third method, which consists in finding the coefficient of utilization for a square room of the narrow dimension and adding to it one-third of the difference between this value and the coefficient for a square room of the long dimension, is proposed, and according to the comparative values as computed from the component curve tables shown for the test room conditions in Table I, this scheme gives values most closely approximating the actual test results. In extremely long narrow rooms the other two methods are likely to give far too high a value for the coefficient.

TABLE I.

COMPARATIVE COEFFICIENT OF UTILIZATION VALUES FOR SQUARE AND
RECTANGULAR ROOMS AS FOUND BY TEST AND
BY CALCULATION METHODS.*

Ceiling height 7 ft. Test plane 3 ft. from floor. Lamps mounted 3 ft. above test plane. Outlets spaced 4.5 ft. x 4.5 ft. Ceiling 64 per cent. Floor 14 per cent. reflection factor.

Reflector	Wall color	Room Dimensions (feet)			
		4.5×4.5 (1×1)	4.5×9 (1×2)	4.5×13.5 (1×3)	4.5×27.0 (1×6)
Bare lamp (Curve EE Fig. 4)	Black (4%)..	Test	15.1	19.8	22.4
		Method A ..	15.3	22.2	27.0
		Difference .	+0.2	+2.4	+4.6
		Method B ..	15.3	21.1	24.9
		Difference .	+0.2	+1.3	+2.5
		Method C ..	15.3	19.2	21.5
		Difference .	+0.2	-0.6	-0.9
					+1.3

TABLE I. (Continued).

Bare lamp	White (81%).Test	41.1	47.5	49.6	51.2
	Method A. . .	42.9	50.1	55.1	64.6
	Difference . . .	+1.8	+2.6	+5.5	+13.4
	Method B. . .	42.9	49.5	52.3	57.1
	Difference . . .	+1.8	+2.0	+2.7	+5.9
	Method C. . .	42.9	47.3	49.2	52.5
	Difference . . .	+1.8	-0.2	-0.4	+1.3
Steel Bowl (Curve AA Fig. 4)	Black (4%)..Test	29.0	33.5	34.6	38.3
	Method A. . .	27.9	35.6	39.8	48.6
	Difference . . .	-1.1	+2.1	+5.2	+10.3
	Method B. . .	27.9	33.9	36.9	40.9
	Difference . . .	-1.1	+0.4	+2.3	+2.6
	Method C. . .	27.9	31.8	33.9	36.5
	Difference . . .	-1.1	-1.7	-0.7	-1.8
Steel Bowl	White (81%).Test	43.3	48.2	49.0	50.2
	Method A. . .	43.6	50.2	52.5	58.0
	Difference . . .	+0.3	+2.0	+3.5	+7.8
	Method B. . .	43.6	48.1	50.0	52.3
	Difference . . .	+0.3	-0.1	+1.0	+2.1
	Method C. . .	43.6	46.6	47.8	49.4
	Difference . . .	+0.3	-1.6	-1.2	-0.8

Method A.—Coefficient for rectangular room taken to be the same as for a square room whose side is the average of the dimensions of the rectangular room.

Method B.—Coefficient for rectangular room taken as the average of the coefficients for square rooms of the long and narrow dimensions respectively.

Method C.—Coefficient for rectangular room taken as coefficient for square room of narrow dimension plus one-third of difference between this value and the coefficient for a square room of the long dimension.

Ceiling and Wall Reflection Factors.—The increase in the coefficient due to light-colored ceilings, as shown in Table 5, is of course widely different, depending upon the percentage of light which reaches the ceiling directly from the lighting units; the increment is, however, directly proportional to the ceiling reflection factor. On the other hand, the increment in the coefficient due to the effect of light walls, is not proportional to the change in wall reflection factor, but is much greater, for instance, in going from 60 to 80 per cent. than from 0 to 20 per cent. This results from the fact that much of the light striking the walls must undergo multiple reflection before reaching the reference plane, as was described in detail in the preliminary report of these tests. This phenomenon largely accounts for the rather common opinion that light walls do not have an important effect in increasing the amount of illumination, especially since even a good light-colored paint which would give a reflection factor of 70 per cent. on a uniform surface such as the ceiling, might only result in an average reflection factor for the walls of 50 per cent. or less, when the areas included by the windows, doors, dark-colored pictures, etc., in small rooms, and the light interference from supporting columns in larger rooms are taken into consideration.

Sample charts showing the percentage reflection factor for different colors of paints and papers are of a considerable assistance in the accurate determination of the proper coefficient, in avoiding the possibility of a wrong estimate of the reflection factors. In the many instances where there is a choice of suitable finishes of rather similar appearance, such color charts are of decided advantage in planning an installation of the highest efficiency consistent with the color tones desired.

Effect of Floor Reflection.—The tests from which the tables of coefficients of utilization for the component curves were computed, were performed in rooms having oak floors whose reflection factor was approximately 14 per cent. This is of the order of the prevailing reflection factor of floors in most interiors. It has been found that even where there is a light-colored floor its effect in increasing the coefficient of utilization is small, and ordinarily the effect can be neglected when determining the coefficient of utilization unless the walls and ceiling are light in color also. In the latter condition the white floor may increase the

effective illumination to an important extent in large sized rooms. Table 2 is included, showing the results of illumination tests with white floors in a small and also a medium sized room with different wall and ceiling reflection factors.

TABLE II.

FACTORS FOR TAKING ACCOUNT OF EFFECT OF FLOOR REFLECTION ON COEFFICIENT OF UTILIZATION.

(Calculated from Coefficient of Utilization tests in small and medium sized rooms, with varied floor reflection factor.)

Reflection factors		Room width	Floor reflection factor			
			0%	14%	40%	80%
Ceiling	Walls	Ceiling height				
0%	0%	1.0	1.00	1.00	1.00	1.00
		2.0	1.00	1.00	1.00	1.00
40%	0%	1.0	1.00	1.00	1.00	1.00
		2.0	1.00	1.00	1.01	1.02
80%	0%	1.0	1.00	1.00	1.00	1.01
		2.0	0.99	1.00	1.02	1.04
40%	40%	1.0	1.00	1.00	1.00	1.01
		2.0	0.99	1.00	1.02	1.04
40%	80%	1.0	1.00	1.00	1.01	1.03
		2.0	0.99	1.00	1.03	1.07
80%	40%	1.0	0.98	1.00	1.03	1.08
		2.0	0.97	1.00	1.05	1.13
80%	80%	1.0	1.00	1.00	1.01	1.02
		2.0	0.99	1.00	1.03	1.08
40%	80%	1.0	0.99	1.00	1.02	1.05
		2.0	0.98	1.00	1.05	1.12
80%	80%	1.0	0.97	1.00	1.06	1.15
		2.0	0.95	1.00	1.09	1.22

Arrangement of Lighting Units.—The coefficient of utilization values for the component curves in Table 5 are based on test installations where the ratio of the distance between lamps to the mounting height above the plane of work, is from 1.5 to 2.0, the

⁶ The coefficient of utilization values for component curves, Table 5, are based on tests in rooms with 14 per cent. floor reflection factor.

maximum order of spacing ratio that has been found to give reasonably uniform illumination for interior lighting units under the conditions obtaining in the usual installation. From the results of a number of illumination tests by different investigators, including those that were made by the authors in the experimental room, it is evident that a greater average illumination of the order of 10 per cent. to 15 per cent. is possible when using a center-of-room arrangement of lamps in comparison with a distributed system of outlets. However, even though higher coefficients of utilization would apply to the center-or-room arrangement of outlets and to installation spacing ratios exceeding the values above, the apparent gain is usually more than counterbalanced by the need for an increased average illumination in order to bring the minimum intensity to the same value as with lamp spacings which give greater uniformity.

Photometer Test Plate.—The coefficient of utilization values in the table for component curves were all obtained with a Weber photometer using a standard transmitting test plate. Test plates of this type are known to give a result several per cent. lower than the true value, as a result of the imperfect diffusion of the glass. Most photometers in common use for illumination work have this standard type of test plate and hence installations designed by this method would show comparable test results with such illuminometers. Subsequent to the performance of most of the tests it became possible to secure a photometer test plate designed to compensate for this error, such as was described before the Society in 1915.⁷ Using this test plate, a number of tests with different types of reflectors in a room 13½ ft. by 27 ft., height 9 ft., were repeated under different conditions as to wall colors. With the compensated test plate the average increase in illumination for different forms of light distribution and wall colors was 4.0 per cent. The difference ranged from 2 per cent. to 7 per cent., and, as might be expected, the larger occurred where there were white walls and reflector types giving high candlepowers at angles near the horizontal.

Accuracy of Three-Curve Calculation Method.—As an indication of the order of accuracy to be expected in the calculation of coefficients of utilization by the three-curve method, data are

⁷ Sharp and Little, I. E. S. TRANSACTIONS, Vol. X, page 727.

shown in Table 3 giving the actual coefficients found by illumination tests in comparison with the values found by the three-curve calculation method for eight reflector type distribution curves illustrated in Fig. 4.

TABLE III.

Comparison of coefficients of utilization as obtained by illumination tests and by three curve calculation method.

Room A.—13.5 ft. x 13.5 ft., ceiling 14 ft. Test plane 3 ft. from floor. One unit mounted 8½ ft. above test plane.

Room C.—13.5 ft. x 27 ft., ceiling 9 ft. Test plane 3 ft. from floor. Eight units spaced 4.5 ft. x 4.5 ft. and mounted 4½ ft. above test plane.

	Reflector	AA	Room A			Room C		
			Ceiling Walls	64%	42%	81%	4%	64%
Reflector	AA	Test	34.5	43.5	48.5	52.4	45.0	50.0
		Calc.	35.4	43.5	46.7	52.8	43.6	48.0
		Diff.	+0.9	0.0	-1.8	+0.4	-1.4	-2.0
Reflector	BB	Test	38.6	Not Tested			49.4	56.2
		Calc.	40.0	—	—	—	49.4	55.4
		Diff.	+1.4	—	—	—	0.	-0.8
Reflector	CC	Test	34.7	42.7	49.7	59.9	45.7	54.6
		Calc.	35.8	42.3	47.8	58.3	44.8	52.8
		Diff.	+1.1	-0.4	-1.9	-1.6	-0.9	-1.8
Reflector	DD	Test	29.7	35.8	42.6	51.6	38.7	47.8
		Calc.	31.5	36.1	40.9	49.8	38.9	46.0
		Diff.	+1.8	+0.3	-1.7	-1.8	+0.2	-1.8
Bare Lamp	EE	Test	25.3	27.3	36.5	48.3	32.6	44.8
		Calc.	25.1	27.4	34.7	47.8	32.3	42.8
		Diff.	-0.2	+0.1	-1.8	-0.5	-0.3	-2.0
Reflector	FF	Test	25.8	27.1	33.0	39.2	35.2	43.6
		Calc.	27.8	26.4	30.2	36.8	34.5	40.6
		Diff.	+2.0	-0.7	-2.8	-2.4	-0.7	-3.0
Reflector	GG	Test	17.2	15.1	17.7	22.3	24.5	29.0
		Calc.	18.2	13.9	16.7	21.5	23.5	28.7
		Diff.	+1.0	-1.2	-1.0	-0.8	-1.0	-0.3
Reflector	HH	Test	16.7	12.1	14.9	18.0	22.7	28.8
		Calc.	16.8	11.4	13.8	18.0	22.0	27.0
		Diff.	+0.1	-0.7	-1.1	0.	-0.7	-1.8

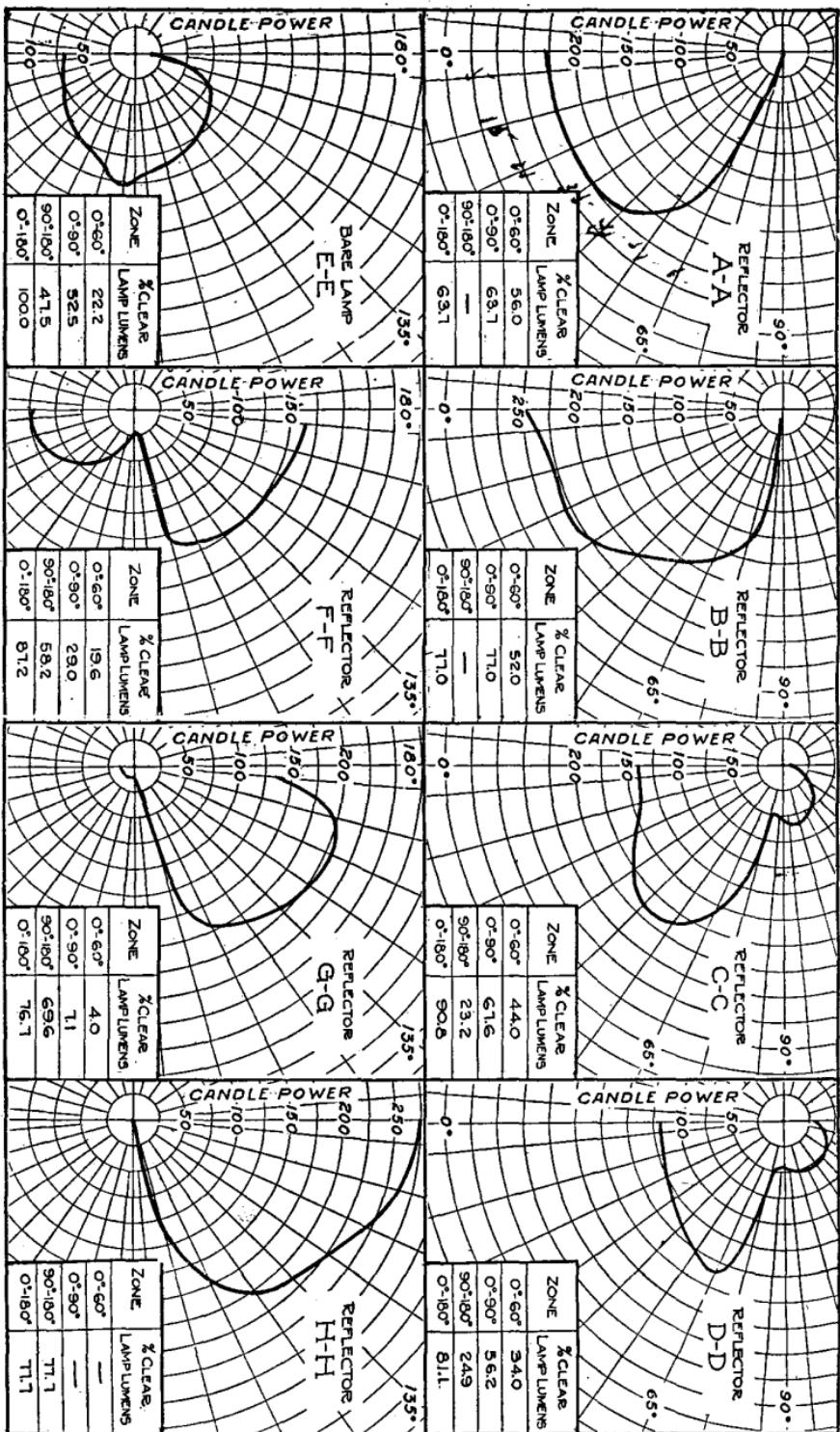


Fig. 4.—Candlepower Distribution Curves of Lighting Units in Table III.

These tests were performed using the same experimental room apparatus that was developed for the basic tests. The reflector systems tested were chosen as having light distributions fairly representative of the various types characteristic for interior lighting equipments, and the differences found in these tests are hardly greater than the individual test variations that might be expected to occur in using illuminometers.

However, as previously mentioned, it is not to be expected that the method presented will give accurate results for installations of equipment giving light concentrated in extremely narrow zones, as for example refractor or projector units, and in the case of installations departing widely from the usual conditions of spacing, hanging height, etc.

TABLES OF COEFFICIENT OF UTILIZATION VALUE FOR DIFFERENT REFLECTOR SYSTEMS.

Illustrating a practical application of the three-curve method, Tables 4 and 4b list coefficients of utilization calculated for twenty reflector systems assuming the distribution curves as shown. In using coefficient of utilization values from such tables in the familiar formula for determining the lamp size necessary in designing an installation,

lumens per lamp

$$= \frac{\text{footcandles} \times \text{depreciation factor} \times \text{area in square feet}}{\text{number of lamps} \times \text{coefficient of utilization}}$$

An allowance of from 1.20 to 1.30 for the depreciation factor to take care of the loss in footcandle intensity from lamp aging, dust collection and depreciation of reflecting surfaces, is not believed to be too high for ordinary direct reflectors, and from 1.30 to even 1.40 is believed to be necessary for equipment having open inverted bowls or reflectors such as semi-indirect and indirect types, depending of course upon the installation and maintenance conditions. Even these maximum values are less than those which tests by different investigators have shown to exist in some lighting installations which had been in service for a considerable period, and in instances where special attention had not been given to the maintenance work.

TABLE 4a

Color (Reflecting Value) of Walls	Ceiling		Light (70%)			Medium (50%)		Dark (30%)	
			Light (50%)	Medium (35%)	Dark (20%)	Medium (35%)	Dark (20%)	Dark (20%)	
Reflector Type	Light Output	Room Ratio	Coefficients of Utilization						
 Clear Lamp	 90° to 180°-0% 0° to 90°-75%	1 1½ 2 3 5	.46 .54 .60 .65 .69	.43 .51 .57 .62 .67	.41 .48 .54 .60 .65	.42 .50 .56 .61 .66	.40 .47 .53 .59 .65	.40 .47 .53 .59 .64	
 Bowl-Frosted Lamp	 90° to 180°-0% 0° to 90°-75%	1 1½ 2 3 5	.45 .52 .56 .62 .66	.49 .49 .53 .60 .65	.47 .47 .51 .57 .63	.48 .48 .52 .58 .63	.46 .50 .56 .62 .62	.46 .50 .56 .62 .62	
 Opal Cap	 90° to 180°-0% 0° to 90°-65%	1 1½ 2 3 5	.40 .47 .51 .56 .60	.37 .44 .48 .54 .58	.35 .42 .46 .52 .57	.37 .44 .48 .53 .57	.34 .42 .46 .51 .56	.34 .42 .46 .51 .55	
 Gear Lamp	 90° to 180°-0% 0° to 90°-65%	1 1½ 2 3 5	.38 .45 .49 .54 .59	.36 .43 .47 .52 .57	.34 .41 .45 .50 .55	.35 .42 .46 .51 .56	.33 .40 .44 .49 .54	.33 .40 .44 .49 .54	
 Bowl-Frosted Lamp	 90° to 180°-0% 0° to 90°-60%	1 1½ 2 3 5	.37 .43 .46 .51 .55	.34 .40 .44 .49 .53	.32 .38 .42 .47 .52	.33 .39 .43 .48 .52	.31 .37 .41 .46 .51	.31 .37 .41 .46 .50	
 Silver Cap	 90° to 180°-0% 0° to 90°-55%	1 1½ 2 3 5	.33 .39 .43 .47 .50	.31 .37 .41 .45 .49	.30 .35 .39 .43 .47	.31 .36 .40 .44 .48	.29 .34 .38 .42 .47	.29 .34 .38 .42 .46	
 Clear Lamp	 90° to 180°-10% 0° to 90°-75%	1 1½ 2 3 5	.36 .44 .50 .56 .62	.31 .39 .46 .53 .59	.28 .36 .42 .48 .54	.30 .37 .44 .51 .57	.28 .35 .41 .47 .53	.27 .35 .41 .47 .53	
 Shading Band	 90° to 180°-1% 0° to 90°-65%	1 1½ 2 3 5	.38 .44 .49 .54 .58	.36 .42 .47 .52 .56	.34 .40 .45 .50 .55	.35 .41 .46 .51 .55	.33 .39 .44 .49 .54	.33 .39 .44 .49 .53	
 Clear Lamp	 90° to 180°-0% 0° to 90°-65%	1 1½ 2 3 5	.44 .50 .55 .59 .63	.41 .47 .52 .57 .61	.39 .45 .50 .55 .59	.41 .47 .52 .56 .59	.39 .45 .50 .54 .58	.38 .44 .49 .54 .58	
 Gear Lamp	 90° to 180°-18% 0° to 90°-75%	1 1½ 2 3 5	.46 .54 .60 .67 .73	.42 .50 .56 .64 .70	.39 .47 .53 .61 .67	.40 .48 .54 .61 .67	.37 .45 .51 .58 .64	.36 .44 .50 .56 .62	

TABLE 4b

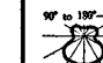
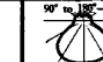
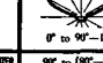
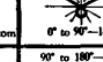
Color (Reflecting Value) of Reflector Type	Light Output	Room Ratio	Coefficients of Utilization			Medium (50%)	Dark (30%)
			Light (50%)	Medium (35%)	Dark (20%)		
LIGHT OPAL 	90° to 180°—34% 	1 1½ 2 3 5	.34 .41 .47 .53 .59	.31 .38 .44 .50 .56	.28 .35 .41 .47 .53	.29 .35 .40 .45 .50	.26 .33 .38 .43 .48
BOWL-FROSTED LAMP	0° to 90°—51%						.24 .30 .35 .40 .45
WHITE OPAL 	90° to 180°—20% 	1 1½ 2 3 5	.40 .47 .52 .58 .62	.37 .44 .48 .55 .60	.34 .41 .46 .52 .58	.35 .42 .46 .52 .57	.33 .39 .43 .49 .55
BOWL-FROSTED LAMP	0° to 90°—60%						.32 .38 .42 .47 .52
DIFFUSIVE PLATE 	90° to 180°—6% 	1 1½ 2 3 5	.31 .37 .42 .47 .51	.28 .34 .39 .44 .49	.26 .32 .37 .42 .46	.28 .33 .38 .43 .48	.25 .31 .36 .41 .45
With Reflector	0° to 90°—58%						
DIFFUSIVE GLASS 	90° to 180°—35% 	1 1½ 2 3 5	.23 .30 .35 .41 .48	.20 .26 .31 .37 .44	.17 .23 .28 .34 .41	.18 .24 .28 .33 .39	.16 .21 .22 .30 .36
Light Opal	0° to 90°—40%						
SIMPLIFIED REFLECTOR 	90° to 180°—20% 	1 1½ 2 3 5	.32 .40 .45 .52 .59	.28 .36 .41 .47 .54	.26 .33 .38 .44 .51	.27 .34 .39 .45 .51	.25 .32 .37 .42 .48
Diffusing Bowl	0° to 90°—40%						.23 .30 .35 .40 .46
ONE-PIECE MOLD 	90° to 180°—17% 	1 1½ 2 3 5	.32 .39 .44 .49 .54	.28 .35 .40 .45 .50	.26 .33 .38 .43 .48	.28 .34 .39 .44 .49	.25 .31 .36 .40 .45
Reflector and Bowl	0° to 90°—55%						
SEMIDIFFUSIVE 	90° to 180°—60% 	1 1½ 2 3 5	.27 .34 .39 .45 .51	.24 .30 .35 .41 .47	.21 .27 .32 .38 .44	.20 .25 .29 .34 .40	.17 .22 .26 .31 .37
Light Opal	0° to 90°—25%						
SEMIDIFFUSIVE 	90° to 180°—70% 	1 1½ 2 3 5	.24 .30 .34 .39 .45	.19 .27 .31 .36 .42	.16 .20 .23 .27 .32	.14 .18 .21 .25 .30	.10 .13 .15 .18 .21
Dense Opal	0° to 90°—10%						
PURPLED-CRIMSON INVERTED 	90° to 180°—55% 	1 1½ 2 3 5	.25 .30 .34 .38 .43	.22 .27 .31 .36 .41	.20 .25 .29 .34 .40	.18 .22 .25 .29 .33	.17 .21 .24 .28 .32
Diffusing Plate Bottom	0° to 90°—15%						
CLEAR LAMP 	90° to 180°—80% 	1 1½ 2 3 5	.22 .27 .31 .36 .42	.19 .24 .28 .33 .39	.17 .22 .26 .31 .37	.14 .17 .20 .24 .28	.07 .09 .11 .13 .16
Clear Lamp	0° to 90°—20%						

TABLE V.—COEFFICIENTS OF UTILIZATION FOR COMPONENT CANDLEPOWER CURVES.

Ceiling Reflection Factor 0%

Wall Reflection Factor	0%	10%	20%	30%	40%	50%	60%	70%	80%	
Room Ratio	COEFFICIENTS OF UTILIZATION									
0.50	Ind. .0 Hor. .03 Dir. 19 24 29	.0 04 05	.0 20 25 30	.0 23 27 31	.0 25 29 33	.0 28 32 36	.0 33 36 39	.0 37 40 43	.0 41 44 47	.0 48 50 52
0.60	Ind. .0 Hor. .06 Dir. 28 33 38	.0 07 08	.0 29 34 39	.0 32 36 40	.0 34 38 42	.0 37 41 45	.0 41 44 47	.0 45 48 51	.0 49 52 55	.0 56 58 60
0.70	Ind. .0 Hor. .08 Dir. 35 40 45	.0 09 10	.0 36 41 46	.0 39 43 47	.0 41 45 49	.0 44 48 52	.0 48 51 54	.0 52 55 58	.0 56 59 62	.0 62 64 66
0.80	Ind. .0 Hor. .09 Dir. 41 46 51	.0 10 11	.0 42 47 52	.0 44 48 52	.0 46 50 54	.0 48 52 56	.0 52 55 58	.0 55 58 61	.0 59 62 65	.0 65 67 69
0.90	Ind. .0 Hor. .10 Dir. 45 50 55	.0 11 12	.0 46 51 56	.0 48 52 56	.0 49 53 57	.0 51 55 59	.0 54 57 60	.0 57 60 63	.0 61 64 67	.0 67 69 71
1.00	Ind. .0 Hor. .11 Dir. 48 53 58	.0 12 13	.0 49 54 59	.0 51 55 59	.0 52 56 60	.0 53 57 61	.0 56 59 62	.0 59 62 65	.0 62 65 68	.0 68 70 72
1.10	Ind. .0 Hor. .12 Dir. 50 55 60	.0 13 14	.0 51 56 61	.0 53 57 61	.0 54 58 62	.0 55 59 63	.0 58 61 64	.0 60 63 66	.0 63 66 69	.0 69 71 73
1.25	Ind. .0 Hor. .13 Dir. 53 58 63	.0 14 15	.0 54 59 64	.0 56 60 64	.0 57 61 65	.0 58 62 66	.0 61 64 67	.0 63 66 69	.0 66 69 72	.0 71 73 75
1.50	Ind. .0 Hor. .15 Dir. 57 62 67	.0 16 17	.0 58 63 67	.0 60 64 68	.0 61 65 69	.0 62 66 69	.0 65 68 71	.0 67 70 73	.0 70 73 76	.0 74 76 78
1.75	Ind. .0 Hor. .17 Dir. 61 66 70	.0 18 19	.0 62 67 70	.0 64 68 71	.0 65 69 72	.0 66 70 73	.0 69 72 75	.0 71 74 76	.0 73 76 78	.0 76 78 80
2.00	Ind. .0 Hor. .19 Dir. 64 69 73	.0 20 21	.0 65 70 73	.0 67 71 74	.0 68 72 75	.0 69 73 76	.0 71 74 76	.0 73 76 78	.0 75 78 80	.0 78 80 82
2.25	Ind. .0 Hor. .21 Dir. 67 72 75	.0 22 23	.0 68 73 76	.0 70 74 77	.0 71 75 78	.0 73 76 78	.0 74 77 79	.0 75 78 80	.0 78 80 82	.0 80 82 83
2.50	Ind. .0 Hor. .22 Dir. 70 74 77	.0 23 24	.0 71 75 78	.0 72 76 78	.0 74 77 79	.0 75 78 80	.0 76 79 81	.0 78 80 82	.0 79 81 83	.0 81 83 84
3.00	Ind. .0 Hor. .25 Dir. 73 77 79	.0 26 27	.0 74 77 79	.0 75 78 80	.0 76 79 81	.0 77 80 82	.0 79 81 83	.0 80 82 83	.0 81 83 84	.0 83 85 86
3.50	Ind. .0 Hor. .27 Dir. 76 79 81	.0 27 28	.0 76 79 81	.0 78 80 82	.0 79 81 83	.0 80 82 83	.0 81 83 84	.0 82 84 85	.0 84 85 86	.0 85 87 88
4.00	Ind. .0 Hor. .29 Dir. 78 81 83	.0 29 30	.0 79 81 83	.0 80 82 84	.0 81 83 84	.0 82 84 85	.0 83 85 86	.0 84 86 87	.0 86 87 88	.0 87 88 89
5.00	Ind. .0 Hor. .31 Dir. 81 83 84	.0 31 32	.0 81 83 84	.0 82 84 85	.0 83 85 86	.0 84 86 87	.0 85 86 87	.0 86 87 88	.0 87 88 89	.0 89 90

TABLE V.—(Continued.)
Ceiling Reflection Factor 10%

Wall Reflection Factor	0%	10%	20%	30%	40%	50%	60%	70%	80%
Room Ratio	COEFFICIENTS OF UTILIZATION								
0.50	Ind.	.01	.01	.02	.02	.02	.03	.04	.04
	Hor.	.04	.05	.06	.07	.08	.10	.12	.15
	Dir.	19 24 29	21 26 31	24 28 32	26 30 34	29 33 37	34 37 40	38 41 44	42 45 48
0.60	Ind.	.02	.02	.02	.03	.03	.03	.04	.04
	Hor.	.07	.08	.09	.10	.11	.13	.16	.19
	Dir.	28 33 38	30 35 40	33 37 41	35 39 43	38 42 46	42 45 48	46 49 52	50 53 56
0.70	Ind.	.02	.02	.02	.03	.03	.03	.04	.05
	Hor.	.09	.10	.11	.12	.14	.16	.19	.22
	Dir.	35 40 45	36 41 46	39 43 47	41 45 49	44 48 52	48 51 54	52 55 58	56 59 62
0.80	Ind.	.02	.02	.03	.03	.03	.04	.04	.05
	Hor.	.10	.11	.12	.13	.15	.17	.20	.24
	Dir.	41 46 51	42 47 52	44 48 52	46 50 54	48 52 56	52 55 58	55 58 61	59 62 65
0.90	Ind.	.02	.03	.03	.03	.04	.04	.04	.05
	Hor.	.11	.12	.13	.14	.16	.19	.22	.25
	Dir.	45 50 55	46 51 56	48 52 56	49 53 57	51 55 59	54 57 60	57 60 63	61 64 67
1.00	Ind.	.03	.03	.03	.04	.04	.04	.05	.06
	Hor.	.12	.13	.14	.15	.17	.20	.23	.30
	Dir.	48 53 58	49 54 59	51 55 59	52 56 60	53 57 61	56 59 62	59 62 65	63 66 69
1.10	Ind.	.03	.03	.03	.04	.04	.04	.05	.06
	Hor.	.13	.14	.15	.16	.18	.21	.24	.31
	Dir.	50 55 60	51 56 61	53 57 61	54 58 62	55 59 63	58 61 64	61 64 67	65 68 71
1.25	Ind.	.03	.03	.04	.04	.04	.05	.05	.06
	Hor.	.15	.16	.17	.18	.20	.23	.26	.33
	Dir.	53 58 63	54 59 64	56 60 64	57 61 65	58 62 66	61 64 67	64 67 70	67 70 73
1.50	Ind.	.03	.04	.04	.04	.05	.05	.05	.06
	Hor.	.17	.18	.19	.20	.22	.25	.28	.35
	Dir.	57 62 67	58 63 67	60 64 68	61 65 69	62 66 69	65 68 71	67 70 73	70 73 76
1.75	Ind.	.04	.04	.04	.05	.05	.05	.06	.07
	Hor.	.19	.20	.21	.22	.24	.27	.30	.36
	Dir.	61 66 70	62 67 70	64 68 71	65 69 72	66 70 73	69 72 75	71 74 76	73 76 78
2.00	Ind.	.04	.04	.05	.05	.05	.06	.07	.07
	Hor.	.21	.22	.23	.24	.26	.28	.31	.37
	Dir.	64 69 73	65 70 73	67 71 74	68 72 75	69 73 76	72 75 77	73 76 78	75 78 80
2.25	Ind.	.04	.05	.05	.05	.06	.06	.06	.07
	Hor.	.23	.24	.25	.26	.28	.30	.32	.38
	Dir.	67 72 75	68 73 76	70 74 77	71 75 78	73 76 78	75 78 80	76 79 81	78 80 82
2.50	Ind.	.05	.05	.05	.06	.06	.06	.07	.08
	Hor.	.25	.26	.27	.28	.30	.32	.34	.39
	Dir.	70 74 77	71 75 78	72 76 78	74 77 79	75 78 80	77 80 82	79 81 83	80 82 84
3.00	Ind.	.05	.05	.06	.06	.06	.07	.07	.08
	Hor.	.27	.28	.29	.30	.32	.34	.36	.40
	Dir.	74 77 79	74 77 79	75 78 80	76 79 81	77 80 82	80 82 84	81 83 84	82 84 85
3.50	Ind.	.05	.06	.06	.06	.07	.07	.07	.08
	Hor.	.29	.30	.31	.32	.33	.35	.37	.39
	Dir.	76 79 81	76 79 81	78 80 82	79 81 83	80 82 83	82 84 85	83 85 86	84 86 87
4.00	Ind.	.06	.06	.06	.07	.07	.07	.08	.08
	Hor.	.31	.32	.33	.34	.35	.36	.38	.42
	Dir.	78 81 83	79 81 83	80 82 84	81 83 84	82 84 85	83 85 86	84 86 87	86 87 88
5.00	Ind.	.06	.06	.07	.07	.07	.08	.08	.09
	Hor.	.33	.34	.35	.36	.37	.38	.39	.43
	Dir.	81 83 84	81 83 84	82 84 85	83 85 86	84 86 87	85 87 88	86 88 89	89 90 91

TABLE V.—(Continued.)
Ceiling Reflection Factor 20%

Wall Reflection Factor	0%	10%	20%	30%	40%	50%	60%	70%	80%	
Room Ratio	COEFFICIENTS OF UTILIZATION									
0.50	Ind.	.02	.03	.03	.04	.04	.04	.05	.06	
	Hor.	.04	.05	.06	.07	.10	.12	.14	.17	
	Dir.	19 24 29	21 26 31	24 28 32	26 30 34	29 33 37	34 37 40	38 41 44	42 45 48	49 51 53
0.60	Ind.	.03	.04	.04	.05	.05	.06	.07	.08	
	Hor.	.08	.09	.10	.11	.13	.15	.18	.22	
	Dir.	28 33 38	30 35 40	33 37 41	35 39 43	38 42 46	42 45 48	46 49 52	50 53 56	57 59 61
0.70	Ind.	.04	.04	.05	.05	.06	.06	.07	.08	
	Hor.	.10	.11	.12	.13	.15	.17	.20	.24	
	Dir.	35 40 45	37 42 47	40 44 48	42 46 50	45 49 53	49 52 55	53 56 59	57 60 63	63 65 67
0.80	Ind.	.04	.05	.05	.06	.06	.07	.08	.09	
	Hor.	.11	.12	.13	.14	.16	.19	.22	.26	
	Dir.	41 46 51	42 47 52	44 48 52	46 50 54	49 53 57	53 56 59	56 59 62	60 63 66	66 68 70
0.90	Ind.	.05	.05	.06	.06	.07	.07	.08	.09	
	Hor.	.12	.13	.14	.16	.18	.21	.24	.28	
	Dir.	45 50 55	46 51 56	48 52 56	50 54 58	52 56 60	55 58 61	58 61 64	62 65 68	68 70 72
1.00	Ind.	.05	.06	.06	.07	.07	.08	.09	.10	
	Hor.	.13	.14	.15	.17	.19	.22	.25	.29	
	Dir.	48 53 58	49 54 59	51 55 59	52 56 60	54 58 62	57 60 63	60 63 66	64 67 70	70 72 74
1.10	Ind.	.06	.06	.07	.07	.08	.08	.09	.10	
	Hor.	.14	.15	.16	.18	.20	.23	.26	.30	
	Dir.	50 55 60	51 56 61	53 57 61	54 58 62	56 60 64	59 62 65	62 65 68	66 69 72	71 73 75
1.25	Ind.	.06	.07	.07	.08	.08	.09	.10	.11	
	Hor.	.16	.17	.18	.20	.22	.25	.28	.32	
	Dir.	53 58 63	54 59 64	56 60 64	57 61 65	59 63 67	62 65 68	65 68 71	68 71 74	73 75 77
1.50	Ind.	.07	.07	.08	.08	.09	.09	.10	.11	
	Hor.	.18	.19	.21	.23	.25	.28	.31	.34	
	Dir.	57 62 67	58 63 67	60 64 68	61 65 69	63 67 70	66 69 72	68 71 74	71 74 77	76 78 80
1.75	Ind.	.07	.08	.08	.09	.09	.10	.11	.12	
	Hor.	.20	.21	.23	.25	.27	.30	.33	.36	
	Dir.	61 66 70	62 67 70	64 68 71	65 69 72	67 71 74	70 73 76	72 75 77	74 77 79	78 80 82
2.00	Ind.	.08	.09	.09	.10	.10	.11	.12	.13	
	Hor.	.22	.23	.25	.27	.29	.32	.35	.38	
	Dir.	64 69 73	65 70 73	67 71 74	68 72 75	70 74 77	73 76 78	74 77 79	76 79 81	80 82 84
2.25	Ind.	.09	.09	.10	.10	.11	.11	.12	.13	
	Hor.	.24	.25	.27	.29	.31	.33	.36	.39	
	Dir.	67 72 75	68 73 76	70 74 77	71 75 78	74 77 79	76 79 81	77 80 82	79 81 83	82 84 86
2.50	Ind.	.09	.10	.10	.11	.11	.12	.13	.14	
	Hor.	.26	.27	.28	.30	.32	.34	.37	.40	
	Dir.	71 75 78	72 76 79	73 77 79	75 78 80	76 79 81	78 81 83	80 82 84	81 83 85	84 86 87
3.00	Ind.	.10	.11	.11	.12	.12	.13	.13	.14	
	Hor.	.29	.30	.31	.33	.35	.37	.39	.42	
	Dir.	75 78 80	75 78 80	76 79 81	77 80 82	78 81 83	80 83 85	82 84 85	83 85 86	86 88 89
3.50	Ind.	.11	.11	.12	.12	.13	.13	.14	.15	
	Hor.	.31	.32	.33	.35	.37	.39	.41	.43	
	Dir.	77 80 82	77 80 82	79 81 83	80 82 84	81 83 84	83 85 86	84 86 87	85 87 88	88 89 90
4.00	Ind.	.12	.12	.13	.13	.14	.14	.15	.16	
	Hor.	.33	.34	.35	.36	.38	.40	.42	.44	
	Dir.	79 82 84	80 82 84	81 83 85	82 84 85	83 85 86	84 86 87	85 87 88	87 88 89	89 90 91
5.00	Ind.	.12	.13	.13	.14	.14	.15	.15	.16	
	Hor.	.36	.37	.38	.39	.40	.42	.44	.46	
	Dir.	82 84 85	82 84 85	83 85 86	84 86 87	85 87 88	87 88 89	88 89 90	89 90 91	90 91 92

TABLE V.—(Continued.)
Ceiling Reflection Factor 30%

Wall Reflection Factor	0%	10%	20%	30%	40%	50%	60%	70%	80%
Room Ratio	COEFFICIENTS OF UTILIZATION								
0.50	Ind. .04 Hor. .05 Dir. 19 24 29	.04 .06 21 26 31	.05 .07 24 28 32	.05 .08 26 30 34	.06 .10 29 33 37	.07 .12 34 37 40	.08 .15 38 41 44	.09 .15 43 46 47	.11 .24 50 52 54
0.60	Ind. .05 Hor. .08 Dir. 28 33 38	.05 .09 30 35 40	.06 .10 33 37 41	.06 .11 35 39 43	.07 .13 38 42 46	.08 .16 43 46 49	.09 .19 47 50 53	.11 .23 51 54 57	.13 .28 58 60 62
0.70	Ind. .06 Hor. .11 Dir. 35 40 45	.06 .12 37 42 47	.07 .13 40 44 48	.07 .14 42 46 50	.08 .16 45 49 53	.09 .19 49 52 55	.10 .22 53 56 59	.12 .26 57 60 63	.14 .31 64 66 68
0.80	Ind. .06 Hor. .12 Dir. 41 46 51	.06 .13 42 47 52	.07 .14 45 49 53	.08 .16 47 51 55	.09 .18 50 54 58	.10 .21 54 57 60	.11 .24 57 60 63	.13 .28 61 64 67	.15 .33 67 69 71
0.90	Ind. .07 Hor. .13 Dir. 45 50 55	.07 .14 46 51 56	.08 .16 48 52 56	.09 .18 50 54 58	.10 .20 52 56 60	.11 .23 56 59 62	.12 .26 59 62 65	.14 .30 63 66 69	.16 .35 69 71 73
1.00	Ind. .08 Hor. .14 Dir. 48 53 58	.08 .15 49 54 59	.09 .17 51 55 59	.10 .19 53 57 61	.11 .21 55 59 63	.12 .24 58 61 64	.13 .27 61 64 67	.15 .31 65 68 71	.17 .36 71 73 75
1.10	Ind. .09 Hor. .15 Dir. 50 55 60	.09 .16 51 56 61	.10 .18 53 57 61	.10 .20 55 59 63	.11 .22 57 61 65	.12 .25 60 63 66	.13 .28 63 66 69	.15 .32 66 69 72	.17 .37 72 74 76
1.25	Ind. .09 Hor. .17 Dir. 53 58 63	.10 .18 54 59 64	.11 .20 56 60 64	.11 .22 57 61 65	.12 .24 59 63 67	.13 .27 62 65 68	.14 .30 65 68 71	.16 .34 68 71 74	.18 .39 74 76 78
1.50	Ind. .10 Hor. .20 Dir. 57 62 67	.11 .21 58 63 67	.12 .23 60 64 68	.12 .25 61 65 69	.13 .27 63 67 70	.14 .30 66 69 72	.15 .33 69 72 75	.17 .36 72 75 78	.19 .41 77 79 81
1.75	Ind. .11 Hor. .22 Dir. 61 66 70	.12 .23 62 67 70	.13 .25 64 68 71	.13 .27 65 69 72	.14 .29 67 71 74	.15 .32 70 73 76	.16 .35 72 75 77	.18 .38 75 78 80	.20 .43 79 81 83
2.00	Ind. .12 Hor. .24 Dir. 64 69 73	.13 .25 65 70 73	.14 .27 67 71 74	.14 .29 68 72 75	.15 .31 70 74 77	.16 .34 73 76 78	.17 .37 75 78 80	.19 .40 77 80 82	.21 .45 81 83 85
2.25	Ind. .13 Hor. .26 Dir. 67 72 75	.14 .27 68 73 76	.15 .29 70 74 77	.15 .31 71 75 78	.16 .33 74 77 79	.17 .36 76 79 81	.18 .39 77 80 82	.19 .42 80 82 84	.21 .47 83 85 87
2.50	Ind. .14 Hor. .28 Dir. 71 75 78	.15 .29 72 76 79	.16 .31 73 77 79	.16 .33 75 78 80	.17 .35 77 80 82	.18 .38 78 81 83	.19 .41 80 82 84	.20 .44 82 84 86	.22 .49 85 87 88
3.00	Ind. .16 Hor. .31 Dir. 75 78 80	.16 .32 75 78 80	.17 .34 76 79 81	.17 .36 77 80 82	.18 .38 79 82 84	.19 .40 81 83 85	.20 .43 82 84 85	.21 .46 84 86 87	.23 .50 87 89 90
3.50	Ind. .17 Hor. .33 Dir. 77 80 82	.17 .34 77 80 82	.18 .36 79 81 83	.18 .38 80 82 84	.19 .40 82 84 85	.20 .42 83 85 86	.21 .45 84 86 87	.22 .48 86 88 89	.24 .51 89 90 91
4.00	Ind. .18 Hor. .36 Dir. 79 82 84	.18 .37 80 82 84	.19 .38 81 83 85	.19 .40 82 84 85	.20 .42 84 86 87	.21 .44 85 87 88	.22 .46 86 88 89	.23 .49 88 89 90	.24 .52 90 91 92
5.00	Ind. .19 Hor. .39 Dir. 82 84 85	.19 .40 82 84 85	.20 .41 83 85 86	.21 .42 84 86 87	.21 .44 86 88 89	.22 .46 88 89 90	.23 .48 89 90 91	.24 .50 90 91 92	.25 .53 91 92 93

TABLE V.—(Continued.)
Ceiling Reflection Factor 40%

Wall Reflection Factor	0%	10%	20%	30%	40%	50%	60%	70%	80%
Room: ratio	COEFFICIENTS OF UTILIZATION								
6.50	Ind.	.05	.05	.05	.06	.07	.08	.10	.12
	Hor.	.05	.06	.07	.08	.11	.14	.17	.21
	Dir.	19 24 29	21 26 31	24 28 32	26 30 34	29 33 37	34 37 40	38 41 44	43 46 49
6.60	Ind.	.07	.07	.08	.09	.10	.11	.13	.15
	Hor.	.08	.09	.11	.12	.14	.17	.21	.25
	Dir.	28 33 38	30 35 40	33 37 41	35 39 43	38 42 46	43 46 49	47 50 53	52 55 58
6.70	Ind.	.08	.08	.09	.10	.11	.12	.14	.16
	Hor.	.11	.12	.14	.15	.17	.20	.24	.29
	Dir.	35 40 45	37 42 47	40 44 48	42 45 50	45 49 53	49 52 55	53 56 59	58 61 64
6.80	Ind.	.09	.09	.10	.11	.12	.13	.15	.17
	Hor.	.12	.13	.15	.17	.19	.22	.26	.31
	Dir.	41 46 51	42 47 52	45 49 53	47 51 55	50 54 58	54 57 60	57 60 63	62 65 68
6.90	Ind.	.10	.10	.11	.12	.13	.14	.16	.18
	Hor.	.14	.15	.17	.19	.21	.24	.28	.33
	Dir.	45 50 55	46 51 56	49 53 57	51 55 59	53 57 61	57 60 63	60 63 66	64 67 69
7.00	Ind.	.11	.11	.12	.13	.14	.15	.17	.19
	Hor.	.15	.16	.18	.20	.22	.25	.29	.34
	Dir.	48 53 58	49 54 59	52 56 60	53 57 61	55 59 63	59 62 65	62 65 68	66 69 72
7.10	Ind.	.12	.12	.13	.14	.15	.16	.18	.20
	Hor.	.16	.18	.20	.22	.24	.27	.31	.36
	Dir.	50 55 60	51 56 61	54 58 62	55 59 63	57 61 65	60 63 66	63 66 69	67 70 73
7.25	Ind.	.13	.13	.14	.15	.16	.18	.20	.22
	Hor.	.18	.20	.22	.24	.26	.29	.33	.38
	Dir.	53 58 63	54 59 64	57 61 65	58 62 66	60 64 68	63 66 69	66 69 72	70 72 75
7.50	Ind.	.14	.15	.16	.17	.18	.19	.21	.23
	Hor.	.21	.23	.25	.27	.29	.32	.36	.40
	Dir.	57 62 67	58 63 67	61 65 69	62 66 70	64 68 71	67 70 73	70 73 76	73 76 79
7.75	Ind.	.15	.16	.17	.18	.19	.20	.22	.24
	Hor.	.23	.25	.27	.29	.32	.35	.39	.43
	Dir.	61 66 70	62 67 71	65 69 72	66 70 73	68 72 75	71 74 77	73 76 78	76 79 81
8.00	Ind.	.17	.18	.19	.20	.21	.22	.24	.26
	Hor.	.25	.27	.29	.31	.34	.37	.41	.45
	Dir.	64 69 73	65 70 73	68 72 75	69 73 76	71 75 78	74 77 79	75 78 80	79 81 83
8.25	Ind.	.18	.19	.20	.21	.22	.23	.25	.27
	Hor.	.27	.29	.31	.33	.36	.39	.43	.47
	Dir.	67 72 75	68 73 76	71 75 78	72 76 79	75 78 80	77 80 82	78 81 83	81 83 85
8.50	Ind.	.19	.20	.21	.22	.23	.24	.26	.28
	Hor.	.29	.31	.33	.35	.38	.41	.45	.48
	Dir.	71 75 78	72 76 79	74 78 80	76 79 81	78 81 83	79 82 84	81 83 85	83 85 87
8.75	Ind.	.21	.22	.23	.24	.25	.26	.27	.29
	Hor.	.32	.34	.36	.39	.41	.44	.47	.50
	Dir.	75 78 80	76 79 81	77 80 82	78 81 83	80 83 85	82 84 86	83 85 86	85 87 88
9.00	Ind.	.22	.23	.24	.25	.26	.27	.28	.30
	Hor.	.35	.37	.39	.42	.44	.46	.49	.52
	Dir.	77 80 82	78 81 83	80 82 84	81 83 85	83 85 86	84 86 87	85 87 88	87 89 90
9.25	Ind.	.24	.25	.26	.27	.28	.29	.30	.32
	Hor.	.38	.39	.41	.44	.46	.48	.51	.54
	Dir.	79 82 84	81 83 85	82 84 86	83 85 86	85 87 88	86 88 89	87 89 90	89 90 91
9.50	Ind.	.25	.26	.27	.28	.29	.30	.31	.32
	Hor.	.41	.42	.44	.46	.48	.50	.53	.55
	Dir.	83 85 86	83 85 86	84 86 87	85 87 88	87 89 90	89 99 01	90 91 92	91 92 93

TABLE V.—(Continued.)
Ceiling Reflection Factor 50%

Wall Reflection Factor	0%	10%	20%	30%	40%	50%	60%	70%	80%	
Room Ratio	COEFFICIENTS OF UTILIZATION									
0.50	Ind. Hor. Dir.	.06 .06 19 24 29	.07 .07 21 26 31	.08 .08 24 28 32	.08 .09 27 31 35	.09 .12 30 34 38	.10 .15 34 37 40	.12 .19 38 41 44	.15 .23 44 47 50	.19 .29 51 53 55
0.60	Ind. Hor. Dir.	.08 .09 28 33 38	.09 .10 30 35 40	.10 .11 33 37 41	.11 .13 36 40 44	.12 .16 39 43 47	.13 .19 43 46 49	.15 .23 47 50 53	.18 .27 52 55 58	.22 .33 59 61 63
0.70	Ind. Hor. Dir.	.10 .11 35 40 45	.11 .12 37 42 47	.12 .14 40 44 48	.13 .16 43 47 51	.14 .19 46 50 54	.15 .22 50 53 56	.17 .26 54 57 60	.20 .30 59 62 65	.23 .36 65 67 69
0.80	Ind. Hor. Dir.	.11 .13 41 46 51	.12 .14 42 47 52	.13 .16 45 49 53	.14 .18 47 51 55	.15 .21 50 54 58	.17 .24 54 57 60	.19 .28 57 60 63	.22 .32 62 65 68	.25 .38 68 70 72
0.90	Ind. Hor. Dir.	.12 .13 45 50 55	.13 .16 46 51 56	.14 .18 49 53 57	.15 .20 51 55 59	.16 .23 53 57 61	.18 .26 57 60 63	.20 .30 60 63 66	.23 .34 64 67 70	.26 .40 70 72 74
1.00	Ind. Hor. Dir.	.13 .16 48 53 58	.14 .18 49 54 59	.15 .20 52 56 60	.16 .22 54 58 62	.17 .25 56 60 64	.19 .28 59 62 65	.21 .32 62 65 68	.24 .36 66 69 72	.27 .42 72 74 76
1.10	Ind. Hor. Dir.	.14 .17 50 55 60	.15 .19 51 56 61	.16 .21 54 58 62	.17 .23 56 60 64	.19 .26 58 62 66	.21 .29 61 64 67	.23 .33 64 67 70	.25 .37 68 71 74	.28 .43 74 76 78
1.25	Ind. Hor. Dir.	.16 .19 53 58 63	.17 .21 54 59 64	.18 .23 57 61 65	.19 .25 59 63 67	.21 .28 61 65 69	.23 .31 64 67 70	.25 .35 67 70 73	.27 .39 70 73 76	.30 .45 76 78 80
1.50	Ind. Hor. Dir.	.18 .22 57 62 67	.19 .24 58 63 67	.20 .26 61 65 69	.21 .29 62 66 70	.23 .32 64 68 71	.25 .35 67 70 73	.27 .39 70 73 76	.29 .43 73 76 79	.32 .48 79 81 83
1.75	Ind. Hor. Dir.	.19 .25 61 66 70	.20 .27 62 67 71	.21 .29 65 69 72	.22 .32 66 70 73	.24 .35 68 72 75	.26 .38 71 74 77	.28 .42 73 76 78	.30 .46 76 79 81	.33 .51 81 83 85
2.00	Ind. Hor. Dir.	.21 .27 64 69 73	.22 .29 65 70 73	.23 .31 68 72 75	.24 .34 69 73 76	.26 .37 71 75 78	.28 .40 74 77 79	.30 .44 76 79 81	.32 .48 79 82 84	.34 .53 83 85 87
2.25	Ind. Hor. Dir.	.23 .29 67 72 75	.24 .31 68 73 76	.25 .33 71 75 78	.26 .36 72 76 79	.27 .39 75 78 80	.29 .42 77 80 82	.31 .46 79 82 84	.33 .50 82 84 86	.35 .55 85 87 89
2.50	Ind. Hor. Dir.	.24 .31 71 75 78	.25 .33 72 76 79	.26 .35 74 78 80	.27 .38 76 79 81	.28 .41 78 81 83	.30 .44 79 82 84	.32 .48 82 84 86	.34 .52 84 86 88	.36 .57 87 89 90
3.00	Ind. Hor. Dir.	.26 .34 75 78 80	.27 .36 76 79 81	.28 .38 77 80 82	.29 .41 78 81 83	.30 .44 80 83 85	.32 .47 82 84 86	.34 .51 84 86 87	.36 .55 86 88 89	.38 .59 89 91 92
3.50	Ind. Hor. Dir.	.28 .37 77 80 82	.29 .39 78 81 83	.30 .41 80 82 84	.31 .44 81 83 85	.32 .47 83 85 86	.34 .50 84 86 87	.36 .54 86 88 89	.38 .57 88 90 91	.40 .61 91 93 94
4.00	Ind. Hor. Dir.	.30 .40 79 82 84	.31 .42 81 83 85	.32 .44 82 84 86	.33 .46 83 85 86	.34 .49 85 87 88	.35 .52 86 88 89	.37 .56 88 90 91	.39 .59 91 92 93	.41 .63 93 94 95
5.00	Ind. Hor. Dir.	.32 .43 83 85 86	.33 .45 83 85 86	.34 .47 84 86 87	.35 .49 85 87 88	.36 .52 87 89 90	.38 .55 89 90 91	.39 .58 91 92 93	.40 .61 92 93 94	.42 .65 94 95 96

TABLE V.—(Continued.)
Ceiling Reflection Factor 60%

Wall Reflection Factor	0%	10%	20%	30%	40%	50%	60%	70%	80%	
Room Ratio	COEFFICIENTS OF UTILIZATION									
0.50	Ind.	.07	.08	.09	.10	.11	.12	.15	.18	.22
	Hor.	.06	.07	.08	.10	.13	.16	.20	.25	.31
	Dir.	19 24 29	21 26 31	24 28 32	27 31 35	30 34 38	35 38 41	39 42 45	44 47 50	51 53 55
0.60	Ind.	.10	.11	.12	.13	.14	.16	.19	.22	.26
	Hor.	.09	.10	.12	.14	.17	.20	.24	.29	.35
	Dir.	28 33 38	30 35 40	33 37 41	36 40 44	39 43 47	44 47 50	48 51 54	53 56 59	60 62 64
0.70	Ind.	.12	.13	.14	.15	.16	.18	.21	.24	.28
	Hor.	.12	.13	.15	.17	.20	.23	.28	.33	.39
	Dir.	35 49 45	37 42 47	40 44 48	43 47 51	46 50 54	50 53 56	54 57 60	59 62 65	66 68 70
0.80	Ind.	.13	.14	.15	.16	.18	.20	.23	.26	.30
	Hor.	.14	.15	.17	.19	.22	.25	.30	.35	.41
	Dir.	41 46 51	43 48 53	46 50 54	48 52 56	51 55 59	55 58 61	58 61 64	63 66 69	69 71 73
0.90	Ind.	.15	.16	.17	.18	.20	.22	.25	.28	.32
	Hor.	.16	.17	.19	.21	.24	.27	.32	.37	.43
	Dir.	45 50 55	46 51 56	49 53 57	51 55 59	54 58 62	58 61 64	61 64 67	65 68 71	71 73 75
1.00	Ind.	.16	.17	.18	.19	.21	.23	.26	.29	.33
	Hor.	.18	.19	.21	.23	.26	.29	.34	.39	.45
	Dir.	48 53 58	49 54 59	52 56 60	54 58 62	56 60 64	60 63 66	63 66 69	67 70 73	73 75 77
1.10	Ind.	.17	.18	.19	.21	.23	.25	.27	.30	.34
	Hor.	.19	.21	.23	.25	.28	.31	.36	.41	.47
	Dir.	50 55 60	51 56 61	54 58 62	56 60 64	58 62 66	62 65 68	65 68 71	69 72 75	75 77 79
1.25	Ind.	.19	.20	.21	.23	.25	.27	.29	.32	.36
	Hor.	.21	.23	.25	.27	.30	.33	.38	.43	.49
	Dir.	53 58 63	54 59 64	57 61 65	59 63 67	61 65 69	64 67 70	67 70 73	71 74 77	77 79 81
1.50	Ind.	.21	.22	.23	.25	.27	.29	.31	.34	.38
	Hor.	.24	.26	.28	.31	.34	.37	.42	.47	.52
	Dir.	57 62 67	58 63 67	61 65 69	63 67 71	65 69 72	68 71 74	71 74 77	74 77 80	80 82 84
1.75	Ind.	.23	.24	.25	.27	.29	.31	.33	.36	.39
	Hor.	.27	.29	.31	.34	.37	.40	.45	.50	.55
	Dir.	61 66 70	62 67 71	65 69 72	67 71 74	69 73 76	72 75 77	74 77 79	77 80 82	82 84 86
2.00	Ind.	.25	.26	.27	.29	.31	.33	.35	.38	.41
	Hor.	.29	.31	.33	.36	.39	.42	.47	.52	.57
	Dir.	64 69 73	65 70 73	68 72 75	70 74 77	72 76 79	75 78 80	77 80 82	80 83 85	84 86 88
2.25	Ind.	.27	.28	.29	.31	.33	.35	.37	.39	.42
	Hor.	.31	.33	.35	.38	.41	.44	.49	.54	.59
	Dir.	67 72 75	68 73 76	71 75 78	73 77 80	76 79 81	78 81 83	80 83 85	83 85 87	86 88 90
2.50	Ind.	.29	.30	.31	.33	.35	.37	.39	.41	.44
	Hor.	.33	.35	.37	.40	.43	.46	.51	.56	.61
	Dir.	71 75 78	72 76 79	74 78 80	77 80 82	79 82 84	80 83 85	83 85 87	85 87 89	88 90 91
3.00	Ind.	.32	.33	.34	.35	.37	.39	.41	.43	.46
	Hor.	.37	.39	.41	.44	.47	.50	.55	.59	.63
	Dir.	75 78 80	76 79 81	77 80 82	79 82 84	81 84 86	82 85 87	85 87 88	87 89 90	90 92 93
3.50	Ind.	.34	.35	.36	.37	.39	.41	.43	.45	.47
	Hor.	.40	.42	.44	.47	.50	.53	.57	.61	.65
	Dir.	78 81 83	78 81 83	80 82 84	82 84 86	84 86 87	85 87 88	87 89 90	89 91 92	92 94 95
4.00	Ind.	.36	.37	.38	.39	.41	.43	.44	.46	.48
	Hor.	.43	.45	.47	.50	.53	.56	.59	.63	.67
	Dir.	80 83 85	81 83 85	82 84 86	84 86 87	86 88 89	87 89 90	89 91 92	92 93 94	94 95 96
5.00	Ind.	.38	.39	.40	.41	.43	.45	.46	.48	.49
	Hor.	.46	.48	.50	.53	.56	.59	.62	.65	.69
	Dir.	84 86 87	84 86 87	85 87 88	86 88 89	88 90 91	90 91 92	92 93 94	93 94 95	95 96 97

TABLE V.—(Continued.)
Ceiling Reflection Factor 70%

Wall Reflection Factor	0%	10%	20%	30%	40%	50%	60%	70%	80%
Room Ratio	COEFFICIENTS OF UTILIZATION								
0.50	Ind.	.08	.09	.10	.11	.13	.15	.18	.22
	Hor.	.07	.08	.09	.11	.14	.17	.21	.27
	Dir.	19 24 29	21 26 31	24 28 32	27 31 35	30 34 38	35 38 41	39 42 45	44 47 50
0.60	Ind.	.12	.13	.14	.15	.17	.19	.22	.26
	Hor.	.10	.11	.13	.15	.18	.21	.25	.31
	Dir.	28 33 38	30 35 40	33 37 41	36 40 44	39 43 47	44 47 50	48 51 54	53 56 59
0.70	Ind.	.14	.15	.16	.17	.19	.21	.24	.28
	Hor.	.13	.14	.16	.18	.21	.25	.29	.35
	Dir.	35 40 45	37 42 47	40 44 48	43 47 51	46 50 54	50 53 56	54 57 60	59 62 65
0.80	Ind.	.16	.17	.18	.19	.21	.23	.26	.30
	Hor.	.15	.16	.18	.20	.23	.27	.32	.38
	Dir.	41 46 51	43 48 53	46 50 54	48 52 56	51 55 59	55 58 61	59 62 65	63 66 69
0.90	Ind.	.17	.18	.19	.21	.23	.25	.28	.32
	Hor.	.17	.18	.20	.22	.25	.29	.34	.40
	Dir.	45 50 55	47 52 57	50 54 58	52 56 60	54 58 62	58 61 64	61 64 67	65 68 71
1.00	Ind.	.19	.20	.21	.23	.25	.27	.30	.34
	Hor.	.18	.20	.22	.24	.27	.31	.36	.42
	Dir.	48 53 58	49 54 59	52 56 60	54 58 62	56 60 64	60 63 66	63 66 69	67 70 73
1.10	Ind.	.20	.21	.23	.25	.27	.29	.32	.35
	Hor.	.20	.22	.24	.26	.29	.33	.38	.44
	Dir.	50 55 60	51 56 61	54 58 62	56 60 64	58 62 66	62 65 68	65 68 71	69 72 75
1.25	Ind.	.22	.23	.25	.27	.29	.31	.34	.37
	Hor.	.22	.24	.26	.29	.32	.36	.41	.47
	Dir.	53 58 63	54 59 64	57 61 65	59 63 67	61 65 69	65 68 71	68 71 74	72 75 78
1.50	Ind.	.25	.26	.28	.30	.32	.34	.37	.40
	Hor.	.25	.27	.30	.33	.36	.40	.45	.50
	Dir.	57 62 67	58 63 67	61 65 69	63 67 71	65 69 72	69 72 75	72 75 78	75 78 81
1.75	Ind.	.27	.28	.30	.32	.34	.36	.39	.42
	Hor.	.28	.30	.33	.36	.39	.43	.48	.53
	Dir.	61 66 70	62 67 71	65 69 72	67 71 74	69 73 76	72 75 78	75 78 80	78 81 83
2.00	Ind.	.30	.31	.32	.34	.36	.38	.41	.44
	Hor.	.31	.33	.36	.39	.42	.46	.51	.56
	Dir.	64 69 73	65 70 73	68 72 75	70 74 77	72 76 79	75 78 80	78 81 83	81 84 86
2.25	Ind.	.32	.33	.34	.36	.38	.40	.43	.46
	Hor.	.33	.35	.38	.41	.44	.48	.53	.58
	Dir.	67 72 75	68 73 76	71 75 78	73 77 80	76 79 81	78 81 83	81 84 86	84 86 88
2.50	Ind.	.34	.35	.36	.38	.40	.42	.45	.48
	Hor.	.35	.37	.40	.43	.46	.50	.55	.60
	Dir.	71 75 78	72 76 79	74 78 80	77 80 82	79 82 84	81 84 86	84 86 88	86 88 90
3.00	Ind.	.37	.38	.39	.41	.43	.45	.47	.50
	Hor.	.39	.41	.44	.47	.50	.54	.58	.63
	Dir.	75 78 80	76 79 81	78 81 83	80 83 85	82 85 87	84 86 88	86 88 89	88 90 91
3.50	Ind.	.40	.41	.42	.44	.46	.48	.50	.52
	Hor.	.42	.44	.47	.50	.53	.57	.61	.66
	Dir.	78 81 83	79 82 84	81 83 85	83 85 87	85 87 88	86 88 89	88 90 91	90 92 93
4.00	Ind.	.42	.43	.44	.46	.48	.50	.52	.54
	Hor.	.45	.47	.50	.53	.56	.60	.64	.68
	Dir.	80 83 85	82 84 86	83 85 87	85 87 88	87 89 90	88 90 91	90 92 93	93 94 95
5.00	Ind.	.45	.46	.47	.48	.50	.52	.54	.56
	Hor.	.49	.51	.54	.57	.60	.63	.66	.70
	Dir.	84 86 87	84 86 87	85 87 88	87 89 90	89 91 92	91 92 93	93 94 95	94 95 96

Reflection Factors

The proportions of light reflected by walls and ceilings of various colors, that is, their Reflection Factors, have an important bearing on both the natural and the artificial lighting. The proportion reflected will depend somewhat upon the color of the incident light. The figures here given show what proportion of the light of MAZDA lamps these painted surfaces reflect. Reflection Factors are of

No. 1
White
Paper
81%

No. 9
Ivory
White
76%

No. 2
Gray
73%

No. 10
Caen
Stone
72%

No. 3
Gray
67%

No. 11
Ivory
72%

No. 4
Gray
51%

No. 12
Ivory
Tan
58%

No. 5
Gray
46%

No. 13
Primrose
67%

No. 6
French
Gray
39%

No. 14
Lichen
Gray
70%

No. 7
Gray
28%

No. 15
Pearl
Gray
70%

No. 8
Gray
18%

No. 16
Silver
Gra
and Ca
Stone
50%

of Colored Surfaces

pecial usefulness in determining the Coefficient of Utilization (ratio of light delivered at the work to total light of lamps) applicable to an interior. The Reaction Factor of any colored surface can be approximated by comparing it with these samples.

No. 17
Buff Stone
and Pale
Ivory
4%
27%



No. 25
Forest
Green
21%
27%



No. 18
Buff
9%
27%



No. 26
Olive
Green
14%
27%



No. 19
Buff Stone
16%
27%



No. 27
Pale Azure
and White
53%
27%



No. 20
Muscat
7%
27%



No. 28
Pale Azure
36%
27%



No. 21
Macadamia
Brown
2%
27%



No. 29
Sky Blue
31%
27%



No. 22
Linen
Green
7%
27%



No. 30
Shell Pink
57%
27%



No. 23
Light Sage
and Ivory
1%
27%



No. 31
Pink
51%
27%



No. 24
Light Sage
3%
27%



No. 32
Cardinal
Red
27%
27%



TABLE V.—(Continued.)
Ceiling Reflection Factor 80%

Wall Reflection Factor	0%	10%	20%	30%	40%	50%	60%	70%	80%
Room Ratio	COEFFICIENTS OF UTILIZATION								
0.50	Ind. .09 07 Dir. 19 24 29 21 26 31 24 28 32 27 31 35 30 34 38 35 38 41 39 42 45 44 47 50 52 54 56	.10 .08 11 14 18 22 28 35	.11 .09 11 14 18 22 27 35	.12 11 14 16 18 22 27 35	.14 14 18 22 27 31 35 38	.17 18 22 27 31 35 38 41	.21 22 28 31 35 38 41 45	.25 28 32 35 38 41 44 50	.31 35 38 40 44 47 52 56
0.60	Ind. .13 10 Dir. 28 33 38 30 35 40 33 37 41 36 40 44 39 43 47 44 47 50 48 51 54 53 56 59 61 63 65	.14 12 14 16 18 22 27 33	.15 14 17 19 18 22 26 37	.16 16 19 19 18 22 26 34	.18 18 22 25 27 31 34 37	.21 22 26 29 31 34 37 40	.25 27 31 33 37 39 42 44	.29 33 37 38 40 42 44 46	.35 40 44 46 47 49 51 55
0.70	Ind. .16 13 Dir. 35 40 45 37 42 47 40 44 48 43 47 51 46 50 54 50 53 56 54 57 60 59 62 65 67 69 71	.17 15 17 19 19 22 26 35	.18 15 17 19 19 22 26 35	.19 17 19 21 21 24 27 35	.21 22 26 27 27 31 34 35	.24 26 26 29 31 36 38 39	.28 31 31 33 36 38 40 42	.32 37 37 38 38 40 42 44	.38 44 44 46 47 49 51 53
0.80	Ind. .18 15 Dir. 41 46 51 43 48 53 46 50 54 48 52 56 51 55 59 55 58 61 59 62 65 64 67 70 71 73 75	.19 17 19 19 19 22 25 34	.20 17 19 22 22 25 29 34	.22 19 21 22 22 25 29 34	.24 25 27 27 27 31 34 35	.27 29 31 31 31 34 37 38	.30 34 36 36 36 38 40 42	.34 40 40 42 42 44 46 48	.40 47 47 49 49 51 53 55
0.90	Ind. .20 17 Dir. 46 51 56 47 52 57 50 54 58 52 56 60 55 59 63 59 62 65 62 65 68 66 69 72 73 75 77	.21 19 21 21 21 24 27 35	.22 19 21 21 21 24 27 35	.24 21 24 24 24 27 31 35	.26 24 27 27 27 31 36 38	.29 27 31 31 31 36 38 39	.32 36 36 36 36 38 40 42	.36 42 42 42 42 44 46 48	.42 49 49 49 49 51 53 55
1.00	Ind. .22 19 Dir. 49 54 59 50 55 60 53 57 61 55 59 63 57 61 65 61 64 67 64 67 70 68 71 74 75 77 79	.23 21 23 21 23 26 29 33	.24 21 23 21 23 26 29 33	.26 21 23 21 23 26 29 33	.28 26 29 29 29 32 33 33	.31 29 33 33 33 36 38 38	.34 33 33 33 33 36 38 38	.38 44 44 44 44 46 48 48	.44 51 51 51 51 53 55 55
1.10	Ind. .23 21 Dir. 51 56 61 52 57 62 55 59 63 57 61 65 59 63 67 63 66 69 66 69 72 70 73 76 77 79 81	.24 23 23 23 25 28 <br;></br;>	.26 23 25 23 25 28 31 35	.28 25 28 25 28 31 34 38	.30 28 31 31 31 34 38 43	.33 31 35 35 35 38 42 43	.36 35 40 40 40 43 47 48	.40 46 46 46 46 48 53 53	.45 53 53 53 53 55 58 58
1.25	Ind. .25 23 Dir. 54 59 64 55 60 65 58 62 66 60 64 68 62 66 70 66 69 72 69 72 75 73 76 79 80 82 84	.26 25 25 25 28 31 34 38	.28 25 28 25 28 31 34 38	.30 28 31 31 31 34 38 43	.33 31 34 34 34 38 42 43	.36 33 38 38 38 42 46 47	.39 35 43 43 43 47 51 52	.43 49 49 49 49 51 53 54	.47 56 56 56 56 58 60 60
1.50	Ind. .28 26 Dir. 58 63 68 59 64 68 62 66 70 64 68 72 66 70 73 70 73 76 72 75 78 76 79 82 83 85 87	.29 29 32 32 35 38 42 45	.31 29 32 32 35 38 42 45	.33 29 32 32 35 38 42 45	.36 29 32 32 35 38 42 45	.39 36 42 42 42 46 50 52	.42 42 47 47 47 48 53 55	.46 53 53 53 53 55 58 58	.50 59 59 59 59 60 62 62
1.75	Ind. .31 29 Dir. 62 67 71 63 68 72 66 70 73 68 72 75 70 74 77 73 76 79 75 78 80 79 82 84 85 87 89	.32 32 35 35 38 42 46 48	.34 32 35 35 38 42 46 48	.36 32 35 35 38 42 46 48	.39 36 42 42 42 46 48 50	.42 39 46 46 46 48 50 52	.45 51 51 51 51 54 56 58	.48 56 56 56 56 58 60 62	.52 62 62 62 62 64 66 66
2.00	Ind. .34 32 Dir. 65 70 74 66 71 74 69 73 76 71 75 78 73 77 80 76 79 81 78 81 83 82 85 87 87 89 91	.35 35 38 38 41 45 49 54	.37 35 38 38 41 45 49 54	.39 35 41 41 44 48 52 56	.42 38 45 45 48 52 56 60	.45 44 49 49 52 56 60 64	.48 54 54 54 54 58 62 65	.51 59 59 59 59 58 60 63	.54 65 65 65 65 58 60 60
2.25	Ind. .36 34 Dir. 68 73 76 69 74 77 72 76 79 74 78 81 77 80 82 79 82 84 81 84 86 85 87 89 89 91	.37 37 40 40 44 48 52 56	.39 37 41 41 44 48 52 56	.41 39 44 44 44 48 52 56	.44 41 44 44 44 48 52 56	.47 44 52 52 52 56 57 59	.50 50 57 57 57 58 59 60	.53 62 62 62 62 63 65 66	.56 67 67 67 67 58 60 60
2.50	Ind. .38 36 Dir. 71 75 78 72 76 79 74 78 80 77 80 82 79 82 84 81 84 86 84 86 88 87 89 91 90 92 94	.39 39 42 42 46 50 54 58	.41 39 42 42 46 50 54 58	.43 39 42 42 46 50 54 58	.46 44 46 46 48 50 54 58	.49 49 54 54 54 58 62 64	.52 59 59 59 59 58 62 64	.55 64 64 64 64 55 66 66	.58 69 69 69 69 58 62 62
3.00	Ind. .42 40 Dir. 75 78 80 76 79 81 78 81 83 80 83 85 82 85 87 84 87 89 87 89 90 89 91 92 92 94 95	.43 43 46 46 50 54 58 62	.45 43 46 46 50 54 58 62	.47 45 47 47 50 54 58 62	.49 47 50 50 54 58 62 65	.52 49 52 52 54 58 62 65	.55 55 57 57 57 58 62 65	.58 67 67 67 67 58 62 62	.61 72 72 72 72 61 66 66
3.50	Ind. .45 44 Dir. 78 81 83 79 82 84 81 83 85 83 85 87 85 87 88 87 89 90 89 91 92 91 93 94 94 96 97	.46 44 50 50 54 58 62 66	.48 47 50 50 54 58 62 66	.50 50 54 54 58 62 66 70	.52 52 55 55 58 62 66 70	.54 54 57 57 58 62 66 70	.57 57 59 59 59 62 66 70	.60 66 66 66 66 57 62 62	.63 74 74 74 74 63 67 67
4.00	Ind. .48 47 Dir. 80 83 85 82 84 86 83 85 87 85 87 88 87 89 9 89 91 92 91 93 94 94 95 96 97 98	.49 47 50 47 53 57 61 64	.51 51 53 47 53 57 61 64	.53 53 57 57 61 64 68 71	.55 55 58 58 61 64 68 71	.57 57 59 59 61 64 68 71	.59 59 62 62 64 67 71 74	.61 72 72 72 72 64 67 67	.64 76 76 76 76 64 68 68
5.00	Ind. .51 51 Dir. 84 86 87 85 87 88 86 88 89 87 89 90 89 91 92 92 93 94 94 95 96 95 96 97 98 99	.52 51 54 54 57 60 64 66	.54 51 57 57 60 64 66	.56 56 58 58 60 64 66	.58 58 61 61 64 67 69	.60 60 62 62 64 67 71 74	.62 62 64 64 66 69 73 77	.64 78 78 78 78 66 70 70	.66 78 78 78 78 68 72 72

NOTE:—Discussion is combined with that for Walls and Floors, page 131.