

BUILDING ELECTRICAL SYSTEMS

INTERIOR LIGHTING

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1. GENERAL

1.01 This section covers guidelines for interior lighting. These recommendations are provided for use in the design of new lighting systems for all telephone company (Telco) buildings.

1.02 Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph.

2. OFFICES

2.01 The purpose of office lighting is to provide for effective visual performance with optimum use of energy. It is important, therefore, to analyze the controllable factors that contribute to visibility, ie, the task, the lighting, and the environment.

2.02 The amount of lighting varies greatly according to the visual task involved. Recommended levels for various spaces are given in Table A.

2.03 These lighting levels have been based as far as possible on the American National Standard Practice for Office Lighting. This should be studied carefully by lighting designers for a better understanding of required lighting levels as well as the effect of veiling reflections. It also covers other important considerations in office lighting design.

2.04 Because the American National Standard Practice is so complete and well illustrated, much of the background material which would usually be included in this section has been omitted. The (ANSI) practice should be considered as not just a reference, but an integral part of this section.

2.05 It should be noted that the recommended levels are adequate for most work performed in the areas listed. However, it is quite possible that higher levels might be needed for more difficult visual tasks such as: Hard pencil writing, poor carbon copies, poor computer printouts, certain drafting and graphic design work and any poorly reproduced, very small or low contrast material.

2.06 For most offices requiring up to about 50 foot-candles, except those having shelves above the work surface, ceiling mounted fixtures should be used for task as well as ambient lighting. The best light sources are 2 or 3 lamp fluorescent fixtures with 48 inch lamps mounted about 8 feet on centers, although a specific design based on lighting calculations should be made for each space. Where a third lamp is provided, it is a good idea to include a fixture mounted switch so that it can be turned off if it is not required due to changes in the office layout. The fixtures should be equipped with the new, more efficient lamps and ballasts and will require about 1.3 to 2.0 watts/square foot.

2.07 Where higher lighting levels are required, they should be provided only for the areas needing them. For small areas, often the most practical way to do this is to supplement the ceiling lighting system with desk lamps.

2.08 *Traffic Service Position System (TSPS) Operating Rooms:* Because of reflected glare from various portions of TSPS operator positions, it is recommended that lighting for these operating rooms be provided only by fully indirect lighting. Continuous rows of indirect lighting fixtures spaced at 8 feet and equipped with high output energy saving fluorescent lamps will usually provide about the right light levels.

2.09 *Directory Assistance Bureaus:* Where printed records have been replaced by micro-

fiche readers or cathode ray screens, the lighting levels will have to be reduced drastically. This has been done successfully by a combination of delamping and replacement of fluorescent lamps with phantom tubes or reflector lamps.

2.10 For new bureaus without directories, the lower lighting levels can, of course, be provided initially. Indirect lighting is probably the best solution to providing the soft, glareless lighting required, with no reflections from the viewing screens.

2.11 *Other Offices With Visual Display Terminals:* In offices utilizing visual display terminals where there are also reading and writing tasks, the lighting design is more difficult. Special care must be taken to avoid glare on the display terminals, while at the same time providing adequate high quality light for reading and writing.

2.12 It is recommended that a *qualified* lighting professional be employed to design these lighting systems.

3. TASK/AMBIENT

3.01 All space must be lighted to a minimum overall level so that people can move about safely, and have a warm and pleasing atmosphere to work in. This ambient lighting should be provided by ceiling mounted fixtures and the level should be about 15 through 20 footcandles at the desk top level. The areas along the outside walls that have windows can utilize daylighting for ambient as well as task lighting much of the time.

3.02 The best light sources for the ambient light are ceiling mounted 2 lamp fluorescent fixtures with 48 inch lamps spaced about 10 feet center-to-center. The fixtures should be equipped with the most efficient lamps and ballasts available and will require less than 0.8 watts/square foot.

3.03 The specific choice and layout of the fixtures must be made by the lighting designer for the particular job, taking into account wall and floor reflectances, geometry of the space, acoustics, costs, etc. Fixtures with parabolic aluminum louvers probably have the best combination of high efficiency, low brightness, low maintenance, and noise control, but they are costly. A good plastic prismatic lens can be very satisfactory in most applications.

3.04 Ambient lighting can also be provided as indirect lighting from furniture mounted task-

ambient fluorescent fixtures. Before attempting this approach, it is suggested that a careful analysis of both first and operating cost be made, because these systems appear to be costly and inefficient.

3.05 Another approach is the use of totally indirect lighting utilizing high intensity discharge lamps for supplying both ambient and task lighting. The units are usually mounted on open office partitions or can be stem mounted from the ceiling. This requires that the partitions and furniture be grouped so that the several desks can be lighted from one fixture. Provided that there are no shelves above the work surfaces this system can provide a good level of high quality light at very low power consumption and at a reasonable cost.

3.06 If shelves are mounted above work surfaces they will block much of the light from ceiling fixtures and it will be necessary to mount the task lights under the shelves. Various approaches have been taken to the design of these lights including lenses designed to throw as much light as possible from the sides, polarizing filters, moveable shields, etc, in an attempt to eliminate veiling reflections. None has been wholly satisfactory, but the best are quite tolerable with a little cooperation from the viewer. This task lighting is very efficient from a power standpoint and will usually add no more than 0.2 watts/ square foot to the ambient lighting power requirement. Switches should be provided for each task light.

4. PERIMETER LIGHTING

4.01 With the lower overall ambient lighting levels that are provided when furniture mounted task lighting is used, consideration must be given to lighting interior walls. Walls which are far removed from windows and daylight might be quite dark and cause a depressing and gloomy atmosphere in the room. If it appears that this will be a problem, these walls should be lighted for aesthetic purposes. A continuous row of fluorescent lamps is a good solution to this problem. They can be recessed in the ceiling or mounted on the wall near the ceiling. Recessed incandescent lamps have also been used successfully, especially if it is desired to light pictures or murals on the walls.

5. EMERGENCY LIGHTING

5.01 *General Offices:* Emergency lighting should be provided in general offices only

where there are no windows, in interior corridors and stairwells, or when emergency lighting is required by the building code. This lighting is best provided by battery operated emergency lighting equipment. There is a tremendous variety of this equipment available now and a selection should be made carefully for appearance, economy, and ease of maintenance.

5.02 It is no longer necessary to install the ugly wet cell battery units which were all that was available at one time. Some units can power several other remote units and there are also central systems which are ideal for some applications. One of the best solutions is to install inverters which will operate some of the regular fluorescent lamps when the power fails. If there is a central office power plant available, the best way to provide emergency lighting is to install 48 Vdc incandescent lamps inside some of the fluorescent fixtures, or in their own incandescent fixtures.

5.03 *Operating Rooms (TSPS, DA, etc):* All of the lighting in operating rooms should usually be supplied from a stand-by generator during power failures. If it is impractical to install such a generator, it is recommended that the dc power plant for the operator's positions be made large enough to operate about one-third of the regular fluorescent lighting by inverters installed in the fixtures. The inverters

should be activated automatically when the regular power fails.

5.04 *Assignment Bureaus and Repair Service Bureaus:* These Bureaus should be treated the same as operating rooms, as it is quite likely they will have to operate during power failures.

6. CENTRAL OFFICE EQUIPMENT

6.01 Lighting of central office equipment is usually done by frame mounted lighting and is the responsibility of network engineering. It is covered in Section 760-230-130.

7. REFERENCES

7.01 This material was based on the following references:

Illuminating Engineering Society of North America (IES)—Lighting Handbook
Application and Reference Volumes

American National Standard Institute (ANSI) Standard Practice for Office Lighting (1982) ANSI/IES RP-1-1982. Published by:
Illuminating Engineering Society of North America
345 East 47th Street
New York, NY 10017

TABLE A
ILLUMINANCE LEVELS
FOOTCANDLES — MAINTAINED (NOTES)

| LOCATIONS | LEVELS | LOCATIONS | LEVELS |
|-------------------------------|---------|------------------------|--------|
| Assignment Bureaus | 70-100 | Kitchens | 70 |
| Auditoriums | 25 | Lobbies | 10 |
| Basements | 10 | Locker Rooms | 10 |
| Boiler Rooms | 10 | Lounges | 10 |
| Business Offices | 30-50 | Mail Rooms (Sorting) | 50-100 |
| Cable Vaults | 5 | Mechanical Equip. Rm | 10 |
| Cafeterias | 25 | Medical Rooms | 70 |
| Classrooms (Training Centers) | 50-70 | Microfiche Readers | |
| Computer Rooms | 30-50* | Keyboards | 15 |
| Computer Terminals | | Screens | 2† |
| Keyboards | 15 | Operating Rooms | 30-50 |
| Cathode Ray Screens | 5† | Parking Lots | 0.5 |
| Conference Rooms | 30-50 | Power Rooms (DC) | 10* |
| Corridors | 5 | Receiving & Ship. Rm | 10 |
| Directory Assistance Bureaus | 70-100Ø | Repair Service Bureaus | |
| Drafting Rooms | 50-150 | With Line Cards | 50-70 |
| Duplicating Machine Rooms | 30-50 | With LMOS | 30-50 |
| Elevators & Escalators | 15 | Stairways | 5 |
| Elevator Machine Rooms | 10* | Stand-by Engine Rooms | 10* |
| Employment Offices | 30-50 | Storage Areas | 5 |
| Garages | 5* | Switchgear Rooms (AC) | 10* |
| General Offices | 30-50 | Toilets | 10 |
| Janitor Closets | 15 | Training Rooms | 30-50 |
| | | Transformer Vaults | 10 |

* For equipment repairs or service provide 70 foot candles by localized or portable lighting.

† Maximum

Ø - With printed Directories.

Notes:

1. The values of illuminance shown are average maintained footcandles as obtained by the lumen method, using zonal-cavity calculations. This method is appropriate only if the luminaires are spaced to obtain reasonably uniform illumination. Where nonuniform levels are provided or for tasks in the vertical plane, point-by-point calculations are required.
2. "Maintained" means the level that will result after the normal unavoidable drop in light output due to lamp deterioration and dirt accumulation.
3. Where a range is given, weighting should be given to the following factors in deciding on a higher or lower level: The **age** of the workers. People over 55 require more light, while those under 40 require less. The importance of **speed and/or accuracy** should be considered also. Finally, **the reflectance** of the task background has an effect, with darker backgrounds requiring more light.

In general, new installations should be designed for levels toward the upper end of the range. Where the levels in existing space fall near or below the lower end of range, corrective action might be required.

TABLE A (CONTD)

ILLUMINANCE LEVELS FOOT CANDLES—MAINTAINED (NOTES)

Notes (Contd):

4. In areas where higher levels are indicated, supplemental lighting should be provided on the tasks rather than increase the overall room lighting level. Uniform illumination over 50 footcandles should usually not be provided.
5. In order to provide more flexibility in the operation of lighting systems, localized switching should be provided in all small areas, rooms, and cubicles. In large areas, such as general office space, provide ample switching so that as much of the lighting as practical can be turned off when not needed. The lights next to a wall with windows should be switched separately so they can be left off on bright days.
6. Require that the maintained design footcandle level be shown on the construction drawings.
7. For more detail on levels for specific tasks where it is felt the above general guidelines are not adequate and for other information helpful in lighting design, see American National Standard Practice For Office Lighting (1982 Issue).