

Let There be at Least Half-Way Decent Light: How Library Illumination Systems Work—And Don't Work

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Summary of a Presentation at
The Public Library Association 2002 Conference in Phoenix

The original presentation was heavily illustrated with color slides and had a number of running jokes, both of which are omitted from this outline. You would have had a lot more fun (and perhaps found things easier to understand) if you had been there in person. It is possible that the program may be repeated at the 2003 conferences of the Illinois Library Association and the Virginia Library Association.

INTRODUCTION

Many libraries have serious problems with lighting. Because most of these problems are easy to prevent if you start off with the right premises, bad lighting is an avoidable evil.

Sometimes major lighting problems can be corrected after your building is constructed, but many cannot. By far the best time to avoid evil in lighting is when you are first designing a building.

Lighting is not an arcane subject. All we need to do in libraries is to provide uniform, high-quality light while avoiding glare and not wasting money.

To deal effectively with architects and engineers, you'll have to understand some basic lighting concepts, particularly so you'll know when and why to shout "no."

This outline is divided into eight parts:

1. Know how lighting technology works
2. Control light level and color
3. Design lighting for maximum building flexibility
4. Avoid glare
5. Keep it simple
6. Conclusions and recommendations

7. Miscellaneous aphorisms
8. Questions

One: KNOW HOW LIGHTING TECHNOLOGY WORKS

To work effectively with lighting designers, you need a quick introduction to lighting technology.

A couple of technical terms first:

In the lighting trade, bulbs are called “lamps.” This can lead to some real confusion. When talking with designers, try to avoid using the word “lamp” to refer to a lighting fixture, or be specific by saying “table lamp” or “floor lamp.”

Some types of lamps require what are called “ballasts.” These are small transformers that raise household voltage to levels high enough to activate the lamps. (Ballasts are the gadgets that provided pleasant interruptions to the school day when they went bad and black tarry gunk dripped down from the light fixtures onto student desks during boring classes.)

Lamp shapes are designated by letters, followed by a number that stands for the diameter of the lamp in eighths of an inch. Some everyday letter designations include:

- A** Standard everyday lamps
- T** Tube, such as fluorescent lamps
- R** Reflector flood
- PAR** Parabolic aluminized reflector (these are as subtle as headlights)

With the exception of LEDs (light emitting diodes, which are used in modern exit signs) there are three major types of sources of artificial light used in libraries—incandescent, fluorescent, and HID.

Incandescent

Incandescent lighting is the system we know best. Some people call it a “hot wire in a bottle.” It's not the first method invented to create electric light, but it's the first practical one for daily use in buildings.

Incandescent lamps come in a vast variety of shapes and sizes—everything from ordinary round bulbs to all sorts of spotlights and other specialized shapes.

What are the main characteristics of incandescent light?

Inefficient

Incandescent light provides relatively little light per watt. For most of us, that's just an economic choice, but some states have laws limiting the amount of lighting wattage per square foot in public buildings. Most standards of this type will make it impossible to use incandescent lamps and still produce sufficient light.

Extremely standard technology

There's nothing tricky about many incandescent lamps.

Accurate color rendition

Because incandescent light is created by heating a filament until it glows, it is a form of "black body radiation" and has all of the wavelengths of visible light. The effect is almost always pleasant.

Warm color temperature

Most incandescent lighting is warmer in color than daylight, but our eyes adjust easily to the difference, which becomes almost unnoticeable when we cannot compare incandescent light and daylight simultaneously.

Controllable

Incandescent light is easy to control. It can be focused for projection or spot illumination. It is easy to adjust the intensity with inexpensive dimmers. An immense variety of special-purpose lamps is available to meet all sorts of special needs.

Concentrated

Incandescent light is too concentrated for most library lighting situations. Trying to provide even, low-glare lighting in large areas is almost impossible with incandescent sources.

Quartz halogen lamps are bright incandescent lamps with a cooler, "whiter" color. This is achieved by allowing the lamp filament to burn at a higher temperature. The name comes from two essential components—a quartz envelope, which can withstand the higher temperature, and halogens inside the lamp, which prevent the filament from burning out. The surfaces of quartz halogen lamps can be extremely hot, and the light is very concentrated. We feel that their best use is for projectors and for jewelry showcases rather than for library illumination.

Fluorescent

In fluorescent lamps, ultraviolet light falls on phosphors that line the insides of the tubes. The phosphors convert UV light to visible light. The quality of phosphors varies a lot—compare, for example, very early color TV with modern color TV.

Fluorescent lights all require ballasts.

Fluorescent lighting has become standard for offices and other spaces requiring bright, uniform light.

Fluorescent lamps are described by the diameter of the tube, given in eighths of an inch. For example, the old-fashioned T-12 lamps are 1½ inches in diameter. Most modern lamps are T-8s or T-5s. This is the way lighting people describe them, so it's good to know what they're talking about.

The basic characteristics of fluorescent light are:

Efficient

The light output per watt with fluorescent light is several times greater than with incandescent light, and about comparable with HID lighting

Wide variation in accuracy of color rendition among lamp types

When you select fluorescent lighting for your library—and it's almost always the right decision—be sure to specify a high level of color rendition (at least 85 CRI, as described later in this material).

You will also want to specify color temperature. Many libraries like a temperature of about 3500° Kelvin, which blends quite well with incandescent light and gives libraries a warm, inviting look after dark.

Once you have specified exact lamp types, **be sure** that no other types are intermixed with them. We have all seen piebald fluorescent fixtures with a variety of odd colors of lamps, and the effect is wretched. Avoid this by settling on one phosphor type from one manufacturer.

Variety of lamp shapes

Standard fluorescent lamps are 4-foot tubes and make a good basic lighting system for a library, although some fixtures, such as pendant bowl fixtures, use banks of shorter lamps. Some modern fixtures have fluorescent tubes bent in loops—so called “biax” lamps. These can be fairly large, as in some parabolic fixtures, or quite small, as in some (desirable) suspended bowl fixtures or (undesirable) recessed downlights.

Standard technology

Fluorescent technology has been around for nearly two-thirds of a century. If you stick with standard lamp shapes, supplies will be cheap and all of your workers will be at home with maintenance needs.

Silent ballasts available.

Everyone has experienced ballast hum. In some libraries with older fixtures, the noise can be amazingly irritating.

One of best ways to avoid ballast hum is by using electronic ballasts.

In addition to the benefits of silence, electronic ballasts save a considerable amount of energy—about 8 watts for every pair of 4-foot lamps. If your library has 750 4-foot lamps, you will save 6,000 watts (plus an additional 2,000 watts in air conditioning load, since every watt saved in lighting saves about 1/3 of a watt in AC).

Electronic ballasts also reduce what some people find an annoying flicker in fluorescent lights, because the electronic ballasts operate at far higher frequencies than magnetic ballasts.

Regardless of which ballasts you select, always specify that they should be “sound rated A.”

High Intensity Discharge

The HID family includes mercury vapor, sodium vapor, and metal halide. Unlike the first two, metal halide lamps have phosphors like fluorescent lamps. Invisible ultraviolet light created by the lamp strikes phosphors, which convert it to visible light.

Everyone is familiar with exterior HID lighting. As the purplish mercury vapor lights have been replaced by sodium vapor, the world of night is increasingly an orange one. In fact, many cities look orange from the air at night.

Metal halide lamps have better color rendition than mercury vapor and sodium vapor, and this has led to their use in libraries and other non-industrial locations.

Characteristics of HID lighting:

Very efficient and concentrated

Like fluorescent lamps, HID lamps produce a great deal of light per watt.

Because relatively small HID lamps can emit a great deal of light, designers find them attractive for small fixtures lighting large spaces. However, modern T-5 fluorescent lamps also are also extremely bright and compact.

Restrike time

A major problem with HID lighting is “restrike time.” When you turn an HID lamp off, it has to cool off and then warm up again before you can turn it back on.

This is annoying under everyday circumstances and disastrous in meeting rooms, where we want to turn lights back on immediately at the end of programs.

Problems with color maintenance

Libraries with metal halide lamps have noticed that—even if a batch of metal halide lamps all come from the same box—the colors may be different. And as the bulbs age, they tend to get worse. We've seen many libraries where a series of identical HID light fixtures vary in color from gray to green to blue to lavender to even bright raspberry.

Librarians often complain that they can open a new carton of lamps, use them to replace all the lamps in a row of ceiling fixtures, and watch the light from the lamps turn all sorts of colors over the next few weeks or months.

Lamp manufacturers are working on the problem, but it hasn't been solved. (Ceramic metal halide lamps represent one approach to the problem.)

Typically noisy ballasts

Ballast hum is particularly pronounced with HID lighting. Frequently, ballasts must be located remotely in order to avoid driving readers and staff up the wall. And sometimes they can still be heard.

Fairly standard technology

There are lots of HID lighting fixtures out there, but be prepared for little or no flexibility in selection of lamps for individual fixtures. HID lamps and ballasts are matched, and substitution of different lamps is usually not an option.

Catastrophic end of service

Problems can result from the high heat and pressure in HID lamps. For example, we have seen fixtures with plastic globes where pieces of material had melted off the lamp housing and fused permanently to the globes. The result is strikingly convincing representation of dead bugs.

Even a greater problem comes from the very occasional tendency of HID lamps to explode—the so-called “catastrophic end of service.” When this happens, bits of blazingly hot glass can rain down on the people below.

Best choice

With the current state of technology, we believe that the best choice for indoor use in libraries is always fluorescent. It offers the best combination of features:

- Color maintenance
- High CRI available
- Silent ballasts available

Quick start

Limited dimming available (but not theatrical quality)

Very traditional technology

And now sufficient compactness with T-5 lamps

Types of fixtures

An amazingly complex variety of fixtures is available, and you will want to work intensively with your designer to select the ones best for your library.

Here are a few basic pointers.

Uplight

Uplighting involves directing light upwards toward a white ceiling, from which it is reflected to light the areas below.

In libraries, uplight is always vastly preferable to downlight. It is far more evenly distributed, and it leads to far lower glare. Always specify uplighting for your library.

Some fixtures are designed to bounce 100 percent of their light off the ceiling, while others have a downlight component of perhaps 30 percent. We prefer 100 percent uplight, since it reduces veiling reflectance (see the section on glare) to a minimum.

One use where mixed up and downlight works well is lighting historic libraries. In this kind of situation, uplight provides the actual working light, while ornamental fixtures with low-wattage bulbs provide a traditional “feel” and give the impression that they are the actual source of light. In such circumstances, we prefer the low-wattage bulbs to be just perceptibly brighter than the ceiling behind them.

Downlight

Downlighting involves shining light directly on areas to be illuminated.

Many fixtures are designed for downlighting.

One very standard type of fixture is the so-called “troffer,” a rectangular fixture fitted flush into the gridwork of a suspended ceiling. Troffers with various types of lenses are found everywhere in offices. If your office ceilings are low (less than about 10 feet) you'll be stuck with troffers, but they're a far poorer choice than uplighting.

If you install troffers in your library, **be sure to avoid those with parabolic wedge lenses**—metallized plastic grids with small square openings. These lenses direct all of the light straight down,

leading to dark walls and ceilings, poorly lighted book spines, harsh shadows, and a general aura of gloom and glare. We've seen them in many libraries, and they are always a very serious mistake.

Recessed downlights

Recessed downlights, otherwise known as “can lights,” are the bane of many libraries, one of the truly evil ways to attempt to illuminate libraries. Can lights have many unpleasant characteristics, including:

- High glare.
- Inefficiency (except for fluorescent can lights).
- Spotty illumination.
- Unpleasant shadows.
- Unpleasant brightness. Looking upward into a can light while you're scanning the top shelves is a particularly nasty experience.
- Because of the high concentration of light, unpleasantly dark ceilings.
- Odd and unattractive patterns of light and dark along walls.

If you are building a library, the chance is about 100 to 1 that your designer will recommend at least some can lights. Head this vile tendency off at the pass by specifying in advance that there will be absolutely no can lights anywhere in your library.

Actually, there are a couple of good uses for can lights. One is single lights shining on the floor inside the entrances to meeting rooms. If these are kept dimmed to a very low level, they will help people arriving in dark rooms to see where they are standing while their eyes adjust to the dark.

Indirect/direct fixtures

A number of fluorescent fixtures exist that supposedly combine direct and indirect. They have baffles that prevent one from seeing the actual lamps inside the fixtures. Both troffer and suspended fixtures of this type exist. Most of the time, these fixtures are used in areas with ceilings lower than 10 feet, but some designers just like the look. Depending on their design, the fixtures are called “recessed indirect” or “direct/indirect.” We think they're better than more direct fixtures, but not much better, and they're still vastly inferior to reflected uplight.

Lighting stacks

If your ceiling is too low for uplighting, be sure that your strips of downlights are perpendicular to your stack aisles. This insures that light shines into every aisle, regardless of how you alter aisle width. Far too many libraries have strips of downlights installed parallel to stack aisles, with some fixtures centered over aisles (good) and others directly above stack units (bad).

In summary

In our opinion, fluorescent lights provide the most reliable, inexpensive, and easily-maintained lighting. With modern versions (such as T-5s) they can replace HID lamps in small fixtures and still provide a great deal of light. For modern libraries, 100 percent uplighting is by far the best. For historic structures, some downlighting may improve the historic feel of the building.

We recommend that you specify “fluorescent 100 percent uplighting” at the start of your project and demand that your designers defend in detail each variation.

Two: CONTROL LIGHT LEVEL AND COLOR

Libraries need lighting that is bright enough and makes colors look good.

Library lighting systems need to provide enough light for reading and to read the labels on the spines of shelved books.

The level of illumination on a surface is measured in footcandles. One source of recommendations for appropriate lighting levels is the IES, the **Illuminating Engineering Society of North America**

For library purposes, 50 to 75 footcandles at tabletop is plenty bright, as long as the light bounces around everywhere rather than shines straight down. We usually suggest 60 footcandles.

Inadequate lighting leads to real misery.

Lighting can also be too bright. We know one library with a central service area illuminated at about 60 footcandles and an adjacent children's department with about 150. The children's department is much too bright for comfort, especially if one moves back and forth frequently between the two areas.

How do we avoid problems with areas that are too bright or too dim? All engineers should have software that calculates illuminating brightness at table top throughout all areas of a building. These programs adjust for ceiling configuration, height, color, typical dust on lamps, aging lamps, etc. And they show lighting levels for relatively small areas. Insist that these calculations be carried out for your library during the design development phase, and demand that any excessively low or high figures be corrected.

Remember, however, that this kind of computer output tells you only brightness at table top. It won't tell you if your lights provide unpleasant glare, or whether the lateral light on the spines of books meets your needs. But if you are using reflected uplighting, and the printouts show a uniform illumination of about 60 footcandles, you should be in pretty good shape.

Color rendition

One major problem with some kinds of lighting (both cheap fluorescent lamps and many HID lamps) is their failure to reproduce colors accurately. This is because some wave lengths are actually missing entirely.

A standard measure of the ability of lighting to reproduce colors adequately is CRI, which stands for “color rendering index.” A CRI of 100 is great, and a CRI of 0 is wretched.

Daylight and incandescent light both have a CRI of 100.

With modern fluorescent lighting, you should expect a minimum CRI of at least 85. Good quality fluorescent lamps will produce this, but cheap ones (such as the old warm white and cool white, both of which are still around but technically obsolete) won't. And a CRI of this level may be nearly impossible to achieve with metal halide lighting.

The light output of lamps is portrayed in charts with distribution curves indicating how much of each wavelength is present. While daylight and incandescent light have smooth curves, with all wavelengths present in relatively similar amounts, the curves for fluorescent and HID light frequently consist primarily of spikes of a handful of wavelengths.

Color temperature measures how warm or cool light is. Unlike CRI, color temperature is not concerned with the presence or absence of wavelengths, but just the balance between warm and cool.

Color temperature is measured in degrees Kelvin. (You don't have to know much about this except to remember that the higher the number the cooler the light.) If you like the appearance of incandescent lights, so your library looks warm and homey rather than cold and industrial inside when people drive by at night, a good first try at color temperature is 3500 degrees Kelvin.

In daily life, our eyes adapt fairly well to changes in color temperature that are not extreme. Typically, we notice them most when we are outdoors at twilight, and we see the warmth of incandescently lighted rooms contrasted with the last of the bluer daylight.

Three: DESIGN LIGHTING FOR MAXIMUM BUILDING FLEXIBILITY

One thing we've all learned over the years is that we keep moving things around. For most purposes, therefore, the ideal type of library lighting is one that works equally well with reading tables, staff work stations, book stacks, and computers.

Avoid task lighting

One type of lighting you will constantly hear recommended is “task lighting.” Task lighting is designed to place light exactly where you need it for a specific purpose.

Unfortunately, task lighting makes it impossible to relocate functions, and it becomes obsolete whenever things are moved. Designers may tell you that it doesn't matter, since you won't move your desk. But they're wrong.

In many situations, task lighting is also too direct.

Avoid it.

Provide uniform illumination

Even illumination is critical in libraries, but it's found all too seldom. Often there are bright and dark spots, particularly up toward the tops of the book stacks and around the perimeter of rooms, where some books are almost impossible to see.

Can lights are particularly given to spotty coverage. In Fred's library, a wing built in the 1970s has 750 incandescent can lights—almost exactly 750 too many. The lighting is terribly uneven, and until the library added supplementary track lighting—providing even more glare and heat and cost—pages had to use flashlights when they were reshelving books in some areas.

Another common error in the placement of fixtures is leaving too much space between the last fixture and the wall. For even lighting levels, the space between the fixtures should be twice the space between the last fixture and the wall. But it often isn't. As a result of dark perimeters, many libraries have had to add supplementary lights along their walls

Good security requires light everywhere

Trying to save money by having little or no light in public areas is a terrible idea in public and school libraries and a bad idea in all libraries.

Dim areas are frightening to users and staff. They encourage lurking.

Some libraries have used timer switches for lights, particularly in stack areas. When a timer switch is turned on, the lights stay on for a pre-selected period of time and then switch off automatically. Many users in such libraries find themselves suddenly plunged into darkness while they are looking for books.

Some libraries have used motion-sensor switches to control lights in offices, restrooms, etc. Mostly, users appear to be annoyed by them. If you are working quietly in your office, the lights may suddenly go off, forcing you to leap up or wave your hands in the air to turn them back on. (We think that turning the lights on by having everyone wave their hands wildly in the air is the origin of the expression, "Many hands make light work." But we may be wrong.)

Four: AVOID GLARE

One of the major lighting problems in libraries is glare. Glare comes in two varieties.

Direct glare blinds us. When the sun or lights shine straight in our eyes, it's almost impossible to see anything, and it's certainly unpleasant to try to work.

Indirect glare is the other type. It consists of images of bright lights reflecting off shiny surfaces, such as book paper (another in the long list of good reasons not to accept donations of *The National Geographic*) or computer screens. The technical name for indirect glare is "veiling reflectance," since the reflected images of concentrated light sources veil the information beneath shiny surfaces.

Much of the glare we experience is due to unfortunate lighting choices.

Avoiding glare is not extraordinarily difficult, but you have to bear the problem in mind while your library is being designed.

Avoid direct lighting

As far as we are concerned, the most satisfactory way to light a library is by bouncing the light off the ceiling. The closer we come to a totally evenly illuminated ceiling, the more we reduce both direct and indirect glare. With scattered downlight lights of any type, you will find areas where it's almost impossible to read the spine labels on high shelves. The fronts of the books will be in darkness, and when you try to look at them you'll find that you're staring straight into a light fixture.

Avoid dark ceilings

Dark ceilings make the entire effect of direct lighting even worse. Doing this kind of thing on purpose in a library is genuinely sinful.

Sometimes, however, we have historic dark ceilings we can't paint white. We saw one example of an arts and crafts era library with an historic dark cork ceiling with stenciling. In this case, the architect fell back on very traditional lighting—dim chandeliers for navigation, plus table and shelf lights for reading. It works well, and no bright lights shine directly in your face.

Prefer north light

Direct sunlight can cause serious problems in libraries. It blinds readers. It fades books. It creates terrible problems with computer screens. And the contrast in brightness between areas struck by daylight and areas with artificial light can make perfectly adequate artificial light seem far too dim.

Yet everyone loves daylight—and to be able to see out. When we visit libraries with windowless rooms, almost the first thing we hear from the staff is how much they want windows.

One way to avoid glare from daylight is to use as much north light as possible. Artists love north light because it is almost never direct—especially in the northern parts of the US. The light from

north windows is almost always pleasant for reading—although even north light can produce glare on computer screens.

South light can be controlled in summer with overhangs over the windows. In winter, the library will need other ways to control the light, although some users like sitting in the direct south sun on winter days.

East light needs morning shading in the summer.

West light is almost always evil. If you have western windows, you will need effective ways to block the light in the afternoon.

Due to the nature of natural light, libraries with east-west orientations usually work better than those with north-south orientations, because they provide the greatest amount of north light and the least west light. When you are selecting a site, remember that one that permits a major north window wall will lead to the best natural lighting and the most pleasant interior. In practice, this usually means a south entrance.

Windows that face any direction except north will usually need shading of some kind, even with modern types of glass. If you want windows with round or pointed tops, plan in advance how you will fit shades to them.

Use clearstories rather than skylights

By and large, architects like skylights much more than librarians do. In libraries, skylights cause all sorts of problems. They are too bright by day and too dark by night. Service desks or reading areas located under skylights will need supplementary artificial lighting, and because a window acts like a black surface at night, the lighting is likely to be direct. Sunlight through skylights can blind readers. It can also make it impossible to use computers when the sun falls on them directly, and annoying when images of the skylights are reflected on the front of computer screens.

In addition, most skylights leak.

If you want the look of a skylight, particularly in the middle of a large space where windows are far away, consider an artificial skylight. But ask your designer to explain in detail how lamps will be replaced.

If you need natural light in the middle of a building, a much better approach is a clearstory—a vertical window set into the roof. It brings in a lot of light, but no direct glare. Clearstories are particularly effective when they face north.

Shade windows that face intense sun

Windows that face direct sun need to be shaded. Special films and types of glass help cope with direct sun—but they don't help enough.

The easiest way to keep sun off glass is through the design of the building. One way is by providing overhangs that shade the windows during the proper seasons. Another standard way is using any of a variety of blinds. A number of translucent blinds are available that control glare without blacking out windows.

For buildings with suitable architecture, another way to control glare is by awnings. These are particularly useful on east and west windows that need shading during the summer more than during the winter. Unlike internal blinds, awnings prevent the sun from striking the glass and warming up the blinds inside the building. The result is improved saving in energy.

Avoid problem surfaces

Another way to reduce glare is to avoid troublesome surfaces.

Avoid shiny surfaces wherever possible, particularly horizontal ones such as glass table or counter tops. Almost all shiny surfaces have annoying reflections. It is particularly difficult to see anything beneath a horizontal glass surface.

Both white and black working surfaces cause eyestrain. White surfaces reflect too much light and blind readers and workers. Black surfaces provide too much contrast between books or other work and the underlying surfaces.

Five: KEEP IT SIMPLE

One way libraries get into lighting trouble is through overly complex systems. Here are some basic ways to avoid troublesome complexity.

Select affordable lighting systems

When designers suggest lighting fixtures, for example, always ask about the cost and availability of lamps. Verify the information by calling lamp suppliers to see whether they actually stock the lamps you will need.

Watch for state pricing contracts on lamps. In Illinois, for example, the state has negotiated an 84 percent discount for state and local government agencies.

Employ tested technology

It's embarrassing to find that the fixtures in your reading room use foreign-made light bulbs that never caught on in America, and that now cost \$375 each and take 4 months to ship.

Few of us can afford to be the first kid on the block, especially if there's no second kid and our lighting system turns out to be an orphan with no replacement parts available. This happens more frequently than one might expect.

Some libraries have elaborate computer-driven systems designed to switch lights off and on in response to changing levels of natural light. Before you accept such a system, ask your designer to provide references for other libraries that have had such systems in place for at least a couple of years. You may find that long-term maintenance costs exceed any energy savings.

Beware of motion sensors

As we mentioned earlier, we have serious doubts about the use of motion sensors for lighting in public buildings. We recommend that libraries purchase efficient lighting systems and skip this kind of automatic gadgetry.

Keep your ceilings at least 10 feet high

Indirect lighting is the only good way to light libraries. It requires a ceiling height of no less than 10 feet, and 12 feet is better.

Use fixtures for which replacement lamps are easily obtainable and inexpensive

We know of one new library where the 12 curved fluorescent lamps in the dramatic central chandelier cost over \$1,000 each. By contrast, with state pricing contracts, you can probably buy a top-quality, high-CRI 4-foot lamp for about \$2. (Only incidentally, the chandelier in question has had ballast problems since it was installed, and one or more tubes are always out. The aesthetic impact is less powerful than a missing front tooth, but that's the general effect.)

Avoid multiple lamp types

There are libraries out there with dozens of different lamp types. Imagine trying to warehouse that many different lamps.

Place fixtures where you can reach them

This is a perpetual problem in library design, one that can occur even in the smallest of libraries.

Some typical problem areas include:

- Coves that are too high to reach.
- Lighting fixtures located directly above furniture—particularly furniture such as service desks that cannot be moved and have tops too irregular or delicate to support ladders.
- Lamps in high fixtures are often changed by using mechanical lifts. You can rearrange your reading tables to accommodate a lift, but you can't move your stacks.
- Fixtures over staircases are frequently a major problem. The lights can be high above the floor, requiring scaffolds to reach them, or they can be located directly above steps, making

it difficult or impossible to set up a stepladder beneath the fixtures. In some cases, the labor cost of replacing lamps leads building managers to simply leave them burned out.

Lamps in indirect lighting fixtures tend to be particularly easy to change because they are lower, and because one looks down into the fixture while changing lamps rather than trying to work overhead.

When fixtures are hard to reach, replace all the lamps at once

This is standard factory technique, because the labor to replace the lamps is usually more than the cost of the lamps, and by the time a few are out, the rest probably don't have long for this world.

But imagine the decision making process when a designer has opted for expensive lamps, such as the \$12,000 worth of \$1,000 lamps in the example listed above.

Be sure your building can accommodate the ladders or lifts you will need to change lamps

Ladders and lifts require storage space, plus hallways, doors, and furnishings through which they can pass. Be sure your building plans account for this.

Six: CONCLUSIONS AND RECOMMENDATIONS

There's nothing terribly complex about the basics of lighting. If you understand them, you'll be much less likely to get into trouble while working with building designers.

When your library is being designed, be extremely alert for violations of good library lighting principles.

Remember that lighting design is part of library building design, not an afterthought. Certain essential features, such as ceiling heights, cannot be retrofitted. If your building has low ceilings, you'll be stuck with second-rate lighting until you knock it down.

Always ask direct questions when you are shown drawings. (For example, always ask how lamps will be changed, and don't settle for a vague answer.)

Make sure you have a lighting engineer on your planning team, and talk with him directly.

If you really want to learn a lot about lighting technology, we recommend the remarkably informative and modestly-priced seminars taught by General Electric at its research facility in Cleveland. See www.gelighting.com/na/institute/index.html, or contact:

GE Lighting Institute
Nela Park
1975 Noble Road
Cleveland OH 44112-6300

1-800-255-1200

Finally, here's an easy formula for straightforward library lighting.

70 to 100% uplight reflected off white ceilings (100% is best)
4-foot T-8 or T-5 fluorescent lamps
Electronic ballasts, sound rated A
85+ Color Rendering Index
About 60 footcandles at tabletop
A minimum ceiling height of 10 feet
Light fixtures spaced to avoid dark perimeters
Light fixtures perpendicular to stack aisles
Absolutely no can lights or task lighting
No white or black working surfaces, and no shiny work surfaces
Specific prior information on how lamps will be changed
No uncontrolled direct natural light, except for north light

Remember that your total aim is to provide uniform, flexible, high-quality light while avoiding glare. Stand your ground.

Seven: MISCELLANEOUS APHORISMS

1. Task lighting and downlighting are not totally evil, but they come close enough for all practical purposes.
2. No matter how bright you make it, good nightclub lighting is never good library lighting.
3. Creating excitement with light in a library is like creating excitement with steps in a nursing home.
4. Shadows are for German noir cinema, not for libraries.
5. Skylights cause impossible glare, but they make up for it by leaking.
6. Computer monitors inset in counter or table tops introduce terrible problems with reflected glare, but it's entertaining to watch people with bifocals attempt to use them.
7. Small light sources are attractive to some designers because they provide "sparkle." You will come to hate sparkle.
8. John's last architects called him "No Can Lights Moorman." It's a nickname any librarian can carry with honor.

9. Perf screens on the undersides of uplights introduce an element of downlight, which designers generally like better than librarians do. Perf screens also show every dead bug.
10. Brand new lighting technology is for people with more money than you have.
11. Always show your plans to the people who will have to change the lamps.
12. Some designers will tell you that 100 percent uplighting is a bad idea, but they're wrong.

Eight: QUESTIONS

If you have questions about this material, please feel free to contact us.

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