

Fig. 7. See Fig. 8.

2. A separate work-sheet should be kept for each man.

3. The humidity of the atmosphere, the time of the year, the days of the week, and days before and after holidays should all be closely noted, as any of these may cause a variation in production.

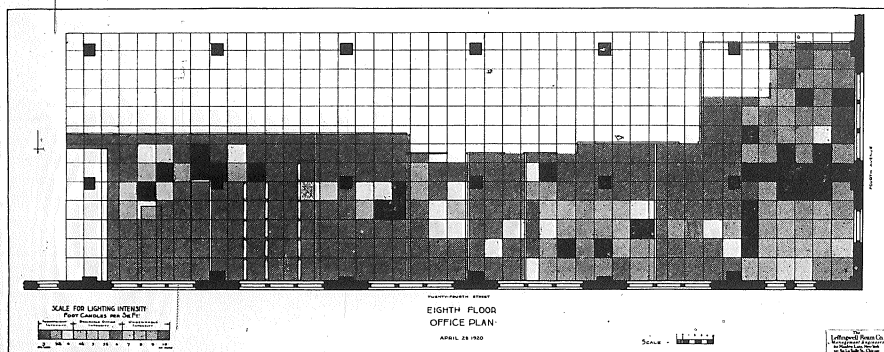


Fig. 8. Leffingwell-Ream Co. Method of Plotting Foot-Candles Intensity—Each Section Represents an Area of 1 Sq. Yd.

4. There should be a number of different illumination steps employed in the test. It is preferable to start with the original system, and check back on this original system several times, as well as to check production at least two times at each level. A check should also be kept on the daylight production when possible.

5. The material supplied the men should be closely inspected, for at this time especially many plants have considerable difficulty in securing their rough products; rough castings may one week require finishing down $\frac{3}{4}$ " and the next week the shipment may have to be finished $\frac{3}{8}$ ".

6. It is desirable that a knowledge that test is under way be kept from the men when possible.

7. There should be a close supervision of the men at all times to see that they are all at work and to note any changes in personnel.

8. There should be a close check on the material supplied the men as well as the power supply, in order to note any shutdown from either of these causes.

9. Objection from the workmen is liable to be experienced when changing the size of lamps and reflectors, but this can largely be overcome by making all changes over the week-end.

10. The foot-candle illumination should be measured at the beginning and end of the hours under consideration as well as at certain intermediate hours. Definite stations should be located for these readings.

In addition to the illustrations of the foot-candle meter (Figs. 2 and 3), I submit herewith other illustrations, chiefly cases of good and poor illumination (Figs. 1 and 4 to 6).

DISCUSSION

W. H. LEFFINGWELL: I am not going to argue about Mr. Harrison's paper. Neither am I going to claim that I know anything about illuminating except what I have learned from the writings of illuminating engineers. The National Lamp Works gets out a number of bulletins such as "The Lighting of Offices and Draughting Rooms." I think that all members should make it a point to get such of those bulletins as may interest them.

Since the work of our firm is mostly in the office and most office work is very intense eye work, we have found this problem of lighting a very important one. The scientific measurement of light by means of the photometer is a difficult matter and for a long time there was no way that we knew anything about for finding out in a simple way what the lighting conditions are. The instrument that Mr. Harrison has shown us here is such a wonderfully simple one that I think almost any engineer who has any lighting problems cannot afford to be without it. It is of a very low price and it gives you a quick result.

What I have to offer tonight is what I think a little better method than is ordinarily used by the illuminating engineer for charting the lighting conditions.

The illumination engineer's diagram, it seems to me, is too technical and abstract for the average business man to understand. I am showing a typical diagram (curve) as used by illuminating engineers kindly loaned to me by the National X-Ray Reflector Company. You will note that the scale across the bottom indicates the number of feet from the center of the lighting unit while the vertical scale indicates the number of foot-candles. This form of charting is merely used to indicate the distribution of light in a typical bay. As a rule, unless one is considering an entirely new building where conditions can be standardized, only an average bay could be considered and thus this method fails to show the true conditions throughout the area.

Now our method, which was originated by our Mr. C. W. Griffin, a member of this Society is to make a pictorial diagram of the entire floor, dividing this floor into squares of one yard in area. We then make a test of the light in each square yard with the foot-candle meter, shown here by Mr. Harrison tonight. Then we color the chart with a range of several shades of three colors. Our scale, as shown at the bottom of the diagram shows three shades of blue as insufficient intensity and ranges from 3 to 4 candles. The desir-

¹Leffingwell-Ream Company, New York and Chicago.

able office intensity ranges from four-and-a-half to six foot-candles and is shown in four shades of yellow. The undesirable intensity we have shown in four shades ranging from pink to intense red and it indicates from seven to ten foot candles and over. The diagram is then colored throughout the entire area.

Figure 7 shows very good distribution of light for part of the area, but very poor in other parts. Figure 8 shows a very spotty condition—some places running down to less than three foot-candles and others as high as twenty foot-candles.

Mr. Harrison has shown us that we can profitably go much higher than we have shown on this scale. I have felt that any intensity above seven or eight foot candles is not necessary in the office chiefly because nearly all the work is on horizontal flat surfaces, but from the demonstration given us tonight I think perhaps I shall have to revise that opinion.

There are one or two things that I should like to say about office lighting particularly. Mr. Harrison showed one installation of the indirect lighting. In the diagram which I am passing around, which is very spotted, was used a semi-indirect, but the semi-indirect did not properly diffuse the lighting throughout the place, so it was supplemented with drop cords. This is the most common way of trying to make the lighting satisfactory and the reason is that these lighting problems are not handled by illuminating engineers, or engineers of any kind. Usually it is an electrician, and about all he knows is wiring and putting up the lamps.

I think it would pay any organization well to have their lighting problems examined by an illuminating engineer. The management engineer is not an illuminating engineer—he is a consulting engineer in management and lighting is only one of his problems. His work in this respect is merely to show the client whether or not the lighting he has is up to standard.

Another thing that I should like to mention, which Mr. Harrison only briefly touched upon, is the false economy of trying to estimate lighting from the standpoint of the cost of the current. Mr. Harrison pointed out that the cost of the lighting is only a very small percentage of the cost of the employee. If we can show by these tests which Mr. Harrison suggests that increased lighting is an economy, I think by all means we ought to do it, because sometimes the business man approaches these things only from the dollars and cents standpoint and not from the standpoint of trying to give his employees the very best working conditions.