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November 1988
Five Dollars

Project: Headquarters, Real Estate and Construction Division, IBM, Stamford CT
Interior Architect: HOK, Dallas
Lighting Design: Ralph Savarese, IBM, Stamford
Lighting: 10" x 3 3/8" Rounded Softshine Indirect Small Office Light by Peerless



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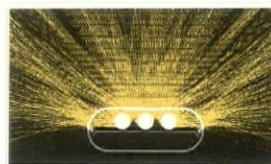
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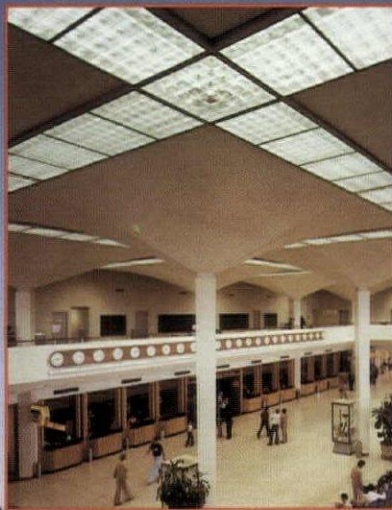


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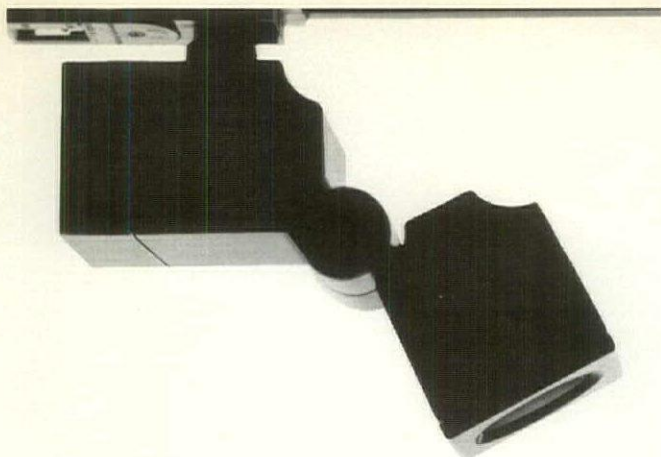
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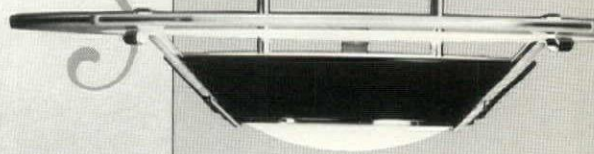
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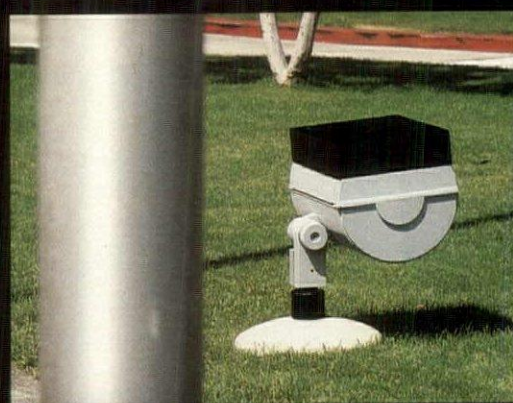
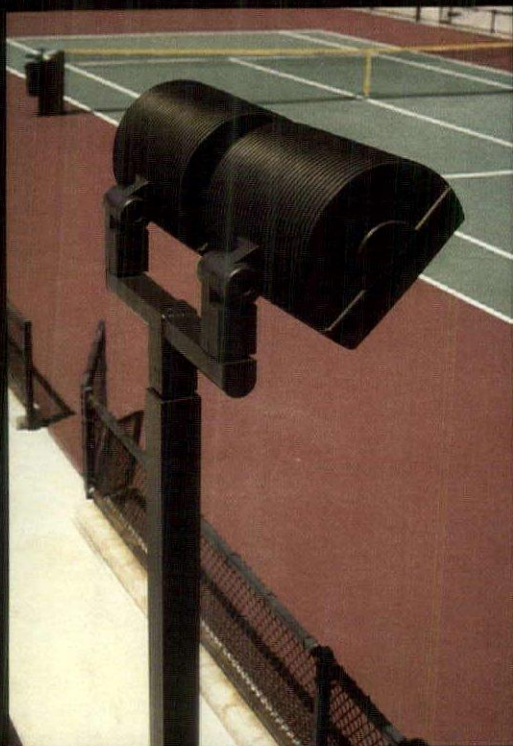
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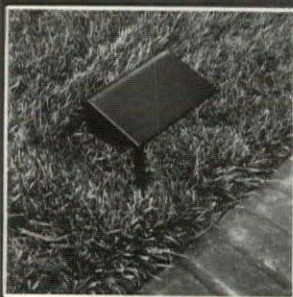


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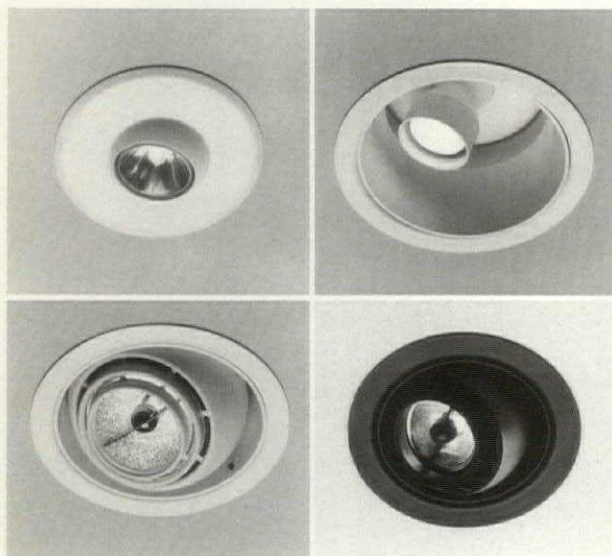
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■ From the Editor

Even I'm not clever enough to think of this. In March, I complained in this column about not being able to buy compact fluorescent lamps at my local hardware store. I even offered an admittedly half-baked analysis about why it would be a long time before they reached the shelves of my local retailers. "They cost too much," I wrote, "and people won't buy them."

I don't know if somebody at the Taunton Municipal Lighting Plant in Massachusetts read my editorial that month and decided to accept my challenge to get this technological wonder into the hands of the people, but they have come up with such an incredible plan to do just that that I could almost kick myself for not thinking of it sooner. According to the October 10th *Wall Street Journal*, they've come up with a plan to lease the darned things to their customers.

What an incredibly good idea.

For 20 cents per month, customers can rent the lamps from the utility company. Suddenly, lots of people are finding out what a great deal these lamps are. It's pretty hard to replace the familiar 75-watt bulb in the yellow and blue box twice for the \$2.40 it costs to lease the compact fluorescent for a year. Not to mention the energy savings. The newspaper reports that one 65-unit condominium complex in the area, using 138 compact fluorescents, showed a \$600 *per month* savings on electric bills from May through July compared with last year's bills. And a \$250 savings on lamp replacements. The utility company has saved too, both by reducing the amount of power it must buy from other utility companies, and by putting off, for the time being, the need to build more generating capacity.

Still, the customers report what everybody who's ever tried to use compact fluorescents has already found out: the lamps are a funny shape, and they don't fit just anywhere. Maybe I was wrong to blame the lamp manufacturers for not lowering the price of the compact fluorescents so they'd catch on. Yes, there are some great fixture designs for the compact fluorescent out there, but I don't see any of those down at my hardware store either. Could be that it'll take both the marketing genius of companies like the Taunton Municipal Lighting Plant *and* some terrific and readily available fixture designs to bring this great invention into the home where it belongs.

Charles Linn, AIA

Letters

"Hot spot" caused by cove detail

I am always disturbed when someone uses a work surface cove detail like that on page 38 of the September 1988 issue. The problem is that it creates a terrible "hot spot" on the counter due to the angle of shielding. Try it. You will see.

The thing I just can't figure out is *why* this is a very common detail, which is used by almost all task furniture manufacturers and designers of every ilk, people who should have checked it out. And so, here comes Bell's First Axiom of Good Design: Designers should routinely be condemned to *use* the things they create.

Don Bell

Donald Bell Associates Architects
Seattle, Washington

The columnist responds

Reader Bell is correct in pointing out the unsuccessful nature of under-cabinet task lighting. What he refers to as "hot spots" are actually reflected images of the concealed lamp on the work surface or task, which create a source of glare that veils the task — technically referred to as veiling reflections. Glossy task materials increase the reflection and the resulting glare. The problem is a result of the geometry of the lamp position relative to the user's eyes.

In the case of the low wall bracket shown in the September issue, the suggested 7-inch to 9-inch height of the shielding board minimizes viewing of the reflected lamp image — except for a portion of the work surface nearest the wall. The task lighting comes from light reflected off the wall and ceiling and from the two ceiling fixtures shown.

The intended focus of the September Lighting Graphics column was the selection of fluorescent lamps for built-in lighting installations. In that column, I should have more clearly identified the decorative and general lighting characteristics of a low wall bracket rather than its task lighting contribution. A future column will cover under-cabinet lighting in more detail.

Sam Mills, AIA

Architect and Lighting Consultant
Edmond, Oklahoma

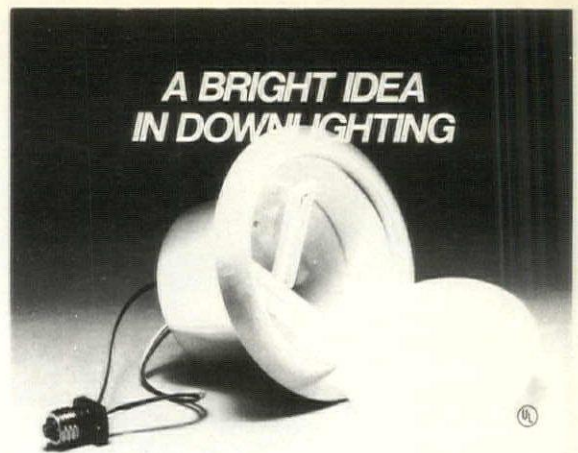
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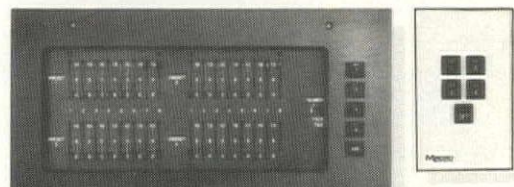
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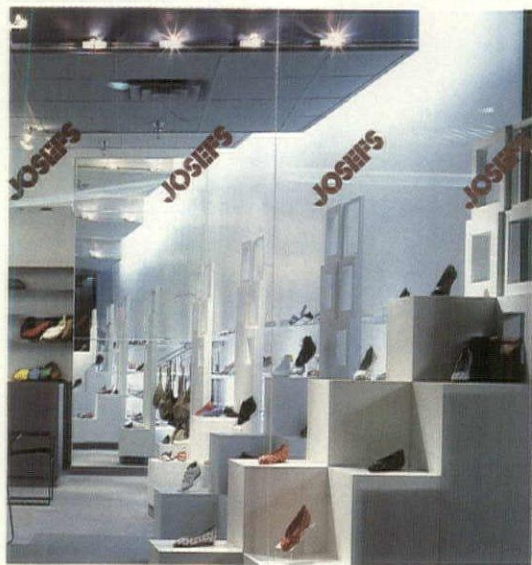
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Circle 10

Shoe store lighting suggests fashionable, desirable product



Project: Josefs
Location: Pavilion Place, Roseville, Minnesota
Client: David Cukier
Interior Designer: Sanford B. Stein, SteinDesign
Photos: Phillip MacMillan James

A retail store is a package for the products inside. Lighting can make suggestions about those products, leading prospective customers to anticipate a particular price range, style, and level of quality. Interior designer Sandy Stein used architectural lighting to create a trendy, spendy feel for a high-end fashion retailer.

Josefs is a small specialty retailer of imported shoes, many from Italy. "We're trying to give customers the message that this is high style, leading edge — everything that the media correlate with Italian design," Stein explains. "A lot of the important style trends from Europe and Japan are rather high-tech looks. There is a correlation between the Italian look of the product and the way we solved design issues in the interior."

Stein likes to use unconventional retail lighting that integrates with architecture. He illuminated Josefs primarily with light reflected off the walls. "Because the store had a narrow plan, we used lighting as a tool to increase the apparent size of the space," Stein says. "We tucked hidden lighting into coffers to make the walls appear to spread wider apart. Backlights in the pedestal display units wash the walls to complete what the coffers are doing. So we're almost turning the store on its side, doing with the walls what is often done with the ceiling. The reflected light serves as a means of both ambient illumination and display lighting."

Shoes are arranged on the pedestals and on transparent acrylic shelves that free span over 6 feet without sagging. Because the pedestals stand away from the wall, their back-

lighting creates a luminous background for the shoes, which appear to float. The result is eye-catching, though it uses more diffused light than Stein typically puts on displayed products. To create sparkle — and to signify a particular design aesthetic — he supplemented the 3000K fluorescents with bare MR16 halogen downlights.

"The MR16s give a high-tech, exposed look, appropriate to the style of the product," says Stein. "They give an inviting look to the space, and they highlight the product very well. I don't object to the little bit of distracting flare that you get from an MR16. I don't find it terribly bothersome in most of the stores I've visited. These are at about 11 feet, and their light output really is moderate; you get more glare from PAR lamps, which are probably the most widely used lamp in retail."

The paint on the stepped soffit reinforces the attention-getting lighting techniques. As the space steps back from the storefront, each gray ceiling section is 10 to 15 percent lighter in value, until the farthest section is nearly pure white. "The effect is to draw your attention into the store," says Stein. "The effects of light and color are all subliminal things that nobody is going to be aware of, but they do help to support the illusion of additional space and volume as you move in." The host of small suggestions act together, tempting prospective customers to take a closer look at the contents of the retail store package.

— Gareth Fenley

For product information, turn to page 62 and see Manufacturers.

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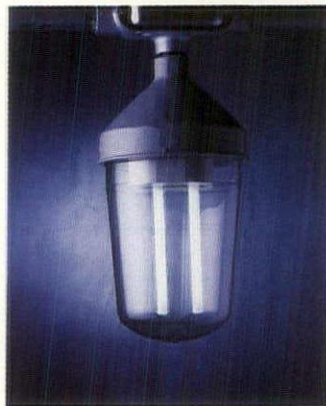
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Fluorescent lamps survive trial by ice



Project: San Francisco-Oakland Bay Bridge

Client: California Department of Transportation

Electrical Engineer: Calvin Jeung

Photos: ©1988 Kent Marshall

Calvin Jeung was skeptical when someone suggested that he dangle compact fluorescent fixtures on a bridge above San Francisco Bay. "The manufacturer told us we could start these fixtures at a very low temperature," he recalls. "So we said, sure, we'll try it. We put one in a freezer for almost four hours, then took it out and started it — a little bit slowly; maybe it took a second or two longer than at the normal starting temperature. But it worked."

After two more freezer tests and a trial installation on site, Jeung approved permanent installation of 850 vaportight fixtures on the San Francisco-Oakland Bay Bridge. The fluorescents replaced a makeshift string of bare incandescent traffic lamps, originally intended as temporary decoration to commemorate the bridge's 50th anniversary. The necklace of lights was so popular that citizens, government, and industry together raised the funds to keep it shining.

Jeung, an engineer with the California Department of Transportation, coordinated the technical end of the project. He realized that the deteriorating incandescent string had to go; the bridge needed a new energy-efficient system that could withstand high winds, corrosive salt air, and moisture from ocean fog. Long lamp life was also important because labor costs for relamping high above the bay exceed the cost of the lamps themselves.

Even with their clearly superior 10,000-hour lamp life and energy-efficient operation, compact fluorescent lamps were an unusual choice for the job. Conservative designers prefer to stay

off the limb of new technology — especially when they are also responsible for maintenance. And, although compact fluorescents have been on the market for several years, they are not yet widely used in harsh outdoor environments.

The system Jeung tested and ultimately specified for the Bay Bridge passed muster because of its top-quality components, including a cast aluminum fixture with a polycarbonate globe. Custom-made brackets hold the weathertight fixtures to the bridge's cables. Two 9-watt lamps in each fixture reduce the likelihood of light points going dark before scheduled relamping. The double-lamp, single-ballast assembly converts 24 watts into 1200 lumens, far outperforming incandescent sources.

The lamps are rated to start dependably at any temperature down to zero degrees Fahrenheit. A few times a year, air temperatures will be cold enough to reduce lumen output, causing a barely noticeable dimming of the Bay Bridge's popular — and now permanent — lighted necklace.

—G.F.

For product information, turn to page 62 and see Manufacturers.

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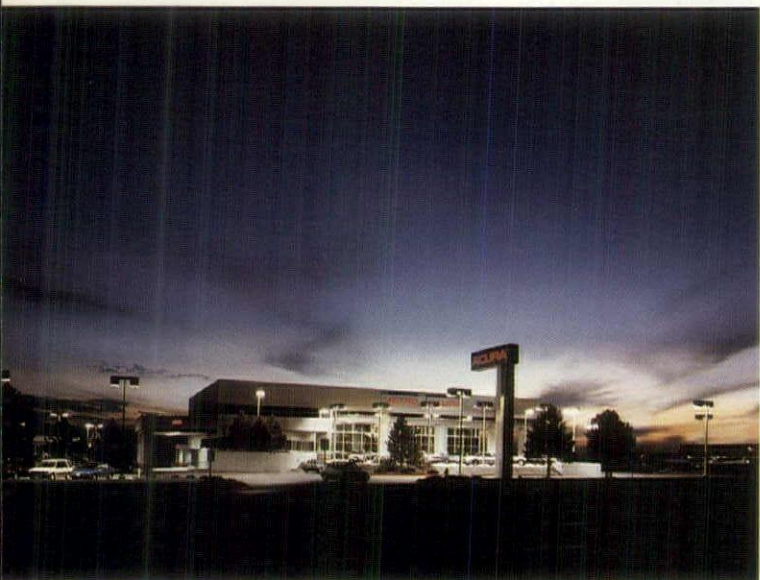
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Project: Metro Acura dealership
Location: Aurora, Colorado
Project: Sil Ter Har dealership
Location: Bloomfield, Colorado
Lighting Designer (both projects): Lighting Systems, Inc., Greg Hubbard

Automobile sales managers light their lots with an eye to improving sales both day and night. The glare of floodlights no longer appeals to them; they prefer architecturally styled cutoff fixtures that are aesthetically pleasing during the day and produce glare-free illumination at night.

Two Colorado auto dealerships illustrate modern auto lot lighting; one is newly lit, the other a retrofit. Both dealers chose metal halide for its good color rendition as well as its long lamp life and energy efficiency. And, both chose lamps oriented vertically in the fixtures, an orientation designed to increase light output by as much as 15 percent over that produced by horizontal-burn lamps and to provide more uniform light distribution.

The Sil Ter Har dealership had fluorescent sources, with four to six 1500-watt lamps per pole. Some of the poles also had quartz accent lights attached about 10 feet off the ground.

The poles were retrofit with single 1000-watt metal halide luminaires. "We eliminated a big energy drain right away by not replacing the quartz spots," says Greg Hubbard, the engineer who installed the fixtures. "They were popular when cars had a lot of chrome to highlight, but most cars have blackout trim now. And accent lights just aren't necessary with the new lighting system."

The cutoff fixture directs the light precisely within the lot's borders, defining the merchandise display area for customers. The luminaires used have one-piece aluminum housings with an electrostatic finish designed to resist cracking and peeling.

Designs for lighting an auto dealership must generally take three areas into consideration: front row display, secondary row display, and storage areas. Metro Acura is located close to competitors, so for front row display, it chose to install two 1000-watt fixtures on 24-foot poles spaced 40 feet on center. Their lighting goal was the brightness of a double fixture and uniform light distribution, avoiding hot spots near the poles and low light levels between them. Poles for the secondary row display are spaced 60 to 80 feet on center; each has two — sometimes three — fixtures. Concrete pedestals, 2 feet high, protect the poles from damage by moving autos. Finally, the storage area is lit for security with 1000-watt lamps.

Sil Ter Har needed only a single fixture per pole because its poles are spaced closer than Metro Acura's. Concrete foundations for front-row poles at both sites are at grade level to avoid blocking the view of the cars. A concrete sidewalk outside front-row pole lines redirects light onto the cars at both sites.

"We measured our foot-candles before and after," says Jack Ter Har, Jr., Sil Ter Har's manager, "and found a 30 percent increase in the light. And our electric bill went down by 40 percent."

—Mike Heffley

For product information, turn to page 62 and see Manufacturers.

We'd like to see your best lighting project: How to send it

It's easy to have your project considered for publication. You don't have to be a writer, but you do need to send enough information to let us "visit" the lighting project.

We want to see creative solutions to indoor and outdoor lighting problems, everywhere and anywhere a lighting problem has been solved with creativity, practicality, and innovation. We're interested in both electrical lighting and daylighting.

To make a preliminary evaluation, we need photographs and a brief written description.

Photographs

Sharp color transparencies focused on the lighting achievement are the next best thing to giving the editorial reviewers a tour of your project. Our first choice is 4 x 5 color transparencies, but we also accept 2 1/4 x 2 1/4 transparencies and 35mm slides. We prefer to review original slides or transparencies; we cannot review color negatives.

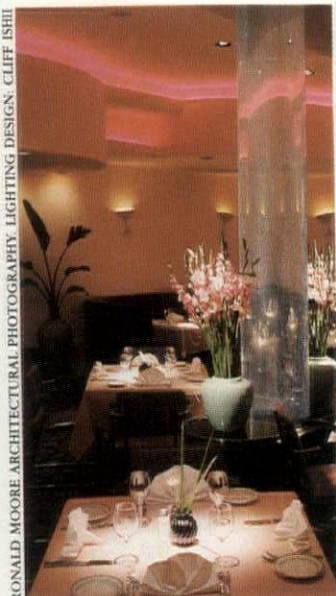
If your professional photos were originally shot as color negatives, please send full-frame prints. We prefer the following enlargements: 4 x 5 contact prints; 4 x 4 prints from 2 1/4 x 2 1/4 film; and 5 x 7 prints from 35mm film.

Be sure to provide the photographer's name and phone number, and indicate who owns publication rights. We return all photos promptly after review or publication.

Written description

Our editorial reviewers focus on information, not presentation; factual details are much more important than writing style. The best write-ups briefly describe the lighting design problem and the way it was solved, explaining the story behind what we see in the photos.

Objectives and scope. A brief statement about the ef-



RONALD MOORE ARCHITECTURAL PHOTOGRAPHY. LIGHTING DESIGN: CLIFF ISHII

fect the designer was after helps us evaluate whether and how well the objectives were fulfilled.

Philosophy. What broader, basic beliefs about what lighting should accomplish for the end user influenced your design objectives? Was the lighting solution chosen primarily for aesthetic effect? User comfort? Energy efficiency? Or for other reasons?

Calculations and planning. What did you do that might help our readers to approach their own work in some new and productive ways? Have you created or discovered a way to predict lighting results?

Light sources and luminaires. Why did you choose the particular lamps, lumi-

naires, and/or glazing used in the project? What custom design or architectural detailing was involved?

Drawings

Drawings are optional. Include sections or details that illustrate the lighting achievement and any special luminaires, installations, or other notable features. If you send a reflected ceiling plan, please send an elevation with it.

The Review Process

Upon reaching our offices, your project submission enters our editorial review process. We send you an acknowledgment letter and circulate your submission among our reviewers. Usually, you can expect to hear from us within four weeks.

When a project is selected for publication, we usually request more information about the design team and your selection of light sources and luminaires. We may arrange a brief telephone interview to discuss design issues.

Finally, we offer contributors an opportunity to review article manuscripts so that we can correct any factual errors before publication.

Time to Publication

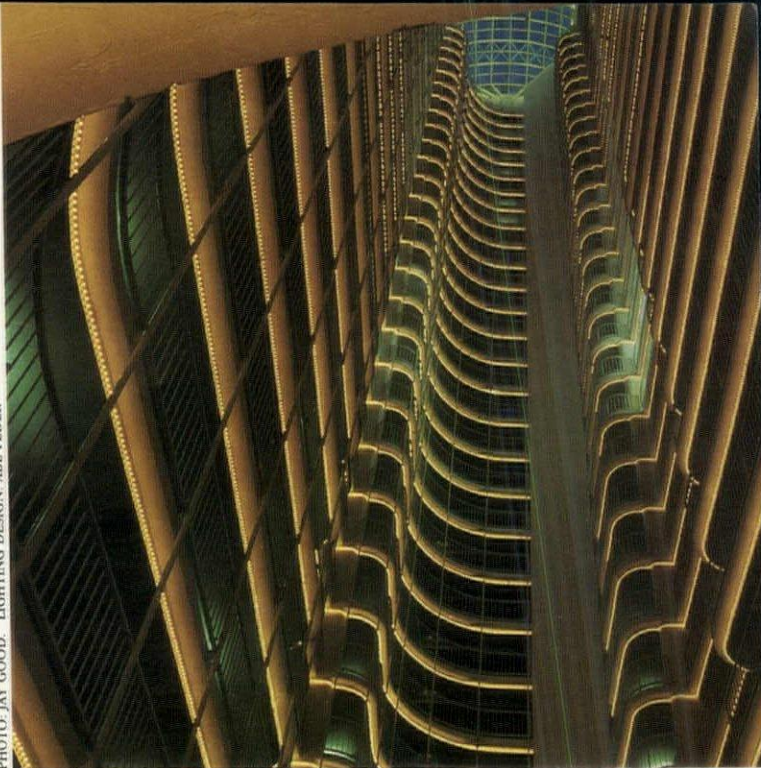
If the materials you submit for review are complete, and if the review and development processes are completed without any difficulties or delays, it is possible to rush a project

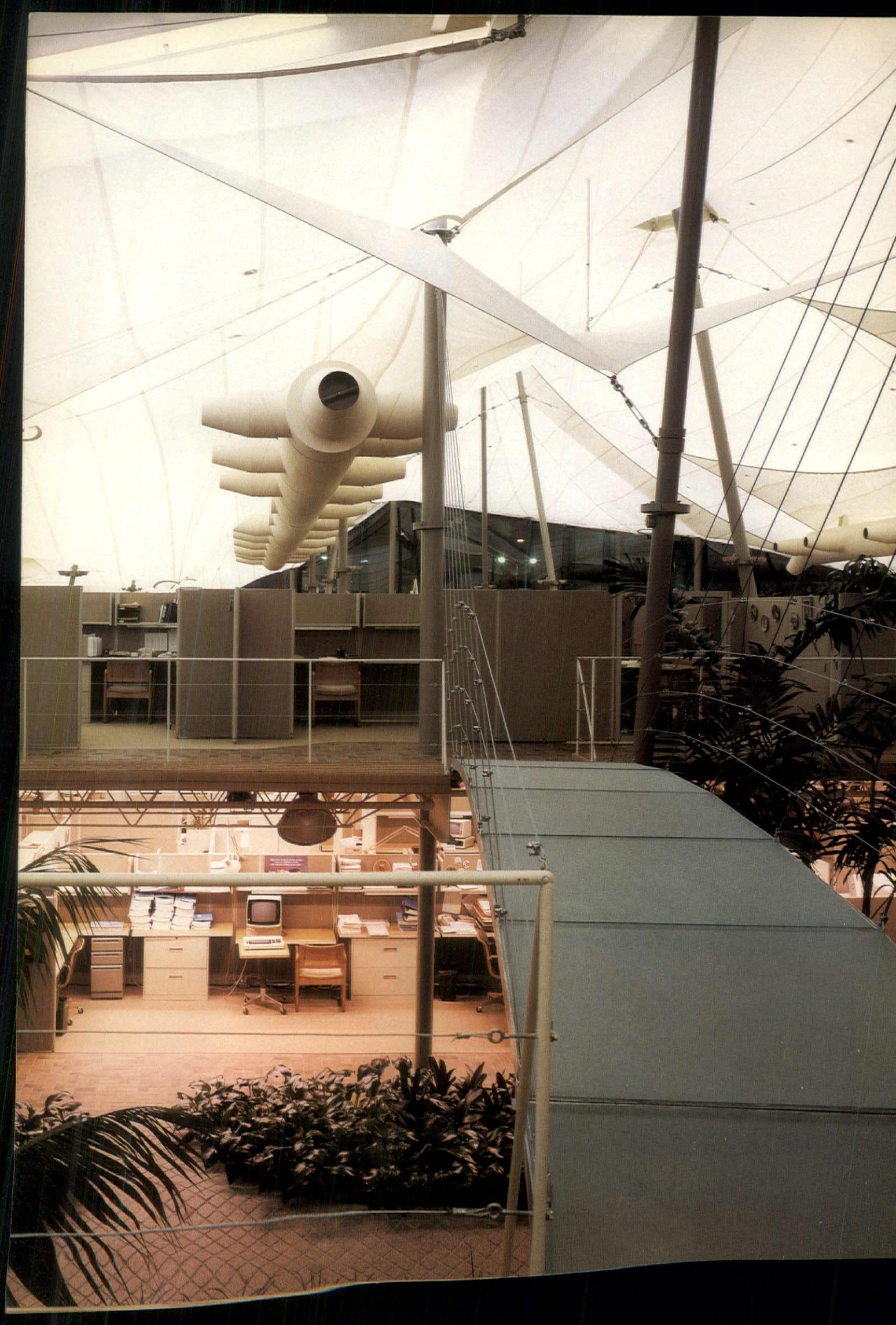
into print in about 10 weeks. Typically, the time to publication — that is, from the time a designer submits materials for review until the published article is mailed to readers — is four to five months. If projects are complex, require additional art or photography, or are chosen to be cover stories, the total time to publication may be six to nine months.

To talk about your project or get more information, telephone our editorial offices at (503) 343-1200.

Send project submission materials to
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PHOTO: JAY GOOD. LIGHTING DESIGN: ABE FEDER







Tensile structures present unique lighting design options, opportunities, potentials

ARTICLE BY
NICHOLAS GOLDSMITH, AIA

COVER PHOTO BY
HOWARD N. KAPLAN

When I first started designing tensile structures with my partner, Todd Dalland, AIA, we were mostly interested in their structural possibilities — very large, economical spans and interesting sculptural shapes. Subsequently, we discovered that the lighting can be beautiful, too. Using fabric surfaces the way a photographer uses an umbrella — to reflect or diffuse light — we can create large lighted volumes. The fabric surfaces can be made in almost any shape imaginable, and can reflect light; translucent fabric can be backlit. Obviously, this is very hard to do with traditional architectural lighting and hard walls.

Many different lighting effects are possible with tensile structures because they have so many shape and fabric options. The light can be diffuse, as well as balanced. An entire structure can be painted with colored light. With some fabric and source combinations, the light can be made to dilate the pupils so they perceive light levels to be higher than they really are. This is a perceptual phenomenon, similar to that which occurs on a bright, sunny day when a person enters a stadium with a fabric roof. Often it seems brighter inside — even though the fabric may transmit only 18 to 20 percent of the light.

We've discovered that tensile structures demand intensely integrated design. Four basic design



The sophisticated tensile structure at the Bradford Exchange, left and above, disguises an unsophisticated lighting system — fluorescent strips applied to the roof of a metal building.

factors are involved — the architectural form, the engineering solution, the acoustic treatment, and the lighting element — and each is as important as the other three. If any one factor is changed, the other three are affected. Tensile structures require an interactive, holistic design approach, so we involve consultants in the early stages of our designs.

Because this is an interactive type of design, the designer must ask early on, "What type of lighting do I need? What is the effect I want?" In the lighting system that we designed for office spaces, for example, we clearly needed diffuse lighting in an atmosphere where CRT screens are a dominant part of the architecture and where glare on the





ELLIOTT KAUFMAN

We collaborated with lighting designer Jerry Kugler to create fixtures that provide diffuse lighting for the China Grill (facing page) in New York City.

An illuminated tensile structure ceiling in the Donna Karan Showroom provides even light for displays and fashion shows. The structure is illuminated by standard A lamps.

screens must be eliminated.

A daylit facility, such as a swimming pool, represents a very different situation. Here, one would like to have as high a light level as possible to cut down on energy costs and to make the space seem larger than it is. But to get natural-looking light, a neutral, light-colored fabric must be used, or the whole structure will act as a gel. A yellow structure could give its users a jaundiced look — that's why it's so important to have these elements described in advance.

Reflected light can also be used. In some concert facilities, we create "house lights" by bouncing light off the inner shell of the structure itself. With a very small amount of wattage, the whole interior surface becomes an efficient source of illumination.

Representative Projects

The Bradford Exchange is basically a standard metal building that has one small area of skylights. The client wanted to create a skylit environment, but the project budget made that impos-

sible. Working with lighting designer Peter Barna, we laid fluorescent light strips directly on the underside of the metal roof, and beneath them we generated a series of seemingly random overlapping fabric structures made of silicone glass fabric. With these structures, we created a large diffuser for the fluorescents. From beneath this diffuser, the lamps are not visible at all.

The skylit central area of the building provides a bright, luminous, daylit environment for trees and plants. This project forced us

to develop a different lighting strategy to make the whole place feel like a fun, enjoyable place to work.

For China Grill, lighting designer Jerry Kugler wanted to get some diffused light into the space, using an organic, Oriental sort of form. He asked us to participate in the collaboration, and we came up with different-sized units that use a rolled aluminum frame and fiber glass wands to prestress the fabric — almost a camping tent technology. We used a polyester fabric with a ure-





The Tensile Lighting System (above and left) is a prototype office lighting system designed in collaboration with lighting

designer Peter Barna. It uses 13-watt compact fluorescents for uplighting and 5-watt compact fluorescents for backlighting.

thane coating and light air-brushed patterns. The fabric was attached to the aluminum frame, which has a cap that fits over a 250-watt quartz light fixture with the same profile as the edge of the aluminum frame. On site, final aiming can be done, and there is no spill of the light. The effect is like an upside-down turtle glowing in the space. The group of units together makes for interesting diffused lighting.

During the last few years, we've developed several showrooms for fashion designer Donna

Karan. The idea there was to have a flexible space that could be used for both sales and fashion shows. On the ceiling, we have developed lighted "wings" of translucent fabric. When models are photographed, the wings provide nice, even fill light overhead. The tensile structure provides very little shadow from any angle. The structure itself is an aluminum grid, which also holds the cabling and the fixtures, which are lamped with standard A lamps.

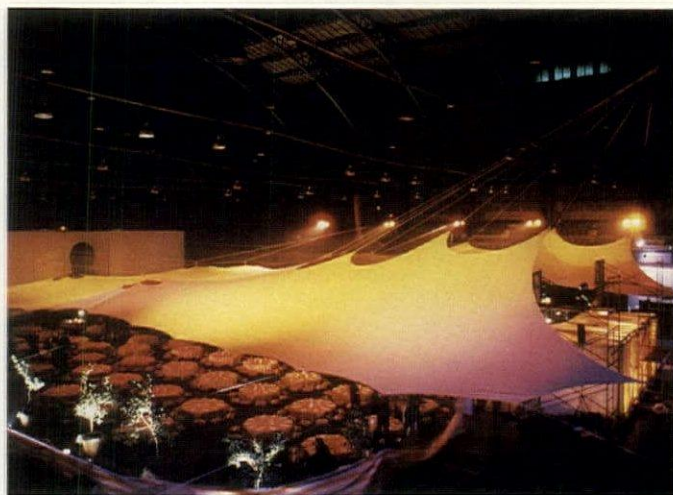
We also designed racks of auto-

mobile headlamps that hang in front of some of the fabric walls. The lenses of these headlamps have been sandblasted, so the light is diffuse, creating the illusion of indirect light.

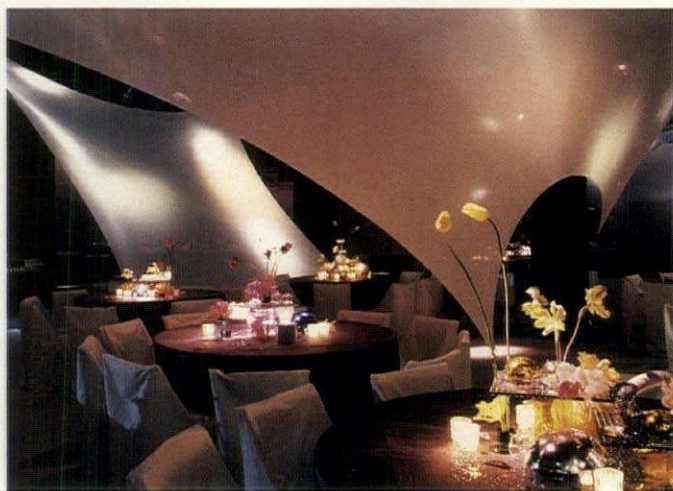
We worked with lighting designer Peter Barna on another project, the prototypical Tensile Lighting System, using Sunar Hauserman's Race System (see *Architectural Lighting*, June 1987). I suspect that someday, somebody will make another try at the reasonable concept of translucent movable panels and over-

head canopies that provide diffuse lighting — without any truly direct lighting. The overhead canopies work as reflectors, reflecting 13-watt compact fluorescent uplights that are attached to the tops of the partitions. Both the panels and the winglike structures attached to the top of the partitions are backlit by 5-watt compact fluorescent lamps.

Lighting Sails and Biderman Industries both used structures that were fabricated and erected temporarily for special events with



MICHAEL LENT



Lighting Sails (left and below right) and the Biderman Industries structure (above right) both demonstrate the effective

use of tensile structures combined with stage lighting for special events.

lighting designer Robert Stortz. These projects show how theatrical lighting and fabric structures can be used together to set the mood for an event. The Roseland Ballroom is basically an extension of this concept, except that it is a permanent installation. In this discotheque situation, it is necessary to have fabric that is a fairly neutral color. By changing the lighting, the room can become pinkish one moment, then bluish the next. The possibilities are limitless.

Mock-Ups and Materials

One of most important things the illumination of a tensile structure does is to help express the shape and *movement* of the fabric surface. Some differentiation in the

intensity of light is desirable — better than light that is totally flat, like the light coming from the lens of a fluorescent troffer. As well, one should be careful to avoid tensile structure lighting that is too strong in the center and dark at the corners. Mock-ups can help test the lighting effects.

Lighting doesn't scale down like other phenomena. Designers who work with color may have experienced a similar problem when working with color chips — they choose a nice color, but when they suddenly see 4000 square feet of it, it doesn't look so good anymore. That's why we often like to do a mock-up when we're working with lighting.

We did a full-scale mock-up

for China Grill, as we do on many projects where the modules are small enough. On large projects, we use a one-half or even one-third scale mock-up. At this size you can work with the lighting to determine whether the source should be farther away or closer, whether the detailing reads or becomes lost in the shadows, and so forth. You can never totally figure out all of the implications for the lighting before you mock up the structure.

The key to a mock-up is knowing where to put the money, so that you can design it as inexpensively as possible, but still find out what you need to know. You don't want to spend \$2000 on aluminum fabrication if the issue is

really whether or not the light dies in the corner of the structure.

Fabric selection is also extremely important. Is the fabric going to be translucent, and if so, *how* translucent? Or will it be reflective? On some projects, we've spent several months on research before finding just the right fabric. On one particular project, we looked at over 100 different fabrics. Many had the right translucency, but they did not diffuse the light enough, so the lamp image was visible behind the fabric. A fabric has to have the right translucency, it must have sufficient diffusion, it must be cleanable, and almost always it must be flameproof.

No one manufactures a fabric



Tensile structures are a permanent part of the Roseland Ballroom, shown above with two different lighting schemes.

for interiors that is advertised as "perfect for backlit translucent fabric panels and prestressed architectural environments." So we look into other business areas where fabric is used. We've used fabrics that are designed for use as filters, others that were designed for the "wet look" that was popular in ski clothing a few years ago. Some fabrics made for use in hospitals are inevitably flame retardant. Often we find the right fabric in the tent or awning industries. Other fabrics that will work include acrylics, polyesters, and nylons. Thousands of materials are available; some have wonderful lighting capabilities, and some are terrible. The designer has to take time and test them out to determine which is

really right for each application.

For the large exterior fabrics, there are basically two different types: those made of glass fibers, and those made of polyester. Both are coated and have a non-stick surface applied. This is essential for cleaning — most of the time one wants the roof to be self-cleaning if possible, but the curvature of the roof often makes that impossible. The glassfiber-based product comes only with 18 percent translucency. It starts out with a cream color that bleaches to white over a period of three or four months. Polyester fabric comes in 15 to 20 different colors and two different translucencies — 18 to 20 percent and 3 to 4 percent — as well as an opaque version.

Tensile Structure Lighting of the Future

As with any new technology, we are using rather conventional materials in new ways. Fabric has been used for centuries as draperies in buildings, but stressing the fabric until it's taut and using that skin as a structural and illumination surface — whether it's translucent or reflective — is basically quite new. Once a person starts working with the technology, it's easy to imagine many applications. Tensile structures can provide a whole new vocabulary of shapes and types of lighting.

Fabric, by nature, gets its strength from curvature, so it accomplishes a three-dimensional strength in a way that is just the

opposite of most materials. Most materials become very expensive when they are made into curved shapes. Fabric is the most efficient, cheapest way to accomplish a given shape and curvature. In the future, even building curtain walls may be built with tensile structures. The exterior will have a translucent skin, with daylight coming through. And because tensile structures are not gravity-maintained, there are a great many potential applications in outer space. ■

The author is a principal of FTL Associates, a firm specializing in the design and engineering of tensile structures, in New York City.

UV filters permit safe, bright lighting of Egyptian antiquities

When lighting designer James Harrington conceived the lighting for Memphis State University's new Egyptian Art Gallery, he had to consider the sensitivity to ultraviolet (UV) light of papyrus, wood, linen, and pigments dating back nearly 6000 years.

His goal was threefold: light the artifacts as brightly as possible for viewing; focus the light as succinctly as possible for a dark ambience; and minimize glare on case covers. He also had to provide maintenance work light. Energy limitations, as well as the fragility of the exhibits, required minimizing heat, humidity, and UV radiation.

Harrington was able to get greater energy efficiency and color rendition than that of typical museum track lighting by using a UV filter that was developed to protect retail fabric displays lit with MR16s. Because it is made of glass and can tolerate more heat than acrylic filters can, the new filter let Harrington take advantage of the high lumen-per-watt output and good color rendition of MR16s. Without the filter, their relatively high operating temperature and UV emissions would have ruled out the use of that lamp. The filter protects the fragile artifacts from the UV radiation.

Mike Heffley

Mike Heffley is an editorial assistant with Architectural Lighting.

UV radiation causes light degradation, that is, the impact of a photon on the long-chain molecules that make up the fibers of paper, fabrics, and wood. Photons break down the molecules by hitting them, turning the substance to powder.

The shorter the light wavelength, the more energetic the photons, and the greater the damage. In the ultraviolet range, degradation increases exponentially, depending upon the temperature, the acidity of a substance, the amount of moisture, and the length of exposure.

Museum curators began to awaken to the dangers of UV degradation in the late 1940s and early 1950s, when research reports started to become available. For a while, the only protection was to store perishables in a dim or dark room. In the early 1960s, manufacturers of acrylic products began to develop lenses for streetlighting that filtered UV. They soon took the easy short step to marketing the first filters that could be attached to other sources.

Frank A. Florentine, a lighting designer at the National Air

and Space Museum, describes its distinguishing features: "The manufacturers coated and baked the filtering material on glass, rather than painting it on or mixing it into the glass itself. The result is effective blocking of the ultraviolet spectrum of the light without yellowing of the filter — and thus the light. This is in contrast to other UV filters that have a photochemical reaction to UV radiation."

The room that houses the Egyptian gallery is roughly 30 feet square; it was previously a lecture room with 12 fluorescent luminaires on its 10-foot ceiling. Now the room has 50 luminaires on 120-volt track. Nine circuits let gallery personnel adapt the lighting to changing displays. Each luminaire accommodates an MR16 lamp with a 12-volt transformer, a dimmer, and a reflector that dissipates heat through the back



UV filter allows this ancient linen-wrapped mummy to be lighted more brightly than would be possible without one.

Project: Egyptian Art Gallery
Location: Memphis State University, Tennessee
Lighting Designer: James R. Harrington

of the fixture. The museum operates the lamps at 75 percent capacity to reduce UV radiation, extend lamp life, and to set an ambience of mystery.

"Actually, it's the ambience," Harrington says, "that makes this design a hit with visitors from around the country. We all wanted to simulate the dark, mysterious glow of the King Tut exhibit that toured the United States a few years ago. The MR16s serve that end quite well here, with their small pool of light and the low ceiling. Their

narrow beam spread also makes them ideal for focusing on objects." The room's colors — a black lay-in ceiling, Egyptian red ocher walls, and blue cases and carpeting — combine with the light to achieve the dark look, reflecting most of the light from the carpet.

Harrington selected combinations of UV filters, diffusing lenses, and honeycomb louvers for each display according to its fragility. In the center area display cases, 50-watt narrow floods provide 4 footcandles to

statuary, wood, and linen; they also provide ambient light. To limit light spill and patterns, 20-watt narrow spots are used to provide wall cases with 2.8 footcandles for viewing and descriptive panels with 3 footcandles for reading. Six dimmable recessed ceiling-mounted luminaires house lamps with elliptical reflectors for maintenance work.

Custom-made linear spread lenses can focus the light of one source on long horizontal and vertical objects. Harrington used

them on two wooden coffins and the standing mummy case cover. The lenses widen the light distribution range of one source, avoiding the overlap patterns that two would create.

Like the original array of artifacts and mummies under the pyramids, the Egyptian exhibit in Memphis is meant to be permanent. Now, however, its preservation is extended to safely bring it to light. ■

For product information, turn to page 62 and see Manufacturers.



Linear spread lens gives one source the light distribution range of two without creating patterns on this mummy case cover.



Dark walls and ceiling absorb the light, leaving most to reflect up from the carpet. The effect is a mysterious ambience around pools of brightness.



Linear spread lens and UV filter permit safe, bright light from a single fixture.

Indirect lighting, daylighting brighten military dining hall

Today's military has changed more than the look of its uniforms and equipment. Facilities on many military bases are being upgraded or built anew, and dining halls are a case in point. Gone are the mess halls portrayed in old war movies — those inhospitable, Spartan places that resembled an aircraft hangar more than a place to eat. Today's military dining halls more closely resemble self-service buffets or smorgasbord restaurants. Some even have piped-in music, chandeliers, and private rooms for small groups.

Changing with the Times
The dining hall on the New York Air National Guard's base at Hancock Field demonstrates how much military facilities have changed in recent years. Located at the center of the base, the energy-efficient building offers a pleasant, inviting space for military personnel to relax.

Project: Hancock Field Dining Hall

Location: Hancock Field, Syracuse, New York

Client: New York Air National Guard

Architect: Quinlivan Pierik & Krause; John D. Quinlivan, partner; David McNeil, project architect

Base Engineer: Lt. Col. Paul Richter

Electrical Design: Robson and Woese, Inc., Anthony Borick, electrical designer

Computer Modeling: Robert Mitchell, Solar Designs Inc.

Photos: Richard Kampas

Susan Degen

Susan Degen is assistant editor of Architectural Lighting.

It is oriented toward the sun so that the dining and food service areas can take full advantage of daylight. Indirect fluorescent lights, dimmed by photosensitive controllers, supplement the daylighting and conserve energy.

The versatile 90-foot-long, 30-foot-wide main dining area accommodates up to 400 people at a time, and doubles as a site for after-hours social events. When not in full service, the dining area can be divided by folding partitions into two or three smaller spaces for meetings and training sessions. "It made sense to set it up so that it could be used for more than just a dining hall," says project

architect David McNeil. "The dining hall is used for food service primarily on weekends. As a training facility, it's used almost every day of the week."

A lucky combination of circumstances made the building possible. "At the time it was designed," says McNeil, "there was a big push to evaluate passive solar techniques. Part of the project requirement was, in effect, to evaluate passive solar and, if we determined that there would be an acceptable payback level, to implement it. They were trying to build up a library on solar energy usage and determine what areas of the country could use what types of solar energy. We were fortunate that



Pendant-mounted indirect fluorescent luminaires light the dining area. Sensors on the underside of luminaires signal daylight levels to solid-state electronic dimming modules wired to standard ballasts. The dimming system helps maintain uniform footcandle levels on surfaces throughout the space by adjusting the output of each lamp group as daylight levels change.

money for both design and construction was allocated during that period."

Indirect Lighting

Daylight and an indirect fluorescent system brighten the dining area with 20 to 30 footcandles of light on work surfaces. The indirect system consists of five 20-foot-long runs of 8-inch-wide pendant-mounted luminaires. McNeil decided to use an indirect system because it "gives the best form of diffuse lighting and couples naturally with daylighting, which is all indirect source in this building. You never want direct sunlight as a primary light source in a building. Even on an overcast

day, you will get 300 to 500 footcandles outside, and on a sunny day it is blinding, up to 4500 footcandles."

A lighting control system helps maintain uniform footcandle levels throughout the dining area. Two fiber-optic photoelectric cells are mounted on the underside of each run, one 10 feet from the windows and another 20 feet. They monitor daylight levels for solid-state electronic dimming modules, which automatically adjust lamp output from 30 to 100 percent of full capacity.

Each dimming module operates independently. "The four lamps nearer the windows are dimmed more often, so I

grouped them on one module," says electrical designer Anthony Borick. "The dimming module for the other length operates six lamps. Working with the light control people, we anticipated how much light would be reflected off the work surfaces. If you mount a sensor on the side, we found, you'd likely see more light than was actually down on the work surface, so we located the sensor on the bottom of the fixture housing."

Dining by Daylight

The architects used energy modeling to analyze building orientation, glazing, passive and active solar heating, daylighting, and insulation. Their analysis

showed that daylighting was a cost-effective option for the dining hall. "In upstate New York," says McNeil, "you have less than 50 percent sunny days. But the advantage of daylighting is that even on an overcast day here, you still have an indirect source that will provide 300 to 500 footcandles on a task surface, if you can take advantage of it."

A 24-foot-high clerestory stretching across the middle of the building serves as both a daytime light source and as a free cooling space where warm air can stratify and be vented away. The space below it is the main circulation area between the dining and serving areas. During the evening, light from 10 250-watt forward-throw metal halide uplights fills the clerestory space. Placed 18 feet on center, five to a side, the uplights "give the same general lighting quality at night as the daylight does during the day," says McNeil.

The main source of daylighting is a 496-square-foot bank of 8-foot-tall south-facing windows with exterior shading and reflecting surfaces. A 4-foot-deep overhang finished in white stucco shades windows from most direct sunlight and reflects indirect daylight into the room. Four feet below the overhang, spaced between six freestanding concrete columns, are five 3 1/2-foot-wide adjustable shading reflectors, or light shelves. "They allow shading of beam radiation during the summer and complete indirect penetration of beam radiation in the winter," says McNeil.

Clad in brushed stainless steel with riveting, the light shelves are reminiscent of an airplane wing. McNeil chose a specular finish for the shelves because he had been dissatisfied with the amount of reflected light from white-finished shelves used in a previous project. "We used brushed stainless rather than polished so that we would get



Ten 250-watt metal halide uplights illuminate the 24-foot-high clerestory to provide an average of 20 footcandles on surfaces in the 18- by 90-foot central service area directly below. The uplights draw attention up to structural elements and banners in the clerestory and provide general nighttime lighting levels similar to daylighting.



Oriented three degrees east of south, the dining hall takes full advantage of daylight in serving and dining areas. Tall win-

dows with stainless steel light shelves, combined with clerestory glazing, bring daylight into the building.



Energy consumption ranges from a maximum of 1.4 watts per square foot to a low 1.2 watts per square foot when the fluorescent system is at 30 percent of full light output.

reflection without imaging. A polished material would reflect the imperfections on its surface, which is not going to stay dead flat throughout the year," he says.

Currently, the light shelves are oriented perpendicular to the windows for maximum shading. "At one time we considered making them trackable," says McNeil, "but that turned out to be too expensive, not cost-effective. They can be adjusted manually, but so far the personnel on the base have chosen not to do so. If we were trying to maximize the amount of light reflecting into the building, we would probably tip them back a little toward the building, but not much."

Because of the extremely low energy consumption — which ranges from 1.2 to 1.4 watts per

square foot — the client is extremely pleased with the lighting system, according to McNeil. The dining area's frequent use for activities other than food service on reserve weekends indicates that other personnel on the base like it too. "The majority of the time, we've since found, the building is being used for classroom instruction," he says. "In fact, it's become quite popular as an educational facility even though there are other classrooms on the base. Perhaps that's because it's a nice place to be in." ■

For product information, turn to page 62 and see Manufacturers.

Product safety, liability issues make designers think like lawyers

The growing impact of product liability litigation has made safety as important an issue for lighting design as aesthetics, light output, light distribution, and cost. Lighting professionals must begin to learn some basics of liability law, no matter how bewildering it appears. They must begin to think like a plaintiff's lawyer.

Product Safety and Liability Concepts

Unfortunately, we live in a litigious society. There are almost a million lawyers in the United States, and the number is growing. Product lawsuits and high stakes damage claims are now commonplace — and often described in detail on the evening news. Product liability law affects product designers, manufacturers, specifiers, and sellers alike. Originally, product liability judgments were limited in scope, but now almost anything goes in the courtroom. It is not surprising, therefore, that many in the lighting industry are unaware of the implications of legal precedents for product liability cases and how such cases relate to them. A good start for lighting professionals unfamiliar with these is to gain a better understanding of the legal concepts of safety and liability.

Three general types of product liability are described in *Everybody's Guide to the Law*, by Melvin Belli: defects in product production, workmanship, and quality control; defects in product design, specifications, and packaging that make a product inherently dangerous even when manufactured correctly; and defects in operating instructions and warnings of possible dangers. Generally speaking, according to Belli, if a defective product causes personal injury or property damage, a person can sue anyone in "the stream of commerce" for damages. In addition to the fixture designer and manufacturer, that can mean any supplier or retail seller,

Irving Schaffer

Irving Schaffer is a principal with Designspring, Inc., of Westport, Connecticut, an industrial design and engineering firm.

architect, lighting designer, and anyone else involved in the chain of distribution. Any specifier can be held accountable for accidental injury or damage to the extent of their insurance or financial resources. Negligence need not be proved.

Those who criticize this judicial expansion of product liability ask whether manufacturers are responsible for devising fool-proof products, and suggest that users are responsible for exercising judgment and avoiding misuse of products in harmful ways. Stoves and light sources, for example, are inherently hot and dangerous to touch. For a designer, manufacturer, or specifier to prevent a product's misuse, their approach to safe product use must include the unforeseeable. In fact, the California Supreme Court called for a "hindsight test" for determining whether a product was unsafe. Liability rulings are equally applicable to products and services.

Many lamp and fixture companies are turning to the product designer as the first line of defense, not only against spiraling costs but also against unsafe design concepts. New project planning is taking into account such legal doctrines as strict liability, implied warranty, *res ipsa loquitur*, interrogatories, and failure to properly warn. These are further explained in the sidebar.



Designers could face product liability litigation if they specify improperly designed luminaires. Halogen task lights like this one are designed with safety in mind.

Product Testing

Portable halogen table lamps are an excellent example of one product type whose design, industry standards, and potential legal intrusion has complicated decisions and challenged attitudes in the lighting industry. No other type of lighting has aroused such interest and controversy at the same time as has the halogen lamp. Its compact size and broad-spectrum light output offer designers the freedom to pursue exciting new fixture designs.

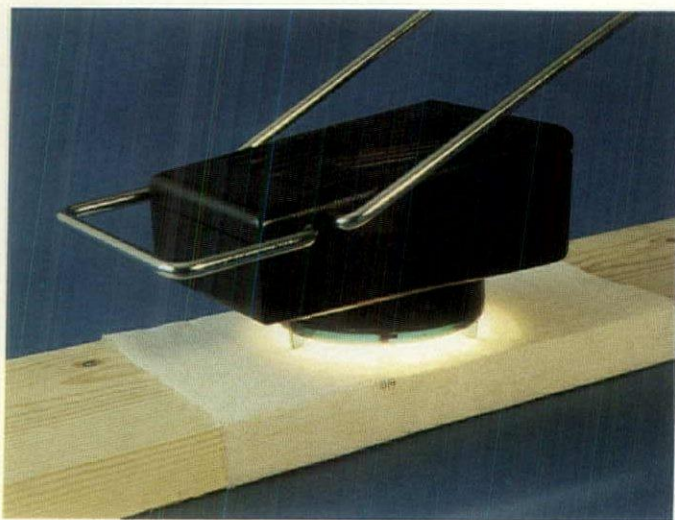
Designs from Europe, where the halogen trend started, have generated a great deal of interest among designers, lamp manufacturers, and consumers. The small size of halogen light sources has led to lampshades for portable task lights that are significantly smaller than shades for standard incandescent and fluorescent light sources. In an office environment, portable halogen task lights contribute to a feeling of openness because, as can be seen in the accompanying photo, they are less overpowering and obtrusive than other sources. Yet with all their advantages and innovative features, the subject of gazing

Underwriters Laboratories approval for portable halogen task lamps remains controversial.

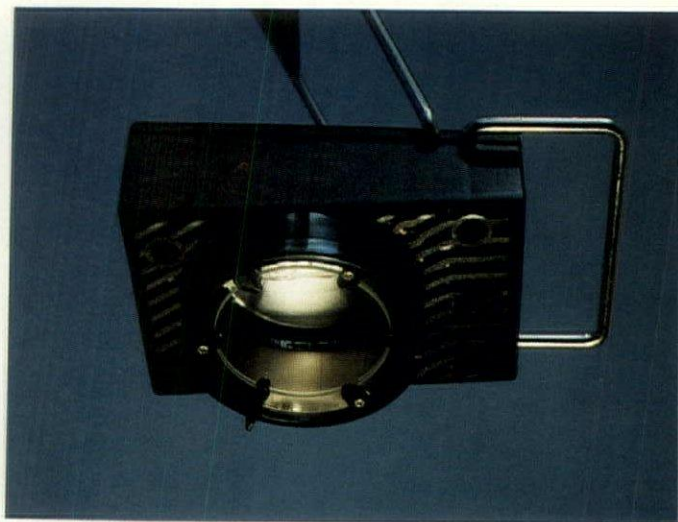
Mystery and myth surround Underwriters Laboratories. One hears that UL standards are confusing, that the agency is too strict, and that no one can pass the tests. Furthermore, many popular European halogen luminaires are sold in the United States without a UL listing, which causes people to ask why lamps that already meet various European electrical and safety standards need UL approval too.

The controversy about test programs at Underwriters Laboratories indicates different understandings of lighting safety and product liability. Many people, in fact, have entirely overlooked the question of vulnerability and responsibility to the end user.

The first National Electrical code was proposed in 1881. In 1894 Underwriters Laboratories was chartered as a not-for-profit organization for establishing standards and methods of investigating products, materials, and components with respect to hazards to life and property. Today, standards exist for thousands of products in a broad



In one abnormal operation test, UL places the lampshade reflector opening directly against two layers of cotton cloth for seven hours.



Revised UL requirements call for protective glass shields, like the one shown here, to limit accidental contact with the bulb surface and to limit the effect of a glass bulb that explodes.

variety of categories throughout many industries. To protect users, they are developed and revised with the participation of the affected public and industry as social and technological changes occur.

The courts view industry-wide standards as minimum requirements for product design and manufacture. Product liability judgments can result from a manufacturer's failure to design a product to the "state of the art." This determines the extent to which a product could have been safely designed, given the scope of knowledge and experience of the industry available at the time of conception, manufacture, and sale. In simple terms, UL standards for lighting products are based on how a lamp functions during both normal and worst possible conditions. These requirements help fixture designers anticipate foreseeable malfunctions in use and require reasonable safeguards. For halogen lamps, the most challenging criteria are the abnormal operation test, the surface temperature test, and marking.

UL standard 153 for Portable Electric Lamps applies to halo-

gen task lights. The 50-watt halogen lamp, by far the most popular, has a surface temperature close to 1200 degrees Celsius (2192 degrees Fahrenheit) and a filament temperature that exceeds 2500 degrees Celsius (4532 degrees Fahrenheit). Its light is bright enough to cause eye discomfort and damage if looked at directly. At these temperatures, the lamp can ignite a fire if it comes into close proximity with materials that ignite at temperatures below the lamp's surface temperature. Cotton cloth, for example, starts to char at 425 degrees Celsius (797 degrees Fahrenheit), and synthetic fibers can ignite at even lower temperatures. The fire hazard becomes further aggravated when lamp fixtures require higher wattage lamps with even higher glass surface temperatures.

UL standards require the use of appropriate construction materials and set limits on surface operating temperatures of such materials, especially plastics, and of components such as wires, transformers, handles, and shade enclosures. These requirements affect fixture

design, suggest the use of lamp guards, and detail the use of warning and instruction labels for operation and relamping. UL standards even cover the way a warning label holds up at the operating temperature of the surface to which it is affixed.

Abnormal operation test. The UL abnormal operation test considers possible accidents to end users, such as an overturned lamp or accidental contact of a lamp with cloth draperies or upholstery. In a representative test, UL actually places the lampshade reflector opening directly against two layers of cotton cloth mounted on a wood board for seven hours, as shown in an accompanying photo. During the test period, the cloth cannot ignite, emit flame, or char. Guards that hold the shade a safe distance away from the cloth are permitted.

Surface temperature test. The surface temperature test determines temperatures for safe handling during normal operation. Shade surface temperatures, for example, are limited to 90 degrees Celsius (194 degrees Fahrenheit), to 60 degrees Celsius (140 degrees Fahrenheit)

for nonmetallic handles. UL's *Recognized Component Directory* lists data such as thermal index, flammability rating, tracking resistance distortion, and resistance to electrical ignition sources for many common construction materials.

Design solutions often evolve from heat transfer calculations and vigorous prototype testing. Until recently, for example, UL specifications for direct contact with a halogen source required only a caution on the warning label. To prevent such contact, however, some lamp designs use an unbreakable glass barrier like that shown in an accompanying photo. But, such a barrier can inhibit the convection cooling needed for safe surface operating temperatures. UL requirements have responded to increased awareness of bulb temperatures, the effects of touching the bulb's glass exploding. Revised UL requirements call for protective glass shields similar to those already used by several companies.

Marking. Marking requirements call for providing information about lamp replacement,

maximum wattage, and voltage. Marking cautions against touching the bulb, looking directly at the light, and about the risk of fire. It outlines broad user safety considerations. In most courts, failure to provide adequate warnings and instructions for foreseeable misuses — as well as intended uses — constitutes a defect in the product and raises the threat of liability.

U.S. and European Standards Designers, manufacturers, and distributors, anxious to benefit from the popularity of portable halogen task lights, say they are puzzled by stringent UL standards and by the absence of such stringency in European standards. Importers question the need for a UL listing if a product already meets European standards. There are, however, vast differences between European and U.S. safety standards and product design criteria. One cannot assume that portable halogen lighting devices imported from Europe will meet U.S. standards, no matter how well made they may be.

In Europe, the major concerns are the high operating voltages (210 to 220 volts) and the insulating barriers required to protect people from these life-threatening circuits. In the United States, the accessibility of live parts is only one concern; others include the flammability of materials used in lamp enclosures and the definitions of enclosures. For example, the UL standards place very specific limitations on materials used to enclose live parts, wiring, and other components, and permissible enclosure materials also differ, depending upon whether a unit is portable, fixed, or stationary. European lamp designers do not have to contend with specifications like UL's flammability tests for plastics and polymeric materials.

UL definitions of enclosure also differ considerably from European standards. Although

European light fixtures can have exposed ballasts and wiring without an enclosing cover, UL standards do not allow this. As a result, many European fixtures must go through major revisions in enclosures before they can gain UL listing — even if they already meet European standards. For example, the plastic housings on many European ceiling fixtures must be replaced with metal ones for the U.S. market or, for stationary or fixed applications, must be made of plastic with a UL flammability rating of 94-5V.

Many European manufacturers have learned the differences between U.S. and European specifications the hard way. If the imported products fail to meet UL standards, they have to be modified, often at considerable additional expense.

Inherent in the difference between European and U.S. standards is the U.S. concept of safety and, ultimately, of product liability. U.S. concepts of product safety are the basic determinant of whether a halogen lighting design meets or fails to meet UL specifications. Designers, engineers, manufacturers, and distributors should strive to exceed these accepted industry standards before designing and introducing new lighting products. Informed lighting professionals look for the UL label to be sure that a specified fixture complies with accepted U.S. safety standards. It is an important obligation to clients and to the end user. The incredible safety record in the lighting industry is a direct result of the efforts, policies, and objectives of the Underwriters Laboratories and its testing standards and to the many enlightened manufacturers that adhere to these requirements.

In the final analysis, when liability becomes a legal issue, a jury decides whether the participants were negligent in the invention, design, development, manufacturing, building, inspec-

Useful legal terms

It is useful to recognize and understand the meaning of some legal terms associated with product liability issues and how they pertain to lamp and fixture design, manufacture, sale, and specification.

Discovery. Both sides in a suit are required to disclose facts and documents that provide material evidence in the case.

Failure to warn. The company must clearly caution the user about all dangers that are not obvious and about the possible consequences of any foreseeable use.

Implied warranty. Offering a product for sale implies that it is reasonably safe to use, meets industry standards and codes, and is made with good workmanship.

Interrogatories. A formal set of questions, called interrogatories, are submitted in writing to the defendant, and the defendant must answer them. With the information from the answers, the plaintiff's counsel can become very familiar with a company's product safety rationale or with any flaws in products revealed from any stage of design, production, packaging, marketing, specification, or distribution.

Res ipsa loquitur. In Latin, "the thing speaks for itself." Something happened, caused an accident, and injured the plaintiff. Proof that an accident happened may be sufficient to suggest that the defendant's negligence was the cause.

Strict liability. In tort law, a manufacturer has an absolute responsibility to provide products without dangerous defects. If injury results from the use of the product, the supplier — anyone responsible for putting the product in the hands of the user — is liable regardless of absence of blame when the product can be shown to have inherently or unreasonably dangerous defects.

tion, testing, labeling, representing, maintaining, supplying, furnishing, selling, selecting, specifying, or purchasing of a defective lighting product or service. Juries determine whether the lighting practitioner did the job in an adequate, knowledgeable, and professional manner.

Ignorance, carelessness, or failure to take the steps necessary to render a safe product or installation can be financially costly and even destroy established reputations. Professionals in all facets of lighting must be aware of and comply with all relevant codes and standards. They should attempt to exceed these requirements by examining the potential for unsafe conditions that may result from their efforts. Safety to the end user or the innocent bystander must be a major consideration. Light-

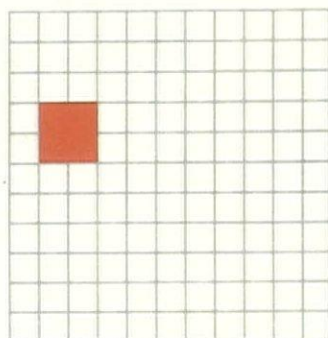
ing specialists — as a minimum — should look for the UL label to be assured of compliance with industry-wide safety standards. When in doubt, think like the plaintiff's lawyer, and consider all the possible things you can do to ensure the safe use of lighting products. ■

Daylighting Techniques

Architectural fabric structures can be used for a multitude of applications: atria, recreational facilities, airport terminals, warehousing, department stores, and shopping malls, to name a few. Acres of fabrics have been used for architectural structures. Fabric structures provide a roofing system that, unlike other roofs, is translucent. A lighting designer can control the amount of daylight that enters a space by selecting a fabric with known solar energy and visible spectrum transmittance properties.

Fabric structures have been built in all types of climates — from the desert of Saudi Arabia to the tundra of Alaska. The fabric is usually nylon or polyester, with a special coating that gives it good resistance to atmospheric pollutants, such as sulfur dioxide, sand, and salt and sea water. The materials are available in a variety of colors, and thicknesses vary from 0.039 inch to 0.118 inch (1 to 3 millimeters). They can stand extreme temperature variations, from as low as minus 67 degrees Fahrenheit to as high as 170 degrees Fahrenheit. The fire performance requirements for architectural fabric are presented in great detail in manufacturers' literature.

Structural systems for the envelopes can be inflatable, cable-net supported tent shapes, or double-curved membranes supported by space frame structures. The structural design and the geometry of membrane structures for typical roof systems are based on repetitive patterns, as shown in the accompanying illustration. The span of the repetitive membrane elements is chosen to minimize the structural loads while preserving the shape of the design. The advantage of this design concept is the small amount of detail needed to produce a cover for a large area. The roof sections can be fabricated elsewhere and put together on the site in a short period of time. Careful attention should be given to the drainage of rain water and



Fabric structures as daylighting systems

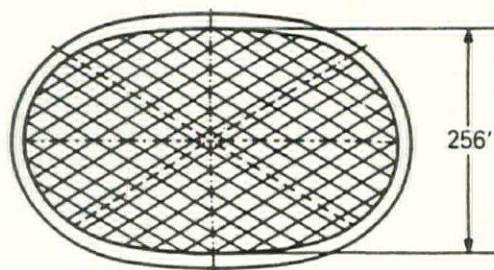
Mojtaba Navvab

Mojtaba Navvab is an assistant professor of architecture in the College of Architecture and Urban Planning at the University of Michigan, Ann Arbor.

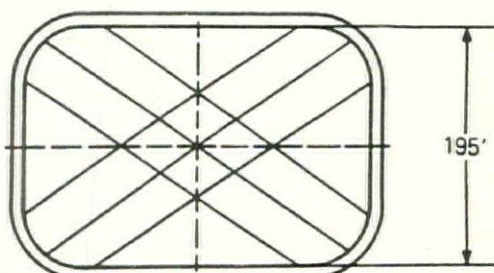
to dirt, wind, and snow loads.

Fabric structures — both air- and tensile-supported — can be designed to be energy efficient if designers integrate the unique properties of the materials with other systems in the building. A designer who is selecting material for a fabric structure must be sensitive to energy factors such as site, climate, structural system, user criteria, and building operation. Each has a major impact on the total energy consumption of that building.

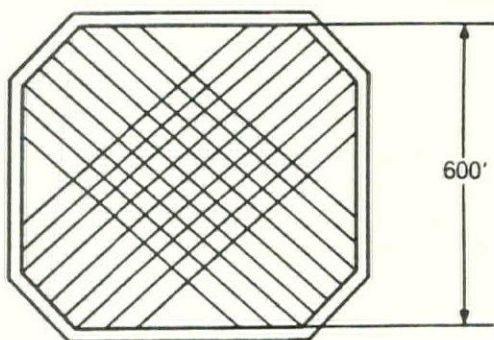
The amount and direction of heat conduction through the fabric depends on the indoor and outdoor air temperatures, the wind speed, and the U value of the fabric material. The surface area of a fabric structure cover is almost always larger than the area it covers. This also increases the conduction or the heat exchange. For example, the U value (BTUs per square foot per degrees Fahrenheit per hour) of fabric materials is in the range of 0.4 to 1.26. The values differ from one season to another, as is shown in the table of thermal



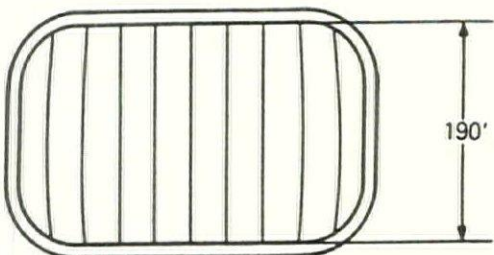
United States Pavilion,
Osaka, Japan



Student Activities Center,
Santa Clara, California



Silverdome,
Pontiac, Michigan



Dedmon Center,
Radford, Virginia

The structural design and geometry of membrane structures for typical roof systems are based on repetitive patterns. From top to bottom: United States Pavilion, Osaka, Japan; Student Activities Center, Santa Clara, California; Silverdome, Pontiac, Michigan; Dedmon Center, Radford, Virginia.

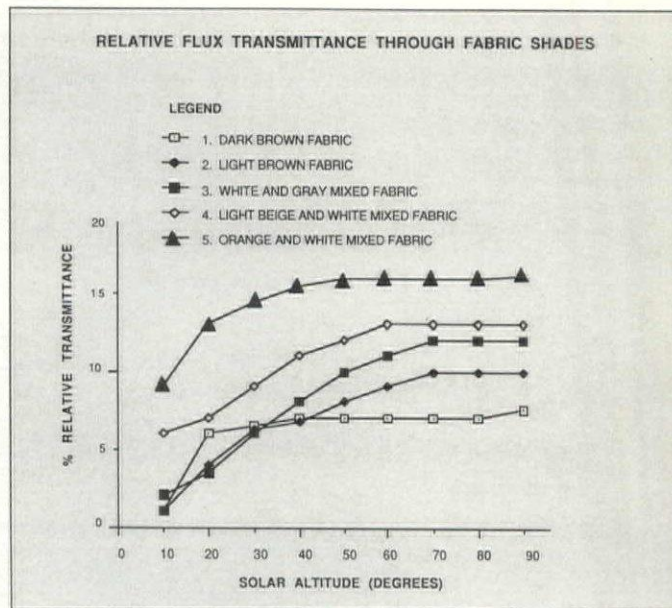


A fiber glass fabric structure atop the atrium at the Hyatt Regency Hotel in Burlingame, California, provides soft, spectrally balanced daylight for plants and people below.

and optical properties of various fabric structures. The irradiance and illuminance from the sun and clear sky on a horizontal, unobstructed surface outdoors are about 317 BTU per square foot and 10,000 footcandles, respectively. A study at the Israel Institute of Technology (Technion) assumed a fiber glass and Teflon fabric structure with reflectivity of 70 to 75 percent, diffused transmittance of 10 to 15 percent, outdoor air temperature at 71 degrees Fahrenheit, indoor air

temperature at 68 degrees Fahrenheit, and a fabric area to covered floor area ratio of 1.5 to 1. The researchers found that the conductive heat loss ranged from 6.5 to 12.5 watts per square foot. The radiation gain from this fabric would be around 9.29 to 18.58 watts per square foot; daylight levels indoors would be 100 to 150 footcandles.

The additional heating load is not desirable in summertime, but the daylight levels are high enough to eliminate some of the



Relative visible transmittance of five different fabric shades under real sky conditions.

electrical lighting loads. Under overcast sky conditions, however, the footcandle level is reduced to 10 to 15 footcandles — a level too low for stores, shopping malls, and other atrium types of buildings, where additional electric lighting will be required. The provision for daylighting within a space does, however, reduce the amount of energy required for electric lighting during the daytime.

Fabrics for architectural structures can be engineered to nearly any shape and are available with many coating materials. When choosing one for a particular application, it is important to understand its transmittance properties. That is, the designer needs to determine how much solar energy and visible light the material under consideration will admit. The transmittance varies as a function of solar angles and wavelengths. The graph above shows the relative visible transmittance of five different fabric shades under real sky conditions.

The results of this kind of in-

vestigation were used when selecting the fabric structure for the atrium cover of the New Hyatt Regency Hotel in Burlingame, California, designed by Hornberger Worstell and Associates in San Francisco. The 10-story-high, 120-foot by 120-foot atrium space is covered by coated fabric on a space frame structure. The German manufacturer fabricated the sections of the space frame and assembled them on the adjacent roofs. They look like rows of 10-foot-high tents; they were joined together one by one and pulled over the atrium, their ends resting on rails on the roofs on either side. This assembly work took only three days. The pre-sewn fiber glass fabric was winched over the space frame and fitted on the vertical struts in only 10 hours.

The atrium space is used as a major circulation space and entertainment area, in which special attention is given to the landscape and plants. The soft light coming through the high-transmittance fabric structure provides spectrally balanced lighting dur-

Optical and thermal properties of single fabric membranes

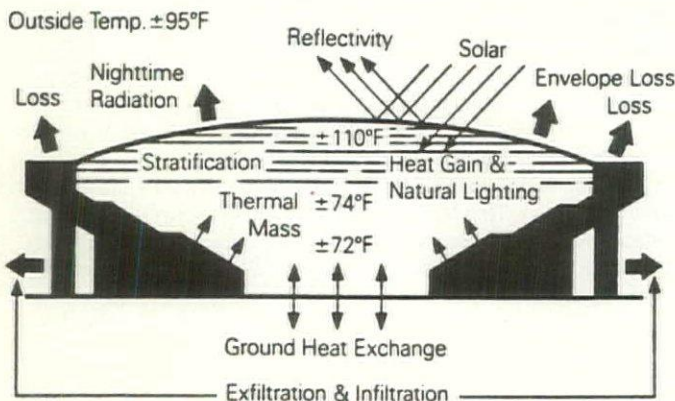
Fabric	A1	A2	B1	B2	C	D	E1	E2	F1	F2	F3	G
Transmission (%)	9	7	13	9	18	22	7	11	9	13	18	23
Reflectance (%)	73	75	73	75	68	69	75	73	75	73	70	67
Absorption (%)	18	18	14	16	14	9	18	16	16	14	12	10
Visible Translucence (%)	7	5	11	8	15	19	—	—	—	—	—	—
Summer Shading Coefficient	.15	.12	.18	.14	.24	.28	.12	.16	.15	.18	.24	—
Winter Shading Coefficient	—	—	—	—	—	—	.12	.16	.14	.18	.24	—
Summer U-Value	0.84	0.84	0.84	0.84	0.84	0.84	0.81	0.81	0.81	0.81	0.81	—
Winter U-Value	1.26	1.26	1.26	1.26	1.26	1.26	1.20	1.20	1.20	1.20	1.20	—

For fabrics E-G, summer U-values are for 7.5 mph wind; winter U-values are for 15 mph wind.

Optical and thermal properties of double fabric membranes

Fabric	A1	A2	B1	B2	C	E1	E2	F1	F2	F3
Transmission (%)	4	3	6	4	8	—	—	—	—	—
Reflectance (%)	74	76	75	76	72	—	—	—	—	—
Absorption (%)	22	21	19	20	20	—	—	—	—	—
Visible Translucence (%)	3	2	4	3	5	—	—	—	—	—
Shading Coefficient	.08	.07	.10	.08	.13	.06	.08	.07	.09	.12
Summer U-Value	0.41	0.41	0.41	0.41	0.41	0.45	0.45	0.45	0.45	0.45
Winter U-Value	0.49	0.49	0.49	0.49	0.49	0.54	0.54	0.54	0.54	0.54
U-Value with 2 inches insulation	—	—	—	—	—	0.14	0.14	0.14	0.14	0.14
U-Value with 4 inches insulation	—	—	—	—	—	0.08	0.08	0.08	0.08	0.08

All data are for a double layer consisting of the fabric indicated plus a liner. For fabrics A-C, the liner is fabric D with a 4-inch air space between layers. For fabrics E-F, the liner is fabric G with an average 10-inch air space, or with insulation as specified. Shading coefficients for fabrics A-C are summer values.



The effective U value can be improved by using the dead air space in the roof area. This illustrates the heat exchange, exfiltration, and infiltration for the Unidome at the University of Northern Iowa.

they are more sensitive to air leakage than conventional buildings.

University studies have also confirmed that heat stratification occurs within the roof profile. The effective U value for the membrane can be improved by using the dead air space developed in the roof area. The supporting graph for the Unidome at the University of Northern Iowa summarizes the building's heat exchange, exfiltration, and infiltration.

Fabric structures are now being used as skylight modules in shopping malls and retail stores. The translucent properties of these materials provide glare-free, diffuse illumination into the space below. The fabric provides true spectral distribution transmission so that merchandise can be seen under natural lighting conditions. The fabric structure industry has also provided acoustical solutions — using either fabric liners or sound-absorbing baffles — to control the echo reverberation and focusing effect that is sometimes created within these spaces.

Fabric structures are established now as building design elements that provide great flexibility for daylighting. They are glare free, and their light transmission levels make them useful for some sports facilities and for outdoor shelters for music, dance, and theatrical activities. Development work in the future will use the air space between two-layer membrane structures as solar energy collectors. ■

The daylighting columnist would like to hear from readers about unique daylighting applications. Write to Mojtaba Navvab, MIES, College of Architecture, University of Michigan, Ann Arbor, MI 48109.

ing the daytime. Low-angle sunlight penetrates the space below the clear glazing system at the perimeter of the atrium's fabric structure cover. The amount of daylight reaching the atrium floor provides the required light levels for most of the plants.

The energy and cost savings are even greater when fabric structures are used for storage areas rather than for atrium buildings because comfort level requirements are less demanding. At night, radiation can dramatically reduce the internal temperature of the space. And, because air-supported structures require air pressure of about 5 pounds per square foot to keep them inflated,

The Lighting Design Professional

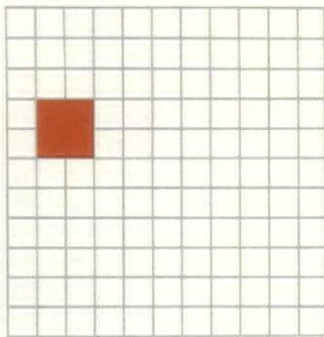
People experience particular feelings, or moods, in all environments. Architects, designers, and critics have always used the language of feeling to describe spaces. Rooms have been called "dreamlike," "cold," "tense," "airy," "crisp," and been described in a host of other subjective ways. Although these moods are the general result of human psychological response to architecture, no doubt a fair share of them are specifically shaped by the way light interacts with the environment.

Lighting designers in both architecture and theater are expected to have an intuitive understanding of mood shaping and to render a space with the appropriate feeling. This intuitively guided skill is the primary nontechnical reason for the existence of lighting consultants. But it is impossible to teach intuition, and lighting design students usually learn only the pure black-and-white science in class. To improve professional practice, we need to come to grips with the emotional, subjective art of lighting.

The Psychology of Light

Several sources provide practical information about the relationship of lighting effects to the mood of a space. The late Professor John Flynn was, perhaps, the most successful researcher in this area. John approached his work with the care and conviction of a good psychological researcher, carefully controlling variables and testing plenty of subjects. His published work should be required reading for every architect and interior designer, for it shows that *patterns of light* — not lighting fixtures — truly create a mood in a space.

Color is another major aspect of light. Some colorists and designers have used the limited research in light and physiology to develop grandiose formulas for "healthy light," a controversial and inconclusive area of



Practical philosophies of lighting psychology

James R. Benya, PE, IALD

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work at best. Psychological research on color has been primarily directed at color in pigment, with limited attention to the effect of tinted or colored light. The best work involving light has demonstrated that light's color temperature can affect *thermal mood* (see *The Lighting Design Professional*, April 1988) and that certain combinations of color temperature and color rendering index (CRI) can create a perception of visual clarity.

Theater is arguably the best training ground for students of mood and environment. In his lectures, John Flynn spoke of

the *visual cue*, an architectural application of the theatrical use of allegoric items to convey meaning. But most importantly, theater lighting is by definition dramatic. Understanding theatrical theories and complexities helps us understand how to create a variety of intense moods within an architectural setting.

Using this range of ideas from design, psychology, and theater, it is possible to define fundamental techniques in lighting psychology for the practitioner. These techniques work regardless of the design aesthetic, period, or architecture, as long as the appropriate type of lighting equipment can be installed.

Visual Cues

In theater, visual cues are often a major part of the set design. Their purpose is simple: to help set the scene. To create a living room cue, for example, the audience is shown walls, sofas, end tables, and the like. We know where we are, and now we are ready to deal with the play and the characters. If the play is set in a certain time in history, the cue is usually dated to give that message, too.

In architecture, the lighting equipment selected is an important determinant of visual cues. Consider, for example, chandeliers. The mere presence of a chandelier in a space signifies that it's the most formal room in the building. Chandeliers in lobbies, ballrooms, and anterooms suggest grandeur in places like hotels and opera halls. To omit a chandelier from a formal dining area is to miss a cue. To use a chandelier of the wrong style is even worse.

Other classic visual cues in architectural lighting include wall sconces or wall brackets next to exterior doors, pendant (hanging) fixtures — but not chandeliers — over casual dining areas, and many small point sources (called *twinkle lights* or *Broadway lights*) for marquees and festive effects.

Clever use of color

Designers can use color temperature and color rendering index (CRI) to affect the mood of a space.

Higher color temperatures are more tense and active; lower color temperatures more relaxed and slow.

To stimulate a feeling of warmth and coziness, use lower color temperature sources.

For a feeling of coolness or sharpness, use higher color temperature sources.

To stimulate a feeling of uneasiness, use a poor CRI source. Sodium sources, for example, will appear murky, while mercury vapor will appear stark and eerie.

For a feeling of luxury and vitality, use an excellent CRI source. Incandescent, halogen, and top-of-the-line fluorescent lamps are examples.

Color Temperature and CRI

According to the theory of *visual clarity*, a person can see more clearly when the light source has a high color temperature and a high color rendering index (CRI). This theory has been at least partly supported by research. We know the human eye performs more poorly at repeated focusing tasks under high pressure sodium (HPS) lamps than under other lamps with higher color temperature and CRI, including fluorescent and metal halide.

With color temperature, the bottom line appears to be the relative quantity of blue light. The higher the color temperature of a light source, the more blue it has in its spectral distribution. Blue, the shortest visible wavelength, bends the most when refracted. For accurate focusing, the eye most likely

Dramatic or dreary? How to predict lighting moods

The simplest way to predict a "dramatic" result begins with a one-point perspective of the space being designed. In the accompanying drawing, a conference room perspective has been overlaid with a dotted line corresponding to the vanishing point elevation. This simple line helps assess the dramatic potential of the room as follows.

- If surfaces below the line are generally brighter than surfaces above the line, then the space will tend to have a dramatic feeling. The space will be less dramatic if the whole lower volume is uniformly bright and will appear more dramatic if significant contrast and shadow exist within the lower area.
- If the surfaces above and below the line are about the same brightness, then the space will be fairly "airy," or neutral. Often this balance is considered "cheery" because it corresponds well to sunny days.
- If the surfaces above the line are generally brighter than those below, the space will tend to be drab and dull. This corresponds to cloudy days, when the sky is brighter than the ground, buildings, and people.

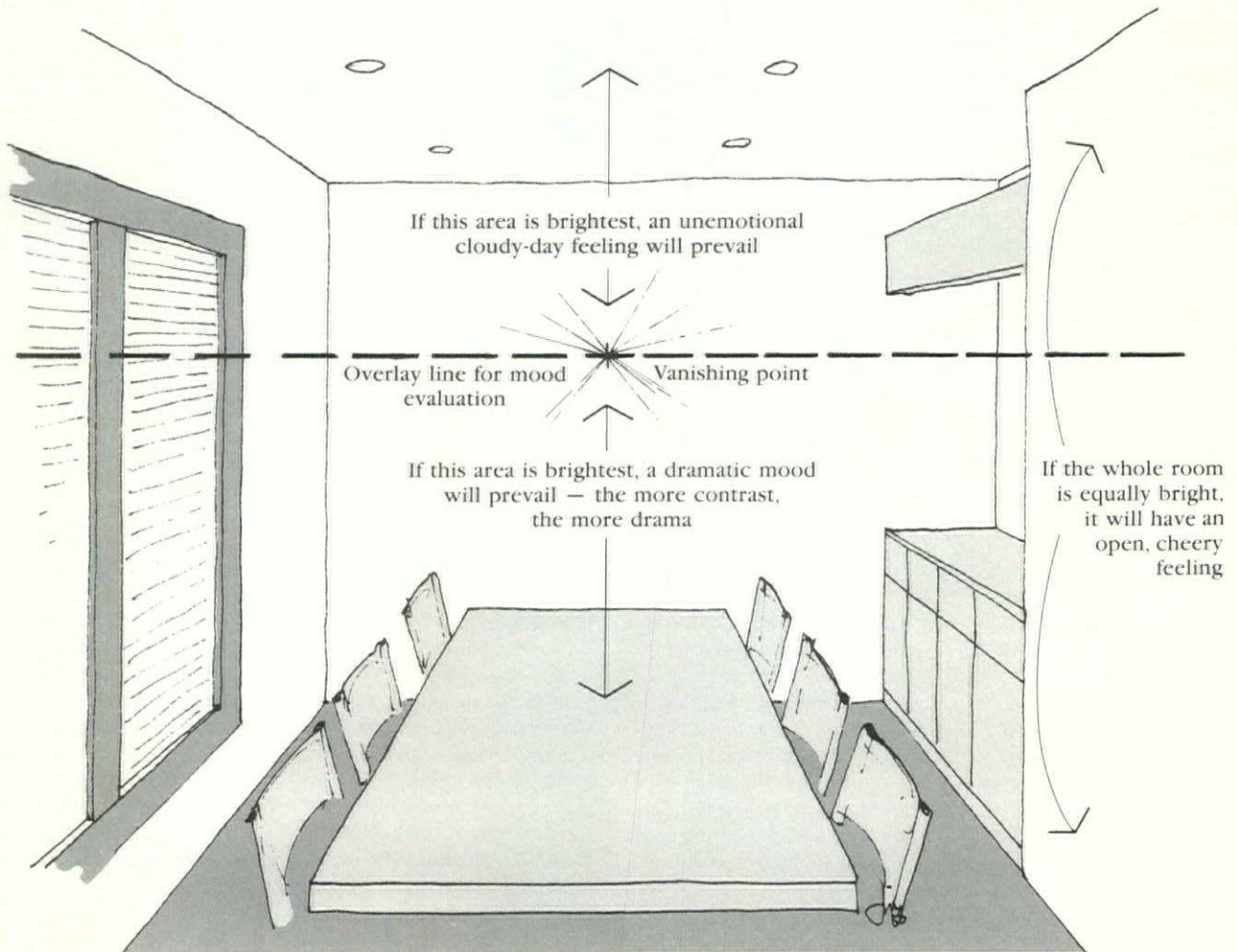
relies upon signals from the retina's cone cells in response to blue wavelengths. Consequently, blue-poor light sources impair focusing and make objects seem fuzzy. Low color temperature environments therefore appear soft-edged and muddy, while high color temperature environments appear crisp and sharp. Blue is missing altogether from the emissions of sodium light sources.

With color rendering index, the bottom line is the overall balance of wavelengths in a source's visible spectrum. CRI is a measure of how well a source renders colors as compared to a "natural" light source of the same apparent color temperature. Because low CRI

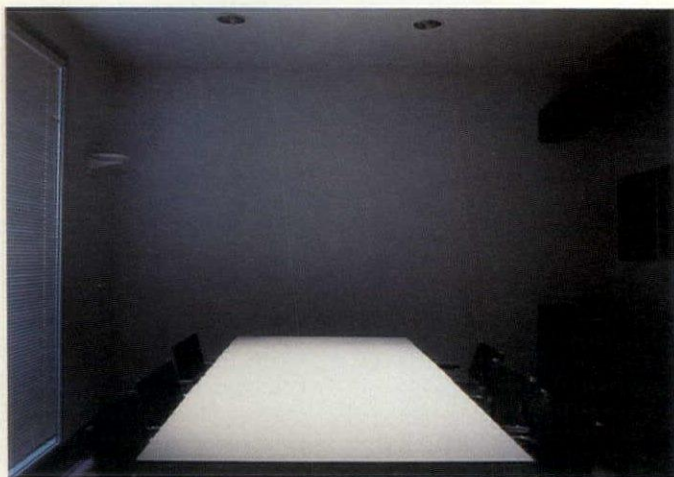
sources have distorted light spectra, they confuse human eyes trying to adjust to an appropriate red-blue balance. HPS light, which lacks blue, is difficult for the eye to accommodate; objects can be seen, but not brought into focus quickly. On the other hand, the blue-rich light from clear mercury vapor lamps, lacking red, makes objects appear horribly unnatural.

Drama

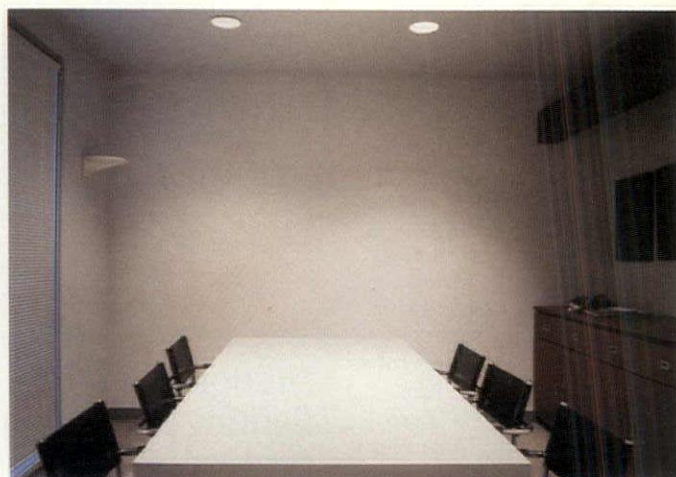
Clients request lighting that evokes a sensation of *drama* more often than any other mood. Fortunately, dramatic lighting is easy to create with modern devices. In fact, equipment and techniques associated



Will the space be dramatic or dreary? A simple drawing helps predict the feelings various lighting designs may evoke.



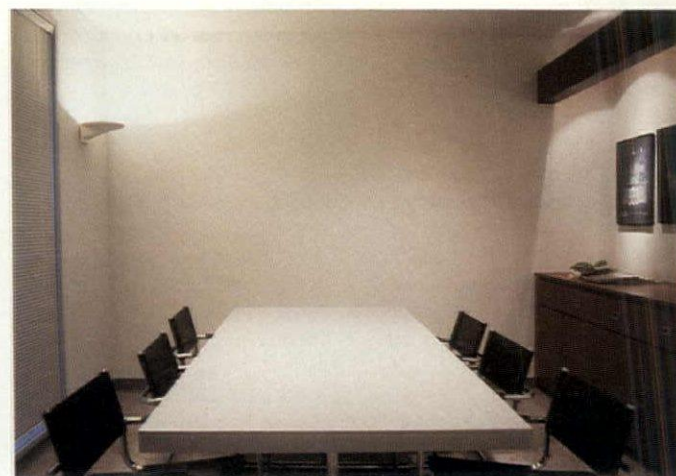
Low-voltage downlighting in the center of the room creates an extremely high-contrast, ultradramatic space.



General lighting with downlights reduces the contrast, but the room is still dramatic and shadowy.



With just uplights, the room takes on a dull, even dreary, cloudy-day appearance.



Uplights, downlights, and accent lights together create a balanced, open appearance.

with this single mood are at the leading edge of electric lighting. Architectural lighting designers face two major problems with drama: predicting it during the design phase and deciding how much will be too much.

Dramatic environments are emotional, entertaining, and exciting. But they are also tense and severe. The sensation of drama has at least something to do with the notion that, by over-highlighting, we leave a great deal of darkness and shadow, evoking natural tension in self-

defense. Downlights create dramatic environments, as do candles on tables, fires in fireplaces, and a follow spot on a performer.

Uplights create the antithesis of drama. Many a designer has been upset when a torchere failed to provide "dramatic" lighting to a living room. By my definition, it can't. It can provide only the soft, shadow-free illumination of a cloudy day — perfect for reading or working, but lacking in enthusiasm.

Up-and-down light sources

like chandeliers tend to create a cheery space, balanced between dramatic and dreary. By emitting glary light, however, chandeliers create comfort problems and wash out the contrast that makes the lower portion of the room interesting. Instead of diffusing sources, use uplighting and downlighting together to create an open and cheery space.

Many good designs have several *layers* of lighting that are independently dimmed, giving the user a choice of

mood. The downlight layer creates drama; the uplight layer creates fill and balance. With appropriately labeled preset dimming systems, users can "dial a mood" in these spaces. Designers who correctly understand the psychological effects of lighting will set the stage with lighting scenes that provide visual cues, color, and drama to create a mood anyone can feel. ■

Software Reviews

Two sets of software from Lighting Sciences expedite calculations for indoor and outdoor lighting designs. The indoor package is named Micro-Eye-Lite, the outdoor package, Micro-Site-Lite.

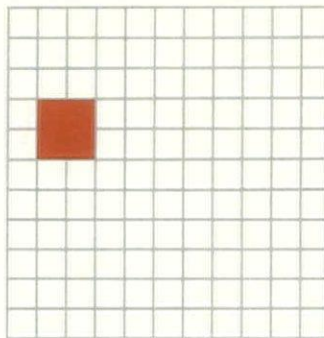
Indoor Lighting Program

Micro-Eye-Lite comes in four versions: demo, condensed, full, and advanced. For this review, I used the demo version, which can read only specific photometric files. There are many subtle differences in the capabilities of the different versions. For instance, equivalent spherical illumination and contrast rendition factor can be calculated with both the demo and the advanced version, but with neither the condensed version nor the full version.

All versions of Micro-Eye-Lite undertake design calculations for fluorescent, HID, and incandescent luminaires using the flux transfer interreflectance method and can accommodate up to nine reflective inserts on each room surface. Each version will output horizontal and vertical luminance and wall exitance in either tabular or graphic form.

Eye-Lite and Site-Lite are oriented toward seasoned lighting professionals who know a lot about computers.

Output can be viewed on the screen before being sent to the Epson or compatible dot matrix printer. Perhaps a future version will take advantage of the increased capability and higher resolutions available in laser printers. Tables of illumination values can be printed out for horizontal or vertical planes, with sloped planes planned for future versions. For those designers whose work is international



Indoor, outdoor lighting calculation programs

David Lord, PhD

David Lord is a professor of architecture at California Polytechnic State University, San Luis Obispo.

in scope, the input and output values can be in English or metric units with full interchangeability.

Outdoor Lighting Program

Micro-Site-Lite is a multi-versioned companion program to Micro-Eye-Lite. It handles most outdoor lighting designs, including floodlighting and roadway and area lighting. For most roadway lighting designs, the program will be used to optimize the spacing of luminaires. For this, the designer enters the mounting height, the kind of roadway lighting to be used, and the desired performance. The program then establishes optimum pole spacing based on cost efficiency.

Users have several output options: horizontal and vertical illuminance, sloped plane illuminance, and pavement luminance for a fixed or a moving observer. Also provided are values for lane luminance,

veiling luminance, or disability glare. These output tables can be printed to the scale of the site plan for direct overlaying.

Micro-Eye-Lite comes on three floppy diskettes with 70 pages of documentation and examples. Micro-Site-Lite is on five diskettes with 70 pages of instructions along with 12 appendices that are longer than the instructions. Unfortunately, the pages to much of the documentation are not numbered; woe if ever the three-ring binder fails and the pages become mixed up. Each program includes an installation routine that simplifies the creation of subdirectories and the initial setup. Both programs run on an IBM XT/AT or compatible with a hard disk. A math coprocessor is recommended to reduce computation time.

With both of these programs, the user takes a back seat to the interface. The programs are oriented toward the seasoned professional, who knows all about lighting and a lot about computers. Perhaps I've been

spoiled by too many pull-down menus, but I found some areas of the program's operation to be slightly opaque. Still, Eye-Lite and Site-Lite both shine in their capacity for handling complex geometries and combinations of luminaires. For many potential users, that capacity will make learning worth the investment in time.

Upgraded Lighting Program

Lux88 from Gardco Lighting continues the service of providing a simple, straightforward, point-by-point outdoor lighting program for lighting designers and engineers. This is an upgrade of their Lux2 program, reviewed earlier in this column. Lux88 proves the computer world axiom: if one waits, everything changes and gets faster, cheaper, and better.

The new Lux88 — it sounds like a detergent powder — has been upgraded to handle photometric data files that are in standard IES format. The menu has been reorganized and sim-

Continued on page 42

Micro-Eye-Lite and Micro-Site-Lite

For information about documentation and program operation, contact

Lighting Sciences, Inc.
7830 East Evans Road
Scottsdale, AZ 85260
(602) 991-9260

For purchasing information, contact

Murray & Gillespie Computer Solutions, Inc.
90 Nolan Court, Unit 22
Markham, Ontario
Canada L3R 4L9
(416) 477-0260

Lux88

For information, contact

Kenneth E. Fairbanks, PE
Vice President for Engineering Services
Gardco Lighting
P.O. Box 2013
San Leandro, CA 94577
(415) 357-6900

Lighting Graphics

The lighted cornice is part of a family of lighting installations identified as built-in, reflecting the architectural origin of their names, such as coves, soffits, valances, brackets, and cornices.

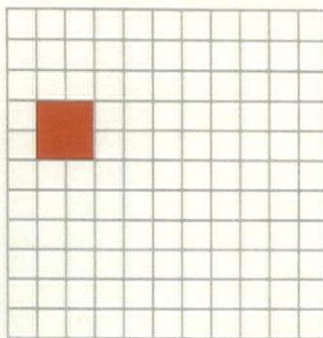
These built-in lighting elements have traditionally offered a simple method of integrating lighting and architecture while, in a more practical sense, they concealed light sources and the corresponding undesirable lamp brightness and glare.

The lighted cornice has a predominantly downward distribution of light that can be characterized as indirect. It furnishes general illumination with a soft-edged, diffused quality along with acceptable levels of task illumination at locations near the wall.

The cornice is sometimes referred to as a wall-lighting element because the wall below receives a large portion of the light and becomes visually prominent in the architectural space. It is particularly effective over bookshelves, decorative wall hangings, murals, and textured materials, such as brick and stone. It also creates interesting effects when used over draperies and blinds. The accompanying drawings illustrate the use of a lighted cornice over bookshelves, where it highlights the color and texture of the books.

It's important to use rapid start lamps that have good color rendering characteristics.

As is true for other fluorescent applications, it's important to use rapid start lamps with good color rendering characteristics and to use a lamp with a color temperature that matches other light sources in the area. For a



Lighted cornices

Sam Mills, AIA, IES

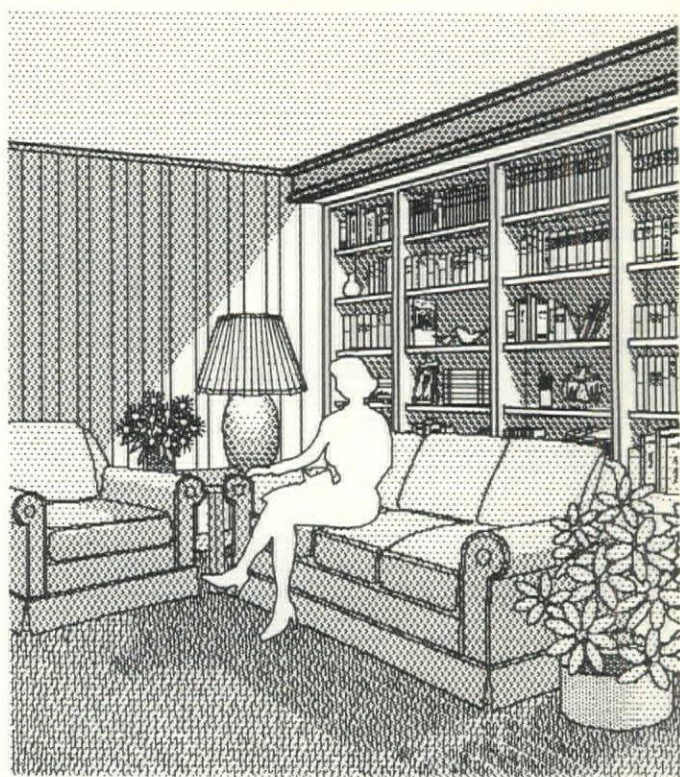
Sam Mills is an architect and lighting consultant with his own firm in Oklahoma City.

continuous uninterrupted line of light, it's also important to use light strips that permit the installation of back-to-back lampholders and to paint the inside of the faceboard a flat white.

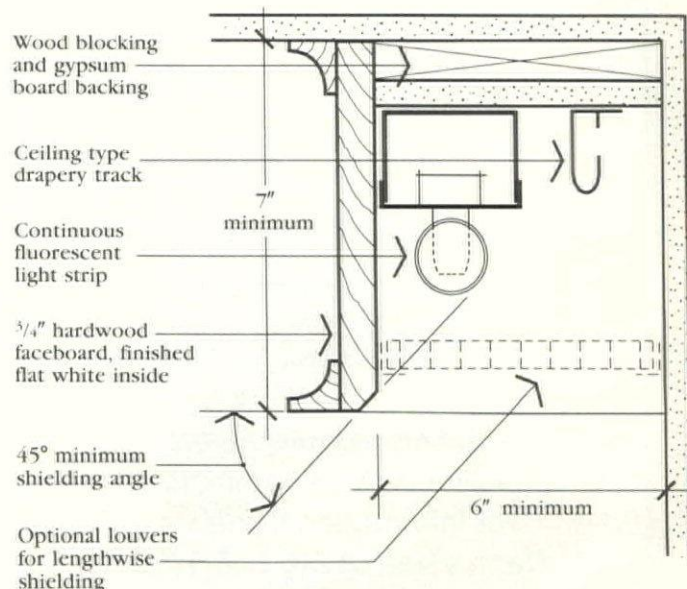
Some installations — over dark-colored surfaces, for example — may require special treatment to produce acceptable levels of light. One solution is to use two rows of lamps; another is to use special reflectors to improve the distribution of light on the lower wall.

When two rows of lamps are used or the installation is viewed from a lengthwise position, it is desirable to use louvers or diffusing plastic at the bottom for shielding the lamps, as shown on the cross-section drawing.

For more complete information on recommended fluorescent lamps and details on two other members of the built-in lighting family, see the February and September 1988 Lighting Graphics columns on lighted wall brackets. ■



Lighted cornices direct their light downward to give dramatic interest to bookshelves, wall hangings, murals, and textured materials, such as brick and stone. The predominantly downward distribution of light can be characterized as indirect. It furnishes general illumination and acceptable levels of task illumination near the wall.



Cornice cross section

Continued on page 42

Continued from page 40

plified, and other changes have been made to simplify and speed up the original program. Although the upgrade has made the new program incompatible with previously created Lux2 input files, a utility is provided to help make the transition.

Lux 88 proves the computer world axiom: If you wait, everything gets faster, cheaper, and better.

Lux88 allows you to use up to six luminaire types, to aim the luminaires, and to print the

results on a grid with up to 70 rows.

The program comes on three diskettes: one for the program and two for photometric data. A compact tutorial and set of instructions make this a lean and clean starter package that will satisfy simple needs for outdoor lighting calculations. Gardco encourages free use and copying of the program in the belief that computer-wise specifiers will generate better and more effective lighting applications. ■

The software review columnist welcomes reader comments and software review suggestions. Write to David Lord, Architecture Department, Cal Poly, San Luis Obispo, CA 93407.

Continued from page 41

Recommended rapid start fluorescent lamps

Lamp	Watts	Color Temp	CRI	Lumens	Lumens per foot
3-foot					
F30T12/IF	30	2750K	89	1160	387
F30T12/WWX	30	3000K	75	1500	500
F30T12/CWX	30	4100K	89	1550	517
F25T8/31K	25	3100K	75	2150	717
F25T8/35K	25	3500K	75	2150	717
F25T8/41K	25	4100K	75	2150	717
4-foot					
F40T12/IF	40	2750K	89	1550	387
F40T12/WWX	40	3000K	75	2200	550
F40T12/CWX	40	4100K	89	2100	525
F32T8/31K	32	3100K	75	2900	725
F32T8/35K	32	3500K	75	2900	725
F32T8/41K	32	4100K	75	2900	725
5-foot					
F40T8/31K	40	3100K	75	3650	730
F40T8/35K	40	3500K	75	3650	730
F40T8/41K	40	4100K	75	3650	730

CRI: Color rendering index

IF: Incandescent-fluorescent, yellow-white

WWX: Warm white deluxe, warm white

35K: Neutral white

CWX: Cool white deluxe

These lamp recommendations, referred to on the preceding page and in the September Lighting Graphics column, were inadvertently omitted from the September issue.

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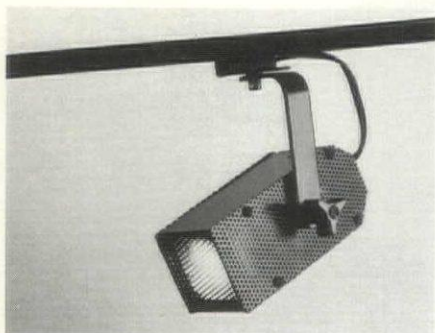
Dennis Neff at 215-668-1700

Help for your lighting problem

Send your lighting design problem or question to *Architectural Lighting*. We'll track down a lighting professional with expertise in that area to get suggestions for solutions.

Address your letters to Lighting Clinic Editor, *Architectural Lighting*, 859 Willamette Street, P.O. Box 10460, Eugene, OR 97440

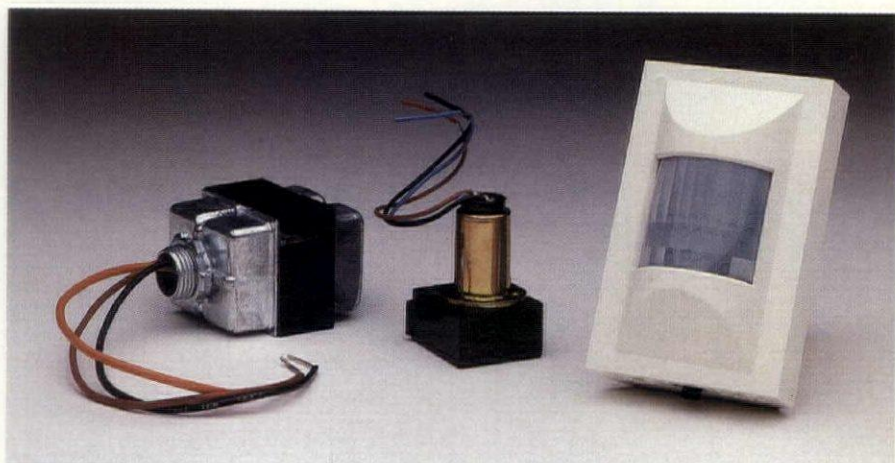
Product Showcase



■ MR16 track fixture

The Modena V track fixture from Luma Lighting's Starline series has a ventilated housing and a heat sink socket holder. The aluminum fixture with marine-grade stainless steel hardware accommodates a 75-watt MR16 lamp and is not too hot to adjust even after several hours of operation, according to the manufacturer. All Starline fixtures come with plastic track and flexible power cable; they need no connectors or couplers. Luma Lighting Industries, Inc., Santa Ana, CA.

Circle 60



■ Combined sensor-control

Sensor Switch has introduced a passive infrared occupancy sensor with a built-in daylight control. Users can adjust the photocontrol so that lights go on or off when the footcandle level in the space is from 20 to 420 footcandles. The sensor covers 1600 square feet, which slave units can in-

crease to 6400 square feet, using as many as three 20-amp control relays. The unit interfaces with a multitap, 120/277- to 24-volt transformer. Sensor Switch, Inc., Branford, CT.

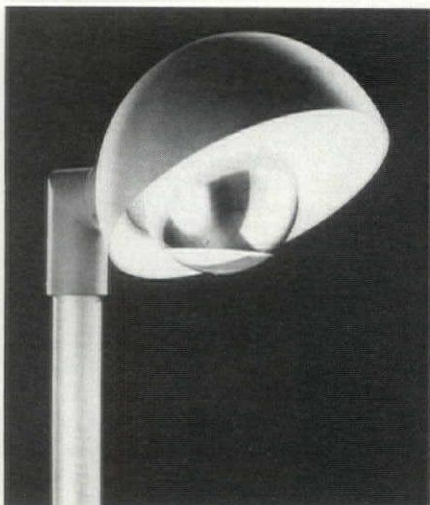
Circle 62



■ Candelabra sconce

The Glendale II is Brass Light Gallery's reproduction of a 1920 candelabra inspired by the Georgian period. It is solid brass and has hand-bent pantry-cock arms mounted on a contoured oval plate. Single- and double-candle versions are offered in various finishes. Brass Light Gallery, Milwaukee, WI.

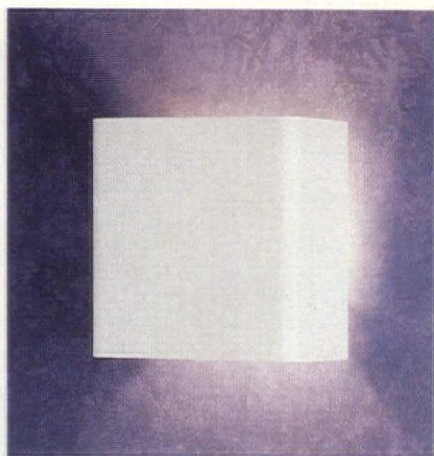
Circle 61



■ Adjustable outdoor lighting

The Quartier luminaire from Poulsen Lighting has a housing that can rotate 30 degrees laterally around a fixed sphere of clear plastic, yielding a bidirectional lighting pattern. A glare shield directs the light to the inside of the hemispherical housing, which reflects it outward. The primary reflecting surface is baked white enamel with a rose tinge. The fixture is designed for HID sources. Poulsen Lighting Inc., Miami, FL.

Circle 63



■ Wall sconce

The Hoban 307 is part of Amerlux's Euro-light series of wall sconces and floor and table lamps. The fixture holds a 100-watt standard incandescent lamp and comes in a matte white or polished brass finish. Amerlux, Fairfield, NJ.

Circle 64

EXIT

THE LEADING EDGE

Yorklite's New Edge-Lit EXIT Signs Will Give You The Design Edge.

Utilizing the smoothly polished edge of a 3/16" plexiglass panel, illumination is highlighted with deeply engraved lettering.

Panel edges are rounded to blend with contemporary styles and a brushed stainless steel mounting plate is beveled to provide a smooth transition from the fixture to ceiling or wall.

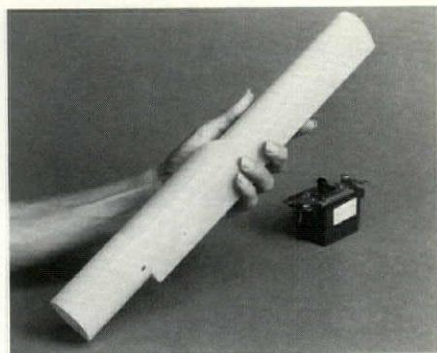
Letters are available in red, green or white with a choice of background colors.

Two separately ballasted fluorescent lamps provide low power consumption, low maintenance and uniform luminance for greater visibility.

YORKLITE

512/385-1773
FAX 512/389-2841

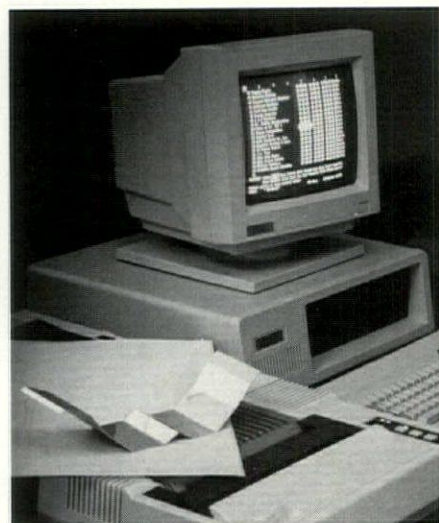
Circle 15



Emergency lighting

Radiant Illumination's switchable SNC2000s wireless emergency lighting system features a self-contained, battery-powered emergency power pack. The unit accommodates a 3-foot fluorescent lamp and can be installed in place of a standard 4-foot lamp to provide up to two hours of emergency lighting when power fails. A power sensor switch replaces a standard wall switch, so fixtures retain the emergency feature even when turned off. Radiant Illumination Inc., North Hollywood, CA.

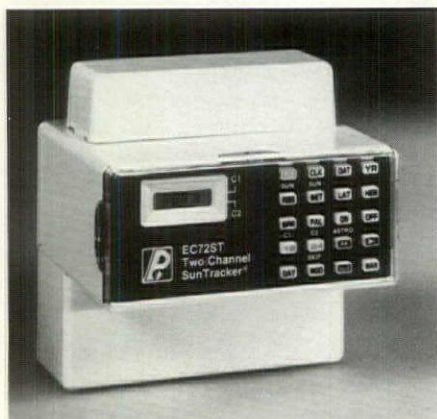
Circle 66



Reflector design service

Badger USA designs reflectors for fluorescent fixtures; the computerized design service is free. The program is designed to maximize reflected light from a given fixture in a specific environment, using the company's reflectors. Badger USA, Baraboo, WI.

Circle 67



Electronic controls

Paragon Electric's SunTracker lighting controls electronically monitor the sun's movement, eliminating the need for photoelectric cells. The controls automatically turn outdoor lights on at dusk and off at dawn, whatever the season. Users can also program the controls to work at preset times; single- and double-channel models provide one and two on-off events. Paragon Electric Company, Inc., Two Rivers, WI.

Circle 65

Lighting the private office...



Elliptipar's high-powered Ensconce® series provides all the benefits of indirect lighting without overhead obstructions. Even with relatively low ceiling heights the surface appears evenly luminous, and the space free of harsh glare. Wall mounting enables concealment within decorative sconces from Elliptipar or others.

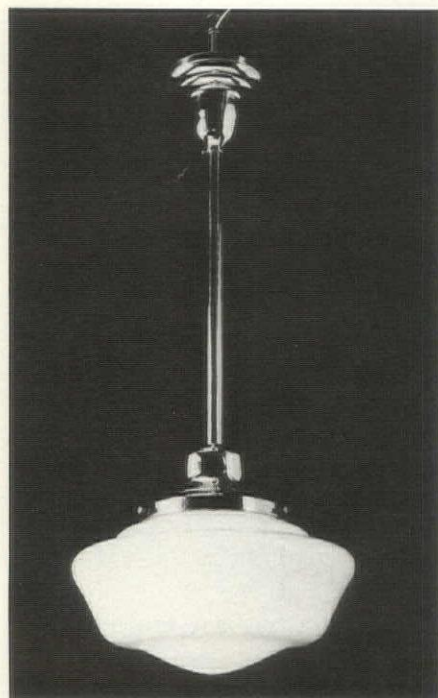
elliptipar inc.

Performance in and From Lighting

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Sylvan R. Shemitz® Designs
© elliptipar, inc. 1988

Circle 16



■ Brass fixture

The Schoolhouse is a solid brass, single pole fixture with a hand-blown glass shade and a lacquered finish. The UL-listed fixture comes with several sizes of shade and takes a 60-watt standard incandescent lamp. Rejuvenation Lamp & Fixture Company, Portland, OR.

Circle 68



■ Low-voltage tape lights

Tempo Industries offers a durable, flexible low-voltage tape lighting system that features a variety of lamp spacing options. The tape lights accommodate replaceable 24-volt lamps of 0.9 or 1.8 watts and are suitable for both indoor and outdoor applications. Tempo Industries, Inc., Santa Ana, CA.

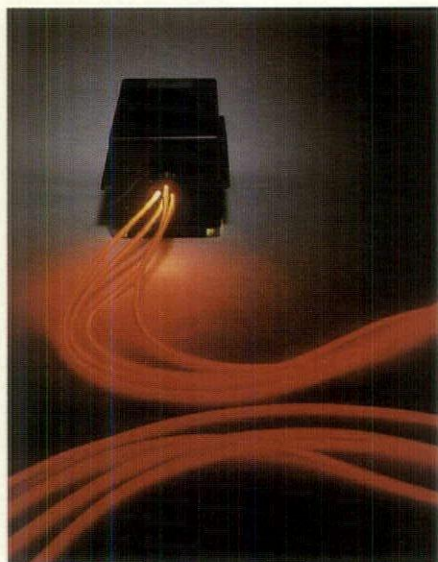
Circle 69



■ Table lamp

Sirmos offers the Crater lamp, which features a stippled texture available in a variety of metallic and matte finishes. The 30-inch-high lamp comes with a square shade measuring 23 inches wide at the bottom and 5 1/2 inches high. Sirmos Inc., Long Island City, NY.

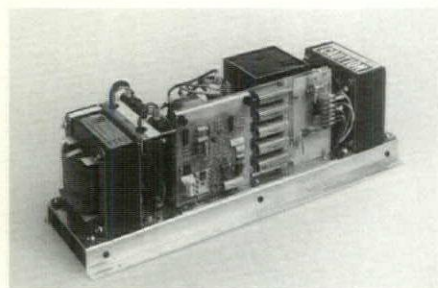
Circle 70



■ Fiber optic light tube

Flexible tubing encases Fiberstars' fiber optic strands, which are illuminated from a light box that holds a quartz halogen source. A motorized color wheel can be placed in the light box to provide light in four colors. No electricity passes through the tubing, so it stays cool and is safe for wet locations. The system is UL listed and can be installed without a permit. Fiberstars, Fremont, CA.

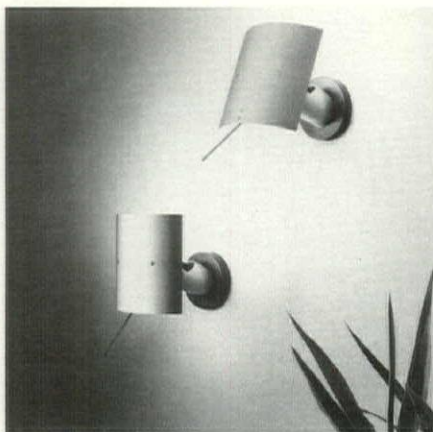
Circle 71



■ Ballasts, igniters

HID Systems carries a full range of instant-start ballasts and igniters for metal halide lamps up to 7500 watts. The devices use less than 20 kilovolts to reignite a hot lamp and have accelerated warm-up and infinite phase dimming with a range greater than 10 to 1. These devices are offered to the OEM, and licensing is available. HID Systems Inc., Sparta, NJ.

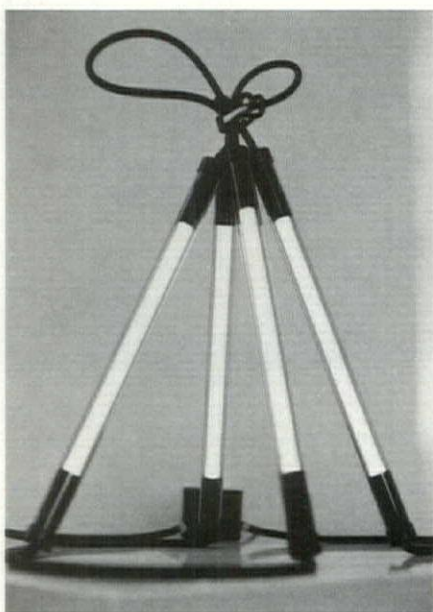
Circle 72



■ Novelty luminaire

Artemide's 1988 collection includes the Enea wall luminaire, designed by Antonio Citterio. Its adjustable aluminum reflector controls the distribution of light from a single 100-watt E27 incandescent lamp. Artemide, Long Island City, NY.

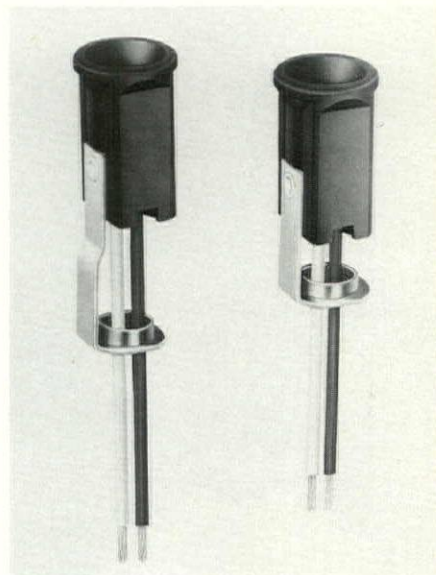
Circle 73



■ Neon tubes

Neon Modular Systems offers Stix, a system of four 16-inch-long neon tubes encased in a high-impact acrylic. The tubes are connected by 20 inches of flexible rubber tubing, which lets users arrange the tubes in a variety of configurations. Neon Modular Systems Inc., New York, NY.

Circle 74



■ Candelabra-base lamp holder

Leecraft Manufacturing offers the series 19-00 candelabra-base lamp holder with a single-leg hickey in sizes from 1¹¹/₁₆ to 3¹⁵/₁₆ inches long. The holders have heat-resistant Valox housings and come with standard 6-inch leads and plastic-insulated wire. Leecraft Manufacturing Co., Inc., Long Island City, NY.

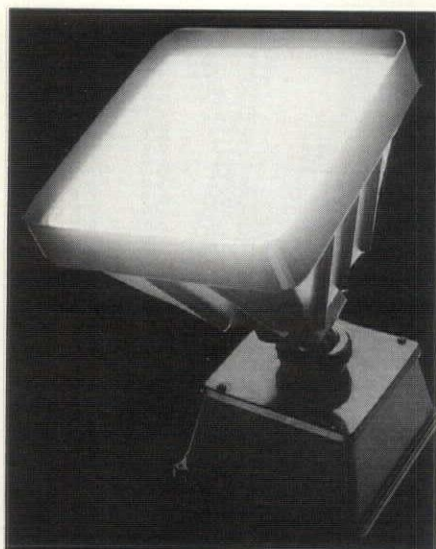
Circle 75



■ Fiber glass lamp holder

The model LH-3P lamp holder from Allied Moulded Products features a grounded outlet molded into its mounting plate and a 3-inch pull chain switch with a string extension. The UL-listed lamp holder is made of shatter-resistant, one-piece fiber glass and will fit 3¹/₄, 3¹/₂, or 4-inch outlet boxes. A choice of screw terminals or 7-inch wire leads is available. Allied Moulded Products, Inc., Bryan, OH.

Circle 76



■ HID floodlight

Innovative Controls offers an HID floodlight for general outdoor illumination that can be used in place of tungsten PAR or quartz floodlights. The unit is made of noncorrosive cast aluminum and has a polycarbonate lens. An adjustable ball joint allows it to be aimed in any direction. The luminaire has an integral solid-state photocell that turns the light on at dusk and off at dawn; it can also be wired to a standard wall switch for manual control. Models are available for high pressure sodium and mercury vapor lamps. Innovative Controls, Inc., Houston, TX.

Circle 77



■ Under-cabinet halogen

The Mity Lite under-cabinet halogen lamp has an adjustable light beam and a linecord on-off switch. The 4¹/₂-by-2¹/₂-by-2-inch fixture uses a 20-watt MR11 source and comes in two semigloss colors. Roxter Manufacturing Corp., Long Island City, NY.

Circle 78

MINOLTA METERS THE MEASURE OF EXCELLENCE

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ENJOY SOME EXCELLENT LIGHT READING.

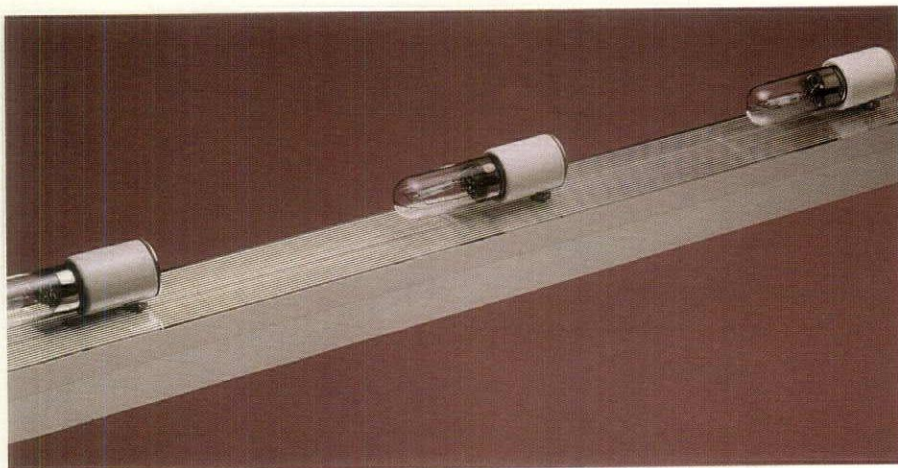
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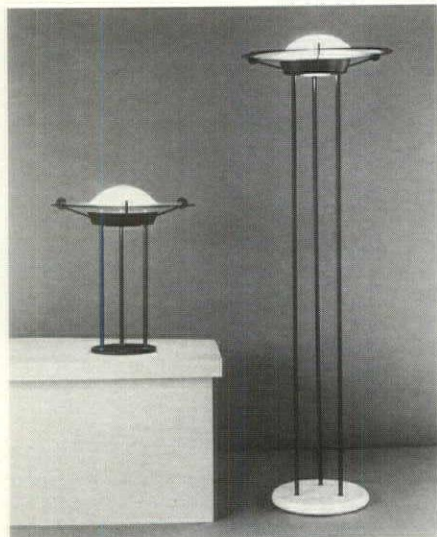


■ HPS light strip

Light strips from Norbert Belfer use 50-watt high pressure sodium lamps for lighting large, open areas that require high levels of illumination. They are energy efficient, require little maintenance, and come with normal or high power factor ballasts. The light strips are designed for use behind

valances or in coves; they come in custom lengths with the lamps 12 inches or 18 inches on center. Norbert Belfer Lighting, Ocean, NJ.

Circle 79



■ Torchere, lamp

The Murray Feiss Galaxy series of torchere and table lamp pairs and ceiling pendants includes seven pieces in clear and opal spiral glass with black edging. The glass is handblown Murano and the bases of the torcheres are of white Carrara marble. All come with halogen lamps. Murray Feiss Import Corp., Bronx, NY.

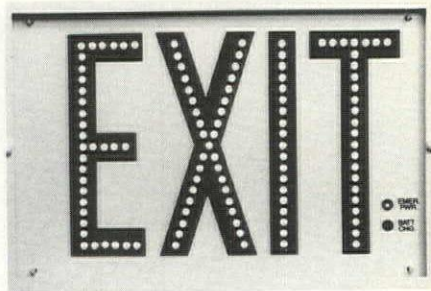
Circle 80



■ Sloped glazing system

Kawneer's 1500 S.T. System is a sloped glazing system that offers a smooth, clean look. It is ideal for small installations and remodeling projects and is flexible enough to handle end walls and hip corners as well as standard slope applications from 15 to 60 degrees. The system can be used on its own to fully enclose an atrium or solarium; the same members can be used on both vertical and sloped areas. Kawneer, Norcross, GA.

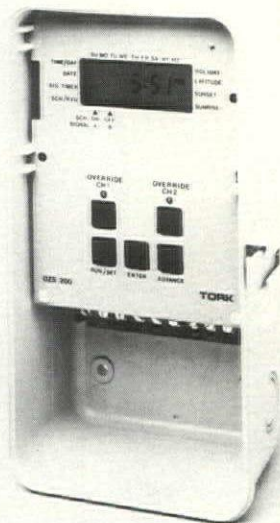
Circle 81



■ LED exit sign

The energy-saving Exitronix sign from Exitronix features a 6-volt DC output, LED construction, and a back-up battery system for continuous, maintenance-free operation. Its 19-foot-candle output is almost four times brighter than minimum NFPA standards and is visible from more than 50 feet away, according to the manufacturer. The UL-approved unit meets or exceeds NFPA life safety code 101 and carries a 20-year guarantee against component failure due to manufacturing defects. Exitronix, Gurnee, IL.

Circle 82

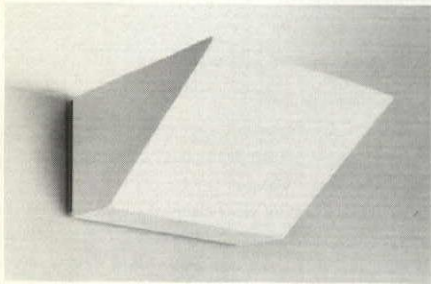


■ Time switch

Tork's model DZS200 electronic time switch has 365-day advance scheduling and controls two channels (up to four circuits) with 48 events per channel per week. Users follow step-by-step instructions and graphics to set schedules. Features include on-off switching in straight and astronomic time combinations, weekly and holiday scheduling with daily variations, manual

override, and automatic adjustment for daylight saving time and leap year. A self-recharging battery retains schedules during power failures. Tork, Mount Vernon, NY.

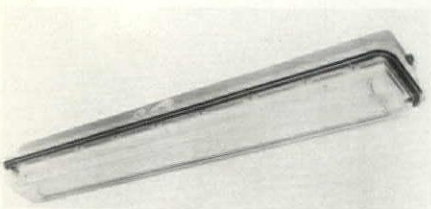
Circle 83



■ **Wall sconce**

Elliptipar's Ensconce reflectors are made for use with Osram's HQI metal halide lamps in applications previously limited to incandescents. The reflectors project light in an asymmetrical pattern for even distribution over a large area from one side of that area. Elliptipar Inc., West Haven, CT.

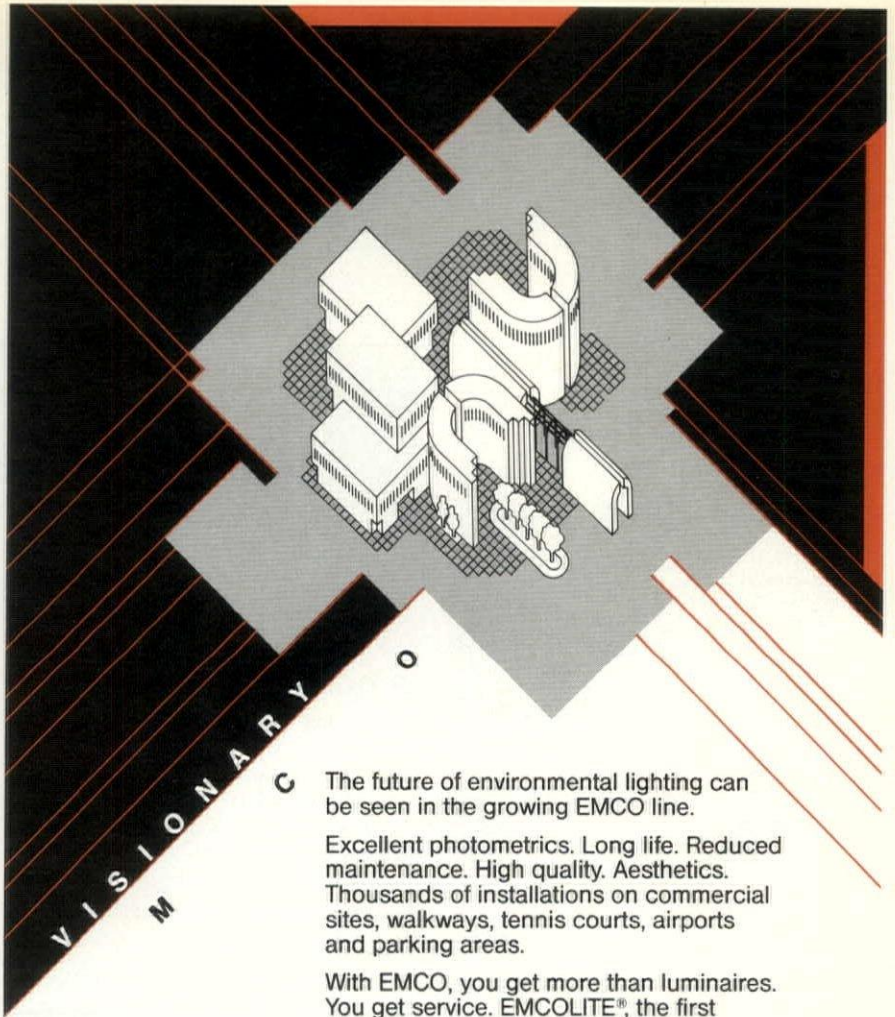
Circle 84



■ **Hazardous-environment fixture**

Crownlite's model VP706HL fluorescent fixture for hazardous or hostile environments has a fire-retardant, injection-molded housing of fiber glass-reinforced polyester. The hinged, injection-molded lens of high-impact, UV-stabilized polycarbonate has a vulcanized rubber gasket that is reinforced by inner and outer steel bands. Plastic lamp holders have spring-loaded telescopic sockets and silver-plated wiping contacts that resist damage from vibration. The fixture accommodates two 20-watt trigger start or 40-watt rapid start fluorescent lamps. Crownlite Manufacturing Corp., Bohemia, NY.

Circle 85



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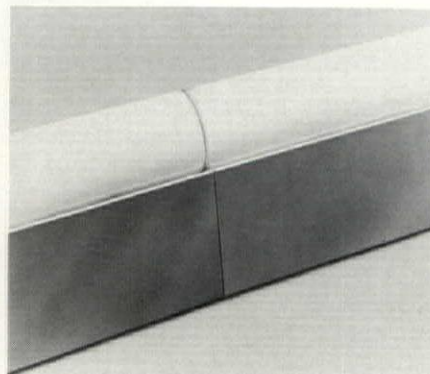
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Circle 18



■ **Incandescent tube**

Alinea linear incandescent tubular accent lights have knockouts for end-to-end mounting. The luminaire provides 2800K light from standard line voltage and can be controlled by a standard incandescent dimmer. The unit comes in eight colors; the tube lights come in three lengths. Lamps are clear, or coated to cut glare. Aamsco Manufacturing Inc., Jersey City, NJ.

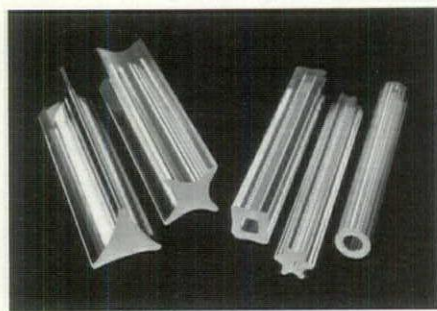
Circle 86



■ Cedar light pole

Ryther-Purdy makes solid and laminated Western red cedar streetlighting poles in a variety of styles and textures. The pole shown has a square shaft with chamfered corners that suggest tapering while retaining strength. All poles have a concealed wireway and are customized for any fixture: top- or side-mounted or with an arm. Ryther-Purdy Lumber Co., Inc., Old Saybrook, CT.

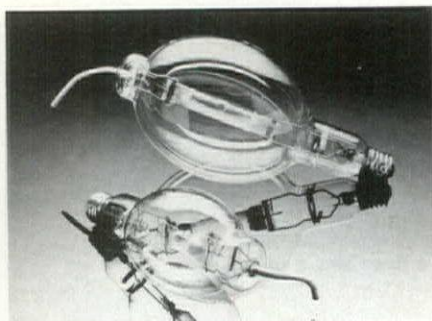
Circle 87



■ Glass rods, tubes

Glass Warehouse distributes Conturax profiled tubes and rods from Schott-Rhurglas, a German company. The rods and tubes are drawn from soda lime and Duran borosilicate glasses; their standard length is 59 inches. They can be used in a variety of lighting and other design applications. The rods and tubes shown are among the company's many standard shapes; others can be custom made. Glass Warehouse, Millville, NJ.

Circle 88



■ Quick restart lamp

Venture Lighting offers instant restrike metal halide lamps for fixtures and power supplies that will accept them. The length of time the lamps have been off determines the light level after reignition, according to the manufacturer. The lamps are intended for sports and industrial lighting. Venture Lighting International, Cleveland, OH.

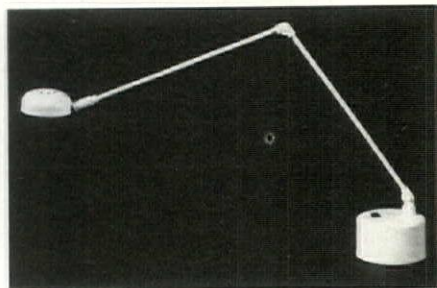
Circle 89



■ Second Empire reproduction

Paul Hanson offers a reproduction table lamp in the Second Empire style from the Masterworks Collection. Its matte black column is supported by bronze lion feet. All parts are completely hand-chased. The ecru shade has tapered panels. Paul Hanson, Carlstadt, NJ.

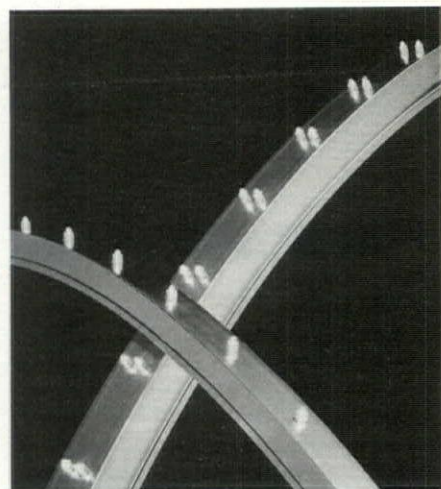
Circle 90



■ Desk lamp

Hi-Lite's Quartzio is a completely adjustable desk lamp with an arm that rotates 360 degrees and extends up to 28 inches; its head also rotates 360 degrees and can be moved up and down. The lamp's height can be adjusted from 0 to 26 inches. It accommodates a 50-watt halogen lamp, is equipped with a high-low switch, and comes in a choice of nine colors and two metal finishes. Hi-Lite Inc., West Haverstraw, NY.

Circle 91



■ Low-voltage strip light

The PT/LW series from Lightworks is a low-voltage lighting strip with replaceable 1-watt lamps in single- and double-row versions. It features an extruded aluminum strip in straight or curved sections with on-center lamp spacings from 3 to 12 inches. Lightworks, Philadelphia, PA.

Circle 92



■ Baffled reflector

The Series BR recessed fluorescent fixture from Lumax has an integral baffle that eliminates high-angle direct lamp glare, according to the manufacturer. The fixture holds slimline or high-output lamps in 4- or 8-foot lengths and is meant for high ceilings in large interior spaces. Its open design permits easy cleaning. Lumax Industries, Inc., Altoona, PA.

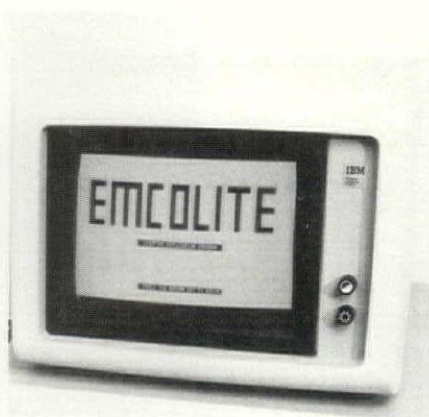
Circle 93



■ Wall lantern

Noral Lighting offers the Roulette II cast-aluminum outdoor lighting fixture with a lens of bulletproof polycarbonate. The lantern accepts a 60-watt incandescent lamp and comes in three corrosion-resistant polyester-based finishes and two lens colors. Wall (shown here), pendant, pedestal, and post mountings are available. Noral Lighting, Inc., Cleveland, OH.

Circle 94



■ Outdoor lighting program

The Emcolite computer program is designed to quickly verify outdoor lighting designs and analyze light levels using the manufacturer's photometric data. The user-friendly program is designed for the IBM PC and compatibles and is offered free, with a manual, to lighting specifiers for use in their offices. Emco Environmental Lighting, Milan, IL.

Circle 95



■ Halogen spot

GE Lighting's Performance Plus halogen PAR 38 spot for display lighting has a lens designed to provide high contrast without filament shadows. The lens provides 14,000 average candlepower in the center of the 90-watt lamp's beam, as compared to the 10,500 candlepower of GE's previous halogen spot. The lens design is a hexagonal pattern of lenticular and stippled treatments meant to prevent spill light. GE Lighting, Cleveland, OH.

Circle 96



■ Loading lights

The Docklite line from Phoenix Products now includes an explosionproof fixture for use with HPS and incandescent loading lights. Aluminum specular finish reflectors focus the beam pattern, and an adjustable arm directs it where most needed. The lights are UL listed for wet locations and meet federal safety standards for use in refinery tanker loading docks and various other hazardous areas. Phoenix Products Co., Inc., Milwaukee, WI.

Circle 97



■ Bollard luminaire

Classic Lamp Posts offers a traditional style bollard luminaire of a plastic and steel composite that simulates cast iron. The bollard is easy to install and maintain and is available directly from the factory at prices lower than those for similar cast iron or cast aluminum products, according to the manufacturer. Classic Lamp Posts, Inc., Miami, FL. ■

Circle 98

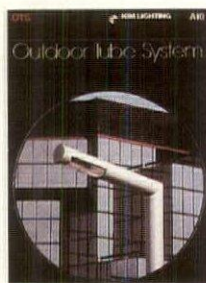
Product Literature



Table lamps

A brochure from Design-Technics features handcrafted ceramic table lamps in several styles. A color chart shows 33 glaze colors, including several metallic finishes. Design-Technics, New York, NY.

Circle 120



Outdoor tube system

A color catalog features the Outdoor Tube System for lighting parking lots, courtyards, pathways, and streets. The system comes in single, dual, and quad lamp-head configurations and accommodates sources from 70 to 400 watts. Kim Lighting, City of Industry, CA.

Circle 121



Portable light lab

The Colite Light Viewing System is a portable light lab for on-location or in-studio viewing of color samples as they would appear under interior light sources. A data sheet describes features. Colite, San Diego, CA.

Circle 122



Emergency ballast

Bodine's CF13 emergency ballast adds emergency lighting capability to fixtures with a 13-watt twin-tube compact fluorescent lamp. A data sheet contains specifications, wiring diagrams, and battery configurations. The Bodine Company, Collierville, TN.

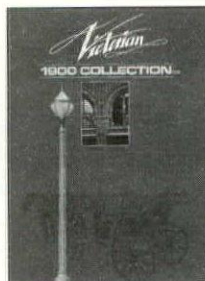
Circle 123



Commercial glazing

Pella metal-clad windows, doors, sunrooms, and sloped glazing systems for commercial building and renovation are fully described and illustrated in a color brochure. Rolscreen Company, Pella, IA.

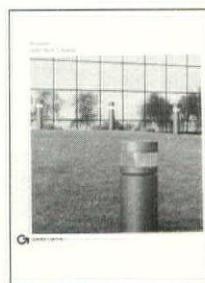
Circle 124



Historical streetlighting

The Victorian 1900 Collection consists of three luminaires and interchangeable poles modeled after early 20th-century streetlights. A color brochure shows natural and terrazzo finishes, seven colors, and three heights. Centrecon Inc., Everett, WA.

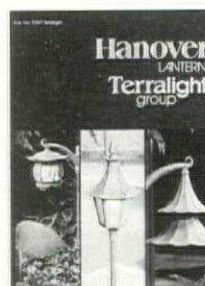
Circle 125



Bollard luminaires

A color catalog of bollard luminaires emphasizes easy installation; resistance to weather, vandals, and insects; and nonglare lighting from hidden lamps, reflectors, and refractors. Gardco Manufacturing Inc., San Leandro, CA.

Circle 126



Landscape lighting

Terralight landscape lighting fixtures can convert current from 120 to 12 volts, are easy to install, and have a built-in timer for preset on-off events. A brochure includes application photos, sketches, and mounting options. Hanover Lantern, Hanover, PA.

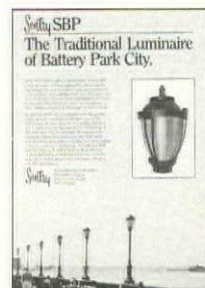
Circle 127



Concealed step lighting

Tube fixtures from Roberts come in several sizes and lengths for recessed lighting of steps, handrails, and coves. A color brochure contains sketches, photos, diagrams, and specifications. Roberts Step-Lite Systems, Oklahoma City, OK.

Circle 128



Outdoor luminaires

The SBP traditional style luminaire is vandal resistant and designed for HID sources. A data sheet shows luminaires and optional matching poles lining the New York harbor and provides construction details. Sentry Electric Corporation, Freeport, NY.

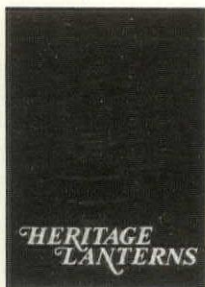
Circle 129



■ Floodlight

A data sheet profiles Spero Lighting's Garti extra-compact floodlight for low-wattage high pressure sodium lamps. The fixture is designed as a cost-effective alternative to PAR, R, and other incandescent fixtures. Spero Lighting, Cleveland, OH.

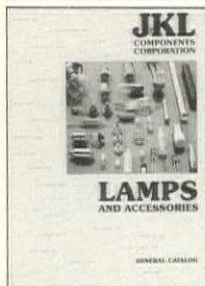
Circle 130



■ Handcrafted fixtures

Heritage Lanterns offers authentic handcrafted reproductions of period fixtures in copper, brass, and pewter. A 40-page color catalog shows wall sconces, chandeliers, outdoor lanterns, and post-top fixtures. Heritage Lanterns, Yarmouth, ME.

Circle 131



■ Lamp collection

A 52-page catalog from JKL Components features a wide selection of miniature and subminiature incandescent, fluorescent, and neon lamps. Data on dimensions, voltages, lumens, lamp life hours, and bases are included. JKL Components Corporation, Pacoima, CA.

Circle 132



■ Shading control systems

A brochure from Somfy Systems outlines applications and specifications for a wide range of motorized window treatments, including rolling shutters, retractable awnings, solar screens, and other shading systems. Somfy Systems Inc., Edison, NJ.

Circle 133



■ Stained glass fixtures

The Meyda Studio's stained glass lamp shades are produced with the copper foil method developed by Louis Tiffany. A color catalog illustrates a wide selection of patterns, matching bases, and attachments for pendant lamps. Meyda Stained Glass Studio, Utica, NY.

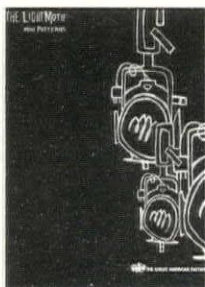
Circle 134



■ Commercial skylights

A 40-page catalog from Super Sky describes and illustrates skylight systems, support techniques, and custom designs. The catalog includes specifications, photos of applications, and detailed schematic drawings. Super Sky Products Inc., Mequon, WI.

Circle 135



■ Steel projection patterns

A brochure depicts a collection of 20 Mini Pattern stainless steel templates for 3 1/2-inch ellipsoidal spotlights, projection fixtures, and moving lights. The Great American Pattern, Hollywood, CA.

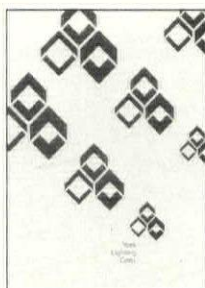
Circle 136



■ Solar-powered shelter

BIG Enterprises offers a low-maintenance, solar-powered bus shelter that features rechargeable batteries, an automatic light timer, and an array panel of silicon solar cells. BIG Enterprises, Inc., South El Monte, CA.

Circle 137



■ Fluorescent luminaires

A 44-page catalog highlights York Lighting's fluorescent luminaires for commercial and industrial applications. Sketches accompany lists of features, sizes, and lamp requirements for each luminaire. York Lighting Corp., St. Laurent, Quebec, Canada.

Circle 138



■ Patterned sheets

Plaskolite offers Optix acrylic and styrene patterned lighting sheets. A data sheet describes important features, patterns, and sizes. Plaskolite, Inc., Columbus, OH.

Circle 139



■ Landscape lighting system

A 33-page color catalog presents the Night Magic landscape lighting system with photos, charts, tables, and illustrations. A section for available accessories is added to information about fixtures for various sources. Lightolier, Secaucus, NJ.

Circle 140



■ Accent lighting

A color 66-page catalog features Capri Lighting's downlight fixtures and accessories for incandescent, HID, low-voltage, and compact fluorescent sources, and discusses lighting techniques and lamp selection. Capri Lighting, Los Angeles, CA.

Circle 145



■ Tubular neon lighting

The TLS-5 combines neon and fluorescent sources in tooled extruded aluminum tubes. Tubes are easily connected for continuous neon, neon-fluorescent, or track lighting. A color brochure describes applications. Staff Lighting Corp., Highland, NY.

Circle 141



■ Illuminated address

Light-House illuminated street numbering fixtures can be operated with an interior control module. Data sheets describe several models, some with functions for continuous or flashing light and for automatic on-off. Light-House Products, Inc., Tuxedo Park, NY.

Circle 146



■ Indoor, outdoor lighting

A 73-page color catalog from Hinkley Lighting contains photos, illustrations, and specifications of indoor and outdoor fixtures. Styles range from traditional to contemporary. Hinkley Lighting, Cleveland, OH.

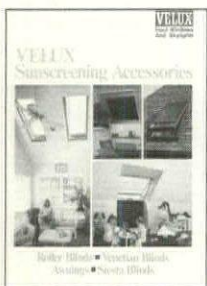
Circle 142



■ Insulated shades

A brochure from Appropriate Technology discusses and shows applications of several insulated window treatments, including Window Quilt, Window Showcase, Skylight Quilt, and Window Manager. Appropriate Technology Corporation, Brattleboro, VT.

Circle 147



■ Sunscreens

A brochure from Velux-America illustrates an extensive line of sunscreening accessories specially designed for roof windows and skylights, including roller blinds, Venetian blinds, awnings, and black-out blinds. Velux-America Inc., Greenwood, SC.

Circle 143



■ Lighting software

Micro-Eye-Lite, a versatile lighting analysis program, calculates illuminance tables and other information for a variety of indoor applications. A brochure describes program capabilities. Lighting Sciences Inc., Scottsdale, AZ.

Circle 148



■ Self-luminous exit signs

Isolite's self-luminous exit and safety signs are powered by hermetically sealed Pyrex tubes that are coated internally with phosphors and filled with tritium gas. They need no batteries or lamps. Isolite Corporation, Wayne, PA.

Circle 144



■ Portable neon fixture

Yoke-mounted Lazerstik portable neon fixtures can be plugged into a 120-volt outlet. Models come in two lengths and a choice of 12 solid colors and 3 multicolor combinations. Paradise Design and Manufacturing International, Inc., Signal Hill, CA. ■

Circle 149

Calendar

- November 18, 1988** **Lighting rental spaces**, DLF event. Speaker: Nini Schwenk of Lightforms. Contact: Sy Bollinger, president, the Designers Lighting Forum of New York, Inc., 58 Stratford Avenue, Greenlawn, NY 11740, (212) 255-8555.
- November 28, 1988** **Calendar deadline** for January *Architectural Lighting*. Contact: Susan Degen, Assistant Editor, *Architectural Lighting*, P.O. Box 10460, Eugene, OR 97440, (503) 343-1200.
- November 29, 1988** **New energy-efficient lighting systems**, workshop, Marlborough, MA. Repeats November 30 in Providence, RI. Contact: Randa Jazairi, Northeast Solar Energy Association, P.O. Box 541, 14 Green Street, Brattleboro, VT 05301, (802) 254-2386.
- December 6-8, 1988** **AEC Expo**, Javits Convention Center, New York City. Show and conference on automation, management, and reprographic systems. Contact: Expoconsul International, Inc., 3 Independence Way, Princeton, NJ 08540, (609) 987-9400.
- December 7-9, 1988** **Interiors conference for historic buildings**, Franklin Plaza Hotel, Philadelphia. Technical and design issues in rehabilitating and restoring historic building interiors. Cosponsors: U.S. National Park Service, ASID, several state historical preservation commissions, others. Contact: The Interiors Conference for Historic Buildings, P.O. Box 27080, Central Station, Washington, DC 20038, (202) 343-9578.
- December 8-9, 1988** **Lighting management**, Orlando, FL. Course on basics of energy-efficient design and retrofit. Contact: Association of Energy Engineers, 4025 Pleasantdale Road, Suite 420, Atlanta, GA 30340, (404) 447-5083.
- December 15, 1988** **Application deadline** for the first Lee Boyack Memorial Scholarship in lighting design for student ASID members in FIDER-accredited interior design programs. Sponsors: Design Foundation and ASID California North Chapter. Contact: Jan Moyer, Design Foundation, 2 Henry Adams Street, Suite 301, San Francisco, CA 94103, (415) 482-1875.
- January 10, 1989** **Tour of lighting installation**, DLF event. Contact: Designers Lighting Forum of Northern California, P.O. Box 1429, San Francisco, CA 94101-1429, (415) 824-8310.
- January 17, 1989** **Entry deadline**, Lights on Town Lake design competition, Austin, TX. Entry fee. Contact: Roy B. Mann, Chairman, Lights on Town Lake Committee, c/o Austin 150 Commission, P.O. 2990, Austin, TX 78769, (512) 346-7997.
- January 18, 1989** **Bathroom lighting**, DLF event. Contact: Sy Bollinger, president, the Designers Lighting Forum of New York, Inc., 58 Stratford Avenue, Greenlawn, NY 11740, (212) 255-8555.
- January 23-26, 1989** **Photometry institute**, Boulder, CO. Course on laboratory testing procedures and photometric techniques. Contact: Independent Testing Laboratories, 3386 Longhorn Road, Boulder, CO 80302, (303) 442-1255.
- February 1, 1989** **Submission deadline** for IES International Illumination Design Awards, Heart of America section. Contact: Mary Robarge, IIDA Awards, 1308 Pennsylvania, Kansas City, MO 64105, (816) 842-7023.
- February 5, 1989** **Entry deadline** for the 1988 Edison Award competition. Open to lighting professionals who use a significant number of GE lamps in a project. Contact: Frank LaGiusa, competition chairman, GE Lighting, Nela Park, Cleveland, OH 44112, (212) 614-5011.
- February 14, 1988** **All the world's a stage**, DLF event. Speaker: Steve Kennedy. Contact: Designers Lighting Forum of Northern California, P.O. Box 1429, San Francisco, CA 94101-1429, (415) 824-8310.
- February 15, 1989** **Product revue 1989**, DLF event. Contact: Sy Bollinger, president, the Designers Lighting Forum of New York, Inc., 58 Stratford Avenue, Greenlawn, NY 11740, (212) 255-8555.
- February 20, 1989** **Heart of America IIDA program**, IES section event. Program includes banquet and presentation of International Illumination Design Award winners. Contact: Mary Robarge, IIDA Awards, 1308 Pennsylvania, Kansas City, MO 64105, (816) 842-7023. ■

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AREA LIGHTING (EXTERIOR)

- ADJUSTA-POST MFG. CO., P.O. Box 71, Norton, Ohio 44203 FAX 216/745-9746 800/321-2132
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 AMERICAN ELECTRIC, 1555 Lynnfield Rd., Memphis, TN 38119 901/682-7766
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 HOLOPHANE, 214 Oakwood Ave., Newark, OH 43055 614/345-9631
 J.H. BAXTER & COMPANY, P.O. Box 10797, Eugene, Oregon 97440 503/689-3020
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 PEMCO CORP., Philadelphia, PA, Exterior HID & Custom Lighting & Poles 215/236-9020
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 STONCO, 2345 Vauxhall Rd., Union, NJ 07083. Contact Phil Henry at 201/964-7000
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 GTE/SYLVANIA LIGHTING, Sylvania Lighting Center, Danvers, MA 01923 617/777-1900
 OSRAM CORP., P.O. Box 7062 Jeanne, Newburgh, NY 12550 914/564-6300
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 NIGHTSCAPING, 1705 E. Colton Ave., Redlands, CA 92373 714/974-2121

LIGHTING DESIGNERS AND CONSULTANTS

- FREDRICK RAMOND INC., 16121 S. Carmentia Rd., Cerritos, CA 90701 FAX 926-1015 213/926-1361
 LIGHTSPACE DESIGN, 2111 Vine, Suite B, Berkeley, CA 94709. Consultant & MFG. 415/540-6023

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- WOODFORM, INC., Portland, OR 97220-1230 800/624-5091

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- EDWIN GAYNOR CO., 200 Charles St., Stratford, CT 06497 203/378-5545 or FAX 203/381-9019
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Manufacturers

Page 12. *Shoe store lighting suggests fashionable, desirable product* (Josefs, Roseville, Minnesota).

Halo: Incandescent fixtures.

Page 14. *Fluorescent lamps survive trial by fire* (San Francisco—Oakland Bay Bridge, California).

Crouse-Hinds: Vaportight fluorescent fixtures.

Philips: 9-watt compact fluorescent lamps.

Page 16. *Floods out, vertical-burn cutoffs in for auto sales* (Metro Acura dealership,

Aurora, Colorado; Sil Ter Har dealership, Bloomfield, Colorado).

Lighting Systems, Inc.: Vertical-burn metal halide fixtures and poles.

GTE/Sylvania: Metal halide lamps.

Page 26. *UV filters permit safe, bright lighting of Egyptian antiquities* (Egyptian Art Gallery, Memphis State University, Tennessee).

Bausch & Lomb, Venture Lighting International: UV-blocking filter.

Capri Lighting: Prismatic diffusing lens, transformer, and dimmer.

GE: MR16 lamps, 120-watt ER40 lamps.

Universe Stage Lighting: Linear-spread lens.

Page 28. *Indirect lighting, daylighting brighten military dining hall* (New York Air National Guard base, Hancock Field, Syracuse, New York).

Conservolite: Electronic dimming modules with remote fiber-optic sensors.

LiteControl: 8-inch-wide indirect fluorescent pendants.

Sterner: 250-watt forward-throw metal halide wall sconces.

Manufacturer credits reflect the products specified for the projects; it is possible that other products were installed during construction or maintenance.

Photographers

Phillip MacMillan James, 2300 Hazelwood Avenue, St. Paul, MN 55109, (612) 777-2303

Richard Kampas, Richard D. Kampas Inc./Photomedia, 1250 East Water Street, Syracuse, NY 13210, (315) 472-1601

Howard N. Kaplan, HNK Architectural Photography, 610 Green Bay Road, Highland Park, IL 60035, (312) 433-6666

Elliott Kaufman, 255 W. 90th #5C, New York, NY 10024, (212) 496-0860

Kent Marshall, Kent Marshall Photography, 899 Pine Street #1912, San Francisco, CA 94108, (415) 928-3169

Optimum Graphics, 1463 East Galbraith Road, Cincinnati, OH 45215, (513) 761-8666

H. Durston Saylor, 14 East Fourth Street, New York, NY 10012, (212) 620-7122

Paul Warchol, 133 Mulberry #6S, New York, NY 10003, (212) 431-3461

Tom Wofford, MSU Photo Services, Memphis State University, Memphis, TN 38152, (901) 678-2196 or (901) 682-1345

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